Proposed Upgrade of Coffs Harbour Regional Boat Ramp Stages 1 and 2

Review of Environmental Factors

Transport for NSW

Book 1 of 2

November 2020

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Accepted on behalf of Transport for NSW by:	Patrick Smyth Project Manager Infrastructure Maritime Infrastructure Delivery Office
Signed:	
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Draft 1	06/11/2020	Lisa Proctor	Greg Collins, Patrick Smyth
Final Draft	13/11/2020	Lisa Proctor	Greg Collins, Patrick Smyth
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Executive summary

The proposal

Transport for NSW proposes to upgrade the Coffs Harbour Regional Boat Ramp on the southern side of Jetty Beach at Coffs Harbour. The proposal is being designed and constructed in two stages:

Stage 1 of the proposal includes:

- Extension of the existing breakwater further north by approximately 75m including a sealed access roadway.
- Existing Essential Energy pole and street light adjacent to boat ramp to be removed. Associated service to sign and CCTV to also be removed. Pole to be replaced with private lighting and supply point as part of Stage 2 design.
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- Widening of the existing boat ramp with an additional two lanes to create a total of six lanes. The existing boat ramp would be topped with concrete to address the poor condition.
- The existing pontoon would be extended by up to 15m and an additional two pontoons would be constructed to the south. The new pontoons would be up to 40m in length. Pile would be driven for each pontoon.
- Dredging of the existing boat ramp basin and channel to -2.5m AHD and transport of the sand to Park Beach via truck.
- Ongoing dredging of channel required to keep operational during construction

Construction of Stage 1 is expected to commence in May 2021 and would take approximately eight months to complete. It is intended to keep the facility open for use during works with some short-term closures possible on occasion.

Stage 2 of the proposal includes:

- Extension of the existing main carpark to include additional parking for cars, boats and trailers.
- A new entrance at the western end of the existing carpark.
- Relocation of the entry from Jordan Esplanade, adjacent to the boat ramp, for safety reasons.
- Diversion of Jordan Esplanade opposite the main carpark, to improve safety.
- New signage.
- New rigging and de-rigging bays around the main carpark.
- A new shared pathway for walking and cycling.
- New lighting.
- Recreational furniture and embellishments including amenities, seating, tables and fish cleaning facilities.
- Landscaping.
- Extension of services including water, power and sewerage.

Construction of Stage 2 is expected to commence in July 2022 and would also take approximately eight months to complete.

Need for the proposal

The Coffs Harbour Regional Boat Ramp is located in a small basin on the southern side of the harbour. Since the original boat ramp and basin was constructed in the mid-1970s there has been a history of difficulties launching and retrieving boats and navigating vessels in the entrance channel to the boat ramp. Following construction, the boat ramp basin regularly suffered from water level surges. Operational difficulties were also experienced in the vicinity of the boat ramp during times that north-easterly swells entered the harbour.

Previous studies recognised that seiching of the harbour can drive water level oscillations within both the inner harbour (on the north side of the main harbour) and the boat ramp basin. Seiching is where a standing wave within an enclosed, or partially enclosed area, sways back and forth.

In addition, sediment migrates into the boat ramp basin creating additional navigation and operational problems. Frequent removal of sediment from the boat ramp basin and navigation channel region is required to maintain the serviceability of the boat ramp.

In 2018 a group of community members formed the Coffs Harbour Regional Boat Ramp Precinct Enhancement Committee (CHRBRPEC) with a vision to develop the boat ramp precinct into a world class facility to meet the high demand for present day and future use of the boat ramp. Safety and congestion issues have been identified by CHRBRPEC to be addressed as a priority. The safety and congestion issues raised by CHRBRPEC have been endorsed by Coffs Harbour City Council.

Proposal objectives

The proposal objectives are the result of a collaboration between key community and agency stakeholders. They are:

1. To improve the safety of the Coffs Harbour Regional Boat Ramp.
2. To increase the capacity of the Coffs Harbour Regional Boat Ramp.
3. To enhance the facilities in the area to create a “boat ramp precinct”.
4. To improve the amenity of the site to create a destination.

Options considered

At the time of the initial options development, physical model testing was being undertaken to assess the potential impacts of the proposed extension of the breakwater. The results indicated that the proposed breakwater extension would be effective at reducing wave energy in the basin, and as such, all concept options for the boat ramp upgrade assumed that a breakwater extension would be included in the proposal to meet the safety objectives.

The initial options were broken down into:

a) **Masterplan Options** - Carpark / Road Alignment Options including formal and informal carparking, adjustments to Jordan Esplanade and other improvements such as amenities, footpaths, landscaping, etc.
b) **Boat Ramp Options”** - Boat Ramp / Basin Options including the boat ramp, pontoons and breakwater extension.

Masterplan Option 1 – Western Rd Diversion

Masterplan Option 1 (Figure 25 of Appendix G) was developed with a view to diverting Jordan Esplanade to the south on the western side of the of the boat ramp facility. The objective of this approach was to maximise the space available within the main carpark. The option also included carpark upgrades to approximately 100 car parking spaces in the main carpark, which has the advantage of maximising the number of boat and trailer parking spots available immediately adjacent to the boat ramp.

The key disadvantage of this option is that it would require a significant retaining wall along the southern side of Jordan Esplanade, which would be costly and possibly unsightly. The other main disadvantage is that it would encroach significantly towards the former Deep Sea Fishing Club site, which is ear-marked for redevelopment by Property NSW. The option included ancillary overflow parking in the areas to the south of Jordan Esplanade, both to the west and east of the existing Gallows Beach carpark.

Masterplan Option 2 – No Road Diversion

Masterplan Option 2 (Figure 26 of Appendix G) was developed with a view to avoiding any diversion of Jordan Esplanade. The objective of this approach was to maximise the space available within the main carpark, without road diversion. This option also included carpark upgrades to approximately 65 carparking spaces in the main carpark, however this would require further encroachment into the existing grassed area to the west.

The key advantages of this option are that it would not require any road diversion or significant retaining walls, and that it would not encroach significantly towards the former Deep Sea Fishing Club site. The option also included ancillary overflow parking in the areas to the south of Jordan Esplanade, both to the west and east of the existing Gallows Beach carpark. The disadvantage is that it encroaches a long way to the west, over valuable foreshore passive open space recreational land, with picnic tables.

Masterplan Option 3 – Eastern Road Diversion

Masterplan Option 3 (Figure 27 of Appendix G) was developed with a view to diverting Jordan Esplanade to the south on the eastern side of the of the boat ramp facility. The objective of this approach was to provide a formalised overflow carpark on the eastern side of the boat ramp, while also making more space available within the main carpark. The option also included carpark upgrades to approximately 65 car parking spaces in the main carpark, and a further 50-100 formalised car and trailer spaces in the eastern carpark.

The key disadvantage of this option is that it would require a significant length of diversion for Jordan Esplanade, which would be costly and possibly unsightly. This option would also reduce significantly the amount of grassed open space foreshore land, converting almost all of the foreshore to paved carparking.

The only advantage is that it would not encroaching significantly towards the former Deep Sea Fishing Club site. The option also included ancillary overflow parking in the areas to the south of Jordan Esplanade, on the western side of the existing Gallows Beach carpark.

Masterplan Option 4 – Central / East Road Diversion

Masterplan Option 4 (Figure 28 of Appendix G) was developed with a view to diverting Jordan Esplanade to the south immediately adjacent to the boat ramp (to make room for a main carpark upgrade), but also on the eastern side of the of the boat ramp to provide additional formalised carparking. The objective of this approach was that the area to the west of the main carpark was considered valuable open space, and it was considered that encroaching into this area would be problematic for Council.

The option included carpark upgrades to approximately 75 car parking spaces in the main carpark, and a further 50-100 formalised car and trailer spaces in the eastern carpark. This option had the advantage of not encroaching significantly towards the former Deep Sea Fishing Club site, although a minor encroachment would be required into the unused grassed area to north-east of the former Deep Sea Fishing Club. The disadvantage of this option is that it would require a significant length of diversion for Jordan Esplanade, which would be costly and possibly unsightly, leading to a significant length of the foreshore being converted to paved car parking. The option also included ancillary overflow parking in the areas to the south of Jordan Esplanade, on the western side of the existing Gallows Beach carpark.

Boat Ramp Option 1 – 6 Lanes, 3 Pontoons

Boat Ramp Option 1 (Figure 29 of Appendix G) was developed with six (6) boat ramp lanes (i.e. two additional lanes to the east of the existing four-lane ramp). In addition, a total of three (3) pontoons was proposed (i.e. two additional pontoons, one in the middle, and one on the eastern end).

This option also considered the extension of the breakwater by up to 75m (based on the preliminary advice available at the time regarding the impacts of the breakwater extension).

This option also included the construction of a rock spur on the western side of the basin to direct wave energy that propagates through the entrance channel towards the beach on the eastern side of the basin, away from the vessel berthing and launching area. The rock spur was discounted from this option, and all of the other boat ramp options as the breakwater extension was modelled to be effective at achieving the same wave energy dissipation outcome.

Boat Ramp Option 2 – Minor Ramp Widening

Boat Ramp Option 2 (Figure 30 of Appendix G) was developed with a widening of the existing four lane ramps to accommodate a second pontoon on the eastern side of the ramp, and providing the standard 4 x 4m wide lanes.

The option also considered the potential to adjust the western pontoon, to bring it closer to the western revetment of the basin, to reduce congestion in the basin.

Boat Ramp Option 3 – 5 Lanes, 2 Pontoons

Boat Ramp Option 3 (Figure 31 of Appendix G) was developed with five (5) boat ramp lanes (i.e. one additional lane to the east of the existing four-lane ramp). A second pontoon was proposed to the east of the third lane (i.e. approximately centrally on the ramp).

Boat Ramp Option 4 – 5 Lanes, 3 Pontoons

Boat Ramp Option 4 (Figure 32 of Appendix G) was developed with five (5) boat ramp lanes (i.e. one additional lane to the east of the existing four-lane ramp). A total of three (3) pontoons was proposed (i.e. two additional pontoons, one to the east of the third lane and one on the eastern end).

All options are described and illustrated in full in Appendix G.

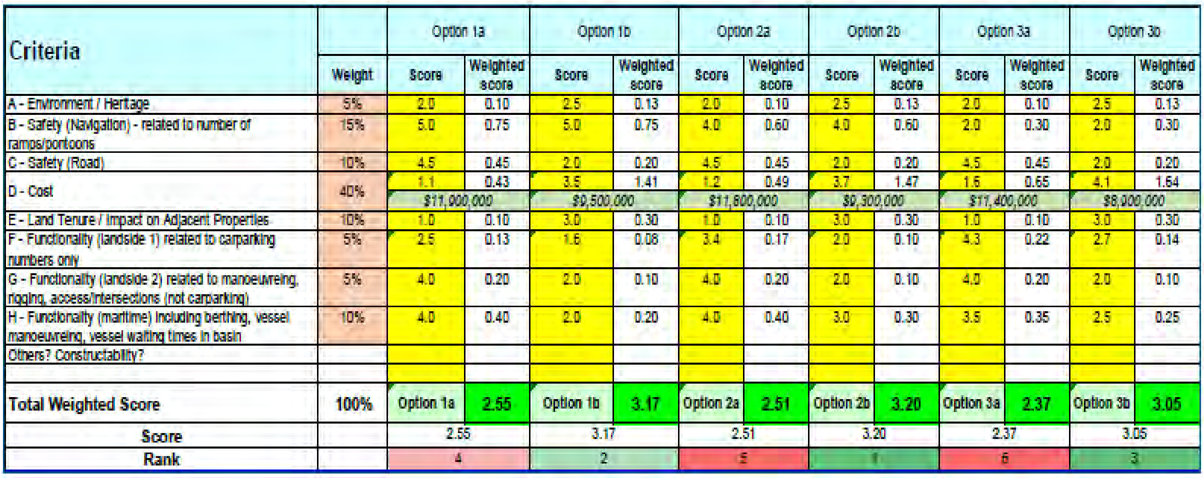
The ‘do nothing’ option was not considered appropriate for carrying forward as it would not achieve any of the proposal’s objectives. The ‘do minimum’ option was considered to involve only ongoing maintenance dredging of the basin and was not considered appropriate for carrying forward as it would not achieve any of the proposal’s objectives. These two options were not considered further in the options assessment.

Following the initial workshop a number of options were progressed into a Multi-Criteria Assessment (MCA).

The following seven criteria were used in the MCA to develop a preferred option. The weighting for each criteria was assigned by the working group based on perceived level of importance of each criteria in carrying forward the proposal as shown below:

Criteria	Adopted Weighting
A - Environment / Heritage – related to impacts on environmental or heritage values	5%
B - Safety (navigation) - related to the number of ramps/pontoons.	15%
C - Safety (road) – related to the effectiveness of any road / intersection access	10%
D - Cost (financial).	40%
E - Land tenure / impact on adjacent properties	10%
F - Functionality related to carparking numbers	5%
G - Functionality (land) related to manoeuvring, rigging, access/intersections	5%
H - Functionality (maritime) including berthing, manoeuvring, vessel waiting times	10%

TfNSW had at this point in time received confirmation of a $10 million budget for the project, which was to cover the maritime aspects of the project, and any essential carpark and amenities upgrades to support the boat ramp facility upgrade. Therefore, it was essential that the preferred option was at least close to this budget. The results of the MCA are shown below:



Criteria		Option 1a		Option 1b		Option 2a		Option 2b		Option 3a		Option 3b	
	Weight	Score	Weighted score	Score	Weighted score	Score	Weighted score	Score	Weighted score	Score	Weighted score	Score	Weighted score
A - Environment / Heritage	5%	2.0	0.10	2.5	0.13	2.0	0.10	2.5	0.13	2.0	0.10	2.5	0.13
B - Safety (Navigation) - related to number of ramps/pontoons	15%	5.0	0.75	5.0	0.75	4.0	0.60	4.0	0.60	2.0	0.30	2.0	0.30
C - Safety (Road)	10%	4.5	0.45	2.0	0.20	4.5	0.45	2.0	0.20	4.5	0.45	2.0	0.20
D - Cost	40%	1.1	0.43	3.5	1.41	1.2	0.49	3.7	1.47	1.6	0.65	4.1	1.64
		$11,900,000		$9,500,000		$11,600,000		$9,300,000		$11,400,000		$8,900,000	
E - Land Tenure / Impact on Adjacent Properties	10%	1.0	0.10	3.0	0.30	1.0	0.10	3.0	0.30	1.0	0.10	3.0	0.30
F - Functionality (landside 1) related to carparking numbers only	5%	2.5	0.13	1.6	0.08	3.4	0.17	2.0	0.10	4.3	0.22	2.7	0.14
G - Functionality (landside 2) related to manoeuvreing, rigging, access/intersections (not carparking)	5%	4.0	0.20	2.0	0.10	4.0	0.20	2.0	0.10	4.0	0.20	2.0	0.10
H - Functionality (maritime) including berthing, vessel manoeuvreing, vessel waiting times in basin	10%	4.0	0.40	2.0	0.20	4.0	0.40	3.0	0.30	3.5	0.35	2.5	0.25
Others? Constructability?													
Total Weighted Score	**100%**	Option 1a	2.55	Option 1b	3.17	Option 2a	2.51	Option 2b	3.20	Option 3a	2.37	Option 3b	3.05
Score		2.55		3.17		2.51		3.20		2.37		3.05	
Rank		4		2		5		1		6		3	

From the MCA exercise, the option known as ‘Option 2b’ scored the highest and was initially identified as the preferred option. Option 2b was considered to be the best option ‘on balance’, however, Option 1b scored similarly.

Based on feedback at a second stakeholder progress workshop held on 29 May 2020, CHBRPEC and TfNSW preferred to adopt Option 1b, as it was still within the $10 million budget allocation, and provided a more robust boat ramp facility to cater for potential future boating demands. All participants in the workshop agreed that the ‘maritime’ works proposed as part of Option 1b should be adopted, that is as follows:

(i) Six (6) lane, three (3) pontoon boat ramp.

(ii) 75m breakwater extension.

(iii) Dredging to a depth of RL -2.5 within the basin to ensure that the existing boat ramp basin and entrance channel complied with design bed levels.

(iv) Consideration of the need to undertake ongoing maintenance dredging to control ongoing shoaling of the end of the extended breakwater, entrance channel and boat ramp basin.

At the same workshop on 29 May 2020, officers from Coffs Harbour City Council expressed concerns with the amount of formalised carparking being proposed in the preferred option. This option exceeded Council's expectations for parking and would encroach on a public reserve. Council's preference, if additional parking needs to be provided, would be to provide informal grassed overflow parking along the verges of Jordan Esplanade.

Coastal process modelling undertaken in later stages noted that an increase in the length of the breakwater to 75m would result in an improvement to vessel navigation safety by increasing the area for vessels to manoeuvre in the lee of the breakwater, as they enter or leave the boat ramp entrance channel, and would include some additional safety contingency between maintenance dredging works due to the longer time for a shoal to form at the head of the breakwater. Given this, a 75m breakwater extension has been adopted in the final concept design. The modelling also showed that regularly dredging the boat ramp basin and entrance channel will typically result in milder wave conditions within the boat ramp basin and will not have an adverse impact on existing wave behaviour in the basin and at the boat ramp and that the deepening has the benefit of improved navigation and serviceability for vessels using the boat ramp. There are plans for a formal survey and dredging program every 12 months in collaboration with Coffs Harbour City Council.

As the detailed design develops, it is likely that further refinements to the concept design will be made, particularly on the basis of constructability and cost, though the major design components and the design footprint will remain the same.

Statutory and planning framework

As the proposal is for the purpose of boating facilities and is to be carried out by TfNSW, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* and development consent from Council is not required.

The proposal is not State significant infrastructure or State significant development.

This REF fulfils TfNSW's obligation under Section 5.5 of the EP&A Act to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

Community and stakeholder consultation

A working group was established in late 2019 to inform the design, program and delivery of the project. The working group meets every three (3) months and consists of staff from Transport for NSW; the Department of Planning, Industry and Environment; Coffs Harbour City Council; Property NSW and community members from the Coffs Harbour Boat Ramp Precinct Enhancement Committee.

This REF will be publicly displayed on the TfNSW website and available for viewing in hard copy at the Coffs Harbour City Council office (Cnr Coff and Castle St, Coffs Harbour) for a period of 21 days. During that time the community will be invited to make submissions which will be formally considered, and responses provided in a submissions report, which would also be made available to the community on the TfNSW website.

The working group, comprising key community and agency stakeholders, will continue to meet regularly throughout the detail design stage.

Environmental impacts

The potential environmental impacts of the proposal are minimal as the works are an upgrade to an existing facility. The main environmental impact of the proposal is the amenity and disruption associated with the construction phase of the proposal.

Temporary Amenity Loss and Disruption

The duration of works is approximately six months for each stage. Works are not proposed outside of standard working hours, but if required for safety and efficiency reasons, would be subject to approval, notification and a management plan.

The primary source of noise during construction would be vehicles and machinery. Two piles will need to be driven for the purpose of the new pontoons. It is likely that this will be the most identifiable source of ‘nuisance’ noise; however, pile driving is likely to be complete within a day and therefore unlikely to attract significant complaint, particularly in light of the community’s support for the project. A Noise and Vibration Management Plan (NVMP) will be prepared and implemented. The NVMP will generally follow the approach in the *Interim Construction Noise Guideline* (ICNG) (DECCW, 2009) and identify:

- All potential significant noise and vibration generating activities associated with the activity.
- Feasible and reasonable mitigation measures to be implemented.
- Arrangements for consultation with potentially affected neighbours and sensitive receivers, including notification and complaint handling procedures.
- Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.
- Training of all site workers to familiarise them with the potential for noise impacts and measures to minimise noise during their activities.

Additional noise mitigation measures would be included to minimise exceedances and will include a range of communication methods with affected receivers.

Other amenity issues during construction may include traffic delays and temporary closure of the boat ramp during dredging or breakwater extension. Written notifications advising of the works including dates, times and navigation restrictions will be circulated to all commercial vessel operators that use the waters within and around Coffs Harbour not less than 21 days prior to works commencing. Signage advising waterway users of the works and the potential effect on navigation will be erected at the proposal site at least two weeks prior to the commencement of works.

Justification and conclusion

The proposal will provide additional lanes for launching and retrieving of vessels, an improved basin environment for increased safety, and improved parking facilities, reserve embellishments and landscaping.

The proposal will support the NSW Government’s *Maritime Infrastructure Plan* (NSW Government, 2019) which identifies Coffs Harbour as a key regional port and investment location for the continued growth of tourism and recreational boating opportunities.

Any potential negative impacts would be temporary and associated with inconveniences caused as a result of construction. The overall long-term benefits of the proposal outweigh the short-term adverse impacts. Management measures have been developed to avoid, minimise and/or mitigate any potential environmental impact. Based on the findings of this REF, the proposal is considered justified and the proposal should proceed subject to the safeguards and management measures detailed in this REF.

Display of the Review of Environmental Factors

This REF is on display for comment between 3 December and 17 December 2020. You can access the documents in the following ways:

Internet

The documents are available as pdf files on the Transport for NSW website at: https://www.rms.nsw.gov.au/projects/CoffsBoatRamp.html

Printed copies

The documents can be viewed at the following locations:

Transport for NSW Maritime, 33 James Craig Road, Rozelle NSW 2039

Coffs Harbour Library, Cnr Coff & Duke Streets, Coffs Harbour NSW 2450

Coffs Harbour City Council office, Cnr Coff and Castle Streets, Coffs Harbour NSW 2450

Copies by request

Printed and electronic copies are available by contacting:

CoffsBoatRamp@transport.nsw.gov.au

There may be a charge for hard copies, CD or USB.

How can I make a submission?

To make a submission about this proposal, please send your written comments to:

Coffs Harbour Boat Ramp Project, Locked Bag 5100, Camperdown NSW 1450

[CoffsBoatRamp@transport.nsw.gov.au]

Submissions must be received by COB 17 December 2020. Submissions will be managed in accordance with the Transport for NSW Privacy Statement which can be found here https://www.rms.nsw.gov.au/about/about-this-website/online-privacy-policy.html or by contacting CoffsBoatRamp@transport.nsw.gov.au and requesting a copy.

What happens next?

Transport for NSW will collate and consider the submissions received during public display of the REF.

After this consideration, Transport for NSW will determine whether or not the proposal should proceed as proposed and will inform the community and stakeholders of this decision.

If the proposal is determined to proceed, Transport for NSW will continue to consult with the community and stakeholders prior to and during construction.

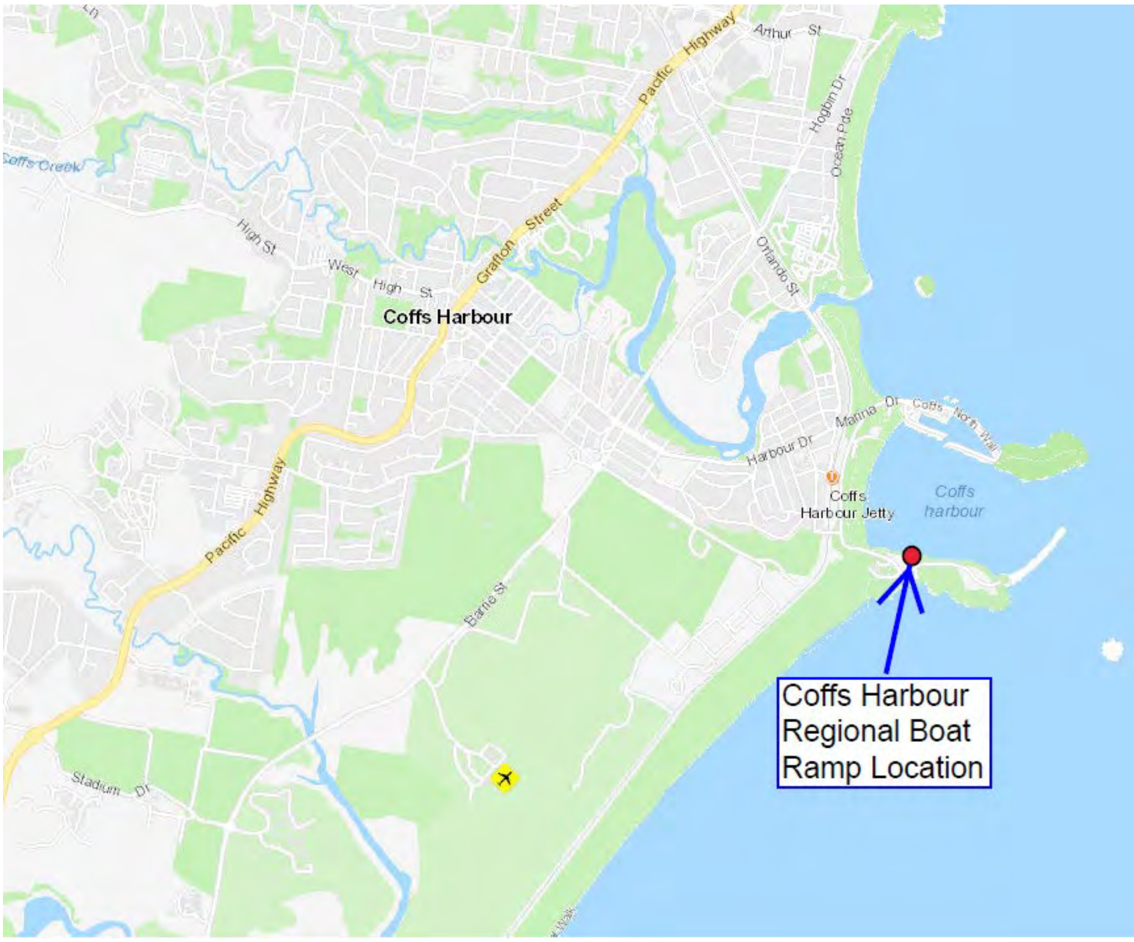
Contents

1 Introduction

1.1 Proposal identification

The proposal site is located in the Coffs Harbour Local Government Area on the north coast of NSW in between Jetty Beach to the north and Gallows Beach to the south.

The Coffs Harbour Regional Boat Ramp is located in a small basin on the southern side of the harbour as shown in Figure 1 below.



Coffs Harbour Regional Boat Ramp Location

Figure 1: Location of Coffs Harbour Regional Boat Ramp
Source: https://www.planningportal.nsw.gov.au/spatialviewer

The proposal footprint encompasses the boat ramp, car parking area, breakwater, part of Jordan Esplanade and a portion of the foreshore reserve as shown in Figure 2 below:

Figure 2: Proposal footprint

Source: https://apps.nearmap.com/maps

A number of heritage items are located in close proximity to the proposal, including the State listed Ferguson's Cottage and the locally listed Buried Trestle Bridge, Tramway Line Site and World War II Gun Turret.

The popular Coffs Harbour Jetty and International Marina are located on the northern side of the harbour. The environmentally significant Muttonbird Island Nature Reserve and Solitary Islands Marine Park are also located on the northern side of the Harbour. Jetty Beach runs the length of the harbour between the proposal site and the International Marina. The former Deep Sea Fishing Club building, now housing an events centre, is located to the west.

Stage 1 of the proposal includes:

- Extension of the existing breakwater by 75m and creation of an access roadway on the crest of the breakwater.
- Widening of the existing boat ramp with an additional three lanes.
- New topping over the existing boat ramp area.
- Extension of the existing pontoon.
- Two new pontoons.
- Dredging of the existing boat ramp basin and channel and deposition of dredged material at Park Beach.

Construction of Stage 1 is expected to commence in May 2021 and would take approximately eight months to complete. It is intended to keep the facility open for use during works as much as possible. Stage 1 works are shown below.

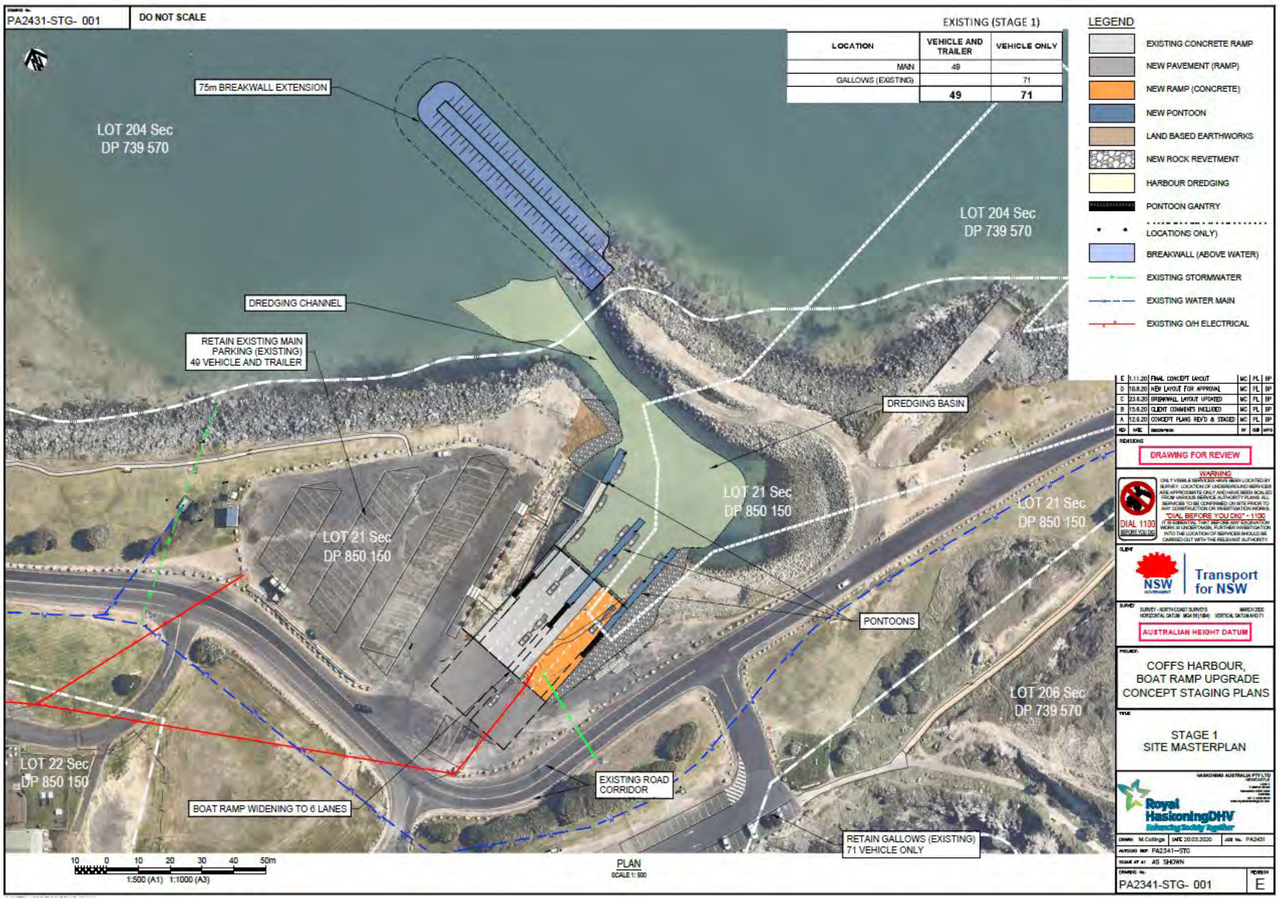


Figure 3: Stage 1 of the proposal

Stage 2 of the proposal includes:

- Extension of the existing main carpark to include additional parking for cars, boats and trailers.
- A new entrance at the western end of the existing carpark.
- Relocating the entry from Jordan Esplanade, adjacent to the boat ramp, for safety reasons.
- Diversion of Jordan Esplanade opposite the main carpark, to improve safety.
- New signage.
- New rigging and de-rigging bays around the main carpark.
- A new shared pathway for walking and cycling.
- A new amenities facility.
- New lighting.
- Recreational furniture and embellishments including seating, tables and fish cleaning facilities.
- A new pedestrian pathway on the south side of Jordan Esplanade with access to Gallows Beach carpark and to the amenities facility in the main carpark area.
- Landscaping.
- Extension of services including water, power and sewerage.

Construction of Stage 2 is expected to commence in July2021 and would also take approximately eight months to complete. Stage 2 works are shown below.

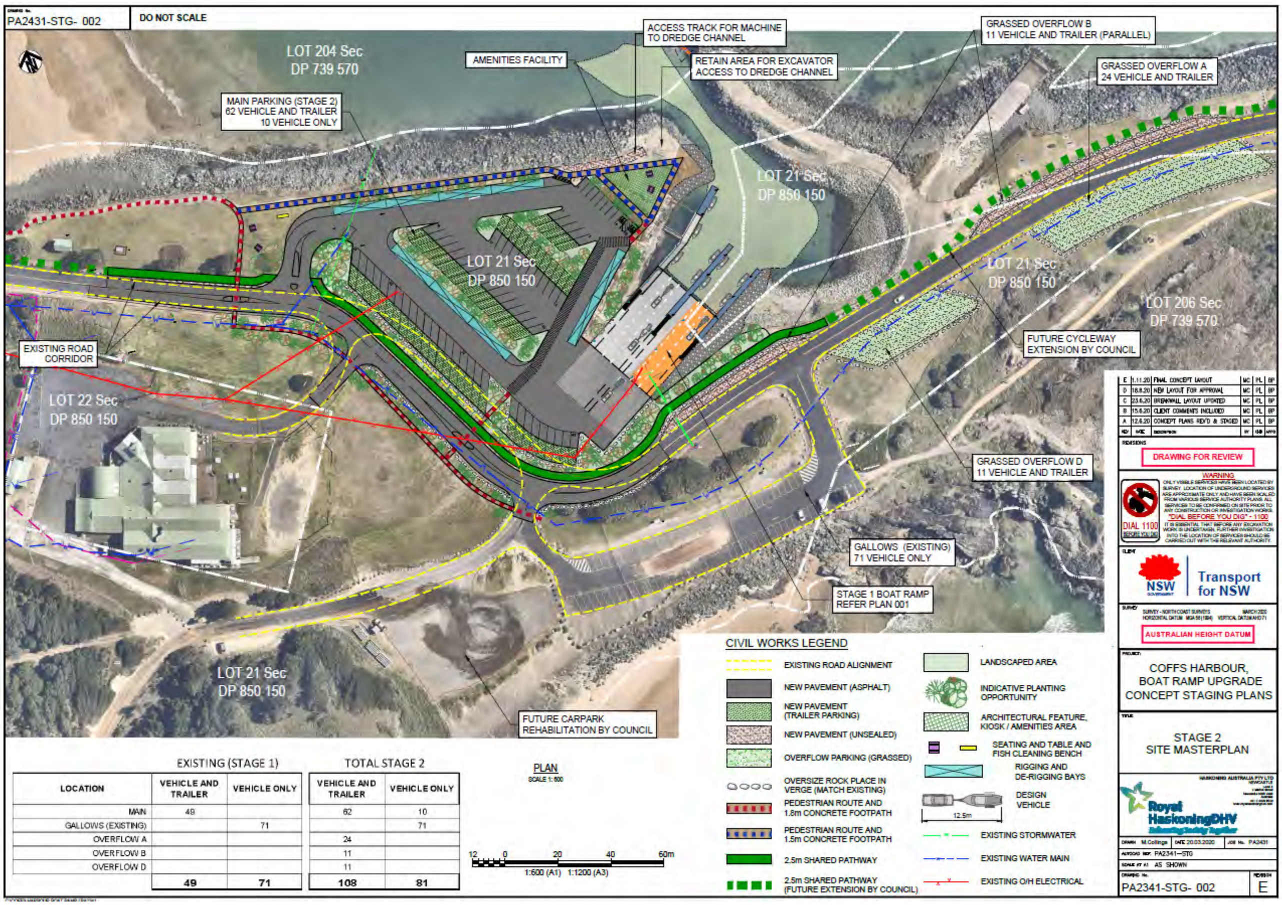


Figure 4: Stage 2 of the proposal

The project is described in more detail in Chapter 3 of this REF.

1.2 Purpose of the report

This Review of Environmental Factors (REF) has been prepared by Blue Sky Planning and Environment on behalf of Transport for NSW Maritime Infrastructure Delivery Office (MIDO). For the purposes of the proposal, Transport for NSW (TfNSW) is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail mitigation and management measures to be implemented.

The description of the proposal and assessment of associated environmental impacts has been undertaken in the context of clause 228 of the *Environmental Planning and Assessment Regulation 2000*, the factors in *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (DUAP, 1995/1996), the *Marinas and Related Facilities EIS Guideline* (DUAP, 1996), the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In doing so, the REF helps to fulfil the requirements of Section 5.5 of the EP&A Act including that TfNSW examine and take into account, to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act.

- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in Section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report.
- The potential for the proposal to significantly impact any matter of national environmental significance or Commonwealth land and the need to make a referral to the Australian Government Department of Agriculture, Water and Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

2 Need and options considered

This chapter describes the need for the proposal in terms of its strategic context and operational need. It identifies the various options considered and the selection of the preferred option for the proposal.

2.1 Strategic need for the proposal

The development of the port of Coffs Harbour was completed around 1946 with the construction of the southern, eastern and northern breakwaters. This interrupted the natural flow of sand, with the harbour acting as a sediment sink and infilling at a rate of around 25,700m^3 per year. (Australian Water and Coastal Studies, 1995).

In the late 1970s the boat ramp was constructed on the southern side of the harbour. Following construction, the boat ramp basin regularly suffered from water level surges and operational difficulties in the vicinity of the boat ramp during times that north-easterly swells entered the harbour. In 2015 the boat ramp basin was extended following numerical and physical modelling studies that indicated that wave action in the boat ramp basin could be reduced by up to 30%. Wave monitoring instruments deployed in the boat ramp basin before and after the extension works indicated a reduction in seiche action was achieved by the 2015 basin extension; however, on occasion, use of the boat ramp remains problematic, most notably by vessels entering the basin during times of low tide levels combined with wave action.

A group of stakeholders who use the Coffs Harbour boat ramp formed the Coffs Harbour Regional Boat Ramp Precinct Enhancement Committee (CHRBRPEC) with a vision to develop the boat ramp precinct into a world class facility to meet the high demand for use of the boat ramp by local and visiting mariners. Following a number of incidents, the safety and congestion of the site has been identified by CHRBRPEC as issues that require addressing as a matter of priority. Coffs Harbour City Council (CHCC) have endorsed the issues raised by CHRBRPEC and funding has been approved by Transport for NSW to undertake improvement works at the boat ramp facility.

Coffs Harbour is identified in the *NSW Maritime Infrastructure Plan 2019 – 2024* (NSW Government, 2019) as a key investment location. It is noted as a significant growth area and popular tourist destination for boaters. The proposal is identified in the Plan as a priority infrastructure outcome to inform future investment in the area.

The Plan establishes a strategic approach to improving maritime infrastructure and facilities to directly benefit users of the State’s waterways, and supports wider NSW Government priorities – including:

- NSW Premier’s Priorities.
- NSW State Infrastructure Strategy.
- Future Transport 2056.
- Maritime Safety Plan 2017-21.
- NSW Marine Estate Management Strategy.

Dredging of channels, protection of harbours and breakwaters, access via boat ramps and amenities and the provision of amenities and car parks are identified in the Plan as some of the main maritime infrastructure needs.

2.2 Existing infrastructure

The proposal site is located at the southern end of Jetty Beach where Jordan Esplanade passes the Coffs Harbour Regional Boat Ramp. The site comprises a level area of land which was reclaimed by filling during the 1950s and 1960s.

Jordan Esplanade is a two-lane sealed section of road which provides access to the boat ramp, Gallows Beach to the south and the southern breakwater further east.

The Coffs Harbour Regional Boat Ramp is constructed of concrete, with armour stone rockfill and tyres lining the basin. It has a single pontoon and is protected from direct wave impact by a small armour rock breakwater orientated in a north-west to south-east direction. There are walkways around the perimeter of the basin and along the small breakwater, constructed of both concrete and gravel in variable condition.

The carpark is sealed and is in moderate condition with some exposure of base materials. Parking spaces are marked but are weathered and in need of re-marking. The carpark provides parking for 49 vehicles with trailers and an additional 10 spaces for light vehicles without trailers immediately south of the boat ramp. A light, power pole and various signs are located on the southern side of the boat ramp.

A fish cleaning station, tables and chairs and a narrow concrete footpath are located on the northern side of the boat ramp. Bollards and large rocks line the interface between the carpark and the reserve. The photos below show the existing infrastructure at the proposal site:

	
Boat ramp breakwater to the north	Existing car and trailer parking area
	
Existing boat ramp, facing south -west	Fish cleaning station on the western side of the carpark

2.3 Proposal objectives and development criteria

2.3.1 Proposal vision and objectives

The CHRBRPEC set the vision for the proposal to be:

> "*The creation of a first-class boat ramp precinct, that provides safe launching, retrieval, and parking for watercraft, supplemented by a recreational area that has an amenities block, and fish and boat cleaning facilities, for use by the local community and visitors to our beautiful coast*. "

Coffs Harbour is identified in the *NSW Maritime Infrastructure Plan 2019 – 2024* (NSW Government, 2019) as a key investment location. It is noted as a significant growth area and popular tourist destination for boaters. The proposal is identified in the Plan as a priority infrastructure outcome to inform future investment in the area.

The proposal objectives are the result of a collaboration between key community and agency stakeholders. They are:

- To improve the safety of the Coffs Harbour Regional Boat Ramp.
- To increase the capacity of the Coffs Harbour Regional Boat Ramp.
- To enhance the facilities in the area to create a "boat ramp precinct".
- To improve the amenity of the site to create a destination.

2.3.2 Design criteria

The design criteria for the proposal are largely taken from the *NSW Boat Ramp Facility Guidelines* (RMS, 2015). Other relevant design standards and guidelines were applied where appropriate. For example, AS 3692 *Guidelines for design of marinas* provides guidance on design depth, which needs to account for a design water level of RL -0.97 at Coffs Harbour. Other design criteria are:

- Vessel draught of 0.9 m (for 8 m power boats).
- Wave height (H), with a recommended allowance of 0.5 x H = 0.25 m (adopting a 0.5 m seiche wave as the design condition).
- Under keel clearance (soft bottom) of 0.3 m.
- Design bed level of RL -2.5 which would typically result in milder wave conditions in the boat ramp basin and would not have an adverse impact on existing seiche behaviour in the basin and at the boat ramp.

The Concept Design Report at Appendix G contains the full details of the design criteria for the proposal.

2.3.3 Urban design objectives

The urban design objectives for the proposal relate to the master-planning of the site for increased community usage and an enhanced experience. These were developed during the options assessment process involving key community and agency stakeholders and the proposal's landscape designers. The urban design objectives for the proposal are:

- Separation of pedestrians / cyclists from vehicle movements along the peninsula is key to ensuring the amenity and safety of users.

- Vegetation screening of the main carpark from Jordan Esplanade and the former Deep-Sea Fishing Club is a priority to enable the preservation and enhancement of the user experience along the peninsula.

- Encouragement of pedestrian linkages to the southern side of the peninsula in the longer term, to connect to views over Gallows Beach, and then on to the end of the peninsula, where users enjoy the experience of the Coffs Harbour Southern Breakwater.
- Emphasising the amenity of the small peninsula on the western side of the boat harbour, to create a visually appealing, architecturally designed amenities block.
- Consider relocating part of Jordan Esplanade to achieve sufficient room for access past the carpark, (i.e., shared pedestrian / cycleway) and sufficient width to provide screening vegetation and vegetation buffers within the main carpark.
- Avoidance of unconsolidated gravel carparks that encourage unsociable vehicular behaviour and are unsightly. Grassed overflow areas should be sufficient for infrequently accessed overflow areas (i.e., areas only utilised during seasonal peak periods).

The Concept Design Report at Appendix G contains the full details of the urban design objectives for the proposal.

2.4 Alternatives and options considered

A number of options were investigated for achieving the objectives of the proposal. Preliminary options were presented to agency and community stakeholders at a workshop in early May 2020. Based on feedback from stakeholders at that workshop, a number of concept design options were progressed using a multi-criteria assessment methodology. The options were then costed and presented back to the external stakeholder group at a second workshop in late May 2020. Full details of the options assessment process are included in the Concept Design Report at Appendix G.

2.4.1 Identified options

At the time of the initial options development, physical model testing was being undertaken to assess the potential impacts of the proposed extension of the breakwater. The results indicated that the proposed breakwater extension would be effective at reducing wave energy in the basin, and as such, all concept options for the boat ramp upgrade assumed that a breakwater extension would be included in the proposal to meet the safety objectives.

The initial options were broken down into:

Masterplan Options (4) - Carpark / Road Alignment Options including formal and informal carparking, adjustments to Jordan Esplanade and other improvements such as amenities, footpaths, landscaping, etc.

Boat Ramp Options (4) - Boat Ramp / Basin Options including the boat ramp, pontoons and breakwater extension.

Masterplan Option 1 – Western Rd Diversion

Masterplan Option 1 (Figure 25 of Appendix G) was developed with a view to diverting Jordan Esplanade to the south on the western side of the of the boat ramp facility. The objective of this approach was to maximise the space available within the main carpark. The option also included carpark upgrades to approximately 100 car parking spaces in the main carpark, which has the advantage of maximising the number of boat and trailer parking spots available immediately adjacent to the boat ramp.

The key disadvantage of this option is that it would require a significant retaining wall along the southern side of Jordan Esplanade, which would be costly and possibly unsightly. The other main disadvantage is that it would encroach significantly towards the former Deep Sea Fishing Club site, which is ear-marked for redevelopment by Property NSW. The option included ancillary overflow parking in the areas to the south of Jordan Esplanade, both to the west and east of the existing Gallows Beach carpark.

Masterplan Option 2 – No Road Diversion

Masterplan Option 2 (Figure 26 of Appendix G) was developed with a view to avoiding any diversion of Jordan Esplanade. The objective of this approach was to maximise the space available within the main carpark, without road diversion. This option also included carpark upgrades to approximately 65 carparking spaces in the main carpark, however this would require further encroachment into the existing grassed area to the west.

The key advantages of this option are that it would not require any road diversion or significant retaining walls, and that it would not encroach significantly towards the former Deep Sea Fishing Club site. The option also included ancillary overflow parking in the areas to the south of Jordan Esplanade, both to the west and east of the existing Gallows Beach carpark. The disadvantage is that it encroaches a long way to the west, over valuable foreshore passive open space recreational land, with picnic tables.

Masterplan Option 3 – Eastern Road Diversion

Masterplan Option 3 (Figure 27 of Appendix G) was developed with a view to diverting Jordan Esplanade to the south on the eastern side of the of the boat ramp facility. The objective of this approach was to provide a formalised overflow carpark on the eastern side of the boat ramp, while also making more space available within the main carpark. The option also included carpark upgrades to approximately 65 car parking spaces in the main carpark, and a further 50-100 formalised car and trailer spaces in the eastern carpark.

The key disadvantage of this option is that it would require a significant length of diversion for Jordan Esplanade, which would be costly and possibly unsightly. This option would also reduce significantly the amount of grassed open space foreshore land, converting almost all of the foreshore to paved carparking.

The only advantage is that it would not encroaching significantly towards the former Deep Sea Fishing Club site. The option also included ancillary overflow parking in the areas to the south of Jordan Esplanade, on the western side of the existing Gallows Beach carpark.

Masterplan Option 4 – Central / East Road Diversion

Masterplan Option 4 (Figure 28 of Appendix G) was developed with a view to diverting Jordan Esplanade to the south immediately adjacent to the boat ramp (to make room for a main carpark upgrade), but also on the eastern side of the of the boat ramp to provide additional formalised carparking. The objective of this approach was that the area to the west of the main carpark was considered valuable open space and it was considered that encroaching into this area would be problematic for Council.

The option included carpark upgrades to approximately 75 car parking spaces in the main carpark, and a further 50-100 formalised car and trailer spaces in the eastern carpark. This option had the advantage of not encroaching significantly towards the former Deep Sea Fishing Club site, although a minor encroachment would be required into the unused grassed area to north-east of the former Deep Sea Fishing Club. The disadvantage of this option is that it would require a significant length of diversion for Jordan Esplanade, which would be costly and possibly unsightly, leading to a significant length of the foreshore being converted to paved car parking, The option also included ancillary overflow parking in the areas to the south of Jordan Esplanade, on the western side of the existing Gallows Beach carpark.

Boat Ramp Option 1 – 6 Lanes, 3 Pontoons

Boat Ramp Option 1 (Figure 29 of Appendix G) was developed with six (6) boat ramp lanes (i.e. two additional lanes to the east of the existing four-lane ramp). In addition, a total of three (3) pontoons was proposed (i.e. two additional pontoons, one in the middle, and one on the eastern end).

This option also considered the extension of the breakwater by up to 75m (based on the preliminary advice available at the time regarding the impacts of the breakwater extension).

This option also included the construction of a rock spur on the western side of the basin to direct wave energy that propagates through the entrance channel towards the beach on the eastern side of the basin, away from the vessel berthing and launching area. The rock spur was discounted from this option, and all of the other boat ramp options as the breakwater extension was modelled to be effective at achieving the same wave energy dissipation outcome.

Boat Ramp Option 2 – Minor Ramp Widening

Boat Ramp Option 2 (Figure 30 of Appendix G) was developed with a widening of the existing four lane ramps to accommodate a second pontoon on the eastern side of the ramp, and providing the standard 4 x 4m wide lanes.

The option also considered the potential to adjust the western pontoon, to bring it closer to the western revetment of the basin, to reduce congestion in the basin.

Boat Ramp Option 3 – 5 Lanes, 2 Pontoons

Boat Ramp Option 3 (Figure 31 of Appendix G) was developed with five (5) boat ramp lanes (i.e. one additional lane to the east of the existing four-lane ramp). A second pontoon was proposed to the east of the third lane (i.e. approximately centrally on the ramp).

Boat Ramp Option 4 – 5 Lanes, 3 Pontoons

Boat Ramp Option 4 (Figure 32 of Appendix G) was developed with five (5) boat ramp lanes (i.e. one additional lane to the east of the existing four-lane ramp). A total of three (3) pontoons was proposed (i.e. two additional pontoons, one to the east of the third lane and one on the eastern end).

All options are described and illustrated in full in Appendix G.

The ‘do nothing’ option was not considered appropriate for carrying forward as it would not achieve any of the proposal’s objectives. The ‘do minimum’ option was considered to involve only ongoing maintenance dredging of the basin and was not considered appropriate for carrying forward as it would not achieve any of the proposal’s objectives. These two options were not considered further in the options assessment.

2.4.2 Methodology for selection of the preferred option

Following the workshop in early May 2020, a number of options were progressed into a Multi-Criteria Assessment (MCA).

All of the options at this stage allowed for the inclusion of a 17,000 m^3 dredge pocket on the southern side of the existing breakwater. The purpose of the dredge pocket was to intercept sand from the sediment transport pathway before it could significantly accumulate around the seaward end of the breakwater and result in shoaling issues similar to present day hazards. A provisional cost of $1 million was allowed for the dredge pocket in each of the options.

The following seven criteria were used in the MCA to develop a preferred option. The weighting for each criteria was assigned by the working group based on perceived level of importance of each criteria in carrying forward the proposal:

Table 2-1: Options Assessment Criteria and Weighting

Criteria	Adopted Weighting
A - Environment / Heritage – related to impacts on environmental or heritage values	5%
B - Safety (navigation) - related to the number of ramps/pontoons.	15%
C - Safety (road) – related to the effectiveness of any road / intersection access	10%

Criteria	Adopted Weighting
D - Cost (financial).	40%
E - Land tenure / impact on adjacent properties	10%
F - Functionality related to carparking numbers	5%
G - Functionality (land) related to manoeuvring, rigging, access/intersections	5%
H - Functionality (maritime) including berthing, manoeuvring, vessel waiting times	10%

Other aspects considered in the MCA were the potential constructability issues with each option, and pedestrian / cyclist safety.

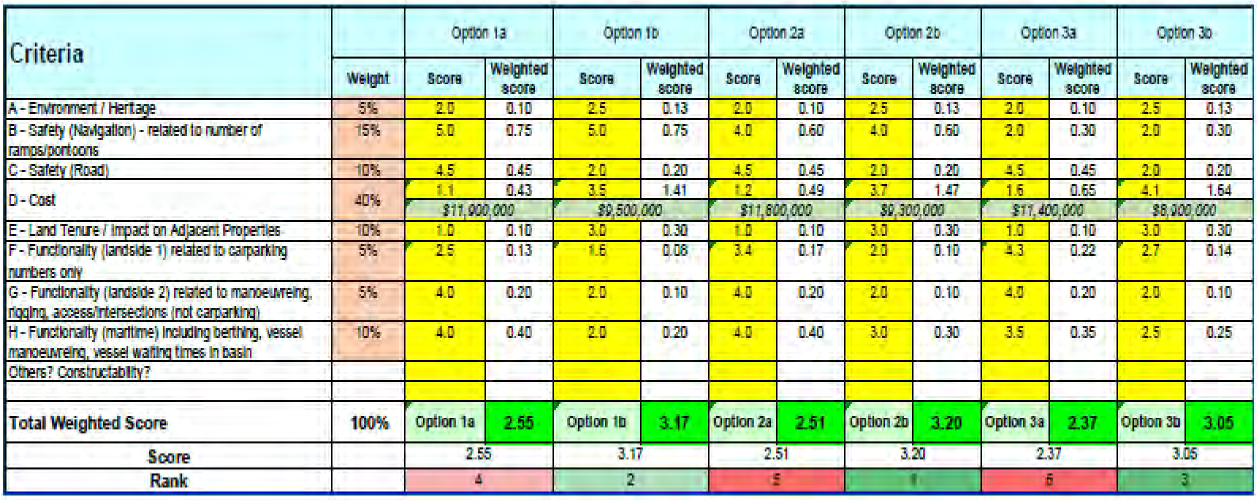
TfNSW had at this point in time received confirmation of a $10 million budget for the project, which was to cover the maritime aspects of the project, and any essential carpark and amenities upgrades to support the boat ramp facility upgrade. Therefore, it was essential that the preferred option was at least close to this budget. Therefore, the cost criterion was weighted to score higher those options that met this budget, and score lower those options that were higher than the budget allowance. The cost estimates prepared by the quantity surveyor are summarised below.

Table 2-2: Options progressed to MCA

Selected Concept Design Options	Preliminary Boating Option	Preliminary Masterplan Option	Cost Estimate (ex. GST)
Option 1a	Boat Ramp Option 1 (6 lanes, 3 pontoons)	MP Option 4 (Road Diversion)	$11,900,000
Option 1b		MP Option 2 (No Road Diversion)	$9,500,000
Option 2a	Boat Ramp Option 4 (5 lanes, 3 pontoons)	MP Option 4 (Road Diversion)	$11,800,000
Option 2b		MP Option 2 (No Road Diversion)	$9,300,000
Option 3a	Boat Ramp Option 3 (5 lanes, 2 pontoons)	MP Option 4 (Road Diversion)	$11,400,000
Option 3b		MP Option 2 (No Road Diversion)	$8,900,000

The working group’s results of the initial MCA are shown in Table 2-3 on the following page.

Table 2-3: MCA Results



Criteria		Option 1a		Option 1b		Option 2a		Option 2b		Option 3a		Option 3b	
	Weight	Score	Weighted score	Score	Weighted score	Score	Weighted score	Score	Weighted score	Score	Weighted score	Score	Weighted score
A - Environment / Heritage	5%	2.0	0.10	2.5	0.13	2.0	0.10	2.5	0.13	2.0	0.10	2.5	0.13
B - Safety (Navigation) - related to number of ramps/pontoons	15%	5.0	0.75	5.0	0.75	4.0	0.60	4.0	0.60	2.0	0.30	2.0	0.30
C - Safety (Road)	10%	4.5	0.45	2.0	0.20	4.5	0.45	2.0	0.20	4.5	0.45	2.0	0.20
D - Cost	40%	1.1	0.43	3.5	1.41	1.2	0.49	3.7	1.47	1.6	0.65	4.1	1.64
		$11,900,000		$9,500,000		$11,600,000		$9,300,000		$11,400,000		$8,000,000	
E - Land Tenure / Impact on Adjacent Properties	10%	1.0	0.10	3.0	0.30	1.0	0.10	3.0	0.30	1.0	0.10	3.0	0.30
F - Functionality (landside 1) related to carparking numbers only	5%	2.5	0.13	1.6	0.08	3.4	0.17	2.0	0.10	4.3	0.22	2.7	0.14
G - Functionality (landside 2) related to manoeuvreing, rigging, access/intersections (not carparking)	5%	4.0	0.20	2.0	0.10	4.0	0.20	2.0	0.10	4.0	0.20	2.0	0.10
H - Functionality (maritime) including berthing, vessel manoeuvreing, vessel waiting times in basin	10%	4.0	0.40	2.0	0.20	4.0	0.40	3.0	0.30	3.5	0.35	2.5	0.25
Others? Constructability?													
Total Weighted Score	**100%**	Option 1a	**2.55**	Option 1b	**3.17**	Option 2a	**2.51**	Option 2b	**3.20**	Option 3a	**2.37**	Option 3b	**3.05**
Score		2.55		3.17		2.51		3.20		2.37		3.05	
Rank		4		2		5		1		6		3	

From the MCA exercise, the option known as ‘Option 2b’ scored the highest and was initially identified as the preferred option. Option 2b included five boat ramp lanes and three pontoons, a rock spur, dredging of the boat ramp basin and an extension of the breakwater. The masterplan components of Option 2b included no road diversions, one large carpark in the same location as the existing carpark and an overflow carpark to the south and east. The total cost estimate for Option 2b was $9.3 million.

Option 2b was considered to be the best option ‘on balance’, however, it was noted that Option 1b (i.e., a 6 lane, 3 pontoon boat ramp with no road diversion, with a total cost estimate of $9.5 million) scored similarly.

2.5 Preferred option

Based on feedback at a second stakeholder progress workshop held on 29 May 2020, CHBRPEC and TfNSW preferred to adopt Option 1b, as it was still within the $10 million budget allocation, and provided a more robust boat ramp facility to cater for potential future boating demands. All participants in the workshop agreed that the ‘maritime’ works proposed as part of Option 1b should be adopted, that is as follows:

(i) Six (6) lane, three (3) pontoon boat ramp.

(ii) 75m breakwater extension.

(iii) Dredging to a depth of RL -2.5 within the basin to ensure that the existing boat ramp basin and entrance channel complied with design bed levels.

(iv) Consideration of the need to undertake ongoing maintenance dredging to control ongoing shoaling of the end of the extended breakwater, entrance channel and boat ramp basin.

At the same workshop on 29 May 2020, officers from Coffs Harbour City Council (CHCC) expressed concerns with the amount of formalised carparking being proposed in the preferred option. This option exceeded Council’s expectations for parking and would encroach on a public reserve. Council’s preference, if additional parking needs to be provided, would be to provide informal grassed overflow parking along the verges of Jordan Esplanade.

To respond to Council’s concerns, traffic planning consultants were engaged by TfNSW to undertake traffic and parking surveys, and landscape and urban designers were engaged to undertake a review of the landscape and urban design aspects of the preferred option. Based on the findings of those studies, the preferred option was refined. Most notably this included a shifting of Jordan Esplanade through the ‘pinch point’ between the former Deep Sea Fishing Club and the existing carpark, identified as essential to ensure the provision of space for a future shared pedestrian path, the provision of space for site landscaping, for better traffic flow and manoeuvring space within the carpark, and to improve the entrance/exit lines.

Coastal process modelling undertaken in later stages noted that an increase in the length of the breakwater to 75m would result in an improvement to vessel navigation safety by increasing the area for vessels to manoeuvre in the lee of the breakwater, as they enter or leave the boat ramp entrance channel, and would include some additional safety contingency between maintenance dredging works due to the longer time for a shoal to form at the head of the breakwater. Given this, a 75m breakwater extension has been adopted in the final concept design. The modelling also showed that regularly dredging the boat ramp basin and entrance channel will typically result in milder wave conditions within the boat ramp basin and will not have an adverse impact on existing seiche behaviour in the basin and at the boat ramp. Furthermore, the proposed deepening has the benefit of improved navigation and serviceability for vessels using the boat ramp. There are plans for a formal survey and dredging program every 12 months in collaboration with CHCC.

As the detailed design develops, it is likely that further refinements to the concept design will be made, particularly on the basis of constructability and cost.

3 Description of the proposal

This chapter describes the proposal and provides descriptions of existing conditions, the design parameters including major design features, the construction method and associated infrastructure and activities.

3.1 The proposal

It is intended to construct the proposal in two stages. Detailed works methodologies will be subject to competitive tender, with likely methodologies considered below.

Stage 1 of the proposal includes:

- Extension of the existing breakwater further north by approximately 75m including the access roadway.
- Existing Essential Energy pole and street light adjacent to boat ramp to be removed. Associated service to sign and CCTV to also be removed. Pole to be replaced with private lighting and supply point as part of Stage 2 design.
-
- Widening of the existing boat ramp with an additional two lanes to create a total of six lanes. The existing boat ramp would be topped with concrete to address the poor condition.
- The existing pontoon would be extended by up to 15m and an additional two pontoons would be constructed to the south. The new pontoons would be up to 40m in length. Pile would be driven for each pontoon.
- Dredging of the existing boat ramp basin and channel to -2.5m AHD and transport of the sand to Park Beach via truck.

Construction of Stage 1 is expected to commence in May 2021 and would take approximately eight months to complete construction. It is intended to keep the facility open for use during works where possible. Where the facility needs to be closed for works, this will not be undertaken during peak use periods and notification will occur prior to closure.

Stage 2 of the proposal includes:

- Extension and resurfacing of the existing main carpark to include additional parking for cars, boats and trailers.
- Blocking of the entry from Jordan Esplanade adjacent to the boat ramp to improve safety and legibility, and provision of a new vehicle entrance at the western end of the existing carpark.
- Diversion of Jordan Esplanade opposite the main carpark to improve safety.
- New signage.
- New rigging and de-rigging bays around the main carpark.
- A new shared pathway for walking and cycling.
- New lighting.
- Recreational furniture and embellishments including amenities, seating, tables and fish cleaning facilities.
- Landscaping.
- Extension of services including water, power and sewerage.

Construction of Stage 2 is expected to commence in July 2021 and would also take approximately eight months to complete.

3.2 Design

The concept design, included in Appendix A, would be further refined at the detailed design stage; however, all works will be undertaken within the same construction footprint.

3.2.1 *Major design features*

- Extension of the existing breakwater further north by approximately 75m including access roadway.
- Widening of the existing boat ramp with an additional two lanes to create a total of six lanes.
- Extension of the existing pontoon by up to 15m and an additional two pontoons constructed to the south. The new pontoons would be up to 40m in length.
- Dredging of the existing boat ramp basin and channel to -2.5m AHD.
- New arrangements for access onto the boat ramp from Jordan Esplanade.
- New facilities including fish cleaning stations, tables and chairs, amenities and pedestrian / cycleways.

3.3 Construction activities

3.3.1 *Work methodology*

The appointed contractor would confirm the final construction activities by agreement with TfNSW. Therefore, this section only indicates a likely method and work plan as it may vary due to the identification of additional constraints before work starts, detailed design refinements, community and stakeholder consultation feedback, and contractor requirements and limitations. Should the work method differ from what is proposed in this REF, the contractor would consult TfNSW to determine if additional assessment is needed.

Prior to commencement of each stage, the community would be informed via the project website and local media to detail works and any potential impacts to the surrounding community and environment.

Site setup

Ancillary facilities (described in section 3.4 below) would be established for use during construction of the proposal.

Traffic control measures (including for vehicles, watercraft and pedestrians) would be established in accordance with a traffic management plan (TMP) prepared by the contractor. Appropriate way finding signage would also be installed advising of alternative routes if required. Construction site entry and exit points from the water and land would be established and signposted.

