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

R1947 Rev 2

March 2025

City of Wanneroo

Mindarie Tees Ct BAW
Detailed Design Report

marinas
boat harbours
canals
breakwaters
jetties
seawalls
dredging
reclamation
climate change
waves
currents
tides
flood levels
water quality
siltation
erosion
rivers
beaches
estuaries

www.coastsandports.com.au

m p rogers & associates pl
creating better coasts and ports

Suite 1, 128 Main Street, Osborne Park, WA 6017
p: +618 9254 6600
e: admin@coastsandports.com.au
w: www.coastsandports.com.au

K2145, Report R1947 Rev 2
Record of Document Revisions

Rev	Purpose of Document	Prepared	Reviewed	Approved	Date
A	Draft for MRA review	J Chen	T Hunt	T Hunt	14/06/24
0	Issued for Client use	J Chen	T Hunt	T Hunt	12/08/24
1	Updated & reissued	J Chen	T Hunt	T Hunt	18/11/24
2	Updated & reissued	J Chen	T Hunt	T Hunt	18/03/25

Form 035 18/06/2013

Limitations of this Document

This document has been prepared for use by the Client in accordance with the agreement between the Client and M P Rogers & Associates Pty Ltd. This agreement includes constraints on the scope, budget and time available for the services. The consulting services and this document have been completed with the degree of skill, care and diligence normally exercised by members of the engineering profession performing services of a similar nature. No other warranty, expressed or implied, is made as to the accuracy of the data and professional advice included. This document has not been prepared for use by parties other than the Client and its consulting advisers. It may not contain sufficient information for the purposes of other parties or for other uses.

M P Rogers & Associates takes no responsibility for the completeness or form of any subsequent copies of this document. Copying this document without the permission of the Client or M P Rogers & Associates Pty Ltd is not permitted.

Table of Contents

Table of Figures

Table of Tables

1. Introduction

The City owns and manages an existing Beach Access Way (BAW) located at the end of the Tees Court, Mindarie. The access structure provides access to a small stretch of beach on the northern Mindarie shoreline. The BAW consists of an asphalt path leading to a set of limestone steps that provide direct access to the beach.

The location of the BAW is presented in the following figure.

Figure 1.1 Location Plan

The City has identified that the Mindarie Tees Ct BAW requires renewal within the next five years, prior to 2026. To allow renewal works to be undertaken, the City engaged M P Rogers & Associates Pty Ltd (MRA) to complete detailed design for a replacement access structure. The scope of the works includes the following:

- Review existing background information to determine the site constraints and opportunities for the design.
- Complete detailed design and documentation of the replacement access structure.

This report presents a summary of the design criteria, considerations and methodology during the detailed design stage.

1.1 Background

The BAW was constructed between 1985 and 1989 as part of the Mindarie Keys Development. A condition assessment conducted in 2021 revealed that the Mindarie Tees Ct BAW is deteriorating and requires renewal within the next five years.

The access structure connects the existing footpath to a small stretch of beach. The footpaths leading to the BAW are generally relatively flat and connect to the BAW which has a steeper gradient. The end of the BAW is a limestone block staircase that leads directly onto the beach. The layout of the existing access structure is shown in the following figure.

Figure 1.2 Layout of the Existing Access Structure

One key requirement of the replacement BAW is to provide improved accessibility to the beach. This has been considered in this design.

2. Existing Site Conditions

The access structure is located at the end of Tees Court, north of the Mindarie Marina as shown in Figure 1.2. MRA completed an inspection of the beach access structure in March 2024 to identify key features and constraints for design. These are discussed in the following sections.

2.1 Existing Footpath

There are a number of footpaths that are connected to the BAW and a nearby car park. The footpaths are generally constructed from asphalt, with standard conservation fence on the dune side. The condition of these footpaths generally appears to be reasonable. However, the construction of the replacement BAW is likely to require the use of these footpaths, possibly by machinery.

It is anticipated that the Contractor is expected to protect these footpaths during the works. Alternatively, the Contractor may choose to for its convenience to replace some of the paths after the works. It is recommended that the treatment to the existing footpaths should be specified in the Contractor's methodology as part of the tender submission.

Figure 2.1 Existing Footpaths

2.2 Beach Access Way

The BAW is generally constructed similarly to the footpath but follows a steeper gradient. The end of the BAW consists of a set of limestone block stairs.

Figure 2.2 Existing BAW

A key requirement for the replacement BAW is to provide improved accessibility to the beach. Given the current relatively steep gradient, this would mean that a longer length of path would be required to accommodate improved accessibility.

2.3 Limestone Block Stairs

A set of stairs is located at the end of the BAW. The stairs are constructed from reconstituted limestone blocks. There is evidence of erosion (e.g. slumped/unstable dune profile) on the seaward side of the stair. The City has advised that the seaward dune profile adjacent to the BAW and stairs consists of bitumen stabilised limestone that has been placed by the City during previous maintenance repairs. Beach rock and rock outcrop is also visible seaward of the stairs and BAW.

Figure 2.3 Limestone Block Stairs

2.4 Existing Survey

The City provided a LiDAR survey of the site taken in October 2023. This survey data has been used for the detailed design.

Based on this survey, the beach level is generally between 1.5 and 2.0 mAHD. The existing natural surface level at the start of the BAW where it connects to the Footpaths is between 4.0 and 5.0 mAHD.

2.5 Detailed Site Inspection

A detailed site inspection was undertaken to provide a better understanding of the underlying ground conditions at the site. The following was completed as part of the inspection.

- Probing and Perth Sand Penetrometer tests have been undertaken along and at the toe of the existing ramp to provide more information on the potential location of the rock layer.
- Hand digging to ground truth the location of surface rock near the toe of the existing stairs and the proposed toe of the new BAW.

The detailed site inspection was completed by MRA in September 2024. A summary of the findings of the inspection is presented by the following. The test locations and the indicative rock levels are presented in the following figure.

- Cement stabilised sand has been found for the area immediately fronting the seaward edge of the existing ramp. Probing and PSPs cannot be undertaken in this area. Therefore, a

PSP was completed in the dune area further seaward of the cement stabilised area and appears to suggest a rock layer may be present 1.5 m below the natural surface level (approximately +1.5 mAHD).

- A PSP undertaken on the dune side of the existing ramp encountered refusal about 2 m below the natural surface level, which may also suggest a hard layer at around +1.5 to 2.0 mAHD.
- At the toe of the existing stairs there appears to be undulating surface rock, as can be observed and confirmed via the probing and PSPs undertaken.

The findings of the detailed site inspection have been incorporated into the detailed design of the access structure.

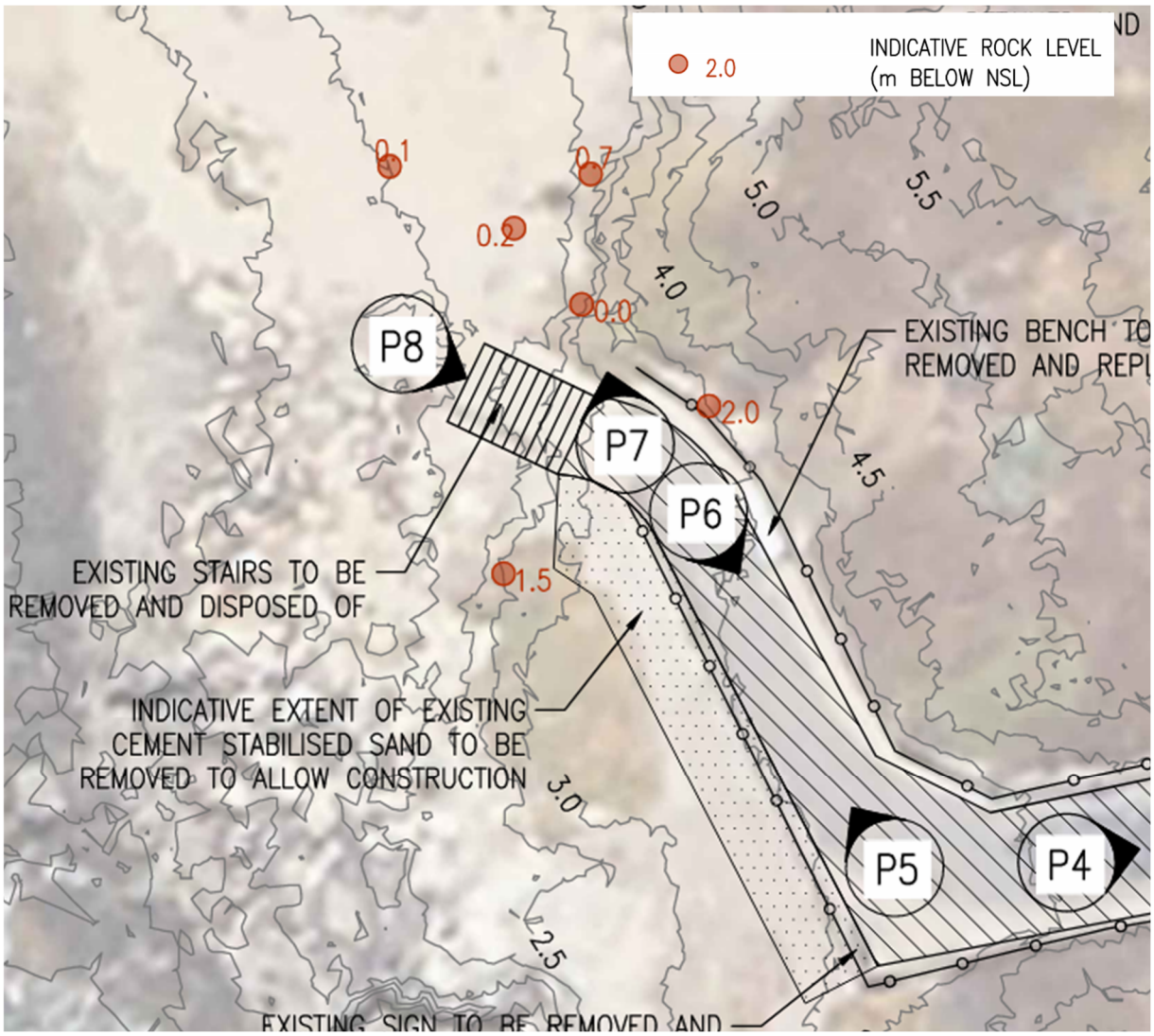


Figure 2.4 Probing Locations & Indicative Rock Level Below Ground

3. Design Considerations

3.1 Design Requirements

The key design considerations were provided by the City's Request for Quotation (RFQ) document and from further discussion with the City. These include the following:

- A minimum design life of 25 years for the replacement Access Structure.
- Consideration of coastal processes.
- Provision of universal access (e.g. a grade of 1 in 14 with landings located at 9 m intervals).
- Public safety considerations.
- Functionality of the access for all weather conditions.
- Monitoring and maintenance requirements.

These items have been considered in the design.

3.2 Design Life & Events

The City requested a 25 years design life for the structural design of the new access structure. This has been adopted for the detailed design.

For a beach access way with a 25 year design life, a 50 year ARI design water level in combination with a 50 year ARI wave event has been used for design.

3.3 Coastal Processes

The BAW provides public access to the active shoreline and as a result, will be constructed in an area which is potentially subject to coastal processes. In line with the Statement of Planning Policy No 2.6: State Coastal Planning Policy (SPP2.6; WAPC 2013), the coastal processes and hazards in the area require consideration.

SPP2.6 guides development on the coast of Western Australia and outlines the process to assess coastal hazard and vulnerabilities. SPP2.6 recognises that development may occur in an area potentially impacted by coastal hazards if:

- the development has an expected lifespan of less than 30 years;
- the development is for public recreation purposes; and
- the development can be removed or modified should it be threatened by erosion or creates an erosion threat to other land.

All of these apply to the proposed replacement beach access structure at Mindarie Tees Court.

The City's Local Planning Policy 4.21: Coastal Assets Policy also recognises that for local, district and regional beaches, beach access points are acceptable permanent assets that could be located within the foreshore reserve or area that may be impacted by coastal hazards.

For a public access structure with a working life of 25 years, it is therefore appropriate to locate the access structure within the coastal hazard area. To determine the impact of the coastal hazards on the replacement access structure, guidance has therefore been taken from the SPP2.6 for calculation of the coastal processes, and have been modified to account for the design life and functional requirements of the access structure.

In line with SPP 2.6, the impact of the following coastal processes were considered:

- Severe storm erosion.
- Historical shoreline movement.
- Recession due to sea level rise.

This assessment was completed using the recent beach survey for the study area completed by the City in 2023. The results of the assessment are presented in the following sections.

3.3.1 Impact of Storm Erosion

MRA simulated the shoreline response to a severe storm using the SBEACH computer model. The input beach profile was created with the 2023 beach survey. The location of the SBEACH profile is shown in Figure 3.1.

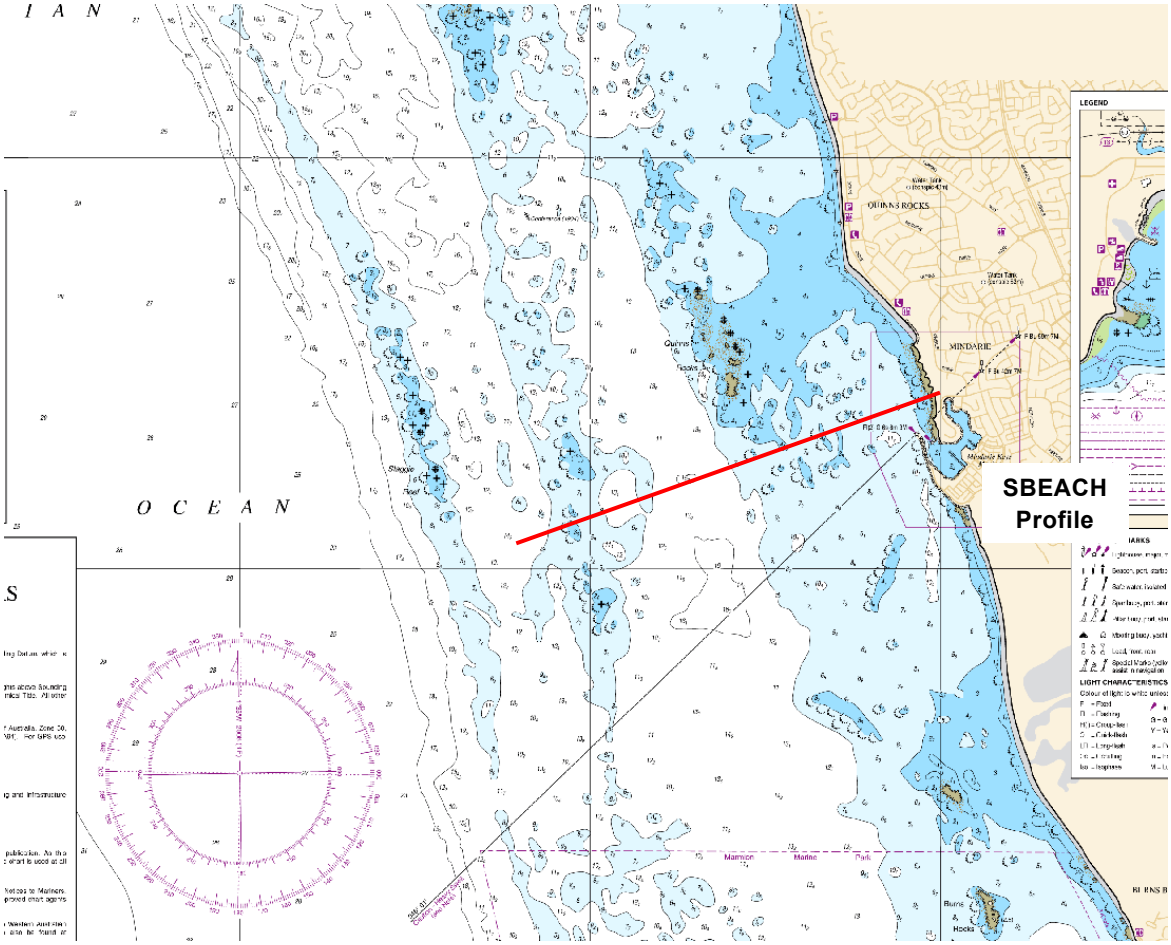


Figure 3.1 SBEACH Profile Location

A 50 year ARI beach erosion event would be appropriate to determine the extent of erosion in the coming 25 years. A 50 year ARI beach erosion event has been taken from MRA's detailed storm selection study (MRA 2018) for this assessment.

The SBEACH model was setup and run with input beach profiles and storm conditions. Shallow beach rock layers/outcrops are visible at a lower elevation and provides protection for the lower portion of the beach/dune profile, this has been included in the SBEACH modelling. The results from the modelling are presented in the following figure. The model outputs in this figure show the initial (pre-storm) profile, final profile and the maximum wave heights and water levels predicted during the storm.

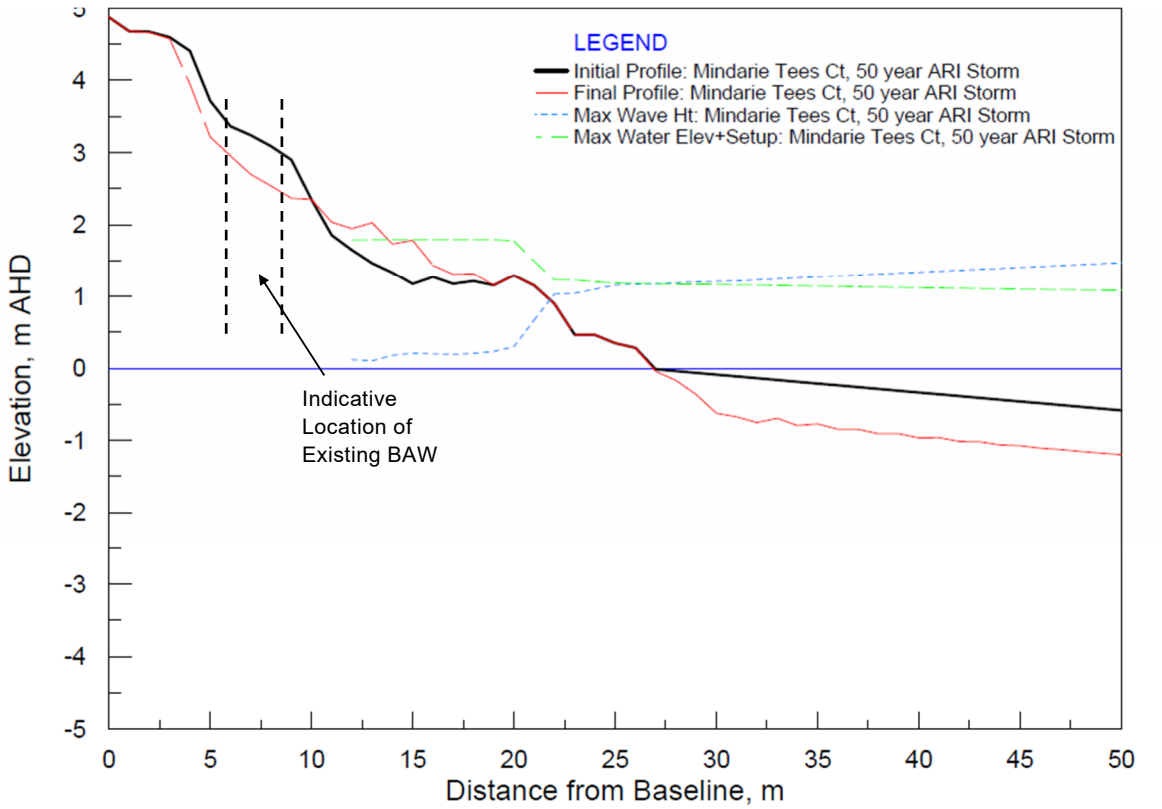


Figure 3.2 SBEACH Output

The SBEACH model indicates that while the lower portion of the dune profile remain relatively stable due to presence of rock, there is still a potential scour in the order of about 0.5 m at the upper portion of the dune profile near the existing BAW. As such, depending on the elevation of the replacement BAW, appropriate scour protection is likely to be required, particularly for the upper portion of the dune. This has been considered in the design.

3.3.2 Long Term Shoreline Movement

MRA has completed a high level review of the shoreline movement using the Department of Transport (DoT)'s coastline database (refer Figure 3.3) and available aerial images (Figure 3.4) for the study area. The outcome of this analysis indicates that the majority of the shoreline fronting the existing BAW is relatively stable due to the presence of rock outcrops. The shoreline position of the beach immediately north of the ramp toe/stairs appears to fluctuate over time but also remain relative stable.

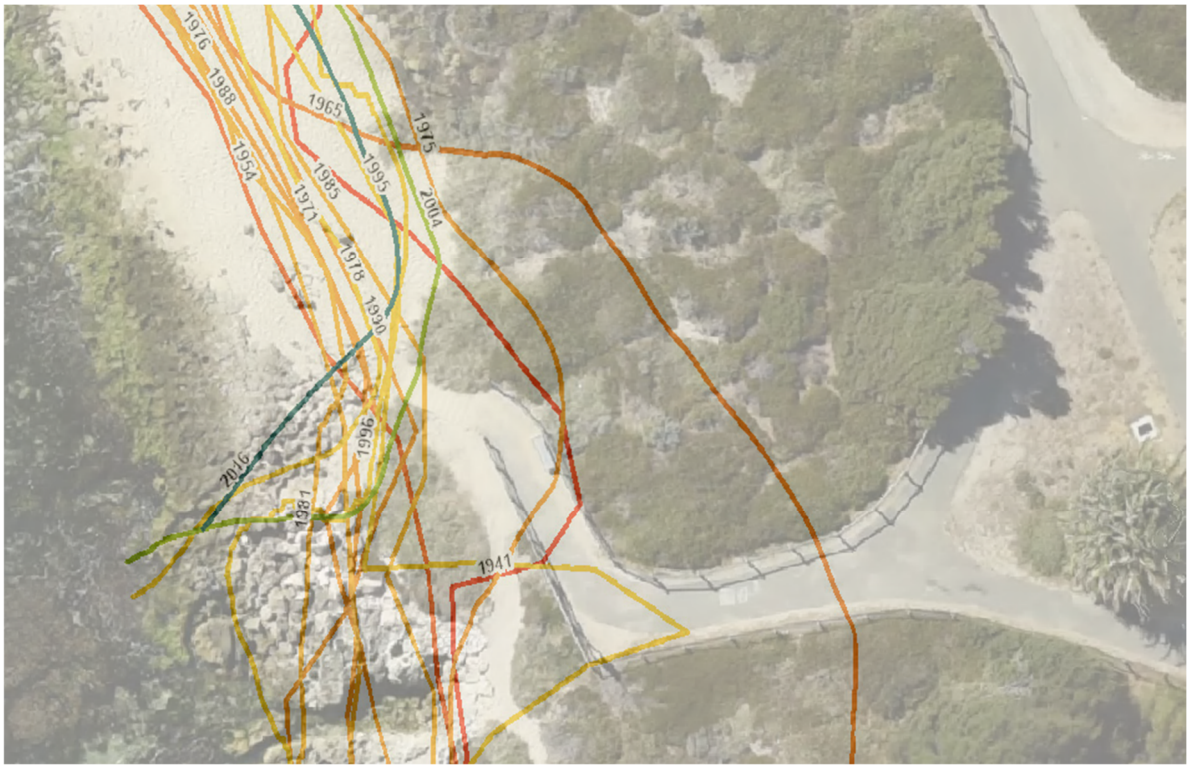


Figure 3.3 DoT Coastline Movement Database

Figure 3.4 Existing BAW - Left: 2008; Right: 2024

For design, it is therefore appropriate for the replacement BAW to follow a similar alignment as the existing BAW. However, to maintain functionality over the design life, one or a combination of the following is required at the toe of the replacement BAW.

- Toe to be founded on competent rock layer.
- Appropriate scour protection.

3.3.3 Sea Level Rise

DoT has released recommendations on the appropriate allowances for climate change and sea level rise to be used for coastal planning in Western Australia (DoT 2010). This sea level rise scenario has been adopted within SPP2.6 and is presented in Figure 3.5.

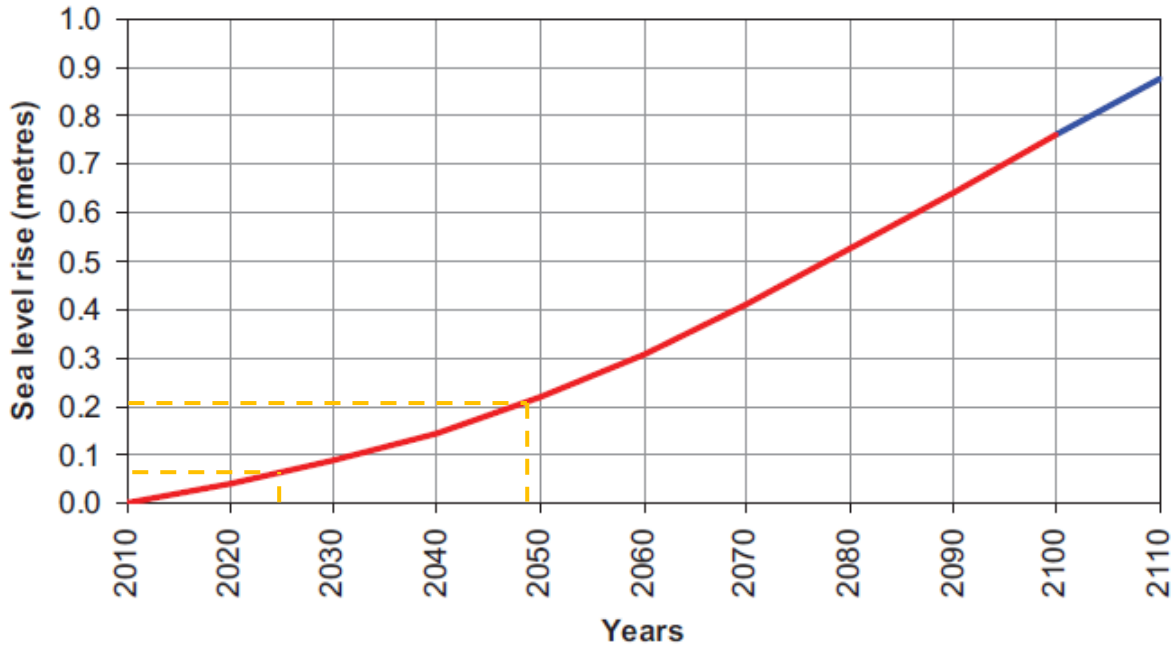


Figure 3.5 Recommended Sea Level Rise Allowances (DoT 2010)

The recommended allowances for sea level rise over 25 year periods have been determined based on Figure 3.5 and are presented in Table 3.1. The sea level rise was estimated relative to the predicted 2024 level.

Table 3.1 Sea Level Rise

Planning Timeframe	Sea Level Rise (m)
2049	0.15

As outlined in previous sections, the presence of the surface rock outcrops along this stretch of shoreline provides protection against shoreline recession from coastal processes. Similarly, the rocky profile would also be likely to provide some protection against shoreline recession due to sea level rise.

3.4 Design Water Levels

3.4.1 Tides

The water levels at the site are affected by the astronomical tides. Measurements have been taken by the DoT using a tide gauge at the Fremantle Fishing Boat Harbour (FFBH), which is approximately 41 km south of the site. Submergence curves have been prepared by the DoT and the key tidal levels are provided in Table 3.2.

Table 3.2 FFBH Tidal Levels

Tidal Plane	Prefix	Still Water Level (mAHD)
Highest Astronomical Tide	HAT	+0.63
Mean High High Water	MHHW	+0.38
Mean Sea Level	MSL	+0.04
Mean Low Low Water	MLLW	-0.30
Lowest Astronomical Tide	LAT	-0.51

Note: 1. Levels taken from DoT Submergence Curve (DOT 1615-13-02A, April 2017)

3.4.2 Extreme Water Levels

Extreme water levels at the study site are typically the result of storm surge. MRA has recently completed an analysis of the FFBH tide gauge record between 1950 and 2022 for DoT to determine extreme storm induced water levels. The analysis was used to predict various storm induced ARI events at the site, summarised in the following table.

Table 3.3 Extreme Water Levels for the Perth Metropolitan Region

Average Recurrence Interval (ARI)	Peak Steady Water Level (mAHD)
1	0.87
50	1.19

Notes: 1. Water level data period 1950-2022, data length 73 years.