Environmental controls would be established in accordance with a construction environmental management plan (CEMP) for the proposal, prepared by the contractor.

Relocation of services

Relocation of the existing electrical lines and the lighting pole further south, and relocation of the existing stormwater facilities within the boat ramp extension footprint. Stormwater facilities would be relocated in consultation with CHCC.

Boat ramp widening and upgrade

Widening of the existing boat ramp with an additional two lanes to create a total of six lanes. The ramp would be widened to the south-east by up to 9m and would be constructed using a combination of concrete cast in-situ slabs and precast planks. The existing boat ramp would be topped with concrete due to its poor condition. Long-reach excavators would be situated on the bank to excavate into the sides of the basin.

The existing pontoon would be extended by up to 15m and an additional two pontoons would be constructed to the south. The new pontoons would be up to 40m in length. Pontoon components would be manufactured off-site and transported to the site by rigid trucks where they will be assembled from boat and land. Piles would be installed to support the new pontoons using piling equipment mounted on a barge.

Basin dredging and beach nourishment

Dredging of the existing boat ramp basin and channel to -2.5m AHD. It is likely that a barge with a mounted long-reach excavator would be used in the basin and channel. Dredged material would be transferred to shore via a short pipeline which would pump the material to a stockpile for de-watering. Trucks would then transport the de-watered sand from the stockpile to Park Beach via Jordan Esplanade and the haulage route shown below in Figure 4. The exact placement location would be confirmed with CHCC and the Surf Club, with the approximate location shown in yellow in Figure 4 below. As the amount of dredged material is minor, it is anticipated that the deposition area would be above the MHWM, in approximately the same deposition location used by CHCC for the basin maintenance dredging.

It is likely that up to 50 truck movements would be required to transport the sand to Park Beach over a period of up to 10 days, subject to weather conditions. The sand would be spread by either bulldozer or front end loader and the works area would be fenced off to the public whilst the deposition and spreading works are undertaken.

The bathymetry survey in Appendix J shows the extent of the proposed dredging footprint.

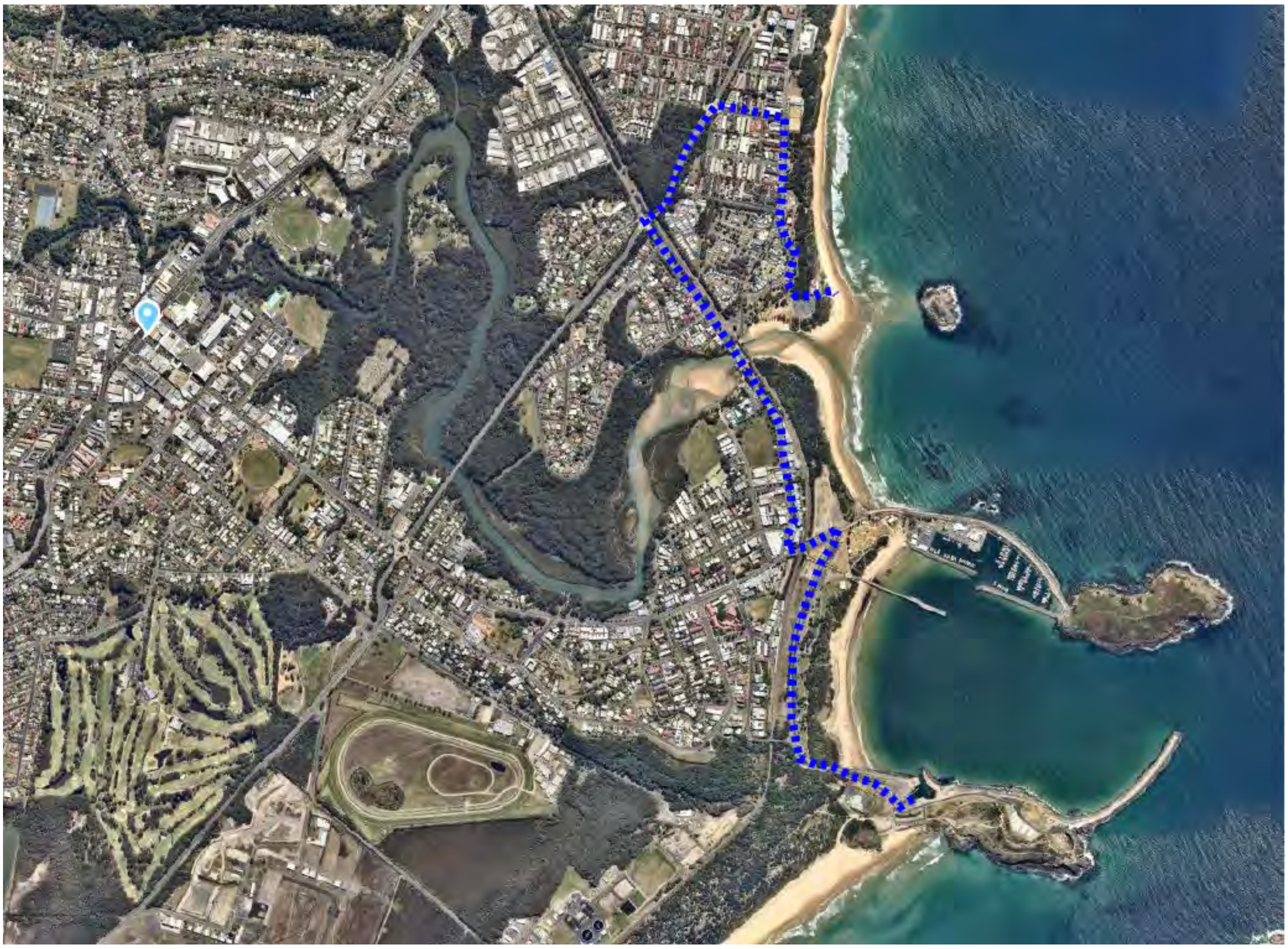


Figure 5: Likely haulage route and sand deposition location at Park Beach

Breakwater extension

The existing breakwater would be extended further north by approximately 75m, using around 17,000m^3 of armour rock. Where possible, rock would be sourced from local quarries and would be transported to the site by rigid trucks with trailers. It is likely that the rock would be placed into the water by long reach excavator working progressively north along the top of the breakwater. The top of the breakwater would then be sealed to make it suitable for all-abilities access.

Extension of services and utilities

Prior to carpark and road diversion works, existing services would be located and new water and sewer lines and power utilities would be constructed.

Carpark extension and resurfacing

Bitumen stripping would occur using a specialised stripping and grinding machine. It will then be shaped to allow for a new surface. The amenities building, washdown facilities, fish cleaning table and street furniture would be constructed after resurfacing is complete. Relocating of the entry from Jordan Esplanade and provision of a new vehicle entrance at the western end of the existing carpark

Traffic controls would be established in both directions on Jordan Esplanade and in conjunction with the carpark works. The new entry would be established, and the existing access point would be blocked by barricades. Construction of the new road section to the south of the existing road would commence including earthworks, placement and compaction of fill material and construction of the alignment back into Jordan Esplanade.

Site landscaping, clean-up and opening of the new facility

At the completion of civil works, the site would be landscaped and tidied, with all construction signage, fencing and waste removed from the site.

3.3.2 Construction hours and duration

It is likely that the proposal will be constructed over a period of approximately two years, with Stage 1 construction commencing in May 2021 and Stage 2 construction commencing in July 2021. The works would be undertaken during standard working hours as follows:

7am to 6pm Monday to Friday; and

8am to 1pm on Saturday.

No work would be undertaken on Sundays or public holidays. Where feasible, no closures of public places would occur during school holidays.

For reasons of site safety and to benefit from favourable weather or tidal conditions, it may be necessary to undertake some works outside of standard hours. Should this occur, an out-of-hours work procedure would be developed by the construction contractor and approved by TfNSW, and potentially affected stakeholders would be notified prior to construction commencement.

3.3.3 Plant and equipment

Plant and equipment likely to be used for the construction of the proposal includes:

- 20 tonne trucks to deliver rock for the breakwater extension.
- Rigid trucks of variable size for delivery of machinery and equipment and potentially for transport of sand. Some trucks may include trailer combinations.
- Barge and dredge.
- Floating piling rigs.
- Boats.
- Backhoe.
- Long-reach excavator (up to 30 tonnes).
- Bulldozer or front-end loader.
- Large long reach excavator (150tonnes) for breakwater construction in deep sections.
- Lifting crane for installation of concrete panels.
- Concrete transit mixers and concrete pumping equipment.
- Compaction roller.
- Smaller equipment such as rock-breakers, concrete saws, hydraulic hammers, etc.

The list above is not exhaustive, as details of equipment to be utilised would be determined during construction planning.

3.3.4 *Earthworks*

There are minimal earthworks associated with the proposal. It is anticipated that earthworks would be limited to:

- The extension of the boat ramp to the south to create additional lanes. This requires excavation of the basin wall, which is comprised almost entirely of fill. The rock from the wall would be re-used on site where possible.
- The carparking area would be resurfaced which would require that the existing bitumen be removed, and the surface levelled.

Excavated material will be re-used on site where possible, or recycled, with disposal undertaken as a last option.

3.3.5 *Source and quantity of materials*

Materials will be sourced locally where possible. It is anticipated that the greatest quantity of materials would be the rock required for the extension of the breakwater, which would be sourced from a quarry and is likely to comprise up to 17,000m^3 of clean rock of various sizes.

3.3.6 *Traffic management and access*

Land-based traffic management measures are likely to include reducing speed limits along Jordan Esplanade, the implementation of controls to avoid traffic conflicts with works vehicles and machinery, and parking closures in the location of the compound area. During the extension of the breakwater there may be up to 40 truck movements per day for a period of two to three months. This would be the busiest period for truck movements. Outside of this period, truck movements would be intermittent and infrequent.

Management of maritime traffic would be undertaken in accordance with the details in Part 7 of this REF and TfNSW Maritime Compliance requirements for navigational safety.

3.4 Ancillary facilities

There is no vegetation required to be removed for the ancillary facilities as they will be located within highly modified, previously disturbed and filled areas as shown in Figure 5 below:

Figure 6: Location of ancillary facilities

It is likely that up to five designated, fenced and signposted works areas will be required for the proposal as follows:

1. A crane set-up area would be allocated and fenced off from the public to the east of the boat ramp within the existing carpark area. It is likely that this would only be required during Stage 1 but will also be allocated for Stage 2 if required by the contractor.
2. The contractor's compound area and site office are likely to be set up in the grassed overflow area A to the east of the boat ramp during both Stages 1 and 2.
3. Stockpiling and de-watering site for the dredged material from the basin. This will be the same location used by CHCC for de-watering and stockpiling during the maintenance dredging.
4. Deposition site at Park Beach.
5. Access for delivery of rock for the breakwater extension along the existing track from Jordan Esplanade on to the breakwater.

-
- All works areas would be signposted and fenced off from the public during works and re-instated upon completion to their original condition, or to an improved condition.

Access to all ancillary areas will be from Jordan Esplanade. Traffic control measures will be in place for the duration of works to slow the movement of traffic past the site access tracks and compound area and to prevent public access to works areas.

It is anticipated that the contractor's compound area and site office will include toilets and amenities for workers, portable site offices, bunded fuel storage areas and parking for site workers. It is not anticipated that the contractor's compound area will require any hardstand areas as the surface is primarily compacted fill and gravel, with some grass cover. Areas are sufficiently flat for parking.

Upon completion of works all ancillary facilities would be removed and the area would be re-instated, stabilised and seeded to prevent erosion.

Although areas suitable for ancillary facilities have been identified, it may be necessary to select alternative sites as a result of the detailed design. When selecting alternative locations for ancillary facilities, the following principles must be applied:

- Minimise encroachment on parking spaces.
- Select areas with low ecological and heritage conservation significance.
- Select areas that are at least 10m from the water.
- Select areas that are already level and do not require additional earthworks.

3.5 Public utility adjustment

The proposal area has existing stormwater infrastructure, water mains and an overhead electricity supply as shown in Figure 6 below. Prior to any works commencing, the exact locations of infrastructure would be determined, and relocations undertaken by way of approval from the relevant service and utility providers.

Figure 7: Approximate location of services and utilities

3.6 Property acquisition

There is no property acquisition required for the proposal. All works will be undertaken on Crown land.

4 Statutory planning framework

This chapter provides the statutory and planning framework for the proposal and considers the provisions of relevant state environmental planning policies, local environmental plans and other legislation.

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 68(2) of ISEPP permits development for navigation and emergency response facilities and environmental management works associated with a boating facility to be carried out on any land by or on behalf of a public authority without consent.

As the proposal is for the purpose of navigation and environmental management works associated with a boating facility, being the dredging of the boat ramp basin and deposition on Park Beach, and is to be carried out by Transport for NSW, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*.

Clause 68(4) of ISEPP permits development for the purpose of boating facilities to be carried out on any land by or on behalf of a public authority without consent. However, such development may only be carried out on land reserved under the *National Parks and Wildlife Act 1974* if the development is authorised by or under that Act.

As the proposal is for the purpose of boating facilities and is to be carried out by Transport for NSW, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*.

Development consent from council is not required. The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974*.

The proposal does not trigger an approval or development consent under *State Environmental Planning Policy (Coastal Management) 2018* (CM SEPP) or *State Environmental Planning Policy (State Significant Precincts) 2005*.

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by ISEPP (where applicable), is discussed in chapter 5 of this REF and is detailed in Appendix C.

State Environmental Planning Policy (State and Regional Development) 2011

State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) identifies development and infrastructure that is State and Regionally significant.

The proposal is not considered Regionally Significant Development as clause 20(2) and 20(2)(b) states *'development for which development consent is not required is not declared to be regionally significant development*'.

Clause 14(1) of the SRD SEPP declares development to be State significant infrastructure if the development is, by the operation of a State environmental planning policy, permissible without development consent and the development is specified in schedule 3 of the SEPP.

Schedule 3 specifies that development for the purpose of boating facilities (not including marinas) by or on behalf of a public authority that has a capital investment value of more than $30 million is State significant infrastructure.

The proposal has a capital investment value of $10 million. This means that the capital investment value trigger of $30 million does not apply.

State Environmental Planning Policy (Coastal Management) 2018

State Environmental Planning Policy (Coastal Management) 2007 (Coastal SEPP) aims to promote an integrated and coordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the Coastal Management Act 2016, including the management objectives for each coastal management area, by:

(a) managing development in the coastal zone and protecting the environmental assets of the coast, and

(b) establishing a framework for land use planning to guide decision-making in the coastal zone, and

(c) mapping the 4 coastal management areas that comprise the NSW coastal zone for the purpose of the definitions in the Coastal Management Act 2016.

The proposal is consistent with the aims of the SEPP as it would protect the environmental assets of the coast.

The proposal is located within the mapped Coastal Environment Area and Coastal Use Area. The proposal is not located within the mapped Coastal Wetlands Area or Littoral Rainforest Area but adjoins the mapped Proximity Area for Coastal Wetlands at the western extent of Stage 2 of the proposal and at the proposed sand deposition site on Park Beach. No works would be undertaken within any proximity area as part of the proposal.

Part 3 Clause 19 of the SEPP states that:

(2) Coastal protection works by public authority

Development for the purpose of coastal protection works may be carried out on land to which this Policy applies by or on behalf of a public authority:

(a) without development consent—if the coastal protection works are:

(i) identified in the relevant certified coastal management program, or
(ii) beach nourishment,
Section 4(1) of the Coastal Management Act 2016 defines coastal protection works to mean:

(a) beach nourishment activities or works, and

(b) activities or works to reduce the impact of coastal hazards on land adjacent to tidal waters, including (but not limited to) seawalls, revetments and groynes.

The proposal falls within the definition of coastal protection works, as defined by the *Coastal Management Act 2016* and is therefore permitted without consent.

4.1.2 Local Environmental Plan

Coffs Harbour Local Environmental Plan (LEP) 2013

The proposal is located in the:

SP2 (Infrastructure) zone – the boat ramp, car park and part of the dredging area within the basin.

RE1 (Public Recreation) zone – foreshore reserve area and overflow carparking areas.

W3 (Working Waterways) zone – part of the dredging area within and at the entrance to the basin, as well as the breakwater extension.

The LEP defines a set of objectives for landuse zones. The proposal is consistent with the objectives of the relevant zones as outlined in the table below:

Table 4-1: Landuse zones

Zone	Objectives	Compliance
SP2	• To provide for infrastructure and related uses. • To prevent development that is not compatible with or that may detract from the provision of infrastructure.	The proposal is the upgrade and provision of infrastructure. The development does not include any components that detract from the provision of infrastructure.
RE1	• To enable land to be used for public open space or recreational purposes. • To provide a range of recreational settings and activities and compatible land uses. • To protect and enhance the natural environment for recreational purposes.	The proposal enables land to be used for recreational purposes. It contributes to protecting and enhancing an area that has long been used for recreational purposes and will provide a long term solution to ongoing problems associated with coastal processes.
W3	• To enable the efficient movement and operation of commercial shipping, water-based transport and maritime industries. • To promote the equitable use of waterways, including appropriate recreational uses. • To minimise impacts on ecological values arising from the active use of waterways. • To provide for sustainable fishing industries.	The proposal is being undertaken for the purpose of improving maritime safety and efficiency, primarily for recreational uses. The site and location are highly modified and have been used for maritime activities for more than 100 years. It is unlikely that the proposal will affect ecological values.

Heritage Items 18 and 19, listed on Schedule 5 of the Coffs Harbour LEP 2013, are located in proximity to the works. The Historic Heritage Assessment at Appendix E confirms that there are no impacts likely on those items.

The proposal is permissible without development consent pursuant to the ISEPP. Therefore, the consent requirements of the LEP do not apply and the proposal may be determined under Division 5.1 of the EP&A Act.

4.2 Other relevant NSW legislation

4.2.1 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims *'to conserve, develop and share the fishery resources of the State for the benefit of present and future generations and, in particular, to*:

- conserve fish stocks and key fish habitats, and
- conserve threatened species, populations and ecological communities of fish and marine vegetation, and
- promote ecologically sustainable development, including the conservation of biological diversity, and
- promote viable commercial fishing and aquaculture industries, and
- promote quality recreational fishing opportunities, and
- appropriately share fisheries resources between the users of those resources, and
- provide social and economic benefits for the wider community of New South Wales.'

To meet these objectives, Part 7 of the FM Act outlines legislative provisions to protect fish habitat and Part 7A outlines provisions to conserve threatened species of fish and marine vegetation and their habitat.

An assessment of the potential impacts of the proposal on marine ecology is included at Appendix F. The assessment concludes that the proposal is unlikely to have a significant impact on any threatened species, marine vegetation or habitat.

Under Section 205 of the FM Act, a permit is required to harm (cut, remove, damage, destroy, shade, etc.,) marine vegetation including saltmarshes, mangroves, seagrass and seaweeds. The proposal does involve the removal of a small amount of seaweed for the breakwater extension and a Section 205 permit will need to be sought for the works.

Further consultation with DPI Fisheries is required in relation to the proposed dredging and the breakwater extension (reclamation) in accordance with Section 199 of the FM Act.

4.2.2 Coastal Management Act 2016

The objects of the Coastal Management Act (CM Act) are to '*manage the coastal environment of New South Wales in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State, and in particular*:

(a) to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience, and

(b) to support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety, and

(c) to acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the coastal zone, and

(d) to recognise the coastal zone as a vital economic zone and to support sustainable coastal economies, and

(e) to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making, and

(f) to mitigate current and future risks from coastal hazards, taking into account the effects of climate change, and

(g) to recognise that the local and regional scale effects of coastal processes, and the inherently ambulatory and dynamic nature of the shoreline, may result in the loss of coastal land to the sea

(including estuaries and other arms of the sea), and to manage coastal use and development accordingly, and

(h) to promote integrated and co-ordinated coastal planning, management and reporting, and

(i) to encourage and promote plans and strategies to improve the resilience of coastal assets to the impacts of an uncertain climate future including impacts of extreme storm events, and

(j) to ensure co-ordination of the policies and activities of government and public authorities relating to the coastal zone and to facilitate the proper integration of their management activities, and

(k) to support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions, and

(l) to facilitate the identification of land in the coastal zone for acquisition by public or local authorities in order to promote the protection, enhancement, maintenance and restoration of the environment of the coastal zone, and

(m) to support the objects of the Marine Estate Management Act 2014.'

The proposed works are located in the coastal zone, as defined by the CM Act 2016. The proposed works are consistent with the objects of the CM Act 2016 as they contribute to maintaining the coastal zone as a vital economic zone and to supporting a sustainable coastal economy by mitigating the impacts and risks of coastal hazards.

Part 3 of the CM Act 2016 applies to any public authority that exercises functions in connection with the coastal zone. Division 4 Clause 23 states:

23 Other public authorities to have regard to coastal management program and coastal management manual:

(1) Public authorities (other than local councils) are to have regard to coastal management programs to the extent that those programs are relevant to the exercise of their functions.

(2) In particular, those public authorities are to have regard to relevant coastal management programs and the coastal management manual in the preparation, development and review of, and the contents of, any plans of management that those public authorities are required to produce and, in doing so, are to have regard to the objects of this Act.

Although there is no coastal management program in place for Coffs Harbour, the *Coffs Harbour Coastal Zone Management Plan Final Report* (BMT WBM, 2019) is relevant to the proposal as it is intended to place dredged sand from the basin on Park Beach, in accordance with the Management Action Implementation Details Part 3.6 Reference BD.1. Placement of material onto Park Beach will only be undertaken if it is confirmed that the dredged material is suitable for beach nourishment. Park Beach has been confirmed with Coffs Harbour City Council as the preferred location for placement of the dredged material.

4.2.3 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) and its supporting regulations set out the environmental impact assessment framework for threatened species, threatened ecological communities and Areas of Outstanding Biodiversity Value (formerly critical habitat) for Division 5.1 activities (amongst other types of development).

Under the BC Act, an assessment of significance must be completed to determine the significance of potential impacts to threatened species, populations and/or communities or their habitat. The preparation of a Species Impact Statement (SIS) based on the provisions of the BC and FM Act should is not required for this proposal.

The assessment of potential biodiversity impacts as a result of the Proposal is described in Chapter 6 of this REF and in detail at Appendix F.

4.2.4 *Protection of the Environment Operations Act 1997*

The *Protection of the Environment Operations Act 1997* (POEO Act) focuses on environmental protection and provisions for the reduction of water, noise and air pollution and the storage, treatment and disposal of waste. The POEO Act introduces licensing provisions for scheduled activities that are of a nature and scale that have a potential to cause environmental pollution. It also includes measures to limit pollution and manage waste.

The proposal would not involve undertaking or carrying out a scheduled activity. If the controls set out in the relevant guidelines and quality assurance specifications, and additional controls detailed in Chapter 7, are implemented and monitored, there is unlikely to be any material water, noise or air pollution impact. Appropriate waste management controls would be introduced to classify, store, transport and dispose of all construction and work-generated waste. A licence under the POEO Act is not required for the proposal.

4.2.5 *Marine Safety Act 1998 and Marine Safety Regulation 2016*

The objects of the *Marine Safety Act 1998* are:

(a) to ensure the safe operation of vessels in ports and other waterways,

(b) to promote the responsible operation of vessels in those waters so as to protect the safety and amenity of other users of those waters and the amenity of occupiers of adjoining land,

(b1) to provide an effective framework for the enforcement of marine legislation,

(c) to provide for the investigation of marine accidents and for appropriate action following any such investigation,

(d) to consolidate marine safety legislation.

The proposal is primarily being undertaken for the purposes of improving safety at the Coffs Harbour Regional Boat Ramp. Consultation was undertaken with NSW Maritime Operations and Compliance Unit to determine the potential impacts of the proposal on the safety of maritime navigation and their recommendations have been included in Part 7 of this REF. The proposal meets the objects of the *Marine Safety Act 1998*.

Under Section 18 of the *Marine Safety Act 1998*, the proposal is considered an aquatic activity as it would be undertaken on navigable waters and would temporarily restrict the availability of those waters for normal use by the public.

As such, Section 97(1) of the *Marine Safety Regulation 2016* would require the work to be subject to an aquatic licence issued by Roads and Maritime.

4.2.6 *National Parks and Wildlife Act 1974*

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the protection of Aboriginal heritage values, national parks and ecological values. The Act makes it an offence to harm Aboriginal objects, places or sites without approval. A Stage 1 assessment in accordance with the Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI assessment - refer to Appendix D) confirms that the proposal has a low potential to impact upon Aboriginal cultural heritage or archaeological items.

The TfNSW Aboriginal Cultural Heritage Advisor (ACHA) has advised that a Stage 1 PACHCI is appropriate for the proposal. An Aboriginal heritage impact permit (AHIP) from OEH under Part 6 of this Act is not required for the proposal.

This is discussed further in Chapter 6 of this REF.

4.2.7 Heritage Act 1977

The *Heritage Act 1977* provides for the protection or conservation of buildings, works, maritime heritage (wrecks), archaeological relics and places of heritage value through their listing on various State and local registers. The Act makes it an offence to harm any non-Aboriginal heritage values without approval. The Historic Heritage Assessment at Appendix E demonstrates that the proposal would have no significant impacts on any item of local, State or Commonwealth heritage value.

4.2.8 Marine Pollution Act 2012

The Marine Pollution Act 2012 sets out provisions to prevent pollution in the marine environment.

The proposal is unlikely to result in any oil, noxious liquid, pollutant, sewage or garbage discharge as controlled under this Act, provided that standard controls are implemented and monitored as described in Chapter 7.

4.2.9 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government for proposed ‘actions that have the potential to significantly impact on matters of national environmental significance (MNES) or the environment of Commonwealth land’. These are considered in Appendix F and in chapter 6 of this REF.

The assessment of the proposal’s impact on MNES and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of Agriculture, Water and Environment under the EPBC Act.

4.2.10 Crown Land Management Act 2016

The Crown Land Management (CLM) Act 2016 provides for the ownership, use and management of the Crown land or a Crown road of NSW. Under Section 2.18 of the CLM Act the Minister may grant a licence over dedicated or reserved Crown land or a Crown road for the purpose of any facility or infrastructure. The proposal area is subject to a combined licence granted to TfNSW by the Minister as shown outlined in red in the diagram below:

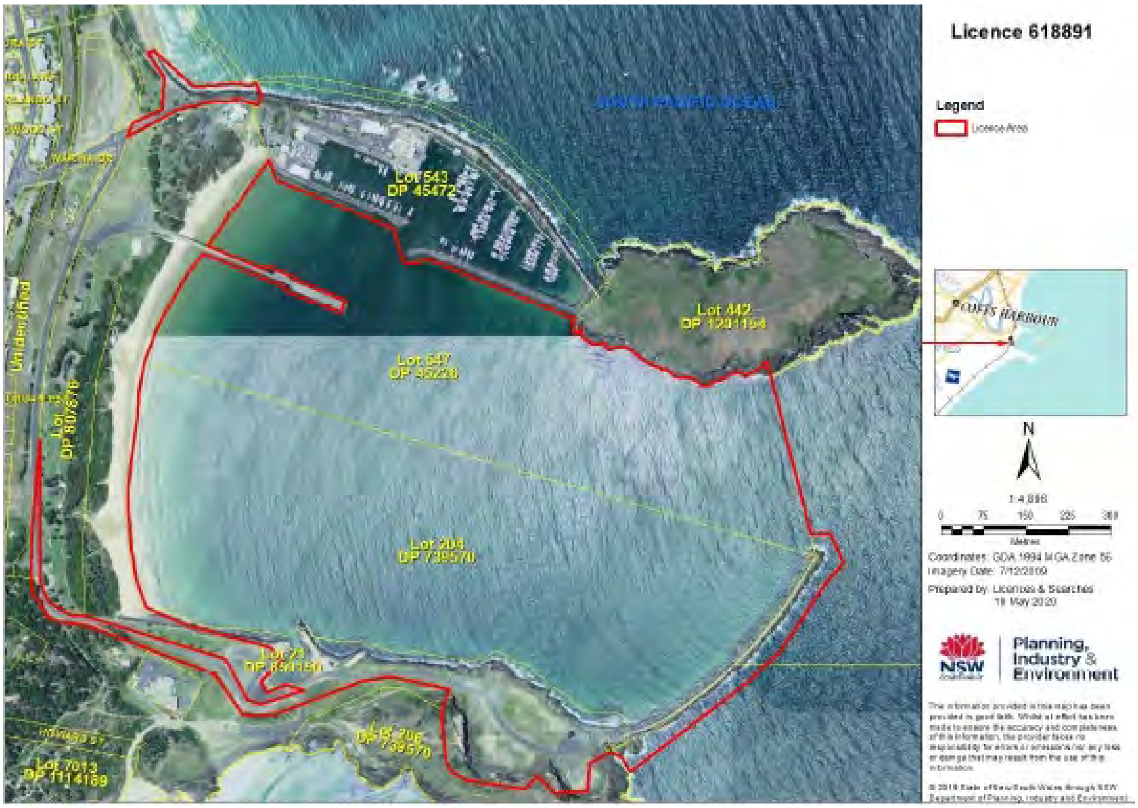


Figure 8: Combined Crown land licence area

Notably, the carpark area is not subject to the combined Crown licence. An amendment to the licence has been sought by TfNSW, but had not been granted at the time of completion of this REF. If the licence has not been amended prior to the commencement of the Stage 2 works, a specific Crown land licence covering the work to the carpark will be required under Section 2.18 of the CLM Act.

4.3 Confirmation of statutory position

As the proposal is for the purpose of boating facilities and is to be carried out by TfNSW, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* and development consent from Council is not required.

The proposal is not State significant infrastructure or State significant development and does not require a referral to the Australian Government under the EPBC Act.

This REF fulfils TfNSW’s obligation under Section 5.5 of the EP&A Act to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

5 Consultation

This chapter discusses the consultation undertaken to date for the proposal and the consultation proposed for the future.

5.1 Consultation strategy

A community and stakeholder engagement plan has been prepared and implemented for the proposal. The objectives of the plan are:

- To build on the community's positive support for the proposal by keeping key stakeholders close to the project as it progresses.
- To keep the local community and other key stakeholders regularly informed of the proposal's progress.
- To provide the wider community and stakeholders with regular and targeted information to build awareness about the proposal.
- To ensure community and stakeholder feedback is continuously fed into communication and engagement and on to the project team.
- To be transparent in all that we do.
- To engage with the community in a manner that is collaborative, innovative, adaptable and sustainable.
- To increase stakeholder understanding of the proposal and its objectives.
- To ensure that community and stakeholder enquiries about the proposal are managed and resolved effectively.
- To ensure that information about the proposal is distributed in an effective and timely manner.

5.2 Community involvement

The need for the proposal was first brought to the attention of TfNSW by the Coffs Harbour Regional Boat Ramp Precinct Enhancement Committee (CHRBRPEC), which is comprised of community members. Coffs Harbour City Council (CHCC) was also an early advocate for the proposal. As the project is community-driven, a participatory approach has been taken to community consultation and involvement throughout the development of the proposal.

A working group was established in late 2019 to inform the design, program and delivery of the proposal. The working group meets every two (2) months and consists of staff from Transport for NSW; Coffs Harbour City Council; Property NSW and community members from CHRBRPEC. It is intended to retain the working group until the completion of Stage 2 construction.

This REF will be placed on public exhibition for a period of not less than 21 days, with submissions on the proposal considered in determining the REF and finalising the detailed design.

5.3 Aboriginal community involvement

The Coffs Harbour and District Local Aboriginal Land Council was contacted by letter and email on 28 August and 23 October 2020 and by phone on 29 October 2020. A description of the works was provided on two occasions, as well as plans of the proposal. Responses via email were received on the 16th and 17th of November and are detailed below.

An Aboriginal Heritage Due Diligence Assessment (AHDDA) has been undertaken for the proposal to assess the potential impacts of the proposed development on Aboriginal archaeology. The AHDDA concludes that, whilst access to the ocean would have provided marine resources for Aboriginal people, the site has been subject to extensive excavation, cut and fill works associated with the boat ramp and associated infrastructure over a long period of time, all of which would have destroyed any evidence of past Aboriginal land uses at those locations.

Table 5-1: Issues raised through Aboriginal community consultation

Agency	Issue raised	Response/where addressed in REF
Coffs Harbour and District Local Aboriginal Land Council	No cultural heritage impacts were raised as the project is taking place on artificial fill and not in the original landscape.	Section 6.9 addresses Aboriginal cultural heritage.
NTSCorp	No response provided at the time of completion of the REF.	The site is not subject to a Native Title claim; therefore, no further action is required in relation to Native Title.

5.4 ISEPP consultation (Coffs Harbour City Council)

Although Coffs Harbour City Council has been closely involved in the design and development of the proposal, they have been formally consulted about the proposal as per the requirements of clauses 13 and 14 of ISEPP. Appendix C of this REF contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered.

Issues that have been raised as a result of the formal ISEPP consultation are outlined below in Table 5.2.

Table 5-2: Issues raised through ISEPP consultation

Agency	Issue raised	Response/where addressed in REF
Coffs Harbour City Council	• Impact of lighting on Shearwater colony on Muttonbird Island. • Consideration be given to underground cables to allow for boats with masts. • Requirement for the substation to be upgraded. • Lighting should be provided for pedestrian crossings. • Power should be available for bbqs, amenities and events. • Solar lighting should be considered for the car park. • The digital sign and lighting will need relocating. • Additional CCTV cameras should be provided. • Low colour temperature lighting should be considered.	• Measures to minimise impacts on bird colonies are included in section 6.6. • The detailed design will carry forward issues relating to cables, electricity supply, CCTV and lighting. The details will be progressed in consultation with CHCC.

5.5 Government agency and stakeholder involvement

The proposal is driven by the community through the CHRBRPEC. This section outlines formal consultation that has been undertaken with various government agencies and stakeholders including:

- Department of Planning, Industry and Environment – Crown Lands
- Department of Planning, Industry and Environment – Biodiversity Conservation Division
- Department of Primary Industries – Fisheries and Marine Parks
- Coffs Harbour and District Local Aboriginal Land Council
- Native Title Search Corporation
- Port Authority of NSW
- Transport for NSW – Maritime Compliance

Issues that have been raised as a result of consultation with these agencies and stakeholders are outlined below in Table 5.3.

Table 5-3: Issues raised through stakeholder consultation

Agency	Issue raised	Response/where addressed in REF
NSW Department of Planning Industry and Environment - Crown Lands	No response provided at the time of completion of this REF.	Part 4 addresses the Crown Land Management Act 2016 and the requirement for a Crown land licence.
NSW Department of Primary Industries – Fisheries and Marine Parks	• Section 199 of the FM Act requires that the proponent consults with DPI Fisheries and considers any matters concerning the proposed work that are raised by DPI Fisheries. • If the proposal includes harm to marine vegetation, Transport for NSW will need to apply to DPI Fisheries for a permit under s205 of the FM Act. • The proposal should aim to avoid impacts to fisheries resources, particularly key fish habitats. • DPI Fisheries' standard minimum information requirements for environmental assessment are clearly detailed in section 3.3 of the DPI Fisheries P&G.	• A copy of the REF and detailed design plans will be provided to DPI Fisheries when available in accordance with Section 199 of the FM Act. • A permit to harm marine vegetation will be sought prior to commencement of works. • The proposal is unlikely to have an impact on key fish habitats. • DPI Fisheries standard minimum information requirements for environmental assessment are addressed in section 6.6 and Appendix F.
Coffs Harbour and District Local	There are no cultural concerns with the proposed works.	Aboriginal cultural heritage is addressed in

Agency	Issue raised	Response/where addressed in REF
Aboriginal Land Council		section 6.9 and Appendix D.
NTSCorp	No response provided at the time of completion of this REF.	The proposal area is not subject to a Native Title claim.
NSW Department of Planning Industry and Environment - Biodiversity Conservation Division	• The REF should describe how any dredged sand would be transported and placed on Park Beach to satisfy Action BD.1 of the Coffs Harbour Coastal Zone Management Plan (CZMP). • The REF should describe how the proposal will avoid impacts on the Coast Headland Pea which occurs adjacent to the works area.	• Part 3 describes how dredged sand will be transported to Park Beach. • All works will be undertaken on previously cleared and disturbed land outside of the habitat of the Coast Headland Pea. Measures to prevent any indirect impacts on this species are described in chapter 6 • The REF has been prepared to address the BCD's guidance materials and requirements.
Port Authority of NSW	Bus parking or bus drop-off area should be provided to tie in with future operations for expedition cruise vessels.	CHCC have advised that grass overflow parking area D would be appropriate for an informal bus drop-off area until Council's strategic planning for the area is completed, nominating formal bus parking, drop-off and turnaround areas outside of the proposal footprint.
Transport for NSW Maritime Operations and Compliance	• Details to be provided of works and land and water-based plant to be used during construction. • A Marine Notice must be prepared advising of the works dates and times. • All maritime plant must comply with the relevant marine legislation. • Signage is to be provided advising of works. • A Vessel Traffic Management Plan must be prepared prior to works commencing.	Section 6.8 addresses navigation safety. The Maritime Safety requirements have been included in the management measures.

Agency	Issue raised	Response/where addressed in REF
	• Notification must be given when areas are to be closed. • An Oil Spill Response Plan must be prepared prior to works commencing. • A Vessel Recovery and Salvage Plan must be prepared prior to works commencing. • Consultation should be undertaken with NSW Maritime at detailed design stage.	

5.6 Ongoing or future consultation

This REF will be publicly displayed on the TfNSW website for a period of not less than 21 days. During that time the community will be invited to make submissions which will be formally considered, and responses provided in a submissions report, which would also be made available to the community on the TfNSW project website.

The working group, comprising key community and agency stakeholders, will continue to meet regularly throughout the detailed design stage.

6 Environmental assessment

This chapter of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of the factors specified in the guidelines *Is an EIS required?* (DUAP, 1995/1996) as required under clause 228(1) of the Environmental Planning and Assessment Regulation 2000 and the *Marinas and Related Facilities EIS Guideline* (DUAP, 1996). The factors specified in clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are also considered in Appendix B.

Site-specific safeguards and management measures are provided to mitigate the identified potential impacts and will be applied during stages 1 and 2 when relevant works are occurring.

6.1 Hydrological issues and coastal processes

6.1.1 Methodology

The investigation included in full at Appendix I utilised nearshore wave historical data outputs from the NSW Government's Nearshore Wave Forecast Tool, historical wind data, sand analysis results, harbour wave measurements, and a review of previous studies and modelling to calibrate a wave, current and sediment transport model to allow the impact of proposed extension to the breakwater to be analysed.

6.1.2 Existing environment

Previous investigations have identified that the boat ramp basin is infilling with marine sand as a result of the net northward littoral drift of sediment along this part of the NSW coastline. As the north sediment transport mechanism is interrupted by the harbour, a sediment deficit is present to the north of Muttonbird Island, resulting in the long-term recession of Park Beach.

Regular dredging of the basin has been undertaken since the late 1980s to maintain navigability and vessel safety, although the overall process and cause of harbour infilling has not been prevented or addressed, and Park Beach continues to experience episodic erosion hazards in between harbour dredging campaigns which nourish Park Beach with dredged sands (MHL 2015).

It is considered that the sand transport rate into the boat ramp basin and entrance channel is in the vicinity of 4,000–6,000 m^3/year.

6.1.3 Potential impacts

The investigation indicates that the effect of the extension to move the shoal created at the breakwater head further offshore may reduce the sediment transported to the boat ramp basin entrance, as the currents acting on the shoal would be less likely to transport sediments directly into the basin. Furthermore, the shift in the shoal location associated with the extension would reduce hazardous entrance conditions.

The modelling showed that it is possible that sediments would accumulate over time in the lee of the breakwater, causing channel sedimentation and entrance navigation issues, an effect which may not have been observed due to limitations in the modelling. Whilst the impacts are likely to be considerably improved as a result of the breakwater extension a program of maintenance dredging will be developed with CHCC to address any gradual siltation issues as part of a sand management plan for the boat ramp.

It was also observed that the extension of the breakwater would likely create a lee, reducing onshore transport of sediment westwards of the boat ramp basin, and lower sedimentation rates in the breakwater head shoal. The modelling indicates that the lee would extend approximately 80m along Jetty Beach from the southern end. The reduction of onshore transport in this 80m length, relative to the existing case, is estimated to be 45%. The modelling result does suggest that some recession to south Jetty Beach may occur and it is recommended that a hydrographic and beach survey be undertaken along and offshore to south Jetty Beach to document existing conditions prior to any extension of the breakwater. The potential recession of south Jetty Beach will be addressed in the sand management plan, with the possibility that sand removed from the basin and channel as part of any maintenance dredging will be placed on south Jetty Beach if recession occurs.

6.1.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Sediment Transport	A hydrographic and beach survey will be undertaken along and offshore to south Jetty Beach to document existing sediment conditions prior to the extension of the breakwater.	TfNSW Project Manager	Pre-construction	Additional safeguard
Sand Management	A Sand Management Plan will be prepared to detail the ongoing management of sediment transport within the basin, channel, and Jetty Beach including (but not limited to) responsibilities for future maintenance, dredging and sand disposal options.	TfNSW Project Manager	Post-construction	Additional safeguard

6.2 Water quality and contamination

6.2.1 Methodology

A search of the NSW EPA's public register of contaminated land revealed no previous contamination records for the proposal site (search completed 23 October 2020).

Sediment sampling and assessment was undertaken in October 2020 within the boat ramp basin and harbour to determine the level of pollutants presents in marine sediments. That assessment is included in full at Appendix H. The samples collected underwent geochemical analysis for a suite of contaminants.

6.2.2 Existing environment

Water quality and contaminants

The water quality within Coffs Harbour is likely to be high. The harbour is subject to high energy wave and tidal flushing, and small amounts of pollutants and contaminants (such as oils and fuels or anti-fouling chemicals from boats) are likely to be quickly flushed and dispersed.

The sediment sampling analysis undertaken within the basin and harbour indicates that all levels of potential contaminants in the sampled marine sediments are either below trigger or detectable levels, and the sediment within the basin is likely to comprise clean marine sand and be suitable for placement on Park Beach for beach nourishment purposes. No Acid Sulfate Soils were detected in any of the samples. Notably, CHCC already undertakes beach nourishment on occasion at Park Beach using dredged sands from the basin and channel and no contamination issues have been reported.

6.2.3 Potential impacts

Construction

Water quality and contamination

Potential impacts during construction may include:

- Turbidity at the dredging site.
- Turbidity associated with the breakwater extension through the placement of rock.
- Fuel and oil spills during works.

The likelihood of contamination during construction is low as the basin and harbour sediments are not contaminated (refer to Appendix H) and measures will be in place to mitigate any spills, as part of a Soil and Water Management Plan.

Dredging mobilises sediments into the water column as sediments are removed from the seabed. Dewatering on the adjacent shoreline may also result in some flow back into the harbour of waters with high loads of sediment. Increases in suspended sediments in the water column can alter the physical chemistry of the water, increase turbidity and reduce available light to the seabed. These suspended sediments will eventually settle on the seabed, which in some areas can impact on reef communities and marine vegetation. This is considered in more detail in part 6.6.

The impacts of this proposal are likely to be very localised due to the small volume of material to be dredged (900-1500m3), while the coarse nature of the clean marine sands will likely facilitate their settlement out of the water column quickly in comparison to finer sediments. The majority of benthic habitat within the harbour is unvegetated sands that is at minimal risk from any sedimentation (full details on this are provided at Appendix F).

Other impacts on water quality can occur as the result of unplanned discharge and accidental spills on construction sites, such as hydrocarbon-based products accidentally entering the marine environment. Once released into the marine environment hydrocarbons can form a thin layer on the water surface that can impact on adjacent shorelines and marine birds, mammals and reptiles that come to the surface to breathe. Preventative checks and thorough environmental management planning and adherence to controls during construction works will be undertaken to minimise the potential for unplanned discharge and accidental spills that could affect water quality.

The extension of the breakwater would also cause localised turbidity as rock is placed on to the seabed. A reef located approximately 150m north of the breakwater will be in close proximity to these works and may potentially be impacted by some temporary sedimentation and increased water turbidity. The reef has been surveyed in detail as part of this REF (full details are provided in Appendix F) and the water column above this reef appears to be naturally very turbid due to its shallow nature and close proximity to the shore, so these impacts are likely to be minimal on the small amount of assemblages that occur there.

The mobilisation of sediments through dredging and extension of the breakwater has the potential to collaterally mobilise any contaminants buried within seabed sediments. Such existing contaminants in the marine environment may include heavy metals, pesticides and polychlorinated biphenyls (PCBs) (Clarke 2001). Testing of the sediments within the basin and channel identified that the potential for these contaminants pose a low risk (refer to Appendix H), so the potential to mobilise contaminants as a result of this proposal is considered low.

Micro plastics are a widespread problem throughout the marine environment and have become an emerging management issue in recent years. Given their presence in all components of the marine environment, including marine organisms, as well as the locality of the proposal (i.e. in a developed area where substantial pollution inputs and human disturbances are known to be present), the presence of micro plastics amongst sediments to be dredged is probable. Consequently, the dredging works will likely mobilise and spread some microplastics. This is unavoidable but is not expected to result in any overall increases in microplastics in the marine environment, rather it is likely to result in a minor redistribution which will quickly settle again.

Operation

Water quality and contamination

As the capacity and safety of the boat ramp will be improved, it is likely that more vessels will use the facility. Although this may increase the amount of fuels and oils that could enter the water, the existing unsafe conditions at the boat ramp have resulted in fuel and oil spills from boats that have been washed against the rocks or have had to increase engine usage as a result of the dangerous basin conditions. Improving the safety and usability of the boat ramp makes it less likely that spills from boat engines will occur.

6.2.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soil and Water	A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil and water pollution and describe how these risks would be addressed during construction. This would include, but not be limited to, measures relating to the following activities to minimise the risk of pollution: • Training of personnel to identify ASS and contaminated sediment. • Spills from concrete pouring. • Oil/fuel/chemical storage and spill management. • Machinery and engine maintenance schedule to reduce oil/fuel leakage.	Contractor	Pre-construction	Additional Safeguard
Water Quality	An Environmental Work Method Statement (EWMS) for the extension of the breakwater must be incorporated into the SWMP and include measures to limit disturbance of the seabed. The EWMS must be approved by the TfNSW LEA.	Contractor	Pre-construction	Additional Safeguard
Water Quality	There is to be no release of dirty water into drainage lines, the harbour or the basin.	Contractor	Construction	Core standard safeguard W1

Impact	Environmental safeguards	Responsibility	Timing	Reference
Water Quality	Visual monitoring of local water quality (i.e., turbidity, hydrocarbon spills/slicks) is to be undertaken on a regular basis to identify any spills, deficient silt curtains or erosion and sediment controls. During dredging works water turbidity or suspended solids should be regularly monitored at the source, as well as100m and 500m from the source. Visual monitoring of any pluming should also be routinely monitored.	Contractor	Construction	Core standard safeguard W2
Water Quality	Visual monitoring of water quality at Park Beach is to be undertaken twice daily during placement works. In the event of any turbidity, placement works will cease and the TfNSW LEA will be contacted.	Contractor	Construction	Additional Safeguard
Water Quality	Water quality control measures are to be used to prevent any materials entering drain inlets.	Contractor	Construction	Core standard safeguard W3
Water Quality	Where dredged sediments require dewatering on site, bunding and/or sediment erosion fencing will be constructed to minimise any flow of waters with high amounts of suspended solids back into the harbour.	Contractor	Construction	Additional Safeguard
Water Quality	Measures to control pollutants from stormwater and spills would be investigated and incorporated in the pavement drainage system for the car park and road diversion at locations where it discharges to the receiving drainage lines. Measures aimed at reducing flow rates during rain events and potential scour would also be incorporated in the design of the pavement drainage system.	Contractor	Pre-construction, Construction	Core standard safeguard W4
Water Quality	Vessels (including barges) are only to be used at suitable tides when no less than 600mm clearance is available between	Contractor	Construction	Core standard safeguard W6

Impact	Environmental safeguards	Responsibility	Timing	Reference
	the underside of the vessel and the bed of the waterway.			
Water Quality	Silt curtains are to be installed, monitored and maintained as needed to contain any sediment during works within the water.	Contractor	Construction	Core standard safeguard W8
Water Quality	Monitoring will be undertaken twice daily for silt containment and entrainment or impingement of marine wildlife. Results of observations will be recorded in a site notebook maintained specifically for the purpose. The notebook will be kept on site and be available for inspection by persons authorised by TfNSW.	Contractor	Construction	Additional safeguard
Water Quality	All rock brought to site is to be clean and free of fines and sediments prior to being placed in the water or on the banks. Any washing of rock on site prior to placement is to be undertaken in a bunded area, with sediment collected and removed from site.	Contractor	Construction	Additional safeguard
Erosion and Sedimentation	Erosion and sediment control measures are to be implemented and maintained to: • Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets • Reduce water velocity and capture sediment on site • Minimise the amount of material transported from site to surrounding pavement surfaces • Divert clean water around the site (in accordance with the Landcom/Department of Housing Managing *Urban Stormwater, Soils and Construction Guidelines* (the Blue Book).	Contractor	Construction	Core standard safeguard E1
Erosion and Sedimentation	Erosion and sediment controls are to be checked and	Contractor	Construction	Core standard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.			safeguard E2
Erosion and Sedimentation	Erosion and sediment control measures are not to be removed until the works are complete for each stage and areas are stabilised.	Contractor	Construction	Core standard safeguard E3
Erosion and Sedimentation	The maintenance of established stockpiles is to be in accordance with the TfNSW Stockpile Site Management Guideline (EMS-TG-10).	Contractor	Construction	Core standard safeguard E4
Potential Acid Sulfate Soils	Land-side soils excavated for utility adjustments and sediments attached to dredging removal must be checked for potential acid sulphate soils.	Contractor	Construction	Additional safeguard
Potential Acid Sulfate Soils	Potential or actual acid sulphate soils are to be managed in accordance with the TfNSW Guidelines for the *Management of Acid Sulphate Materials 2005*.	Contractor	Construction	Core standard safeguard X1
Potential Acid Sulfate Soils	Silt curtains are to be installed prior to and around the area of works that may disturb the seabed, including the breakwater extension.	Contractor	Construction	Core standard safeguard W7
Contamination	If suspected contaminated areas are encountered during excavations on land, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the TfNSW LEA and the NSW EPA.	Contractor	Detailed design, Construction	Additional safeguard
Contamination	Water and sewage services will be designed in accordance with *AS3500.2:2015* and operated to ensure the risk of spills is avoided.	Contractor	Construction, Operation	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Spills	All fuels, chemicals and liquids are to be stored in an impervious bunded area a minimum of 50 metres away from any water.	Contractor	Construction	Additional safeguard
Spills	Refuelling of plant and equipment and storage of hazardous materials on barges is to occur within a double-bunded area.	Contractor	Construction	Core standard safeguard R3
Hazards and Risks	Vehicle wash down and/or washout is to occur in a designated bunded area.	Contractor	Construction	Core standard safeguard R5
Spills	A spill/emergency management plan which incorporates the following safeguards will be set out within the CEMP: • Methods to be used to stop a spill, contain and control the flow, clean up the spill, and record the spill. • Equipment barges carrying plant or machinery would be fitted with impervious bunding around equipment which contain chemicals or fuels to prevent chemical spills or leakages from entering the water. • Emergency spill kits would be kept on site at all times and maintained throughout the construction work. The spill kit must be appropriately sized for the volume of substances at the work site. • A spill kit would be kept on each barge and at the works compound. Spill kits for the barges will be specific for working within the marine environment. • Emergency contacts would be kept in an easily accessible location on the construction work site and on all construction vessels. All crew would be advised of these	Contractor	Pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	contact details and procedures. • If a spill to water occurs, the Contract Manager and TfNSW LEA would be notified immediately, in accordance with *RMS Environmental Incident Classification and Reporting Procedure February 2016*. • All staff will be made aware of the location of the spill kits and trained in their use. In the event of a spill during operation, the incident emergency plan would be implemented in accordance with the '*NSW State Waters Marine Oil and Chemical Spill Contingency Plan*' (Maritime, 2012).			

Other safeguards and management measures that would address water quality, contamination and waste management impacts are identified in sections 6.5 and 6.6.

6.3 Air quality

6.3.1 Methodology

The methodology was limited to a qualitative assessment due to the open, coastal location of the proposal.

6.3.2 Existing environment

The proposal is located in an area subject to prevailing north-easterly winds; therefore, the ambient air quality in general is likely to be high. The only likely contributors to any reduction in background air quality would be vehicles and marine traffic, although it is unlikely that impacts from these sources would be significant.

6.3.3 Potential impacts

Construction

Air quality impacts during construction of the proposal would include temporary impacts associated with dust particles and combustion sources. Anticipated sources of dust and dust-generating activities include dust from the loading and transfer of material from trucks, removal and placement of rock and waste materials from the basin, and re-surfacing of the carpark.

Minimal and very localised excavation and soil stockpiling is expected as a result of the proposal. As such the dust load generated over a typical construction day is likely to be minor and is not expected to result in reduced local air quality. As the site is subject to prevailing north-easterly winds dust generation may have an impact if safeguards are not implemented on site to prevent dust.

Other potential air quality impacts include emissions of CO, NO_2 and SO_2 associated with combustion of diesel fuel and petrol from construction vehicles, vessels, plant and equipment. Based on the duration of works, the number of emission sources and the scheduling of machinery (i.e., not all machinery would be operating simultaneously), potential emissions affecting air quality are expected to be minimal and would not affect the overall air amenity in the vicinity of the proposal.

Any potential odour emissions during works to sewerage system pipes are expected to be negligible. It is also expected that potential construction air quality impacts can be managed through the effective implementation of mitigation measures.

Operation

Air quality impacts during the operation of the boat ramp would include emissions of CO, NO_2, SO_2 and compounds associated with the combustion of diesel from vessels, as is currently the case. As the improved boat ramp facility is likely to result in increased use, there may be a slight long-term reduction in air quality. Impacts are likely to be minimal given the ambient environment and the significant distance to sensitive receivers.

6.3.4 *Safeguards and management measures*

Impact	Environmental safeguards	Responsibility	Timing	Reference
Air Quality	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will identify: • All potential dust generating activities associated with the proposal. • Feasible and reasonable mitigation measures to be implemented. • Arrangements for consultation with potentially affected neighbours, including notification and complaint handling procedures. • Contingency measures to be implemented in the event of a significant dust episode. • Training of all site workers to familiarise them with the potential for dust impacts and measures to minimise dust during their activities. The AQMP will include a range of communication methods with potentially affected receivers.	Contractor	Pre-construction	Standard safeguard
Air quality	Construction vehicles, vessels, plant and equipment should be maintained in good working order and switched off when not in use. No idling of construction	Contractor	Construction	Standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	vehicles or vessels is to be permitted.			
Dust	Works (including the spraying of paint and other materials) are not to be carried out during strong winds or in weather conditions where high levels of dust or airborne particulates are likely.	Contractor	Construction	Standard safeguard
Dust	Vehicles transporting waste or other materials that may produce odours or dust are to be covered during transportation.	Contractor	Construction	Standard safeguard
Dust	Stockpiles or areas that may generate dust are to be managed to suppress dust emissions.	Contractor	Construction	TfNSW *Stockpile Site Management Guideline* (EMS-TG-10).

6.4 Noise and vibration

6.4.1 Methodology

Construction noise is assessed with consideration of the *Construction Noise and Vibration Guideline* (CNVG) (RMS, 2016) and the *Interim Construction Noise Guideline* (ICNG) (DECCW, 2009). The ICNG is a non-mandatory guideline that is usually referred to by local councils and other NSW government entities. The ICNG recommend standard hours for construction activities, which will be adhered to for the proposed works, except in extenuating circumstances.

The TfNSW Construction Noise Estimator Tool (Distance Based Assessment – Construction Scenario) was used to determine the likely impacts of the construction phase of the project on nearby receivers. The Tool also includes safeguards that are required to be implemented to mitigate any potential impacts.

6.4.2 Existing environment

During peak periods, such as school holidays, special events and weekends, the background noise levels of the site and surrounds are likely to be moderate to high due to vehicles travelling along Jordan Esplanade and watercraft traffic using the boat ramp. At these times it is likely that the day-time background noise levels would be approximately 50 - 60dBA. Outside of peak times they may be as low as 40dBA.

The site is located at a significant distance from any residential receiver, with the closest residential receiver being an isolated dwelling 180m north-west of the boat ramp and approximately 100m north-west of the location proposed for roadworks. The nearest residential street is Camperdown Street which is located approximately 450m north-west of the proposal site.

The closest non-residential receiver is the RED-C Events Centre located in the former Deep Sea Fishing Club premises on Jordan Esplanade opposite the boat ramp at a distance of approximately 60m from the proposed roadworks at the intersection of the Centre and the boat ramp.

6.4.3 *Potential impacts*

Construction

The duration of works is approximately six months for each stage. Works are not proposed outside of standard working hours, but if required for safety and efficiency reasons, would be subject to approval, notification and a management plan.

The primary source of noise during construction is vehicles and machinery. Two piles will need to be driven for the purpose of the new pontoons. It is likely that this will be the most identifiable source of ‘nuisance’ noise; however, pile driving is likely to be complete within 1 to 2 days and therefore unlikely to attract significant complaint, particularly in light of the community’s broad support for the project.

Table 6-1: Recommended noise management levels (ICNG)

Period	Management Level L_{Aeq} (15min)
Residential recommended standard hours	Noise affected level: RBL + 10 Highly noise affected level: 75 dB(A)
Residential outside recommended standard hours	Noise affected level: RBL + 5
Offices, retail outlets	70 dB(A)

RBL = Rating Background Noise Level

The noise affected level represents the point above which there may be some community reaction to noise. Where the noise affected level is exceeded, all feasible and reasonable work practices to minimise noise should be applied and all potentially impacted residents should be informed of the nature of the works, expected noise levels, duration of works and a method of contact.

The highly noise affected level represents the point above which there may be strong community reaction to noise and is set at 75 dB(A). Where noise is above this level, respite periods may be required by restricting the hours when the loudest activities can occur, considering:

- Times identified by the community when they are less sensitive to noise.
- If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
- The heritage impact assessment at Appendix E identifies that the use of vibrating machinery for the works on Jordan Esplanade may have an impact on the heritage-listed Ferguson’s Cottage which is located more than 180m to the north-west of the proposal. Measures will be in place to limit the likelihood of this occurring, including a dilapidation survey prior to road works.
- Vibration impacts may also be experienced during the pile driving for the pontoons. As there are no buildings within 100m of the piles, it is unlikely that the vibration from this component of the works would have a detrimental impact.

Operation

As the improved boat ramp facility is likely to encourage increased use, it is likely that there would be a minor increase in noise levels. Impacts are likely to be minimal given the ambient environment and the significant distance to sensitive receivers. Broad community support for the project, including the potential for the facility to increase usage, is one of the community's main objectives for the proposal. This acceptance, along with the significant distance to any sensitive receiver, makes it unlikely that operational noise complaints will occur.

6.4.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and Vibration	A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the *Interim Construction Noise Guideline* (ICNG) (DECCW, 2009) and identify: • All potential significant noise and vibration generating activities associated with the activity. • Feasible and reasonable mitigation measures to be implemented. • Arrangements for consultation with potentially affected neighbours and sensitive receivers, including notification and complaint handling procedures. • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. • Training of all site workers to familiarise them with the potential for noise impacts and measures to minimise noise during their activities. The CNVMP will include standard mitigation measures as described in the CNVG. Additional noise mitigation measures would be included to minimise exceedances and will include a range of communication methods with affected receivers.	Contractor	Pre-construction	Section 4.6 of QA G36 Environment Protection

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and Vibration	A management procedure will be in place for noise and vibration complaints that may arise from the construction work. Each complaint must be investigated and appropriate noise and/or vibration amelioration measures be put in place to mitigate future exceedances.	Contractor	Construction	Additional safeguard
Working Hours	Works will be undertaken during the ICNG recommended standard working hours of Monday to Friday 7am to 6pm, Saturday 8am to 1pm and no work on Sundays or public holidays. Where feasible, closures of roads and the boat ramp will not be undertaken during school holiday periods. If required for safety and efficiency reasons, work outside of standard working hours would be subject to TfNSW approval, notification and a management plan.	Contractor	Construction	Additional safeguard
Vibration	A dilapidation survey of the heritage listed Ferguson's Cottage will be undertaken prior to the commencement of any works within 100m of the item.	Contractor	Construction	Additional safeguard

6.5 Landscape character and visual impact

Landscape character is the combined quality of the built, natural and cultural aspects that make up an area and provide its unique sense of place. Landscape in this context is taken to include all qualities and characteristics of a tract of land – landform, vegetation, built form and infrastructure. In this case, the landscape includes Coffs Harbour, the foreshore along Jetty Beach, the headland to the south and the distant view of the offshore islands.

6.5.1 Methodology

The landscape character and visual impacts of the Proposal have been assessed in accordance with the principles of the RMS' *Environmental Impact Assessment Practice Note - Guidelines for Landscape Character and Visual Impact Assessment No. EIA-N04* (RMS, n.d.). The assessment considers the sensitivity of the existing landscape and the magnitude of the proposed change to determine the likely visual impact on landscape character.

6.5.2 Existing environment

The coastline of Coffs Harbour is a major focus for recreation and the basis for much of the tourism in the region. Jetty Beach and the boat ramp offer accessible developed recreational facilities within a high amenity marina, beach, dune and headland environment.

The precinct is of high value to the community. Although the broader locality has high visual appeal and is a valuable tourist location, the boat ramp and carpark are in a state of minor disrepair and dilapidation which detracts from the visual amenity and appeal of the area.

The visual sensitivity of the landscape is likely to be moderate to high as the view is identifiable and deliberately ‘sought’; however, landscaping is noticeably absent in the vicinity of the boat ramp and areas of cracked hardstand, tyres and weeds prevail which detract from the amenity and scenic quality of the location.

Figure 9 Facing north across the boat ramp with the mountains and islands in view

6.5.3 Potential impacts

Construction

During the construction of the proposal there is likely to be a significant decrease in the visual amenity of the area due to the presence of machinery, plant, fencing and noise. Although the amenity will be decreased, it is contained within a small area of the broader landscape and is likely to be tolerated well by the community as the proposal has strong and widespread community support.

Operation

Upon completion of the Stage 2 works it is likely that there would be a significant improvement in the landscape character and visual amenity of the area, as previously dilapidated areas will be of a higher quality and vegetation screening of the main carpark from Jordan Esplanade and the former Deep Sea Fishing Club will be provided to enhance the user experience along the peninsula.

6.5.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Amenity	The construction area will be kept clean and clear of rubbish at all times.	Contractor	Construction	Additional safeguard
Visual Character	The construction site compound will be returned to its pre-construction state or as detailed in the detailed design documentation.	Contractor	Post-Construction	Additional safeguard
Light Spill	Lighting would be directionally controlled to limit the impacts of light spill on surrounding natural areas.	Contractor	Construction	Additional safeguard

Other safeguards and management measures that would address landscape character and visual impacts are identified in sections 6.2, 6.3 and 6.8.

6.6 Biodiversity

6.6.1 Methodology

A specialist aquatic ecology assessment was undertaken to assess the potential biodiversity impacts of the Proposal. It is included in full at Appendix F of this REF. The purpose of the assessment was to:

- Identify any potential impacts from the proposal on threatened biodiversity, MNES, fish habitat, marine vegetation, other fauna, areas of outstanding biodiversity value, aquaculture leases, and water quality.
- Provide recommendations regarding adoption of environmental controls and mitigation measures into the CEMP and identify any additional permit and approval requirements under the FM Act, including any requirements for a Species Impact Statement (SIS).