3.4.3 Sea Level Rise

Extreme and ambient water levels are both expected to increase in the future with sea level rise as a result of climate change. The DoT (2010) released recommendations on the appropriate allowances for sea level rise to be used in coastal planning and development in Western Australia. The allowances are presented in Figure 3.5.

For a design life of 25 years, the recommended sea level rise allowance is therefore approximately 0.15 m. This has been considered in the design.

3.5 Design Waves

MRA completed SBEACH modelling to simulate the nearshore wave transformation at the site. Based on this, the nearshore significant wave height is in the order of about 1.0 m. At the location of the scour protection, the significant wave height is reduced to less than 0.3 m.

3.6 Rock Level

To ensure long term functionality of the BAW, the toe of the replacement BAW need to be founded onto a competent rock layer.

Given the highly variable nature of the rock profile, it is envisaged that the location of the rock layer should be confirmed via exposure of the rock layer.

The toe of the BAW should be founded on a competent rock layer. This means that:

- The rock layer should generally be continuous with little to low degree of weathering and fracturing.
- The rock layer at the proposed toe location should not consist of any loose rocks, debris or rocks with large discontinuities with high potential to breakdown into smaller pieces of rocks.

3.7 Aboriginal Heritage

MRA completed an online search of Registered Aboriginal Sites using the DPLH Aboriginal Heritage Inquiry System. This search portal can be found at Aboriginal Cultural Heritage Inquiry System (dplh.wa.gov.au)

Figure 3.6 Aboriginal Heritage Places Extract

Based on the designs presented in Section 4, portions of the works summarised above impact on Aboriginal Registered Site 21589 (Rosslare Soak).

Therefore, approval is required from the DPLH to undertake the works, which is to be arranged by the City. An experienced Heritage Consultant could be engaged to assist in obtaining the relevant Aboriginal Heritage approvals for the works.

4. Concept Design

Based on the design considerations and the key design requirements, three concept options were developed and provided to the City for consideration. Following discussions with the City, given the limitations on site, constraints on the extent, and scope of the proposed options, these options would not provide universal access, but would still provide a significant improvement to accessibility.

- Option 1 – Modify the existing footpaths at the entrance to form part of the new access ramp that provide improved accessibility. This would provide an access ramp with the ramp toe located at a similar location of the existing stairs.
- Option 2 – Start the access ramp at the current location. To provide improved accessibility this would mean the new ramp (and associated scour protection) will take up a large portion of the beach.
- Option 3 – Reinstate the beach access as per the existing, which would involve a new concrete path and access stairs. The option would be simpler to implement but would not provide improved accessibility.

Option 1 was recommended by MRA and subsequently confirmed by the City as the preferred option. An extract of the selected concept option is presented in the following figure.

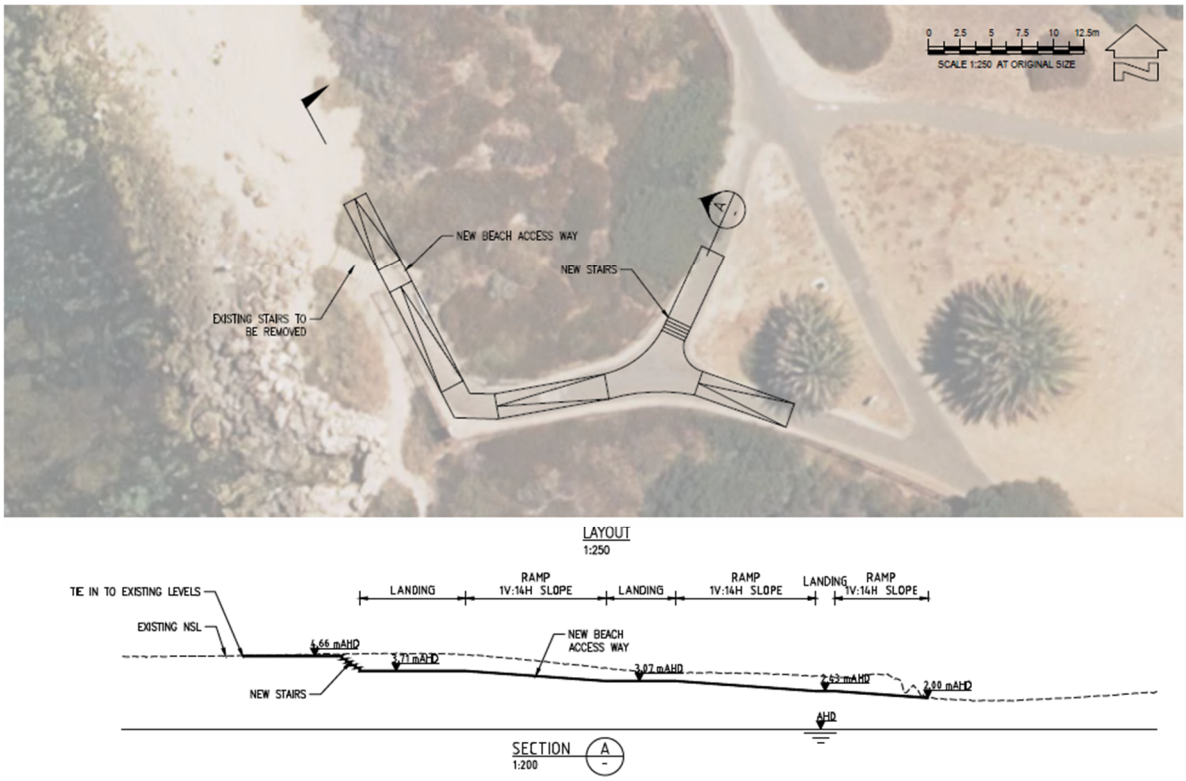


Figure 4.1 Preferred Concept Option for Replacement BAW

5. Detailed Design & Documentation

The following sections outline the key design features, assumptions and methods for the detailed design of a replacement to the existing BAW. The design drawings are presented in Appendix A.

5.1 Existing Footpath

The existing asphalt footpaths that lead to the BAW are to be replaced as part of this works. The new footpath should be reinstated to the existing alignment and levels to allow a smooth transition.

5.1.1 Transition & Tie in to Existing

There are two existing footpaths at varying levels and lengths that connect to the BAW. To allow for a smooth transition and ensure both footpaths can tie into to the new BAW, the existing footpaths would connect directly to the new BAW.

5.2 New BAW

The new BAW has been designed to remain in service after 25 years with an appropriate level of maintenance. The design also accounts for actions from pedestrians. Detailed description of the design loads considered is presented in Section 5.3.

5.2.1 Alignment & Extent

The alignment and extent of the replacement BAW is governed by the need to tie into and provide a smooth transition to the existing infrastructure. Review of coastal processes also indicate that the existing alignment is generally appropriate. Therefore, the design of the new BAW has been completed on the basis of following a similar alignment and extent to the existing.

5.2.2 Gradient & Elevation

To provide an improved access, the new BAW has a 1V:14H slope with landings provided at 9 m intervals, as per the design requirements of AS1428. However, this mean that the levels of the new BAW would be notably lower than the existing, resulting in bulk earthworks, excavation and dune disturbance.

To minimise the extent of dune disturbance and earthworks, a 1V: 2H batter is proposed for reinstatement of the disturbed dune areas. This gradient is generally appropriate for revegetation and stabilisation. Flatter slopes may be possible but are likely to result in a significantly larger extent of excavation and dune disturbance.

5.2.3 New Concrete Access Ramp

A new Concrete Access Ramp would be constructed at the location of the existing BAW. The main considerations for the Concrete Access Ramp are as follows.

- Given the new BAW is located at notably lower levels than the existing, there is a potential that the new access ramp may be founded on or obstructed by rock along the alignment of the ramp.
- The need to tie into the existing level of the adjacent footpaths.
- The toe of the ramp to be founded on rock.

To account for the above considerations. two details have been proposed for construction of the new Concrete Access Ramp.

- Concrete Access Ramp placed over compacted subbase. This detail can be used where the existing natural surface level is low and there is generally no limestone encountered.

- Concrete Access Ramp placed directly over and keyed into limestone rock. This detail would be used where limestone outcrops are encountered. In this case the limestone rock would be broken out to allow construction of the ramp.

For the new concrete access ramp, a 50 MPa concrete mix with the inclusion of catalytic crystalline addictive (XYPEX) has been included in the design. The catalytic crystalline addictive was included to provide some capacity to "self-heal" micro cracks that may develop on the concrete ramp surface over its service life.

5.2.4 Handrails

From discussions with the City, a simple stainless steel handrail with kick plate was adopted for design. The handrails would be provided between the last landing and the toe of the access ramp in accordance with AS1428.1.

5.2.5 Limestone Block Retaining Wall

A Limestone Block Retaining Wall was proposed for sections of the new BAW. This retaining wall provides the following functions.

- Acts as a barrier to potential scour of the upper portion of the dune and undermining of the new Access Ramp.

- Acts as a retaining wall to accommodate level differences between the new BAW and existing natural surface level.

5.2.6 Rock Scour Protection

Rocks for scour protection need to be sufficient size to withstand the forces applied by wave and actions. The required armour size under wave action was calculated using the Hudson and Van der Meer formulae (CIRIA 2007).

The required representative rock size (W_{50}) is approximately 0.1 t. This assumes the rock will be placed in a single layer. A summary of the rock size is presented in Table 5.1.

Table 5.1 Recommended Rock Sizes

Class	Range (t)	W_{50} (t)	D_{50} (m)
Limestone Rock	0.1 – 0.3	0.2	0.4

5.3 Design Actions

Based on the type of structure and the intended use of the Access Structure, AS1170.1 (2002), AS2156.2 (2001) and AS1657 (2018) require the BAW to be capable of supporting a pedestrian crowd load. The following imposed actions have been designed for:

- Uniformly Distributed Surcharge: 4.0 kPa

- Point Load Surcharge: 4.5 kN

5.4 Durability

The durability of the new BAW is achieved by using concrete members in combination with stainless handrails, fixings and fittings. This minimises the likelihood of corrosion in the coastal environment.

6. Construction Considerations

6.1 Site Access

The site can be accessed via the footpath from Tees Court or from the car park located along Rosslare Promenade, north of the Mindarie Marina. The method of access and laydown will disturb the existing vegetation and would need to be confirmed with the City.

Ultimately the proposed construction methodology should be left to the discretion of Tenderers to provide value for money solutions to the City.

6.2 Removal of Existing BAW

To enable the construction of the new BAW, the existing BAW would need to be completely removed and disposed of.

6.3 Concrete Access Ramp

The following general methodology is proposed for the construction of the Concrete Access Ramp.

- Undertake any necessary vegetation clearing as per the vegetation clearing permit.
- Removal of all elements of the existing access structure including all existing asphalt and fences.
- Excavation to allow construction.
- Contractor to complete site measurements to enable setout. The site measurement and set out information forwarded to the City for approval.
- Break out cement stabilised sand and limestone rock (if required).
- Backfill and compact subbase as required.
- Supply, place and cure Concrete Access Ramp.
- Supply and installation of new balustrade on both sides of the Concrete Access Ramp.
- Reinstatement of the existing natural surface level around the Concrete Access Ramp.
- Stabilisation of the disturbed areas of dune.
- Reinstate or replace any adjacent dune fence affected to the City's requirements. Any fencing removed shall be disposed of offsite at an appropriate facility, and fencing shall be replaced in accordance with City's standard drawing TS 01-7-1.

7. Maintenance

For the new BAW, the design life has been set at 25 years. To ensure that this design life is achieved, monitoring and maintenance will be required. Monitoring activities would enable the maintenance program to be refined and modified over time. This section outlines these monitoring and maintenance requirements.

7.1 New BAW

The following monitoring activities are recommended for the new BAW. This incorporates all elements of the structure.

The monitoring is recommended for completion by personnel experienced in the design and maintenance of coastal structures.

Table 7.1 Recommended Monitoring Activities for BAW

Frequency	Activity
Annual	Visual inspection of the concrete access ramp, scour protection, limestone block wall, handrail, and structure as a whole. This would focus on settlement, cracking of concrete surface, movement of the paths, loose fittings, inspection of visible damage etc.
After significant storm event	As for annual monitoring
5 Yearly	As required or identified from annual inspections.

7.1.1 Maintenance

The following maintenance activities are recommended for the new BAW.

Table 7.2 Recommended Maintenance Activities for BAW

Frequency	Activity
Annual	General cleaning
Approximately 5-10 year intervals (and as required from inspections)	Replenish and repacking of rock scour protection, replacement of handrail elements.
Approximately 5-10 year intervals (and as required from inspections)	Repointing of mortar joint on the limestone block wall.
Approximately 10-15 year intervals (and as required from inspections)	Refacing weathered blocks on the limestone block wall.
Approximately 10-15 year intervals (and as required from inspections)	Retightening of fixings on handrails and kick plate.
Approximately 10-15 year intervals (and as required from inspections)	Replace fence mesh and/or fence posts
As required from inspections	Repair cracks on the surface of the concrete access ramp.
As required from inspections	Repair damaged section of the concrete access ramp

The BAW would likely be at the end of its useful service life after 25 years and would require replacement or removal.

8. Cost Estimate

8.1 Opinion of Probable Capital Cost for BAW

An opinion of probable cost for the replacement of the BAW has been prepared based on recent rates for similar types of works in the Perth Metropolitan area.

The following should be considered regarding the construction cost estimate:

- The cost estimate is based on tendered rates over several years. There has been a recent increase in material and labour prices over the past year. These have been included, but additional increases should be considered by the City if the construction is delayed.
- The cost for any other approvals has not been included.
- It is assumed the cleared vegetation and excavated material can be reused on site.
- A 15% contingency has been included for a detailed design cost estimate. This is used to cover uncertainty such as material costs, mobilisation costs and site conditions.
- Future escalation has not been included. As the marine construction industry in WA has limited resources and is currently in high demand, prices can vary significantly from one project to another.

The current demand for marine and civil works is high, and a number of experienced marine Contractors have advised that there is limited capacity to undertake further works at the moment. Therefore, given the current high demand and limited resources in the marine construction industry, it is recommended that the City allow sufficient time in the schedule for both the tender and construction phase of this project to ensure the most cost-effective outcome can be achieved.