6.6.2 Existing environment

Aquatic

The site is located approximately 1km south of the Solitary Islands Marine Park (SIMP) boundary. Important threatened species populations associated with the SIMP and areas around Coffs Harbour include aggregation sites for the critically endangered Grey Nurse Shark (*Carcharias taurus*) at North and South Solitary Islands (DPI 2018), breeding and nesting sites on islands for threatened and migratory birds (NPWS 2016), important areas for the threatened Black Rockcod (*Epinephelus daemelii*) (DPI 2012a) and the majority of the known current distribution of the critically endangered marine brown alga (*Nereia lophocladia*) (DPI 2018b).

The entirety of intertidal habitat within the study area was comprised of artificial habitat associated with the boat ramp, pontoon piles and in most part the harbour breakwaters consisting of large ballast rock that encompassed the smaller inlet for the boat ramp and the northern side of Coffs Harbour. The ballast rock provides some substrate for settlement by sessile invertebrates. Several species of intertidal invertebrates were recorded on the breakwater and some shorebirds were recorded foraging in the area at low tide.

Subtidal habitat in the study area includes nearby rocky reef areas inside Coffs Harbour, lower subtidal areas of the breakwater between the Low Water Mark and breakwater toe, and soft sediment habitats. Natural rocky reef habitat is restricted to a small area of reef around 0.01 ha, located approximately 150m north of the boat ramp breakwater.

Review of sightings data, field observations of species, species habitat use and general habitat within the study area determined that the following species have a moderate or higher likelihood of occurrence:

Ten species of marine and shore birds:

1. Flesh-footed Shearwater (*Ardenna carneipes*)
2. Sooty Shearwater (*A. grisea*)
3. Wedge-tailed Shearwater (*A. pacifica*)
4. Short-tailed Shearwater (*A. tenuirostris*)
5. Lesser Frigatebird *(Fregata ariel*)
6. Common Tern (*Sterna hirundo*)
7. Crested Tern (Thalasseus bergii)
8. Sooty Oystercatcher (*Haematopus fuliginosus*)
9. Pied Oystercatcher (*H. longirostris*)
10. Little Tern (Sterna albifrons)

One species of marine mammal:

1. Australian Fur-seal (Arctocephalus pusillus doriferus)

Three species of marine reptiles:

1. Green Turtle (*Chelonia mydas*)
2. Hawksbill Turtle (Eretmochelys imbricata)
3. Loggerhead Turtle (*Caretta caretta*)

Two species of sharks and fish:

- White Shark (Carcharodon carcharias)
- Black Rockcod (Epinephelus daemelii)

One marine alga:

1. Brown Alga (Nereia lophocladia)

Terrestrial

The shoreline surrounding the boat ramp and adjacent to the breakwater is highly modified and disturbed due to the historical filling and construction of the boat ramp and associated carpark, and the adjacent Jordan Esplanade. Shoreline vegetation is largely absent, with the exception of some ornamental plantings on the opposite side of Jordan Esplanade. Although the threatened Coast Headland Pea (*Pultenaea maritima*) has been recorded on nearby headlands, there are no naturally occurring vegetation communities within the works footprint and with the implementation of the safeguards provided in this report, no indirect impacts are likely.

The sand placement site at Park Beach is an open area of sandy shoreline located between the frontal dune system and the mean high-water mark (MHWM). It is subject to gradual erosion and more severe episodic scouring associated with storm events. There is no vegetation located on either the access track to the sand placement site at Park Beach or on the placement site itself.

6.6.3 Potential impacts

It is unlikely that there would be any impact on biodiversity beyond the construction stage as the proposal comprises the upgrade of an existing facility and potential impacts are primarily associated with disturbance during works. The table below summarises the potential impacts of the proposal on biodiversity. A full assessment of the impacts is included in Appendix F.

Table 6-2: Potential biodiversity impacts

Potential Impact	Description
Removal or modification of shoreline habitat	The shoreline habitat within the proposal footprint consists of man-made seawalls constructed from large ballast rock, which will require some modification.
Removal or modification of intertidal habitat	Intertidal habitat within the proposal footprint consists of manmade seawalls constructed from large ballast rock and piles, and pontoon and concrete surfaces associated with the boat ramp. The works will include removal and replacement of artificial habitat associated with the boat ramp.
Removal or modification of subtidal habitat	The subtidal habitat within the proposal footprint consists of soft sandy unvegetated sediments. These sediments will require removal via dredging in places to remove shoaling sands and provide sufficient draught for safe access to and use of the boat ramp.
Harm to marine vegetation (saltmarshes, mangroves, seagrasses and seaweeds)	It is expected the proposed works will result in some removal and disturbance of seaweeds (macroalgae) attached to lower areas of the seawall to be modified and boat ramp associated structures to be replaced. No saltmarshes, mangroves or seagrasses occur.
Removal or loss of threatened species	It is unlikely that any threatened species will be removed or lost as part of this proposal.
Removal, modification or disturbance of potential threatened species habitat	The proposed works may result in removal and modification of some habitat associated with the seawall that could potentially be used by threatened species. This includes intertidal habitat used by threatened bird species for foraging and by seals for refuge as well as subtidal habitat which may potentially be used by fish for refuge or where threatened marine alga may potentially establish.
Disturbance or modification of a threatened population or community	No threatened populations or communities are expected to be disturbed by the proposal.
Disturbance and impacts on other intertidal fauna species	Disturbance and impacts that will include potential removal of intertidal fauna will occur where intertidal fauna has colonised areas of the existing seawall and boat ramp structures requiring modification.
Increased shading of the seabed from the additional pontoons	Habitat under the additional pontoons consists of unvegetated sediments only, which do not include any light sensitive communities. Shading of these areas has minimal ecological significance.
Disturbance and impacts on other subtidal fauna species	Disturbance of fish will occur, which utilise resources associated with the seawall and soft sediments to be dredged. Some benthic invertebrate and infauna will likely be removed and lost during the dredging works.

Potential Impact	Description
Fragmentation of habitat	The proposal is not expected to result in the fragmentation of any habitat. In most part, it will be confined to the existing footprint and artificial/man-made features in the area.
Generation of underwater noise with potential to impact on marine mammals, fish, sharks, rays and turtles.	Construction works to extend the seawall, increased vessel movements and piling associated with construction for this project will result in the generation of underwater noise. There is potential that this noise may cause behavioural and potentially physiological impacts to marine fauna, especially marine mammals.
Mobilisation of sediments impacting on habitat within and adjacent to the proposal footprint	Mobilisation of sediments from this proposal will likely occur during dredging works and construction works to extend the eastern seawall. Sedimentation of adjacent habitats associated with other areas of the seawall and nearby reef may receive short-term increases in sedimentation, which may impact on the habitat quality in these areas.
Reduction in water quality from construction works	Mobilisation of sediments from this proposal will likely occur during dredging works and construction works to extend the eastern seawall. Some short-term and localised disturbances to water quality from elevated turbidity and suspended solids are likely to occur during construction works. Reduced water quality may have some short-term and localised impacts on habitat quality within Coffs Harbour.
Impact on water quality from unplanned spills during construction works	Construction works will likely require some machinery mounted from floating barges. Where machinery is operating on or over the water, unplanned spills may quickly enter the adjacent water. Reduced water quality and hydrocarbon-based contaminants can have significant and fatal impacts on marine fauna if they do not have the ability to move out of the area.
Invasion or spread of non-native or invasive species	Equipment brought to site during construction works has potential to introduce non-native or invasive species to the site from other areas.
Removal of structures with marine growth	Removal of marine structures with growth will provide some short-term and localised reductions in habitat quality for marine fauna that use these areas for refuge, and fish that may forage for prey amongst these structures.
Injury caused by ingestion of, or entanglement in, harmful marine debris	Materials used during construction work that are not contained or disposed of correctly have potential to find their way into the water.
Increased potential for vessel interactions during construction works	Some air breathing marine fauna, especially marine turtles, are vulnerable to vessel strike. Vessel strike can result in serious injuries and in many cases can be fatal for marine fauna.
Smothering of the nests of shorebirds during beach nourishment at Park Beach	If sand placement is undertaken in the vicinity of nesting birds, eggs or chicks may be directly smothered during sand placement.
Smothering of native vegetation with dust during construction works	If dust is generated during construction, it has the potential to smother nearby native vegetation communities.

Potential Impact	Description
Lighting impacts on nearby nesting bird colonies	Artificial light can disrupt critical wildlife behaviour and cause physiological changes in wildlife, in particular on fledgling seabirds.

Operation

Lighting impacts on nearby nesting bird colonies has been identified as the only potential ongoing impact of concern during the operational phase. Natural darkness has a conservation value in the same way that clean water, air and soil has intrinsic value. Artificial light can disrupt critical behaviour and cause physiological changes in wildlife. For example, fledgling seabirds may not take their first flight if their nesting habitat never becomes dark (Australian Department of the Environment and Energy, 2019). Consequently, artificial light has the potential to stall the recovery of a threatened species. These impacts can be mitigated through lighting hardware design and control and have been considered in the safeguards below to mitigate potential effects.

Conclusion on significance of impacts

Direct impacts from the proposal would include some disturbance of artificial habitat, however, the proposal will result in a significant amount of similar additional habitat as a result of the proposed breakwater extension. The removal and modification of some lower sections of the breakwater will likely have short-term impacts on common macroalgae, which may be dislodged or removed. Some threatened and migratory marine fauna are also known (e.g. shorebirds) and others may use habitat associated with these structures. Subsequently careful management of construction works in this area will be undertaken.

Direct seabed disturbances from dredging and the extended breakwater are confined to unvegetated and mobile marine sands. Indirect impacts, as a result in changes in patterns of sand accretion as a result of the extended breakwater may also affect the nearby reef and southern end of Jetty Beach.

Upgraded lighting may also impact adjacent intertidal habitat use. Although these areas are not considered to be of ecological significance to any threatened or migratory populations of marine fauna.

Construction works will have some short-term disturbances on habitat quality. These disturbances will include construction noise in intertidal areas, underwater noise during piling works and some periods of reduced water quality during dredging. The piling works associated with this proposal are very minimal and expected to only result in short-term disturbances. The dredging works will be confined to clean marine sands close to the boat ramp basin entry and any water quality disturbances are expected to be very localised to the south-eastern corner of the harbour.

The proposal is considered unlikely to have a significant impact on State and/or Commonwealth listed threatened biodiversity. As such, referral to the Department of the Environment under the EPBC Act is not required. Similarly, the preparation of a Species Impact Statement (SIS) based on the provisions of the BC and FM Act are not required. However, based on the *NSW Policy and guidelines for fish habitat conservation and management*, a Section 205 - permit to harm (cut, remove, damage, destroy, shade etc.) marine vegetation (saltmarshes, mangroves, seagrass and seaweeds) will likely be required, and further consultation with DPI Fisheries will be undertaken regarding this, prior to the commencement of works. Further consultation under Section 199 of the FM Act will also be required with DPI Fisheries in relation to the breakwater extension and dredging.

To manage the potential risks that the proposal may pose to marine habitat, flora and fauna, the potential for impacts to adjacent habitat during construction from noise, reduced water quality and the mobilisation of sediments, and the generation of underwater noise, a series of safeguards will be incorporated into the CEMP for the proposal as detailed in the table below.

6.6.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Threatened Species	If unexpected threatened fauna or flora species are discovered, stop works immediately and follow the TfNSW *Unexpected Threatened Species Find Procedure in the Roads and Maritime Services Biodiversity Guidelines 2011 – Guide 1.*	Contractor	Construction	Core standard safeguard F3
Habitat Protection	Anchoring and/or use of construction vessels (including barges) is not permitted over sensitive marine vegetation or rocky reef habitat.	Contractor	Construction	Core standard safeguard F10
Habitat Protection	All activities are to minimise disturbance to shallow water habitats under, and in the immediate vicinity of water based structures, including disturbance of seabed sediments and smothering habitats from propeller strike or excessive propeller wash.	Contractor	Construction	Core standard safeguard F11
Habitat Protection	All activities are to be carried out to avoid spreading marine pests including: • Removal of weeds, animals or sediment from equipment and disposal to an appropriate waste receptacle or facility. • Disposal of sewage and bilge water at an approved pump out facility.	Contractor	Construction	Core standard safeguard F12
Water pollution	An Oil Spill response plan to mitigate and respond to any oil spill caused by any vessels will be prepared and submitted to navigationadvicenorth@rms.nsw.gov.au	Contractor	Pre-construction	Maritime consultation response letter
Lighting	All new lighting will be designed undertaking consultation with NPWS to minimise impacts on nesting bird colonies. The *Draft National Light Pollution Guidelines for Wildlife* (Australian Department of the Environment and Energy,	TfNSW Project Manager	Pre-construction	CHCC consultation response email, *Draft National Light Pollution Guidelines for Wildlife* (Australian

Impact	Environmental safeguards	Responsibility	Timing	Reference
	2019) will be considered in designing new lighting.			Department of the Environment and Energy, 2019)
Habitat Protection	Finalisation of detailed design is to give consideration for the replacement and extended seawall and breakwater structures to be constructed with materials similar to those that are currently in place.	TfNSW Project Manager	Detailed design	Additional safeguard
Threatened Species	Additional survey of the seawall and reef for the threatened Black Rockcod must be undertaken 4 weeks prior to construction works. This should be undertaken to ensure the species has not recruited to these areas since the original survey. Should this species be found, a management plan will need to be prepared in consultation with DPI Fisheries.	TfNSW Project Manager	Pre-construction	Additional safeguard
Nesting fauna	Inspection of the seawalls and breakwater and southern end of Jetty Beach for evidence of nesting marine and shorebirds must be undertaken within 4 weeks prior to construction works. The inspection must also include searches for nesting marine turtles. Should these be found, a management plan will need to be prepared in consultation with DPI Fisheries and NPWS.	TfNSW Project Manager	Pre-construction	Additional safeguard
Vessel strike	Construction vessels should travel at no greater than 8 knots speed within 500m of the proposal footprint during construction works to minimise potential for interaction and/or vessel strike on marine fauna.	Contractor	Construction	Additional safeguard
Underwater Noise	To manage impacts of underwater noise on marine fauna the following will be undertaken during piling works: • The entire harbour is to be considered an observation zone for	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	marine mammals and turtles. The observation zone should be monitored for marine mammals and turtles for a period of no less than 30mins before start-up of piling. - A soft start-up procedure should be implemented to provide fish, sharks and rays, as well as intertidal fauna such as birds an opportunity to move away from the area. This procedure should include a gradual increase in piling impact energy over a 15 minute time period starting from no greater than 50%. This should be implemented at the start of each day or after a pause in piling works of 30 minutes or greater. - A shut down zone for marine mammals and turtles should be implemented for an area that extends 500m from the entrance to the boat ramp basin. Incursions of marine mammals and/or turtles into this zone during piling operations triggers a temporary shutdown of piling operations. Further guidance on managing piling works can be found in the *SA Underwater Piling Noise Guidelines* (DPTI 2012).			
Domestic pets	No domestic animals are to be brought onto site during construction works to minimise potential for disturbance of any shorebirds.	Contractor	Construction	Additional safeguard
Shorebirds	Intertidal areas should be avoided at low tide when	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	shorebirds are actively foraging within 50m of areas with active construction works, including the sand placement area at Park Beach.			
Shorebirds	If any marine or shorebirds are found to be nesting, or Fur-seals resting, within 100m of the construction footprint, the works should cease immediately and the local NPWS office notified.	Contractor	Construction	Additional safeguard
Marine Turtles	The contractor should liaise monthly with the local NPWS office to ensure no nesting turtles are using Jetty Beach.	Contractor	Construction	Additional safeguard
Vessel Speed	A reduced vessel speed limit of 4 knots to reduce potential for future vessel strikes of marine fauna will be implemented for waters to the west inside the extended eastern breakwater.	TfNSW	Operation	Additional safeguard
Nesting Birds	Should any nesting birds with potential to be impacted by the upgraded lighting be encountered during construction works, they will be monitored for at least one season post construction works.	TfNSW	Operation	Additional safeguard

Other safeguards and management measures that would address biodiversity impacts are identified in sections 6.2, 6.3 and 6.4.

6.7 Socio-economic

Socio-economic impact assessment (SEIA) involves analysing the social and economic consequences of a development. It involves identifying and evaluating likely changes to, or impacts on, communities and businesses as a result of a proposed development and to mitigate or manage impacts and maximise benefits.

6.7.1 Methodology

An assessment of the socio-economic impacts of the proposal has been undertaken with reference to the RMS *Environmental Impact Assessment Practice Note on Socio-economic assessment EIA-N05* (RMS, n.d.) The Proposal has been assessed at a 'basic level' in accordance with the provisions of the Practice Note. In assessing the level of significance of impacts, consideration is given to:

- The range of potential direct and indirect impacts during construction and operation.
- Cumulative impacts with other proposals.
- Whether potential impacts may be positive, negative or neutral.

6.7.2 Existing environment

The CHRBRPEC's final report to the NSW Government (CHRBRPEC, 2018) identified socio-economic factors as one of the major driving forces for the required upgrade of the facility. That report notes that there are "*4546 registered pleasure craft in the Coffs Harbour Region and many thousands more visitors using the ramp precinct, with significant economic returns to the community*" (CHRBRPEC, 2018). Although the exact numbers of visitors to the boat ramp precinct are unknown, the significant economic value of the boat ramp precinct is acknowledged in the *NSW Maritime Infrastructure Plan* (NSW Government, 2019) as a key investment location where investment in enhancing state-owned and other maritime infrastructure will deliver the greatest overall benefits for recreational boating, the commercial fishing and aquaculture industry, and tourism.

6.7.3 Potential impacts

Construction

During the construction phases, various elements of the works may affect the level of usage of the facility, in particular the introduction of construction facilities, plant and equipment to the environment which will affect views, vistas and amenity. This may result in a short-term decrease in tourism to the precinct as it will temporarily become a less desirable location. It is likely that Coffs Harbour as a destination will be resilient to the short-term reduction in visitation as there are other attractors in close proximity, including Jetty Beach, Gallows Beach, the marina and the headland.

Operation

There is community and government recognition of the potential for the proposal to result in significant positive socio-economic impacts. The proposal is driven by the community and CHRBRPEC's final report to the NSW Government (CHRBRPEC, 2018) identified that "*public support for the Committee's proposed ten enhancements has been nothing short of phenomenal. In a relatively short period of time in excess of 12,222 locals and visitors, have petitioned the NSW Government for the Committee's vision for a world class ramp precinct to be implemented*".

The CHCC is currently progressing its strategic planning for the Coffs Harbour Jetty Foreshore Precinct to activate and revitalise the Coffs Harbour Foreshore area which adjoins the boat ramp precinct. Both projects are likely to leverage off each other through the benefits to the tourism industry and local community as a result of construction and activation of the foreshore as a destination.

Although there is strong community support for an improved boat ramp precinct, there are a number of aquatic events held in Coffs Harbour that may be impacted by the proposed extension of the breakwater. These include fishing events, swimming events and other boating events. Targeted consultation will be undertaken with community groups to ensure that they are kept informed about the proposed breakwater extension.

6.7.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Community Engagement	A Communication and Stakeholder Plan (CSP) will be prepared and implemented to help provide timely and accurate information to the community during construction. The CSP will include (as a minimum):	Contractor	Pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	• Procedures and mechanisms that will be used to engage with affected landowners, business owners and the wider community to identify potential access and parking impacts and develop appropriate management measures. • Procedures to keep the community informed about construction and any associated changes to conditions (e.g., detours or lane closures) such as through advertisements in local media and advisory notices or variable message signs.			
Emergency Access	Access for emergency vehicles will be maintained at all times during construction.	Contractor	Construction	Additional safeguard
Notification	Consultation will be undertaken with potentially affected residences prior to the commencement of and during works in accordance with the *Community Involvement and Communications Resource Manual* (RTA, 2008). Consultation would include newsletters or letterbox drops providing information on the proposed works, working hours and a contact name and number for more information or to register complaints.	TfNSW project manager	Pre-construction	Additional safeguard
Notification	Road users and the local community will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	TfNSW project manager	Pre-construction	Additional safeguard

Other safeguards and management measures that would address socio-economic impacts are identified in sections 6.2, 6.3, 6.4, 6.5, 6.8 and 6.12.

6.8 Traffic, access and parking

6.8.1 Methodology

A specialist traffic and parking assessment was undertaken to inform the design of the Proposal. It is included in the Concept Design Report at Appendix G of this REF. The scope of the assessment was to:

- Review parking demands at the boat ramp and surrounding area.
- Assess the proposed carpark design in accordance with AS2890 and the *NSW Boat Ramp Facility Guidelines* (NSW Government, 2015).
- Undertake a swept path assessment of key manoeuvring areas.
- Review the proposed carpark functionality, operations and safety.
- Assess the access design including turn warrants, manoeuvrability and sight lines.
- Review the proposed pedestrian facility design for functionality, safety and inclusiveness.

6.8.2 Existing environment

The existing Coffs Harbour boat ramp comprises a three-lane boat ramp with a single pontoon. There are 49 marked car and trailer parking spaces with access provided to Jordan Esplanade via an informal crossover which is approximately 33m wide.

Jordan Esplanade is a two-lane public road with a 50km/h posted speed limit and no kerb and channel. There is existing public carparking south and east of the boat ramp.

The existing pedestrian path network terminates on the northern side of the boat ramp carpark, directing pedestrians through the carpark and past the manoeuvring area for the boat ramp. A shared path connection is located east of the boat ramp on the northern side of Jordan Esplanade; however, no connection currently exists through or past the boat ramp.

6.8.3 Potential impacts

Construction

Access

Construction traffic movements and deliveries to the site would be via Jordan Esplanade. Typical land-based vehicles likely to be used during construction include:

- 20 tonne trucks to deliver rock for the breakwater extension.
- Rigid trucks of variable size for delivery of machinery and equipment and potentially for transport of sand. Some trucks may include trailer combinations.
- Barge and dredge.
- Boats.
- Backhoe.
- Long-reach excavator (up to 30 tonnes).
- Cranes (up to 80 tonnes), including a franna crane and mobile crane.
- Compaction roller.
- Smaller equipment such as rock-breakers, concrete saws, hydraulic hammers, etc.

It is anticipated that up to 150 truck movements would be undertaken for the construction of the proposal, including up to 40 truck movements over a five-day period for the transport of sand from the basin during the dredging in Stage 1. This would result in a moderate increase in the number of heavy vehicles that travel on the surrounding road network; however, truck movements are anticipated to be intermittent and dispersed over the duration of the construction phase (approximately one year in total) and it is not expected that construction will cause noticeable delays or damage on surrounding roads.

There is an appropriate access for sand to be delivered by truck to Park Beach, which is used for regular beach nourishment campaigns. The access minimises conflicts with pedestrians.

Site-specific Construction Traffic Management Plans would be in place to manage the construction traffic over the duration of the proposed works and no significant adverse impacts are likely.

Parking

Construction vehicles would primarily be parked within the works compound. Intermittently, larger vehicles may be parked for short periods in the public carparking area. The Construction Traffic Management Plan would set the parameters for the use of the public parking area by construction vehicles.

Operation

Trip generation is expected to vary between an even distribution of vehicles entering and exiting, and a ‘tidal’ movement of vehicles (e.g., higher ingress movements during optimal boating or launch conditions). As Jordan Esplanade is a no through road, most trips will travel to and from the west. Movements to and from the east will only occur at times when overflow parking is used.

Traffic generated by the boat ramp is not expected to result in adverse impacts to the operations of the surrounding road network with an estimated 1-2 vehicles entering or exiting the boat ramp carpark during peak periods.

It is understood that the boat ramp may on occasion have peak or seasonal spikes during events, during which utilisation of the boat ramp may increase significantly. Additional traffic may be generated during these times; however, this is not consistent with typical day-to-day operations and is not considered to be a significant adverse impact.

Parking

A total of 108 boat and trailer parking spaces are proposed as well as 10 vehicle-only parking spaces. Considering the average surveyed demand of 22 spaces and peak demand of 81 spaces Survey undertaken in July-August 2020) , the proposed parking supply is considered sufficient to cater for demand. This will cater for an additional 27 spaces more than the highest recorded peak.

The provision of vehicle-only parking equates to slightly less than one space per six car and trailer spaces which generally aligns with TfNSW recommendations. It is noted that the surrounding area also includes a significant supply of existing vehicle-only parking spaces which can be utilised.

Access

Stage 2 of the proposal includes a new configuration for access to Jordan Esplanade. The access location has been moved to the west to maximise separation between the top of the boat ramp and the access point, thereby minimising potential conflicts.

Under the relevant Australian Standard an access is required which is 6-9m wide. The access has been designed to cater for design vehicle swept paths and exceeds the minimum requirements. The access includes a separated entry and exit lane (minimum 4m wide each) with a central pedestrian refuge and kerb returns of approximately 12m radius.

The sight distance to the east and west along Jordan Esplanade exceeds the desirable 69m for a 50km/h road frontage as per the requirements of AS2890.1.

Active Transport

The boat ramp concept includes:

- A 2.5m wide shared path on the northern side of Jordan Esplanade. This connects to the existing pathway at the western extent of the boat ramp. The shared path terminates on the eastern side of the boat ramp allowing for future connection to the existing pathway

network further east which continues to the southern breakwater. This pathway caters for the key east-west pedestrian and cyclist route on the northern side of Jordan Esplanade. It also provides connection between the boat ramp and other parking facilities accessed from Jordan Esplanade, including overflow parking proposed as part of the boat ramp upgrade.
- A 1.8m wide pedestrian path along the southern side of Jordan Esplanade. This provides connection between the existing carpark and proposed overflow parking areas on the southern side of Jordan Esplanade and the boat ramp.
- A 1.5m wide pedestrian path connecting the existing pathway network (west of the boat ramp) to the boat ramp along the foreshore.
- Two refuge crossings across Jordan Esplanade.
- The above active transport facilities are considered a key design element of the boat ramp facility, providing both pedestrian connection to and from the boat ramp and allowing safe pedestrian movements past the boat ramp.

Opportunities for active transport would be improved as a result of the proposal.

6.8.4 Safeguards and management measures

Land Traffic

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction Traffic	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will include as a minimum: • Confirmation of haulage routes. • Measures to maintain access to local roads and properties where applicable. • Site specific traffic control measures (including signage) to manage and regulate traffic movement. • Measures to maintain pedestrian and cyclist access. • Requirements and methods to consult and inform the local community of impacts on the local road network. • Access to construction sites including entry and exit locations and measures to prevent construction	Contractor	Pre-construction	Section 4.8 of *QA G36 Environment Protection* *Roads and Maritime Traffic Control at Work Sites Manual* (RTA, 2010)

Impact	Environmental safeguards	Responsibility	Timing	Reference
	vehicles queuing on public roads. • A response plan for any construction traffic incident. • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic. • Monitoring, review and amendment mechanisms.			
Road closure	A temporary works application and road closure application will be submitted to Council for any road closures required for construction	Contractor	Pre-construction, Construction	Additional safeguard
Construction Traffic	A traffic control plan will be prepared in accordance with the 'Traffic control at work sites manual' (RTA, 2010a) and Australian Standard 1742.3 Manual of uniform control devices	Contractor	Pre-construction	Core standard safeguard T3
Construction Traffic	All Traffic Control Plans (TCP) will be implemented by a certified Traffic Controller who will be onsite during work hours to ensure all signage is provided in accordance with the requirements of the approved TMP.	Contractor	Construction	Additional safeguard
Construction Traffic	At no time will contractors be allowed to park private vehicles within loading areas, which are for the sole purpose of the loading/ unloading of materials and equipment.	Contractor	Construction	Additional safeguard
Construction Traffic	Truck routes will be established prior to the commencement of any works, including the truck size, access location and	Contractor	Pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	provision of loading and unloading areas to minimise the impact on the existing road network and pedestrians. Pedestrian access will be safely maintained at all times.			
Construction Traffic	All trucks will enter and exit the site in a forward direction. All drivers will be linked via radio and called to the site when required to ensure no trucks queue.	Contractor	Construction	Additional safeguard
Construction Traffic	Where possible, current traffic movements and property accesses are to be maintained during the works. Any disturbance is to be minimised to prevent unnecessary traffic delays.	Contractor	Construction	Core standard safeguard T1

Maritime Traffic

Impact	Environmental safeguards	Responsibility	Timing	Reference
Maritime Traffic	Where possible, current vessel movements and public accesses to the waterway and foreshore are to be maintained during works. Any disturbance is to be minimised as much as practicable.	Contractor	Construction	Core standard safeguard T2
Access	Any access to waterways using barges/boats or similar is to be via an existing boat ramp with no disturbance to the bank or surrounding vegetation.	Contractor	Construction	Core standard safeguard G4
Maritime Traffic	A Maritime Traffic Management Plan will be prepared and implemented as part of the CEMP. The plan will be devised in consultation with the local Boating Safety Officer. NSW Maritime will have final approval of the plan.	Contractor	Pre-construction	Maritime consultation response
Maritime Traffic	Any works impacting on navigation during the construction phase will seek NSW Maritime support 21 days prior to works commencing. A full scope of	Contractor	Pre-construction, Construction	Maritime consultation response

Impact	Environmental safeguards	Responsibility	Timing	Reference
	works including dates and time frames is to be provided to the relevant Maritime Compliance Officer.			
Maritime Traffic	Any barge and all associated work boats will comply with the relevant Marine Legislation for survey, crewing, registration and safety equipment.	Contractor	Pre-construction, Construction	Maritime consultation response letter
Navigation Safety	Vessels will exhibit lights and day shapes in accordance with *International Regulations for Preventing Collisions at Sea*. Due to the high volume of, and close proximity to, vessel traffic, additional lighting of barge/work boats will be undertaken to increase vessel and plant visibility including when unattended at night.	Contractor	Pre-construction, Construction	*International Regulations for Preventing Collisions at Sea*
Navigation safety	Any cables including anchor cables, pipes and ancillary equipment which presents as a potential hazard to people or vessels will be appropriately marked, including the use of lights at night. Marking of objects will be clarified with the relevant NSW Maritime Boating Safety Officer prior to placement.	Contractor	Pre-construction, Construction	Maritime consultation response letter
Navigation Safety	Submerged cables may present as a hazard to craft anchoring. These hazards will be mitigated through measures including (but not limited to) the application of appropriate signage and lighting, written notification to stakeholders and broadcasting of marine safety alerts to prevent anchoring issues, or impact on vessels retrieving their anchors.	Contractor	Pre-construction, Construction	Maritime consultation response letter
Navigation Safety	Written notifications advising of the works including dates, times and navigation restrictions will be circulated to all commercial vessel operators that use the waters	Contractor	Pre-construction	Maritime consultation response letter

Impact	Environmental safeguards	Responsibility	Timing	Reference
	within and around Coffs Harbour not less than 21 days prior to works commencing.			
Navigation Safety	A legal Marine Notice advising vessel operators of the works including dates, times and navigation restrictions will be placed at visible locations at local boat ramps in Coffs Harbour. The Marine Notice will include any restrictions.	Contractor	Pre-construction	Maritime consultation response letter
Navigation Safety	Signage advising waterway users of the works and the potential effect on navigation will be erected at the proposal site at least two weeks prior to the commencement of works.	Contractor	Pre-construction	Maritime consultation response letter
Navigation Safety	The relocation, removal or additional installation of navigation aids will be done in consultation with NSW Maritime.	Contractor	Pre-construction	Maritime consultation response letter
Navigation Safety	Coffs Harbour Marine Rescue will be advised when works are in progress so that a message can be broadcast at regular intervals to notify commercial and recreational vessels of the operations. In the first instance NSW Maritime will provide Marine Rescue with the Marine Notice to broadcast the restrictions and general awareness of the works in progress. Changes to times or work methods will be notified to Marine Rescue, and barge contractors will log on and log off with Marine Rescue daily.	Contractor	Construction	Maritime consultation response letter
Navigation Safety	Should the area around the barge operations need to be closed at any time during the works, notification to the Boating Safety Officer or the Senior Boating Safety Officer will be undertaken as early as possible.	Contractor	Construction	Maritime consultation response letter
Navigation Safety	A Vessel Recovery and Salvage Plan will be	Contractor	Pre-construction	Maritime consultation

Impact	Environmental safeguards	Responsibility	Timing	Reference
	submitted to navigationadvicenorth@rms.nsw.gov.au. In the event that a barge becomes dislodged due to heavy seas or any other occurrence, the plan will include reference to contingencies around removal.			response letter

6.9 Aboriginal cultural heritage

6.9.1 *Policy setting*

An assessment of potential impacts on Aboriginal cultural heritage has been undertaken to meet the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010), the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011), the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (OEH, 2010) and the *Procedure for Aboriginal cultural heritage consultation and investigation* (PACHCI) - *Resource 1* (RMS, n.d.).

6.9.2 *Methodology*

An Aboriginal Heritage Due Diligence Assessment was undertaken for the proposal and is included in full at Appendix D with the Stage 1 PACHCI assessment.

A review of the archaeological literature of the region, and more specifically the Coffs Harbour area and the results of an AHIMS search, provided essential contextual information for the assessment.

An archaeological predictive model was established to identify areas of archaeological sensitivity. It involved reviewing existing literature to identify basic site distribution patterns which were then modified according to the specific environment of the proposal area to form a predictive model for the site location. A sampling strategy was then used to test the model and the results of the survey used to confirm, refute or modify the model. The proposal area, consisting of a highly disturbed slope, was surveyed as two survey units based on landform elements and project areas.

6.9.3 *Existing environment*

The site types identified throughout the area appear to be low density/small occupation sites that were associated with more secular activities. The broader landform assessment also suggests that larger sites indicative of larger camping groups may be located on the valley floors, mainly due to available room compared to the limited and uneven surfaces of the sandstone areas where large scale habitation is not possible, but may have been utilised as activity areas away from the main camp.

The project area has been subject to extensive works associated with the existing boat ramp and associated infrastructure including roads, carparks and coastal erosion stabilisation works as well as erosion. Due to these significant land uses and their associated impacts at depth, no sites are expected to be located in the project area.

No archaeological sites or Potential Archaeological Deposits (PADs) were identified during the survey and this is likely due to the fact that the past and present land uses would have displaced and/or destroyed any evidence of past Aboriginal land use.

In view of the predictive modelling and the results obtained from the survey, it is concluded that the survey provides a valid basis for determining the probable impacts of the proposal and formulating recommendations for the project. The survey results demonstrate the absence of Aboriginal objects within the project area, which is consistent with results obtained from other studies in the local area in similar environmental contexts.

6.9.4 Potential impacts

As all works for the proposal will be undertaken in highly modified and disturbed areas, and ground penetration is reasonably shallow, it is not expected that there would be any impact on Aboriginal cultural heritage. The safeguards and management measures below are precautionary only.

6.9.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Statutory obligation	All site workers involved in construction activities must be made aware of the statutory legislation protecting sites and places of significance. Of particular importance is the National Parks and Wildlife Amendment (*Aboriginal Objects and Aboriginal Places) Regulation 2010*, under the National Parks and Wildlife Act 1974	Contractor	Construction	Additional safeguard
Artefacts	If Aboriginal heritage items are uncovered during the works, all works in the vicinity of the find must cease and the TfNSW Aboriginal cultural heritage officer and LEA contacted immediately. Steps in the TfNSW *Standard Management Procedure: Unexpected Heritage Items* must be followed.	Contractor	Construction	Core standard safeguard B1
Consultation	Consultation with the Coffs Harbour LALC will be undertaken to progress the detailed design giving consideration to Aboriginal cultural heritage issues	TfNSW project manager	Detailed design	Additional safeguard

6.10 Historic heritage

6.10.1 Methodology

An historic heritage assessment of the proposal is included at Appendix E. The following tasks were undertaken:

- Searches of local, state and national heritage registers and planning instruments;
- Review of previous heritage studies and assessments;
- Background historical research to understand past land use and heritage significance;

- Site inspection to assess potential heritage impacts;
- Significance assessments;
- Impact assessment of the proposal on heritage significance and the potential for archaeological remains; and
- Provision of management recommendations to avoid and/or minimise heritage impacts.

6.10.2 Existing environment

The first European known to visit Coffs Harbour was John Korff in the 1840s (after whom Coffs Harbour is named). John Korff's association with the place to later bear his name occurred in the 1840s when he and his ship took shelter during a gale. John Korff is generally credited as the 'discoverer' of Coffs Harbour, and several other local places bear his name: North Coff Island now known as Muttonbird Island, South Coff Island now known as Corambirra Point, Korff's Islet, Coffs Creek and Korff Street. 'Korff's Harbour' became 'Coffs Harbour' through a spelling error in the NSW Government Gazette which declared Reserve 15 at Coffs Harbour comprising 960 acres on 24 December 1861.

The need to create calmer waters to assist Coffs Harbour's development as a shipping port had been recognised in the late 19th century and was noted in 1890 maritime surveys of Coffs Harbour and Woolgoolga, and in 1912 the scheme proposed by engineers, de Burgh and Keele, was accepted. The scheme involved linking North and South Coff Islands to the mainland and building an additional ocean breakwater from South Coff Island in a north-eastern curve to create a sheltered harbour. Work began on the south side of the harbour in 1913 with the construction of a timber viaduct (trestle bridge) linking South Coff Island to the mainland in order to set up a quarry at South Coff Island to supply the rock for the northern breakwater. By 1915 the quarry was in full operation and a tramline had been built to transport rock from South Coff Island along the shoreline to the northern breakwater.

The following legislated heritage items are known to occur within, or near, the area of the proposal.

Table 6-3: Heritage items

Item Name	Item Number (LEP and State Heritage List)	Address	Property Description	Significance	Source
Ferguson's Cottage	I9 01802	1 Breakwater Road, Coffs Harbour	Part Lot 21 DP850150	State	Coffs Harbour LEP 2013/ NSW Heritage inventory
Buried trestle bridge, tramway line site and World War II gun Turret	I8 1360005	Jordan Esplanade, Coffs Harbour	Lot 21 DP 850150	Local	Coffs Harbour LEP 2013/ NSW Heritage Inventory
Line of Former Rail Tracks, Coffs Harbour Breakwaters and Foreshore (archaeology)	I8 1360006	Jordan Esplanade, Coffs Harbour	As above	Archaeological	NSW Heritage Inventory

A number of non-legislated heritage items were recorded during the site inspection which are likely to have potential historic heritage significance. These are listed in full on page 22 of Appendix E. All legislated and non-legislated historic heritage items are shown below:

Figure 10: Listed heritage items shown on an aerial view
Source: (CoAssociates, 2020)

6.10.3 Potential impacts

Construction

The land use history of the site and historical research indicates the presence of former structures in the area and potential archaeological features were observed during the site inspection. The proposal area is therefore considered to have some archaeological potential, albeit that the area is highly disturbed.

The state listed Ferguson's Cottage is located within close proximity to the works area but is not within the project boundary and is unlikely to be directly impacted. Some minor indirect impacts may occur due to vibration and dust, and safeguards and management measures are proposed below to mitigate any risk.

The World War II gun turret is not located within the project boundary and is unlikely to be impacted as it is located at a sufficient distance from the works area.

The locally-listed buried trestle bridge and tramway line site is located within the project boundary and may be impacted by the works, although no direct heritage impacts to the buried trestle bridge and rail area are intended. The former rail and crane areas are buried beneath the existing carpark and the delineation is now broken by the excavated area of the existing boat ramp and basin inlet.

Operation

It is unlikely that the proposal will have any impact on historic heritage during the operation of the boat ramp.

6.10.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Vibration impacts on Ferguson’s Cottage	Low vibration machinery and methods must be used at the western end of Jordan Esplanade where new asphalt pavement is proposed, and within 100m of Ferguson’s Cottage.	Contractor	Construction	Additional safeguard
Destruction of historic maritime infrastructure	The two large ship bollards and adjacent large chain blocks, located in grassed overflow parking area B, are to be retained and protected.	Contractor	Construction	Additional safeguard
Destruction of archaeological relics	If unexpected heritage items are uncovered during the works, all works must cease in the vicinity of the material/find and the steps in the Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items must be followed. Roads and Maritime Services Senior Environment Specialist - Heritage must be contacted immediately.	Contractor	Construction	Core standard safeguard H2

Other safeguards and management measures that would address Non-Aboriginal heritage impacts are identified in sections 6.3 and 6.4.

6.11 Waste management

6.11.1 Existing environment

The boat ramp basin and channel are regularly dredged by CHCC using a long-reach excavator. Sand is typically stockpiled and de-watered before being transported by truck to other areas. Occasionally the dredged sand is re-used for beach nourishment at Park Beach in accordance with the Coffs Harbour CZMP action reference BD.1 (BMT WBM, 2019). As the sand from the basin and channel are clean marine sand and are being re-used within the same sediment compartment, the dredged material is not classified as a waste stream.

Bins for public use are located in various areas along the foreshore, and waste from the fish cleaning tables is washed into the harbour via a pipe from the fish cleaning station.

6.11.2 Potential impacts

Construction

Construction waste will be minimal as there is limited demolition. Waste streams are likely to be typical of most infrastructure work sites and would include:

- Tyres, scrap metals, concrete and plastics from the boat ramp works.
- Concrete, asphalt and bitumen from the carpark upgrade.
- Topsoils and grass.
- Timber, plastics and metals from signage, lights and other infrastructure.
- Fuels and oils from plant and machinery.
- General waste from workers.

Waste management measures will be implemented during works to minimise and mitigate any potential impacts as part of a Waste Management Plan.

Operation

It is likely that the usage of the boat ramp and surrounding foreshore will increase as a result of the proposal. This will be mitigated by the provision of additional bins to ensure that littering does not increase.

6.11.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Waste Management	A Waste Management Plan must be prepared that follows the TfNSW *Technical Guide: Management of road construction and maintenance waste*.	Contractor	Pre-construction, Construction	Core safeguard M1
Waste Management	Opportunities for reuse or recycling of removed items will be investigated prior to the commencement of works. If unable to be reused or recycled, the waste material will be appropriately disposed of at a landfill site and records of disposal retained. Waste generated by the proposal will be recycled as a first preference where practical.	Contractor	Pre-construction, Construction	Additional safeguard
Waste Management	All wastes associated with the works will be classified prior to removal from the site. Waste classification will be undertaken in accordance with the	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Waste Classification Guidelines (EPA, 2014).			
Waste Management	A designated stockpile area will be established for non-hazardous materials for temporary stockpiling prior to disposal. The area will be fenced to exclude public access.	Contractor	Construction	Additional safeguard
Waste Management	Potentially contaminated waste will be stored separately with appropriate containment to protect human health and the environment. This will include handling the material in accordance with SafeWork NSW standard procedures. These materials would only be transported by a licensed waste contractor to a licensed waste facility.	Contractor	Construction	Additional safeguard
Waste Management	Waste material is not to be left on site once the works have been completed for each stage.	Contractor	Construction	Core safeguard M9

6.12 Climate change

6.12.1 Strategic framework

The *NSW Coastal Planning Guideline: Adapting to Sea Level Rise* (DoP, 2010) applies to the proposal. This guideline requires that the following criteria be considered when designing development proposals:

1. Development avoids or minimises exposure to immediate coastal risks (seaward of the immediate hazard line).

2. Development provides for the safety of residents, workers or other occupants on site from risks associated with coastal processes.

3. Development does not adversely affect the safety of the public off site from a change in coastal risks as a result of the development.

4. Development does not increase coastal risks to properties adjoining or within the locality of the site.

5. Infrastructure, services and utilities on site maintain their function and achieve their intended design performance.

6. Development accommodates natural coastal processes.

7. Coastal ecosystems are protected from development impacts.

8. Existing public beach, foreshore or waterfront access and amenity is maintained.

The NSW Climate Change Policy Framework defines the NSW Government's role in reducing carbon emissions and adapting to the impacts of climate change. Of particular relevance to the proposal, the framework supports coastal planning projects and the implementation of works identified in certified coastal zone management plans or coastal management programs.

6.12.2 Potential impacts

Construction

Climatic factors would affect the construction of the proposal during adverse weather conditions such as prolonged heavy rain, high winds and coastal storms causing large waves with the potential to delay the completion of construction.

Construction would contribute to climate change through the generation of greenhouse gases from construction activities. Greenhouse gases would be generated through the use of fossil fuels by construction plant and equipment, transportation of personnel and materials, and the embodied carbon in the materials used such as concrete and steel.

Opportunities exist to reduce the greenhouse gas emissions for the proposal through investigating alternative, lower embodied carbon options for construction.

The delivery of the dredged material to Park Beach for beach nourishment will achieve a key action (BD.1) within the Coffs Harbour Coastal Zone Management Plan (BMT WBM, 2019).

Operation

The proposal will deliver infrastructure with improved resilience to climate change by addressing coastal processes through an improved facility and extended breakwater.

Design of the proposal has taken into account wave action and predicted sea level rise. More extreme and more frequent weather events as a result of climate change may lead to more rapid degradation of the proposal. This may result in additional maintenance requirements.

The floating pontoons would be able to rise and fall with the tide, including any change in sea level. The new piles would provide an appropriate freeboard to accommodate the adopted sea level rise benchmarks for the NSW coast.

6.12.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Climate Change	Where possible, procure recycled content construction materials and use lower embodied energy concrete for lower-strength applications where feasible.	Contractor	Construction	Additional safeguard
Climate Change	Select the most fuel-efficient plant, equipment and vehicles available.	Contractor	Construction	Additional safeguard
Climate Change	Regularly maintain all plant and vehicles, including any water vessels, to maintain fuel efficiency.	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Climate Change	Procure locally produced goods and services where feasible and cost effective to reduce transport fuel emissions.	Contractor	Construction	Additional safeguard
Climate Change	Alternative fuel and power sources (such as biodiesels and ethanol blends) will be used wherever practicable.	Contractor	Construction	Additional safeguard

6.13 Cumulative impacts

6.13.1 Study area

The study area for this assessment of cumulative impacts is the area from Gallows Beach north to Park Beach where beach nourishment is proposed.

6.13.2 Other projects and developments

Table 6-4: Past, present and future projects

Project	Construction impacts	Operational impacts
Jetty4Shores (future project)	Construction of the next stages of the Jetty4Shores project may increase the amount of construction traffic on local roads and cause a temporary loss of amenity and open space whilst works are being undertaken.	The completed Jetty4Shores project and the completed Boat Ramp Precinct will together create a significant coastal destination with positive socio-economic impacts for the region.
Ongoing basin and channel dredging	It is likely that a minor amount of dredging will be required within the basin and channel to maintain an appropriate depth. This will cause short-term temporary disruption but will be undertaken outside of peak periods. Additionally, dredged sand will be used beneficially for local beach nourishment.	The ongoing basin and channel dredging are necessary to ensure a high level of safety and usability at the boat ramp.

6.13.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic	The Consultation Plan will include ongoing communication	TfNSW Project Manager	Pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	with Coffs Harbour City Council to minimise the likelihood of construction work in the foreshore area occurring at the same time as the construction phases of the proposal.			

Other safeguards and management measures that would address cumulative impacts are identified in section 6.8.

7 Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are also listed.

7.1 Environmental management plans

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Project Environmental Management Plan (PEMP) and a Construction Environmental Management Plan (CEMP) will be prepared to describe the safeguards and management measures identified. The PEMP and CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The PEMP and CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the relevant Transport for NSW Environment Officer, prior to the commencement of any on-site works. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP and PEMP would be developed in accordance with the specifications set out in the QA Specification G36 – Environmental Protection (Management System), QA Specification G38 – Soil and Water Management (Soil and Water Plan), and QA Specification G10 - Traffic Management.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

Table 7-1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN1	General - minimise environmental impacts during construction	A CEMP will be prepared and submitted for review and endorsement by the Transport for NSW Environment Manager prior to commencement of the activity. As a minimum, the CEMP will address the following: • any requirements associated with statutory approvals • details of how the project will implement the identified safeguards outlined in the REF • issue-specific environmental management plans • roles and responsibilities • communication requirements • induction and training requirements • procedures for monitoring and evaluating environmental performance, and for corrective action • reporting requirements and record-keeping • procedures for emergency and incident management	Contractor / Transport for NSW Project Manager	Pre-construction/ detailed design	QA Specification G36 – Environmental Protection (Management System)

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• procedures for audit and review The endorsed CEMP will be implemented during the undertaking of the activity			
GEN3	General – environmental awareness	All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular ‘toolbox’ style briefings. Site-specific training will be provided to personnel engaged in activities or areas of higher risk.	Contractor/ Transport for NSW project manager	Pre-construction, Construction	Standard safeguard
AF1	Ancillary Facilities	Ancillary facilities will be designated, signposted and fenced off to prevent access by the general public, in accordance with the location shown in Chapter 3 of the project REF.	Contractor	Construction	Additional safeguard
HICP1	Sediment Transport	A hydrographic and beach survey will be undertaken along and offshore to south Jetty Beach to document existing sediment conditions prior to the extension of the breakwater.	TfNSW Project Manager	Pre-construction	Additional safeguard
HICP1	Sand Management	A Sand Management Plan will be prepared to detail the ongoing management of sediment transport within the basin and channel, including (but not limited to) responsibilities for future maintenance, dredging and sand disposal options.	TfNSW Project Manager	Post-construction	Additional safeguard
WQC1	Soil and Water	A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil and water pollution and describe how these risks would be addressed during construction. This would include, but not be limited to, measures relating to	Contractor	Pre-construction	Additional Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		the following activities to minimise the risk of pollution: • Training of personnel to identify ASS and contaminated sediment. • Spills from concrete pouring. • Oil/fuel/chemical storage and spill management. • Machinery and engine maintenance schedule to reduce oil/fuel leakage.			
WQC2	Water Quality	An Environmental Work Method Statement (EWMS) for the extension of the breakwater must be incorporated into the SWMP and include measures to limit disturbance of the seabed. The EWMS must be approved by the TfNSW LEA.	Contractor	Pre-construction	Additional Safeguard
WQC3	Water Quality	There is to be no release of dirty water into drainage lines, the harbour or the basin.	Contractor	Construction	Core standard safeguard W1
WQC4	Water Quality	Visual monitoring of local water quality (i.e., turbidity, hydrocarbon spills/slicks) is to be undertaken on a regular basis to identify any spills, deficient silt curtains or erosion and sediment controls. During dredging works water turbidity or suspended solids should be regularly monitored at the source, as well as100m and 500m from the source. Visual monitoring of any pluming should also be routinely monitored.	Contractor	Construction	Core standard safeguard W2
WQC5	Water Quality	Visual monitoring of water quality at Park Beach is to be undertaken twice daily during placement works. In the event of any turbidity, placement works will cease and the TfNSW LEA will be contacted.	Contractor	Construction	Additional Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
WQC6	Water Quality	Water quality control measures are to be used to prevent any materials entering drain inlets.	Contractor	Construction	Core standard safeguard W3
WQC7	Water Quality	Where dredged sediments require dewatering on site, bunding and/or sediment erosion fencing will be constructed to minimise any flow of waters with high amounts of suspended solids back into the harbour.	Contractor	Construction	Additional Safeguard
WQC8	Water Quality	Measures to control pollutants from stormwater and spills would be investigated and incorporated in the pavement drainage system for the car park and road diversion at locations where it discharges to the receiving drainage lines. Measures aimed at reducing flow rates during rain events and potential scour would also be incorporated in the design of the pavement drainage system.	Contractor	Pre-construction, Construction	Core standard safeguard W4
WQC9	Water Quality	Vessels (including barges) are only to be used at suitable tides when no less than 600mm clearance is available between the underside of the vessel and the bed of the waterway.	Contractor	Construction	Core standard safeguard W6
WQC10	Water Quality	Silt curtains are to be installed, monitored and maintained as needed to contain any sediment during works within the water.	Contractor	Construction	Core standard safeguard W8
WQC11	Water Quality	Monitoring will be undertaken twice daily for silt containment and entrainment or impingement of marine wildlife. Results of observations will be recorded in a site notebook maintained specifically for the purpose. The notebook will be kept on site and be available for inspection by persons authorised by TfNSW.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
	Water Quality	All rock brought to site is to be clean and free of fines and sediments prior to being placed in the water or on the banks. Any washing of rock on site prior to placement is to be undertaken in a bunded area, with sediment collected and removed from site.	Contractor	Construction	Additional safeguard
WQC12	Erosion and Sedimentation	Erosion and sediment control measures are to be implemented and maintained to: • Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets • Reduce water velocity and capture sediment on site • Minimise the amount of material transported from site to surrounding pavement surfaces • Divert clean water around the site (in accordance with the Landcom/Department of Housing Managing *Urban Stormwater, Soils and Construction Guidelines* (the Blue Book).	Contractor	Construction	Core standard safeguard E1
WQC13	Erosion and Sedimentation	Erosion and sediment controls are to be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.	Contractor	Construction	Core standard safeguard E2
WQC14	Erosion and Sedimentation	Erosion and sediment control measures are not to be removed until the works are complete for each stage and areas are stabilised.	Contractor	Construction	Core standard safeguard E3
WQC15	Erosion and Sedimentation	The maintenance of established stockpiles is to be in accordance with the TfNSW Stockpile Site Management Guideline (EMS-TG-10).	Contractor	Construction	Core standard safeguard E4

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
WQC16	Potential Acid Sulfate Soils	Land-side soils excavated for utility adjustments and sediments attached to dredging removal must be checked for potential acid sulphate soils.	Contractor	Construction	Additional safeguard
WQC17	Potential Acid Sulfate Soils	Potential or actual acid sulphate soils are to be managed in accordance with the TfNSW Guidelines for the *Management of Acid Sulphate Materials 2005*.	Contractor	Construction	Core standard safeguard X1
WQC18	Potential Acid Sulfate Soils	Silt curtains are to be installed prior to and around the area of works that may disturb the seabed, including the breakwater extension.	Contractor	Construction	Core standard safeguard W7
WQC19	Contamination	If suspected contaminated areas are encountered during excavations on land, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the TfNSW LEA and the NSW EPA.	Contractor	Detailed design, Construction	Additional safeguard
WQC20	Contamination	Water and sewage services will be designed in accordance with *AS3500.2:2015* and operated to ensure the risk of spills is avoided.	Contractor	Construction, Operation	Additional safeguard
WQC21	Spills	All fuels, chemicals and liquids are to be stored in an impervious bunded area a minimum of 50 metres away from any water.	Contractor	Construction	Additional safeguard
WQC22	Spills	Refuelling of plant and equipment and storage of hazardous materials on barges is to occur within a double-bunded area.	Contractor	Construction	Core standard safeguard R3
WQC23	Hazards and Risks	Vehicle wash down and/or washout is to occur in a designated bunded area.	Contractor	Construction	Core standard safeguard R5

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
WQC24	Spills	A spill/emergency management plan which incorporates the following safeguards will be set out within the CEMP: • Methods to be used to stop a spill, contain and control the flow, clean up the spill, and record the spill. • Equipment barges carrying plant or machinery would be fitted with impervious bunding around equipment which contain chemicals or fuels to prevent chemical spills or leakages from entering the water. • Emergency spill kits would be kept on site at all times and maintained throughout the construction work. The spill kit must be appropriately sized for the volume of substances at the work site. • A spill kit would be kept on each barge and at the works compound. Spill kits for the barges will be specific for working within the marine environment. • Emergency contacts would be kept in an easily accessible location on the construction work site and on all construction vessels. All crew would be advised of these contact details and procedures. • If a spill to water occurs, the Contract Manager and TfNSW LEA would be notified immediately, in accordance with *RMS Environmental Incident*	Contractor	Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Classification and Reporting Procedure February 2016. All staff will be made aware of the location of the spill kits and trained in their use. In the event of a spill during operation, the incident emergency plan would be implemented in accordance with the '*NSW State Waters Marine Oil and Chemical Spill Contingency Plan*' (Maritime, 2012).			
WM1	Waste Management	A Waste Management Plan must be prepared that follows the TfNSW *Technical Guide: Management of road construction and maintenance waste*.	Contractor	Pre-construction, Construction	Core safeguard M1
WM2	Waste Management	Opportunities for reuse or recycling of removed items will be investigated prior to the commencement of works. If unable to be reused or recycled, the waste material will be appropriately disposed of at a landfill site and records of disposal retained. Waste generated by the proposal will be recycled as a first preference where practical.	Contractor	Pre-construction, Construction	Additional safeguard
WM3	Waste Management	All wastes associated with the works will be classified prior to removal from the site. Waste classification will be undertaken in accordance with the *Waste Classification Guidelines (EPA, 2014)*.	Contractor	Construction	Additional safeguard
WM4	Waste Management	A designated stockpile area will be established for non-hazardous materials for temporary stockpiling prior to disposal. The area will be fenced to exclude public access.	Contractor	Construction	Additional safeguard
WM5	Waste Management	Potentially contaminated waste will be stored separately with appropriate containment to protect human health and the environment. This will	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		include handling the material in accordance with SafeWork NSW standard procedures. These materials would only be transported by a licensed waste contractor to a licensed waste facility.			
WM6	Waste Management	Waste material is not to be left on site once the works have been completed for each stage.	Contractor	Construction	Core safeguard M9
AQ1	Air Quality	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will identify: • All potential dust generating activities associated with the proposal. • Feasible and reasonable mitigation measures to be implemented. • Arrangements for consultation with potentially affected neighbours, including notification and complaint handling procedures. • Contingency measures to be implemented in the event of a significant dust episode. • Training of all site workers to familiarise them with the potential for dust impacts and measures to minimise dust during their activities. The AQMP will include a range of communication methods with potentially affected receivers.	Contractor	Pre-construction	Standard safeguard
AQ2	Air Quality	Construction vehicles, vessels, plant and equipment should be maintained in good working order and switched off when not in use. No idling of construction vehicles or vessels is to be permitted.	Contractor	Construction	Additional safeguard
AQ3	Air Quality	Works (including the spraying of paint and other materials) are not to be carried out during strong	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		winds or in weather conditions where high levels of dust or airborne particulates are likely.			
AQ4	Dust	Vehicles transporting waste or other materials that may produce odours or dust are to be covered during transportation.	Contractor	Construction	Additional safeguard
AQ5	Dust	Stockpiles or areas that may generate dust are to be managed to suppress dust emissions in accordance with TfNSW *Stockpile Site Management Guideline* (EMS-TG-10).	Contractor	Construction	Additional safeguard
NV1	Noise and Vibration	A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the *Interim Construction Noise Guideline* (ICNG) (DECCW, 2009) and identify: • All potential significant noise and vibration generating activities associated with the activity. • Feasible and reasonable mitigation measures to be implemented. • Arrangements for consultation with potentially affected neighbours and sensitive receivers, including notification and complaint handling procedures. • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. • Training of all site workers to familiarise them with the potential for noise impacts and measures to minimise noise during their activities. The CNVMP will include standard mitigation measures as described in the CNVG. Additional	Contractor	Pre-construction	Section 4.6 of QA G36 Environment Protection

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		noise mitigation measures would be included to minimise exceedances and will include a range of communication methods with affected receivers.			
NV2	Noise and Vibration	A management procedure will be in place for noise and vibration complaints that may arise from the construction work. Each complaint must be investigated and appropriate noise and/or vibration amelioration measures be put in place to mitigate future exceedances.	Contractor	Construction	Additional safeguard
NV3	Working Hours	Works will be undertaken during the ICNG recommended standard working hours of Monday to Friday 7am to 6pm, Saturday 8am to 1pm and no work on Sundays or public holidays. Where feasible, closures of roads and the boat ramp will not be undertaken during school holiday periods. If required for safety and efficiency reasons, work outside of standard working hours would be subject to TfNSW approval, notification and a management plan.	Contractor	Construction	Additional safeguard
NV4	Vibration	A dilapidation survey of the heritage listed Ferguson's Cottage will be undertaken prior to the commencement of any works within 100m of the item.	Contractor	Construction	Additional safeguard
LCVI1	Amenity	The construction area will be kept clean and clear of rubbish at all times.	Contractor	Construction	Additional safeguard
LCVI2	Visual Character	The construction site compound will be returned to its pre-construction state or as detailed in the detailed design documentation.	Contractor	Post-Construction	Additional safeguard
LCVI3	Light Spill	Lighting would be directionally controlled to limit the impacts of light spill on surrounding natural areas.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B1	Threatened Species	If unexpected threatened fauna or flora species are discovered, stop works immediately and follow the TfNSW *Unexpected Threatened Species Find Procedure in the Roads and Maritime Services Biodiversity Guidelines 2011 – Guide 1.*	Contractor	Construction	Core standard safeguard F3
B2	Habitat Protection	Anchoring and/or use of construction vessels (including barges) is not permitted over sensitive marine vegetation or rocky reef habitat.	Contractor	Construction	Core standard safeguard F10
B3	Habitat Protection	All activities are to minimise disturbance to shallow water habitats under, and in the immediate vicinity of water based structures, including disturbance of seabed sediments and smothering habitats from propeller strike or excessive propeller wash.	Contractor	Construction	Core standard safeguard F11
B4	Habitat Protection	All activities are to be carried out to avoid spreading marine pests including: • Removal of weeds, animals or sediment from equipment and disposal to an appropriate waste receptacle or facility. Disposal of sewage and bilge water at an approved pump out facility.	Contractor	Construction	Core standard safeguard F12
B5	Water pollution	An Oil Spill response plan to mitigate and respond to any oil spill caused by any vessels will be prepared and submitted to navigationadvicenorth@rms.nsw.gov.au	Contractor	Pre-construction	Maritime consultation response letter
B6	Lighting	All new lighting will be designed undertaking consultation with NPWS to minimise impacts on nesting bird colonies. The *Draft National Light Pollution Guidelines for Wildlife* (Australian	TfNSW Project Manager	Pre-construction	CHCC consultation response email, *Draft National*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Department of the Environment and Energy, 2019) will be considered in designing new lighting.			*Light Pollution Guidelines for Wildlife* (Australian Department of the Environment and Energy, 2019)
B7	Habitat Protection	Finalisation of detailed design is to give consideration for the replacement and extended seawall and breakwater structures to be constructed with materials similar to those that are currently in place.	TfNSW Project Manager	Detailed design	Additional safeguard
B8	Threatened Species	Additional survey of the seawall and reef for the threatened Black Rockcod must be undertaken 4 weeks prior to construction works. This should be undertaken to ensure the species has not recruited to these areas since the original survey. Should this species be found, a management plan will need to be prepared in consultation with DPI Fisheries.	TfNSW Project Manager	Pre-construction	Additional safeguard
B9	Nesting fauna	Inspection of the seawalls and breakwater and southern end of Jetty Beach for evidence of nesting marine and shorebirds must be undertaken within 4 weeks prior to construction works. The inspection must also include searches for nesting marine turtles. Should these be found, a management plan will need to be prepared in consultation with DPI Fisheries and NPWS.	TfNSW Project Manager	Pre-construction	Additional safeguard
B10	Vessel strike	Construction vessels should travel at no greater than 8 knots speed within 500m of the proposal footprint during construction works to minimise	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		potential for interaction and/or vessel strike on marine fauna.			
B11	Underwater Noise	To manage impacts of underwater noise on marine fauna the following will be undertaken during piling works: • The entire harbour is to be considered an observation zone for marine mammals and turtles. The observation zone should be monitored for marine mammals and turtles for a period of no less than 30mins before start-up of piling. • A soft start-up procedure should be implemented to provide fish, sharks and rays, as well as intertidal fauna such as birds an opportunity to move away from the area. This procedure should include a gradual increase in piling impact energy over a 15 minute time period starting from no greater than 50%. This should be implemented at the start of each day or after a pause in piling works of 30 minutes or greater. • A shut down zone for marine mammals and turtles should be implemented for an area that extends 500m from the entrance to the boat ramp basin. Incursions of marine mammals and/or turtles into this zone during piling operations triggers a temporary shut down of piling operations.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Further guidance on managing piling works can be found in the *SA Underwater Piling Noise Guidelines* (DPTI 2012).			
B12	Domestic pets	No domestic animals are to be brought onto site during construction works to minimise potential for disturbance of any shorebirds.	Contractor	Construction	Additional safeguard
B13	Shorebirds	Intertidal areas should be avoided at low tide when shorebirds are actively foraging within 50m of areas with active construction works, including the sand placement area at Park Beach.	Contractor	Construction	Additional safeguard
B14	Shorebirds	If any marine or shorebirds are found to be nesting, or Fur-seals resting, within 100m of the construction footprint, the works should cease immediately and the local NPWS office notified.	Contractor	Construction	Additional safeguard
B15	Marine Turtles	The contractor should liaise monthly with the local NPWS office to ensure no nesting turtles are using Jetty Beach.	Contractor	Construction	Additional safeguard
B16	Vessel Speed	A reduced vessel speed limit of 4 knots to reduce potential for future vessel strikes of marine fauna will be implemented for waters to the west inside the extended eastern breakwater.	TfNSW	Operation	Additional safeguard
B17	Nesting Birds	Should any nesting birds with potential to be impacted by the upgraded lighting be encountered during construction works, they will be monitored for at least one season post construction works.	TfNSW	Operation	Additional safeguard
SE1	Communication	A Communication and Stakeholder Plan (CSP) will be prepared and implemented to help provide timely and accurate information to the community during construction. The CSP will include (as a minimum):	Contractor	Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Procedures and mechanisms that will be used to engage with affected landowners, business owners and the wider community to identify potential access and parking impacts and develop appropriate management measures. • Procedures to keep the community informed about construction and any associated changes to conditions (e.g., detours or lane closures) such as through advertisements in local media and advisory notices or variable message signs.			
SE2	Emergency Access	Access for emergency vehicles will be maintained at all times during construction.	Contractor	Construction	Additional safeguard
SE3	Notification	Consultation will be undertaken with potentially affected residences prior to the commencement of and during works in accordance with the *Community Involvement and Communications Resource Manual* (RTA, 2008). Consultation would include newsletters or letterbox drops providing information on the proposed works, working hours and a contact name and number for more information or to register complaints.	TfNSW project manager	Pre-construction	Additional safeguard
SE4	Notification	Road users and the local community will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	TfNSW project manager	Pre-construction	Additional safeguard
TAP1	Construction Traffic	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will include as a minimum:	Contractor	Pre-construction	Section 4.8 of *QA G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Confirmation of haulage routes. • Measures to maintain access to local roads and properties where applicable. • Site specific traffic control measures (including signage) to manage and regulate traffic movement. • Measures to maintain pedestrian and cyclist access. • Requirements and methods to consult and inform the local community of impacts on the local road network. • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • A response plan for any construction traffic incident. • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic. • Monitoring, review and amendment mechanisms.			*Roads and Maritime Traffic Control at Work Sites Manual* (RTA, 2010)
TAP2	Construction Traffic	A traffic control plan will be prepared in accordance with the 'Traffic control at work sites manual' (RTA, 2010a) and Australian Standard 1742.3 Manual of uniform control devices	Contractor	Pre-construction	Core standard safeguard T3
TAP3	Construction Traffic	All Traffic Control Plans (TCP) will be implemented by a certified Traffic Controller who will be onsite during work hours to ensure all	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		signage is provided in accordance with the requirements of the approved TMP.			
TAP4	Construction Traffic	At no time will contractors be allowed to park private vehicles within loading areas, which are for the sole purpose of the loading/ unloading of materials and equipment.	Contractor	Construction	Additional safeguard
TAP5	Construction Traffic	Truck routes will be established prior to the commencement of any works, including the truck size, access location and provision of loading and unloading areas to minimise the impact on the existing road network and pedestrians. Pedestrian access will be safely maintained at all times.	Contractor	Pre-construction	Additional safeguard
TAP6	Construction Traffic	All trucks will enter and exit the site in a forward direction. All drivers will be linked via radio and called to the site when required to ensure no trucks queue.	Contractor	Construction	Additional safeguard
TAP7	Construction Traffic	Where possible, current traffic movements and property accesses are to be maintained during the works. Any disturbance is to be minimised to prevent unnecessary traffic delays.	Contractor	Construction	Core standard safeguard T1
TAP8	Road closure	A temporary works application and road closure application will be submitted to Council for any road closures required for construction.	Contractor	Pre-construction, Construction	Additional safeguard
TAP9	Maritime Traffic	Where possible, current vessel movements and public accesses to the waterway and foreshore are to be maintained during works. Any disturbance is to be minimised as much as practicable.	Contractor	Construction	Core standard safeguard T2
TAP10	Maritime Traffic	A Maritime Traffic Management Plan will be prepared and implemented as part of the CEMP. The plan will be devised in consultation with the	Contractor	Pre-construction	Maritime consultation response

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		local Boating Safety Officer. NSW Maritime will have final approval of the plan.			
TAP11	Maritime Traffic	Any works impacting on navigation during the construction phase will seek NSW Maritime support 21 days prior to works commencing. A full scope of works including dates and time frames is to be provided to the relevant Maritime Compliance Officer.	Contractor	Pre-construction, Construction	Maritime consultation response
TAP12	Maritime Traffic	Any barge and all associated work boats will comply with the relevant Marine Legislation for survey, crewing, registration and safety equipment.	Contractor	Pre-construction, Construction	Maritime consultation response letter
TAP13	Access	Any access to waterways using barges/boats or similar is to be via an existing boat ramp with no disturbance to the bank or surrounding vegetation.	Contractor	Construction	Core standard safeguard G4
TAP14	Navigation Safety	Vessels will exhibit lights and day shapes in accordance with *International Regulations for Preventing Collisions at Sea*. Due to the high volume of, and close proximity to, vessel traffic, additional lighting of barge/work boats will be undertaken to increase vessel and plant visibility including when unattended at night.	Contractor	Pre-construction, Construction	*International Regulations for Preventing Collisions at Sea*
TAP15	Navigation safety	Any cables including anchor cables, pipes and ancillary equipment which presents as a potential hazard to people or vessels will be appropriately marked, including the use of lights at night. Marking of objects will be clarified with the relevant NSW Maritime Boating Safety Officer prior to placement.	Contractor	Pre-construction, Construction	Maritime consultation response letter

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
TAP16	Navigation Safety	Submerged cables may present as a hazard to craft anchoring. These hazards will be mitigated through measures including (but not limited to) the application of appropriate signage and lighting, written notification to stakeholders and broadcasting of marine safety alerts to prevent anchoring issues, or impact on vessels retrieving their anchors.	Contractor	Pre-construction, Construction	Maritime consultation response letter
TAP17	Navigation Safety	Written notifications advising of the works including dates, times and navigation restrictions will be circulated to all commercial vessel operators that use the waters within and around Coffs Harbour not less than 21 days prior to works commencing.	Contractor	Pre-construction	Maritime consultation response letter
TAP18	Navigation Safety	A legal Marine Notice advising vessel operators of the works including dates, times and navigation restrictions will be placed at visible locations at local boat ramps in Coffs Harbour. The Marine Notice will include any restrictions.	Contractor	Pre-construction	Maritime consultation response letter
TAP19	Navigation Safety	Signage advising waterway users of the works and the potential effect on navigation will be erected at the proposal site at least two weeks prior to the commencement of works.	Contractor	Pre-construction	Maritime consultation response letter
TAP20	Navigation Safety	The relocation, removal or additional installation of navigation aids will be done in consultation with NSW Maritime.	Contractor	Pre-construction	Maritime consultation response letter
TAP21	Navigation Safety	Coffs Harbour Marine Rescue will be advised when works are in progress so that a message can be broadcast at regular intervals to notify commercial and recreational vessels of the operations. In the first instance NSW Maritime will provide Marine Rescue with the Marine Notice to	Contractor	Construction	Maritime consultation response letter

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		broadcast the restrictions and general awareness of the works in progress. Changes to times or work methods will be notified to Marine Rescue, and barge contractors will log on and log off with Marine Rescue daily.			
TAP22	Navigation Safety	Should the area around the barge operations need to be closed at any time during the works, notification to the Boating Safety Officer or the Senior Boating Safety Officer will be undertaken as early as possible.	Contractor	Construction	Maritime consultation response letter
TAP23	Navigation Safety	A Vessel Recovery and Salvage Plan will be submitted to navigationadvicenorth@rms.nsw.gov.au. In the event that a barge becomes dislodged due to heavy seas or any other occurrence, the plan will include reference to contingencies around removal.	Contractor	Pre-construction	Maritime consultation response letter
ACH1	Statutory obligation	All site workers involved in construction activities must be made aware of the statutory legislation protecting sites and places of significance. Of particular importance is the National Parks and Wildlife Amendment (*Aboriginal Objects and Aboriginal Places) Regulation 2010*, under the National Parks and Wildlife Act 1974	Contractor	Construction	Additional safeguard
ACH2	Artefacts	If Aboriginal heritage items are uncovered during the works, all works in the vicinity of the find must cease and the TfNSW Aboriginal cultural heritage officer and LEA contacted immediately. Steps in the TfNSW *Standard Management Procedure: Unexpected Heritage Items* must be followed.	Contractor	Construction	Core standard safeguard B1
ACH3	Consultation	Consultation with the Coffs Harbour LALC will be undertaken to progress the detailed design giving	TfNSW project manager	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		consideration to Aboriginal cultural heritage issues			
HH1	Vibration impacts on Ferguson's Cottage	Low vibration machinery and methods must be used at the western end of Jordan Esplanade where new asphalt pavement is proposed, and within 100m of Ferguson's Cottage.	Contractor	Construction	Additional safeguard
HH2	Destruction of historic maritime infrastructure	The two large ship bollards and adjacent large chain blocks, located in grassed overflow parking area B, are to be retained and protected.	Contractor	Construction	Additional safeguard
HH3	Destruction of archaeological relics	If unexpected heritage items are uncovered during the works, all works must cease in the vicinity of the material/find and the steps in the Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items must be followed. Roads and Maritime Services Senior Environment Specialist - Heritage must be contacted immediately.	Contractor	Construction	Core standard safeguard H2
CC1	Climate Change	Where possible, procure recycled content construction materials and use lower embodied energy concrete for lower-strength applications where feasible.	Contractor	Construction	Additional safeguard
CC2	Climate Change	Select the most fuel-efficient plant, equipment and vehicles available.	Contractor	Construction	Additional safeguard
CC3	Climate Change	Regularly maintain all plant and vehicles, including any water vessels, to maintain fuel efficiency.	Contractor	Construction	Additional safeguard
CC4	Climate Change	Procure locally produced goods and services where feasible and cost effective to reduce transport fuel emissions.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
CC5	Climate Change	Alternative fuel and power sources (such as biodiesels and ethanol blends) will be used wherever practicable.	Contractor	Construction	Additional safeguard
CI1	Traffic	The Consultation Plan will include ongoing communication with Coffs Harbour City Council to minimise the likelihood of construction work in the foreshore area occurring at the same time as the construction phases of the proposal.	TfNSW Project Manager	Pre-construction	Additional safeguard

7.3 Licensing and approvals

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
Crown Land Management Act 2016 (Division 3.4, 5.5 and 5.6)	Lease or licence to occupy areas of Crown land if the combined licence area is not amended prior to commencement of Stage 2 works. Note: Work on Crown land triggers the requirement for a 24KA notice under the *Native Title Act 1993*. The notice is to be prepared by the legal team and sent to NTSCORP. This is required whether there is a claim on the land or not.	Prior to start of the activity
Fisheries Management Act 1994 (s199)	Notification to the Minister for Primary Industries prior to any dredging (work that involves the removal of any of material from water that disturbs, moves or harms woody debris, snags, gravel beds, cobbles, rocks, boulders, rock bars or aquatic vegetation is considered dredging) or reclamation work. A copy of the REF and detailed design should be submitted with the notification.	A minimum of 28 days prior to the start of work.
Fisheries Management Act 1994 (s205)	A permit must be sought for harm to marine vegetation for the breakwater extension as seaweeds are likely to be damaged or removed for the purpose of the works. A copy of the REF and detailed design should be submitted with the notification.	Prior to start of the activity
Marine Safety Act 1998	Under Section 18 of the *Marine Safety Act 1998*, the proposal is considered an aquatic activity as it would be undertaken on navigable waters and would temporarily restrict the availability of those waters for normal use by the public. As such, Section 97(1) of the *Marine Safety Regulation 2016* would require the work to be subject to an aquatic licence issued by Maritime.	Prior to start of the activity.

8 Justification and conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site, and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

8.1 Justification

The proposal is for the upgrade of the Coffs Harbour Regional Boat Ramp. The upgrade will provide additional lanes for launching and retrieving vessels, an improved basin environment for increased safety, and improved parking facilities, reserve embellishments and landscaping.

The proposal would support the NSW Government's *Maritime Infrastructure Plan*, which identifies Coffs Harbour as a key regional port and investment location for the continued growth of tourism and recreational boating opportunities.

Any potential negative impacts would be temporary and associated with inconveniences caused as a result of construction. The overall long-term benefits of the proposal outweigh the short-term adverse impacts. Management measures have also been developed to avoid, minimise and/or mitigate any potential environmental impact. Based on the findings of this REF, the proposal is considered justified.

8.1.1 Social factors

The proposal is expected to deliver the following social benefits:

- Provide facilities and infrastructure that improve safety.
- Contribute to the growth of boating tourism.
- Improve community facilities and green space.

8.1.2 Biophysical factors

Biophysical factors contributing to the justification of the proposal include designing the proposal so that it is resilient to the projected impacts of a changing climate and coastal processes.

8.1.3 Economic factors

Construction of the proposal would have a long-term economic benefit to the region. Construction would generate employment of up to 10 full-time workers and a further 30 to 40 jobs through multiplier impacts. Increase in visitation would generate improved tourism spend each year, of which significant amounts would be captured by surrounding businesses.

8.1.4 Public interest

Stakeholder consultation undertaken as part of the concept design development has revealed a significant level of public interest in the proposal regarding potentially positive impacts of improved navigational safety, as well as public amenity and tourism growth through improved parking and reserve facilities. These impacts have been assessed in the REF.

8.2 Objects of the EP&A Act

Table 8-1: Assessment against the objectives of the Act

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State’s natural and other resources.	The proposal will result in positive socio-economic impacts as it will provide a safe and attractive facility for watercraft users.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	The preferred option was selected based on economic, environmental and social considerations and provides a sustainable development outcome.
1.3(c) To promote the orderly and economic use and development of land.	The proposal promotes the orderly and economic use of land by improving the unsafe conditions of the site and improving usability and access.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the proposal.
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The proposal includes measures to protect the environment during construction and operation.
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The proposal includes measures to promote the sustainable management of built and cultural heritage.
1.3(g) To promote good design and amenity of the built environment.	The proposal results in improved design and amenity of the facility.
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the proposal.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the proposal.

Object	Comment
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	A participatory approach to community engagement was undertaken from the outset of the proposal, as it is community-driven.

8.2.1 *Ecologically sustainable development*

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

The precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that, where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

This principle was considered during the options development. The precautionary principle has guided the assessment of environmental impacts for this REF and the development of mitigation measures as follows:

- Issues that may cause serious or irreversible environmental damage as a result of the proposed project, and where there is scientific uncertainty as to the nature of the damage, have been considered.
- Best available technical information, environmental standards and measures have been used to minimise environmental risks.
- The preferred option minimises impacts on marine ecology, with particular consideration of sensitive areas.
- Measures have been included to avoid or minimise potential damage to known items or areas of heritage significance during construction.
- Conservative ‘worst case’ scenarios were considered while assessing environmental impact.
- Specialist studies were incorporated to gain a detailed understanding of the existing environment.

Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Intergenerational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations. Intergenerational equity has guided the proposal design as well as the assessment of environmental impacts for this REF and the development of mitigation measures as follows:

- A preferred option was selected that minimises impacts on sensitive ecological areas to ensure that such areas are conserved for future generations.
- Water quality measures were included into the design to ensure that the impacts on the marine environment are minimised both for the short and long term.

- An Aboriginal heritage due diligence assessment was carried out during the environmental assessment phase to avoid or minimise the potential for irreparable damage to occur to Aboriginal cultural heritage during construction.
- The economic benefits for surrounding areas for the current and future generations were identified.
- Issues that have potential long-term implications were minimised or avoided, e.g., consumption of non-renewable resources, waste disposal, greenhouse emissions, removal of vegetation and impacts on water quality, through concept selection and application of management measures.
- Requirements to minimise the impact of climate change from greenhouse emissions were implemented, e.g., avoiding vegetation clearance, optimising fuel economy of all construction machinery, use of green energy for on-site electrical energy requirements, use of recycled materials where feasible and investigating the feasibility of using biofuels in construction equipment.
- Benefits that the project provides to current and future generations of local communities and the surrounding region that would maintain or enhance the health, diversity and productivity of the environment were identified.

Conservation of biological diversity and ecological integrity

The proposal would have a minor temporary impact on marine biodiversity, in particular macro algae. However, the impacts on macro algae are unlikely to substantially compromise the biological diversity and ecological integrity of Coffs Harbour. Management measures have been included in this REF to avoid, minimise and/or mitigate impact on marine biodiversity, in particular the ancillary site selection criteria which were established for construction phase facilities to avoid native vegetation disturbance.

Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision-making requires consideration of all environmental resources which may be affected by the carrying out of a project, including air, water, land and living things. The following matters are relevant:

- Environmental issues were considered as key matters in the option selection process and in the economic and financial feasibility assessments for the project.
- The value of the project to the community in terms of improved safety was recognised.

8.3 Conclusion

The proposed upgrade of the Coffs Harbour Regional Boat Ramp is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts on matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on the amenity of the area during construction. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also improve the safety and efficiency of the Coffs Harbour Regional Boat Ramp and have long-term socio-economic benefits for the region. On balance the proposal is considered justified and the following conclusions are made.

Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of Agriculture, Water and Environment is not required.

9 Certification

This Review of Environmental Factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Lisa Proctor
Director
Blue Sky Planning and Environment
Date: 18 November 2020

I have examined this Review of Environmental Factors and accept it on behalf of Transport for NSW.

Patrick Smyth
Project Manager Infrastructure
Maritime Infrastructure Delivery Office
Date: 18 November 2020

10 References

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RMS, n.d. *EIA Practice Note - Guidelines for Landscape Character and Visual Assessment . EIA No.4.* s.l.:s.n.

RMS, n.d. *EIA Practice Note on Socio-economic Impact Assessment. EIA No.5.* s.l.:s.n.

RMS, n.d. *Procedure for Aboriginal Cultural heritage consultation and investigation.* s.l.:s.n.

RMS, n.d. *Construction and Maintenance Noise Estimator Tool*. s.l.:s.n.

RTA, 2008. *Community Involvement and Communications Resource Manual.* s.l.:s.n.

Terms and acronyms used in this REF

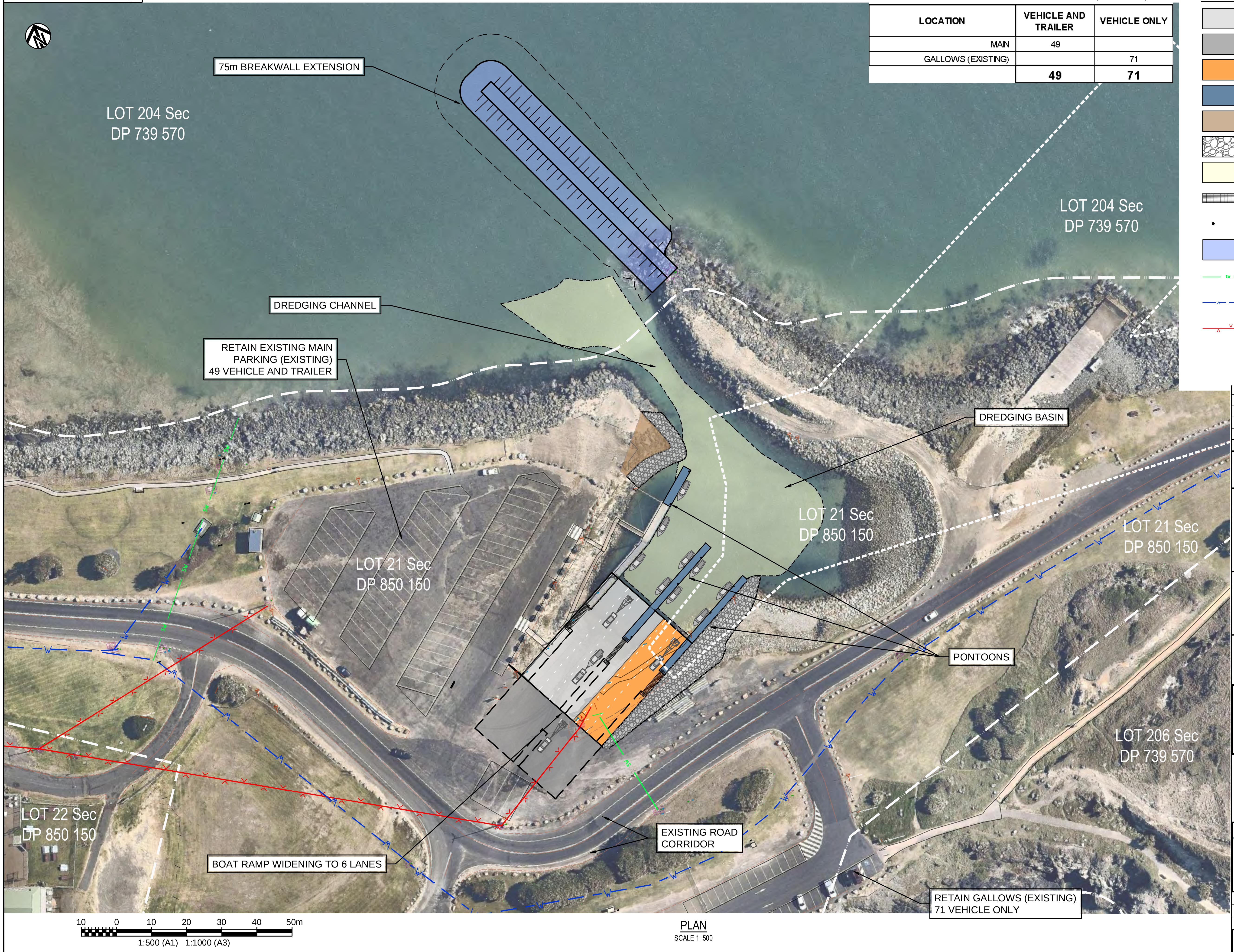
Term/ Acronym	Description
AHD	Australian Height Datum
AS	Australian Standard
BC Act	*Biodiversity Conservation* Act *2016* (NSW)
CEMP	Construction Environmental Management Plan
CM SEPP	State Environmental Planning Policy (Coastal Management) 2018
EIA	Environmental Impact Assessment
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW). Provides the legislative framework for land use planning and development assessment in NSW.
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased.
FM Act	*Fisheries Management Act 1994* (NSW)
Heritage Act	*Heritage Act 1977* (NSW)
ICNG	Industrial Construction Noise Guideline
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
LALC	Local Aboriginal Land Council
LEA	Lead Environmental Adviser for Transport for NSW
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
MHWM	Mean high water mark
MNES	Matters of national environmental significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
Piles	Foundations used to support marine structures and offshore platforms
Pontoon	A floating structure serving as a dock
QA Specifications	Specifications developed by Transport for NSW for use with road work and bridge work contracts let by Transport for NSW.
Seiching	The formation of a standing wave in an enclosed or partially enclosed body of water. The key requirement for formation of a seiche is that the body of water be at least partially bounded, allowing the formation of the standing wave which then sways back and forth.
TfNSW	Transport for NSW

Appendix A

Concept Design

DRAWING No.
PA2431-STG- 001

DO NOT SCALE



PLAN
SCALE 1: 500

EXISTING (STAGE 1)

LOCATION	VEHICLE AND TRAILER	VEHICLE ONLY
MAIN	49	
GALLOWS (EXISTING)		71
	49	**71**

LEGEND

▭	EXISTING CONCRETE RAMP
▩	NEW PAVEMENT (RAMP)
🟧	NEW RAMP (CONCRETE)
🟦	NEW PONTOON
🟫	LAND BASED EARTHWORKS
▨	NEW ROCK REVETMENT
🟨	HARBOUR DREDGING
▥	PONTOON GANTRY
● ●	Ø300 PILES (INDICATIVE LOCATIONS ONLY)
🟦	BREAKWALL (ABOVE WATER)
—SW—	EXISTING STORMWATER
—W—	EXISTING WATER MAIN
—V—	EXISTING O/H ELECTRICAL

REV	DATE	DESCRIPTION	BY	CHK	APPD
E	1.11.20	FINAL CONCEPT LAYOUT	MC	PL	BP
D	18.8.20	NEW LAYOUT FOR APPROVAL	MC	PL	BP
C	23.6.20	BREAKWALL LAYOUT UPDATED	MC	PL	BP
B	15.6.20	CLIENT COMMENTS INCLUDED	MC	PL	BP
A	12.6.20	CONCEPT PLANS REV'D & STAGED	MC	PL	BP

REVISIONS

DRAWING FOR REVIEW

WARNING

ONLY VISIBLE SERVICES HAVE BEEN LOCATED BY SURVEY. LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND HAVE BEEN SCALED FROM VARIOUS SERVICE AUTHORITY PLANS. ALL SERVICES TO BE CONFIRMED ON SITE PRIOR TO ANY CONSTRUCTION OR INVESTIGATION WORKS.

"DIAL BEFORE YOU DIG" - 1100

IT IS ESSENTIAL THAT BEFORE ANY EXCAVATION WORK IS UNDERTAKEN, FURTHER INVESTIGATION INTO THE LOCATION OF SERVICES SHOULD BE CARRIED OUT WITH THE RELEVANT AUTHORITY.

DIAL 1100
BEFORE YOU DIG

CLIENT
NSW GOVERNMENT
Transport for NSW

SURVEY
SURVEY - NORTH COAST SURVEYS MARCH 2020
HORIZONTAL DATUM MGA 56 (1994) VERTICAL DATUM AHD 71

AUSTRALIAN HEIGHT DATUM

PROJECT:
COFFS HARBOUR,
BOAT RAMP UPGRADE
CONCEPT STAGING PLANS

TITLE:
STAGE 1
SITE MASTERPLAN

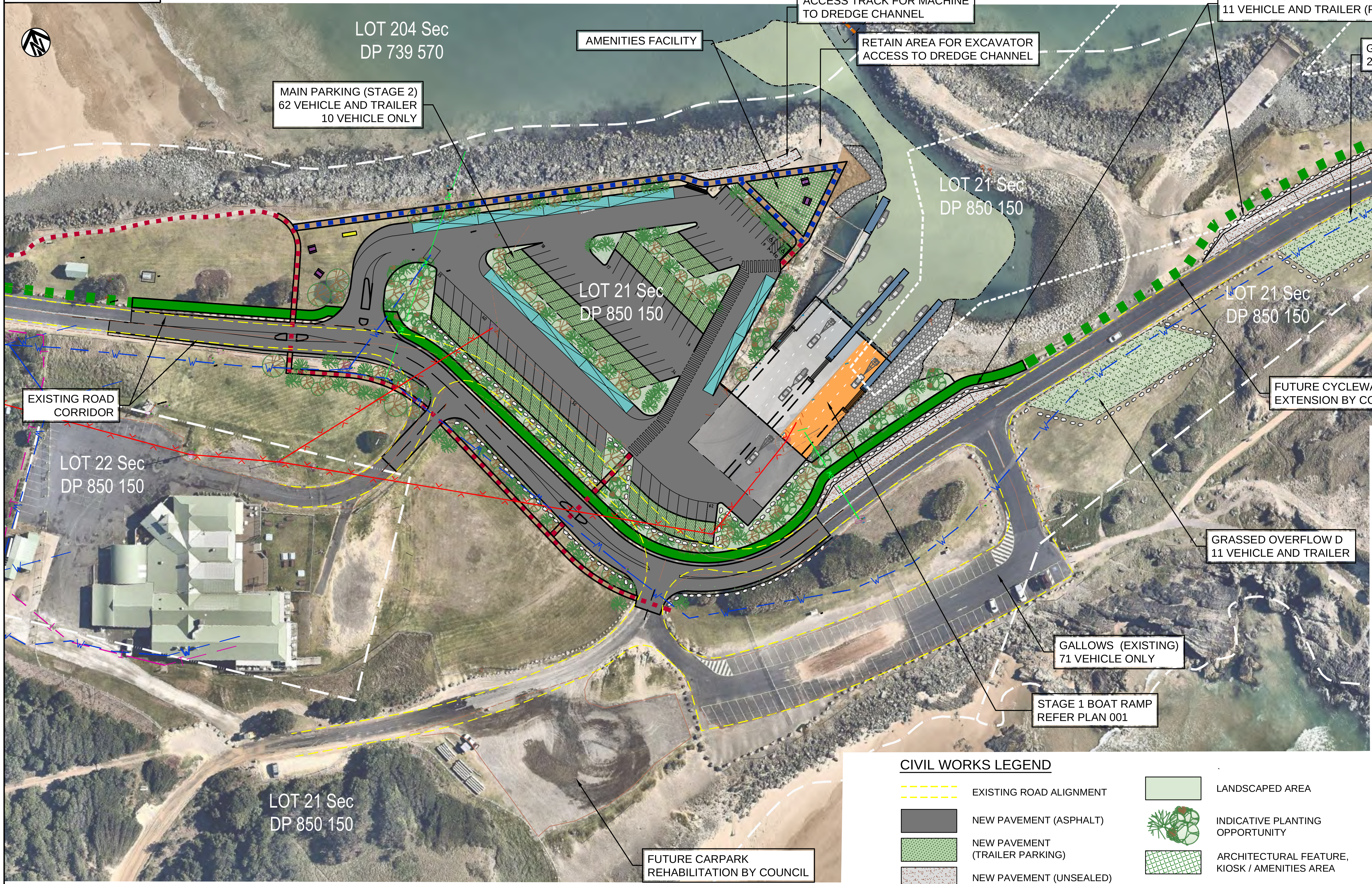
HASKONING AUSTRALIA PTY LTD
NEWCASTLE
Level 3
2 Market Street
Newcastle NSW 2300
Australia
+61 2 4926 9500
www.royalhaskoningdhv.com

Royal HaskoningDHV
Enhancing Society Together

DRAWN M.Collings
DATE 20.03.2020
JOB No. PA2431
AUTOCAD REF. PA2341–STG
SCALE AT A1 AS SHOWN
DRAWING No. PA2341-STG- 001
REVISION E

DRAWING No.
PA2431-STG- 002

DO NOT SCALE



PLAN
SCALE 1: 600

12 0 20 40 60m
1:600 (A1) 1:1200 (A3)

LOCATION	EXISTING (STAGE 1) VEHICLE AND TRAILER	EXISTING (STAGE 1) VEHICLE ONLY	TOTAL STAGE 2 VEHICLE AND TRAILER	TOTAL STAGE 2 VEHICLE ONLY
MAIN	49		62	10
GALLOWS (EXISTING)		71		71
OVERFLOW A			24	
OVERFLOW B			11	
OVERFLOW D			11	
	49	**71**	**108**	**81**

CIVIL WORKS LEGEND

- - -	EXISTING ROAD ALIGNMENT
■	NEW PAVEMENT (ASPHALT)
▨	NEW PAVEMENT (TRAILER PARKING)
▨	NEW PAVEMENT (UNSEALED)
▨	OVERFLOW PARKING (GRASSED)
○○○○	OVERSIZE ROCK PLACE IN VERGE (MATCH EXISTING)
🟥	PEDESTRIAN ROUTE AND 1.8m CONCRETE FOOTPATH
▨	PEDESTRIAN ROUTE AND 1.5m CONCRETE FOOTPATH
🟩	2.5m SHARED PATHWAY
■ ■ ■ ■	2.5m SHARED PATHWAY (FUTURE EXTENSION BY COUNCIL)
🟩	LANDSCAPED AREA
●	INDICATIVE PLANTING OPPORTUNITY
▨	ARCHITECTURAL FEATURE, KIOSK / AMENITIES AREA
■ ■	SEATING AND TABLE AND FISH CLEANING BENCH
☒	RIGGING AND DE-RIGGING BAYS
12.5m	DESIGN VEHICLE
— SW —	EXISTING STORMWATER
— W —	EXISTING WATER MAIN
— ^ —	EXISTING O/H ELECTRICAL

REV	DATE	DESCRIPTION	BY	CHK	APPD
E	1.11.20	FINAL CONCEPT LAYOUT	MC	PL	BP
D	18.8.20	NEW LAYOUT FOR APPROVAL	MC	PL	BP
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REVISIONS

DRAWING FOR REVIEW

WARNING
ONLY VISIBLE SERVICES HAVE BEEN LOCATED BY SURVEY. LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND HAVE BEEN SCALED FROM VARIOUS SERVICE AUTHORITY PLANS. ALL SERVICES TO BE CONFIRMED ON SITE PRIOR TO ANY CONSTRUCTION OR INVESTIGATION WORKS.
"DIAL BEFORE YOU DIG" - 1100
IT IS ESSENTIAL THAT BEFORE ANY EXCAVATION WORK IS UNDERTAKEN, FURTHER INVESTIGATION INTO THE LOCATION OF SERVICES SHOULD BE CARRIED OUT WITH THE RELEVANT AUTHORITY.

DIAL 1100 BEFORE YOU DIG

CLIENT
NSW GOVERNMENT
Transport for NSW

SURVEY
SURVEY - NORTH COAST SURVEYS MARCH 2020
HORIZONTAL DATUM MGA 56 (1994) VERTICAL DATUM AHD 71

AUSTRALIAN HEIGHT DATUM

PROJECT:
COFFS HARBOUR,
BOAT RAMP UPGRADE
CONCEPT STAGING PLANS

TITLE:
STAGE 2
SITE MASTERPLAN

HASKONING AUSTRALIA PTY LTD
NEWCASTLE
Level 3
2 Market Street
Newcastle NSW 2300
Australia
+61 2 4926 9500
www.royalhaskoningdhv.com

Royal HaskoningDHV
Enhancing Society Together

DRAWN M.Collings DATE 20.03.2020 JOB No. PA2431
AUTOCAD REF. PA2341-STG
SCALE AT A1 AS SHOWN
DRAWING No. PA2341-STG- 002 REVISION E

C:\COFFS HARBOUR BOAT RAMP \ PA2341

Appendix B

Consideration of Clause 228(2) Factors

Consideration of Matters of National Environmental Significance

Clause 228(2) Checklist

Factor	Impact
a) Any environmental impact on a community? In the short term the community will be subject to a loss of amenity and public space whilst the works are being undertaken. The safeguards included in this REF will ensure that any potential loss of amenity is minimised. In the long term the community will have access to higher quality public infrastructure and space.	Minor short-term negative. Nil long term.
b) Any transformation of a locality? In the short term the works area will be subject to disruption and reduced public access. In the longer term the locality will be positively transformed into a high-quality boat ramp precinct with improved facilities.	Minor short-term negative. Major long-term positive.
c) Any environmental impact on the ecosystems of the locality? Although some disturbance of marine habitat is unavoidable during the works, provided that the safeguards included in this REF are implemented there are unlikely to be any long-term impacts.	Minor short-term negative. Nil long term.
d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? The amenity, quality and recreational value of the environment will be reduced whilst works are being undertaken. At completion the proposal will significantly improve the aesthetic and recreational value of the locality.	Minor short-term negative. Major long-term positive.
e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? The construction works have been identified as potentially having a minor impact on heritage items in the vicinity. Provided that the safeguards included in this REF are implemented on site it is unlikely that the impacts would be significant.	Minor short-term.
f) Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974)?* Although some disturbance of natural systems is unavoidable during the works, provided that the safeguards included in this REF are implemented there are unlikely to be any long-term impacts.	Minor short-term negative. Nil long term.
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The proposal is unlikely to result in the endangering of any species of animal, plant or other form of life.	Nil
h) Any long-term effects on the environment? There are no long-term effects on the environment likely, provided that the safeguards included in this REF are implemented.	Nil

Factor	Impact
i) Any degradation of the quality of the environment? The quality of the environment will be reduced whilst works are being undertaken due to construction impacts. No long-term degradation of the environment is likely, provided that the safeguards included in this REF are implemented.	Minor short-term negative. Nil long term.
j) Any risk to the safety of the environment? Some risks to the safety of the environment are possible due to construction impacts. No long-term safety risks are likely, provided that the safeguards included in this REF are implemented.	Minor short-term negative. Nil long term.
k) Any reduction in the range of beneficial uses of the environment? In the short term the works area will be subject to disruption and reduced public access. In the longer term the range of beneficial uses of the environment will be increased due to the creation of a high-quality boat ramp precinct with improved facilities.	Minor short-term negative. Major long-term positive.
l) Any pollution of the environment? Provided that the safeguards included in this REF are implemented, it is unlikely that there would be any pollution of the environment.	Nil.
m) Any environmental problems associated with the disposal of waste? It is anticipated that there would be minimal waste. No contaminated waste is likely to be generated and no problems with the disposal of waste are likely.	Nil.
n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The proposal does not rely upon the use of resources that are, or are likely to become, in short supply.	Nil.
o) Any cumulative environmental effect with other existing or likely future activities? No other construction works are likely to be undertaken in close proximity at the same time as the proposal. In the longer term the proposal will make a positive contribution to a larger effort to improve the Coffs Harbour Foreshore Precinct in line with council’s strategic planning for the area.	Nil short-term. Major long-term positive.
p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? There will be some change to sediment movement as a result of the breakwater extension. This will be managed by continuing a program of minor maintenance dredging and beach nourishment.	Minor long-term.

Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act, the following matters of national environmental significance and impacts on the Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of Agriculture, Water and Environment.

Factor	Impact
a) Any impact on a World Heritage property? There are no World Heritage properties in close proximity to the proposal and no indirect impacts on any World heritage property are likely.	Nil
b) Any impact on a National Heritage place? There are no National Heritage places in close proximity to the proposal and no impacts on any National Heritage place are likely.	Nil
c) Any impact on a wetland of international importance? There are no wetlands of international importance in close proximity to the proposal and no indirect impacts on any wetlands are likely.	Nil
d) Any impact on a listed threatened species or communities? There are no listed threatened species or communities likely to be impacted by the proposal, provided that the safeguards and mitigation measures detailed in this REF are implemented.	Nil
e) Any impacts on listed migratory species? There are no listed migratory species likely to be impacted by the proposal provided that the safeguards and mitigation measures detailed in this REF are implemented.	Nil
f) Any impact on a Commonwealth marine area? No impacts on a Commonwealth marine area are likely, provided that the safeguards and mitigation measures detailed in this REF are implemented.	Nil
g) Does the proposal involve a nuclear action (including uranium mining)? The proposal does not involve a nuclear action.	Nil
h) Additionally, any impact (direct or indirect) on the environment of Commonwealth land? There is no Commonwealth land in close proximity to the proposal and no indirect impacts on any Commonwealth land is likely.	Nil

Appendix C

Statutory Consultation Checklists and Agency Referral Responses

Infrastructure SEPP

Certain development types

Development type	Description	Yes/No	If 'yes' consult with	ISEPP clause
Carpark	Does the project include a carpark intended for use by commuters using regular bus services?	No	Coffs Harbour City Council and the occupiers of adjoining land	ISEPP cl. 95A
Bus Depots	Does the project propose a bus depot?	No	Coffs Harbour City Council and the occupiers of adjoining land	ISEPP cl. 95A
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No	Coffs Harbour City Council and the occupiers of adjoining land	ISEPP cl. 95A

Development within the Coastal Zone

Issue	Description	Yes/No/ NA	If 'yes' consult with	ISEPP clause
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No	Coffs Harbour City Council	ISEPP cl. 15A

Council related infrastructure or services

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Stormwater	Is the work likely to have a *substantial* impact on the stormwater management services which are	No	Coffs Harbour City Council	ISEPP cl.13(1)(a)

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
	provided by council?			
Traffic	Is the work likely to generate traffic to an extent that will *strain* the capacity of the existing road system in a local government area?	No	Coffs Harbour City Council	ISEPP cl.13(1)(b)
Sewerage system	Will the work involve connection to a council-owned sewerage system? If so, will this connection have a *substantial* impact on the capacity of any part of the system?	The work will be connected to a council-owned sewerage system but will not have a substantial impact on the capacity of the system.	Coffs Harbour City Council	ISEPP cl.13(1)(c)
Water usage	Would the work involve connection to a council-owned water supply system? If so, would this require the use of a *substantial* volume of water?	The work will be connected to a council-owned water supply system but will not have a substantial impact on the capacity of the system.	Coffs Harbour City Council	ISEPP cl.13(1)(d)
Temporary structures	Would the work involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, would this cause more than a *minor* or *inconsequential* disruption to pedestrian or vehicular flow?	The work will involve the installation of a temporary structure and the enclosing of a public place which is under Council control but will not cause more than a minor disruption to pedestrian and vehicle flow.	Coffs Harbour City Council	ISEPP cl.13(1)(e)
Road & footpath excavation	Would the work involve more than *minor* or	Yes. The work will involve more than a	Coffs Harbour City Council	ISEPP cl.13(1)(f)

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
	inconsequential excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	minor excavation to Jordan Esplanade and the footpath within the Reserve.		

Local heritage items

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the work? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than *minor* or *inconsequential?*	The work may involve some inadvertent disturbance of a local heritage item. The heritage impact assessment at Appendix E indicates that the potential impacts are likely to be minor and can be avoided with safeguards.	Coffs Harbour City Council	ISEPP cl.14

Flood liable land

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Flood liable land	Is the work located on flood liable land? If so, would the work change flood patterns to more than a *minor* extent?	No	Coffs Harbour City Council	ISEPP cl.15
Flood liable land	Is the work located on flood liable land? (to any extent). If so, does the work comprise more than minor alterations or additions to, or the demolition of, a building, emergency	No	State Emergency Services Email: erm@ses.nsw.gov.au	ISEPP cl.15AA

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
	work or routine maintenance?			

Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled *Floodplain Development Manual: the management of flood liable* land published by the New South Wales Government.

Public authorities other than councils

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
National parks and reserves	Is the work adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act?	No	Environment, Energy and Science, DPIE	ISEPP cl.16(2)(a)
National parks and reserves	Is the work on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	Environment, Energy and Science, DPIE	ISEPP cl. 16(2)(b)
Aquatic reserves	Is the work adjacent to an aquatic reserve or a marine park declared under the *Marine Estate Management Act 2014*?	No	Department of Planning, Industry and Environment	ISEPP cl.16(2)(c)
Sydney Harbour foreshore	Is the work in the Sydney Harbour Foreshore Area as defined by the *Place Management NSW Act 1998?*	No	Property NSW	ISEPP cl.16(2)(d)
Bush fire prone land	Is the work for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	Rural Fire Service	ISEPP cl.16(2)(f)
Artificial light	Would the work increase the amount of artificial light in the night sky and that is on land within the dark sky region as	No	Director of the Siding Spring Observatory	ISEPP cl.16(2)(g)

Issue	Potential impact	Yes/No	If ‘yes’ consult with	ISEPP clause
	identified on the dark sky region map?			
Defence communications buffer land	Is the work on buffer land around the defence communications facility near Morundah?	No	Secretary of the Commonwealth Department of Defence	ISEPP cl. 16(2)(h)
Mine subsidence land	Is the work on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	No	Mine Subsidence Board	ISEPP cl. 16(2)(i)

OUR REF: C20/557

30 September 2020

Mr Patrick Smyth
Project Manager Infrastructure
Transport for NSW
PO Box K659
HAYMARKET NSW 1240
Via email: Patrick.smyth@transport.nsw.gov.au

Dear Mr Smyth

Re: Review of Environmental Factor considerations for Coffs Harbour Regional Boat Ramp upgrade

I refer to your letter of 28 August 2020 seeking advice from DPI Fisheries on the preparation of a Review of Environmental Factors (REF) for the proposed upgrade of the Coffs Harbour Regional Boat Ramp.

DPI Fisheries is responsible for ensuring that fish stocks are conserved and that there is “no net loss” of key fish habitats upon which they depend. To achieve this, the Coastal Systems Unit assesses activities under Part 4 and Part 5 of the *Environmental Planning and Assessment Act 1979* in accordance with the objectives of the FM Act, the aquatic habitat protection and threatened species conservation provisions in Parts 7 and 7A of the FM Act, and the associated and *Policy and Guidelines for Fish Habitat Conservation and Management (2013 Update)* (DPI Fisheries P&G) (https://www.dpi.nsw.gov.au/fishing/habitat/protecting-habitats/toolkit). In addition, DPI Fisheries is responsible for ensuring the sustainable management of viable commercial fishing and aquaculture; quality recreational fishing; and to promote the continuation of Aboriginal cultural fishing within NSW.

Part 7 *Fisheries Management Act 1994* Approvals

The table below outlines actions that trigger sections of the *Fisheries Management Act* 1994. The proposed works will involve dredging and reclamation works and may involve harm marine vegetation works if seagrass or other marine vegetation will be impacts by the works.

For the dredging and reclamation component of the works, as Transport for NSW (the proponent) is a public authority (other than a local government authority), s199 of the FM Act will apply to this proposal. Section 199 of the FM Act requires that the proponent consults with DPI Fisheries and considers any matters concerning the proposed work that are raised by DPI Fisheries. Consultation would normally be in the form of provision of the final design plans and REF.

If the proposal includes harm to marine vegetation, Transport for NSW will need to apply to DPI Fisheries for a permit under s205 of the FM Act.

Sections	Description of action	Legislative trigger
198-202	Dredge (digging) and / or reclamation (filling) of land permanently or periodically inundated by water (including wetlands).	Digging and / or filling below the Highest Astronomical Tide (~1m AHD) in estuaries. Digging and / or filling within the high bed of 3rd order and higher watercourses (based on 1:25,000 scale maps) and/or draining water from land for its reclamation. Activities described in cl 226 *Fisheries Management (General) Regulation* 2019
205	Harming marine vegetation (seagrass, mangroves and kelp)	Gather, cut, pull up, destroy, poison, dig up, remove, injure or otherwise harm marine vegetation or any part of it. Activities described in cls 228-229 *Fisheries Management (General) Regulation* 2019
218-220	Obstructing free passage of fish, in waterways	Construction or alteration of a dam, floodgate, causeways or weir or otherwise creation of an obstruction

Avoiding impacts to fisheries resources

Key fish habitats are defined within the policy and guidelines and are graded by ‘type’ on the basis of their sensitivity, or their importance to the survival of fish (refer to section 3.2 of the DPI Fisheries P&G for further information). The proposal should first aim to avoid impacts to fisheries resources, particularly key fish habitats. Where impacts to key fish habitats cannot be avoided, the preference is to impact less sensitive key fish habitats over more highly sensitive key fish habitats.

Offsetting unavoidable impacts to fisheries resources

It is highlighted that in the DPI Fisheries P&G, SEPP Coastal Wetlands, saltmarsh and seagrass are considered TYPE 1 *Highly Sensitive Key Fish Habitat* while mangroves (when outside of mapped SEPP 14 Coastal Wetlands) are considered TYPE 2 *Moderately Sensitive Key Fish Habitat*. Section 3.3.3.2 of the DPI Fisheries P&G notes that DPI Fisheries enforces a ‘no net loss’ habitat policy as a condition of consent perhaps requiring proponents to conduct habitat rehabilitation and/or provide environmental compensation for all unavoidable impacts to marine vegetation. An offset ration of 2:1 applies for harming of marine vegetation.

Other information requirements

DPI Fisheries’ standard minimum information requirements for environmental assessment are clearly detailed in section 3.3 of the DPI Fisheries P&G. Please ensure that these information requirements are addressed in the REF. This will facilitate effective assessment of the proposal and reduce delays.

If you have any further enquiries please contact me on 02 6626 1375 or jonathan.yantsch@dpi.nsw.gov.au.

Yours sincerely

Jonathan Yantsch
Senior Fisheries Manager, Coastal Systems (North Coast)
Aquatic Environment, Primary Industries NSW

24 September 2020

Mr Patrick Smyth
Project Manager Infrastructure
MIDO
Transport for NSW

Sent via email: Patrick.Smyth@transport.nsw.gov.au

Dear Mr Smyth

COFFS HARBOUR REGIONAL BOAT RAMP UPGRADE PROPOSAL – STAKEHOLDER CONSULTATION

Thank you for your letter of 28 August 2020 requesting comment on the proposal of the regional boat ramp upgrade at Coffs Harbour which includes the extension of the existing breakwater by 75m, widening and topping the existing boat ramp, extending the existing pontoon, installing two new pontoons and dredging the existing boat ramp basin and channel.

NSW Maritime – Operations and Compliance North requests consideration is given to the following when preparing the REF:

1. Any works impacting on navigation during the construction phase must seek NSW Maritime support 21 days prior to works commencing. A full scope of works including dates and time frames is to be provided to *NavigationAdviceNorth@rms.nsw.gov.au.*

2. NSW Maritime will prepare and publish a Marine Notice on the Maritime website and the Government Gazette advising the dates and nature of the works. NSW Maritime recommends that this forms part of the communications plan for this project.

3. Any Barge and all associated work boats to comply with the relevant Marine Legislation for survey, crewing, registration and safety equipment.

4. Vessels must exhibit lights and day shapes in accordance with International Regulations for Preventing Collisions at Sea. Due to the high volume of and close proximity to vessel traffic, additional lighting of barge/work boats is advised as long as it does not conflict with Regulations for Preventing Collisions at Sea. For example the installation of white deck lights on barges to increase vessel and plant visibility especially when unattended at night.

5. Any cables including anchor cables, pipes and ancillary equipment which presents as a potential hazard to people or vessels should be appropriately marked, including the use of lights at night. Marking of objects to be clarified with NSW Maritime Boating Safety Officer prior to placement.

6. Submerged cables may present as a hazard to craft anchoring. These hazards must be mitigated. Application of appropriate signage and lighting, written notification to stakeholders and broadcasting of marine safety alerts may be options to prevent anchoring issues, or impact on vessels retrieving their anchors.

7. Written notifications advising of the works including dates, times and navigation restrictions are to be circulated to the Coffs Harbour commercial vessel operators

8. Written notification advising vessel operators of the works including dates, times and navigation restrictions are to be placed at visible locations at local boat ramps in Coffs Harbour. The Marine Notice includes any restrictions and could be used for this purpose as it is a legal document that also gives compliance officers powers to enforce any conditions in place for vessels. It is not enforceable unless the signs/notices are erected

9. Signage is required advising waterway users of the works and the potential effect on navigation at least two weeks prior to commencement of works at boat ramps

10. The Contractor is to develop a Traffic Management Plan to minimise interruption to vessels entering and leaving the boat harbour, as well as commercial vessels operating from Coffs Harbour Marina. This may include placement of additional navigation aids to warn the boating public of potential hazards. This plan should be devised in consultation with the local Boating Safety Officer. NSW Maritime will have final approval of the plan.

11. Any costs associated with the relocation, removal or additional installation of navigation aids would be the responsibility of the Barge Contractor and will be done in consultation with NSW Maritime.

12. Coffs Harbour Marine Rescue is to be advised when works are in progress so that a securite message can be broadcast at regular intervals to notify commercial and recreational vessels of the operations. In the first instance NSW Maritime will provide Marine Rescue with the Marine Notice to broadcast the restrictions and general awareness of the works in progress. It is the responsibility of the Contractor to communicate any changes to times or work methods to Marine Rescue, and to log on and log off with Marine Rescue daily.

13. Should the area around the barge operations need to be closed at any time during the works, notification to the Boating Safety Officer or the Senior Boating Safety Officer is required as early as possible

14. An Oil Spill response plan to mitigate and respond to any oil spill caused by any vessels is to be submitted to *navigationadvicenorth@rms.nsw.gov.au*

15. A vessel recovery and salvage plan is to be submitted to *navigationadvicenorth@rms.nsw.gov.au*. In the event that the barge becomes dislodged due to heavy seas or any other occurrence the plan should include reference to contingencies around removal from the beach area and break walls of the Coffs Harbour waters.

NSW Maritime requests consultation at each of the detailed design stages of the project to provide comment on the level of impact the proposed works will have on the safety of navigation.

For your reference the local Maritime Officers contact details are:

1. Boating Safety Officer, Anna Sedlak 0418 420 102
2. Senior Boating Safety, Dean Moore 0418 434 164

Please forward future correspondence and enquires with regards to the boat ramp upgrade project to *navigationadvicenorth@rms.nsw.gov.au* and for all correspondence relating to barges and barge movements associated with this project please email *rod.mcdonagh@transport.nsw.gov.au* or contact Manager Operations, Rod McDonagh on 0418 494 153.

Yours sincerely

LmHourigan.

Lynda Hourigan
Project Officer North
Maritime
Transport for NSW

From: Patrick Smyth <Patrick.Smyth@transport.nsw.gov.au>
Sent: Monday, 19 October 2020 1:22 PM
To: Patrick Lawless; Lisa Proctor
Subject: FW: S.45 & SEPP NOtice of Proposed Electrical Works - off Jordan Esplanade, Coffs Harbour Ref: 7050212

Patrick/Lisa

[redacted]

[redacted]

Patrick Smyth
Project Manager Infrastructure
Maritime Infrastructure Delivery Office
Transport for NSW – Newcastle

T (02) 4981 7636 | **M** 0409 758663

From: Anne Shearer [mailto:anne.shearer@chcc.nsw.gov.au]
Sent: Monday, 19 October 2020 12:27 PM
To: projects@powersol.com.au
Cc: Patrick Smyth <Patrick.Smyth@transport.nsw.gov.au>; Nat Redman <nat.redman@chcc.nsw.gov.au>
Subject: S.45 & SEPP NOtice of Proposed Electrical Works - off Jordan Esplanade, Coffs Harbour Ref: 7050212

Good morning Steven
Thank you for the opportunity to make a submission to the proposed electrical works for the Coffs Harbour Boat Ramp. Please forward the REF for review when it is completed.
Comments from the Senior Environmental Project Officer are as follows:

The design shows new Flood light at the ramp. This will need to be of appropriate lux due to the Shearwater colony on Muttonbird Island. Lighting at the boat ramp has previously been a potential issue. NPWS will need to be consulted as to the acceptable level of lighting. This should all be addressed in the REF.

I have cc'd Nat Redman into this email if you require any further information.

Other comments from key Council staff include several questions about the scope of the works including:

- Consideration of underground cables, particularly as there may be boats with masts.

- Requirement for the substation to be upgraded and power supply
- Lighting for pedestrian crossings
- Power for recreational facilities such as bbqs, amenities and events
- Possible use of solar lighting for the carpark
- Relocation of the existing digital sign and lighting / CCTV
- Additional CCTV cameras.
- Consider low colour temperature lighting.

Kind Regards

Anne Shearer
Section Leader (Acting)
Asset Strategies | Coffs Harbour City Council
T: 02 66 484 414 M: 0457 799 221

anne.shearer@chcc.nsw.gov.au
| www.coffsharbour.nsw.gov.au | @coffscouncil | @heartofcoffs | www.heartofcoffs.com.au

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Planning,
Industry &
Environment

Our Ref: DOC20/708637
Your Ref: Your letter dated 28 August 2020

Transport for NSW
Maritime Infrastructure Delivery Office
PO Box K659
Haymarket NSW 1240

Attention: Mr Patrick Smyth – Project Manager Infrastructure

Dear Mr Smyth

Re: Review of Environmental Factors Environmental Assessment Requirements– Proposed Upgrade of Coffs Harbour Regional Boat Ramp

Thank you for your letter dated 28 August 2020 about the Proposed Upgrade of Coffs Harbour Regional Boat Ramp seeking Environmental Assessment Requirements (EARs) from the Biodiversity and Conservation Division (BCD) of the Environment, Energy and Science Group in the Department of Planning, Industry and Environment. I appreciate the opportunity to provide input and apologise for the delay in respondiing.

The BCD was formerly part of the Office of Environment and Heritage, but now forms part of a Group that has responsibilities relating to biodiversity (including threatened species and ecological communities, or their habitats), National Parks and Wildlife Service estate, climate change, sustainability, flooding, coastal and estuary matters.

On July 1, 2020 Aboriginal cultural heritage (ACH) regulatory functions were transferred from the BCD to Heritage NSW in the Department of Premier and Cabinet. For advice on ACH please contact Heritage NSW at heritagemailbox@envionment.nsw.gov.au

We note that the project will be assessed in accordance with Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Review of Environmental Factors (REF) EARs provided by the Biodiversity and Conservation Division are limited to Aboriginal cultural heritage, biodiversity, NPWS estate, acid sulphate soils, flooding, stormwater and coastal erosion.

The proponent should ensure that the REF will be sufficiently comprehensive to enable unambiguous assessment of all direct and indirect impacts of the proposed activity.

In particular, the REF should describe:

1. how any dredged sand would be transported and placed on Park Beach in order to satisfy Action BD.1 of the Coffs Harbour Coastal Zone Management Plan (CZMP).
2. how the proposal will avoid impacts within the Saving our Species defined site polygon for the threatened Coast Headland Pea (*Pultenaea maritima*), which occurs adjacent to the proposed boat ramp upgrade area.

We consider that this information is necessary for a comprehensive REF for the proposed activity.

The full list of our requirements that may need to be addressed in the REF is provided in **Attachment 1**. In preparing the REF, the proponent should refer to the relevant guidance material listed in **Attachment 2.**

If you have any further questions about this advice, please do not hesitate to contact Mr Paul Houlder, Project Officer Data Support, at paul.houlder@environment.nsw.gov.au or on 6670 8679.

Yours sincerely

Dimitri Young 28 September 2020

DIMITRI YOUNG
Senior Team Leader Planning, North East Branch
Biodiversity and Conservation

Enclosures:
Attachment 1 - BCD Recommended Environmental Assessment Requirements for REF – Proposed Upgrade of Coffs Harbour Regional Boat Ramp
Attachment 2 - REF Guidance Material

From: Matthew Smith <programs@coffsharbourlalc.com.au>
Sent: Monday, 16 November 2020 5:17 PM
To: Lisa Proctor
Cc: Patrick Smyth; Greg Collins
Subject: RE: Coffs Harbour Regional Boat Ramp Upgrade

Hi Lisa,

I have ran this proposal by our Garby and Jagun Knowledge holders and they have not expressed any concern in regards to cultural impacts of this project.

The 75m of extended wall has prompted the thought and question "would not a 40m rock-wall do the job in preventing wave impacts to vessels using the boat ramp?" (it is a lot of wall – and a lot of rock dug out from another place, and I am sure a lot of cost that could be saved, and a lot of maintenance with additional silt building up and not being able to naturally disperse).

I am sure the 75m extended wall would be an eyesore for the public looking over from Jordan Esplanade towards Muttonbird Island also – The shorter the length of wall extension the better in terms of environmental and visual impact.

Kind Regards,

Yaarri Yarraang

Matthew Smith

Working Days – Monday to Friday

Programs Coordinator
Coffs Harbour and District Local Aboriginal Land Council
PO Box 6150 Coffs Harbour NSW 2450
|Ph| 02 6652 8740 **|M|** 0417 419 344 **|E|** programs@coffsharbourlalc.com.au

Gumbaynggirr - Ngiyaala junga-ngarraanga Girrwaanbi-biin gungangulam wajaarrgundi gilinggal-wanggaan-wiil,
I acknowledge the traditional owners of country throughout Australia and their continuing connection to land, sea and community.
I respect the Elders past and present on Gumbaynggirr country.

From: Lisa Proctor <lisa@blueskyplanning.com.au>
Sent: Monday, November 16, 2020 3:42 PM
To: Matthew Smith <programs@coffsharbourlalc.com.au>
Cc: Patrick Smyth <patrick.smyth@transport.nsw.gov.au>; Greg Collins <Greg.COLLINS@transport.nsw.gov.au>
Subject: Coffs Harbour Regional Boat Ramp Upgrade

FAO: Matt Smith

Hi Matt.

Appendix D

Aboriginal Heritage Due Diligence Assessment

Transport for NSW

Coffs Harbour Boat Ramp

LGA: Coffs Harbour

Aboriginal Heritage Due Diligence Assessment

24 August 2020

McCARDLE CULTURAL HERITAGE PTY LTD

ACN 104 590 141 • ABN 89 104 590 141

PO Box 166, Adamstown, NSW 2289
Mobile: 0412 702 396 • Email: penny@mcheritage.com.au

McCARDLE
CULTURAL HERITAGE

Report No: J20063 DD

Approved by:	Penny McCardle
Position:	Director
Signed:	
Date:	24 August 2020

This report has been prepared in accordance with the scope of services described in the contract or agreement between McCardle Cultural Heritage Pty Ltd (MCH), ACN: 104 590 141, ABN: 89 104 590 141, and Transport for NSW. The report relies upon data, surveys, measurements and specific times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by Transport for NSW. Furthermore, the report has been prepared solely for use by Transport for NSW and MCH accepts no responsibility for its use by other parties.

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APPENDICES

LIST OF FIGURES

EXECUTIVE SUMMARY

McCardle Cultural Heritage Pty Ltd (MCH) has been engaged by Blue Sky Planning and Environment on behalf of Transport of NSW to undertake an Archaeological Due Diligence Assessment for the proposed Coffs Harbour Regional Boat Ramp Upgrade. The project area includes Coffs Harbour Boat Ramp and immediate surrounds including Lot 21 DP 850150 and Lot 7301 DP 1135520.

The assessment has been undertaken to meet Heritage NSW, Department of Premier & Cabinet - Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010), the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH 2011), the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW and the brief.

The study area is located in the North Coast bioregion, one of the most diverse bioregions in NSW and is situated on Holocene sands with no raw materials available locally for stone tool manufacturing. The project area consists primarily of disturbed soils landscape in the east and a small portion of the project area on the Look-At-Me-Now soil landscape in the west. The project area is located at the southern end of Jetty Beach and the closest reliable fresh water source is Coffs Creek located approximately 1.1 kilometres north-west of the project area. Whilst the beach area would have provided an abundance of marine resources, the project area has been subject to extensive works associated with the existing boat ramp and associated infrastructure including roads, car parks and coastal erosion stabilisation works and additional disturbances would have derived from natural processes.

A search of the AHIMS register has shown that 13 known Aboriginal sites are currently recorded within two kilometres of the project area. Of these, three sites are recorded twice each (all ACD), with a total of 10 sites. There are no registered sites or Aboriginal Places within the project area. Based on the AHIMS results and examination of previous assessments of the area, it can be expected that:

- the likelihood of locating sites increases with proximity to available water; either creeks/rivers along valley floors or sinkholes/cistern within sandstone formations;
- the likelihood of finding large sites increases markedly with proximity to reliable water;
- the most prominent site types are ceremonial, artefacts and shell middens;
- a variety of stone artefact types will be located though the majority will be flakes, flaked pieces and debitage;
- a variety of raw materials utilised in stone tool manufacture will be represented, though the majority of sites will be predominated by mudstone and silcrete; and
- the majority of sites will be subject to disturbances including human and natural.

The project area has been subject to extensive works associated with the existing boat ramp and associated infrastructure including roads, car parks and coastal erosion stabilisation works as well as erosion. Due to these significant land uses and their associated impacts at depth, no sites are expected to be located in the project area. Prior to such impacts, artefact scatters, isolated finds and shell middens may have been present.

The project area, consisting of a highly disturbed slope, was surveyed as two survey units (SU) that was based on landform elements and project areas (cemented/sealed and grassed). The cemented and sealed areas included the existing roads, par parks, and boat ramp, all of which had been subject to largescale excavation and fill works with 100% exposures and zero visibility of the surface soils due to the cement/sealed surfaces.

The remaining three grassed areas (CP1, CP2 and CP4) have also been subject to previous clearing and excavation works to alter the landform to suit the foreshore area. Exposures were high (100%) and visibility was moderate at 60%.

No archaeological sites or Potential Archaeological Deposits (PADs) were identified during the survey and this is likely due to the past and present land uses that would have displaced and/or destroyed any evidence of past Aboriginal land use.