A breakdown of the estimated construction cost is presented in the following tables.

Table 8.1 Cost Estimate for New BAW

Item	Activity	Quantity	Units	Unit Rate	Subtotal	Total for Item
1	**Preliminaries**					**$ 18,500**
1.1	Building Permit	1	Item	$ 2,500	$ 2,500	
1.2	Insurances and management plans	1	Item	$ 3,000	$ 3,000	
1.3	Documentation	1	Item	$ 2,500	$ 2,500	
1.4	Mobilisation and site establishment	1	Item	$ 7,500	$ 7,500	
1.5	Demobilisation and site clean-up	1	Item	$ 3,000	$ 3,000	
2	**Demolition, Clearing & Earthworks**					**$ 6,300**
2.1	Demolish and dispose of existing asphalt access ramp	215	m^2	$ 20	$ 4,300	
2.2	Clearing and minor earthwork to create laydown area, allow installation of fencing and construction as required	1	Item	$ 2,000	$ 2,000	
3	**Concrete Access Ramp**					**$ 101,655**
3.1	Excavate,wash away and remove sand to expose limestone rocks or sufficient to allow construction.	1	Item	$ 16,000	$ 16,000	
3.2	Allow for minor rock breaking/ removal of cement stabilised sand to allow construction of the new ramp.	1	Item	$ 5,000	$ 5,000	
3.3	Supply and install subbase for concrete path	35	m^3	$ 525	$ 18,375	
3.4	Supply, place and cure concrete path (including stairs).	30	m^3	$ 1,200	$ 36,000	
3.5	Supply & installation of stainless steel handrails.	15	m	$ 1,400	$ 21,000	
3.6	Supply & installation of conservation fence.	88	m	$ 60	$ 5,280	
4	**Retaining Wall & Scour Protection**					**$ 33,000**
4.1	Supply and Place reconstituted limestone block wall	36	m	$ 750	$ 27,000	
4.2	Supply, place and grout rock scour protection	12	m^3	$ 500	$ 6,000	
5	**Dune Stabilisation**					**$ 14,150**
5.1	Reinstate natural dune and beach profile following completion of the stairs	1	Item	$ 5,000	$ 5,000	
5.2	Supply and install Coir Mesh to disturbed sections of the dune	305	m^2	$ 30	$ 9,150	
	Subtotal 1				**$ 173,605**	**$ 173,605**
	Contingencies	**15**	**%**		**$ 26,041**	**$ 26,041**
	Subtotal 2				**$ 199,646**	**$ 199,646**
	Goods & Services Tax				**$ 19,965**	**$ 19,965**
	Total Estimated Cost				**$ 219,610**	**$ 219,610**

Notes: 1. Base date for cost estimate is November 2024.
2. Rates are based on tendered prices for similar works in the Perth Metropolitan Region.
3. Assumes cleared vegetation and excavated material can be reused on site.

9. Safety in Design

9.1 Introduction

The current legislation within Australia requires designers to demonstrate that they have identified the risks in construction, use, management, maintenance and demolition of their design and that they have taken appropriate measures to eliminate or reduce these risks. In particular, the Work Health and Safety Regulations 2022 require designers to provide the following information to the Client.

- The hazards that the designer has identified:
  - As part of the design process.
  - That arise from the construction of the design.
  - To which a person at the construction site may be exposed.
  - In the use of the structures.
  - In the maintenance of the structures.
  - In the demolition of the structures.
- The designer's assessment of the risk of injury or harm to a person resulting from identified hazards.
- The measures the designer has taken to reduce the risks.
- Any hazards where the designer has not done anything to reduce the risks.

Therefore, to meet the legislative requirements and to help the City quantify, understand and manage these risks, a Safety in Design (SID) assessment as described in the following sections has been completed.

The following outlines the different stages of the SID assessment and presents the outcomes from this assessment. It is important that the City understands these risks and the uses of the structure for which they apply. These risks should be communicated to any parties involved in the future construction, management, maintenance, management or demolition of the structure.

9.1.1 Principles of Safe Design

The key principles that impact on achieving SID have been identified by the Australian Safety and Compensation Council and are summarised in the following table.

Table 9.1 Principles of Safe Design

Principle	Description
1: People With Control	People with influence or control over the design have responsibility to ensure safe design.
2: Product Life Cycle	Safe design applies to every stage in the life cycle, from design to demolition. It involves eliminating or minimising risks as early in the life cycle as possible.
3: Systematic Risk Management	Application of risk identification, assessment and control processes to achieve safe design.
4: Safe Design Knowledge and Capability	Either demonstrated or accessed by any person with control or influence over design.
5: Information Transfer	Effective communication and documentation of design and risk control information between all party involved in the life cycle is essential for safe design approach.

9.1.2 Qualifications

The design documentation process includes various project stages and involves different parties who provide input and decisions to arrive at the final design. Such inputs may positively or negatively impact the safety however it is understood all parties have responsibility for health and safety in the design documentation stage and have each met their obligation under the Health & Safety Legislation.

This Report does not in any way mitigate the Builders, Contractors or end Users obligations and responsibilities under the legislation to ensure safe work practices and the provision of a safe work environment as required by the OSH Act and the OSH Regulations.

All parties are required by law to ensure, as far as practicable, that any information received about the hazards that have been identified and the risk control measures that have been considered and/or put in place, are passed on to the parties responsible for construction, operation and use. In providing this report MRA has discharged its obligations under the Act and responsibility to ensure ongoing compliance passes onto the Construction Contractors and Owner/Developer/End User.

It shall be noted that anyone who alters or modifies the design documentation without consulting MRA will assume the duties of the designer. Any changes to the design documentation may affect the health and safety of those who work on or use the design documentation and must therefore be considered by the party altering or modifying the design.

9.2 Basis of Safety in Design Assessment

The following section outlines the basis of the design considered in the SID assessment. This includes the considered uses, construction, maintenance and demolition methodologies and any key assumptions.

This SID assessment should be updated throughout the life cycle of the design and particularly should there be any changes to the items outlined below. Any uses of the design, construction

methodologies and maintenance, management or demolition activities outside of these may require further consideration of the risks to safety. The responsibility for the SID of those additional activities or items rests with the designer of those items.

9.2.1 Document List

A list of the design documents for the Mindarie Tees Ct BAW that formed the basis of the SID assessment are presented in the following table.

Table 9.2 List of Design Documents

Document Number	Document Title
Report R1944	Mindarie Tees Ct BAW - Technical Specification
Report R1947	Mindarie Tees Ct BAW - Detailed Design Report

9.3 Safety in Design Assessment

To complete the SID assessment, MRA adopted the approach presented in Figure 9.1.

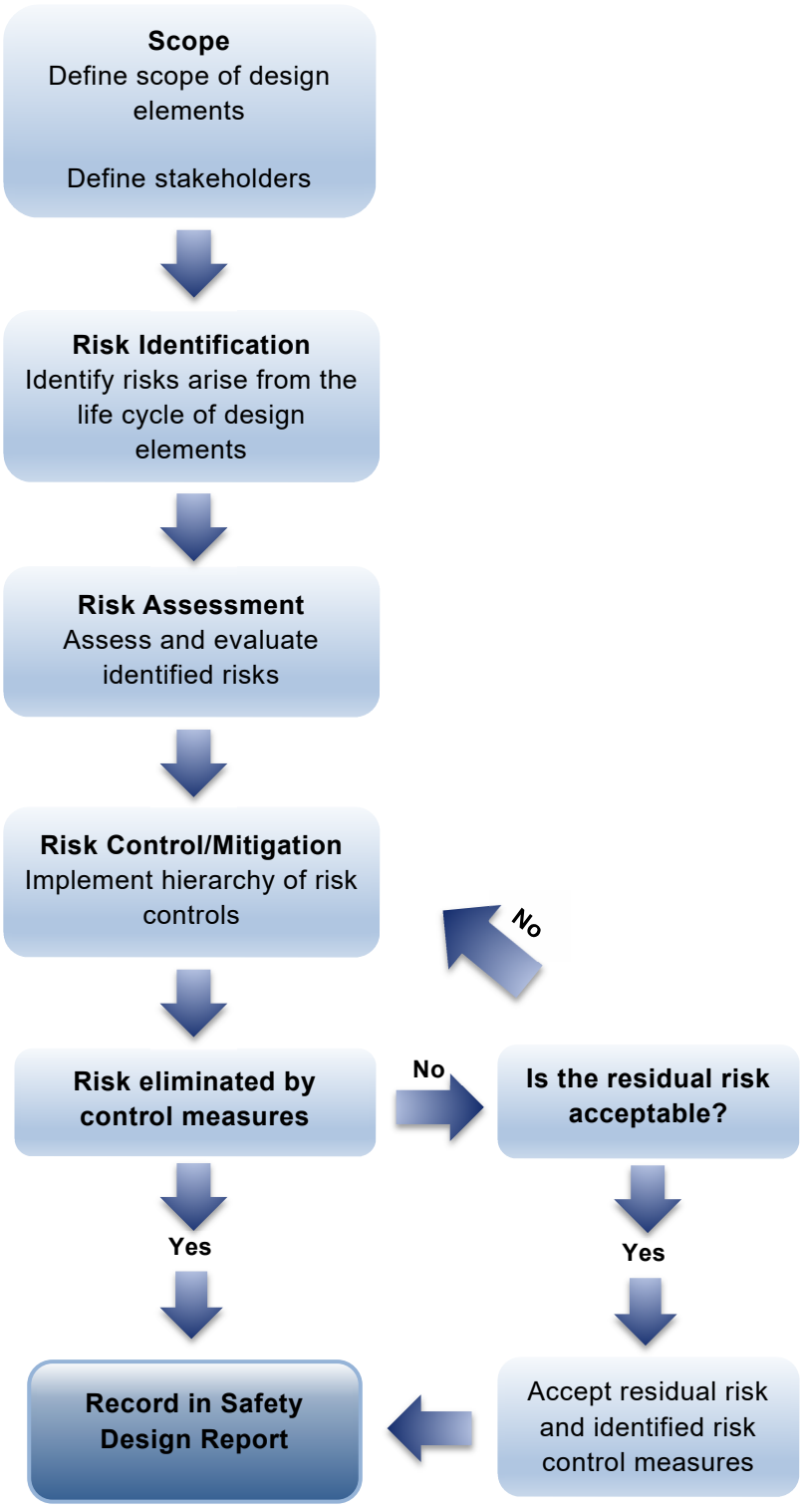


Figure 9.1 Steps in Safety in Design Assessment

The stages of the SID assessment are discussed in the following sections.

9.3.1 Stakeholders

The primary focus of a safe design is the elimination or minimisation of risk to a party that may be influenced by the design. This includes any party that may be involved in the design,

construction, operation, maintenance and demolition of the design elements in this project. A list of relevant stakeholders is presented below.

- The City (Client).
- MRA.
- Contractor.
- The Public.
- Marine based State Agencies such as DoT, etc.

9.3.2 Risk Identification

The risk identification involves identifying design related risks/hazards associated with the life cycle of the project. In particular, the risk identification stage should aim to identify risks/hazards that may affect the stakeholders during the design, construction, operation, maintenance and demolition stage of the upgraded revetment. The life cycle of the design elements for this project is presented in Figure 9.2.

Figure 9.2 Life Cycle of the Design Elements

The risk identification was completed using the following procedures to identify risks over the whole lifecycle of this project.

- Examining design records and experience from past similar types of projects.
- Consulting relevant Australian Standards, codes and guidance materials.
- Examining available data on particular construction technique.
- Constructability review with special emphasis on occupational safety and health issues.
- Considering any particular issues associated with the intended use of the project, and including any foreseeable misuse.
- Examining available maintenance records from past similar types of projects and considering required maintenance.
- Examining records and data on demolition of past similar projects and considering required demolition.

9.3.3 Risk Assessment

To quantify the impact (e.g. injury and harm) of the risks identified and assess the effectiveness of risk control measures, the identified risks were evaluated, and an initial risk rating was provided for each risk event. The risk evaluation process was repeated after risk control measures were adopted.

The risk evaluation involves assessment of the likelihood of risk occurrence, and the consequences should the risks occur. A likelihood rating as presented in Table 9.3 was assigned to each risk event. Subsequently a consequence rating presented in Table 9.4 was then assessed and assigned to each risk event. Based on the likelihood and consequence rating, the overall risk rating for each risk event was determined using the risk matrix presented in Table 9.5.

Table 9.3 Likelihood Rating

Likelihood	Description	Indicative Return Period	Indicative Probability (over the timeframe)
5 – Almost Certain	Common/frequent occurrence. Expected to occur on an annual basis.	Every year or more	> 0.9
4 – Likely	Is known to occur or has happened regularly. The event has occurred a number of times in the last decade.	Every three years	> 0.3, < 0.9
3 – Possible	Could occur, or known to occur based on anecdotal evidence. The event might occur once per decade.	Every ten years	> 0.1, < 0.3
2 – Unlikely	Not likely to occur very often, but does occur from time to time.	Every thirty years	> 0.03, < 0.1
1 – Rare	Conceivable but only in exceptional circumstances.	Every 100 years	> 0.03

Table 9.4 Consequence Rating

Consequence	Description
5 – Substantial	Results in fatality or permanent widespread environmental damage.
4 – Major	Results in permanent injury or significant environmental damage.
3 – Moderate	Results in injury and illness or major but recoverable environmental damage.
2 – Minor	Results in medical treatment or recoverable interim environmental damage.
1 – Negligible	Results in first aid treatment or short term environmental damage.

Table 9.5 Risk Matrix

		Consequence				
Probability (Likelihood)		Negligible (1)	Minor (2)	Moderate (3)	Major (4)	Substantial (5)
	Almost Certain (5)	Medium (8)	High (16)	High (18)	Extreme (22)	Extreme (25)
	Likely (4)	Low (4)	Medium (10)	High (17)	Extreme (21)	Extreme (24)
	Possible (3)	Low (3)	Medium (9)	Medium (12)	High (19)	Extreme (23)
	Unlikely (2)	Low (2)	Low (6)	Medium (11)	Medium (14)	High (20)
	Rare (1)	Low (1)	Low (5)	Low (7)	Medium (13)	Medium (15)

The design response to the resultant risk levels is outlined in the following table.

Table 9.6 Design Response to Risks

Risk Level	Actions to be Taken
Extreme	Immediate action required to reduce risk. Engineering input required to reduce risk.
High	Immediate action required to reduce risk. Engineering input required to reduce risk.
Medium	Action required to reduce risk. Engineering input required to reduce risk.
Low	May require localised control measures – business as usual.

In general, the extreme and high risk items are considered intolerable and require input to reduce the risk. Low risk items are considered tolerable. Risk controls are outlined further below.

9.3.4 Risk Control

Risk control is the implementation of risk mitigation measures to reduce or eliminate the risks identified. The Code of Practice – Safe Design of Buildings and Structures (Commission for Occupational Safety and Health, 2008) outlined a 'hierarchy of control' model. This model was used to determine the most appropriate risk control measures for each risk event and it is summarised in the following table.

Table 9.7 Hierarchy of Control

Type of Control	Description
Elimination	Remove hazard from the structure or site through design.
Substitution	Substituting or replacing hazard or hazard component through redesign or design modification.
Isolation	Isolate or separate hazard from the people involved.
Engineering Controls	If the hazard cannot be eliminated, substituted or isolated, design or install elements to counteract the hazard (e.g. guard or barrier).
Administrative Controls	This involves noting in the design the use of safe work practices to reduce risks (e.g. work procedures, signage).
Personal Protective Equipment (PPE)	Use of PPE near potential risks/hazard.

Risk control measures higher up the hierarchy (such as elimination, substitution and isolation) were adopted to control the identified risks where possible, as these control measures are generally more passive and do not rely on the actions of people. In the case where the risk cannot be eliminated or reduced so far as is reasonably practicable, administrative controls which include providing information on remaining or residual risks, and further control measures were adopted.

It is noted that a single risk control measure may be used to treat many risks, and that multiple control measures may be required to control a single risk.

A summary of the results from the SID assessment is presented in the Risk Register in Appendix B. Included in the register are the ratings associated with the identified risk and the proposed mitigation measures to reduce the risks.

9.4 Residual Risks

The residual risk is the level of risk that remains and is transferred after all risk control measures are successfully implemented at the completion of the design. It is noted that the majority of the risks identified in the SID assessment have been treated with control measures that either eliminated or reduced the risks to an acceptable level. However, there are still some residual risks that have a high risk rating, and will require on-going monitoring and management. This may be achieved by applying administrative controls and the use of PPE. The higher residual risks for this project and the corresponding control measures required are presented in the following table. It should be noted that there are a number of other medium risks which also require consideration and these are outlined in the Risk Register in Appendix B.

Table 9.8 High Residual Risks & Corresponding Control Measures

Phase of Works	Residual Risk	Residual Risk Owner	Control Measures
Construction	Public interference with site. Conflicts between pedestrians, beach users and the works.	Contractor	Contractor's management plans as well as Pedestrian, and Traffic Management Plan to be reviewed. Appropriate signage, fencing.
Construction	Injury during construction.	Contractor	Contractor's management plans and construction methodology. OHS practices, training, PPE
Construction	Workers hit by moving plants on construction site.	Contractor	Contractor's management plans including appropriate traffic management, PPE, OHS practices and training.

From the SID assessment there is a maintenance and management item that the City will need to consider, outlined below:

- General monitoring and maintenance of the new BAW.

Other measures are outlined in the Risk Register provided in Appendix B.

These residual risks and management measures are to be communicated by the Client to any parties involved in the future construction, management and maintenance or demolition of the revetment.

It is noted that the SID assessment should be maintained throughout the project. Risk measures implemented should be monitored and reviewed regularly to ensure they have eliminated the risk or reduced it to an acceptable level.

10. Conclusions

MRA has been engaged by the City of Wanneroo to complete the detailed design of a replacement BAW at the end of Tees Court, Mindarie. The detailed design includes a Concrete Access Ramp, Limestone Block Retaining Wall and Rock Scour Protection to replace the existing. Where possible, the aim is to minimise earthworks, dune disturbance and rock breaking to reduce construction impacts, cost and waste.

This design report presents the background, existing site conditions, design features, assumptions and detailed design for the site. Expected maintenance activities and construction considerations have also been included, as well as a Safety in Design assessment.

11. References

Australian Government, 2022. *Work Health and Safety Regulation 2022*.

CERC 1984. *Shore Protection Manual*. US Government Printing Office, Washington DC, USA.

CIRIA,CUR, CETMEF, 2007. *The Rock Manual. The use of rock in hydraulic engineering (2nd Edition).* C683, CIRIA, London.

City of Wanneroo, 2008. *Local Planning Policy 4.21: Coastal Assets*. City of Wanneroo, Perth.

Commission for Occupational Safety and Health. (2008). *Code of practice: Safe design of buildings and structures*. Department of Mines and Petroleum, Perth.

Department of Planning, Lands and Heritage, 2024. *Aboriginal Cultural Heritage Inquiry System*. https://achknowledge.dplh.wa.gov.au/

DoT, 2010. *Sea Level Change in Western Australia - Application to Coastal Planning*. Coastal Infrastructure, Fremantle.

Department of Transport. *Coastline Movements - Vegetation Lines (DOT-023)*. Department of Transport, Western Australia. Retrieved August 12, 2024, from https://catalogue.data.wa.gov.au/dataset/coastline-movements

GHD 2021. *City of Wanneroo Assets Structural Assessment, 12537609-REP-002-1.* Prepared for City of Wanneroo.

Komar P D 1998. Beach Processes and Sedimentation (2nd Edition). Prentice Hall Inc, New Jersey, USA.

MRA 2018. *Design Event Selection for Erosion Hazard Assessment – West & South Coasts of WA, MRA Report R1004 Rev 2*. Prepared for the Department of Transport.

Standards Australia 2001. *Australian Standard 2156.2-2001: Walking tracks – Part 2: Infrastructure design*. Standards Australia, Sydney, NSW.

Standards Australia 2016. *Australian / New Zealand Standard 1170.1-2002: Structural design actions – Permanent, imposed or other actions*. Standards Australia, Sydney, NSW.

Standards Australia 2018. *Australian Standard 1657-2018: Fixed platforms, walkways, stairways and ladders – Design, construction and installation*. Standards Australia, Sydney, NSW.

WAPC 2013. *State Planning Policy No. 2.6 - State Coastal Planning Policy*. Western Australian Planning Commission, Perth.

Work Health and Safety Commission, 2022. *Code of Practice – Safe Design of Structures*.

12. Appendices

Appendix A **Detailed Design Drawings**

Appendix B **Risk Register**

Appendix A Detailed Design Drawings

AT CORRECT SCALE THIS IS 100 mm

City of Wanneroo

MINDARIE TEES COURT BEACH ACCESS WAY

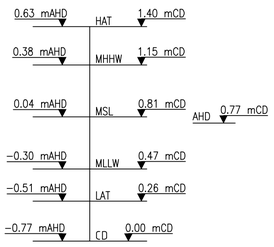
DRAWING No.	TITLE
D2145-01-01	DRAWING LIST & LOCALITY PLAN
D2145-02-01	EXISTING CONDITIONS & DEMOLITION PLAN
D2145-03-01	LAYOUT & SECTION
D2145-04-01	SECTIONS & DETAILS - SHEET 1 OF 2
D2145-04-02	SECTIONS & DETAILS - SHEET 2 OF 2
D2145-05-01	RAMP DETAILS

GENERAL NOTES:

1. THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE TECHNICAL SPECIFICATION. ANY DISCREPANCIES ARE TO BE REFERRED TO THE CLIENT'S REPRESENTATIVE BEFORE PROCEEDING.
2. SURVEY PROVIDED BY CITY OF WANNEROO COMPLETED IN OCTOBER 2023. THE LEVELS AND CONTOURS REFLECT THE SURFACE AT THE TIME OF SURVEY ONLY.
3. HORIZONTAL DATUM IS MAP GRID OF AUSTRALIA IN GDA 2020. VERTICAL DATUM IS VERTICAL DATUM IS AUSTRALIAN HEIGHT DATUM (AHD).
4. AERIAL PHOTOGRAPH SOURCED FROM DEPARTMENT OF TRANSPORT TAKEN IN JANUARY 2022.
5. THE CONTRACTOR SHALL CONFIRM THE LOCATION OF AND PROTECT ANY UNDERGROUND SERVICES IN THE AREA OF THE WORKS. THE CONTRACTOR SHALL CONTACT BEFORE YOU DIG (WWW.BYDA.COM.AU).
6. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.
7. SET OUT COORDINATES AND DIMENSIONS ARE TO BE CONFIRMED ON SITE PRIOR TO WORKS COMMENCING. REFER ANY DISCREPANCY TO THE CLIENT'S REPRESENTATIVE. IF IN DOUBT ASK.
8. SITE ACCESS AND LAYDOWN AREAS TO BE CONFIRMED WITH CLIENT'S REPRESENTATIVE PRIOR TO WORKS.
9. EXISTING NATURAL SURFACE LEVEL AT THE TOE OF THE STRUCTURE TO BE REINSTATED FOLLOWING COMPLETION OF THE NEW STRUCTURE.
10. ON COMPLETION OF THE WORKS A SET OF MARKED UP AND SIGNED "AS CONSTRUCTED" DRAWINGS SHALL BE FORWARDED TO THE CLIENT'S REPRESENTATIVE.

DESIGN NOTES:

1. ACCESS STRUCTURE DESIGNED IN ACCORDANCE WITH THE FOLLOWING AUSTRALIAN STANDARDS:
   - AS1170:2002 – STRUCTURAL DESIGN ACTIONS
   - AS1657:2018 – FIXED PLATFORMS, WALKWAYS, STAIRWAYS AND LADDERS – DESIGN, CONSTRUCTION AND INSTALLATION
   - AS3600:2018 – CONCRETE STRUCTURES
   - AS3700:2018 – MASONARY STRUCTURES
   - AS2156.2:2001 – WALKING TRACKS – INFRASTRUCTURE DESIGN
2. DESIGN LIFE: 25 YEARS
3. DESIGN LOADS:
   - PEDESTRIAN CROWD LOAD: 4.0 kPa
   - STAIR TREAD LOAD: 2.2 kN/M



TAKEN FROM DOT FREMANTLE SUBMERGENCE CURVE DOT 01615-13-02A 26/04/2017

TIDAL LEVELS

1:20

LOCALITY PLAN

1:2,000

CAD:D21450101[C]

REV	DATE	APPROVED	AMENDMENT
C	19.02.25	JYC	UPDATED & REISSUED
B	25.10.24	JYC	REVISED ISSUE
A	12.07.24	JYC	PRELIMINARY ISSUE

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

CLIENT: City of Wanneroo

DESIGNED	CHECKED	APPROVED
J CHEN	T HUNT	
DRAWN	CHECKED	
R BORJA	J CHEN	

m p rogers & associates pl
coastal and port engineers
Suite 1, 128 Main Street
Osborne Park 6017
Western Australia
T: +61 8 9254 6600
F: +61 8 9254 6699
admin@coastsandports.com.au

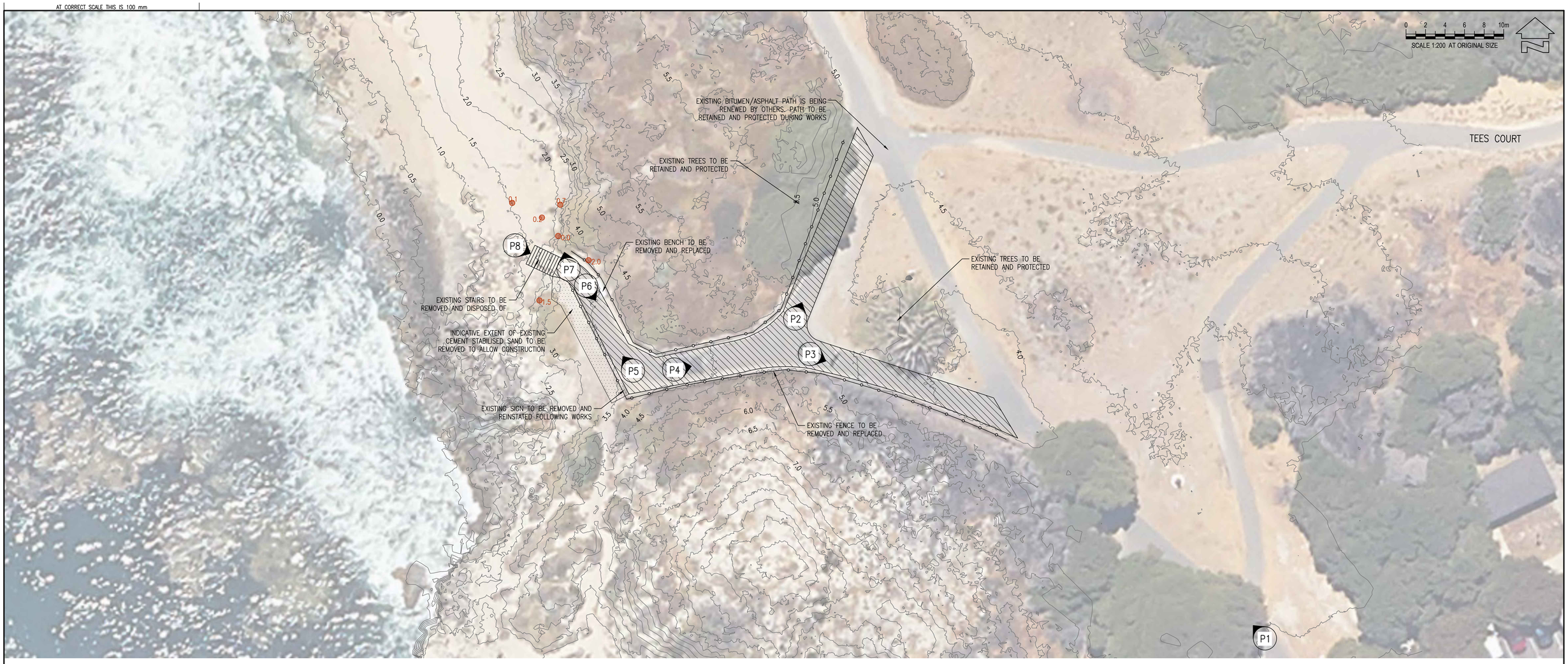
PROJECT: MINDARIE TEES COURT BEACH ACCESS WAY

TITLE: DRAWING LIST & LOCALITY PLAN

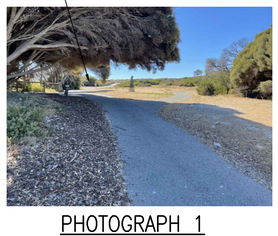
SCALE AT A1: AS SHOWN | DRAWING NUMBER: D2145-01-01 | REV: C

AT CORRECT SCALE THIS IS 100 mm

AT CORRECT SCALE THIS IS 100 mm



EXISTING SIGN TO BE RETAINED AND PROTECTED



PHOTOGRAPH 1

EXISTING TREE TO BE RETAINED AND PROTECTED

EXISTING BITUMEN/ASPHALT PATH TO BE REMOVED AND REPLACED

PHOTOGRAPH 2

EXISTING TREE TO BE RETAINED AND PROTECTED

EXISTING FENCE TO BE REMOVED AND REPLACED

PHOTOGRAPH 3

EXISTING TREE TO BE RETAINED AND PROTECTED

EXISTING BITUMEN/ASPHALT PATH TO BE REMOVED AND REPLACED

PHOTOGRAPH 4

EXISTING BENCH TO BE REMOVED AND REINSTATED FOLLOWING WORKS

PHOTOGRAPH 5

EXISTING SIGN TO BE REMOVED AND REINSTATED FOLLOWING WORKS

PHOTOGRAPH 6

PHOTOGRAPH 7

EXISTING FENCE AND CEMENT STABILISED SAND TO BE REMOVED TO ALLOW CONSTRUCTION

EXISTING STAIRS TO BE REMOVED AND DISPOSED OF

PHOTOGRAPH 8

LEGEND:

- 0.0 — CONTOUR
- EXTENT OF BITUMEN/ASPHALT PATH TO BE REMOVED AND REPLACED
- INDICATIVE EXTENT OF EXISTING CEMENT STABILISED SAND TO BE REMOVED
- STAIRS TO BE REMOVED AND DISPOSED OF
- FENCE TO BE REMOVED AND REPLACED
- 2.0 — INDICATIVE ROCK LEVEL (m BELOW NSL)
- P1 — PHOTO LOCATIONS

NOTES:

1. SURVEY PROVIDED BY CITY OF WANNEROO COMPLETED IN OCTOBER 2023. THE LEVELS AND CONTOURS REFLECT THE SURFACE AT THE TIME OF SURVEY ONLY.
2. CONTOURS SHOWN AT 0.5m INTERVALS.
3. SITE PHOTOS WERE TAKEN ON 25 MARCH 2024.
4. INDICATIVE ROCK LEVEL BASED ON SITE OBSERVATIONS AND MEASUREMENTS TAKEN ON SEPTEMBER 2024.

CAD:D21450201[C]

AT CORRECT SCALE THIS IS 100 mm

REV	DATE	APPROVED	AMENDMENT
C	19.02.25	JYC	UPDATED & REISSUED
B	25.10.24	JYC	REVISED ISSUE
A	12.07.24	JYC	PRELIMINARY ISSUE

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

CLIENT City of Wanneroo

DESIGNED	CHECKED	APPROVED
J CHEN	T HUNT	
DRAWN	CHECKED	
R BORJA	J CHEN	

m p rogers & associates pl
coastal and port engineers
Suite 1, 128 Main Street
Osborne Park 6017
Western Australia
t: +61 8 9254 6600
f: +61 8 9254 6699
admin@coastsandports.com.au

PROJECT MINDARIE TEES COURT BEACH ACCESS WAY

TITLE EXISTING CONDITIONS & DEMOLITION PLAN

SCALE AT A1 1:200 | DRAWING NUMBER D2145-02-01 | REV C

AT CORRECT SCALE THIS IS 100 mm

0 1 2 3 4 5m
SCALE 1:100 AT ORIGINAL SIZE

SETOUT POINTS		
SOP #	EASTING	NORTHING
SOP1	376,749.062	6,493,703.632
SOP2	376,747.267	6,493,699.254
SOP3	376,745.635	6,493,695.276
SOP4	376,745.179	6,493,694.166
SOP5	376,741.762	6,493,685.840
SOP6	376,763.314	6,493,675.321
SOP7	376,751.211	6,493,679.436
SOP8	376,743.816	6,493,681.951
SOP9	376,736.394	6,493,681.712
SOP10	376,727.536	6,493,680.124
SOP11	376,725.030	6,493,679.660
SOP12	376,723.969	6,493,681.707
SOP13	376,719.830	6,493,689.699
SOP14	376,719.278	6,493,690.765
SOP15	376,716.518	6,493,696.092

LEGEND:

- 0.0 — CONTOUR
- NEW CONCRETE ACCESS RAMP
- ROCK SCOUR PROTECTION
- LIMESTONE BLOCK WALL
- HANDRAIL
- NEW CONSERVATION FENCING
- VEGETATION DISTURBANCE
- SOP 1 — SETOUT POINT
- 2.0 — INDICATIVE ROCK LEVEL (m BELOW NSL)

NOTES:

1. SURVEY PROVIDED BY CITY OF WANNEROO COMPLETED IN OCTOBER 2023. THE LEVELS AND CONTOURS REFLECT THE SURFACE AT THE TIME OF SURVEY ONLY.
2. CONTOURS SHOWN AT 0.5m INTERVALS.
3. INDICATIVE ROCK LEVEL BASED ON SITE OBSERVATIONS AND MEASUREMENTS TAKEN ON SEPTEMBER 2024.

TIE IN TO EXISTING BITUMEN/ASPHALT PATH LEVELS
SOP 1
+4.66 mAHD
SOP 2
SOP 3
+4.36 mAHD
SOP 4
SOP 5
+3.71 mAHD
SOP 8
SOP 9
SOP 10
SOP 11
+3.07 mAHD
SOP 12
SOP 13
+2.43 mAHD
SOP 14
SOP 15
SOP 7
+4.27 mAHD
SOP 6
ROCK SCOUR PROTECTION
WALL TRANSITION FROM RETAINING WALL TO BLOCK WALL
TYPE 1 BLOCK WALL
TYPE 2 BLOCK WALL
EXISTING TREE TO BE RETAINED AND TRIMMED TO ALLOW CONSTRUCTION (IF REQUIRED)
TIE IN TO EXISTING BITUMEN/ASPHALT PATH LEVELS
EXISTING BITUMEN/ASPHALT PATH TO BE RETAINED AND PROTECTED
INDICATIVE DUNE DISTURBANCE AREA
R8
R16
5.8m
4.3m
1.2m
9m
7.8m
14.1m
2.3m
0.1
0.7
0.2
0.3
2.0
1.5
A (04-02)
B (04-01)
C (04-01)
D (04-01)

LAYOUT
1:100

EXISTING BITUMEN/ASPHALT PATH TO BE RETAINED AND PROTECTED
TIE IN TO EXISTING BITUMEN/ASPHALT PATH LEVELS
5.8m LANDING
4.3m
1.2m LANDING
9m
VARIES
9m
VARIES
9m
1.2m LANDING
6m
4.66 mAHD
1V:14H SLOPE
4.36 mAHD
1V:14H SLOPE
3.71 mAHD
1V:14H SLOPE
3.07 mAHD
1V:14H SLOPE
2.43 mAHD
1V:14H SLOPE
2.00 mAHD
EXISTING BEACH LEVELS AT TOE OF STRUCTURE TO BE REINSTATED FOLLOWING WORKS
INDICATIVE ROCK LEVEL
EXISTING NSL
AHD

SECTION A
1:100

(HANDRAIL AND FENCING NOT SHOWN FOR CLARITY)

AT CORRECT SCALE THIS IS 100 mm

CAD:D21450301[D]

REV	DATE	APPROVED	AMENDMENT	REV	DATE	APPROVED	AMENDMENT
D	21.03.25	JYC	UPDATED & REISSUED				
C	19.02.25	JYC	UPDATED & REISSUED				
B	25.10.24	JYC	REVISED ISSUE				
A	12.07.24	JYC	PRELIMINARY ISSUE				

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

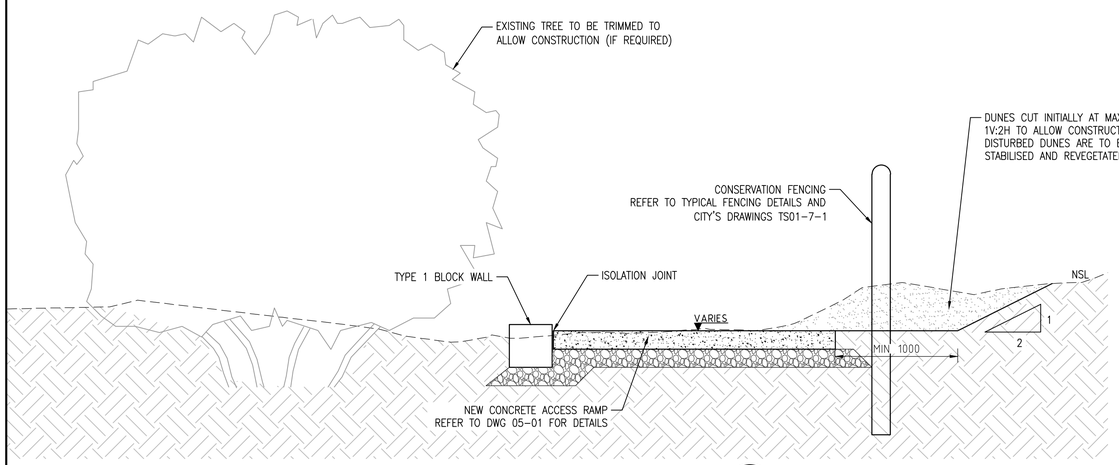
CLIENT City of Wanneroo

DESIGNED	CHECKED	APPROVED
J CHEN	T HUNT	
DRAWN	CHECKED	
R BORJA	J CHEN	

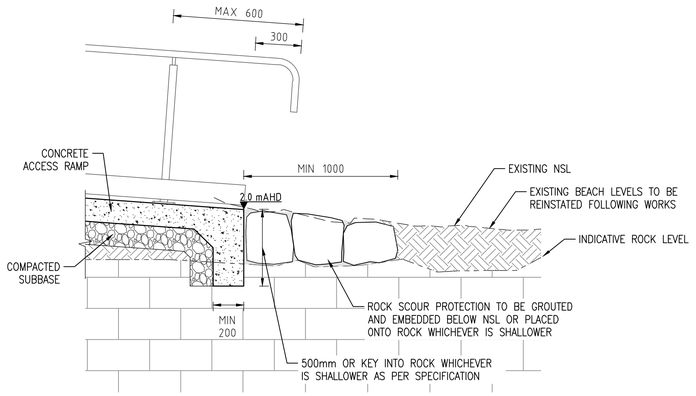
m p rogers & associates pl
coastal and port engineers
Suite 1, 128 Main Street
Osborne Park 6017
Western Australia
t: +61 8 9254 6600
f: +61 8 9254 6699
admin@coastsandports.com.au

PROJECT: MINDARIE TEES COURT BEACH ACCESS WAY
TITLE: LAYOUT & SECTION
SCALE AT A1: AS SHOWN
DRAWING NUMBER: D2145-03-01
REV: D