As no sites or PADs were identified, there are no impacts on the archaeological record and the following recommendations are provided:

1) The persons responsible for the management of onsite works will ensure that all staff, contractors and others involved in construction and maintenance related activities are made aware of the statutory legislation protecting sites and places of significance. Of particular importance is the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010, under the National Parks and Wildlife Act 1974; and

2) Should any Aboriginal objects be uncovered during works, all work will cease in that location immediately and the Environment Line contacted.

GLOSSARY

Aboriginal Place: are locations that have been recognised by the Minister for Climate Change and the Environment (and gazetted under the *National Parks and Wildlife Act 1974*) as having special cultural significance to the Aboriginal community. An Aboriginal Place may or may not include archaeological materials.

Aboriginal Site: an Aboriginal site is the location of one or more Aboriginal archaeological objects, including flaked stone artefacts, midden shell, grinding grooves, archaeological deposits, scarred trees etc.

Artefact: any object that is physically modified by humans.

Artefact scatter: a collection of artefacts scattered across the surface of the ground (also referred to as open camp sites).

Assemblage: a collection of artefacts associated by a particular place or time, assumed generated by a single group of people, and can comprise different artefact types.

Backed artefact: a stone tool where the margin of a flake is retouched at a steep angle and that margin is opposite a sharp edge.

Background scatter: a term used to describe low density scatter of isolated finds that are distributed across the landscape without any obvious focal point.

Core: a chunk of stone from which flakes are removed and will have one or more negative flake scars but no positive flake scars. The core itself can be shaped into a tool or used as a source of flakes to be formed into tools.

Debitage: small pieces of stone debris that break off during the manufacturing of stone tools. These are usually considered waste and are the by-product of production (also referred to as flake piece).

Flake: any piece of stone struck off a core and has a number of characteristics including ring cracks showing where the hammer hit the core and a bulb of percussion. May be used as a tool with no further working, may be retouched or serve as a platform for further reduction.

Flaked piece/waste flake: an unmodified and unused flake, usually the by-product of tool manufacture or core preparation (also referred to as debitage).

Harm: is defined as an act that may destroy, deface or damage an Aboriginal object or place. In relation to an object, this means the movement or removal of an object from the land in which it has been situated

In situ: archaeological items are said to be "in situ” when they are found in the location where they were last deposited.

Retouched flake: a flake that has been flaked again in a manner that modified the edge for the purpose of resharpening that edge.

Typology: the systematic organization of artefacts into types on the basis of shared attributes.

ACRONYMS

ACHA	Aboriginal Cultural Heritage Assessment
ACHMP	Aboriginal Cultural Heritage Management Plan
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit

AHIMS SITE ACRONYMS

ACD	Aboriginal ceremonial and dreaming
AFT	Artefact (stone, bone, shell, glass, ceramic and metal)
ARG	Aboriginal resource and gathering
ART	Art (pigment or engraving)
BOM	Non-human bone and organic material
BUR	Burial
CFT	Conflict site
CMR	Ceremonial ring (stone or earth)
ETM	Earth mound
FSH	Fish trap
GDG	Grinding groove
HAB	Habitation structure
HTH	Hearth
OCQ	Ochre quarry
PAD	Potential archaeological deposit.
SHL	Shell
STA	Stone arrangement
STQ	Stone quarry
TRE	Modified tree (carved or scarred)
WTR	Water hole

1 INTRODUCTION

1.1 INTRODUCTION

McCardle Cultural Heritage Pty Ltd (MCH) has been engaged by Blue Sky Planning and Environment on behalf of Transport of NSW to undertake an Archaeological Due Diligence Assessment for the proposed Coffs Harbour Regional Boat Ramp Upgrade.

The assessment has been undertaken to meet Heritage NSW, Department of Premier & Cabinet - Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010), the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH 2011), the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW and the brief.

The purpose of a due diligence assessment is to assist proponents to exercise due diligence when carrying out activities that may harm Aboriginal objects or Aboriginal places and to determine whether that should apply for a consent to harm Aboriginal objects or Places through an Aboriginal Heritage Impact Assessment (AHIP). The purpose of this due diligence report is to demonstrate that all reasonable and practicable measures have been undertaken to prevent harm to any Aboriginal objects and/or places within the project area. This report has met the requirements and considered the relevant environmental and archaeological information, the project land condition, the nature of the proposed development activity and impacts, as well as preparing appropriate recommendations.

1.2 THE PROJECT AREA

The project area includes Coffs Harbour Regional Boat Ramp and immediate surrounds. Including Lot 21 DP 850150 and Lot 7301 DP 1135520, the location of the project area is shown in Figures 1.1 to 1.3.

Figure 1.1 Location of the project area

1.3 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The Coffs Harbour boat ramp is located in a small basin on the southern side of the harbour. Since the original boat ramp and basin was constructed in the mid-1970s there is a history of reports by mariners of difficulties launching and retrieving boats and navigation vessels in the entrance channel to the boat ramp. Following construction, the boat ramp basin regularly suffered from water level surges and operational difficulties were also experienced in the vicinity of the boat ramp during times that north-easterly swell entered the harbour.

In 2015 the boat ramp basin was extended following numerical and physical modelling studies that indicated seiche action in the boat ramp basin could be reduced by up to 30%. Wave monitoring instruments deployed in the boat ramp basin before and after the extension works indicated a reduction in seiche action was achieved by the 2015 basin extension and reports and observations from mariners using the boat ramp indicate that seiche action has decreased since basin extension was completed. However, on occasions use of the boat ramp remains problematic, most notably by vessels entering the ramp basin during times of low tide levels combined with wave action.

A group of stakeholders that use the Coffs Harbour boat ramp formed the Coffs Harbour Regional Boat Ramp Precinct Enhancement Committee (CHRBRPEC) with a vision to develop the boat ramp precinct into a world class facility to meet the high demand for present day and future use of the boat ramp by local and visiting mariners. Following a number of incidents, in particular over the 2018 Easter holiday period, where over a dozen boats were washed onto rocks at the entrance to the boat ramp basin, the safety and congestion of the site has been identified by CHRBRPEC as issues that require addressing. Harbour City Council (CHCC) have endorsed the issues raised by CHRBRPEC and funding has been approved by Transport for NSW to undertake improvement works at the boat ramp facility. The project is being designed and constructed in two Stages. Stage 1 scope of work (Figure 1.2) will include:

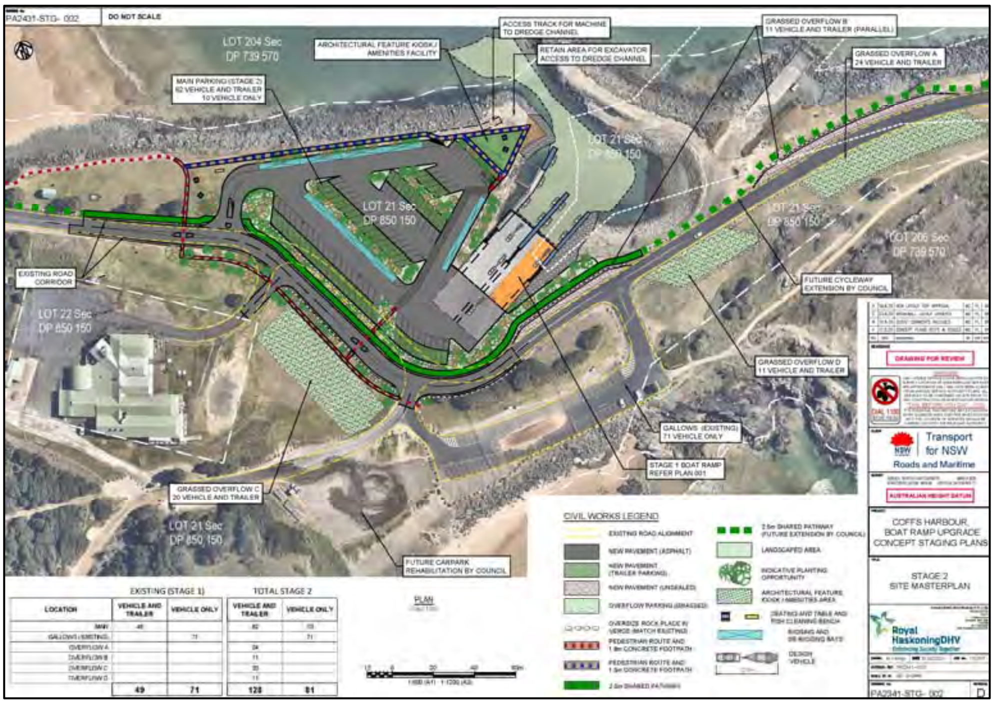
- Extension of the existing breakwater by 75m
- Widening of the existing boat ramp with an additional two lanes
- New topping over the existing boat ramp area
- Extension of the existing pontoon
- Two new pontoons
- Dredging of the existing boat ramp basin and channel

Figure 1.2 Stage 1

Stage 2 will focus primarily on improvements to parking, access and landscaping. It is proposed to commence stage 1 mid-2021 and commence stage 2 in mid-2022. Stage 2 scope of work (Figure 1.3) will include:

- Extension of the existing main carpark to include additional parking for cars, boats and trailers
- New carpark entrance at the western end of the carpark
- Block off entry adjacent to the boat ramp off Jordan Esplanade for safety reasons
- Diversion of Jordan Esplanade opposite the main carpark
- New road signage
- New rigging and de-rigging bays around the main carpark
- A new shared pathway (2.5m wide) for walking/cycling
- New amenities facility and kiosk
- New lighting and signage
- Recreational furniture including seating and tables
- Pedestrian pathway on the south side of Jordan Esplanade with access to Gallows Beach carpark and to the amenities facility in the main carpark area
- Landscaping
- Extension of services including water, power and sewerage

Figure 1.3 Stage 2



Any development or impacts occurring within the project area will have regard to and be managed in accordance with the requirements and provisions of the National Parks and Wildlife Act 1974.

1.4 OBJECTIVES OF THE DUE DILIIGENCE ASSESSMENT

The objectives and primary tasks of this due diligence assessment were to:

- Undertake a search of the Aboriginal Heritage Management System (AHIMS) and other relative registers;
- Undertake preliminary research into the environmental and archaeological contexts of the project area;
- Develop a predictive model of site location for the project area;
- Undertake a field survey of the project area;
- Assess the potential impacts of the proposed development on any identified Aboriginal sites or potential archaeological deposits (PADs) identified within the project area;
- Assess the significance of any identified Aboriginal objects or sites identified within the project area;
- Complete and submit site cards to the AHIMS for any Aboriginal sites identified; and
- Provide appropriate recommendations.

1.5 LEGISLATIVE CONTEXT

The following overview of the legislative framework, is provided solely for information purposes for the client, and should not be interpreted as legal advice. MCH will not be liable for any actions taken by any person, body or group as a result of this general overview and MCH recommends that specific legal advice be obtained from a qualified legal practitioner prior to any action being taken as a result of the general summary below.

Land managers are required to consider the effects of their activities or proposed development on the environment under several pieces of legislation. Although there are a number of Acts and Regulations protecting Aboriginal heritage, including places, sites and objects, within NSW, the three main ones include:

- National Parks and Wildlife Act (1974, as amended)
- National Parks and Wildlife Regulation (2009)
- Environmental Planning and Assessment Act (1979)

1.5.1 NATIONAL PARKS AND WILDLIFE ACT (1974, AS AMENDED)

The National Parks and Wildlife Act (1974), Amended 2010, is the primary legislation for the protection of Aboriginal cultural heritage in New South Wales. The NPW Act protects Aboriginal heritage (places, sites and objects) within NSW and the Protection of Aboriginal heritage is outlined in s86 of the Act, as follows:

- “A person must not harm or desecrate an object that the person knows is an Aboriginal object” s86(1)
- “A person must not harm an Aboriginal object” s86(2)
- “A person must not harm or desecrate an Aboriginal place” s86(4)

Penalties apply for harming an Aboriginal object, site or place. The penalty for knowingly harming an Aboriginal object (s86[1]) and/or an Aboriginal place (s86[4]) is up to $550,000 for an individual and/or imprisonment for 2 years; and in the case of a corporation the penalty is up to $1.1 million.

The penalty for a strict liability offence (s86[2]) is up to $110,000 for an individual and $220,000 for a corporation.

Harm under the National Parks and Wildlife Act (1974, as amended) is defined as any act that; destroys defaces or damages the object, moves the object from the land on which it has been situated, causes or permits the object to be harmed. However, it is a defence from prosecution if the proponent can demonstrate that;

1) harm was authorised under an Aboriginal Heritage Impact Permit (AHIP) (and the permit was properly followed), or
2) the proponent exercised due diligence in respect to Aboriginal heritage.

The 'due diligence' defence (s87[2]), states that if a person or company has applied due diligence to determine that no Aboriginal object, site or place was likely to be harmed as a result of the activities proposed for the Project Area, then liability from prosecution under the NPW Act 1974 will be removed or mitigated if it later transpires that an Aboriginal object, site or place was harmed. If any Aboriginal objects are identified during the activity, then works should cease in that area and OEH notified (DECCW 2010:13). The due diligence defence does not allow for continuing harm.

The archaeological due diligence assessment and report has been carried out in compliance with the NSW DECCW 2010 Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW.

1.5.2 NATIONAL PARKS AND WILDLIFE REGULATION (2009)

The National Parks and Wildlife Regulation 2009 provides a framework for undertaking activities and exercising due diligence in respect to Aboriginal heritage. The Regulation (2009) recognises various due diligence codes of practice, including the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW which is pertinent to this report, but it also outlines procedures for Aboriginal Heritage Impact Permit (AHIP) applications and Aboriginal Cultural Heritage Consultation Requirements (ACHCRs); amongst other regulatory processes.

1.5.3 ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979 (EP&A ACT)

EP&A Act establishes the statutory framework for planning and environmental assessment in NSW and the implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local councils. The EP&A Act contains three parts which impose requirements for planning approval:

- Part 3 of the EP&A Act relates to the preparation and making of Environmental Planning Instruments (EPIs), State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).
- Part 4 of the EP&A Act establishes the framework for assessing development under an EPI. The consent authority for Part 4 development is generally the local council, however the consent authority may by the Minister, the Planning Assessment Commission or a joint regional planning panel depending upon the nature of the development.
- Part 4, Division 4.1 of the EP&A Act establishes the assessment pathway for State significant development (SSD) declared by the State Environmental Planning Policy (State and Regional Development) 2011 (NSW). Once a development is declared as SSD, the Secretary's Environmental Assessment Requirements (SEARs) will be issued outlining what issues must be considered in the EIS.

- Part 5 of the EP&A Act provides for the control of 'activities' that do not require development consent and are undertaken or approved by a determining authority. Development under Part 5 that are likely to significantly affect the environment is required to have an EIS prepared for the proposed activity.
- Part 5.1 of the EP&A Act establishes the assessment pathways for State significant infrastructure (SSI). Development applications made for SSI can only be approved by the Minister. Once a development is declared as SSI, the SEARs will be issued outlining what issues must be addressed in the EIS.

The applicable approval process is determined by reference to the relevant environmental planning instruments and other controls, LEPs and State Environmental Planning Policies (SEPPs). This project falls under Part 5.

1.6 ABORIGINAL COMMUNITY CONSULTATION

A due diligence assessment relates to the physical identification of Aboriginal objects, sites and places. Community consultation is only required once Aboriginal objects, sites or places have been identified and an Aboriginal Heritage Impact Permit (AHIP) is deemed necessary. Section 5.2 of the 2010 Due Diligence Code of Practice for the protection of Aboriginal Objects in NSW specifically states that;

> *'consultation with the Aboriginal community is not a formal requirement of the due diligence process' (2010:8).*

1.7 QUALIFICATIONS OF THE INVESTIGATOR

Penny McCardle: Principal Archaeologist/Forensic Anthropologist has 19 years' experience in Indigenous archaeological assessments, excavation, research, reporting, analysis and consultation and fifteen years Forensic Anthropology experience in skeletal identification, biological profiling and skeletal trauma reconstruction and identification.

- BA (Archaeology and Palaeoanthropology, University of New England 1999
- Hons (Archaeology and Palaeoanthropology): Physical Anthropology, University of New England 2001
- Forensic Anthropology Course, University of New England 2003
- Armed Forces Institute of Pathology Forensic Anthropology Course, Ashburn, VA 2008
- Analysis of Bone trauma and Pseudo-Trauma in Suspected Violent Death Course, Erie College, Pennsylvania, 2009
- Documenting Scenes of War and Human Rights Violations. Institute for International Criminal Investigations, 2018
- PhD, University of Newcastle, 2019

1.8 REPORT STRUCTURE

The report includes Section 1 which outlines the project, Section 2 presents the environmental and archaeological context, Section 3 provides the results and discussion and Section 4 presents the Impact Assessment, Section 5 discusses the mitigation measures and Section 6 provides the management recommendations.

2 ENVIRONMENTAL AND ARCHAEOLOGICAL CONTEXT

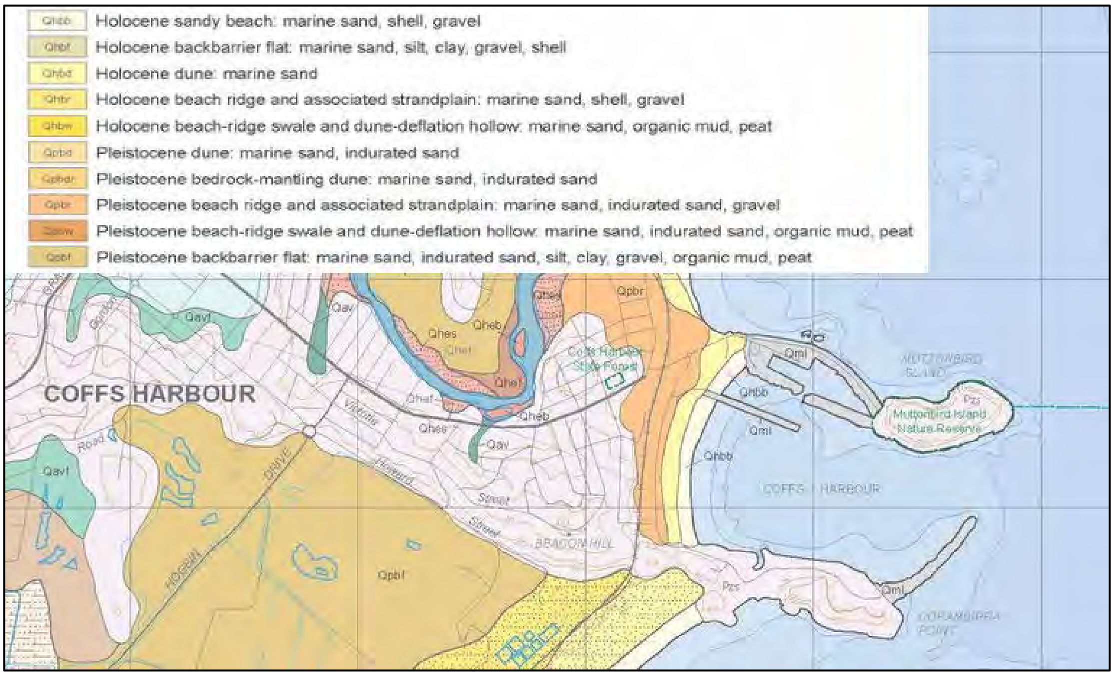
The archaeological due diligence process and assessment requires that the available knowledge and information in relation to the environmental and archaeological contexts is considered. The purpose of this is to assist in identifying whether Aboriginal objects, sites or places are likely to be present within the project area based on archaeological predictive modelling and in what condition they may be found in given the environmental impacts.

2.1 LOCAL ENVIRONMENT

Past site location and land use are closely linked to the environment including the landform, geology, geomorphology, soils, waterways and associated resources. The environmental context is important to identify potential factors relating to past Aboriginal land use patterns.

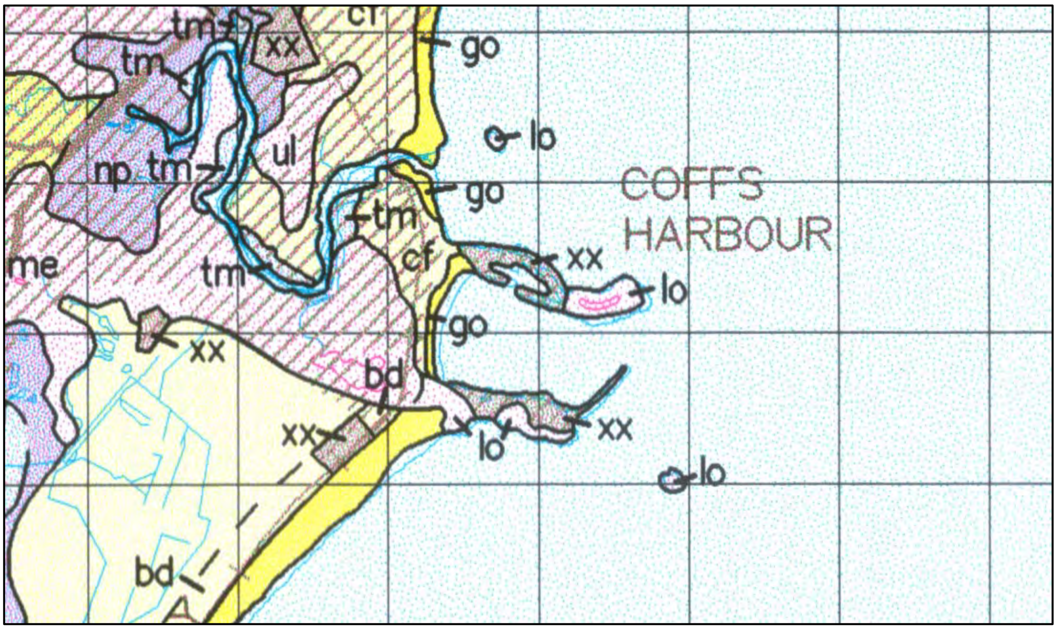
The study area is located in the North Coast bioregion, one of the most diverse bioregions in NSW (NPWS 2003). At the time of the breaking up of Gondwana, the coast of the Australian continent was uplifted and warped and as the ocean widened, the uplifted block subsided at the coast and river systems developed that eroded back toward the inland flexure along the warp. There was rapid headward erosion of these streams that formed the Great Escarpment which is very prominent in the North Coast bioregion. The present-day coastline is a relatively recent development. During the cold periods of the Quaternary, the sea level was more than 100 m lower than at present and in the past 18,000 years it has risen to its present position, sweeping sand from the continental shelf before it. This sand has accumulated in the coastal barrier systems (NPWS 2003:172). The project area, as illustrated in Figure 2.1, is situated on the on Holocene sands with no raw materials available locally for stone tool manufacturing.

Figure 2.1 Coffs Harbour Boat Ramp geology (Coffs Harbour Area Coastal Quaternary Geology Map 2008)



As shown in Figure 2.2, the project area consists primarily of disturbed soils landscape in the east and a small portion of the project area on the Look-At-Me-Now soil landscape in the west. The Look-At-Me-Now soils landscape consists of a dark brown stony clay loam A_1 horizon that overlays a brown clay loam A_2 horizon that overlays a dark brown clay B horizon (Milford 1999:59-62). The surface areas of this landform within the project rea have been removed, highly disturbed with no potential for in situ subsurface deposits within the depth of those disturbances. The disturbed terrain includes man-made areas to the east with the original deposits removed or buried (Milford 1999:158-159) with zero potential for cultural materials to be present. Previous geotechnical investigations at the boat ramp and Jordan Esplanade (Regional Geotechnical Solutions 2014) identified the subsoils were fill material to the depth of testing (>2.6 and >1.5 metres respectively) not natural.

Figure 2.2 Soil landscapes of the project area



The project area is located at the southern end of Jetty Beach and the closest reliable fresh water source is Coffs Creek located approximately 1.1 kilometres north-west of the project area. Whilst the beach area would have provided an abundance of marine resources, the project area has been subject to extensive works associated with the existing boat ramp and associated infrastructure including roads, car parks and coastal erosion stabilisation works. Additional disturbances would have derived from natural processes. The patterns of deposition and erosion within a locality can influence the formation and/or destruction of archaeological sites. Within an environment where the rate of erosion is generally high, artefacts deposited in such an environment will be eroded downslope after being abandoned. Additionally, bioturbation processes such as the redistribution and mixing of cultural deposits occurs as a result of burrowing and mounding by earthworms, ants and other species of burrowing animals. Artefacts can move downwards through root holes as well as through sorting and settling due to gravity, and translocation can also occur as a result of tree falls (Balek 2002; Peacock and Fant 2002:92).

The project area is located within an environment that provided marine resources but lacked fresh water and raw materials required for stone tool manufacturing. In relation to modern alterations to the landscape, the use of the project area for the boat ramp and associated infrastructure would have had significant impacts on the landscape through the excavation works required for such facilities and would have also displaced any cultural materials that may have been present.

2.2 ARCHAEOLOGICAL CONTEXT

A review of the archaeological literature of the region, and more specifically the Coffs Harbour area and the results of an AHIMS search provide essential contextual information for the current assessment.

2.2.1 ABORIGINAL HERITAGE INFORMATION MANAGEMENT SYSTEM (AHIMS)

It must be noted that there are many limitations with an AHIMS search including incorrect site coordinates due to errors and changing of computer systems at AHIMS over the years that failed to correctly translate old coordinate systems to new systems. Secondly, AHIMS will only provide up to 110 sites per search, thus limiting the search area surrounding the project area and enabling a more comprehensive analysis and finally, few sites have been updated on the AHIMS register to notify if they have been subject to a s90 and as such what sites remain in the local area and what sites have been destroyed, to assist in determining the cumulative impacts, is unknown. In addition to this, other limitations include the number of studies in the local area, high levels of erosion have proven to disturb sites, site contents, and the extent of those disturbances is unknown. Thus, the AHIMS search is limited and provides a basis only that aids in predictive modelling.

A search of the AHIMS register (Appendix A) indicate there are has shown that 13 known Aboriginal sites are currently recorded within two kilometres of the project area. Of these, three sites are recorded twice each (all ACD), with a total of 10 sites (Figure 2.1). There are no registered sites or Aboriginal Places within the project area.

Figure 2.3 Location of AHIMS sites

2.2.2 HERITAGE REGISTER LISTINGS

The National Heritage List, the Commonwealth Heritage List, the Australian Heritage Database, Australia's National Heritage List, The National Trust Heritage Register State Heritage Inventory the and the Coffs Harbour Local Environmental Plan have no Aboriginal objects, sites or places listed within the project area.

2.2.3 SUMMARY OF THE ARCHAEOLOGICAL CONTEXT

All archaeological surveys throughout the local area have been undertaken in relation to environmental assessments for developments. The most relevant investigations indicate differing results and observations based on surface visibility and exposure, alterations to the landscape, proximity to water sources and geomorphology.

Previous assessments of the local area (Macdonald and Collins 1999; Consulting Environmental Engineers 2000; Collins 1997, 1999, 2002, 2008; Kelleher Nightingale Consulting 2020) have identified that Aboriginal Ceremonial and Dreaming sites are the most prominent in the immediate local area followed by artefacts sites and shell middens. Corambirra Point (immediately east of the boat ramp area) is a well-known traditional ceremonial site and has been recorded since 1976. Collins (2008) note that The Mudjay Elders maintain that South Coffs Headland adjacent to South Coffs Island was a traditional men’s camp site associated with ceremonial activities on the island. Alternatively, Bagawa Birra Aboriginal Corporation representative maintained that the Corambirra Coffs Headland/Boambee Beach area is a traditional women’s area. Kelleher Nightingale Consulting (2020) identified a culturally significant pathway that connects the coast with the Orara Valley and traverses the culturally significant Roberts Hill Ridge. This path ends at Jetty and Boambee Beaches and links to the culturally highly significant Corambirra Point and Giidany Miirlalr (Muttonbird Island area). These assessments have also identified that both landform and distance to water were important factors in past Aboriginal land use. The assessments indicate a relatively intensive traditional use of the Boambee Beach locality and hind dunes of the area which would have abutted the now drained and filled coastal swamps) with less activity and past Aboriginal land use in the east.

2.3 SYNTHESIS OF ENVIRONMENTAL AND ARCHAEOLOGICAL CONTEXTS

The site types identified throughout the area appear to be either low density/small occupation activities or sites that were associated with more secular activities. The broader landform assessment also suggests that larger sites indicative of larger camping groups may be located on the valley floors mainly due to available room compared to the limited and uneven surfaces of the sandstone areas where by large scale habitation is not possible, but may have been utilised as activity areas away from the main camp. Based on information gained from previous studies, both regionally and locally, within a two-kilometre radius of our project area, it can be expected that:

- the likelihood of locating sites increases with proximity to available water; either creeks/rivers along valley floors or sinkholes/cistern within sandstone formations;
- the likelihood of finding large sites increases markedly with proximity to reliable water;
- the most prominent site types are ceremonial, artefacts and shell middens;
- a variety of stone artefact types will be located though the majority will be flakes, flaked pieces and debitage;
- a variety of raw materials utilised in stone tool manufacture will be represented, though the majority of sites will be predominated by mudstone and silcrete; and

- the majority of sites will be subject to disturbances including human and natural.

2.4 PREDICTIVE MODEL FOR THE PROJECT AREA

An archaeological predictive model is established to identify areas of archaeological sensitivity so it can be used as a basis for the planning and management of Aboriginal heritage. It involves reviewing existing literature to identify basic site distribution patters. These patterns are then modified according to the specific environment of the project area to form a predictive model for site location within the specific project area. A sampling strategy is then used to test the model and the results of the survey used to confirm, refute or modify the model.

Land-systems and environmental factors are commonly used factors in predictive modelling based on the assumption that they provide distinctive sets of constraints and opportunities that influenced past Aboriginal land use patterns. As land use patterns may differ between zones (due to different environmental conditions), this may result in the physical manifestation of different spatial distributions and forms of archaeological evidence. The predictive model presented here is based on the following information;

- Landform units;
- Previous archaeological assessments conducted within the region;
- Distribution of known sites and site densities; and
- Traditional Aboriginal land use patterns.

Also taken into consideration are land use impacts (both natural and anthropomorphic) that may have resulted in a disturbed landscape and associated archaeological record. However, these assumptions may only be clarified during survey and the model updated accordingly if needed.

The project area has been subject to extensive works associated with the existing boat ramp and associated infrastructure including roads, car parks and coastal erosion stabilisation works as well as erosion. Due to these significant land uses and their associated impacts at depth, no sites are expected to be located in the project area. Prior to such impacts, brief descriptions of the site types that may have occurred in the project area are presented below.

- **Artefact scatters**

Also described as open campsites, artefact scatters and open sites, these deposits have been defined at two or more stone artefacts within 50 metres of each other and will include archaeological remains such as stone artefacts and may be found in association with camping where other evidence may be present such as shell, hearths, stone lined fire places and/or heat treatment pits. These sites are usually identified as surface scatters of artefacts in areas where ground surface visibility is increased due to lack of vegetation. Erosion, agricultural activities (such as ploughing, grazing) and access ways can also expose surface campsites. Artefact scatters may represent evidence of;

- ➢ Large camp sites, where everyday activities such as habitation, maintenance of stone or wooden tools, manufacturing of such tools, management of raw materials, preparation and consumption of food and storage of tools has occurred;
- ➢ Medium/small camp sites, where activities such as minimal tool manufacturing occurred;
- ➢ Hunting and/or gathering events;
- ➢ Other events spatially separated from a camp site, or
- ➢ Transitory movement through the landscape.

- **Isolated finds**

Isolated artefacts are usually identified in areas where ground surface visibility is increased due to lack of vegetation. Erosion, agricultural activities (such as ploughing) and access ways can also expose surface artefacts. Isolated finds may represent evidence of;

- Hunting and/or gathering events; or
- Transitory movement through the landscape.

- **Shell middens**

Middens result from seasonal camping and exploitation of oysters and freshwater mussels. Extended camping results in the deposition of a feature that is distinguishable from a natural shell layer. This includes the inclusion of burnt or blackened shell, non-molluscan fauna, dis-articulated bivalves, charcoal, burnt wood, hearth stones, stone artefacts and stratification. Middens are usually found on the coast and on the shorelines of estuaries, lakes and inland rivers. Although sometimes identified on ridges, these middens tend to be less extensive than those close to the resource base. Smaller lenses of shell deposition also occur close to water. Shell middens may represent evidence of;

- Large camp sites, where everyday activities such as habitation, maintenance of stone or wooden tools, manufacturing of such tools, management of raw materials, preparation and consumption of food and storage of tools has occurred;
- Medium/small camp sites, where activities such as a small meal was cooked and/or consumed;
- Hunting and/or gathering events;
- Other events spatially separated from a camp site, or
- Transitory movement through the landscape.

3 RESULTS AND DISCUSSION

To comply with the due diligence requirement that a visual inspection of the project area be undertaken, an archaeological survey across the project area was undertaken by MCH archaeologist Penny McCardle on 3rd August 2020. The survey focused on areas of high ground surface visibility and exposures (erosional features, cleared areas).

3.1 SURVEY UNITS

The project area, consisting of a highly disturbed slope, was surveyed as two survey units (SU) that was based on landform elements (following McDonald *et al* 1984) and project areas (cemented/sealed and grassed).

The cemented and sealed areas included the existing roads, par parks, and boat ramp, all of which had been subject to largescale excavation and fill works with 100% exposures and zero visibility of the surface soils due to the cement/sealed surfaces.

The remaining three grassed areas (CP1, CP2 and CP4) has also been subject to previous clearing and excavation works to alter the landform to suit the foreshore area. Exposures were high (100%) and visibility was moderate at 60%. Examples of the project area are provided in Figures 3.1 to 3.8.

Figure 3.1 CP1 western end facing east

Figure 3.2 CP2 western end facing east

Figure 3.3 CP4 western end facing east

Figure 3.4 Existing 48 vehicle & trailer car park (facing north)

Figure 3.5 Boast ramp facing north east

Figure 3.6 CP4 western end facing east

Figure 3.7 Existing 70 vehicle car park eastern end facing west

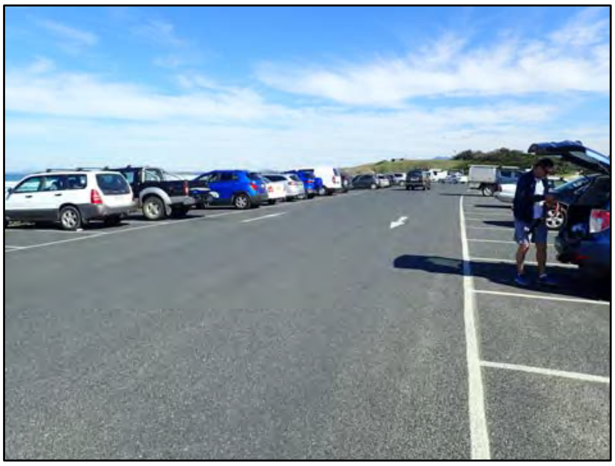


Figure 3.8 CP3 eastern end facing west

The level and nature of the effective survey coverage is considered satisfactory to provide an effective assessment of the investigation area. The coverage was comprehensive for both obtrusive site types (e.g. grinding grooves and scarred trees) and for the less obtrusive surface stone artefact sites by surface visibility constraints that included vegetation cover and minimal exposures.

3.2 ARCHAEOLOGICAL SITES AND PADS

No archaeological sites or Potential Archaeological Deposits (PADs) were identified during the survey and this is likely due to the past and present land uses would have displaced and/or destroyed any evidence of past Aboriginal land use.

In view of the predictive modelling and the results obtained from the effective coverage, it is concluded that the survey provides a valid basis for determining the probable impacts of the proposal and formulating recommendations for the project. The survey results demonstrate the absence of Aboriginal objects within the project area. The results are consistent with those obtained from other studies in the local area in similar environmental contexts.

3.3 CONCLUSION

It is well established that proximity to water was an important factor in past occupation of the area. The surrounding area contains no raw materials that are typically used in the manufacture of stone tools, and as such it can be assumed that any artefacts identified would be of materials traded and/or transported from other locations. Whilst access to the ocean close by would have provided marine resources, the project area had been subject to extensive excavation,cut and fill works associated with the boat ramp and associated infrasturcture, all of which would have destryoyed any evidence of past Aborighinal land uses at those locations.

4 ASSESSMENT OF IMPACTS

The archaeological record is a non-renewable resource that is affected by many processes and activities. As outlined in Section 2 and Section 3, the various natural processes and human activities have impacted on archaeological deposits through both site formation and taphonomic processes.

4.1 IMPACTS

The Heritage NSW, Department of Premier & Cabinet - Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (2010:21) describes impacts to be rated as follows:

1) Type of harm: is either direct, indirect or none
2) Degree of harm is defined as either total, partial or none
3) Consequence of harm is defined as either total loss, partial loss, or no loss of value

As no sites or PADs were identified, there are no impacts on the archaeological record.

5 MITIGATION AND MANAGEMENT STRATEGIES

Specific strategies, as outlined through the Heritage NSW, Department of Premier & Cabinet: Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010b), the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH 2011), and the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (DECCW 2010c), are considered below for the management of the identified site within the project area.

5.1 CONSERVATION/PROTECTION

Conservation is the first avenue and is suitable for all sites, especially those considered high archaeological significance and/or cultural significance. Conservation includes the processes of looking after an indigenous site or place so as to retain its significance and are managed in a way that is consistent with the nature of peoples' attachment to them.

As no sites or PADs were identified conservation/protection is not required.

5.2 FURTHER INVESTIGATION

An Aboriginal Heritage Impact Permit (AHIP) is no longer required to undertake test excavations (providing the excavations are in accordance with the Code of Practice for Archaeological Investigations in NSW). Subsurface testing is appropriate when a PAD has been identified, and it can be demonstrated that sub-surface Aboriginal objects with potential conservation value have a high probability of being present, and that the area cannot be substantially avoided by the proposed activity.

As no sites or PADs were identified further investigations are not justified.

5.3 AHIP

If harm will occur to an Aboriginal object or Place, then an AHIP is required from Heritage NSW. If a systematic excavation of the known site could provide benefits and information for the Aboriginal community and/or archaeological study of past Aboriginal occupation, a salvage program may be an appropriate strategy to enable the salvage of cultural objects. The AHIP may also include surface collection of artefacts.

As no sites or PADs were identified an AHIP is not required.

6 RECOMMENDATIONS

6.1 GENERAL

1) The persons responsible for the management of onsite works will ensure that all staff, contractors and others involved in construction and maintenance related activities are made aware of the statutory legislation protecting sites and places of significance. Of particular importance is the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010, under the National Parks and Wildlife Act 1974; and

2) Should any Aboriginal objects be uncovered during works, all work will cease in that location immediately and the Environmental Line contacted.

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Collins. J. 1997. Proposed upgrading Coffs Harbour Airport. Cultural Heritage Assessment. Report to GHD Pty Ltd.

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Milford, H.B. 1999. *Soil Landscapes of the Coffs Harbour 1:100 000 Sheet*. Department of Land and Water Conservation, Sydney.

Office of Environment and Heritage (OEH), 2011. Guide to Investigating, Assessing and reporting on Aboriginal Cultural Heritage in NSW. Department of Environment, Climate Change and Water NSW, Sydney.

Regional Geotechnical Solutions. 2014. Boat Ramp Upgrade, Jordan Esplanade, Coffs Harbour NSW. Geotechnical Assessment. Report to Coffs Harbour City Council.

APPENDIX A

AHIMS Search Results

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS Web Services (AWS)

Search Result

Purchase Order/Reference : Coffs Harbour

Client Service ID : 523691

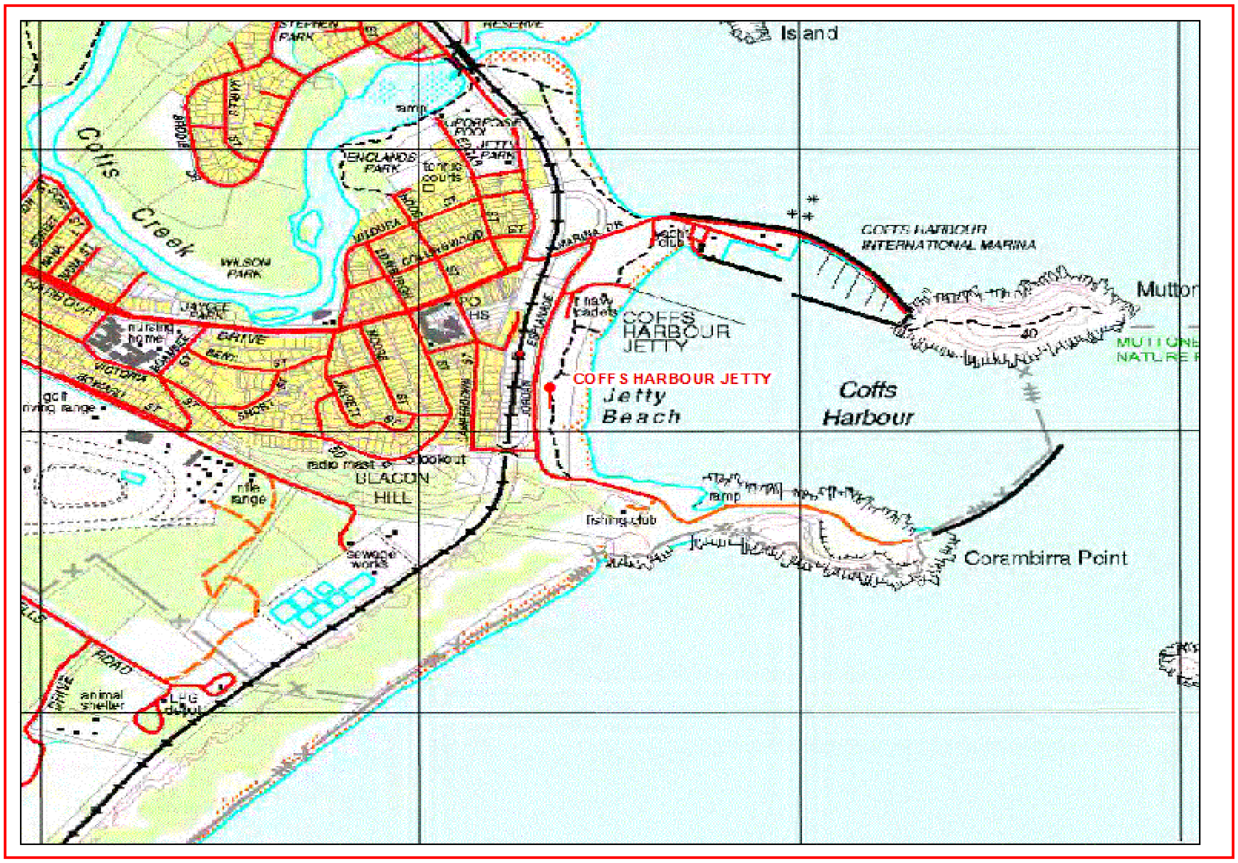
Penny Mccardle
Po Box 166
Adamstown New South Wales 2289
Attention: Penny Mccardle
Email: penny@mcheritage.com.au

Date: 29 July 2020

Dear Sir or Madam:

AHIMS Web Service search for the following area at Datum :GDA, Zone : 56, Eastings : 512000 - 515000, Northings : 6646000 - 6648000 with a Buffer of 50 meters. Additional Info : assessment, conducted by Penny Mccardle on 29 July 2020.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

13	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Coffs Harbour

Client Service ID : 523691

SiteID	**SiteName**	**Datum**	**Zone**	**Easting**	**Northing**	**Context**	**Site Status**	**SiteFeatures**	**SiteTypes**	**Reports**
22-1-0398	Coffs Creek PAD	GDA	56	512190	6647839	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Umwelt (Australia) Pty Limited - Individual users					**Permits**	3494,3495	
22-1-0579	Coffs Jetty South East	GDA	56	514057	6646639	Open site	Valid	Aboriginal Ceremony and Dreaming : -		
	Contact	**Recorders**	Coffs Harbour City Council - cnr Coff and Castle Streets,Mr.Marten Bouma					**Permits**		
22-1-0559	Muttonbird Island	GDA	56	514566	6647394	Open site	Valid	Aboriginal Ceremony and Dreaming : -		
	Contact	**Recorders**	Coffs Harbour City Council - cnr Coff and Castle Streets,Mr.Marten Bouma					**Permits**		
22-1-0300	Custodian Burial - Clybucca	AGD	56	512470	6647610	Open site	Valid	Burial : 1		
	Contact T Russell	**Recorders**	Vic Buchanan					**Permits**		
22-1-0311	Coffs Creek 3	AGD	56	512605	6647345	Open site	Valid	Aboriginal Ceremony and Dreaming : -		
	Contact T Russell	**Recorders**	Mr.Steve Hart					**Permits**		
22-1-0309	Coffs Creek 1	AGD	56	512607	6647344	Open site	Partially Destroyed	Aboriginal Ceremony and Dreaming : -		
	Contact T Russell	**Recorders**	Mr.Steve Hart					**Permits**	3494,3495	
22-1-0340	Dunhill-Stone Quarrie	AGD	56	513181	6646626	Open site	Valid	Stone Quarry : -		
	Contact Mr.Steve Hart	**Recorders**	Mr.Steve Hart					**Permits**		
22-1-0310	Coffs Creek 2	AGD	56	513261	6646485	Open site	Partially Destroyed	Aboriginal Ceremony and Dreaming : -		
	Contact T Russell	**Recorders**	Mr.Steve Hart					**Permits**	3494,3495	
22-1-0080	Corambirra Stone Tool Workshop;	AGD	56	513400	6646380	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Mrs.Lisa Southgate					**Permits**		
22-1-0028	Coffs Harbour;	AGD	56	513400	6647500	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	Miss.Marjorie Sullivan					**Permits**		
22-1-0140	CHSS-7	AGD	56	513450	6646350	Open site	Valid	Shell : -		
	Contact	**Recorders**	Ms.Jacqueline Collins					**Permits**		
22-1-0018	South Coffs Island;Coffs Harbour;	AGD	56	514300	6646300	Open site	Valid	Aboriginal Ceremony and Dreaming : -	Natural Mythological (Ritual)	101054
	Contact	**Recorders**	Ray Kelly,Mr.Richard Kelly					**Permits**		
22-1-0017	North Coffs Island, Muttonbird Island	AGD	56	514300	6647600	Open site	Valid	Aboriginal Ceremony and Dreaming : -	Natural Mythological (Ritual)	
	Contact	**Recorders**	Harry Creamer					**Permits**		

Report generated by AHIMS Web Service on 29/07/2020 for Penny Mccardle for the following area at Datum :GDA, Zone : 56, Eastings : 512000 - 515000, Northings : 6646000 - 6648000 with a Buffer of 50 meters. Additional Info : assessment. Number of Aboriginal sites and Aboriginal objects found is 13

Appendix E

Historic Heritage Impact Assessment

COFFS HARBOUR

BOAT RAMP UPGRADE

HERITAGE IMPACT ASSESSMENT

September 2020

CoAssociates pty ltd

Project client: **Transport for NSW Maritime Infrastructure Delivery Office (MIDO) / Blue Sky Planning and Environment**

Planning Consultant: Lisa Proctor, Blue Sky Planning and Environment

Author/s: Lillian Cullen, Grad Dip UNE Heritage and Brian Carberry

Document status: Final

Date: 03/09/2020

Local Government Area/s: Coffs Harbour

Project Documents viewed and Revision status

Document/ Drawing	Title	Author	Revision/ Date
200819\PA2341-STG-001 Plan - 19.08.20.pdf	Coffs Harbour Boat Ramp Upgrade, Concept Staging Plans Stage 1 Site Master Plan	Royal Haskonning DHV Haskonning Australia Pty Ltd Newcastle	19.08.20
200819\PA2341-STG-002 Plan - 19.08.20.pdf	Coffs Harbour Boat Ramp Upgrade, Concept Staging Plans Stage 2 Site Master Plan	Royal Haskonning DHV Haskonning Australia Pty Ltd Newcastle	19.08.20

Cover photograph: Trestle Bridge and rail line, looking westward towards Coffs Harbour foreshore.

Source: "*Breakwater Construction 1915 [picture]*", Coffs Harbour Library, (www: coffsharbour.spydus.com/cgi-bin/spydus.exe/FULL/WPIC/BIBENQ/6488829/436875,1?FMT=IMG)

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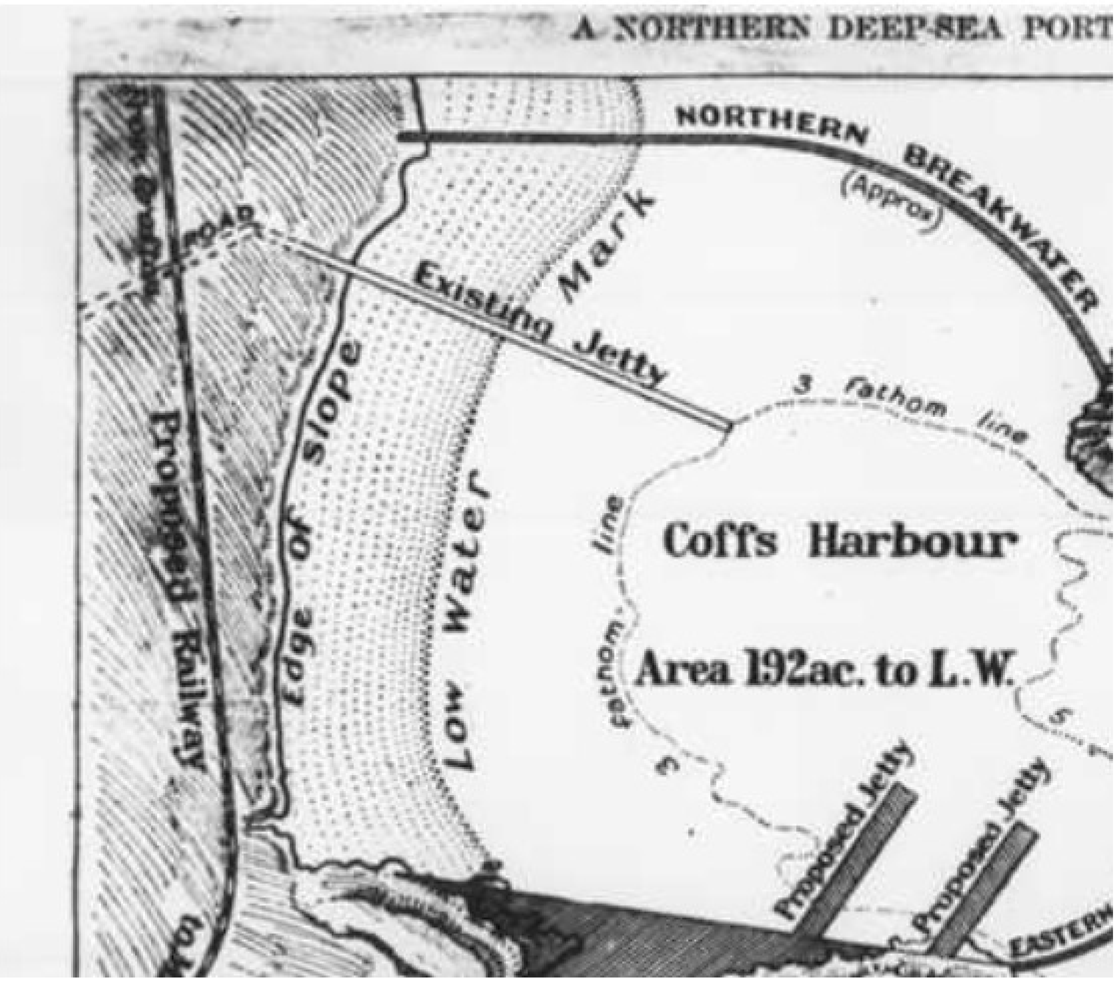

Plate 1: “The deposition that changed the course of Coffs Harbour’s history.”
From: https://coffscoastheritage.info/page/3/.

1. Introduction

a) Project Background and Aims

At the south end of the Coffs Harbour beach/foreshore, the peninsula: Corambirra Point, was initially a separated island referred to as South Coff Island. A land bridge from the foreshore to South Coff Island was built in the early 20th century to form a peninsula. With breakwaters then constructed out from this peninsula, one referred to as the East Breakwater, forms the main southern enclosure to the Harbour. A smaller breakwater shoreward from the Point, built in the 1970's, provides a sheltered inlet for landing of trailered boats on a concrete ramp.

This project: ***Coffs Harbour Boat Ramp Upgrade***, is to upgrade the facilities for trailered boats by way of providing additional landing ramps, extending the existing breakwater wall to this inlet, formalising and extending the car and trailer parking in the vicinity and providing upgraded amenities.

The project is being designed and constructed in two Stages.

Stage 1 scope of work will comprise:

- Extension of the existing breakwater by 75m
- Widening of the existing boat ramp with additional two lanes
- New topping over the existing boat ramp area
- Extension of the existing pontoon
- Two new pontoons
- Dredging of the existing boat ramp basin and channel

Stage 2 scope of work will include:

- Extension of the existing main carpark to include additional parking for cars, boats and trailers
- New carpark entrance at the western end of the carparking
- Block off entry adjacent to boat ramp off Jordan Esplanade for safety reasons
- Diversion of Jordan Esplanade road opposite the main carpark
- New road signage
- New rigging and de-rigging bays around the main carpark
- A new shared pathway (2.5m) for walking/cycling
- New amenities facility and kiosk

- New Lighting and signage

- Recreational furniture including seating and tables

- Pedestrian pathway on south side of Jordan Esplanade with access to Gallows Beach carpark and to amenities facility in the main carpark area

- Landscaping

- Extension of services including water, power and sewerage

With the intention of completing the work in stages, this heritage assessment takes into consideration the two stages, as a total project.

In reviewing the heritage information from Coffs Harbour City Council and NSW Heritage, the following state listed heritage item is in close proximity to the work of this project:

- **Ferguson Cottage.**

The following locally listed heritage item may be impacted by the work of this project:

- **Buried Trestle Bridge, Tramway Line Site, and World War 11 Gun Turret.**

Noting that the World War 11 Gun Turret is not located within the project boundary.

(Refer to Appendix A for Heritage inventory forms)

This report undertakes a heritage assessment to determine the likely impacts of the proposed works on the heritage items and their associated heritage significance, and makes recommendations to guide heritage management during the course of the works.

The heritage assessment has been prepared in accordance with the 'Statements of Heritage Impact' guidelines published by the NSW Heritage Office and Department of Urban Affairs & Planning (19960, revised 2002), and originally published as part of the NSW Heritage Manual.

b) Project Site Location

Coffs Harbour is situated on the north coast of New South Wales, with this project being located at the south end of the harbour on the peninsula formerly South Coff Island. The project site area is centred around the existing boat ramp, its associated breakwall, the trailer and vehicle parking areas and amenities.

Plate 2: Locality Map of Coffs Harbour Boat Ramp.
(Source: Haskonning / Manly Hydraulics Laboratory, NSW Government)

c) Methodology and Report Outline

To complete this heritage impact assessment report, the following tasks were undertaken:

- Searches of local, state and national heritage registers and planning instruments (Section 2);
- Review of previous heritage studies and assessments (Section 3);
- Background historical research to understand past land use and heritage significance (Section 4);
- Site inspection to assess potential heritage impacts (Section 5);
- Significance assessments (Section 6);
- Impact assessment of the proposed works on heritage significance and the potential for archaeological remains (Section 7); and
- Provision of management recommendations to avoid and/or minimise heritage impacts (Section 8).

d) Limitations

This report is limited to consideration of Heritage elements of significance related to the project site with relevance to post European settlement in Australia.

e) Corrections

Every effort has been made to ensure the accuracy and appropriateness of this report. If any part of this report is considered to be incorrect or inaccurate, please notify Coassociates Pty Ltd., in the first instance.

2. Regulatory and Assessment Framework

a) Introduction

The following section includes a summary of relevant state legislation and associated local planning instruments designed to protect and conserve significant heritage items and their values. The results of Heritage NSW and Coffs Harbour heritage register searches undertaken on 14th August 2020 are also summarised in the relevant subsections and presented in Appendix A.

b) State Legislation

Environmental Planning and Assessment Act 1979

The Environmental Planning and Assessment Act 1979 (EP&A Act) establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process in NSW. The Act requires that environmental impacts, including those to heritage items, are considered prior to development. The EP&A Act also requires local governments to prepare planning instruments, such as Local Environmental Plans to provide guidance on the level of environmental assessment required. The EP&A Act also allows for the gazettal of State Environmental Planning Policies.

c) State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policies (SEPPs) are environmental planning instruments which specify planning controls for certain areas and/or types of development within the State. SEPPs may also identify the development assessment system that applies to developments and the type of environmental assessment required. In this circumstance the practical effect of a SEPP is to override local government controls, by allowing certain types of development in an area. The State Environmental Planning Policy (Infrastructure) 2007 (hereafter referred to as ‘ISEPP’) Division13 68(4) is relevant to this project and allows for development types that are permitted without local government consent.

Division13 68(4) of the ISEPP considers Port, Wharf or boating facilities. This division includes the following:

- Development permitted without consent
- Development for the purpose of wharf or boating facilities may be carried out by or on behalf of a public authority without consent on any land. However, such development may be carried out on land reserved under the *National Parks and Wildlife* Act 1974 only if the development is authorised by or under that Act.

d) Heritage Act 1977

The Heritage Act 1977 is a statutory tool designed to conserve environmental heritage in NSW. It is used to regulate development impacts on the State's historical heritage assets. The Act defines a heritage item as "a place, building, work, relic, moveable object or precinct". To assist with the management of the State's heritage assets, the Act distinguishes between items of local and State heritage significance. Items that are assessed as having State heritage significance are listed on the NSW State Heritage Register (SHR). Proposals to alter, damage, move or destroy heritage items listed on the SHR (or protected by an Interim Heritage Order [IHO]), require an approval under s.60 of the Heritage Act 1977.

Archaeological features and deposits are afforded statutory protection by the 'relics provisions' of the Act. A relic is defined as "any deposit, artefact, object or material evidence that relates to the settlement of the area that comprises NSW, not being Aboriginal settlement, and is of State or local heritage significance".

e) State Heritage and Conservation (s170) Registers

Under s170 of the Heritage Act 1977, NSW government agencies are required to maintain a register of heritage assets under their control or ownership. Each government agency is responsible for ensuring that the items entered on its register under s.170 are maintained with due diligence in accordance with State Owned Heritage Management Principles. Items listed on s170 Heritage and Conservation Registers are listed on the State Heritage Inventory (SHI). A search of the s170 heritage register on 17th August 2020 has indicated that there are no s170 heritage items located within, or in close proximity to, the project works area.

f) Local government planning instruments

Each LGA is required to create and maintain a Local Environmental Plan (LEP) that identifies and conserves items of environmental heritage, including historical heritage items (which include archaeological sites). These items are protected under the EP&A Act. Heritage items are listed in Schedule 5 and are subject to the planning controls and provisions set out in Clause 5.10 (Heritage Conservation) of each LEP. The Project works area is located within the LGA of Coffs Harbour (LEP 2013).

Table 1: Heritage listed items on or near the works area

Item Name	Item No. LEP & SHI	Address	Property Description	Significance	Source
Ferguson Cottage	I9 01802	1 Breakwater Road, Coffs Harbour, NSW 2450	Part Lot 21 DP850150	State	Coffs Harbour LEP 2013/ NSW Heritage inventory
Buried trestle bridge, tramway line site and World War II gun turret	I8 1360005	Jordan Esplanade, Coffs Harbour	Lot 21, DP 850150	Local	Coffs Harbour LEP 2013/ NSW Heritage Inventory
*Line of Former Rail Tracks, Coffs Harbour Breakwaters and Foreshore (archaeology)	I8 1360006	Jordan Esplanade, Coffs Harbour	As above	Archaeological	NSW Heritage Inventory

*This inventory form, whilst titled somewhat differently to the above “Buried trestle, tramway line site and World War II gun turret” contains similar information.

The state listed Ferguson Cottage is located within close proximity to the works area, but is not within the project boundary. The locally listed buried trestle bridge and tramway line site is located within the project boundary and may be impacted by the works. The World War II gun turret is not located within the project boundary. Recommendations on mitigation measures and management of these items is included at the end of this document.

3. Previous Heritage Assessments/ Studies

a) Introduction

The following subsections provide a brief summary of available historical heritage literature relevant to the Project works area, including previous heritage studies and archaeological assessments.

b) Previous Heritage Assessments

Coffs Harbour City: Coffs Harbour Heritage Study 2015.
Author: Robin Hedditch. Heritage Consultant, for Coffs Harbour City Council.
The study reviewed various items in the local government area of Coffs Harbour. Specific information in respect to this project is that titled: “The Coffs Harbour breakwalls (1913-1928)” (at pages 24,25).

Coffs Harbour Eastern Breakwater Remedial Works Review of Environmental Factors. 2012
Author: BMT WBM for NSW Crown Lands.

Within that review was a Heritage Assessment Report titled:
Coffs Harbour Eastern Breakwater Rail Line Photographic Survey and Archival Recording, June 2012.
Author: Robin Hedditch, for Department of Crown Lands, NSW Land and Property Management Authority.
That report, although mainly focused on the Breakwater, provides further photographs and history relevant to the original quarry at South Coff Island, the Trestle Bridge (Viaduct) and the rail line.

Coffs Harbour City Council, Heritage Inventory 1997. Old Tramway Line Site - Jetty Foreshore-Coffs Harbour Jetty.
Author: EJE

c) Previous assessment recommendations

No heritage recommendations have been made in the above studies or reports pertaining to the specific site of this project.

4. Historical Context

a) Introduction

This section provides historical background information relevant to the Project works area within Coffs Harbour and foreshore.

This is not a comprehensive regional history of the Coffs Harbour area, but instead focuses on past land use and development within the project works area for the purpose of providing a context for known and potential historical heritage items. Information has been obtained primarily using secondary sources, including previous heritage studies (see Section 3). Primary resources, such as parish plans and other maps, have been sourced from the National Library of Australia's TROVE online discovery service (NLA), State Library of NSW and the Department of Land and Property Information (LPI) and are included, where appropriate.

b) Coffs Harbour

Early European settlement (1840s –1870s)

The Coffs Harbour area was explored and settled relatively late in the 19th century. Maritime exploration of the northern NSW coastline was difficult due to a lack of natural harbours north of Port Stephens, and land-based exploration was hindered by dense forests and the large number of rivers that needed crossing. Few northern rivers were navigable or allowed easy landings. Exceptions were the Clarence River explored in 1839 and the Bellinger River discovered in 1841. Early coastal shipping routes between the convict settlements of Sydney, Newcastle, Port Macquarie and Brisbane bypassed this area of the coast, and the inland exploration of northern NSW and southern Queensland after Allan Cunningham's expedition of 1827 led to an inland road linking Kempsey to Grafton by way of Ebor. As a result, the northern coastline of NSW was generally overlooked, and the area broadly covered by the modern-day Coffs Coast remained remote and sparsely settled by Europeans until well into the 19th century.

John Korff (1799-1870)

The first European known to visit Coffs Harbour was John Korff in the 1840s (after whom Coffs Harbour is named). John Korff was born in London. John Korff's association with the place later to bear his name occurred in the 1840s when he and his ship, Brothers took shelter during a gale in the lee of South Coff Headland. He is said to have remained there for four days during which time his sons, Frederick and Gordon, went ashore. (It has been variously claimed this event took place in 1845, 1847 and 1850. Some even claim the event never took place at all.) Despite the historical uncertainty, John Korff is generally credited as the 'discoverer' of Coffs Harbour, and several other local places bear his name: North Coff Island now known as Muttonbird Island, South Coff Island now known as Corambirra Point, Korff's Islet, Coffs Creek and Korff Street. 'Korff's Harbour' became Coffs Harbour through a spelling error in the NSW Government Gazette which declared Reserve 15 at Coffs Harbour comprising 960 acres on 24 December 1861.

Early Logging

Walter Harvie is considered the area's first settler and it is thought he arrived around 1865-1866 (the date is sometimes given as 1870). He first logged Bongil Creek, setting up his camp in what is now Sawtell Reserve. He was then directed to Coffs Creek by local Aboriginals where he set up his second camp on the north side of Coffs Creek near the present-day showground. From there he worked up Coffs Creek to the Red Hill area. John Bayldon bought land between Bongil and Boambee Creeks which he named 'Boambi Run'. He built a large slab house and planted vegetable gardens and an orchard. After leaving Coffs, Walter Harvie returned to the Bellinger River, settled in Raleigh to become a farmer and ferry operator. He then moved to Bonville and later lived in Coffs Harbour where he retired and wrote a valuable account of his early days of Coffs Harbour. He died in 1932.

The discovery of gold (1881)

The other significant event of the early development of the Coffs Harbour area was the discovery of gold in the 1880s. It resulted in a sudden, large influx of people and represents the second wave of European arrivals to this part of the north coast. Gold was discovered in 1881 when two brothers called Sharpe, discovered a nugget of gold-bearing quartz in an abandoned campsite in the Orara Valley. They located the mother lode and the Lady Matilda mine was the first gold mine operation in the area.

Coffs Harbour town

The Government Surveyor, H A Evans laid out a town plan for a new village at present-day Coffs Harbour in 1886. He acted under instructions from the District Surveyor, William Braylesford Greaves, after whom it appears Evans wished to name the new town. When the plan was published in the Government Gazette in 1886, the town's name appeared as 'Brelsford'. By this time, the fledgling settlement was informally known as Coffs Harbour and the official name of Brelsford was dropped in 1897.[1]

c) Harbour Facilities

In addition to the Timber getting and Gold Mines, Coffs Harbour also had other early industries, including Dairy farming and local timber saw mills. The north coast rail line arrived at Coffs Harbour in 1915. Prior to the railway, the main means of transport to Sydney and the coastal towns was by ship. Accordingly facilities for access to the ships was an early need of the Harbour.

From 1885 onwards a constant stream of representations were made for government-built jetties to be provided.The jetty at Coffs Harbour was approved in late 1889 with the tender closing in January 1890. Work was sometimes hampered by bad weather, at one time, 300 feet of the jetty was washed away in a violent storm, but work continued without interruption until August 1892 when the jetty was completed and included a narrow-gauge train line and five ton steam-operated crane at the seaward end for loading vessels.

The first permanent hardwood timber mill in the area was in Coramba, established in January 1903 by William Shaw. It was cutting 22,000 super feet of ironbark per week for export to New Zealand via Sydney. It was loaded at Coffs Harbour which, at the time, was visited by two ships a week, the 'Dorrigo' and the 'Cavanba', each travelling north and south.

rom two ships a week in both directions in 1903, Coffs Harbour jetty was receiving about eight a week (over 400 a year) in 1906 and traffic remained at this level for the next 10 years. [2]

Plate 3: 1922 "Fifth edition Map of COFFS HARBOUR and Suburban Lands. Parish of Coff, County of Fitzroy, Land District of Bellingen, Dorrigo Shire. NSW 1922". Note on South Coff Island: "4th. February 1916". Part of "Reclamation" showing. Also clear is that the position of the "Trestle Bridge" was necessarily between the nearest corner of South Coff Island and the shoreline, with the single line indicating the route of the rail line.[3]

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[1] R. Hedditch, *Coffs Harbour Heritage Study 2015*, , Coffs Harbour City Council 2015.

[2] *Op. Cit.*

[3] https://hlrv.nswlrs.com.au/ Town of Coffs Harbour 2 of 2.

d) The Coffs Harbour breakwalls (1913-1928)

The need to create calmer waters to assist Coffs Harbour's development as a shipping port had been recognised in the late 19th century and noted by Commander Howard in his 1890 maritime surveys of Coffs Harbour and Woolgoolga. In the early years of the 20th century the idea was put forward several times by various advocates and in 1912, the scheme proposed by engineers, Messrs de Burgh and Keele was accepted. (Mr de Burgh was Chief Engineer for Harbour and Water Supply.) The scheme involved linking North and South Coff Islands to the mainland and building an additional ocean breakwall from South Coff Island in a north-eastern curve to create a sheltered harbour. Additional jetties were proposed at South Coff Island but these were never built.Work began on the south side of the harbour in 1913 with the construction of a timber viaduct (trestle bridge) linking South Coff Island to the mainland in order to set up a quarry at South Coff Island to supply the rock for the northern breakwall. By 1915 the quarry was in full operation and a tramline had been built to transport rock from South Coff Island along the shoreline to the northern breakwater. This tramline also utilised part of the existing Coffs Harbour Timber Company tramline that had been built by Henry Edgar Day in 1905.

The northern breakwall involved linking North Coff Island (Muttonbird Island) to the mainland. Originally the contract was issued to Norton Griffith but the arrangement fell through and NSW Department of Public Works took over the work in May 1917 with about half of the northern breakwall completed. The work was completed on 24 May 1924. For several years following, the stonework was left to settle before being capped with concrete. This was done over time until July 1935.[4]

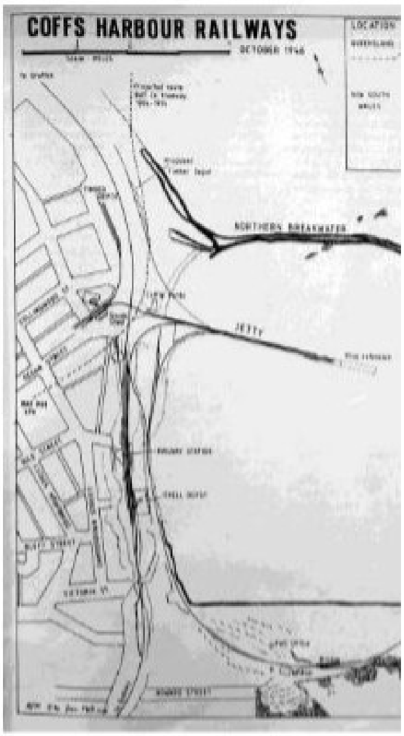

Figure 7: PWD plan of rail lines at Coffs Harbour, prepared in Octob
1985).

Plate 4: PWD drawing plans prepared in 1946. "Figure 7" (Top) shows the whole of the Jetty Foreshore of Coffs Harbour. "Figure 8" shows the extent of the reclamation that then bridged South Coff Island to the mainland. That also shows the various rail lines on South Coff Island and the reclaim area, as well as the outline of the two quarry recesses. (Source: Kramer: *Ships and timber: a short history of Coffs Harbour port and associated railways*.)

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[4] R. Hedditch, *Coffs Harbour Heritage Study 2015*, , Coffs Harbour City Council 2015

e) South Coff Island Connection

With the rock being obtained from the South Coff Island quarry for the breakwall works, the initial action was to build the rail line from the foreshore of the harbour over the gap between the foreshore and South Coff Island and then run along the north edge of South Coff Island up to the quarry area. This required the construction of the Trestle Bridge (Viaduct) over the gap between the foreshore and the island. As the PWD drawings indicate and as is now the case, the gap between foreshore and the island was closed with a straight line shoreline of fill, creating a substantial land form to the island. In forming that landfill, it has been indicated that:

> At the same time, the viaduct was progressively covered over with fill from the quarry until the sea was closed off and South Coff Island was joined to the mainland. This work was completed in 1928.[5]

f) Eastern Breakwall

Work on the curved eastern breakwall began in 1918 but there were major delays and setbacks as the breakwall was washed away several times in storms. In 1926 the works were inspected by visiting UK engineer, Sir George Buchanan, who was inspecting Australia ports on behalf of the Commonwealth Government. Buchanan had several concerns with the plans. The concrete blocks and the stone from the quarry were not large enough, the sea face of the northern breakwall required additional protection, and the overall plan would not provide sufficient shelter as the created harbour enclosure would still be exposed to storms from the ENE to ESE directions. At the time of his visit both breakwalls suffered damage from storms.

Only part of Buchanan's advice was heeded. Larger 40-ton concrete blocks were deployed and the eastern (ocean) breakwall was extended to 1,530 feet but his suggestion to rebuilt it on a different alignment was not taken up. On 6 October 1939 the eastern breakwall was completed with the concrete capping occurring in stages over the next 2-3 years. 6

Plate 5: "Trestle Bridge under construction 1914."
(Source: Coffs Harbour Regional Museum, ref: mus07-7626)

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[5] Op.cit.

[6] R Hettich, *Coffs Harbour Heritage Study 2015* (October 2015), Coffs Harbour City Council.

Plate 6: “Viaduct to South Coffs Island 1915”. Completed
(Source: Coffs Harbour Library: “Picture Coffs Harbour” bookmark link: https://coffsharbour.spydus.com/cgi-bin/spydus.exe/ENQ/WPIC/ BIBENQ?SETLVL=&BRN=199681)

g) Boat Ramp and Inlet

The boat ramp basin was constructed in the mid-1970s.7

In recent years (2014 and beyond) there have been a series of works on the boat ramp basin area. These have included dredging, widening and other maintenance works.

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[7] M Kulmar, et al. *Coffs Harbour Boat Ramp - Long wave data collection to evaluate performance of basin extension works*. NSW Government, Manly Hydraulics Laboratory (MHL), Manly Vale, NSW (https://www.coastalconference.com/2016/papers2016/Mark%20Kulmar.pdf)

5. Site Description

a) Introduction

A physical inspection was undertaken on the 6 August 2020 by Lillian Cullen. The inspection focused on the proposed impact footprint and known and potential heritage items nearby. A site meeting was also held with Lisa Proctor (Blue Sky Planning and Environment), and representatives from MIDO.

b) Corambirra Point and Peninsula

The proposed works;

Existing Boat Ramp Upgrade, including adjacent areas of vehicle access, parking and amenities. The works cover a general approach area over the peninsula that was originally South Coff Island and the landfill area back to the foreshore. (Refer to following Plate 7)

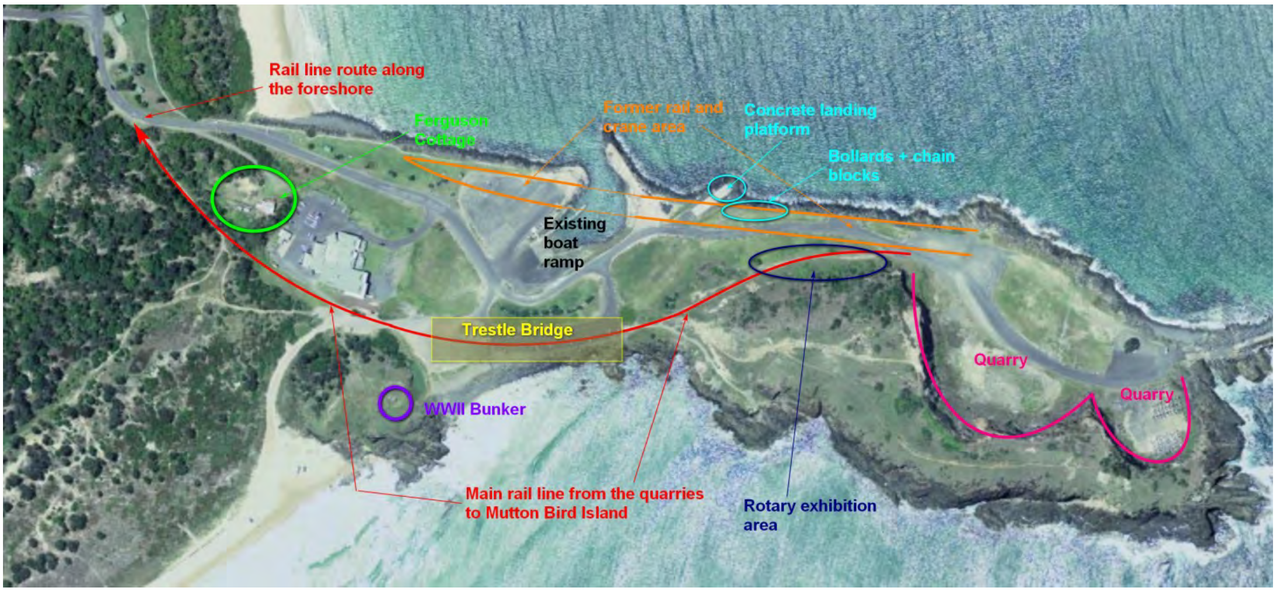


Plate 7: Overlay showing the Ferguson Cottage, rail lines and Trestle Bridge locations on a current aerial view. (Aerial view by NSW SIX maps.)

As indicated on the overlay;

- The route of the main rail line (Red) crosses the site and follows the foreshore line that then links across to the breakwall linking Mutton Bird Island.
- The zone of the orange lines indicates the area of rail lines on the peninsula breakwall that included a crane. This delineation is now broken by the excavated area of the existing Boat Ramp and basin inlet.
- The Trestle Bridge (Viaduct) is located in the yellow zone, originally the small gap between South Coff Island and the foreshore, prior to the landfill work commencing.
- The area between the Trestle Bridge, rail line and the north breakwall face is the large (crescent shape, not shaded) area that was filled in, as part of the process of forming the peninsula.
- Ferguson cottage (bright green) is located back from the foreshore and is sited between the route of the main rail line and the current access road onto the peninsula.
- The existing boat ramp and its basin (black), is the groin inlet along the northern breakwall, developed in the mid 1970's.
- The two quarries (pink) are toward the east end of the peninsula and open to the north. WW11 Observation Bunker (purple) location is highlighted in the original image. (The delineation of the rail lines on this layout are derived from the PWD diagram at Plate: 4)
- The two bollards and nearby chain blocks are shown at light blue.
- The Rotary exhibition elements are located in the dark blue area.

c) **Archaeological potential**

The land use history of the site and historical research indicates the presence of former structures in the project area and potential archaeological features were observed during the site inspection. The Project works area is therefore considered to have some archaeological potential, abet that the area is highly disturbed.

6. Assessment of Significance

a) Significance framework

The NSW Heritage Manual guideline, ‘Assessing Heritage Significance’ (NSW Heritage Office 2001) provides the framework for significance assessments and Statements of Significance. These guidelines incorporate the seven aspects of cultural heritage value identified in the Australia ICOMOS Charter for Places of Cultural Significance, The Burra Charter, 2013 (Burra Charter) into a framework currently accepted by the NSW Heritage Council.

b) Significance assessments

Both Ferguson cottage and the buried timber trestle bridge, tramway line site, and World War 11 gun turret are heritage listed and have existing heritage assessment criteria and statements of significance.

Ferguson Cottage is in close proximity to the work of this project, it is not within the project boundary. Under this circumstance the project works will not impact the heritage item. As the heritage criteria has already been established for this item and it can be easily viewed in the Appendix of this document they will not be repeated here.

The **Buried Trestle Bridge, Tramway Line Site** may be impacted by the work of this project, being that it is located within the project site. The World War 11 Gun Turret is not located within the project boundary.

Buried timber trestle bridge, tramway line site, and World War 11 gun turret

Statement of significance:

The buried timber trestle rail bridge at South Coff Headland is of high local significance as a surviving and integral part of the original infrastructure of the large-scale harbour reclamation works that were undertaken in Coffs Harbour between 1913 and 1939. The trestle rail bridge was built between 1913-1915 and progressively filled in as part of the works until completely buried by 1928 and today forms part of the land bridge between the former South Coff Island and the mainland. The buried timber trestle rail bridge is also significant as an example of a standard timber rail underbridge built by PWD until 1935, of which few remain in NSW.

All surviving buildings and remnants of the PWD harbour construction works are important in demonstrating this critical phase of Coffs Harbour’s past history as a busy, shipping port and are essential to understanding how Coffs Harbour was created. The buried timber trestle bridge is of high social significance as a well-known and highly esteemed part of those early capital works.

The following significance assessment information is provided from the existing heritage inventory form:

Criterion	Significance
SHR Criteria a) [Historical significance]	The buried timber trestle rail bridge at South Coff Headland is of local significance as a surviving and integral part of the original infrastructure of the large-scale harbour reclamation works that were undertaken in Coffs Harbour between 1913 and 1939. The works involved the earlier constructed timber jetty, two harbour breakwalls, a reclamation wall along the harbour foreshore, the timber trestle bridge and the associated rail lines used in the construction of the breakwalls and for later regular maintenance. These works drastically re-shaped the physical form of Coffs Harbour's coastline and created the man-made harbour we see today. These works, and the North Coast Railway, were largely responsible for the growth and development of Coffs Harbour itself. The trestle rail bridge was built between 1913-1915 and progressively filled in as part of the works until completely buried by 1928 and today forms part of the land bridge between the former South Coff Island and the mainland. The buried timber trestle rail bridge is also significant as a rare example of a standard timber rail underbridge built by PWD until 1935, of which few remain in NSW. All surviving buildings and remnants of the PWD harbour construction works are important in demonstrating this critical phase of Coffs Harbour's past history as a busy, shipping port and are essential to understanding how Coffs Harbour was created.
SHR Criteria d) [Social significance]	Of high local significance. Knowledge of, and curiosity about, Coffs Harbour's harbour formation works, the breakwater rail lines and the earlier privately-built timber tramlines are an important aspect of Coffs Harbour's sense of identity. They evoke a now-defunct industrial past and their period of operation (1917-1970s) is still within living memory. The story of how Coffs Harbour foreshore came to be continues to exert a powerful sentimental and romantic appeal over Coffs Harbour residents, and the buried timber trestle bridge is a well-known and highly esteemed part of those early capital works.
SHR Criteria e) [Research potential]	Of high local significance having some potential to reveal information about timber trestle rail underbridge construction. Has high archaeological potential as a surviving and integral part of the original

	infrastructure of the large-scale harbour reclamation works.
SHR Criteria f) [Rarity]	Of high local significance. Potentially rare example of a standard timber rail underbridge built by PWD until 1935. Two similar timber rail underbridge survive in the LGA on the former Glenreagh-Dorrigo branch line and several similar rail overbridge also survive. Timber trestle rail underbridge are increasingly rare within NSW and survive mainly on disused and former branch lines.
SHR Criteria g) [Representativeness]	Likely to be good representative example of the standard timber trestle rail underbridge built by PWD until 1935 and of high local significance.
Integrity/Intactness:	Not known

c) Additional significant items

In addition to the above legislated heritage items, the following additional items are considered to have heritage significance and accordingly are to be recognised on the site and appropriate precautions taken to ensure no detrimental impingement is caused by the project works:

Item description	**location**	**Assessed significance**	**Comment/ Action**
Two large ship bollards and adjacent large chain blocks	On the east side of the boat ramp inlet near unformed carpark area, adjacent to new parking area	Significant maritime elements	Provide barriers to protect items during construction
Stepped Concrete landing pad	On the east side of the Boat Ramp inlet breakwater	Unclear, research has not identified any significance	Outside project area
Rail line, rail buggy and associated exhibition items, including the exhibition display board	Rotary Project exhibition area	Significant as a repository of remains and exhibition area for the listed item	Retain and utilise for future items if required, avoid locating compound, parking or storing materials in this area
Nearby remains near the above: Part boiler remains, concrete culvert box, various timber items and associated fixings (Bolts, screws and nails).	As above	As above	As above
Two quarry rock faces	Quarry area	Significant as the main source of rock for the local breakwalls	Outside project area

d) Significance Assessment Recommendations

The state listed Ferguson cottage is located outside the boundary of the intended project works and is not expected to be impacted by this project. Care is to be taken to ensure that no impingement upon this property (eg: vibration and dust) occurs during construction.

The locally listed buried trestle bridge and associated rail lines are within the boundary of this project. Care is to be taken in terms of potential archaeological items being uncovered. Refer to recommendations following.

The WW11 bunker (included in the title of the above item) is located nearby in an elevated position. Its location is at the boundary of the project works, inland from Gallows Beach. However, unless activities of the project impinge on this item, (eg: vibration and dust) it is not expected that the WW11 bunker will be affected.

Additional items noted as significant in the table above are to be protected with barriers during construction. The Rotary exhibition area is to be fenced off from the works should they extend to this area. Site materials, compound and contractor parking is not to occur in this area.

7. Heritage Impact Assessment

Coffs Harbour Boat Ramp Upgrade

a) Proposed Works

The **Coffs Harbour Boat Ramp Upgrade** project being undertaken in two stages consists of:

Stage 1 scope of work will comprise:

- Extension of the existing breakwater by 75m
- Widening of the existing boat ramp with additional two lanes
- New topping over the existing boat ramp area
- Extension of the existing pontoon
- Two new pontoons
- Dredging of the existing boat ramp basin and channel

Stage 2 scope of work will include:

- Extension of the existing main carpark to include additional parking for cars, boats and trailers
- New carpark entrance at the western end of the carparking
- Block off entry adjacent to boat ramp off Jordan Esplanade for safety reasons
- Diversion of Jordan Esplanade road opposite the main carpark
- New road signage
- New rigging and de-rigging bays around the main carpark
- A new shared pathway (2.5m) for walking/cycling
- New amenities facility and kiosk
- New Lighting and signage
- Recreational furniture including seating and tables
- Pedestrian pathway on south side of Jordan Esplanade with access to Gallows Beach carpark and to amenities facility in the main carpark area
- Landscaping
- Extension of services including water, power and sewerage

b) **Impact Assessment**

The 'Statements of Heritage Impact' guidelines (NSW Heritage Office and Department of Urban Affairs & Planning 1996, revised 2002) pose a range of questions for consideration when assessing impacts for various types of development. Relevant questions relating to development adjacent to a heritage item/s are addressed below:

- *How is the impact of the new development on the heritage significance of the item or area to be minimised?*

The works are very similar, although upgraded, to the existing site use arrangement. It is intended that the access roads and car and trailer parking in and around the site will be improved for safety and ease of use. The new amenities block will be located near the existing breakwall and ramp and is visually removed from Ferguson Cottage by at least 500 meters. The works are occurring on already highly disturbed land. This document makes recommendations in respect to the management of archaeological relics should they be found during the course of the project.

- *Why is the new development required to be adjacent to a heritage item?*

Existing facilities in this area require to be upgraded. There are no current toilet amenities and existing access roads require maintenance and realignment for safety reasons. The trestle bridge and associated items are buried below the existing ground and carpark surface.

- *How does the curtilage allowed around the heritage item contribute to the retention of its heritage significance?*

There will be no change to the curtilage of the former trestle bridge and associated rail lines area, given that they are buried items. The trestle bridge and rail lines have been buried and incorporated into land fill, and are not visually evident.

An exhibition area showcasing significant items, created by the Rotary Club, is located south of the project area and will not be disturbed with the upgrade works.

- *How does the new development affect views to, and from, the heritage item? What has been done to minimise negative effects?*

Ferguson Cottage is not visually evident from the upgrade works area. It is set into a hillside and surrounded by vegetation and only a small amount of roof area of the cottage is visible from this site.

- *Is the development sited on any known, or potentially significant archaeological deposits? If so, have alternative sites been considered? Why were they rejected?*

As noted above the trestle bridge and associated items are buried below the existing ground and carpark surface. NSW Heritage considers the items to be archaeological and completely buried

by 1928 (Refer to NSW Heritage inventory form).
Existing facilities in this area require to be upgraded. There are no current toilet amenities and existing access roads require maintenance and realignment for safety reasons.

• *Will the public, and users of the item, still be able to view and appreciate its significance?*

The public will benefit from upgraded facilities in this area.
They will continue to gain access to and be able appreciate the exhibition area showcasing the heritage of the former rail and trestle bridge items and interpretive information, created by the local Rotary Club.

Aspects of the proposal that respect or enhance the heritage significance of the heritage items:

- No heritage impact to the Ferguson Cottage is proposed. Ferguson's Cottage is located outside of the boundary of the upgrade works. Some possible impingement may occur due to vibration and dust activities. Accordingly it is required that minimal vibration machinery be used and that appropriate activity be arranged to stop dust moving outside the boundary of the project in this area.

- No direct heritage impacts to the Buried Trestle Bridge and rail area are intended. If elements of those items become uncovered, those elements are not to be disturbed. A professional archaeologist is to be commissioned with consequent directions and any actions carried out as provided by that person.

- The two large ship bollards and adjacent large chain blocks are to be retained and protected during the works.

- No heritage impact to the WW11 Bunker is proposed due to its location outside the area of the upgrade works.

8. Recommendations

The proposed upgrade works have been assessed and are considered to have minimal heritage impact on the existing heritage items within the work site and adjoining areas. This area has been highly disturbed and the trestle bridge and associated rail lines on the project site have been removed or are buried. Specifically the trestle bridge is nominated as being buried in the process of building up the present landform in the area.

The following recommendations are made:

1. The site area adjoining the Ferguson Cottage is to be suitably protected by the use of minimal vibration machinery and that appropriate activity be arranged to stop dust moving outside the boundary of the project.

2. The two large ship bollards and adjacent large chain blocks, located in the new carpark area: *Grassed overflow B*, are to be retained and protected during the works.

3. Archaeological relics
In the unlikely event that historical archaeological relics are discovered during ground disturbance activities, work in the immediate area would need to cease and suitably qualified professional archaeologist be engaged to assess the condition, extent and likely significance of the remains. Depending on the results of this assessment, OEH may need to be notified of the discovery in accordance with s146 of the Heritage Act 1977.

9. References

S. Newman, Local Studies Librarian, Community and Cultural Services, Coffs Harbour City Council. (http://libraries.coffsharbour.nsw.gov.au/)

R. Hedditch: *Coffs Harbour eastern breakwater rail line photographic survey and archival recording* June 2012

N. Yates: *Coffs Harbour: Vol1: pre-1880 to 1945.*

BMT WBM: *Coffs Harbour eastern breakwater, Remedial Works Review of Environmental Factors, , Final report*, Contract no: Crown Lands 1112-22, June 2012. (Robin Hedditch document following, included within that report.)

R. Hedditch: *Coffs Harbour Heritage Study 2015*, October 2015, Coffs Harbour City Council - (P24 onward: "The Coffs Harbour Breakwalls (1913 - 1928)")

J. Kramer: *Ships and timber: a short history of Coffs Harbour port and associated railways.*

Our Stories, Coffs Coast Heritage (https://coffscoastheritage.info/2018/06/the-story-of-the-coffs-harbour-jetty/):
G. Watts: "*The Deposition that changed the course of Coffs Harbour's History.*"
Also:
S Newman: *"The magic years of Brian Hodge, Coffs Harbour High School Cadet"*, April 20, 2020.
Japanese map.

Legislation and Regulatory documents
Environmental Planning and Assessment Act 1979
State Environmental Planning Policy (Infrastructure) 2007
Heritage Act 1977
Coffs Harbour Local Environmental Plan 2013

10. Annexe A – Heritage Inventory Forms

a) Buried timber trestle rail bridge (archaeology)

Item details

Name of item: Buried timber trestle rail bridge (archaeology)

Type of item: Archaeological-Terrestrial

Group/Collection: Transport - Rail

Category: Railway Bridge/ Viaduct

Primary address: Jordan Esplanade, Coffs Harbour, NSW 2450

Local govt. area: Coffs Harbour

All addresses

Street Address	Suburb/town	LGA	Parish	County	Type
Jordan Esplanade	Coffs Harbour	Coffs Harbour			Primary Address

Statement of significance:

The buried timber trestle rail bridge at South Coff Headland is of high local significance as a surviving and integral part of the original infrastructure of the large-scale harbour reclamation works that were undertaken in Coffs Harbour between 1913 and 1939. The trestle rail bridge was built between 1913-1915 and progressively filled in as part of the works until completely buried by 1928 and today forms part of the land bridge between the former South Coff Island and the mainland. The buried timber trestle rail bridge is also significant as an example of a standard timber rail underbridge built by PWD until 1935, of which few remain in NSW.

All surviving buildings and remnants of the PWD harbour construction works are important in demonstrating this critical phase of Coffs Harbour's past history as a busy, shipping port and are essential to understanding how Coffs Harbour was created. The buried timber trestle bridge is of high social significance as a well-known and highly esteemed part of those early capital works.

Date significance updated: 22 May 13

Note: The State Heritage Inventory provides information about heritage items listed by local and State government agencies. The State Heritage Inventory is continually being updated by local and State agencies as new information becomes available. Read the OEH copyright and disclaimer.

Description

Designer/Maker: Public Works Department

Builder/Maker: Public Works Department

Construction years: 1913-1928

The bridge has lain completely buried since 1928. Nothing of the bridge is visible.

Photographs of the trestle bridge before it was enclosed by infill reveal it was built in the standard manner of PWD timber trestle rail underbridges. It consisted of a series of tall cross-braced timber trestles supporting timber beams over which were laid the rail deck and tracks.

The early photographs show the bridge comprised nine spans and included timber side rails.

Physical description: Similar rail underbridges from the same period survive on the nearby Glenreagh-Dorrigo branch line and in a few places in NSW. Such rail underbridges are increasingly rare in NSW and survive mainly on disused branch lines.

Note on the gauge: According to John Kramer’s history of the Coffs Harbour jetty railways, the original rail lines along the jetty itself were narrow-gauge (ie 3 ft 6 inches in width) but with the completion of the Coffs-Raleigh section of the North Coast Railway in standard gauge, the jetty tramlines lines were converted to standard gauge in 1915 (ie 4 ft 8 inches). The earlier, privately-built BAT and other timber tramlines were built in narrow gauge. The breakwater rail lines, built after 1915, were always standard gauge.

Physical condition and/or Archaeological potential: Current physical condition is not known.

Date condition updated:22 May 13

More information on specifications of the bridge’s construction might be contained with PWD records within NSW State Records, which have not been consulted for this report.

Further information: Any future interpretation of Coffs Harbour’s jetty and foreshore needs to explain the full extent of government works around the harbour, the changes to the landforms, and how all the major elements (jetty, breakwaters, buildings, timber tram lines and railway lines, quarry and rolling stock etc) worked together to form a busy, industrial complex that served Coffs Harbour as a working port for 80 years (1892-1970s).

Current use: Archaeological site

Former use: Trestle timber rail underbridge

History

The buried timber trestle bridge forms part of the standard-gauge rail line built to facilitate the construction of Coffs Harbour's two breakwalls in 1915.

Following the completion of the government jetty in August 1892 and the rapid growth of the timber, sugar cane, and dairy industries around Coffs Harbour, it was decided to improve the town's harbour facilities. The large-scale engineering scheme to create a safe and tranquil shipping harbour was designed by government engineers de Burgh and Keele in 1910-1911.

The scheme involved building two breakwaters to link North Coff (Muttonbird) and South Coff Islands to the mainland and enclosing some 200 acres of water (at low tide).

A timber trestle bridge or viaduct was part of the first stage of works that began in 1913 and involved building a timber trestle bridge that linked South Coff Island to the mainland. This was done so that the base of South Coff Island could be used as a quarry to source rocks for the breakwaters. By 1915 a rail line had been built to transport the rocks from the quarry to where the northern breakwater was to start.

Historical notes:

As work progressed, fill from the quarry was used to build a reclamation wall along the southern side of the harbour. This eventually created a land bridge between the southern end of the beach and South Coff Island. By 1928 the island had been joined to the mainland and the earlier timber trestle bridge completely enclosed by earthworks.

Work on the northern breakwater began in 1915, with the engagement of Norton Griffith and Co. However, this contract was terminated shortly after and the NSW PWD took over the works in May 1917. The northern breakwater reached Muttonbird Island on 12 May 1924 and concrete capping of the crest was undertaken in stages until completed in July 1935.

Work on the eastern breakwater began in 1917 with a ceremony to mark the first stone being put into position on 17 June 1917. However, work didn't begin in earnest until 1918. The breakwater was built between late 1918 and October 1939 reaching its current length of 1530 feet. Over the next 2-3 years the crest was concreted in stages.

Following the completion of the jetty and the harbour breakwaters, Coffs Harbour became a major NSW coastal shipping port exporting large amounts of hardwood timber, fruit and vegetables, and dairy products. It was also the major point of arrival for visitors and settlers to the Coffs Harbour area until the Coffs-Glenreagh section of the North Coast Railway was completed in 1922 and the later completion of the Pacific Highway.

The years after the Second World War saw a gradual decline in coastal shipping. Shipping activity at Coffs Harbour gradually wound down until 22 July 1979 when the last commercial ship was loaded. Following that, various sections of the government rail lines that serviced the jetty, the breakwaters and the private timber tramlines no longer in use were taken up at different times. The exposed rail lines along the length of the eastern breakwater are the only rail and tram lines still visible and it is uncertain if any section of either the earlier narrow-gauge timber tramlines or standard gauge PWD rail lines survive under later road works.

Historic themes

Australian theme (abbrev)	New South Wales theme	Local theme
3. Economy-Developing local, regional and national economies	Environment - cultural landscape-Activities associated with the interactions between humans, human societies and the shaping of their physical surroundings	(none)-
4. Settlement-Building settlements, towns and cities	Towns, suburbs and villages-Activities associated with creating, planning and managing urban functions, landscapes and lifestyles in towns, suburbs and villages	(none)-

Assessment of significance

SHR Criteria a) [Historical significance]	The buried timber trestle rail bridge at South Coff Headland is of local significance as a surviving and integral part of the original infrastructure of the large-scale harbour reclamation works that were undertaken in Coffs Harbour between 1913 and 1939. The works involved the earlier constructed timber jetty, two harbour breakwalls, a reclamation wall along the harbour foreshore, the timber trestle bridge and the associated rail lines used in the construction of the breakwalls and for later regular maintenance. These works drastically re-shaped the physical form of Coffs Harbour's coastline and created the man-made harbour we see today. These works, and the North Coast Railway, were largely responsible for the growth and development of Coffs Harbour itself. The trestle rail bridge was built between 1913-1915 and progressively filled in as part of the works until completely buried by 1928 and today forms part of the land bridge between the former South Coff Island and the mainland. The buried timber trestle rail bridge is also significant as a rare example of a standard timber rail underbridge built by PWD until 1935, of which few remain in NSW. All surviving buildings and remnants of the PWD harbour construction works are important in demonstrating this critical phase of Coffs Harbour's past history as a busy, shipping port and are essential to understanding how Coffs Harbour was created.
SHR Criteria d)	Of high local significance. Knowledge of, and curiosity about, Coffs Harbour's harbour

[Social significance]	formation works, the breakwater rail lines and the earlier privately-built timber tramlines are an important aspect of Coffs Harbour's sense of identity. They evoke a now-defunct industrial past and their period of operation (1917-1970s) is still within living memory. The story of how Coffs Harbour foreshore came to be continues to exert a powerful sentimental and romantic appeal over Coffs Harbour residents, and the buried timber trestle bridge is a well-known and highly esteemed part of those early capital works.
SHR Criteria e) [Research potential]	Of high local significance having some potential to reveal information about timber trestle rail underbridge construction. Has high archaeological potential as a surviving and integral part of the original infrastructure of the large-scale harbour reclamation works.
SHR Criteria f) [Rarity]	Of high local significance. Potentially rare example of a standard timber rail underbridge built by PWD until 1935. Two similar timber rail underbridge survive in the LGA on the former Glenreagh-Dorrigo branch line and several similar rail overbridge also survive. Timber trestle rail underbridge are increasingly rare within NSW and survive mainly on disused and former branch lines.
SHR Criteria g) [Representativeness]	Likely to be good representative example of the standard timber trestle rail underbridge built by PWD until 1935 and of high local significance.
Integrity/Intactness:	Not known
Assessment criteria:	Items are assessed against the State Heritage Register (SHR) Criteria to determine the level of significance. Refer to the Listings below for the level of statutory protection.

Listings

Heritage Listing	Listing Title	Listing Number	Gazette Date	Gazette Number	Gazette Page
Local Environmental Plan		I8	27 Sep 13		

Study details

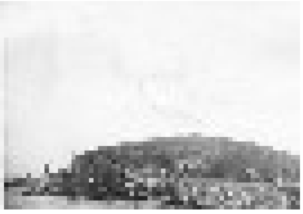
Title	Year	Number	Author	Inspected by	Guidelines used
CHCC Heritage Study	1998		EJE Consulting		Yes
Coffs Harbour Heritage Study	2013		Robin Hedditch		Yes

References, internet links & images

Type	Author	Year	Title	Internet Links
Photograph	Coffs Harbour Regional Museum		Historic Photograph Collection	
Written	John Kramer for the Light Railways Research Society of Australia,	1985	Ships and Timber: A Short History of Coffs Harbour Port and Associated Railways,	

	Victoria.		
Written	Neil Yeates	1990	Coffs Harbour Vol 1 & 2
Written	Robin Hedditch	2012	Coffs Harbour Eastern Breakwater Rail Line Photographic Survey and Archival Recording

Note: internet links may be to web pages, documents or images.



(Click on thumbnail for full size image and image details)

Data source

The information for this entry comes from the following source:

Name:	Local Government
Database number:	1360005

b) Ferguson's Cottage

Item details

Name of item:	Ferguson's Cottage
Other name/s:	Fergusons
Type of item:	Built
Group/Collection:	Aboriginal
Category:	Place of significance
Location:	Lat: -30.3108252910 Long: 153.1399799580
Primary address:	1 Breakwater Road, Coffs Harbour, NSW 2450
Local govt. area:	Coffs Harbour
Local Aboriginal Land Council:	Coffs Harbour

Property description

Lot/Volume Code	Lot/Volume Number	Section Number	Plan/Folio Code	Plan/Folio Number
PART LOT	21		DP	850150

All addresses

Street Address	Suburb/town	LGA	Parish	County	Type
1 Breakwater Road	Coffs Harbour	Coffs Harbour			Primary Address

e) Owner/s

Organisation Name	Owner Category	Date Ownership Updated
Land and Property Management Authority (LPMA)	State Government	

f) Statement of significance:

Ferguson's Cottage, as the home of Nanny Ferguson and the heart of her community work, is of historic, social and cultural significance for the local Coffs Harbour Aboriginal community and also for many Aboriginal people in the North coast region and beyond as it symbolises a legacy of reconciliation and the deepening of Aboriginal European understanding that was brought about by the tireless efforts of Evelyn "Nanny" and Andrew Ferguson during the 1950s and the 1960s.

The Fergusons' work in dealing with the social pressures and racism impacting on the Aboriginal community of Coffs Harbour and the north coast; their position as role models for employment within the Aboriginal community and their work mediating with local and state government authorities, was integral to the acceptance of cultural relationships between Aboriginal and white people during a time when Aboriginal people were not widely accepted within the European community. The Fergusons' achievements in cross cultural relations, was acknowledged and accepted throughout the region and is one 'symbolic' example of similar improvements (albeit small and slow) in community relations in NSW.

Ferguson's Cottage was seen as a safe haven for many Aboriginal people either from the community or on those passing through Coffs Harbour while travelling up and down the coast. Nanny Ferguson was a fighter for law and order among her own people and insisted that the Welfare protect the Aboriginal children and defend their rights.

Today Ferguson's Cottage is held in high regard by the Aboriginal and white community as it represents the 'place' where reconciliation began for Coffs Harbour. Generations of the Ferguson's continue to reside in the cottage, and today the legacy is still carried on by members of the Ferguson family.

The building was originally constructed as a site office for the staged construction and maintenance of a major piece of Public Works Department (PWD) infrastructure, the South Coffs Harbour breakwater initiated by prominent Public Works Engineer, EM de Burgh. As PWD construction buildings such as Ferguson's Cottage were usually demolished or relocated at completion of works it is notable that the cottage, due to its use by the Ferguson family, still sits on its original sleeper sub-structure and is thus significant as a rare surviving example of a temporary site office constructed by the Department of Public Works.

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Date significance updated: 26 Jun 07

Note: The State Heritage Inventory provides information about heritage items listed by local and State government agencies. The State Heritage Inventory is continually being updated by local and State agencies as new information becomes available. Read the OEH copyright and disclaimer.

g) Description

Designer/Maker: Department of Public Works

Builder/Maker: Department of Public Works

The cottage is a small weatherboard building, with additions to the rear and an iron roof with a front veranda approximately 5m by 2m. The house structure sits on the original sleepers while the back section has some areas of added concrete flooring approximately 50 metre areas timber on ground (sand).

Physical description:

The front section of the house consists of the original 2 rooms, the original kitchen. The lining of the walls are made of old horse hair.

There have been some modifications to the kitchen area for safety reasons including new electrical wiring. The back section has been modified slightly with an additional room added, were the toilet and wash area is.

Further modifications to the back section include the connection of coldwater to the back laundry area via the old copper piping that existed. The original roofing has been replaced with the same fabric of corrugated iron.

Physical condition and/or Archaeological potential:

The building is in extremely poor condition. The structure is built from hard wood, and remains on the original sleepers which are in need of replacement. The front roof section replaced second hand iron. The area where the cottage is located has potential for further archaeological research due to its significant location on the headland which was a ceremonial site. Previous archaeological studies have identified many sites within close vicinity of the cottage.age.

Date condition updated:22 Dec 04

1970s additional rooms at rear section of house built .

There have been some modifications to the kitchen area for safety reasons including new electrical wiring. The back section has been modified slightly with an additional room added, were the toilet and wash area is.

Modifications and dates:

Further modifications to the back section include the connection of coldwater to the back laundry area via the old copper piping that existed. The original roofing has been replaced with the same fabric of corrugated iron.

Iron roof front section of house replaced 2 years ago (c.2002?) with same style corrugated iron, Electrical wiring front section of house up graded.

October 2004, veranda boards port and front replaced and painted.

Further information:

The family have requested to repaint the roof with the Aboriginal flag as the original roof once had.

Current use: Residence for members of the Ferguson family generation

Former use: Occupied by the Ferguson family

h) History

Historical notes:

The building was originally associated with the construction or maintenance of the South Coffs breakwater by the Public Works Department - probably as a temporary construction office.

Coffs Harbour was constructed in stages. Work began in 1912 on a causeway from the mainland to South Coffs Island, where a quarry was opened on the headland, a railway laid and plant installed.

Whilst work on the exposed eastern breakwater (extending out from South Coffs Island) begun in 1918, numerous wash-aways resulted in the wall not being completed until October 1939, with the finishing work of concreting the core of the wall completed in 1943. The inadequate size of the rock available from the quarry on South Coffs Island was a major cause of the breakwater's instability. The casting and tipping of 100 ton concrete blocks to armour the seaward face helped solve the problem.

As construction buildings including offices were generally built by carpenters often without plans and demolished on completion of the work, or moved to another site if transportable, the building is likely to be a rare surviving example of such a structure. The fact that the cottage is sitting on the original sleeper substructure, suggests it was probably not intended to serve for a long term.

Association of the building with the Ferguson Family started with Mr Andrew Ferguson who was a ganger and works supervisor for the Department of Public works on the breakwater construction in the late '40s, '50s and '60s.

The Public Works' Coffs Harbour District Engineer at the time, Mr Hugh Bailey, entered into an arrangement with Mr Ferguson to allow his family to occupy the 'office' as a family home during the early 1950s. Prior to this arrangement the family lived on the nearby block of Dung Hill. Repair dumping to the Harbour was needed in 1953 and whilst it is possible that the building was an office associated with that work, it could have been built when earlier works were underway, as Ferguson's occupation was justified on the basis that no construction work was taking place.

Allowing the family to occupy the 'office' as a cottage was an exceptional step for a Government official at the time. In the 1950's, the status of Aboriginal people was quite different from the present day. The decision was based on two reasons, one explicit and the other implicit.

The explicit reason was in exchange for Andrew Ferguson providing oversight of the harbours southern headland and construction areas in the periods when no construction work was taking place. This is the formal justification cited by offices of the Department of Public Works. In the succeeding years the arrangement with the Ferguson family was endorsed by successive district Engineer's of the Department, including Len Harper in the '60s and Ron Colley in the '70s. (They acknowledged the arrangement to the members of our community and to officers of the Department of Lands.)

Repair dumping to the Harbour was needed in 1953 and whilst it is possible that the building was an office was associated with that work, it could have been built when earlier works were underway, as Ferguson's occupation was justified on the basis that no construction work was taking place.

The implicit reason that the Fergusons were allowed to make their home in the cottage was the high regard that the Public Work's District Engineer held for the good works and social contribution made by Andrew

Ferguson's wife, Evelyn Ferguson, or "old Mrs Ferguson" as she was known in the Public Works Office at Coffs Harbour. (This can be attested to by a retired officer of the Department who still resides in Coffs Harbour.)

At the Departments Head Office in Sydney, successive Principle Engineers of the then Harbours and Rivers Branch, (subsequently Rivers and Ports Branch, and Coastal Branch), including John Kerle, Glan Evans, Michael Clarke and John Malone acknowledged the arrangement in their dealings on the harbour.

When the Department was considering conceptual plans for a large tourist development on the southern foreshore in the early 1980's under the then Minister Laurie Brereton, it specifically excluded any intrusion on the Ferguson dwelling because their valid occupation of site was not disputed.

Mrs Evelyn Ferguson, also known as Nanny Ferguson, was an exceptional lady. Her life had lasting significance to both the Aboriginal and white communities of Coffs Harbour, the north coast region and beyond.

During the 1950s and 1960s, the status of Aboriginal people was low and relationships with the broader community were strained. Housing was poor, education was minimal and health conditions were unacceptable. Evelyn Ferguson was a strong Aboriginal woman who confronted all of these issues head-on over her life, and in doing so provided a bridge between the Aboriginal and white communities and was a pioneer in many aspects of Aboriginal life that are now accepted as conventional.

Evelyn Ferguson had the ability to function equally in both Aboriginal and white communities because of her wisdom, her communication skills and the respect in which she was held. She was an active member of the Seven Day Adventist Church and encouraged her family to attend services, facilitating cross-cultural mixing and friendships at a time when it was rare. She was held in high regard by the police, who knew her as "Granny Ferg". On many occasions during the 1950s and 1960s they brought the communities' and individual's problems to her for mediation and resolution because of her wisdom, respect and authority.

She was also a well regarded and integral contact point between "the Welfare" and the local and regional Aboriginal communities. In the early days, "the Welfare" constantly intervened between kids and their families, and the families from the local area and further afield looked to Nanny Ferguson for advice and protection. Her battles with welfare and social service authorities were many. She stood up for the kids, saw that their rights were observed, gave assurances on their behalf and then ensured that the assurances were honoured. In the role of an Elder, she took it upon herself to protect the communities' children and defend their rights. Her strength of character meant that her words carried authority and were accepted by both "the Welfare" and the Aboriginal community.

She was also respected by the business community of Coffs Harbour. She was a personal friend of the

Symmonds family who operated a large department store, and went fishing with them on many occasions. She was known and respected by Hugh Bailey, the Public Works District Engineer- the person responsible for allocating the dwelling to her family. Such relationships during that time were extraordinary and provided an exemplary model of cross cultural acceptance for both the Aboriginal European people in the Coffs Harbour and wider community.

The "bridge" that Nanny Ferguson forged between the Aboriginal community and local and wider community and servises was vital to the lives and history of inter ccommunity relations for the local Aboriginal people, those in the coastal region and beyond.

In the 1950s and 1960s, education amongst Aboriginal children was merely something one did to avoid "the Welfare". Nanny Ferguson did much to change this by example, insisting that all her children, grandchildren and extended family gain the best possible education. She recognised that education was the key to future employment and community advancement and endeavoured to convince others of this. Despite the burdens of her own family, Nanny Ferguson held down a job as a laundress at the District Hospital and later the Sunny Side Maternity Hospital. In doing so provided a role model for her community. Such influence has continued, and today education remains a core value of the community.

Nanny Ferguson is remembered by the local and wider European and Aboriginal community as a lady brimming with love and care. As well as her own children, she took in nephews and nieces, grandchildren, members of the extended family and anyone who needed help from the local and wider Aboriginal community. No-one was ever denied a bed or a meal. Sometimes the little cottage accommodated up to 15 children and half a dozen adults who were in need of shelter and assistance. It was for this reason that the extension to the family home was made in the early 1970s. Later a number of small sheds or 'bunkers' were built for more room. If there was not enough food, she would simply go fishing herself and catch a meal. The cottage was a "home", a safe place, in its truest sense to several generations of the family, the extended family and anyone in need.

The cottage is the symbol of Nanny Ferguson and her legacy which continues to be held in high esteem within the community of Coffs Harbour and Aboriginal people from wider afield who were embraced by Nanny Ferguson's generosity. Today, the good relations and respect nurtured by Nanny Ferguson continues within the community of Coffs Harbour. Her legacy remains in the values that Nanny Ferguson instilled in her family and extended family and demonstrated to the community at large. It remains in the cohesiveness of the Aboriginal community in Coffs Harbour.

The building also has an important association with the maintenance of a significant public work, the Coffs Harbour, which was initiated under the eminent Public Works engineer E.M. de Burgh who as Chief Engineer for Harbours and Water Supply (1909 - 1927), was in charge of the Coffs Harbour Improvement Works.

i) Historic themes

Australian theme (abbrev)	New South Wales theme	Local theme
2. Peopling-Peopling the continent	Aboriginal cultures and interactions with other cultures-Activities associated with maintaining, developing, experiencing and remembering Aboriginal cultural identities and practices, past and present.	All nations - places of battle or other early interactions between Aboriginal and non-Aboriginal peoples-
4. Settlement-Building settlements, towns and cities	Accommodation-Activities associated with the provision of accommodation, and particular types of accommodation – does not include architectural styles – use the theme of Creative Endeavour for such activities.	Community Safe House-
5. Working-Working	Labour-Activities associated with work practises and organised and unorganised labour	Working on public infrastructure projects-
8. Culture-Developing cultural institutions and ways of life	Creative endeavour-Activities associated with the production and performance of literary, artistic, architectural and other imaginative, interpretive or inventive works; and/or associated with the production and expression of cultural phenomena; and/or environments that have inspired such creative activities.	Building and using prefabricated structures-
9. Phases of Life-Marking the phases of life	Persons-Activities of, and associations with, identifiable individuals, families and communal groups	Associations with the National Trust of Australia (NSW)-

j) Assessment of significance

SHR Criteria a) [Historical significance]	Ferguson's cottage is of heritage historic significance as it was the home of Evelyn Nanny Ferguson and the heart of the community welfare work. Nanny Ferguson's and her husband Andrew's achievements form a long term legacy of reconciliation and the deepening of Aboriginal European understanding during the 1950s and the 1960s in Coffs Harbour, the coastal region and beyond. The cottage itself is a symbol to Aboriginal people as a safe house and place where many could find refuge or guidance. The current generation of the Ferguson family who still occupy the cottage continue to maintain Nanny Ferguson's legacy.
SHR Criteria b) [Associative significance]	Ferguson's cottage is significant for it was associated with Evelyn "Nanny" Ferguson who was an exceptional lady within the Aboriginal and white community both locally, regionally and beyond. During the 1950's and 60's Nanny Ferguson was the voice for Aboriginal people on issues relating to the social pressures and racism impacting on the Aboriginal Community of Coffs Harbour and the North coast. Nanny Ferguson tirelessly dealt with the Welfare and other state and local government departments on the unnecessary removal of children from their

	families and defended children's rights. Nanny Ferguson was a pioneer in encouraging Aboriginal people to gain the best possible education and engaged in facilitating cross-cultural mixing through the church and her broader social and work network. The Fergusons' achievements in cross cultural relations, was acknowledged and accepted throughout the region and is one 'symbolic' example of similar improvements in community's in NSW. The heritage significance of the cottage is also enhanced through its association with the staged construction and maintenance of an important piece of PWD infrastructure, the South Coffs Harbour breakwater which was originally designed by eminent Public Works engineer EM de Burgh.
SHR Criteria d) [Social significance]	The cottage is socially significant to the Coffs Harbour Aboriginal community, Gumbular Julip Elders organisation and many other individuals in the coastal region and throughout the State, both Aboriginal and non-Aboriginal, who have fond memories of the cottage. The house is important to the local, regional and wider Aboriginal community's sense of place as Ferguson's Cottage was a place of security, a safe house, a place where a bed, a meal and assistance for Aboriginal people dealing with the European beau racy was assured in difficult times. What happened at Ferguson's Cottage while it was Nanny Ferguson's home, was an ongoing expression of the cultural and social values held by Aboriginal people for many years. Today Ferguson's Cottage is held in high regard by the Aboriginal and white community as it represents the 'place' where reconciliation began for Coffs Harbour.
SHR Criteria f) [Rarity]	The cottage is significant as a rare surviving example of 'temporary' construction office built by the Department of Public Works.
SHR Criteria g) [Representativeness]	The cottage represents the typical way of life of living for Aboriginal people. A small 2 bedroom cottage, which during the 50's and 60's had no electricity or lighting and yet housed up to 15 children and half a dozen adults or more including family, extended family members, other family members or anyone who needed shelter. Ferguson's cottage is outstanding because it retains its high integrity within the community as a safe house and it represents the tireless efforts of Nanny Ferguson who brought salvation for Aboriginal people and closed the gap between the Aboriginal and white communities. The cottage is also a representative and rare surviving example of a temporary site office constructed by the Department of Public Works.
Integrity/Intactness:	As a building, it is small and unpretentious. But as a symbol to the Aboriginal community and many individuals it is beyond price because of the life a a very special person who lived there and the legacy she left for both the Aboriginal and white communities.
Assessment criteria:	Items are assessed against the State Heritage Register (SHR) Criteria to determine the level of significance. Refer to the Listings below for the level of statutory protection.

k) Procedures /Exemptions

Section of act	Description	Title	Comments	Action date
21(1)(b)	Conservation Plan submitted for comment	Review of Ferguson's Cottage Conservation Management Strategy		Apr 28 2008

Standard exemptions for works requiring Heritage Council approval

l) Listings

Heritage Listing	Listing Title	Listing Number	Gazette Date	Gazette Number	Gazette Page
Heritage Act - State Heritage Register		01802	27 Nov 09	184	5856

m) References, internet links & images

Type	Author	Year	Title	Internet Links
Written	Coffs Harbour Local Aboriginal Land Council	2004	Correspondence	
Written	Coffs Harbour Local Aboriginal Land Council	2004	Timeline of Events re Coffs Harbour and Cottage	
Written	Jamison Architects Jamison Architects	2009	Ferguson's cottage 1 Breakwater Road Coffs Harbour :conservation management strategy	
Written	Leonie Coltheart	1997	Between Wind and Water	
Written	Leonie Coltheart		A Guide to the History of the Public Works Department	
Written	Marie Craig Tarplee	2004	My Great-Aunt Evelyn Victoria Ferguson	

Note: internet links may be to web pages, documents or images.

(Click on thumbnail for full size image and image details)

n) Data source

The information for this entry comes from the following source:

Name:	Heritage Office

c) Line of Former Rail Tracks. Coffs Harbour Breakwaters and Foreshore (Archeology)

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Heritage NSW

Search for NSW Heritage

Item details

Name of item:
Line of Former Rail Tracks, Coffs Harbour Breakwaters and Foreshore (archaeology)
Type of item:
Archaeological-Terrestrial
Group/Collection:
Transport - Rail
Category:
Railway
Primary address:
Jordan Esplanade, Coffs Harbour, NSW 2450
Local govt. area:
Coffs Harbour
All addresses

Street Address	Suburb/town	LGA	Parish	County	Type
Jordan Esplanade	Coffs Harbour	Coffs Harbour			Primary Address

Statement of significance:

The line of the former rail tracks along the Coffs Harbour breakwaters and foreshore are of local significance in being part of the large-scale public works undertaken by the NSW Government between 1890 and 1939. These works drastically re-shaped the physical form of Coffs Harbour's coastline and created the man-made harbour we see today. These works, and the North Coast Railway, were largely responsible for the growth and development of Coffs Harbour itself.

The line of the former railway helps to capture the distinctive features of that critical phase of Coffs Harbour's past history as a busy, shipping port. The layout of the former tram and rail lines make sense of the current land forms around the harbour and are essential to understanding how Coffs Harbour was created.

Even though they are now largely absent, the breakwater rail lines continue to exert a powerful sentimental/romantic appeal over Coffs Harbour residents and form part of the identity of Coffs Harbour.
Date significance updated: 22 May 13
Note: The State Heritage Inventory provides information about heritage items listed by local and State government agencies. The State Heritage Inventory is continually being updated by local and State agencies as new information becomes available. Read the Department of Premier and Cabinet copyright and disclaimer.

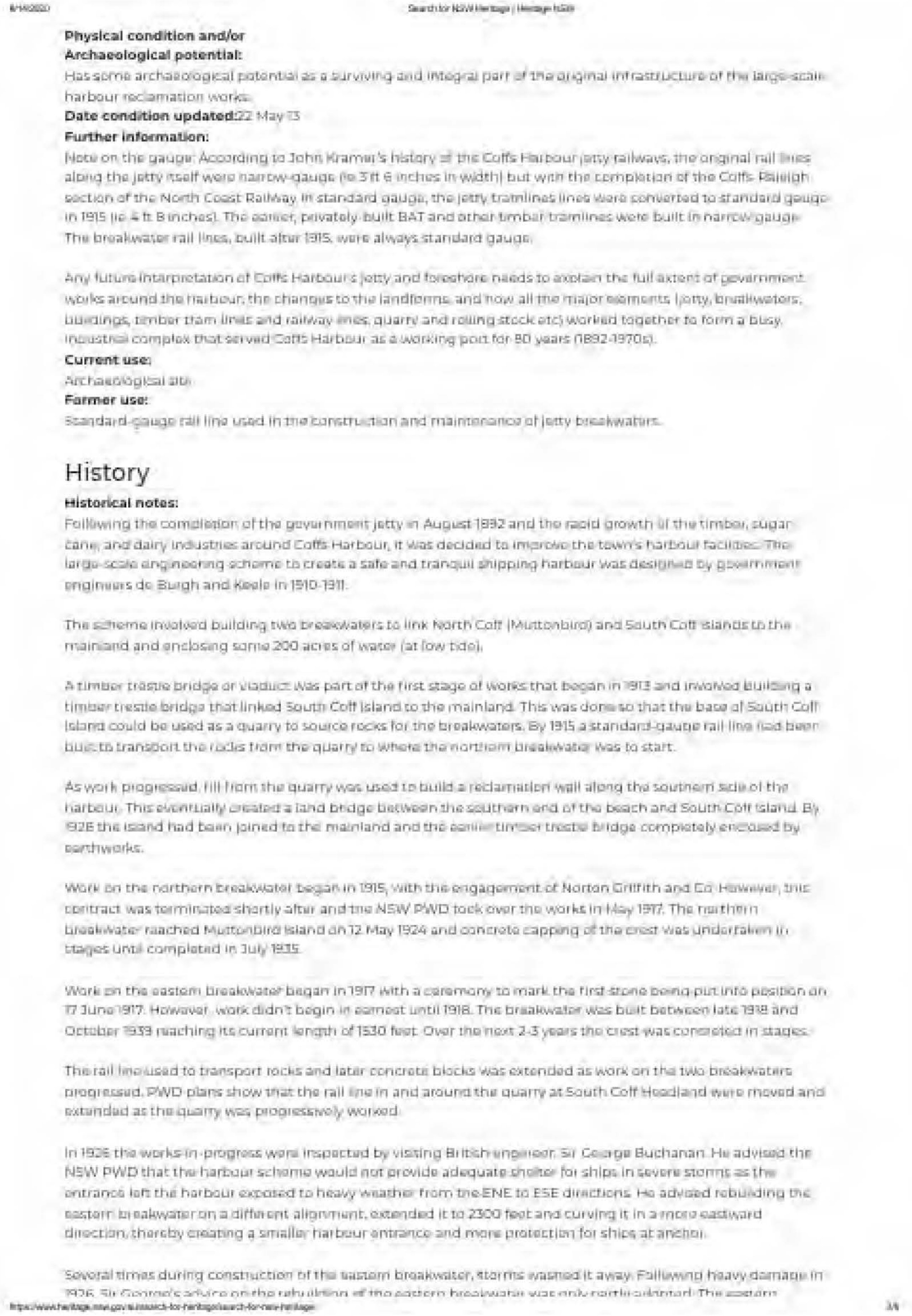
Description

Designer/Maker:
Public Works Department
Builder/Maker:
Public Works Department
Construction years:
1913-1939
Physical description:
There are currently no remaining visible sections of the rail line. The last remaining section that extended along the eastern breakwater was covered over in the major repair works undertaken by PWD in 2012.

This listing sheet is for the known "line" of the railway. Some remnants of the rail line may survive under current road works but these have not been investigated for this report.

More information on specifications of the rail lines' construction might be contained with PWD records within NSW State Records, which have not been consulted for this report.

https://www.heritage.nsw.gov.au/search-for-heritage/search-for-nsw-heritage/



8/14/2020 Search for NSW Heritage | Heritage NSW

Physical condition and/or Archaeological potential:
Has some archaeological potential as a surviving and integral part of the original infrastructure of the large-scale harbour reclamation works.
Date condition updated:22 May 13
Further information:
Note on the gauge: According to John Kramer's history of the Coffs Harbour jetty railways, the original rail lines along the jetty itself were narrow-gauge (ie 3 ft 6 inches in width) but with the completion of the Coffs-Raleigh section of the North Coast Railway in standard gauge, the jetty tramlines lines were converted to standard gauge in 1915 (ie 4 ft 8 inches). The earlier, privately-built BAT and other timber tramlines were built in narrow gauge. The breakwater rail lines, built after 1915, were always standard gauge.

Any future interpretation of Coffs Harbour's jetty and foreshore needs to explain the full extent of government works around the harbour, the changes to the landforms, and how all the major elements (jetty, breakwaters, buildings, timber tram lines and railway lines, quarry and rolling stock etc) worked together to form a busy industrial complex that served Coffs Harbour as a working port for 80 years (1892-1970s).
Current use:
Archaeological site
Former use:
Standard-gauge rail line used in the construction and maintenance of jetty breakwaters.

History

Historical notes:
Following the completion of the government jetty in August 1892 and the rapid growth of the timber, sugar cane, and dairy industries around Coffs Harbour, it was decided to improve the town's harbour facilities. The large-scale engineering scheme to create a safe and tranquil shipping harbour was designed by government engineers de Burgh and Keele in 1910-1911.

The scheme involved building two breakwaters to link North Coff (Muttonbird) and South Coff islands to the mainland and enclosing some 200 acres of water (at low tide).

A timber trestle bridge or viaduct was part of the first stage of works that began in 1913 and involved building a timber trestle bridge that linked South Coff Island to the mainland. This was done so that the base of South Coff Island could be used as a quarry to source rocks for the breakwaters. By 1915 a standard-gauge rail line had been built to transport the rocks from the quarry to where the northern breakwater was to start.

As work progressed, fill from the quarry was used to build a reclamation wall along the southern side of the harbour. This eventually created a land bridge between the southern end of the beach and South Coff Island. By 1926 the island had been joined to the mainland and the earlier timber trestle bridge completely enclosed by earthworks.

Work on the northern breakwater began in 1915, with the engagement of Norton Griffith and Co. However, this contract was terminated shortly after and the NSW PWD took over the works in May 1917. The northern breakwater reached Muttonbird Island on 12 May 1924 and concrete capping of the crest was undertaken in stages until completed in July 1935.

Work on the eastern breakwater began in 1917 with a ceremony to mark the first stone being put into position on 17 June 1917. However, work didn't begin in earnest until 1918. The breakwater was built between late 1918 and October 1939 reaching its current length of 1530 feet. Over the next 2-3 years the crest was concreted in stages.

The rail line used to transport rocks and later concrete blocks was extended as work on the two breakwaters progressed. PWD plans show that the rail line in and around the quarry at South Coff Headland were moved and extended as the quarry was progressively worked.

In 1926 the works-in-progress were inspected by visiting British engineer, Sir George Buchanan. He advised the NSW PWD that the harbour scheme would not provide adequate shelter for ships in severe storms as the entrance left the harbour exposed to heavy weather from the ENE to ESE directions. He advised rebuilding the eastern breakwater on a different alignment, extended it to 2300 feet and curving it in a more eastward direction, thereby creating a smaller harbour entrance and more protection for ships at anchor.