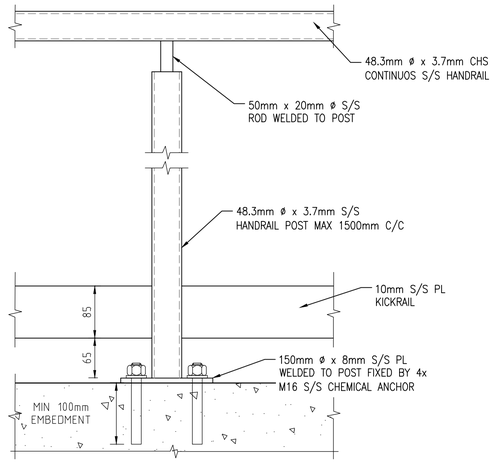
AT CORRECT SCALE THIS IS 100 mm



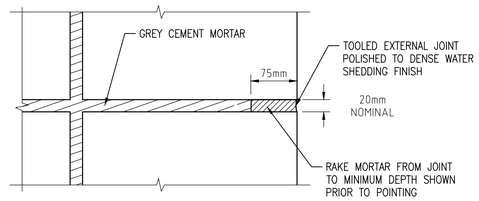
SECTION B 03-01
1:25



TYPICAL END RAMP AND HANDRAIL DETAILS
1:20

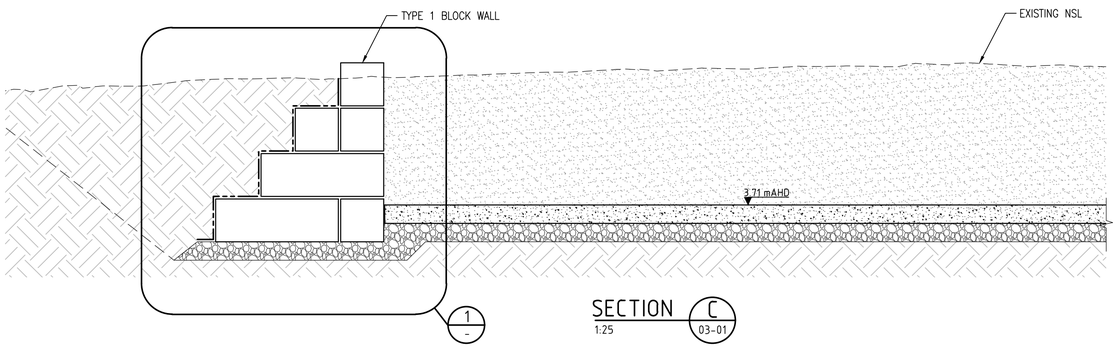


TYPICAL HANDRAIL DETAILS
1:5

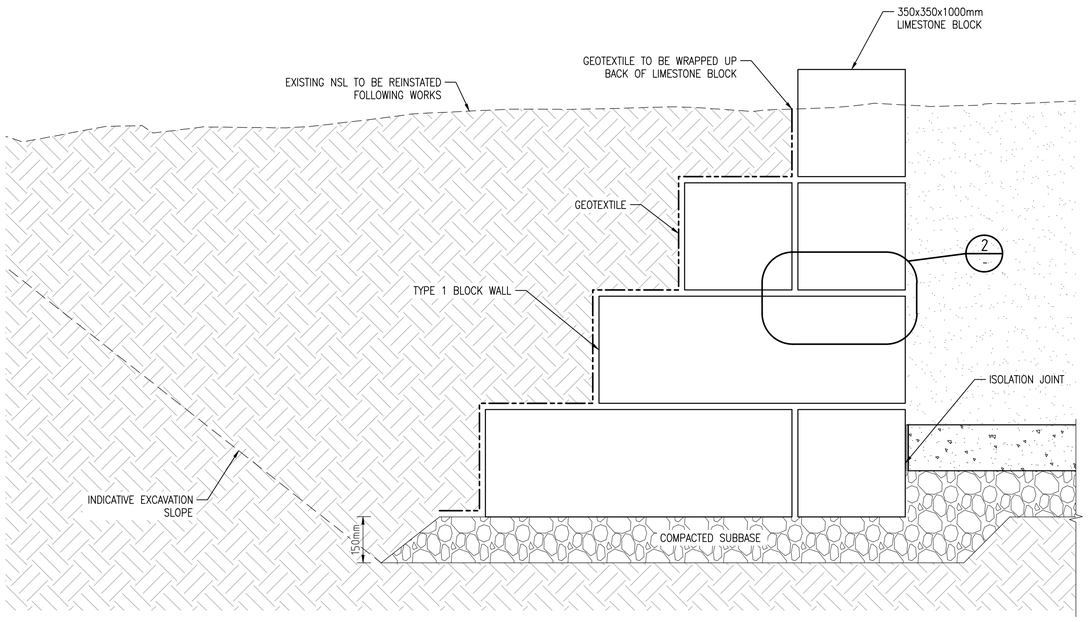


DETAIL 2 -
1:5

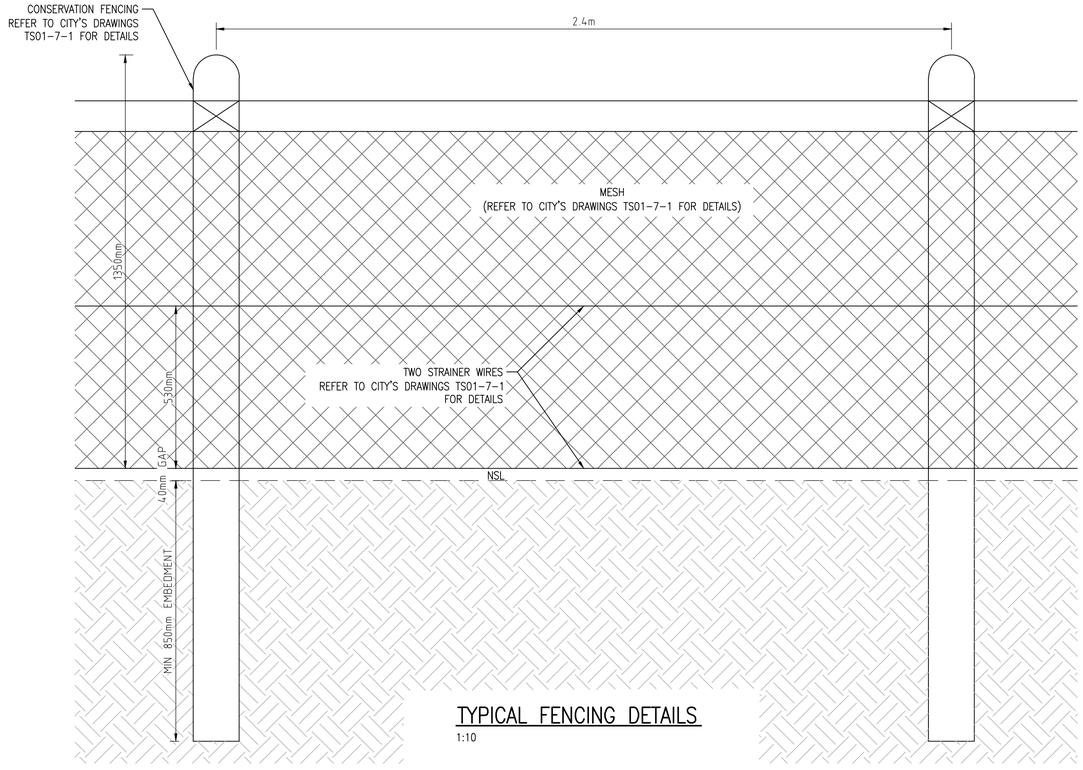
TYPICAL MORTAR DETAILS



SECTION C 03-01
1:25



DETAIL 1 -
1:10



TYPICAL FENCING DETAILS
1:10

CAD:D21450401[C]

AT CORRECT SCALE THIS IS 100 mm

REV	DATE	APPROVED	AMENDMENT	REV	DATE	APPROVED	AMENDMENT
C	19.02.25	JYC	UPDATED & REISSUED				
B	25.10.24	JYC	REVISED ISSUE				
A	12.07.24	JYC	PRELIMINARY ISSUE				

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

CLIENT City of Wanneroo

DESIGNED	CHECKED	APPROVED
J CHEN	T HUNT	
DRAWN	CHECKED	
R BORJA	J CHEN	

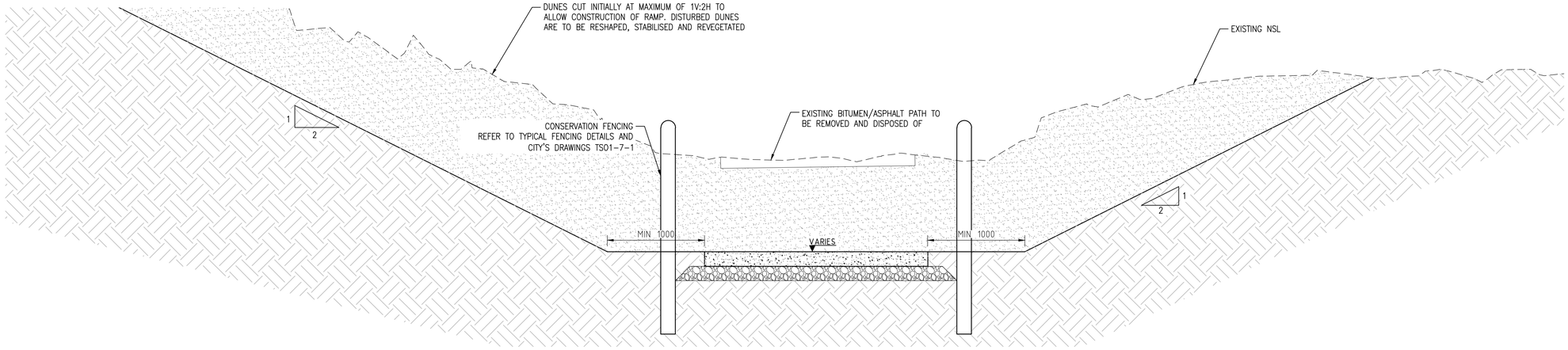
m p rogers & associates pl
coastal and port engineers
Suite 1, 128 Main Street
Osborne Park 6017
Western Australia
t: +61 8 9254 6600
f: +61 8 9254 6699
admin@coastsandports.com.au

PROJECT MINDARIE TEES COURT BEACH ACCESS WAY

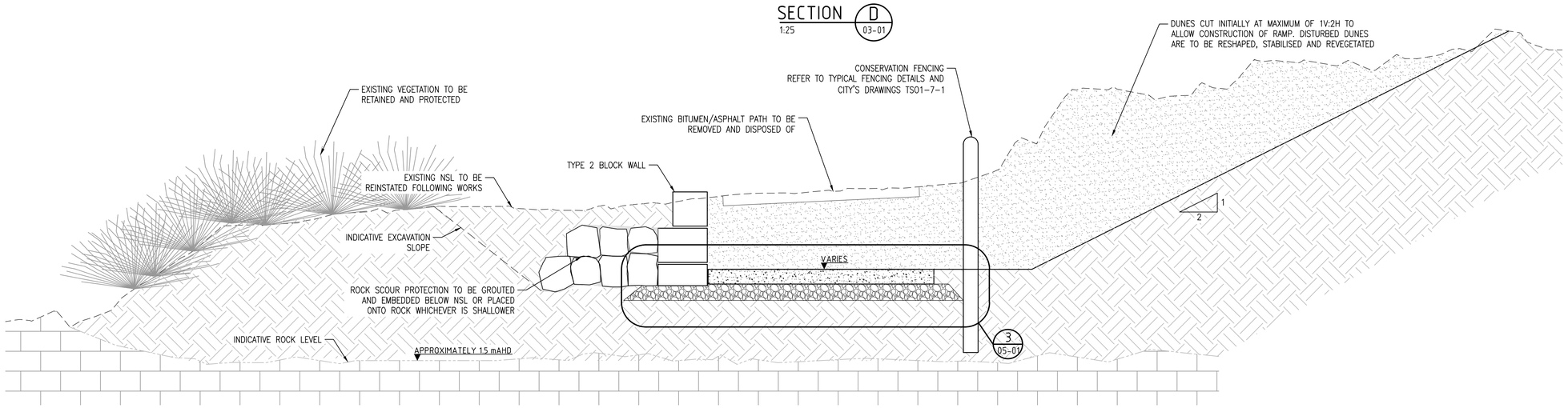
TITLE SECTIONS & DETAILS SHEET 1 OF 2

SCALE AT A1	DRAWING NUMBER	REV
AS SHOWN	D2145-04-01	C

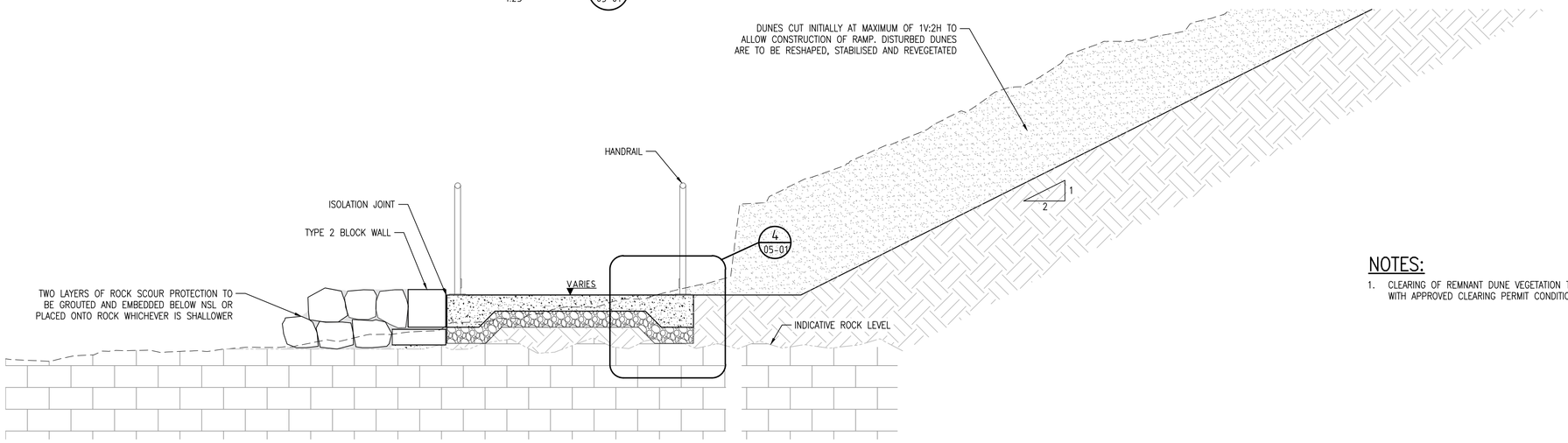
AT CORRECT SCALE THIS IS 100 mm



SECTION D
1:25
03-01



SECTION E
1:25
03-01



SECTION F
1:25
03-01

NOTES:

1. CLEARING OF REMNANT DUNE VEGETATION TO COMPLY WITH APPROVED CLEARING PERMIT CONDITIONS.

CAD:D21450402[C]

AT CORRECT SCALE THIS IS 100 mm

REV	DATE	APPROVED	AMENDMENT	REV	DATE	APPROVED	AMENDMENT
C	19.02.25	JYC	UPDATED & REISSUED				
B	25.10.24	JYC	REVISED ISSUE				
A	12.07.24	JYC	PRELIMINARY ISSUE				

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

CLIENT City of Wanneroo

DESIGNED	CHECKED	APPROVED
J CHEN	T HUNT	
DRAWN	CHECKED	
R BORJA	J CHEN	

m p rogers & associates pl
coastal and port engineers
Suite 1, 128 Main Street
Osborne Park 6017
Western Australia
t: +61 8 9254 6600
f: +61 8 9254 6699
admin@coastsandports.com.au