Several times during construction of the eastern breakwater, storms washed it away. Following heavy damage in 1926, Sir George's advice on the rebuilding of the eastern breakwater was only partly adopted. The eastern

https://www.heritage.nsw.gov.au/search-for-heritage/search-for-nsw-heritage/ 3/6

breakwater was extended some 330 feet to a total length of 1530 feet but it was built on the original alignment.

Sir George Buchanan also recommended the use of heavy concrete blocks in conjunction with the quarried stone as the quarried stones were not large or heavy enough on their own. This advice was heeded and the quarry at South Coff Island was also used to manufacture and store 40-ton concrete blocks. A combination of stone boulders and concrete blocks were used for both breakwaters.

Following the completion of the jetty and the harbour breakwaters, Coffs Harbour became a major NSW coastal shipping port exporting large amounts of hardwood timber, fruit and vegetables, and dairy products. It was also the major point of arrival for visitors and settlers to the Coffs Harbour area until the Coffs-Glenreagh section of the North Coast Railway was completed in 1922 and the later completion of the Pacific Highway.

The years after the Second World War saw a gradual decline in coastal shipping. Shipping activity at Coffs Harbour gradually wound down until 22 July 1979 when the last commercial ship was loaded. Following that, various sections of the government rail lines that serviced the jetty, the breakwaters and the private timber tramlines no longer in use were taken up at different times.

Since construction was fully completed in 1939, the Department of Public Works carried out regular maintenance on the breakwaters. To facilitate repairs and rebuilding of the breakwaters, the former quarry was used as a storage facility for pre-cast concrete blocks, and the rail lines (with small steam locomotives and tipping trolleys) were retained to transport and position the blocks.

According to John Kramer, the steel rails along the eastern breakwater remained in situ until 1953. Due to the harsh and corrosive coastal conditions, it was decided to lift the rails when not in use, coat them with bituminous paint and store them at the quarry until they were needed again.

Major breakwater repairs were undertaken in 1970 following a large coastal storm and again in 1974 to reposition blocks and make further repairs. Following this, funding for major maintenance was curtailed to support increased work on other coastal harbours in NSW.

It was at this time (circa 1974) that the eastern breakwater rail line was used to transport blocks for repairs and maintenance for the last time. A stationary crane and, according to John Kramer, Landrovers were used to haul the tipping trolleys carrying blocks. Since the early 1970s major maintenance of the breakwater has not occurred on a regular basis. Without regular maintenance and repair, the breakwater itself and the surviving remnants of the rail lines have slowly deteriorated.

Until 2012 the exposed rail lines along the length of the eastern breakwater were the only rail and tram lines still visible in and around the jetty at Coffs Harbour and it is uncertain if any section of either the earlier narrow gauge timber tramlines or standard gauge PWD rail lines survive under later road works.

2012 Major repair works to the eastern breakwater
In 2012 PWD announced a major project to increase the height and width of the eastern breakwater in order to ensure its future viability. This would require adding more concrete blocks and raising the crest of the breakwater to resist damage from strong seas. The works would result in covering over the last remaining visible section of the breakwater rail lines.

Given the heavily deteriorated condition of the rail line and crest of the breakwater, it was decided to allow the works to proceed following archival recording of the remaining visible sections of rail line.

Historic themes

Australian theme (abbrev)	New South Wales theme	Local theme
3. Economy-Developing local, regional and national economies	Environment - cultural landscape-Activities associated with the interactions between humans, human societies and the shaping of their physical surroundings	(none)
3. Economy-Developing local, regional and national economies	Transport-Activities associated with the moving of people and goods from one place to another, and systems for the provision of such movements	(none)
3. Economy-Developing local, regional and national economies	Transport-Activities associated with the moving of people and goods from one place to another, and systems for the provision of such movements	(none)
4. Settlement-Building settlements, towns and cities	Towns, suburbs and villages-Activities associated with creating, planning and managing urban functions, landscapes and lifestyles in towns, suburbs and villages	(none)

Assessment of significance

SHR Criteria a)

(Historical significance)

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The line of the former rail tracks along the Coffs Harbour breakwaters and foreshore are of local significance in being part of the large scale public works undertaken by the NSW Government between 1890 and 1939. These works drastically re-shaped the physical form of Coffs Harbour's coastline and created the man-made harbour we see today. These works, and the North Coast Railway, were largely responsible for the growth and development of Coffs Harbour itself.

The rail lines transported rocks and concrete during construction and were later used for maintenance. They have been largely taken up or, in the case of the eastern breakwater, left exposed to the harsh coastal conditions for so long and without protection and maintenance that the surviving rail tracks have irredeemably perished. They have been covered over by recent repair works done by PWD.

The line of the former railway helps to capture the distinctive features of that critical phase of Coffs Harbour's past history as a busy, shipping port. The layout of the former tram and rail lines make sense of the current land forms around the harbour and are essential to understanding how Coffs Harbour was created.

SHR Criteria d)

[Social significance]

Of local significance. Knowledge of, and curiosity about, Coffs Harbour's breakwater rail lines and the earlier privately-built timber tramlines are an important aspect of Coffs Harbour's sense of identity. They evoke a now-defunct industrial past and their period of operation (1917-1970s) is still within living memory. Even though they are now largely absent, the breakwater rail lines continue to exert a powerful sentimental/romantic appeal over Coffs Harbour residents.

SHR Criteria e)

[Research potential]

Of local significance having potential to reveal information about the former rail lines and their operation in the construction and ongoing repair of the Coffs Harbour breakwaters.

Integrity/Intactness:

Listing is for the line of the rail only.

Assessment criteria:

Items are assessed against the State Heritage Register (SHR) Criteria to determine the level of significance. Refer to the Listings below for the level of statutory protection.

Listings

Heritage Listing	Listing Title	Listing Number	Gazette Date	Gazette Number	Gazette Page
Local Environmental Plan		[illegible]	[illegible] Sep 13		

Study details

Title	Year	Number	Author	Inspected by	Guidelines used
[illegible]			[illegible]		Yes
Coffs Railway Heritage Study	2001		[illegible]		Yes

References, internet links & images

Type	Author	Year	Title	Internet Links
Photograph	Coffs Harbour Regional Museum		Historic Photograph Collection	
Written	John Kramer for the Light Railway Research Society of Australia [illegible]	[illegible]	Ships and Timber: A Short History of Coffs Harbour Port and Associated Railways	
Written	Neil Yeates	1990	Coffs Harbour Vols 1 & 2	
Written	Bob Hedstrom	2002	Coffs Harbour Eastern Breakwater Heritage Photographic Survey and Archival Recording	

Note: Internet links may be to web pages, documents or images.

[illegible] Search for NSW Heritage | Heritage NSW

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Data source

The information for this entry comes from the following source:

Name:

Local Government

Database number:

1360006

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Every effort has been made to ensure that information contained in the State Heritage Inventory is correct. If you find any errors or omissions please send your comments to the Database Manager.

Appendix F

Aquatic Ecology Assessment

Aquatic Ecology Assessment

Coffs Harbour Regional Boat Ramp Upgrade

Prepared For: Blue Sky Planning and Environment

Report Date: 17 November 2020

H2O Consulting Group Pty Ltd

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Document Details	
Report Title	Aquatic Ecology Assessment
Project Title	Coffs Harbour Regional Boat Ramp Upgrade
Prepared For	Blue Sky Planning and Environment
Report Date	17 November 2020
Project Team	David Cummings, Will Macbeth

Document Control

Version	Approved by	Qualification / Position	Date
R0	David Cummings	BSc (Hons) PhD - Director (H2O Consulting group)	17.11.2020

Disclaimer:

The information provided in this document is based on knowledge, understanding and field observations at the time of review of associated materials and/or site survey. The report should be read and considered in its entirety including consideration of the limitations described in the report.

H2O Consulting Group Pty Ltd has completed this assessment in accordance with the relevant federal, state and local legislation. H2O Consulting Group Pty Ltd accepts no liability or responsibility for contents of this report in respect of any use of, or reliance upon, by any third party or for any use other than the purposes for which it was commissioned. Unauthorised use of this document is prohibited.

Acknowledgements: We would like to thank Brett Vercoe for assistance with fieldwork.

Cover Photo: Coffs Harbour Boat Ramp

Executive Summary

H2O Consulting Group was engaged by Blue Sky Planning and Environment on behalf of Transport for NSW (TfNSW) to prepare an Aquatic Ecology Assessment for the upgrade of the Coffs Harbour Regional Boat Ramp (CHRBR). The boat ramp provides a significant piece of regional infrastructure, however in its current design it is continuing to have operational difficulties due to sea conditions and shoaling of sediments.

The works include upgrading of boat ramp, modifications and dredging of the basin and entry channel, and extension of the eastern breakwater. The boat ramp upgrade works will be confined to the existing boat ramp basin, while it is also proposed to extend the existing eastern breakwater 75m north and further into the harbour.

A review of available information and searches of threatened species databases were undertaken to identify potential threatened and migratory species that may occur. Site investigations, surveys, and habitat mapping to identify impacts on the marine environment were undertaken in August 2020.

Searches of the NSW Bionet sightings database review of the EPBC Act Protected Matters Report identified 77 threatened and migratory marine species that may occur in the Study Area. These included 49 marine and shorebirds, 11 marine mammals, 12 sharks, rays and fish, five reptiles and a marine alga. Review of sightings data, site investigations and habitat-based assessments identified 17 of these threatened and migratory marine species required further consideration as part of this assessment.

The habitat within the proposal footprint was found to be predominately artificial habitat (both intertidal and subtidal) provided by the seawalls and eastern breakwater, as well as a benthic habitat of unvegetated sandy sediments. Mapping works also identified a small reef in the vicinity of the proposal footprint, which will require further consideration of potential indirect impacts to it as a result of the proposal.

Direct impacts from this proposal will include some disturbance of artificial habitat provided by the seawall and breakwater within the Study Area, however the proposal will create a significant amount of additional, similar habitat with the proposed breakwater extension. The removal and modification of some lower sections of the seawall will likely have short-term impacts on some common macroalgae. Some threatened marine fauna (e.g. shorebirds) are known to use and others (e.g. fish) may use habitat associated with these structures. Subsequently careful management of these species will be required should they be present during construction works.

Direct seabed disturbances from dredging and construction of the extended breakwater are confined to unvegetated and very mobile marine sands. Indirect impacts in the form of changes in patterns of sand accretion as a result of the extended breakwater may have some effect on the nearby reef and southern end of Jetty Beach. In addition, upgraded lighting may also impact adjacent intertidal habitat use, although these areas are not considered to be of ecological significance to any threatened or migratory populations of marine fauna.

Construction works will have some short-term disturbances on habitat quality. These disturbances will include construction noise in intertidal and supratidal areas, underwater noise during piling works and some periods of reduced water quality during dredging works. The piling works are associated with this proposal are very minimal and expected to only result in short-term disturbances. The dredging works will be confined to clean marine sands close to the boat ramp basin entry and any water quality disturbances are expected to be very localised to the south-eastern corner of the harbour.

The proposal is considered unlikely to have a significant impact on State and/or Commonwealth listed threatened biodiversity. As such, referral to the Department of the Environment under the EPBC Act is not required. Similarly, the preparation of a Species Impact Statement (SIS) based on the provisions of the BC and FM Act should not be required. However, based on the NSW Policy and guidelines for fish habitat conservation and management, a ***Section 205 - permit to harm (cut, remove, damage, destroy, shade etc.) marine vegetation (saltmarshes, mangroves, seagrass and seaweeds)*** will likely be required. A ***Section 199 consultation for dredging and reclamation*** for the proposed dredging and extended breakwater construction.

Table of Content

1 Background

1.1 Overview

H2O Consulting Group was engaged by Blue Sky Planning and Environment on behalf of Transport for NSW (TfNSW) to prepare an Aquatic Ecology Assessment for the upgrade of the Coffs Harbour Regional Boat Ramp (CHRBR). The boat ramp provides a significant piece of regional infrastructure, however in its current design it is continuing to have operational difficulties due to sea conditions and shoaling of sediments. In response, the department is planning to undertake the works under ***Crown Lands Act 1989*** and State Environmental Planning Policy (Infrastructure) 2007, Division 25, to upgrade the facility.

The original boat ramp was constructed in the 1970s. However, since then the difficulties in launching and retrieving boats and navigating vessels in the entrance channel have been ongoing. Following modelling studies, upgrade works that included extension of the basin occurred in 2015, however the boat ramp has continued to be impacted by water level surges, has minimal draught at the entry channel during periods of low tide, is affected by a north-east swell, and requires ongoing dredging works currently being undertaken by local Council.

1.2 Locality

The Coffs Harbour boat ramp is located in a small basin (boat ramp basin) on the southern shoreline of the inside of Coffs Harbour, on the NSW North Coast (Figure 1). The boat ramp falls within the Local Government Area of Coffs Harbour City Council.

The Coffs Harbour boat ramp is adjacent to, but outside the boundaries of Solitary Islands Marine Park, which extends from Muttonbird Island on the northern side of the harbour north to the Sandon River.

1.3 Description of the proposal

The works include upgrading of boat ramp, modifications and dredging of the basin and entry channel and extension of the eastern breakwater. These areas are considered the proposal footprint (Subject Site).

The works are proposed to be constructed in two stages.

Stage 1 of the proposal includes:

- The works with potential to impact on the marine environment are typically confined to Stage 1 of the proposal. These works include:
- Extension of the existing breakwater further north by approximately 75m including a sealed access roadway.
- Existing Essential Energy pole and street light adjacent to boat ramp to be removed. Associated service to sign and CCTV to also be removed. Pole to be replaced with private lighting and supply point as part of Stage 2 design.
- Widening of the existing boat ramp with an additional two lanes to create a total of six lanes. The existing boat ramp would be topped with concrete to address the poor condition.
- The existing pontoon would be extended by up to 15m and an additional two pontoons would be constructed to the south. The new pontoons would be up to 40m in length. Pile would be driven for each pontoon.
- Dredging of the existing boat ramp basin and channel to -2.5m AHD and transport of the sand to Park Beach via truck.
- Ongoing dredging of channel required to keep operational during construction

Construction of Stage 1 is expected to commence in May -2021 and would take approximately eight months to complete. It is intended to keep the facility open for use during works with some short-term closures possible on occasion.

Stage 2 of the proposal includes:

- Extension of the existing main carpark to include additional parking for cars, boats and trailers.
- A new entrance at the western end of the existing carpark.
- Relocation of the entry from Jordan Esplanade, adjacent to the boat ramp, for safety reasons[
- Diversion of Jordan Esplanade opposite the main carpark, to improve safety.
- New signage.
- New rigging and de-rigging bays around the main carpark.
- A new shared pathway for walking and cycling.
- New lighting.
- Recreational furniture and embellishments including amenities, seating, tables and fish cleaning facilities.
- Landscaping.
- Extension of services including water, power and sewerage.

Construction of Stage 2 is expected to commence in July -2022 and would also take approximately eight months to complete.

- Extension of the existing breakwater further north by approximately 75m.
- Relocation of the existing electrical lines and the lighting pole.
- Widening of the existing boat ramp with an additional two lanes to create a total of 6 lanes. Upon completion of the widening, the boat ramp would be topped with concrete.
- Extending the existing pontoon by up to 15m and an additional two pontoons would be constructed to the south, requiring two new pylons each of up to 40m in length.
- Dredging of the existing boat ramp basin and channel to -2.5m AHD and transport of the sand to Park Beach. The volume of sand estimated for removal is at 900m^3 with an upper limit of 1500m^3.
- Construction of Stage 1 is expected to commence in mid-2021 and would take approximately 6 months to complete.

In addition to the above, new lighting proposed in Stage 2 of the proposal also has potential for impacts of marine fauna, especially marine and shore birds that may nest and roost at night in the area.

1.4 Relevant Legislation and Policies

The following legislation and policies have been considered in this ecological assessment:

- NSW ***Environmental Planning and Assessment Ac***t 1979
- NSW ***Fisheries Management Act 1994***
- NSW ***Biodiversity Conservation Act 2016***
- NSW ***Coastal Management Act 2016***
- Commonwealth ***Environment Protection and Biodiversity Conservation Act 1999***
- NSW ***Protection of the Environment Operations Act 1997***

The legislative context for the assessment is outlined in the following sections.

1.4.1 Environmental Planning and Assessments Act 1979

Development in NSW falls under the provisions of the ***Environmental Planning and Assessment Act 1979*** (EP&A Act) and subordinate legislation. Under Section 5.5 of the EP&A Act, there is a duty for determining authority to consider the environmental impacts of proposed activities. The specific aspects of these environmental considerations are detailed in Clause 228 of the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation).

The EP&A Act also provides an assessment framework for the consideration of threatened species, populations, ecological communities and their habitats. Section 5A of the EP&A Act lists seven factors to be considered when proposed projects are deemed to have an impact on the habitat of threatened biodiversity listed on the FM Act. The assessment of significance, or seven-part test, sets the criteria for determining whether a proposal is likely to have a significant impact on threatened biodiversity listed under the FM Act that, if this is identified, would necessitate the preparation of a Species Impact Statement (SIS).

For this proposal any potential to impact on threatened species, populations or ecological communities listed under the FM Act will require consideration under Section 5A of the EP&A Act.

1.4.2 *Fisheries Management Act 1994*

The objectives of the ***Fisheries Management Act 1994*** (FM Act) are to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations, and in particular to:

- conserve fish stocks and key fish habitats;
- conserve threatened species, populations and ecological communities of fish and marine vegetation;
- promote ecologically sustainable development, including the conservation of biological diversity, consistently with these objectives;
- promote viable commercial fishing and aquaculture industries;
- promote quality recreational fishing opportunities;
- appropriately share fisheries resources among the users of those resources;
- provide social and economic benefits for the wider community of NSW; and
- recognise the spiritual, social and customary significance of fisheries resources to Aboriginal persons and to protect, and promote the continuation of Aboriginal cultural fishing.

To meet the primary objectives, Part 7 of the FM Act deals with the protection of aquatic habitats, with Part 7A addressing the conservation of threatened species. Part 7 commonly applies to dredging and reclamation works, protection of marine vegetation including mangroves and seagrass, protection of spawning of certain fish, and noxious fish and marine vegetation.

If a public authority (including a local council or state agency) is a determining authority under Part 5 of the EP&A Act, they may still be required to obtain the following approvals or undertake consultation under the following provisions:

- Section 199 – Under s199 of the FM Act, the Minister for Primary Industries is required to be consulted over any dredging or reclamation works carried out, or proposed to be authorised, by a public authority (other than a local government authority) (i.e. any excavation within, or filling or draining of, water land or the removal of woody debris, snags, rocks or freshwater native aquatic vegetation or the removal of any other material from water land that disturbs, moves or harms these in-stream habitats).
- Section 200 – A permit is required for dredging or reclamation work carried out by a local government authority, unless these works are authorised by a relevant public authority (other than NSW DPI) or under the Crown Lands Act 1989.

- Section 205 – A permit to harm (cut, remove, damage, destroy, shade etc) marine vegetation (saltmarshes, mangroves, seagrass and seaweeds).
- Section 219 – A permit to obstruct the free passage of fish.

Listings of threatened species, populations and ecological communities gazetted under the FM Act are relevant to this assessment. Threatened biota impacted by this construction proposal must be assessed under section 5A of the EP&A Act.

Key fish habitat policy

NSW DPI recognises that certain types of activities have varying degrees of impact on key fish habitats and, as such, require different levels of control and regulation. As a general principle, NSW DPI requires that proponents should, as a first priority, aim to avoid impacts upon key fish habitats. Where avoidance is impossible or impractical, proponents should then aim to minimise impacts. For any unavoidable remaining impacts consideration is to be given to establishment of suitable offsets or compensation.

Where key fish habitat is impacted by this proposal, suitable offsets or compensation will be required to be negotiated with NSW DPI Fisheries.

1.4.3 Biodiversity Conservation Act 2016

The Biodiversity Conservation Act 2016 (BC Act) provides for legal protections of biodiversity and threatened species in NSW. Specifically, it provides for the following:

- A process for declaring and protecting areas of outstanding biodiversity value.
- The listing of threatened species, populations and ecological communities, with critically endangered, endangered and vulnerable species under Schedule 1.
- The listing of critically endangered, endangered and vulnerable ecological communities under Schedule 2.
- The listing of extinct species, species extinct in the wild and collapsed ecological communities of animals and plants under Schedule 3.
- Requirements for the preparation of a species impact statement (SIS).
- Determining where the Biodiversity Offset Scheme (BOS) applies to proposals.

The BC Act sets the criteria for determining whether a proposal is likely to have a significant impact on threatened biodiversity listed under the BC Act. If significant impacts are identified, it would necessitate the preparation of a SIS.

To identify areas with outstanding biodiversity value the Biodiversity Values (BV) Map has been prepared under Part 7 of the BC Act to protected land sensitive to impacts from development and clearing. The map forms part of the Biodiversity Offsets Scheme Threshold, which is one of the triggers for determining whether the Biodiversity Offset Scheme (BOS) applies to a clearing or development proposal. Types of land the Environment Agency Head can include on the BV Map include the following:

- Coastal wetlands and littoral rainforest mapped under the State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP).
- Core koala habitat identified in a plan of management under State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44).
- Declared Ramsar wetlands defined by the Environment Protection and Biodiversity Conservation Act 1999.
- Land containing threatened species or threatened ecological communities identified as having potential for serious and irreversible impacts (SAII) under section 6.5 of the BC Act.

- Protected riparian land.
- High conservation value grasslands or groundcover.
- Old growth forest identified in mapping developed under the National Forests Policy Statement, but excluding areas not meeting the criteria published jointly by the Minister for the Environment and the Minister for Primary Industries.
- Rainforest identified in mapping developed under the National Forests Policy Statement, but excluding areas not meeting the criteria published jointly by the Minister for the Environment and the Minister for Primary Industries.
- Declared areas of outstanding biodiversity value.
- Council-nominated areas with connectivity or threatened species habitat that the Minister for the Environment considers will conserve biodiversity at bioregional or state scale.
- Land that, in the opinion of the Environment Agency Head, is of sufficient biodiversity value to be included.

Listed items of threatened biodiversity under the BC Act with potential to be impacted by this proposal will require further consideration. In addition, direct or indirect impacts to any adjacent areas identified as having outstanding biodiversity values may trigger the requirement for determination under the BOS.

1.4.4 Coastal Management Act 2016

The objectives of the ***Coastal Management Act 2016*** (CM Act) are to manage the coastal environment of NSW in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic wellbeing of the people of the State.

The CM Act defines the coastal zone, comprising four coastal management areas:

- Coastal wetlands and littoral rainforests area.
- Coastal vulnerability area.
- Coastal environment area.
- Coastal use area.

Part 2 of the CM Act establishes management objectives specific to each of these management areas, reflecting their different values to coastal communities.

The CM Act, along with the State Environmental Planning Policy (Coastal Management) 2018, forms part of the Coastal Management framework.

The proposed upgrade works will be required to be carried out in a manner that is consistent with the objectives of the CM Act.

State Environmental Planning Policy (Coastal Management) 2018

The State Environmental Planning Policy (Coastal Management) 2018 (CM SEPP) aims to promote an integrated and coordinated approach to land use planning in the coastal zone in a manner consistent with the objectives of the Coastal Management Act 2016. The CM SEPP provides maps of the coastal zone management areas and identifies development controls for consent authorities to apply to each coastal management area to achieve the objectives of the CM Act.

Consideration of the relevant coastal management areas and identified development controls will require consideration as part of these upgrade works.

1.4.5 *Environmental Protection and Biodiversity Conservation Act* 1999

The purpose of the ***Environmental Protection and Biodiversity Conservation Act 1999*** (EPBC Act) is to ensure that actions likely to cause a significant impact on matters of national environmental significance undergo an assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, development or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a controlled action and may not be undertaken without prior approval from the Commonwealth Minister for the Department of Environment (DoE).

The EPBC Act identifies and categorises matters of national environmental significance (MNES) as the following:

- World heritage properties
- National heritage places
- Wetlands of international importance (Ramsar wetlands)
- Threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- Nuclear actions (including uranium mining)
- The Great Barrier Reef Marine Park
- A water resource, in relation to coal seam gas development and large coal mining development.

Listings of MNES deemed relevant to this proposal will require further considered under the guidance provided by the EPBC Act.

1.4.6 Protection of the Environment Operations Act 1997

The ***Protection of the Environment Operations Act 1997*** (POEO Act) is the key piece of environment protection legislation administered by the Environmental Protection Authority (EPA). The POEO Act relates to noise, air and water pollution and waste management. There is a broad allocation of responsibilities under the Act between the EPA, local councils and other public authorities. The EPA is made the regulatory authority for:

- activities listed in Schedule 1 to the Act and the premises where they are carried out;
- activities carried out by a State or public authority; and
- other activities in relation to which a licence regulating water pollution is issued.

The POEO Act provides for the provision of and conditioning of activities requiring environmental protection licensing. Scheduled activities as listed under Schedule 1 of the Act require an Environmental Protection License (EPL) from the EPA, unless clauses in Schedule 1 specify otherwise.

Dredging works are classed as a 'water based extractive activity' under Schedule 1 of this Act. Works requiring removal of 30,000 m^3 or greater of material, such as in the case of these proposed dredging works, are considered a scheduled activity and an EPL will be required. Any removal of material will require further consideration in regard to waste classification, Acid Sulphate Soil (ASS) risk, and the potential direct and indirect ecological consequences these items may have on the environment.

1.5 Assessment Objectives

The objectives of this assessment are to:

- Identify any potential impacts from the proposal on threatened biodiversity, MNES, fish habitat, marine vegetation, other fauna, areas of outstanding biodiversity value, aquaculture leases, and water quality; and
- Provide recommendations regarding adoption of environmental controls and mitigation measures into the CEMP and identify any additional permitting and approval requirements under the FM Act, including any requirements for an SIS.

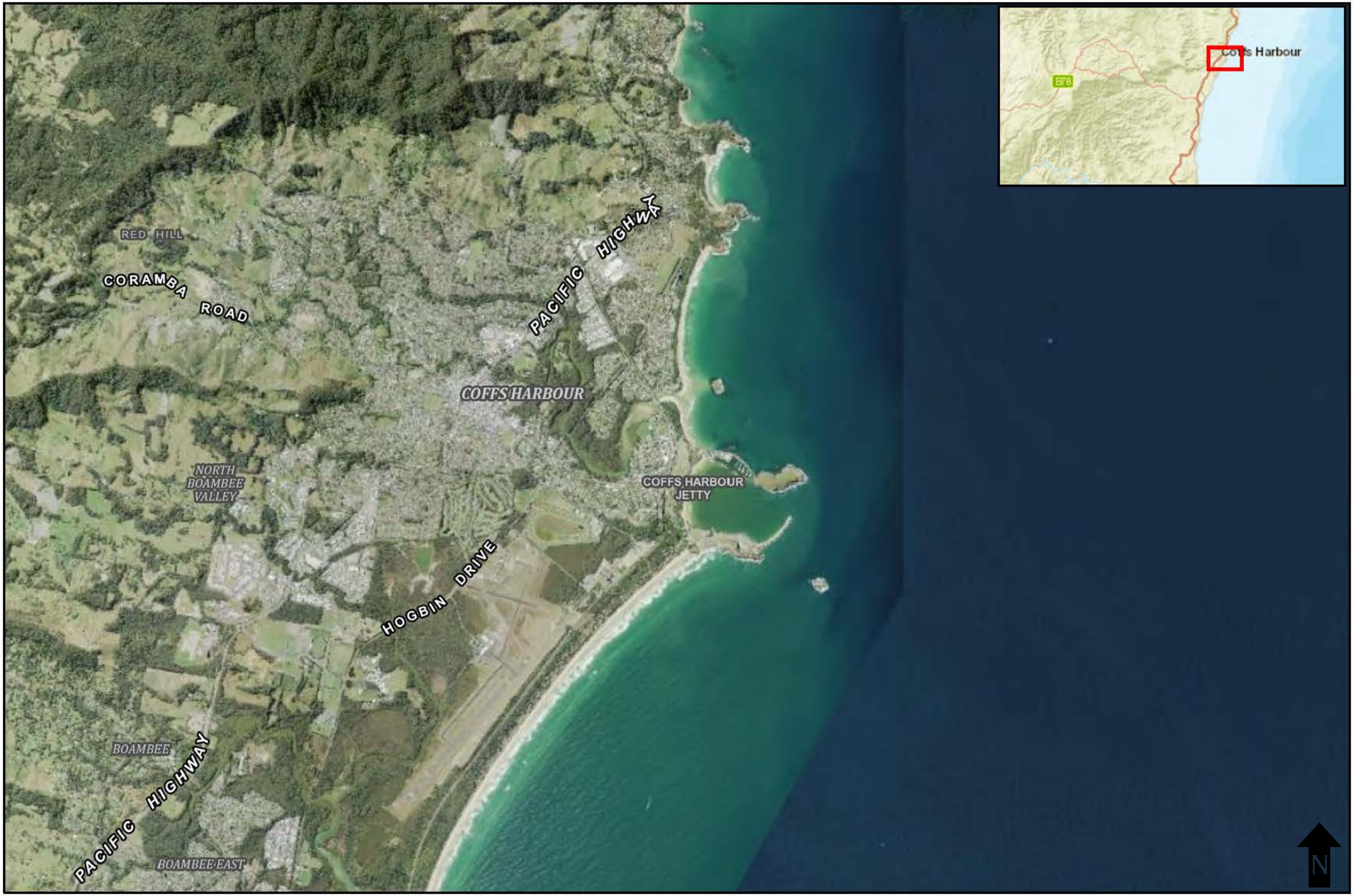

Figure 1: Location of the proposal

CHRBR Upgrade

0 1 2 4 Kilometres

Aerial imagery source: Six Maps 2020
Version 1.0; 05/11/2020

2 Review of Existing Information

2.1 Ecology

The Solitary Islands Marine Park (SIMP) is located along a stretch of the NSW North Coast where the East Australian Current meets cooler waters from the south. The SIMP was the first declared marine park in NSW and covers an area of 70,000 hectares and 100 kilometres of coastline from the northern side of Muttonbird Island at Coffs Harbour north to Plover Island at the entrance to the Sandon River. The State-managed SIMP extends offshore to the three nautical mile mark (boundary between NSW and Commonwealth waters), where it adjoins the Commonwealth-managed SIMP.'The SIMP consists of five main Solitary Islands and includes a rich diversity of plants and animals supported by a complex mix of habitats (DPI 2018a), including areas of coral reef and several important populations of threatened and migratory species.

The coral reef is considered the most southerly extent of coral reefs along the Australian east coast. Coral reefs in places have been reported to support up to 100% coral cover, with typical reefs having between 8.5 and 50.9% cover (Harriott et al. 1994). This includes over 90 coral species , with corals of the Pocilloporidae, followed by Acroporidae, Dendrophylliida and Faviidae taxa dominating cover (Harriott et al. 1994, Edgar 2015). Areas of coral reefs are reported to occur just outside of Coffs Harbour, including on the northern side of Muttonbird Island (Harriott et al. 1994), but have not been found inside Coffs Harbour itself.

Important threatened species populations associated with the SIMP and areas around Coffs Harbour include: aggregation sites for the critically endangered Grey Nurse Shark (*Carcharias taurus*) at North and South Solitary Islands (DPI 2018); breeding and nesting sites on islands for threatened and migratory birds (NPWS 2016); important areas for the threatened Black Rockcod (*Epinephelus daemelii*) (DPI 2012a); and the majority of the known current distribution of the critically endangered marine brown alga *Nereia lophocladia* (DPI 2018b).

Nearby islands provide habitat for migratory birds and are used as nesting sites for various seabirds and shorebirds. Four types of Shearwater are likely to breed on the Solitary Islands (*Ardenna carneipes, grisea* and *pacifica*, and *Puffinus gavia*), with another, the Short-tailed Shearwater (*A. tenuirostris*), recorded as a visiting species (NPWS 2016). The Wedge-tailed Shearwater (*A. pacifica*) is also well documented to breed and nest on nearby Muttonbird Island (NPWS 2009). In addition, Crested Terns (*Thalasseus bergii*) use North, North-West and South Solitary islands for nesting during the summer months of most years, Silver Gulls (*Chroicocephalus novaehollandiae*) nest around South Solitary Island and are known to have nested on North Solitary Island, while the islands are also known to be used by a range of other marine birds (NPWS 2016). On Muttonbird Island the Short-tailed Shearwater (*A. tenuirostris*), Eastern Reef Egret (*Egretta sacra*), Sooty Shearwater (*A. grisea*) and Lesser Frigatebird (*Fregata ariel*) have also been reported to occur (NPWS 2009).

The critically endangered *Nereia lophocladia* is a small brown alga that is typically less than 15 cm long. The species was initially described from Port Phillip Heads in Victoria in 1888 and rediscovered in 1980 adjacent to Muttonbird Island. More recent surveys have found its current distribution to be confined to shallow reefs between Sawtell and Woolgoolga Headland (DPI 2018b). Targeted surveys for the species on the northern side of Muttonbird Island identified multiple discrete patches of the alga growing at the sand-rock interface on low profile reef habitat. Other nearby sites identified as part of these surveys included along the toe of the northern breakwater, the western side of Coffs Reef, and Coffs Reef Gulch (Yee et al 2017). In 2019 further targeted surveys in preparation for this project of the eastern breakwater and adjacent shore inside Coffs Harbour were commissioned by the Department of Industry, Crown Lands and Water. The surveys were completed by Southern Cross University and targeted potential habitat along the eastern side of the breakwater and southern shore of the harbour. These surveys did not detect *N. lophocladia* sporophytes in the survey area inside Coffs Harbour. Furthermore, much of the shallow, wave-impacted reef on the southern shores of the harbour appeared unsuitable for sporophytes of the alga to persist (Kelaher and Mamo 2019). This coincided with earlier findings of surveys that failed to find *Nereia* inside Coffs Harbour itself (Yee *et al* 2017).

2.2 Coastal Processes

Ongoing long-term sediment accretion has been occurring in Coffs Harbour since its construction in 1946. Previous studies indicate the harbour may be infilling as a result of the net northward littoral drift of sediment along this part of the NSW coastline, with periodic dredging of the harbour required and occurring since 1980 (MHL 2019 and 2020). The enclosed nature of the harbour causes long period oscillations known as 'seiching' to cause water level oscillations that impact on the harbour and boat ramp basin (MHL 2019).

The extent of the sediment transport pathway along the southern breakwater that impacts on the boat ramp basin has been estimated to be 5,700 m^3/year (MHL 2020). The current works propose to extend the eastern breakwater 75m to the north as part of improvements to the boat ramp. Further modelling investigations by MHL (2020) have predicted:

- a potential reduction in transport along the breakwater's eastern face, resulting in positive accretion along the eastern breakwater face.
- extension of the eastern breakwater would cause the sedimentation leeward of the breakwater head to be deposited further from shore.
- is small negative net sediment transport (scour) occurring in the area of the existing offshore reef under the existing conditions. Estimated annually to be between 21 and 29cm/yr.
- a reduction affecting onshore transport of sediment to south Jetty Beach. This reduction is estimated to be 45% of sediment across an 80m stretch of the beach.

2.3 Sediment Quality

In 2019 surface sediments were investigated along the eastern side of the eastern breakwater for potential dredging. These works concluded that the concentrations of contaminants of potential concern were below the NAGD screening levels, and the material was not considered to be a potential acid sulfate risk (GHD 2019). Further sediment sampling commissioned by Department of Industry, Crown Lands and Water to support this proposal investigated sediments within the boat ramp basin and in areas where shoaling is occurring at the entrance to the boat ramp basin. This assessment found the level of contamination is typically below Practical Quantitation Limit (PQL), or below the NAGD screening levels apart from one sample that has elevated levels of Tributyltin (TBT). The contaminated sample was collected from an area that the proposed works are unlikely to disturb material in therefore the TBT contaminated material is unlikely to be impacted Regional (Geotechnical Solutions 2020).

3 Methodology and Approach

3.1 Threatened Species Searches

Relevant databases were searched in August 2020, applying a 10 km radius around the Subject Site to identify threatened biodiversity and migratory species that may potentially occur at the locality. The following databases and information sources were searched:

- Bionet, Atlas of NSW Wildlife
- EPBC Act Protected Matters Report tool
- NSW DPI Fisheries Threatened species lists
- Sightings data for various species from the Atlas of Living Australia

3.2 Ecological Mapping

Mapping of existing ecological features important to this assessment was reviewed using the following online tools:

- Fisheries NSW Spatial Data Portal – Mapping of Estuarine Macrophytes, Aquaculture, Marine Protected Areas, and Coastal Management SEPP layers.
- Biodiversity Values and Threshold Tool – Biodiversity values

A review of the potential environmental constraints identified via these maps was undertaken.

3.3 Site Investigations

Consideration was given to habitat within 100m of the proposal footprint (Study Area). Site investigations completed as part of this assessment included:

- Inspection and description of general habitat within the Study Area;
- Description of intertidal flora and fauna, including opportunistic observations of marine and shorebirds.
- Description of subtidal flora and fauna observed during in-water inspection using snorkelling equipment.
- Review of potential habitat for threatened species, including inspection of intertidal and subtidal areas of natural habitat and artificial structures;
- Snorkel/breath hold search of all areas of subtidal reef onside the Study Area for threatened Black Rockcod.

3.4 Mapping

Mapping of aquatic habitat was done within a 100m radius of the proposed works footprint. The mapping focused on determining benthic habitat and an area of reef towards the north of the proposal footprint. The seabed was surveyed using a towed camera and drop camera to provide real-time imagery of the seabed, with additional spot inspections by snorkeler.

Mapping data were collected *in situ* using a specialised data form collection application with GPS integration for benthic mapping. Data were then imported into GIS-based mapping software, which created shapefiles and polygons based on interpretation of the following data sources:

- *In-situ* estuarine mapping data
- Aerial imagery

- Bathymetry

3.5 Threatened Species Assessment

The threatened species assessment was undertaken via desktop review of 'sightings', assessment of the habitat in the Study Area, and determination of the likelihood of occurrence of each species using the criteria outlines in Table 1. Species considered further were those in the 'Known', 'High' and 'Moderate' categories, and where impacts on the species from the proposed works could reasonably be considered to occur.

Table 1: Likelihood of occurrence criteria

Likelihood of occurrence	Criteria
Known	The species was observed within the Study Area. The species is known to inhabit the Study Area.
High	The species has frequently been recorded previously in the Study Area or similar habitats in the locality. The species is known or likely to maintain resident populations surrounding the Study Area. It is likely that the species utilises habitat or resources that are abundant or in good condition within the Study Area. The species is known or likely to visit the Study Area during regular seasonal movements or migration.
Moderate	The species has infrequently been recorded previously in the Study Area or similar habitats in the locality. The Study Area contains potential marginal and/or modified habitat and resources for the species, which it may occasionally utilise. The species is unlikely to maintain sedentary populations, however, may seasonally use resources within the Study Area opportunistically or during migration.
Low	The species has not been recorded previously in the Study Area or similar habitats in the locality. The Study Area is beyond the current distribution range of the species. If present in the Study Area the species would likely be a transient visitor. The Study Area contains only very marginal habitat for the species, which would not be relied upon for its on-going local existence.
Unlikely	The species is highly restricted to certain geographical areas not within the Study Area. The habitat within the Study Area is unsuitable for the species.

3.6 Limitations

Fauna surveys were limited to the assessment of habitat values and other opportunistic observations. Habitat assessments are conservative, defaulting to assume presence where there is insufficient knowledge to determine otherwise.

Numerous threatened fauna species are seasonal and/or may be transient in nature. Some fauna can only be detected during certain seasons (e.g. migration patterns or seasons). For instance, some migratory bird species may be seen only at certain times of the year, as they migrate to more significant nearby sites.

The extent of reef in the Study Area may change temporally with the accretion of sands and/or following weather conditions that generate easterly swell.

Mapping is limited to broad-scale mapping guided by field observations taken with a GPS accuracy of approximately +/- 3m. More detailed mapping may be required to identify more precise boundaries and seasonal changes in seagrass coverage and densities.

Assessment of threatened species is limited to marine species that are reliant on marine habitat, which may include oceanic areas, pelagic waters, or shoreline habitat below the Mean High-Water Mark (MHWM).

4 Results and Findings

4.1 Description of Habitat

4.1.1 Shoreline Habitat

The shoreline surrounding the boat ramp and adjacent to the seawall to be extended is highly modified due to construction of the boat ramp and associated carpark, and the adjacent road, Jordan Esplanade. Shoreline vegetation is largely absent, with the exception of some ornamental plantings on the opposite side of Jordan Esplanade.

The boat ramp is also located approximately 300m towards Corambirra Point from the vegetated shoreline of the adjacent Jetty Beach. Jetty Beach is a popular protected swimming beach locate close to commercial and tourist facilities within the city of Coffs Harbour.

Observations of shoreline habitat use by several shorebird species were recorded during the site survey (Table 2). These are described further in Section 4.3.

Photos of the shoreline associated with the boat ramp and eastern breakwater are provided in Plate 1.

4.1.2 Intertidal habitat

The entirety of intertidal habitat within the Study Area was comprised of artificial habitat associated with the boat ramp, pontoon piles and, in most part, the harbour seawalls and eastern breakwater. The seawalls and breakwater consisted of large ballast rock that encompassed the smaller inlet for the boat ramp and the northern side of Coffs Harbour. The ballast rock provides some substrate for settlement by sessile invertebrates.

Several species of intertidal invertebrates were recorded on the seawall and some shorebirds were recorded foraging in the area at low tide (Table 2). These are described further in Section 4.3.

Photos of intertidal habitat associated with the seawalls and breakwater are provided in Plate 2

4.1.3 Subtidal habitat

Subtidal habitat in the Study Area included nearby rocky reef areas inside Coffs Harbour, lower subtidal areas of the seawall between the Low Water Mark and seawall toe, and soft sediment habitats. Natural rocky reef habitat is restricted to a small area (~500m^2) of shallow, turbid reef located approximately 150m north of eastern breakwater. This reef is highly complex with gutters and crevices along its crest, while the edges gradually transition into the sand below a dense covering of macroalgal wrack. This reef is likely the only permanent natural reef inside Coffs Harbour. The reef typically lacked any areas of canopy-forming macroalgae during the survey, which are likely regularly dislodged during any easterly weather conditions.

Bathymetry also indicates that two other areas inshore from this area may include some natural rocky rises collectively covering another ~1.0 Ha). However, at the time of survey these were not detected and appeared to be covered by sand, indicating they are inconstant reef areas of sand-scoured rock that are periodically covered by sand (Figure 2).

The ballast at the toe of the seawall provides some fringing artificial reef around the edges of the boat ramp basin and Coffs Harbour. This ballast typically extends below the water line 2-4m inside the boat ramp inlet, and 5-10m from the Coffs Harbour seawall, before it reaches sand. The lower section of the seawall near the toe provides some habitat for macroalgae to establish, although it was observed to be typically patchy with limited diversity.

The sands are unvegetated and consist of clean marine sands with shallow shoaling (<1m) notable around the entrance to the boat ramp basin.

Numerous sessile invertebrates and fish species, along with a few macroalgae species were recorded in subtidal areas (Table 2). These are described further in Section 4.3

Photos of subtidal habitat associated with soft sediment areas are provided in Plate 3 and rocky habitat in Plate 4.

Table 2: List of species observed during the site survey.

Common Name	Species	Reef	Rockwall	Soft sediment
Fish, rays and sharks				
Scissortail Sergeant	*Abudefduf sexfasciatus*	√		
Yellowfin Bream	*Acanthopagrus australis*	√	√	√
Eastern Blue Groper	*Achoerodus viridis*	√	√	
Rock Cale	*Aplodactylus lophodon*	√	√	
Stars-and-stripes Puffer	*Arothron hispidus*	√		
Common Silverbiddy	*Gerres subfasciatus*		√	
Luderick	*Girella tricuspidata*	√	√	√
Port Jackson Shark	*Heterodontus portusjacksoni*	√		
Moses Perch	*Lutjanus russellii*		√	
Sea Mullet	*Mugil cephalus*	√	√	√
Crimsonband Wrasse	*Notolabrus gymnogenis*		√	
Ornate Wobbegong Shark	*Orectolobus ornatus*	√		
White-ear	*Parma microlepis*	√		
Black-spot Goatfish	*Parupeneus signatus*	√		
Black-tipped Bullseye	*Pempheris affinis*	√		
Gunther's Wrasse	*Pseudolabrus guentheri*	√		
Tarwhine	*Rhabdosargus sarba*	√	√	
Blue-lined goatfish	*Upeneichthys lineatus*		√	
Invertebrates				
Six-plated Barnacle	*Chthamalus antennatus*		√	
Blue-belled Tunicates	*Clavelina* sp.	√		
Cartrut Shell	*Dicathais orbita*	√		
Colonial Ascidean	*Didemnum* sp.	√		
Tubeworm	*Galeolaria caespitosa*	√	√	
Blacklip Abalone	*Haliotis rubra*	√		
Red-throated Ascidean	*Herdmania momus*	√	√	
Mulberry Whelk	*Morula marginalba*		√	
Sand Anemone	*Oulactis muscosa*		√	
Perons Limpet	*Patella peronii*		√	
Oyster Limpet	*Patelloida mimula*		√	
Slate Pencil Urchin	*Phyllacanthus parvispinus*	√		
Red Bait Crab	*Plagusia chabrus*	√	√	
Cunjevoi	*Pyura stolonifera*	√	√	
Sydney Rock Oyster	*Saccostrea glomerata*		√	
Sponge	*Spongia* sp.	√		
Rose Barnacle	*Tesseropora rosea*		√	
Macroalgae				

Common Name	Species	Reef	Rockwall	Soft sediment
Sinuous Ballweed	*Colpomenia sinuosa*	√	√	
Coralline Algae	*Corallina officinalis*	√	√	
Brown Macroalga	*Padina crassa*		√	
Red Alga	*Pterocladia lucida*		√	
Gulfweed	*Sargassum* sp.	√	√	
Sea Lettuce	*Ulva* sp.	√	√	
Sinuous Ballweed	*Colpomenia sinuosa*	√	√	
Marine and shore birds				
Silver Gull	*Chroicocephalus novaehollandiae*		√	
Sooty Oystercatcher	*Haematopus fuliginosus*		√	
Australian Pelican	*Pelecanus conspicillatus*		√	
Great Cormorant	*Phalacrocorax carbo*		√	
Crested Tern	*Thalasseus bergii*		√	
Australian White Ibis	*Threskiornis molucca*		√	

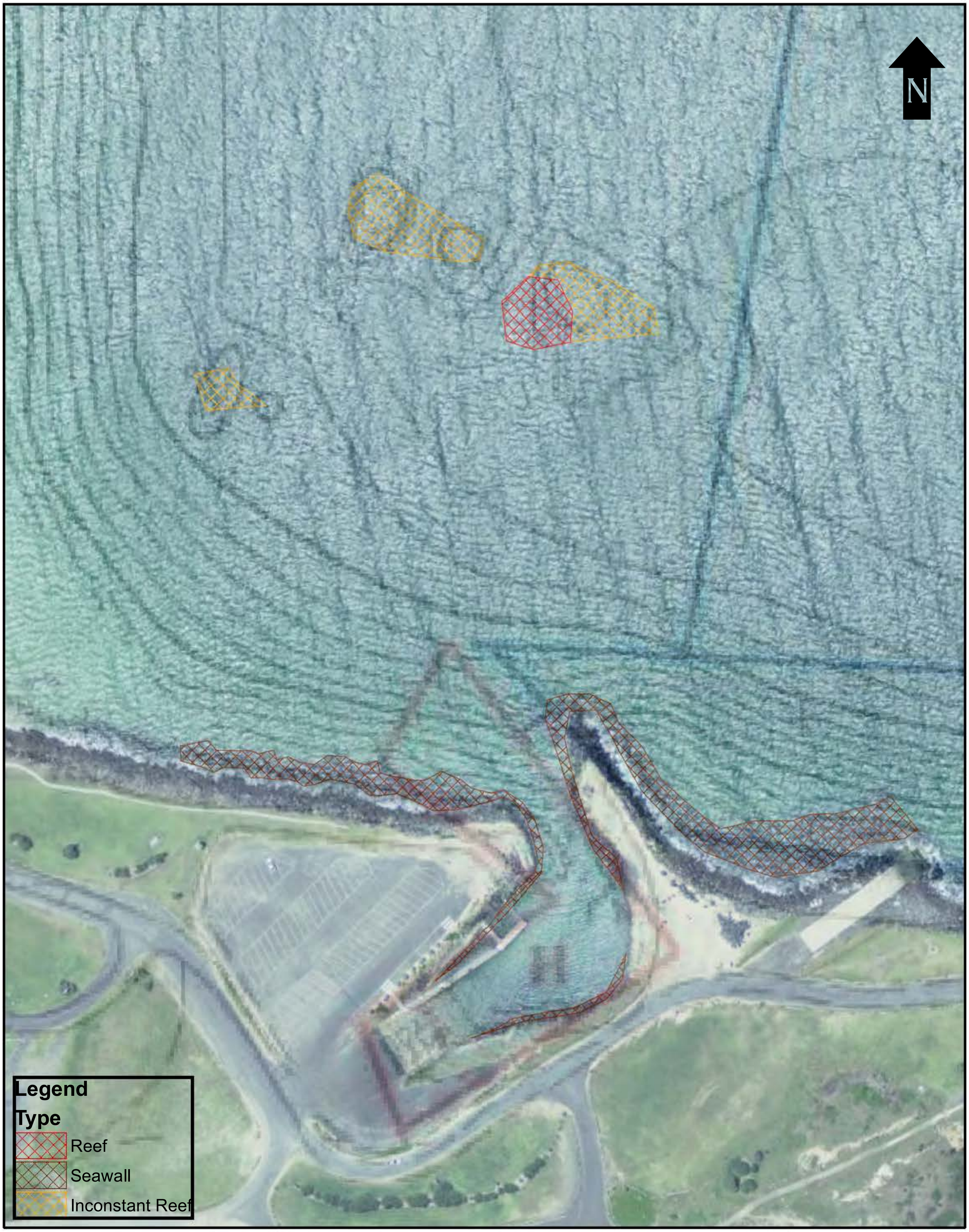

Figure 2: Habitat map

CHRBR Upgrade

Aerial imagery source: Six Maps 2020
Drawings projected in WGS84
Version 2.0; 12/11/2020

4.2 Threatened and Migratory Species

Searches of the NSW Bionet sightings database review of the EPBC Act Protected Matters Report identified 77 threatened and migratory marine species that may occur in the Study Area. These included 49 marine and shorebirds, 11 marine mammals, 12 sharks, rays and fish, five reptiles and a marine alga (Table 3). Full results from the NSW Bionet search and EPBC Act Protected Matters Report are provided in Appendix 3.

Review of sightings data (Figure 3), field observations of species, species habitat use and general habitat within the Study Area determined that the following have at least a Moderate likelihood of occurrence in the Study Area:

- Ten species of marine and shorebirds
  - Five of these are marine birds
    - Flesh-footed Shearwater (*Ardenna carneipes*)
    - Sooty Shearwater (*A. grisea*)
    - Wedge-tailed Shearwater (*A. pacifica*)
    - Short-tailed Shearwater (*A. tenuirostris*)
    - Lesser Frigatebird (*Fregata ariel*)
  - Two of these species are seabirds
    - Common Tern (*Sterna hirundo*)
    - Crested Tern (*Thalasseus bergii*)
  - Three species are shorebirds
    - Sooty Oystercatcher (*Haematopus fuliginosus*)
    - Pied Oystercatcher (*H. longirostris*)
    - Little Tern (*Sterna albifrons*)
- One species of marine mammal, the Australian Fur-seal (*Arctocephalus pusillus doriferus*)
- Three species of marine reptiles
  - Green Turtle (*Chelonia mydas*)
  - Hawksbill Turtle (*Eretmochelys imbricata*)
  - Loggerhead Turtle (*Caretta caretta*)
- Two species of sharks and fish
  - White Shark (*Carcharodon carcharias*)
  - Black Rockcod (*Epinephelus daemelii*)
- One marine alga, the brown alga *Nereia lophocladia*.

These species will require further consideration as part of the impact assessment.

Table 3: Likelihood of Occurrence table for threatened species.

Common Name	Scientific Name	NSW status	Comm. Status	Likelihood of Occurrence
Marine and shore birds				
Common Noddy	*Anous stolidus*	P	C, J	Low – No sightings recorded in the locality. Typically seen in tropical areas and associated with offshore islands.
Fork-tailed Swift	*Apus pacificus*	P	C, J, K	Low – No sightings recorded in the locality. Any occurrence is likely to be rare and exclusively aerial.
Flesh-footed Shearwater	*Ardenna carneipes*	V, P	J, K	**High** – Sightings recorded within the locality and potentially may nest on offshore Islands in the adjacent SIMP.
Sooty Shearwater	*Ardenna grisea*	P	J	**High** – Sightings recorded within the locality and potentially may nest on offshore Islands in the adjacent SIMP.
Wedge-tailed Shearwater	*Ardenna pacifica*	P	J	**Known** – Nests on Muttonbird Island and other offshore Islands in the adjacent SIMP.

Common Name	Scientific Name	NSW status	Comm. Status	Likelihood of Occurrence
Short-tailed Shearwater	*Ardenna tenuirostris*	P	C, J, K	**High** – Sightings recorded within the locality, however does not nest in the adjacent SIMP.
Bush Stone-curlew	*Burhinus grallarius*	E, P		Low – No sightings recorded in the locality. Habitat within the Study Area is only very marginal for this species.
Red Knot	*Calidris canutus*	P	E, C, J, K	Low – No sightings recorded in the locality. Typically a wading species, with only very marginal habitat in the Study Area.
Curlew Sandpiper	*Calidris ferruginea*	E, P	CE, C, J, K	Low – No Sightings recorded in the locality. Habitat within the Study Area is only very marginal for this species.
Streaked Shearwater	*Calonectris leucomelas*	P	C, J, K	Low – No sightings recorded in the locality. Any occurrence is likely to be rare and exclusively aerial.
Antipodean Albatross	*Diomedea antipodensis*	V, P	V	Low – No sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Gibson's Albatross	*Diomedea antipodensis gibsoni*	V, P	V	Low – No Sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Southern Royal Albatross	*Diomedea epomophora*	P	V	Low – Occasional records in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial as part of transient visits.
Wandering Albatross	*Diomedea exulans*	E, P	V	Low – Occasional records in the locality. Typically, an oceanic species and any occurrences are likely to be exclusively aerial as part of transient visits.
Northern Royal Albatross	*Diomedea sanfordi*	P	E	Low – No sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Black-necked Stork	*Ephippiorhynchus asiaticus*	E, P		Low – No Sightings recorded in the locality. Typically a wading species, with only very marginal habitat in the Study Area.
Beach Stone-curlew	*Esacus neglectus*	CE, P		Low – Occasional records in the locality. Habitat within the Study Area is only very marginal for this species.
Lesser Frigatebird	*Fregata ariel*	P	C, J, K	**Moderate** – Sightings recorded within the locality and around nearby Muttonbird Island. May forage across the Study Area at times.
White-bellied Storm-Petrel	*Fregetta grallaria grallaria*	P	V	Low – No sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Latham's Snipe	*Gallinago hardwickii*	P	J, K	Low – Occasional records in the locality. Habitat within the Study Area is only very marginal for this species.
Sooty Oystercatcher	*Haematopus fuliginosus*	V, P		**Known** – Observed foraging on the rock wall in the Study Area during site investigations.
Pied Oystercatcher	*Haematopus longirostris*	E, P		**Moderate** – Sightings recorded within the locality. The Study Area provides some limited marginal foraging habitat at low tide.
Little Eagle	*Hieraaetus morphnoides*	V, P		Low – Occasional sightings in the locality. Habitat within the Study Area is only very marginal for this species.
White-throated Needletail	*Hirundapus caudacutus*	P	V, C, J, K	Low – Occasional sightings in the locality. Habitat within the Study Area is only very marginal for this species.
Black Bittern	*Ixobrychus flavicollis*	V, P		Low – Occasional sightings in the locality. Habitat within the Study Area is only very marginal for this species.
Bar-tailed Godwit (baueri)	*Limosa lapponica baueri*	P	V	Low – No sightings recorded in the locality. Typically a wading species, with only very marginal habitat in the Study Area.
Northern Siberian Bar-tailed Godwit	*Limosa lapponica menzbieri*	P	CE	Low – No Sightings recorded in the locality. Typically a wading species, with only very marginal habitat in the Study Area.
Southern Giant-Petrel	*Macronectes giganteus*	P	E	Low – Occasional sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Northern Giant-Petrel	*Macronectes halli*	V, P	V	Low – Occasional sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.

Common Name	Scientific Name	NSW status	Comm. Status	Likelihood of Occurrence
Eastern Curlew	*Numenius madagascariensis*	P	CE, C, J, K	Low – Occasional sightings recorded in the locality. Typically a wading species, with only very marginal habitat in the Study Area.
Sooty Tern	*Onychoprion fuscata*	V, P		Low – Occasional sightings recorded in the locality. Typically an oceanic species confined to offshore Islands and only seen on the coast during rare transient visits.
Fairy Prion	*Pachyptila turtur subantarctica*	P	V	Low – No Sightings recorded in the locality. Typically confined to Islands in southern Australia, any occurrences are likely to be rare and confined to transient visits.
Sooty Albatross	*Phoebetria fusca*	V, P	V	Low – No Sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Gould's Petrel	*Pterodroma leucoptera leucoptera*	V, P	E	Low – Occasional sightings recorded in the locality. Not Known to known to breed on Islands in the SIMP. Likely only a transient visitor to the Study Area.
Kermadec Petrel	*Pterodroma neglecta neglecta*	V, P	V	Low – No sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Little Tern	*Sterna albifrons*	E, P	C, J, K	**Moderate** – Sightings recorded within the locality and occasionally on the beach inside Coffs Harbour and the Study Area.
Common Tern	*Sterna hirundo*	P	C, J, K	**Moderate** – Occasional sightings recorded within the locality. Some marginal foraging habitat occurs within the Study Area.
Australian Fairy Tern	*Sternula nereis nereis*	P	V	Low – No sightings recorded within the locality. Habitat within the Study Area is only very marginal for this species.
Masked Booby	*Sula dactylatra*	V, P	J, K	Low – Occasional sightings recorded in the locality. Typically, confined to tropical offshore Islands. Likely only a transient visitor to the Study Area.
Buller's Albatross	*Thalassarche bulleri*	P	V	Low – No sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Northern Buller's Albatross	*Thalassarche bulleri platei*	P	V	Low – No Sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Shy Albatross	*Thalassarche cauta*	V, P	V	Low – Occasional sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
White-capped Albatross	*Thalassarche cauta steadi*	P	V	Low – No sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Chatham Albatross	*Thalassarche eremita*	P	E	Low – No sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Campbell Albatross	*Thalassarche impavida*	P	V	Low – No sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Black-browed Albatross	*Thalassarche melanophris*	V, P	V	Low – Occasional sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Salvin's Albatross	*Thalassarche salvini*	P	V	Low – No sightings recorded in the locality. Typically an oceanic species and any occurrences are likely to be exclusively aerial.
Crested Tern	*Thalasseus bergii*	P	J	**Known** – Observed foraging in the Study Area during site investigations.
Hooded Plover	Thinornis rubricollis	CE, P	V	Low – No sightings recorded in the locality. Typically a wading species, with only very marginal habitat in the Study Area.
Marine mammals				
Australian Fur-seal	*Arctocephalus pusillus doriferus*	V, P		**Moderate** – Occasional sightings recorded within the locality. Some marginal foraging and refuge habitat occurs within the Study Area.
Sei Whale	*Balaenoptera borealis*	P	V, B	Low – No sightings recorded in the locality. Typically remains offshore and very unlikely to enter Coffs Harbour.

Common Name	Scientific Name	NSW status	Comm. Status	Likelihood of Occurrence
Bryde's Whale	*Balaenoptera edeni*	P	B	Low – Occasional sightings recorded in the locality. Typically remains offshore and very unlikely to enter Coffs Harbour.
Blue Whale	*Balaenoptera musculus*	E, P	E, B	Low – No sightings recorded in the locality. Typically remains offshore and very unlikely to enter Coffs Harbour.
Fin Whale	*Balaenoptera physalus*	P	V, B	Low – No sightings recorded in the locality. Typically remains offshore and very unlikely to enter Coffs Harbour.
Dugong	*Dugong dugon*	E, P	B	Low – No recent sightings recorded in the locality. The lack of any seagrasses inside Coffs Harbour means there is only very marginal habitat for this species and it is only likely to be a transient visitor to the Study Area.
Southern Right Whale	*Eubalaena australis*	E, P	E	Low – Occasional sightings recorded in the locality. Typically remains offshore and very unlikely to enter Coffs Harbour.
Humpback Whale	*Megaptera novaeangliae*	V, P	V	Low – Regular sightings recorded in the locality. Typically remains offshore and very unlikely to enter Coffs Harbour.
Killer Whale	*Orcinus orca*	P	B	Low – No sightings recorded in the locality. Typically remains offshore and very unlikely to enter Coffs Harbour.
Sperm Whale	*Physeter macrocephalus*	V, P	B	Low – No sightings recorded in the locality. Typically remains offshore and very unlikely to enter Coffs Harbour.
Indo-Pacific Humpback Dolphin	*Sousa chinensis*		B	Low – No sightings recorded in the locality. Only very marginal habitat in the Study Area and use likely limited to transient visits.
Marine reptiles				
Green Turtle	*Chelonia mydas*	V, P	V, B	**High** – Regular sightings within the locality. The species may use habitat to forage or for refuge within the Study Area at times.
Leatherback Turtle	*Dermochelys coriacea*	E, P	E, B	Low – No sightings recorded in the locality. Typically remains offshore and unlikely to enter Coffs Harbour.
Hawksbill Turtle	*Eretmochelys imbricata*	P	V, B	**Moderate** – Occasional sightings within the locality. The species may use habitat to forage or for refuge within the Study Area at times.
Loggerhead Turtle	*Caretta caretta*	E, P	E, B	**Moderate** – Occasional sightings within the locality. The species may use habitat to forage or for refuge within the Study Area at times.
Flatback Turtle	*Natator depressus*	P	V, B	Low – No sightings recorded in the locality. Typically confined to more tropical waters, only likely to be a transient visitor to the Study Area .
Fish, sharks, and rays.				
Grey Nurse Shark	*Carcharias taurus*	CE, P	CE	Low – Known to occur in the locality, however use of habitat in the harbour and Study Area is considered rare.
White Shark	*Carcharodon carcharias*	V, P	V	**Moderate** – Occasionally recorded within the locality. The Study Area includes some marginal habitat for foraging.
Black Rockcod	*Epinephelus daemelii*	V, P	V	**Moderate** – Occasionally recorded within the locality. The Study Area includes some marginal habitat for foraging and refuge.
White's Seahorse	*Hippocampus whitei*	E		Low – Occasionally recorded within the locality, however typically confined to inside estuaries. The Study Area provides only very marginal habitat for the species.
Mackerel Shark	*Lamna nasus*	P	B	Low – Rarely recorded in coastal areas. Typically remains offshore near the continental shelf edge and very unlikely to enter Coffs Harbour.
Reef Manta Ray	*Manta alfredi*	P	B	Low – Occasionally recorded within the locality, Typically remains offshore and unlikely to enter Coffs Harbour.
Giant Manta Ray,	*Manta birostris*	P	B	Low – Occasionally recorded within the locality, Typically remains offshore and unlikely to enter Coffs Harbour.
Whale Shark	*Rhincodon typus*	P	V	Low – Occasionally recorded within the locality, Typically remains offshore and unlikely to enter Coffs Harbour.
Indo-Pacific Humpback Dolphin	*Sousa chinensis*	P	B	Low – Rarely recorded in NSW waters. The Study Area provides only very marginal habitat for the species.
Scalloped Hammerhead Shark	*Sphyrna lewini*	E		Low – Rarely recorded in coastal areas. Typically remains offshore near the continental shelf edge and very unlikely to enter Coffs Harbour.
Great Hammerhead Shark	*Sphyrna mokarran*	V		Low – Occasionally recorded in coastal areas, but rarely known to enter harbours. Only likely to be a transient visitor in the Study Area.