PROJECT: MINDARIE TEES COURT BEACH ACCESS WAY

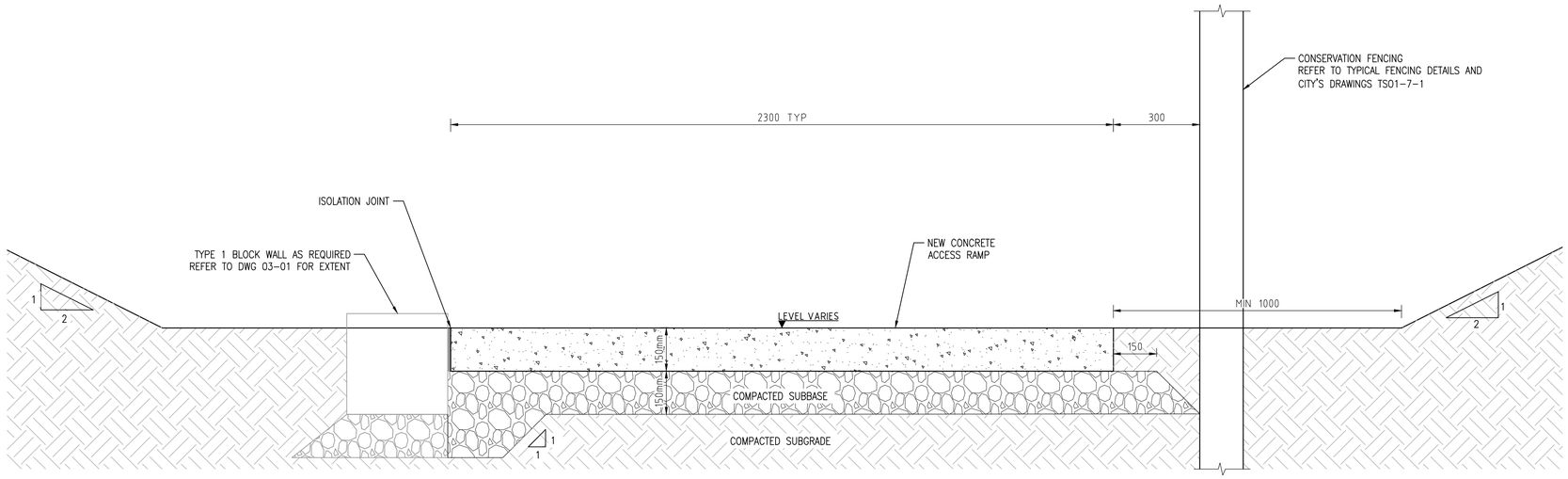
TITLE: SECTIONS & DETAILS
SHEET 2 OF 2

SCALE AT A1: AS SHOWN

DRAWING NUMBER: D2145-04-02

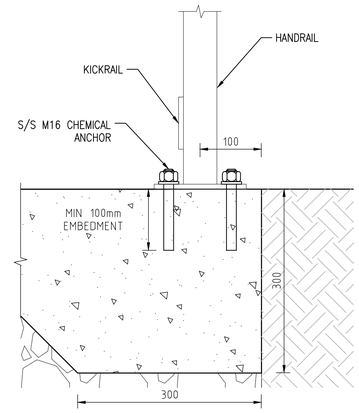
REV: C

AT CORRECT SCALE THIS IS 100 mm



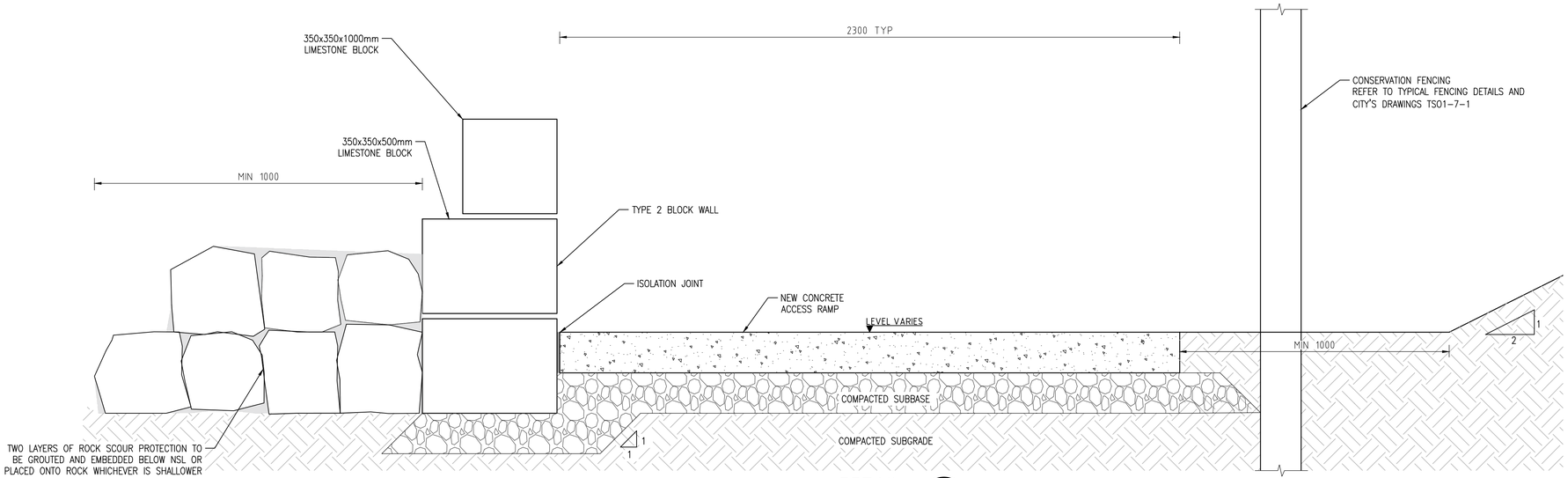
TYPE 1 BLOCK WALL – PATH DETAILS

1:10



DETAIL 4 / 04-02

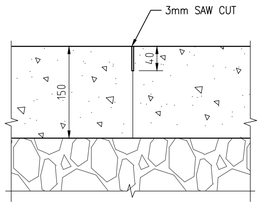
1:5



DETAIL 3 / 04-02

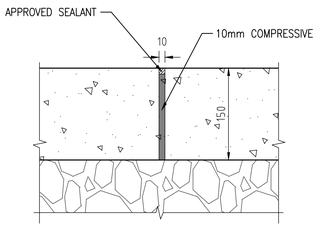
1:10

TYPE 2 BLOCK WALL – PATH DETAILS (SAND SURFACE)



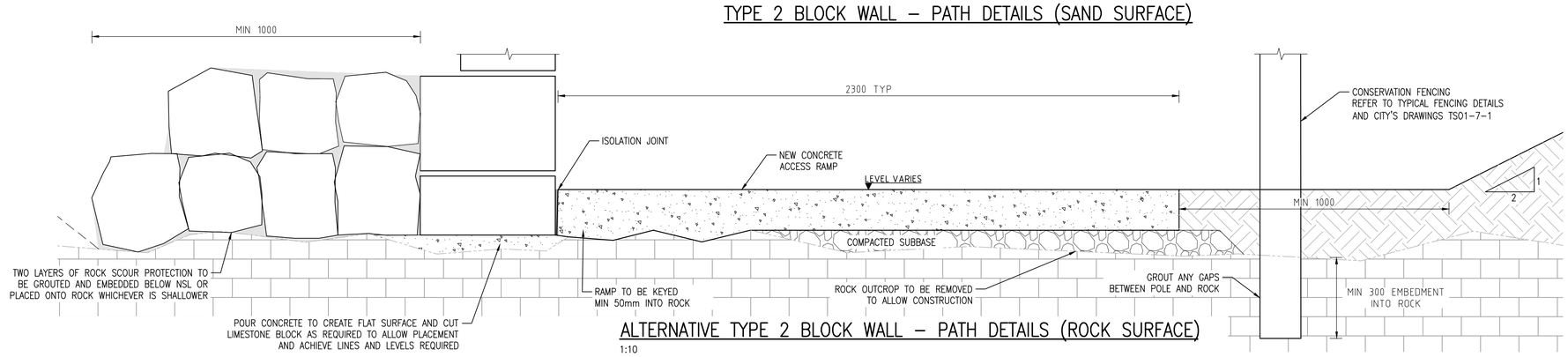
TYPICAL CONTRACTION JOINT DETAILS

1:5



TYPICAL ISOLATION/EXPANSION JOINT DETAILS

1:5



ALTERNATIVE TYPE 2 BLOCK WALL – PATH DETAILS (ROCK SURFACE)

1:10

NOTES:

1. ALTERNATIVE DETAIL TO BE USED WHERE SHALLOW ROCK LAYER IS ENCOUNTERED.
2. ALL CONCRETE FOR THE WORK SHALL BE 50 MPa AND IN ACCORDANCE WITH THE SPECIFICATION.

CAD:D21450501[C]

AT CORRECT SCALE THIS IS 100 mm

REV	DATE	APPROVED	AMENDMENT	REV	DATE	APPROVED	AMENDMENT
C	19.02.25	JYC	UPDATED & REISSUED				
B	25.10.24	JYC	REVISED ISSUE				
A	12.07.24	JYC	PRELIMINARY ISSUE				

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

CLIENT City of Wanneroo

DESIGNED	CHECKED	APPROVED
J CHEN	T HUNT	
DRAWN	CHECKED	
R BORJA	J CHEN	

m p rogers & associates pl
coastal and port engineers

Suite 1, 128 Main Street
Osborne Park 6017
Western Australia

t: +61 8 9254 6600
f: +61 8 9254 6699
admin@coastsandports.com.au

PROJECT: MINDARIE TEES COURT BEACH ACCESS WAY

TITLE: RAMP DETAILS

SCALE AT A1: AS SHOWN | DRAWING NUMBER: D2145-05-01 | REV: C

Appendix B Risk Register

SAFETY IN DESIGN REGISTER - CoW Mindarie Tees Ct BAW

Work Break Down Structure	Risk Identification			Risk Rating Before Treatment				Residual Risk Assessment			Residual Risk Allocation
Phase DE=Design C=Construction O=Operation M=Maintenance D=Demolition	**Hazard**	**Causes**	**Potential Consequences**	**Likelihood**	**Consequence**	**Rating**	**Mitigation Plan - Elimination Measure, Design Initiative or Control**	**Likelihood**	**Consequence**	**Rating**	**Residual Risk Owner (Contractor, Public & City)**
Design											
General											
DE	Design inadequate for purpose.	Design not completed in accordance with Standards or inexperienced designer	Personal injury, collapse of structure	3	3	12	Design completed by experienced coastal engineer to the required standards. Chartered Engineer with Engineers Australia reviewed the design.	1	3	7	City, Public
Concrete Access Ramp Design											
DE	Fall due to slip hazard.	Slippery surfaces due to water and marine growth on access ramp.	Death/personal injury.	3	4	19	access ramp designed to have a broomed finish to increase slip resistance. City to carry out regular maintenance and cleaning of access ramp surface.	1	4	13	City, Public
DE	Fall off edge.	Public access structure.	Personal injury.	2	4	14	A handrail and kerb installed at the edge.	1	4	13	City, Public
DE	Inundation and wave action.	Severe storm events.	Damage to structre and potential personal injury.	2	5	20	Ramp designed to cater for high winter water level event. The City to manage access during extreme event such as during severe storm.	1	4	13	City, Public
DE	Exposure of ramp foundation leading to instability of the ramp.	Severe storm erosion and long term shoreline recession.	Damage to structre and potential personal injury.	2	5	20	ramp designed to be founded on rock. There is also scour protection to protect against scour and erosion.	1	4	13	
DE	Injury to beach user due to loss of access.	Severe storm erosion and long term shoreline recession.	Personal injury.	2	4	14	Toe of ramp founded on rock to ensure access after severe storm erosion and shoreline recession.	1	3	7	City, Public
Construction											
General											
C	Public interference with site.	Poor site management and/or insufficient fence, signage.	Death/personal injury.	2	5	20	Contractor's management plans as well as Traffic, Pedestrian and Cyclist Management Plan to incorporate required mitigation measures. Appropriate signage, fencing.	1	5	15	Contractor, Public
C	Injury during construction.	Construction works.	Death/personal injury.	2	5	20	Contractor's management plans and construction methodology. OHS practices, training, PPE.	1	5	15	Contractor
C	Workers hit by moving plants on construction site.	Construction works.	Death/personal injury.	2	5	20	Contractor's management plans and construction methodology. OHS practices, training, PPE.	1	5	15	Contractor
C	Spill of pollutants into water.	Fuel, spills from construction machinery, boats or other	Public health and environmental issues	3	3	12	Contractor's management plans and construction methodology. Spill response kit to be used.	1	3	7	Contractor, Public
C	Damage to existing services & infrastructure during excavation.	Poor construction control and planning.	Delays and additional costs to rectify. Death/personal injury.	2	5	20	Contractor's management plans and construction methodology to be reviewed. Dial before you Dig, services located & marked.	1	3	7	Contractor
C	Injury due to noise and vibration.	Construction works.	Personal injury.	3	3	12	Contractor's management plans and construction methodology. OHS practices, training, PPE.	2	2	6	Contractor
Excavation & Demolition Works											
C	Damage to existing services & infrastructure during excavation.	Poor construction control and planning.	Delays and additional costs to rectify. Death/personal injury.	2	5	20	Contractor's management plans and construction methodology to be reviewed. Dial before you Dig, services located & marked.	1	3	7	Contractor
C	Collapse of shoring structures	Poor construction control and insufficient temporary shoring.	Personal injury and damage of equipment.	3	5	23	Contractor's management plans and construction methodology to be reviewed. OHS practices, training, PPE	2	4	14	Contractor
D	Contamination of soil.	Poor construction control. Contaminants from previous works.	Affect public health, amenity. Damage to environment.	2	4	14	Contractor's management plans and construction methodology to be reviewed.	1	4	13	Contractor
C	Hazardous substances used in structure to be demolished come into contact with person.	Removal of Asbestos and concrete platform.	Personal health affected.	3	4	19	Contractor's management plans and construction methodology. OHS practices, training, PPE.	2	2	6	Contractor
Concrete Access Ramp											
C	Crush injury.	Lifting/placing of piles.	Death/personal injury.	2	5	20	Contractor's management plans and construction methodology. OHS practices, training, PPE	2	4	14	Contractor
C	Formwork collapse	Inadequate supports for formwork.	Injury.	3	4	19	Contractor's management plans and construction methodology. OHS practices, training, PPE.	2	2	6	Contractor
Operations & Maintenance											
Concrete Access Ramp											
O	Fall due to slippery surface.	Slippery surfaces due to water and marine growth on access ramp.	Personal injury.	3	4	19	City to complete regular maintenance and cleaning of access ramp surface.	1	4	13	City, Public
M	Injury during maintenance.	Maintenance to concrete access ramp.	Death/personal injury.	3	3	12	Contractor's management plans and construction methodology. OHS practices, training, PPE. MRA designed concrete access ramp to high standard to reduce potential maintenance requirements.	2	2	6	Contractor
O	Inundation of foreshore.	Severe water level events	Death/personal injury.	2	5	20	City to manage beach access during extreme events.	1	5	15	City, Public
Decommissioning and Demolition at end of Service Life											
D	Structure uncontrolled collapse during demolition.	Poor construction control and insufficient temporary shoring.	Injury and damage of equipment.	2	5	20	Contractor's management plans and deconstruction methodology to be reviewed. OHS practices, training, PPE.	1	5	15	Demolition Contractor
D	Contamination of soil.	Poor construction control. Contaminants from previous works.	Affect public health, amenity. Damage to environment.	2	4	14	Structures does not use any hazardous substances, convention construction materials used.	1	3	7	City, Public

m p rogers & associates pl
www.coastsandports.com.au