Common Name	Scientific Name	NSW status	Comm. Status	Likelihood of Occurrence
Southern Bluefin Tuna	*Thunnus maccoyii*	E		Low – Rarely recorded in coastal areas. Typically remains offshore near the continental shelf edge and very unlikely to enter Coffs Harbour.
Other				
Marine Brown Alga	*Nereia lophocladia*	CE		Low – Known to occur nearby and in the locality, but not inside Coffs Harbour. The Study Area provides only marginal habitat for the species. Targeted surveys did not find it on the southern breakwater or offshore reef.

4.3 Marine Fauna and Flora

4.3.1 Marine and shorebirds

The waters inside Coffs Harbour and the Study Area are used by a diverse range of marine birds including many migratory species. For the majority of species these occurrences are exclusively aerial and part of migratory movements along the coastline or from offshore areas. However, the migratory and threatened Flesh-footed Shearwater (*Ardenna carneipes*), and migratory Sooty (*A. grisea*) and Wedge-tailed (*A. pacifica*) Shearwaters may breed on nearby Islands in the Solitary Islands Marine Park, including on Muttonbird Island at the entrance to Coffs Harbour. In addition, the migratory Crested Tern (*Thalasseus bergii*) is also known to occur, while the Short-tailed Shearwater (*A. tenuirostris*) and Common Tern (*Sterna hirundo*) occasionally occur in the locality. Another migratory marine bird, the Lesser Frigatebird (*Fregata ariel*), is also recorded regularly on Muttonbird Island. Many of these threatened and migratory marine birds, as well as the more common gulls, cormorants and pelicans, are also likely at times to forage in waters inside Coffs Harbour, including in the Study Area.

Numerous shorebirds may also occur in the Study Area. Common species such as the White Australian Ibis (*Threskiornis Molucca*) is commonly seen along the shoreline in the Study Area. During the survey, a pair of the threatened Sooty Oystercatchers (*Haematopus fuliginosus*) were seen foraging on the seawall in the Study Area at low tide. The seawalls and breakwater are likely to provide foraging habitat for a diversity of common shorebirds that forage amongst rocks at low tide. As there is minimal to no sandy intertidal habitat within the Study Area, potential foraging habitat for wading shorebirds is limited, while roosting and resting areas are confined to adjacent areas of Jetty Beach. Shore birds that forage on mud and sandflats, such as the threatened Pied Oystercatcher (*H. longirostris*) that is regularly seen in the locality, and Little Tern (*S. albifronsi*), which are often found on sand spits, have been sighted on rare occasions adjacent to the Study Area on Jetty Beach.

4.3.2 Marine mammals and reptiles

The Australian Fur-seal (*Arctocephalus pusillus doriferus*) has been recorded at times in the locality. These fur-seals are likely to be transient visitors to the area and at times may enter Coffs Harbour to forage or for refuge. Fur-seals will at times use intertidal areas and adjacent areas of the shoreline to haul out and take refuge, so the shoreline around Coffs Harbour and the boat ramp may at times, albeit rarely, provide refuge and resting habitat for Australia Fur-seals.

Other marine mammals in the area include whales and dolphins. Whales regularly migrate and travel close to shore along this area of the NSW coast, however they are very unlikely to enter the shallower waters inside Coffs Harbour. Some coastal dolphin species may at times enter Coffs Harbour to forage or for refuge. These are likely to include the more common species that frequent harbours in NSW such as the Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*) and the Common Dolphin (*Delphinus delphis*).

A number of marine turtles have been sighted in the locality, including Green Turtle (*Chelonia mydas*), Hawksbill Turtle (*Eretmochelys imbricata*) and Loggerhead Turtle (*Caretta caretta*). On occasions these turtles may enter Coffs Harbour to forage or for refuge during migrations along the coastline. In addition, Green and Loggerhead turtles may at times nest along northern NSW beaches.

4.3.3 Fish, sharks and rays

Fish, sharks and rays were observed using subtidal habitats associated with the nearby reef, the seawall, and soft sediment areas. Many of these species, such as the common and more pelagic Yellowfin Bream (*Acanthopagrus australis*), Luderick (*Girella tricuspidate*) and Sea Mullet (*Mugil cephalus*), were observed in all three of these habitats (Table X) and are likely to regularly use resources and move between them all. With its higher complexity, gutters and crevices, the reef provides the most significant fish, shark and ray habitat in the Study Area. This was confirmed by the higher diversity of fish, and presence of some larger species, such as the Ornate Wobbegong Shark (*Orectolobus ornatus*) and Port Jackson Shark (*Heterodontus portusjacksoni*), in the gutters and crevices. Given this reef is of such a small size and limited habitat, isolated inside the harbour, apparently lacks any connectivity with other reefs and is more then 1500m from any known aggregation sites, it is unlikely to be used by the critically endangered Grey Nurse Shark (*Carcharias taurus*).

The reef also provides some marginal potential refuge habitat for the threatened Black Rockcod (*Epinephelus daemelii*), while the seawall may also provide some marginal habitat for juveniles. However, none were found in the Study Area (reef or seawall) during the site survey.

Soft sediment areas are likely to provide habitat for various benthic fish and ray species, while some of the larger ray species are likely to forage around the boat ramp at times.

Other larger and more pelagic species of fish, shark and rays, may also occur in the Study Area at times, typically when entering Coffs Harbour as part of transient visits and/or while foraging. This may at times include the threatened White Shark (*Carcharodon carcharias*), which is regularly sighted close to shore along this area of the coastline.

The lack of seagrasses and established canopy-forming macroalgae beds, and very shallow nature of the boat harbour in places that artificial structures (piles) occur, provide minimal potential habitat within the Study Area for protected Syngnathid fish.

4.3.4 Invertebrates

Intertidal areas of the seawall were found to have an abundant coverage of Rose Barnacles (*Tesseropora rosea*) in higher tidal areas, tube worms (*Galeolaria caespitosa*) in mid areas, and cunjevoi (*Pyura stolonifera*) in lower areas. Other fauna on intertidal sections of the seawall included various limpets, the Mulberry Whelk (*Morula marginalba*) and Sydney Rock Oysters (*Saccostrea glomerata*). The presence of these invertebrates also provided foraging habitat at low tides for some shorebirds. The seawall is also likely to provide habitat for several shore crabs that use the rocky shoreline.

In subtidal areas the Red-throated Ascidean (*Herdmania momus*) and sponges were the most common invertebrates and most abundant on the reef. Other grazing molluscs were noted, with Blacklip Abalone (*Haliotis rubra*) observed in crevices on the reef. The reef, and to a lesser extent the lower section of the seawall, are also likely to provide habitat for a diverse range of smaller, more cryptic species of crustaceans and other invertebrates not observed during the survey.

Soft sediment areas provide habitat for benthic fauna that live on and in the sands. These may include larger crustaceans and echinoderms on the surface and much smaller polychaetes, amphipods and bivalves within the sediments (infauna).

4.3.5 Macroalgae

Macroalgae habitat in the Study Area occurred along the seawall and on the reef. Coralline Algae (*Corallina officinalis*) and Sea Lettuce (*Ulva* sp.) was observed in lower intertidal areas on the seawall. The toe of the seawall was found to also have several common macroalgae species, including the brown alga *Padina crassa*, Gulfweed (*Sargassum sp.*) and the red alga *Pterocladia lucida*. On the reef, macroalgae was typically confined to areas nearer to the reef crest where sand scouring and smothering by macroalgae wrack was less prevalent. Occasional occurrences of the brown alga *Padina crassa* and Gulfweed (*Sargassum sp.*) were observed, however the encrusting brown Sinuous Ballweed (*Colpomenia sinuosa*) and turfing brown and red algae species dominated the available substrate.

Some marginal habitat for the threatened brown marine alga *Nereia lophocladia* was observed where the rocky and sandy habitats meet around the toe of the seawall and on the reef , however it was not found as part of the general description of subtidal flora in the Study Area.

4.3.6 Marine Plants

The Study Area did not include any marine plants such as saltmarsh, mangroves or seagrasses, nor did it appear suitable for the establishment of these species.

4.4 Wetlands of International importance

No wetlands of international importance (RAMSAR) occur within the Study Area or nearby in the wider locality.

4.5 Other Protected Matters

Searches of other protected matters under the EPBC Act identified 97 listed marine species, 29 listings under whales and other cetaceans and one Australian Marine Park for the Commonwealth area of the Solitary Islands Marine Park (See Appendix 3 for further details).

4.6 Key Fish Habitat

The waterways within the Study Area are mapped as Key Fish Habitat (Fairfull 2013). Areas with macroalgae along the toe of the seawalls and breakwater, the natural reef area north of the eastern breakwater and stable marine sediments are considered to be Type 2: moderately sensitive Key Fish Habitat. Areas associated with shoaling and unstable soft sediments are considered to have minimal fauna and considered to be Type 3: minimally sensitive Key Fish Habitat (Fairfull 2013).

4.7 Areas of Outstanding Biodiversity Value

No areas of Outstanding Biodiversity Value occur inside the Study Area, however some areas have been identified behind nearby Jetty Beach due to the presence of Littoral Rainforest (Appendix 2).

4.8 Aquaculture

No aquaculture areas occur in the vicinity of the Study Area

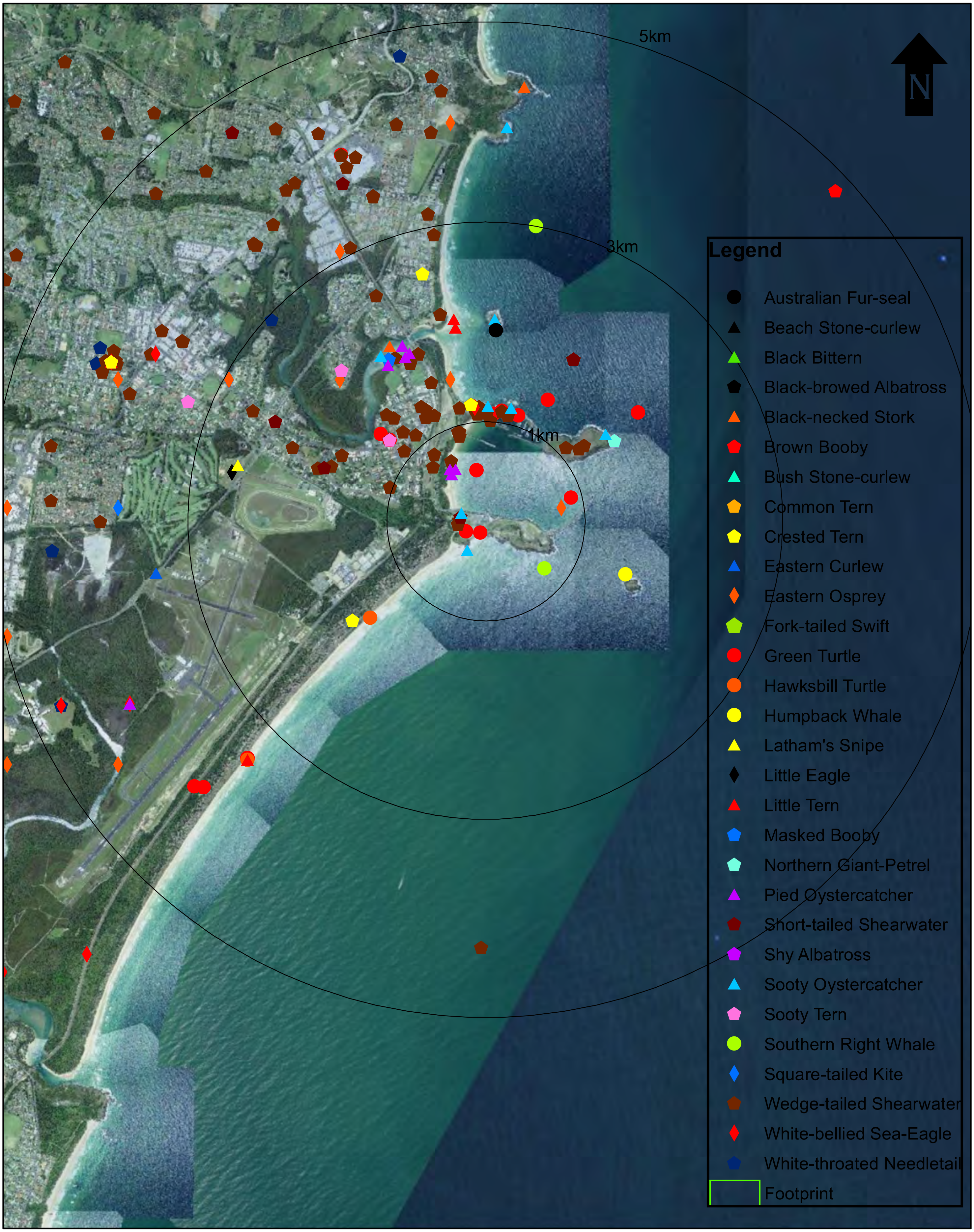

Figure 3: Fauna sightings data

CHRBR Upgrade

0 0.5 1 2 3 Kilometres

Aerial imagery source: Six Maps 2020
Sightings data source: Bionet 2020
Drawings projected in WGS84
Version 1.0; 05/11/2020

5 Impact Assessment

This section provided an assessment of the potential impacts of the proposal on the aquatic environment. Impacts are categorised as direct or indirect as described in DECC (2007), which states:

"Direct impacts are those that directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.

"Indirect impacts occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. As with direct impacts, consideration must be given, when applying each factor, to all of the likely indirect impacts of the proposed activity or development."

A likelihood rating of known, likely or unlikely has been assigned to each of the potential impacts listed in Table 4.

Table 4: Assessment of potential direct and indirect impacts from the proposal.

Impact	Likelihood	Description
Direct		
Removal or modification of shoreline habitat	Known	The shoreline habitat within the proposal footprint consists of man-made seawalls constructed from large ballast rock, which will require some modification, including extension to the north-west.
Removal or modification of intertidal habitat	Known	Intertidal habitat within the proposal footprint consists of man-made seawalls constructed from large ballast rock, piles and pontoon, and concrete surfaces associated with the boat ramp. The seawall will require some modification, including extension to the north-west. The works will include removal and replacement of artificial habitat associated with the boat ramp.
Removal or modification of subtidal habitat	Known	The subtidal habitat within the proposal footprint consists of soft sandy, unvegetated sediments. These sediments will require removal via dredging in places to remove shoaling sands and provide sufficient draught for safe access to and use of the boat ramp.
Harm to marine vegetation (saltmarshes, mangroves, seagrasses and seaweeds)	Known	It is expected the proposed works will result in: • Some removal and disturbance of seaweeds (macroalgae) attached to lower areas of the seawall to be modified, and boat ramp associated structure to be replaced. No saltmarshes, mangroves or seagrasses occur in the Study Area.
Removal or loss of threatened species	Unlikely	It is unlikely that any threatened species will be removed or lost as part of this proposal.
Removal or modification of potential threatened species habitat	Possible	The proposed works may result in removal and modification of some habitat associated with the seawall that could potentially be used by threatened species. This habitat includes • Intertidal habitat used by threatened bird species for foraging. • Intertidal habitat which may potentially be used by seals for refuge. • Subtidal habitat which may potentially be used by fish for refuge. • Subtidal habitat where threatened marine alga may potentially establish.
Disturbance within potential threatened species habitat	Known	During construction works the proposal will result in disturbances during modifications to the seawall to: • Intertidal habitat used by threatened bird species for foraging. • Intertidal habitat which may potentially be used by seals for refuge. • Subtidal habitat where threatened marine alga may potentially establish.

Impact	Likelihood	Description
Disturbance of a threatened population or community	None	No threatened populations or communities are expected to be disturbed by the proposal.
Modification of habitat for a threatened population or community	None	No threatened populations or communities occur in the Study Area.
Disturbance and impacts on other intertidal fauna species.	Known	Disturbance and impacts that will include potential removal of intertidal fauna will occur where intertidal fauna has colonised areas of the existing seawall and boat ramp structures requiring modification.
Increased shading of the seabed from the additional pontoons	Known	Habitat under the additional pontoons consists of unvegetated sediments only, which do not include any light-sensitive communities. Shading of these areas would have minimal ecological significance.
Disturbance and impacts on other subtidal fauna species	Known	Disturbance of fish that utilise resources associated with the seawall and soft sediments to be dredged will occur. Some benthic invertebrates and infauna will likely be removed and lost during the dredging works.
Fragmentation of habitat	Unlikely	The proposal is not expected to result in the fragmentation of any habitat. In most part, it will be confined to the existing footprint and artificial/man-made features in the area.
Increased artificial lighting with potential to impact on fauna habitat.	Possible	Some fauna groups are susceptible to impacts from artificial lighting on their habitat. This is most relevant for species of shore and marine birds that may use areas of the adjacent shoreline for nesting or roosting at night.
Generation of underwater noise with potential to impact on marine mammals, fish, sharks, rays and turtles.	Possible	Construction works to extend the seawall, increased vessel movements and piling associated with construction for this project will result in the generation of underwater noise. There is potential that this noise may potentially cause behavioural and physiological impacts to marine fauna, especially marine mammals.
Indirect Impacts		
Mobilisation of sediments impacting on habitat within and adjacent to the proposal footprint	Likely	Mobilisation of sediments from this proposal will likely occur during dredging works and construction works to extend the eastern breakwater. Adjacent habitats associated with other areas of the breakwater and nearby reef may receive short-term increases in sedimentation, which may impact on the habitat quality and sessile invertebrate and macroalgal assemblages in these areas.
Mobilisation of sediments with contaminants and microplastics	Possible	Dredging works will disturb sediments and result in mobilisation of any contaminants if present or microplastics, which may impact on surrounding habitat, water quality and fauna.
Reduction in water quality from construction works	Likely	Mobilisation of sediments from this proposal will likely occur during dredging works and construction works to extend the eastern seawall. Some short-term and localised disturbances to water quality from elevated turbidity and suspended solids are likely occur during construction works. Reduced water quality may have some short-term and localised impacts on habitat quality within Coffs Harbour.
Generation of underwater noise with potential to impact on habitat quality of marine mammals, fish, sharks, rays and turtles.	Known	Construction works to extend the seawall, increased vessel movements and piling associated with construction for this project will result in the generation of underwater noise. There is potential that this noise may reduce habitat quality for some marine fauna, especially marine mammals.
Impact on water quality from unplanned spill during construction works	Possible	Construction works will likely require some machinery mounted from floating barges. Where machinery is operating on or over the water, unplanned spills may quickly enter the adjacent water. Reduced water quality and hydrocarbon-based contaminants can have significant and fatal impacts on marine fauna if they are not diluted, removed and /or dispersed from the area.
Increased indirect shading of adjacent areas of the seabed from the additional pontoons	Possible	The extended northern pontoon may result in some additional partial shading of macroalgae associated with the lower section and toe of the seawall.
Invasion or spread of non-native or invasive species	Possible	Equipment brought to the site during construction works has potential to introduce non-native or invasive species from other areas.
Removal of structures with marine growth	Known	Removal of marine structures with growth will provide some short-term and localised reductions in habitat quality for marine fauna that use these areas for refuge, and fish that may forage for prey amongst these structures.
Injury caused by ingestion of, or entanglement in, harmful marine debris	Possible	Materials used during construction work that are not contained or disposed of correctly have potential to find their way into the water.

Impact	Likelihood	Description
Increased potential for vessel interactions during construction works	Likely	Some air breathing marine fauna, especially marine turtles are vulnerable to vessel strike. Vessel strike can result in series injuries and in many cases can be fatal for marine fauna.

5.1 Water Quality

Dredging mobilises sediments into the water column as sediments are removed from the seabed. Dewatering on the adjacent shoreline may also result in some flow back into the harbour of waters with high loads of sediment. Increases in suspended sediments in the water column can alter physical chemistry of the water, increase turbidity and reduce available light to the seabed. These suspended sediments will eventually settle on the seabed, which in some areas can impact on reef communities and marine vegetation (Clark 2001).

The impacts of this proposal are considered to be very localised due to the small volume of material to be dredged (900-1500m^3), while the coarse nature of the clean marine sands will likely facilitate their settlement out of the water column quickly in comparison to finer sediments. The majority of benthic habitat within the harbour is unvegetated sands that is at minimal risk from any sedimentation. However, the reef north of the eastern breakwater will be in close proximity to these works and may potentially be impacted by some sedimentation and increased water turbidity. The water column above this reef appears to be naturally very turbid due to its shallow nature and close proximity to shore, so these impacts are likely to be minimal on the assemblages that occur there.

Other impacts on water quality can occur as the result of unplanned discharged and accidental spills on construction sites, such as hydrocarbon-based products accidentally entering the marine environment. Once released into the marine environment hydrocarbons can form a thin layer on the water surface that can impact on adjacent shorelines and marine birds, mammals and reptiles that come to the surface to breathe (Clark 2001). Preventative checks and thorough environmental management planning and adherence during construction works will be required to minimise the potential for unplanned discharged and accidental spills.

5.2 Sediment Quality

The mobilisation of sediments has potential to collaterally mobilse any contaminants buried within those sediments. Such existing contaminants in the marine environment may include heavy metals, pesticides and polychlorinated biphenyls (PCBs) (Clarke 2001). Testing of the sediments within the Study Area identified that the potential for these contaminants pose a low risk(Regional Geotechnical Solutions), so the potential to mobilise contaminants as a result of this proposal is considered low.

Micro plastics are widespread problem throughout the marine environment and have become an emerging management issue in recent years (Andrady 2017). Given their presence in all components of the marine environment, including marine organisms (Alimba and Faggio 2019), as well as the locality of the Study Area (i.e. in a developed area where substantial pollution inputs and human disturbances are known to be significant), the presence of micro plastics amongst sediments to be dredged is probable. Consequently, the dredging works will likely mobilise and spread some microplastics. This is unavoidable, but is not expected to result in any overall increases in microplastics in the marine environment.

5.3 Marine Habitat

Impacts on marine habitat and vegetation from this proposal will include:

- Disturbance, modification and/or removal of artificial habitat during modification and/or removal of the seawall and existing structures associated with the boat ramp, including intertidal and subtidal habitat.
- Disturbance and removal of soft sediment habitat during dredging works.
- Increased shading of the seabed from the additional and extended pontoons.
- Potential for indirect impacts through changes in sediment accretion on reef habitats associated with the seawalls, breakwater and the offshore reef.
- Reduced habitat quality due to short-term disturbances to water quality and the generation of both underwater and construction noise, and a possible reduction in prey species for larger species.

5.3.1 Artificial and man-made structures in the Project Area

Shoreline areas of intertidal habitat will be modified, which may require some removal, repositioning and replacement of ballast associated with the seawalls inside the boat ramp basin. This will include shallow areas of ballast rock along the southern side of the boat ramp basin and at the southwestern corner of the entry channel. In addition, some removal, repositioning and replacement of ballast rock will likely occur at the northern end of the existing easterly breakwater that requires extension. These areas are used by both marine and shorebirds (especially at low tide), colonised by macroalgae and sessile invertebrates, and frequented by grazing gastropods, crustaceans and fish. Construction works will result in additional noise, both outside and in the water, physical disturbance and removal of some habitat. This habitat will, however, be replaced by additional seawall armouring inside the boat ramp basin and along the extended breakwater. The extended breakwater will also likely result in a net positive gain in artificial habitat for marine species in the Study Area over the longer term.

5.3.2 Reef habitat in areas adjacent to the Project Area

Reef habitat in adjacent areas includes both artificial and natural habitats. Artificial reef habitats are associated with the lower section and toes of the seawalls inside Coffs Harbour, which extend east from the breakwater and west from the boat ramp basin entry channel. Natural reef habitats occur approximately 150m east of the existing breakwater and extend in a westerly direction towards Jetty Beach. This reef is located approximately 75m from the proposal footprint and is the only known area of permanent natural offshore reef habitat within Coffs Harbour. Near its crest, the reef provides crevices, deep cracks and an elevated level of habitat complexity for marine species not offered by artificial habitat within the harbour. Given this, it likely provides a significant area of refuge for some benthic sharks and a positive effect on the attraction of reef fish into the harbour. This reef is, however, located in a very dynamic area of the harbour, and regular covering and scouring via the movement of sands, along with smothering by accumulations of macroalgae that are washed into the harbour, appear to impact on the habitat quality around the edges and shallow margins of this reef.

Coastal process investigations predict that impacts on this reef may include some scouring affect as a result of a negative accretion rate of 21 to 29 cm/yr (MHL 2020). This may result in some expansion and uncovering of the reef around its edges and in areas where bathymetry data indicates it may be inconstant as it is periodically covered by sand. These small amounts of negative accretion are not expected to impact on reef complexity and the habitat it provides for fauna amongst its cracks and crevices.

5.3.3 Soft sediment habitat

Soft sediment habitat in the project area consists of clean marine sands. These sediments provide habitat for benthic fish and epibenthic and infaunal invertebrates. Most fish and mobile epibenthic invertebrates are likely to move away from the area once the disturbance commences. Infauna, however, are typically most abundant within the upper 100mm of sediment (Morrisey et al. 1992) and will likely be removed during the dredging works. The areas of soft sediments in the entry channel to the basin are currently being regularly deposited and then removed by a mechanical dredge, so these areas of sediment are likely to have minimal abundances of infauna due to their mobilised nature.

5.4 Marine Species

The works have potential to impact on several groups of marine species, which include some threatened and migratory species. These groups include:

- Marine and shorebirds
- Marine mammals and reptiles
- Fish, sharks and rays
- Invertebrates
- Macroalgae

5.4.1 Marine and shorebirds

Marine and shorebirds may regularly use the seawall and structure associated with the boat ramp in the Study Area to forage, rest or roost and potentially nest at times. Such species are known to include gulls, terns and cormorants, which are common in coastal areas along the NSW North Coast. Impacts on these birds may include short term disturbances to habit quality relating to reduced water quality, lower prey abundances, construction noise, modification of some to the existing rocky shoreline habitat and potential for increased artificial light sources from the upgrade to lighting, which may impact on any birds that roost at night or nest near the upgraded facilities.

The vulnerable Sooty Oystercatcher (H*. fuliginosus*) is known to forage at low tide in intertidal areas on the seawall and breakwater within the Study Area. The Sooty Oystercatcher typically forages along rocky shorelines and amongst tidal pools along the NSW coastline (NSW Scientific Committee 2008). Construction works will result in the disturbance and some short-term removal of this habitat, however similar habitat is available within the harbour, which in most part is armed by seawalls and sheltered by breakwaters. Additional assessment through a 5-Part test was undertaken for the Sooty Oystercatcher (Appendix 4). This assessment concluded the species is unlikely to be significantly affected by the proposed activity. The proposal will result in some disturbances during construction and modifications to a very small area of shoreline. Overall, these modifications are expected to result in additional potential habitat for the Sooty Oystercatcher once construction is completed.

The Pied Oystercatcher (*H. longirostrisi)*, which typically forages on intertidal flats of inlets and bays, open beaches and sandbanks (DPIE 2020), was found to have a moderate likelihood of occurrence. Changes to sand accretion at the southern end of Jetty Beach has some potential for indirect impacts on habitat for this species. Additional assessment through a 5-Part test was undertaken for the Pied Oystercatcher (Appendix 4). This assessment concluded that the species is unlikely to be significantly affected by the proposed activity. The species has only a moderate likelihood of occurrence in this area, while the adjacent sandy shoreline areas associated with Jetty Beach and waters within and adjacent to the Study Area provide only marginal habitat for the species.

A wide diversity of other marine birds that forage along the coastline are likely to forage in waters within the Study Area at times. These species are typically birds of flight that spend the majority of their time in coastal areas foraging aerially over very large areas of water along the coastline and at sea (SEWPAC 2012). Marine birds that may use resources in the Study Area include several species of migratory and threatened shearwaters (*A. carneipes*, *grisea, pacifica,* and *tenuirostris*), some of which also breed on nearby Islands (NPWS 2016). Given this, the waters inside Coffs Harbour and at times within the Study Area are likely to contribute to important feeding grounds for these species, particularly during the breeding season, which typically occurs in the Solitary Islands and on Muttonbird Island following their arrival in August, with nesting commencing in November and continuing until the adult birds leave in early April and fledgling chicks in late May (NPWS 2009). Other migratory marine birds known to occur in the Study Area include the Crested Tern (*T. bergii*), Lesser Frigatebird (*F. ariel*), Common Tern (*Sterna hirundo*) and Little Tern (*S. albifrons*). These marine birds typically forage over the water and rely on detecting prey aerially from above (NPWS 2004; Billerman et al. 2020; DAW 2020; DPIE 2020). Potential impacts on the water quality of waters used to forage by these birds has potential to affect foraging habitat quality of these species. This may be through reduced prey detection success from waters with elevated levels of turbidity (Lunt and Smee 2015), or due to a reduction in prey abundance. Impacts on these marine birds have been considered further as part of a 5-Part test and through the Impact Assessment Criteria. This assessment concluded that marine birds are unlikely to be significantly affected by the proposed activity. Potential impacts on marine birds from this proposal are confined to areas of marginal habitat inside the Study Area, where some minor modifications to artificial habitat and short-term disturbances during construction may occur. Further, the adjacent sandy shoreline at the southern end of Jetty Beach is not considered to be significant for roosting and nesting by migratory and marine birds such as the Little Tern.

5.4.2 Marine mammals

Some smaller marine mammals such as dolphins and seals may enter the harbour at times. There is potential that marine mammals may be impacted by disturbances during construction works. Piling produces noise levels that are amongst the highest recorded for construction activities (DPTI 2012) and may impact on marine mammals (MacGillivray 2013). Other lesser sources of underwater noise may include vessel operations associated with construction. Many marine mammals that may occur in the Study Area and adjacent waters, including Bottlenose Dolphins (*Tursiops truncates)* and Fur Seals, are susceptible to underwater noise. The most likely impact of underwater noise on marine mammals will be a short-term reduction in habitat quality. This may result in many species of marine mammals, especially dolphins, avoiding the area during such works. Short-term impacts of underwater noise on marine mammals can be divided into two categories: behavioural and physiological. Behavioural impacts may include changes in: vocalisation, resting, diving and breathing patterns; mother-infant spatial relationships; avoidance of the noise source; interference with animal communication; and hinderance of acoustic signal detection (DPTI 2012, Erbe 2012, Faulkner et al. 2017). Physiological impacts are typically considered to be auditory injuries, which can result in a reduction in the animal's hearing sensitivity, or an increase in hearing threshold that may result in lesser be temporary threshold shift (TTS) or great permanent threshold shift (PTS) to animals hearing (DPTI 2012). Piling works associated with this proposal are minimal, confined to two piles, and likely to be completed in 1-2 days. The level of impact from piling noise also, however, depends on the type of piling and the frequency range of the target species. Impact piling is estimated to generate a Sound Pressure Level (SPL) of 180–235 dB re 1 µPa with peak levels up to 190–245 dB re 1 µPa, while vibro-driving is typically slightly less loud at a SPL of 160–200 dB re 1 µPa (DPTI 2012). While there are no quantitative national guidelines on acceptable exposure levels of marine mammals to underwater noise, the South Australian Government's Underwater Piling Noise Guidelines (DPTI 2012), which are based on research by Southall et al (2007) on behavioural and physiological impacts, are the accepted guide on the levels.

Dolphins are unlikely to spend substantial periods of time inside the harbour, although they may enter the harbour at times. The underwater noise exposure criteria for behavioural impacts on dolphins is a SPL of 160 dB re 1 µPa for impact driving and a SPL of 120 dB re 1 µPa for vibro-driving, while the physiological noise exposure criteria is a peak SPL of 224 dB re 1 µPa for impact piling and a SPL of 180 dB re 1 µPa for vibro-driving (DPTI 2012). Given this, all piling is likely to have a behavioural impact on any dolphins, while impact piling can potentially have physiological impacts on dolphins if close enough to the noise source. Physiological impacts on dolphins are not expected to occur unless they are in close proximity to the source such as inside the boat ramp basin itself, however underwater noise from piling may have behavioural impacts on any dolphins inside the harbour.

The vulnerable Australian Fur-seal (*Arctocephalus pusillus doriferus*) may potentially occur in the Study Area. These seal species may spend days or months inside harbours during their visits. During these visits they are likely to utilise areas of rocky intertidal shoreline to haul out, rest and take refuge. The rocky intertidal shoreline inside the Study Area provides such potential habitat for these species. If present in the vicinity, construction works may disturb any Australian Fur Seals utilising adjacent intertidal habitats to rest, or reduce prey availability in close proximity to their refuge habitat on the shoreline. While in the water Australian Fur-seals may also be impacted by underwater noise. The underwater noise exposure criteria for behavioural impacts on pinnipeds is also a SPL of 160 dB re 1 µPa for impact driving and a SPL of 120 dB re 1 µPa for vibro-driving, while the physiological noise exposure criteria is a Peak SPL of 2212 dB re 1 µPa for impact piling and a SPL of 190 dB re 1 µPa for vibro-driving (DPTI 2012). Given this, Fur-seals would likely need to be inside the boat ramp basin itself for the piling to have a physiological impact, however the piling potentially could have behavioural impacts on any Fur-seals present in harbour waters during piling works. Impacts on Australian Fur-seals have been considered further as part of a 5-Part test. This assessment concluded that the Australian Fur-seal is unlikely to be significantly affected by the proposed activity. Habitat use in the vicinity of the Study Area is likely to be very occasional, if at all, and likely restricted to occasional individual visits during transient movements along the coast. In any case, potential impacts would be confined to short-term disturbances in habitat quality.

5.4.3 Marine reptiles

Some marine reptiles may be transient visitors to the site at times. These include the Green Turtle (*Chelonia mydas*), Loggerhead Turtle (*Caretta caretta*) and Hawkesbill Turtle (*Eretmochelys imbricata*). Increased vessel interactions and potential ship strikes are key threats to marine turtles. Some additional vessel operations will be required during construction works, although vessel movements in association with construction works are expected to be minimal in comparison to recreational vessel movements that occur in the area. The proposal may also result in potential for permanently increased risk of vessel strike as a result of additional capacity and subsequently use of the facility following construction. Another major threat to marine turtles is entanglement in or ingestion of marine debris. Any construction materials not disposed of correctly and/or which end up in the water could become an entanglement risk or be ingested by marine turtles.

There is also potential that disturbances to water quality and generation of underwater noise will result in reduced habitat quality for marine turtles during construction works. Marine turtles are not considered as sensitive to underwater noise as some fish and marine mammals, however there is anecdotal evidence that marine turtles may still experience acoustic annoyance and mild tactile detection or physical discomfort from underwater noise (Viada *et al* 2008), with mortality possibly occurring at 210 dB SE_{cum} (Popper and Hawkins 2018).

Green Turtles and Loggerhead Turtles may also sporadically, and in low densities, nest on beaches in northern NSW (DPIE 2020). There is potential for changes in coastal processes facilitated by the extended breakwater to reduce sand accretion at the southern end of Jetty Beach. This area does provide some very marginal potential habitat that could potentially be used by marine turtles to nest; however, given it is a busy beach with high levels of human disturbance, and not a known nesting spot for marine turtles, potential risks to nesting marine turtles in this area is considered low.

Additional assessment through a 5-Part test and Significant Impact Criteria was undertaken for marine turtles (Appendix 4). This assessment concluded that marine turtles are unlikely to be significantly affected by the proposed activity. Habitat use in the vicinity of the Study Area is considered to be only very occasional and represents a very small proportion of the range these species forages across in the wider locality. The habitat is also not critical to their lifecycle, with any nesting on adjacent areas of Jetty Beach considered rare and unlikely.

5.4.4 Fish, sharks and rays

Many of the impacts on the fish assemblage from the proposal are likely to be confined to the smaller, less motile and more cryptic species, including juveniles of some larger species, especially those that live amongst areas of the seawalls and breakwater that will require modification. Some short-term disturbances to benthic fish, sharks and ray species associated with soft sediments may also occur during dredging works. Other construction works may also generate underwater noise, with potential for both direct and indirect impacts of fish (Dahl et al. 2015), sharks and rays (Chapuis et al. 2018). Interim guidelines developed for fish identify triggers for TTS at >186 dB SEL_{cum}, recoverable injury at 203 dB SEL_{cum} and mortality at 207 dB SEL_{cum}, while for sharks and rays these are TTS at >186 dB SEL_{cum}, recoverable injury at 216 dB SEL_{cum} and mortality at 219 dB SEL_{cum} (Popper and Hawkins 2018).

Additional indirect impacts on fish, sharks and rays as a result of habitat disturbances and modification may also occur as a result of the proposal. These include changes to nearby offshore reef habitat facilitated by proposal-induced changes in coastal processes, and short-term disturbances to habitat quality from reduced water quality.

The majority of the fish assemblage associated with the seawalls and breakwater will likely move to adjacent areas of similar habitat during construction. Similarly, benthic fish, shark and ray species associated with softs sediment areas will also likely move to adjacent areas in the harbour if disturbed. Given the extent of impacted areas will be minimal in comparison to the remaining available habitat in adjacent areas, these impacts are not expected to have ecologically significant impacts on species that use these habitats.

The area of reef provides one of the only areas of natural reef in the harbour, although it appears heavily scoured and smothered in algal wrack in places. This reef is also likely inconstant in places; however, it does exhibit high levels of complexity and habitat value nearer to its crest. This habitat was found to support a range of benthic shark species and provide potential habitat for cryptic fish species such as the Vulnerable Black Rockcod (*Epinephelus daemelii*). No Black Rockcod were found during the site survey on the reef or habitat associated with seawalls and breakwater. While use of this potential habitat currently appears unlikely given that this species has a high level of site fidelity (Malcom and Harasti 2010), temporal variability in habitat use by Black Rockcod remains very poorly understood (Malcom and Harasti 2010). Indirect and longer-term impacts in the form of habitat changes to the nearby reef as a result changes in sediment accretion are considered to be of minimal potential impact on fish, sharks and rays from the proposal. Accretion is expected to be negative and low resulting in scour rather than any smothering (MHL 2020).

Should Black Rockcod be present during construction works, physical habitat disturbance as a result of construction works or underwater noise during piling has potential to impact this species. Further impacts on potential habitat associated with the offshore reef may also occur due to changes in sediment accretion in this area. Impacts on the Black Rockcod have been considered further as part of a 7-Part test and through the Impact Assessment Criteria. This assessment concluded that Black Rockcod are unlikely to be significantly affected by the proposed activity. Potential Black Rockcod habitat inside the Study Area is marginal habitat only and is not expected to be significant to the local population. Impacts from the proposal are restricted to minor modifications of marginal habitat and disturbances during construction works, which may have some localised and short-term influence on habitat quality, if they are present in the Study Area at that time.

In addition to the above, habitat disturbances may reduce habitat quality for larger, more pelagic species of fish, sharks and rays, as well as their prey, during construction works. It is also likely that some larger, transient predatory species, such as the endangered White Shark (*C. carcharias*), may utilise habitat within the harbour at times. Habitat quality for these large predators may be reduced via lower water quality, fewer prey species and underwater noise. Any impacts on water quality are expected to be very minimal and localised and would not be expected to impact large pelagic species such as the White Shark. Most of these species also forage over very large areas that encompass habitats along lengths of the local coastline and around the offshore islands of the SIMP. Any changes in prey item abundance in the Study Area is not expected to be of ecological significance to these species. Underwater noise may also have physiological impacts on pelagic species such as the White Shark if they are in close proximity to the source or inflict behavioural impacts if they are present in nearby waters during piling. Impacts on the White Shark have been considered further as part of a 7-Part test and through the Impact Assessment Criteria. This assessment concluded that the White Shark is unlikely to be significantly affected by the proposed activity. Impacts from the proposal are restricted to some minor modifications of foraging habitat and potential disturbances during construction works, which may include some underwater noise in a small amount of non-core habitat.

5.4.5 Invertebrates

Invertebrates with potential to be impacted include common invertebrates (e.g. molluscs, gastropods and ascidians) associated with intertidal and subtidal areas of the seawall and breakwater to which disturbance will occur during construction. These impacts will be short-term and sessile invertebrates will likely recolonise these areas, and the additional sections of the breakwater to be constructed, rapidly following completion of the construction.

Some more mobile invertebrates (typically crustaceans such as rock crabs, shrimp and isopods) may also occur amongst the existing ballast rock. These species will likely quickly move into adjacent habitats, but there is potential that individuals of some of the more cryptic species may remain attached to the rock or associated marine growth and be removed. Furthermore, the removal of habitat structures that provided refuge will increase the risk of predation of these species until they obtain suitable replacement habitat. Other mobile invertebrates associated with benthic soft sediments are likely to move away once dredging disturbances commence, although there remains potential that some accidental removal will occur.

Disturbance and/or removal of infauna inhabiting the sandy soft sediment during dredging is likely to occur. The impacts on infauna are expected to be confined to proportionally small areas in relation to their overall distribution throughout surrounding soft sediment habitat. Any impacts that do occur are expected to be minimal given that the area to be dredged is part of very active sediment transport pathway with continual and near constant maintenance dredging occurring (MHL 2019 and 2020), and infauna abundances in these sediments likely to be reduced and highly modified already. Post dredging, less frequent dredging requirements and greater sediment stability may assist in the recovery of infauna in this area – a process that has been found to commence within several months of dredging works elsewhere (Wilber and Clarke 2011).

5.4.6 Macroalgae

Several common macroalga species were identified during the survey, however the brown alga *N. lophocladia* was not seen. Some patches of common macroalgae will likely be disturbed during modifications to the seawalls and breakwater, however these algae will likely re-colonise the impacted existing and new structures following construction works. Periodic exposure of the site to large north-easterly swells is also likely to be have regular disturbances of these macroalgae assemblages irrespective of the proposal. Some macroalgae on the nearby offshore reef may also be indirectly affected by changes to sand accretion rates (MHL 2020). This may impact on macroalgal assemblages towards the sand-rock interface and in low profile areas. However, existing sediment transport pathways appear to be influencing habitat in some areas towards the edge of this reef and influencing its extent, resulting in the reef appearing to be inconstant in some areas, especially closer to shore. Furthermore, the area between the breakwater and offshore reef appears to capture a large amount of wrack and detritus, reducing water quality and smothering the seabed nearer towards the southern edge of the reef. These existing processes are likely to limit the establishment of some macroalgae and may result in significant levels of scouring in places at times.

Targeted surveys done in 2019 in preparation for this project did not find *N. lophocladia* along the eastern side of the breakwater or on the southern side of the harbour (Kelaher and Mamo 2019). The small area of offshore reef north of the breakwater may also provide some marginal habitat for *N. lophocladia*. While this reef is not expected to be directly impacted, any prolonged impacts on water quality or potential changes in accretion rates of sediment may have indirect impacts on this reef. Given the species is described to prefer the sand-rock interface of reefs (Yee et al 2017), any changes in sediment accretion on the reef would have potential to impact on the habitat of this species if present in this area. Further targeted surveys of this reef during November 2020 (Kelaher 2020), also did not find *N. lophocladia* on this reef and concluded the shallow turbid characteristics provided only very marginal habitat for the species.

6 Recommendations and Conclusions

6.1 Recommendations

This section details recommendations for measures to avoid, minimise and mitigate ecological impacts on the marine environment. The recommendations have been provided for pre-construction, construction and post-construction phases of the project.

6.1.1 Pre-Construction:

The following actions are recommended to be completed prior to construction works:

- Finalisation of detailed design should give consideration to the replacement and extended seawall and breakwater structures to be constructed with materials similar to those that are currently in place.
- Finalisation of detailed design of upgraded lighting should include liaison with NPWS to determine appropriate lighting to minimise potential impacts on marine and shorebirds that may nest in the area.
- Additional survey of the seawall and reef for threatened Black Rockcod within 4 weeks prior to construction works. This should be undertaken to ensure the species has not recruited to these areas since the original survey as part of this investigation. Should Black Rockcod be found, further consultation and the preparation of an appropriate management plan will need to be negotiated with DPI Fisheries.
- Inspection of the seawalls, breakwater and southern end of Jetty Beach for evidence of nesting marine birds, shorebirds and marine turtles within 4 weeks prior to construction works. Should nesting fauna be found, further consultation and the preparation of an appropriate management plan will need to be negotiated with DPIE and/or NPWS.

6.1.2 During Construction

The following actions are recommended to be implemented during construction works. It is recommended that these be adopted into the Construction Environmental Management Plan (CEMP) for the works.

- Adequately manage and store waste products and material in designated areas on the site.
- All construction vessels and work locations are to have designated litter disposal bins to avoid potential for marine debris.
- All machinery should be routinely checked for leaks, with an emergency spill kit to be kept on site at all times. All staff are to be made aware of the location of the spill kit and trained in its use.
- All fuels and hydrocarbon-based products are to be stored in a bunded area away from the waters edge.
- Construction vessels should travel at no greater than 8 knots of speed within 500m of the proposal footprint during construction works to minimise potential for interaction and/or vessel strike on marine fauna.
- To manage impacts of underwater noise on marine fauna, the following is recommended during piling works:
    - The entire harbour is to be considered an observation zone for marine mammals and turtles.
    - The observation zone should be monitored for marine mammals and turtles for a period of no less than 30 mins before start-up of piling.

- A soft start-up procedure should be implemented to provide fish, sharks and rays, as well as intertidal fauna such as birds, an opportunity to move away from the area. This procedure should include a gradual increase in piling impact energy over a 15 minute time period starting from no greater than 50%. This should be implemented at the start of each day or after a pause in piling works of 30 minutes or greater.
- A shut down zone for marine mammals and turtles should be implemented for an area that extends 500m from the entrance to the boat ramp basin. Incursions of marine mammals and/or turtles into this zone during piling operations triggers a temporary shut down of piling operations.

Further guidance of managing piling works can be found in the SA Underwater Piling Noise Guidelines (DPTI 2012).

- During dredging works water turbidity or suspended solids should be regularly monitored at the source, as well as at distances of 100m and 500m from the source. Visual monitoring of any pluming should also be routinely monitored. Where practical, silt curtains should be positioned around the disturbance source during the dredging works.
- If sediments require dewatering on site, suitable bunding and/or sediment erosion fencing should be constructed to minimise any flow of waters with high loads of suspended solids back into the harbour.
- No domestic animals are to be brought onto site during construction works to minimise potential for disturbance of any shorebirds.
- Should shorebirds be foraging in intertidal areas within 50m of active construction works, reasonable care should be taken to ensure that the birds are not harmed in any way.
- If any marine or shorebirds are found to be nesting, or Fur-seals resting within 100m of the project area during construction works, the works should cease immediately and the local NPWS office notified.
- The contractor should liaise monthly with the local NPWS office to ensure no nesting turtles are using Jetty Beach.

6.1.3 Post-Construction

At the completion of construction works the following actions are recommended.

- All waste and construction materials are removed from the site.
- All environmental controls such as sediment fencing are removed from the site.
- Introduction of a reduced vessel speed limit of 4 knots for waters to the west of the extended eastern breakwater should be considered to mitigate for the risk of future vessel strikes on marine fauna.

6.2 Conclusions

Direct impacts from this proposal will include some disturbance of existing artificial habitat provided by the seawall and breakwater within the Study Area, however the proposal will result in a significant amount of additional, similar habitat being created as part of the proposed breakwater extension. The removal and modification of some lower sections of the seawall will likely have short-term impacts on some common macroalgae in the form of dislodgement or removal. Some threatened and migratory marine fauna (e.g. shorebirds) are known to use and others (e.g. fish) may use habitat associated with these structures. Careful management of these species will be required should they be present during construction works.

Direct seabed disturbances from dredging and construction of the extended breakwater are confined to unvegetated and very mobile marine sands. Indirect impacts in the form of changes in patterns of sand accretion as a result of the extended breakwater may also affect the nearby reef and southern end of Jetty Beach. In addition, upgraded lighting may also impact adjacent intertidal and/or supratidal habitat use, although these areas are not considered to be of ecological significance to any threatened or migratory populations of marine fauna.

Construction works will have some short-term disturbances on habitat quality. These disturbances will include construction noise in intertidal and supratidal areas, underwater noise during piling works and some periods of reduced water quality during dredging. The piling works associated with this proposal are very minimal and expected to only result in short-term disturbances. The dredging works will be confined to clean marine sands close to the boat ramp basin entry and any water quality disturbances are expected to be very localised to the south-eastern corner of the harbour.

The proposal is considered unlikely to have a significant impact on State and/or Commonwealth listed threatened biodiversity. As such, referral to the Department of the Environment under the EPBC Act is not required. Similarly, the preparation of a Species Impact Statement (SIS) based on the provisions of the BC and FM Act should not be required. However, based on the NSW Policy and guidelines for fish habitat conservation and management, a *Section 205 - permit to harm (cut, remove, damage, destroy, shade etc.) marine vegetation (saltmarshes, mangroves, seagrass and seaweeds)* will likely be required. A *Section 199 consultation for dredging and reclamation* for the proposed dredging and extended seawall is also likely to be required from DPI Fisheries.

To manage the potential risks that this proposal may pose to marine habitat, flora and fauna, the potential for impacts to adjacent habitat during construction from noise, reduced water quality and the mobilisation of sediments, and the generation of underwater noise, a series of recommendations have been provided. These recommendations should be adopted into the CEMP for construction works for this proposal.

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7 References

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Plates

Plate 1: Existing boat ramp, pontoons, seawalls and breakwater.

A: Boat ramp, B: existing pontoons, C: basin entry channel and seawalls, and D: eastern breakwater.

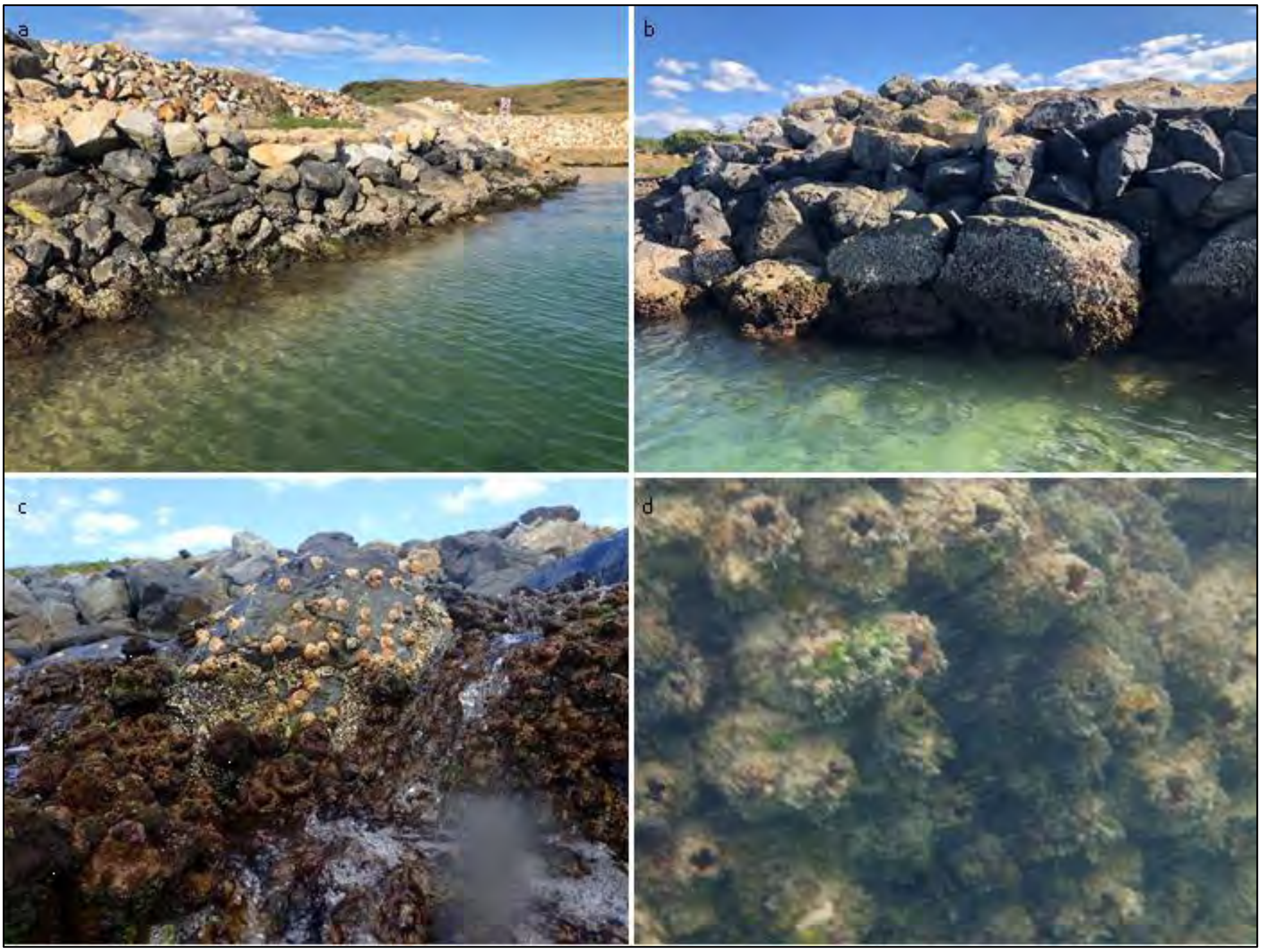


Plate 2: Intertidal habitat in the Study Area.

A: lower rocks along the seawalls inside the boat ramp basin, B lower rocks outside the boat ramp basin, C: Cunjevoi and barnacles at low tide, and D: cunjevoi with turfing green alga *Ulva lactuca*.

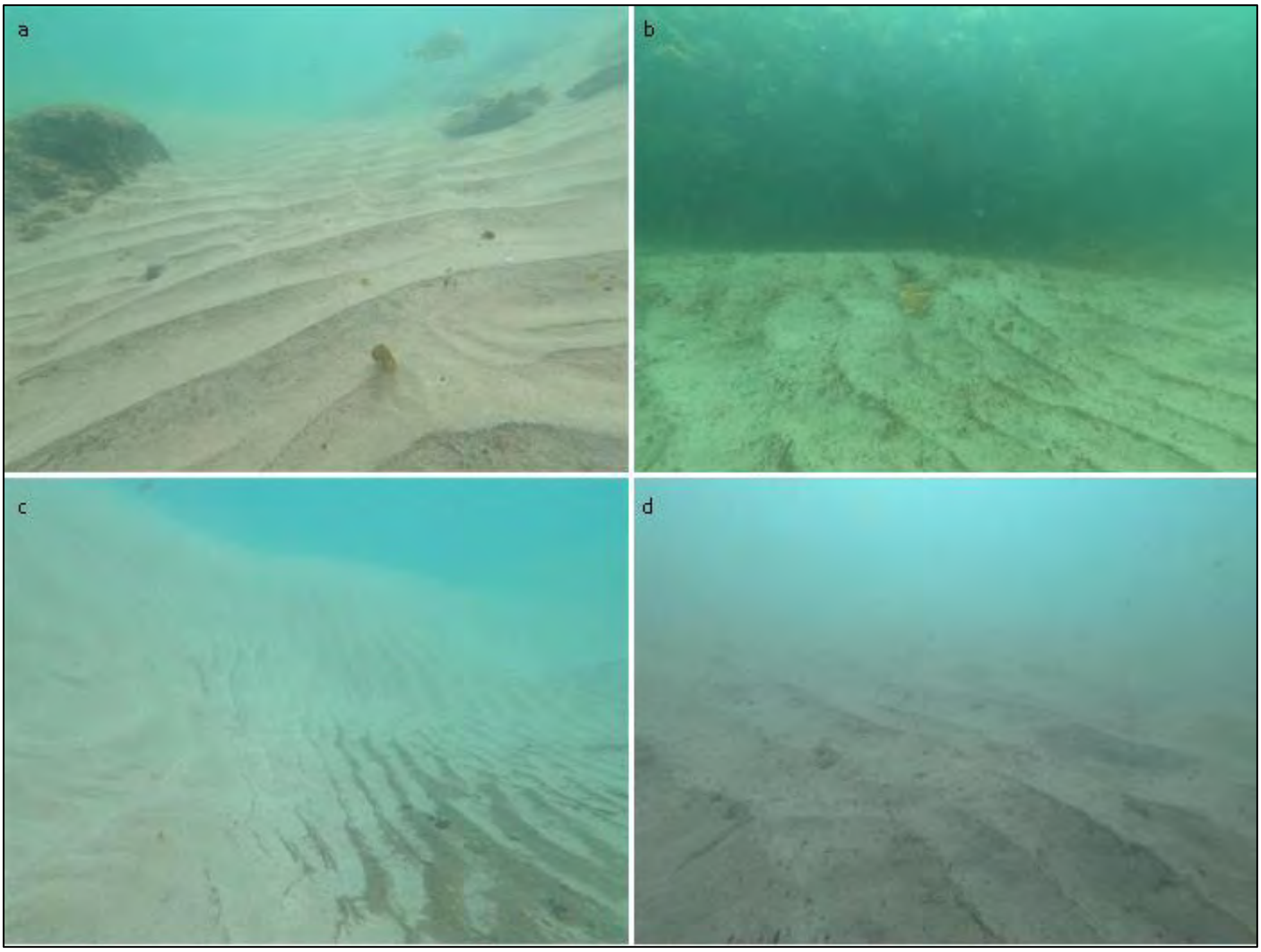


Plate 3: Soft sediment habitat within the Study Area.

A:Clean sands and rock near the toe of the seawall inside the boat ramp basin, B: sand at the toe of the eastern breakwater, C:shoaling sands at the entrance to the boat ramp basin, and D: unvegetated sands immediately north of the head of the breakwall.

Plate 4: Sub-tidal habitat in the Study Area.

A: Brown seaweed *Sargassum* sp. along the edges of the seawalls, B: Sand scoured rock at the toe of the breakwater, C: Turfing algae and sessile invertebrate dominated habitat on the adjacent reef , and D: A puffer fish with encrusting sponges on the adjacent reef.

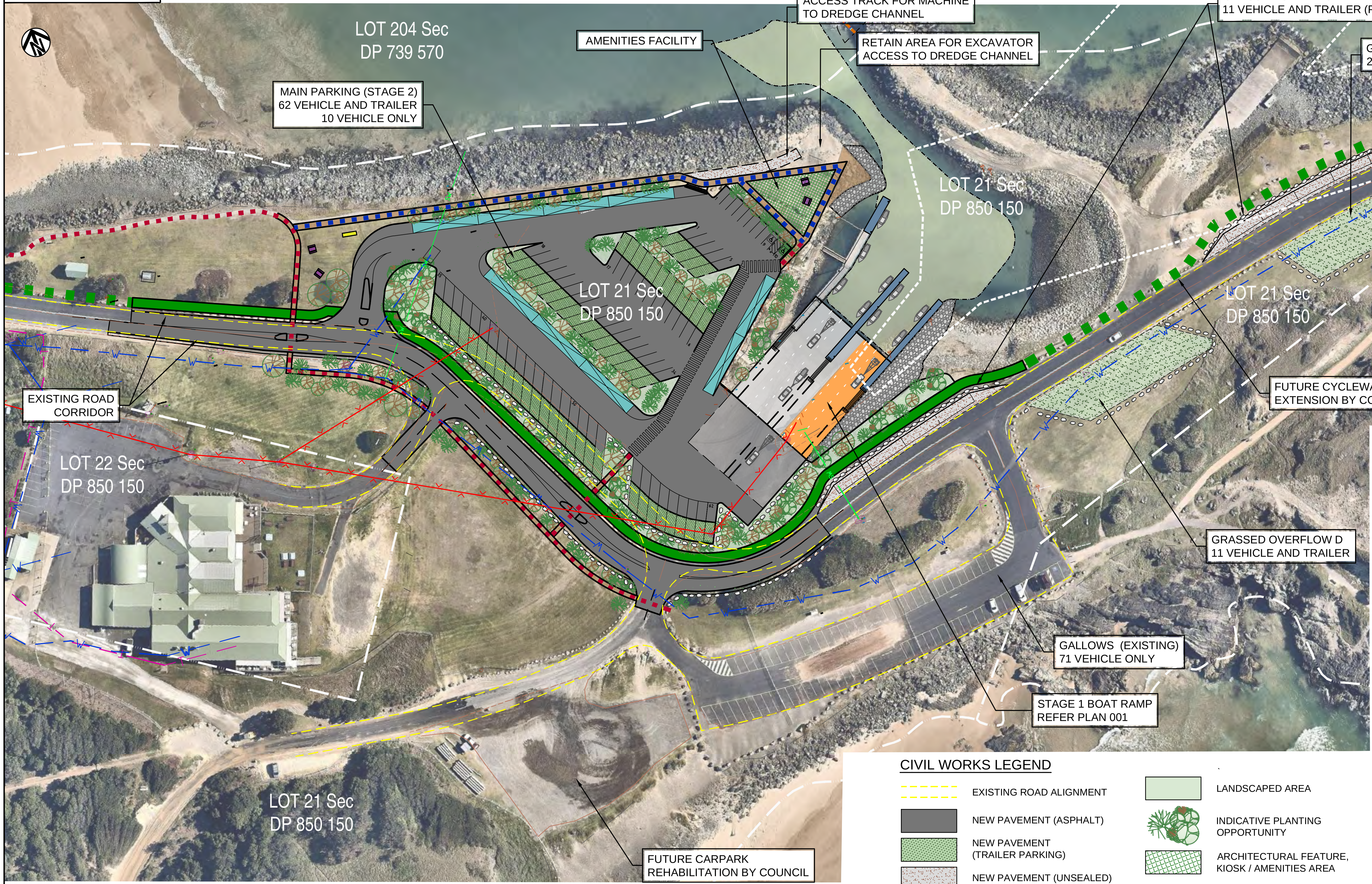
Appendix 1: Design Drawings

A1.1: Stage 1 Masterplan

A1.1: Stage 2 Masterplan

DRAWING No.
PA2431-STG- 002

DO NOT SCALE



CIVIL WORKS LEGEND

- - -	EXISTING ROAD ALIGNMENT
■	NEW PAVEMENT (ASPHALT)
▨	NEW PAVEMENT (TRAILER PARKING)
▨	NEW PAVEMENT (UNSEALED)
▨	OVERFLOW PARKING (GRASSED)
○○○○	OVERSIZE ROCK PLACE IN VERGE (MATCH EXISTING)
▮▮▮▮	PEDESTRIAN ROUTE AND 1.8m CONCRETE FOOTPATH
▮▮▮▮	PEDESTRIAN ROUTE AND 1.5m CONCRETE FOOTPATH
🟩	2.5m SHARED PATHWAY
■ ■ ■ ■	2.5m SHARED PATHWAY (FUTURE EXTENSION BY COUNCIL)
🟩	LANDSCAPED AREA
●	INDICATIVE PLANTING OPPORTUNITY
▨	ARCHITECTURAL FEATURE, KIOSK / AMENITIES AREA
■ ■	SEATING AND TABLE AND FISH CLEANING BENCH
▨	RIGGING AND DE-RIGGING BAYS
12.5m	DESIGN VEHICLE
— SW —	EXISTING STORMWATER
— W —	EXISTING WATER MAIN
— E —	EXISTING O/H ELECTRICAL

	EXISTING (STAGE 1)		TOTAL STAGE 2	
LOCATION	VEHICLE AND TRAILER	VEHICLE ONLY	VEHICLE AND TRAILER	VEHICLE ONLY
MAIN	49		62	10
GALLOWS (EXISTING)		71		71
OVERFLOW A			24	
OVERFLOW B			11	
OVERFLOW D			11	
	49	**71**	**108**	**81**

PLAN
SCALE 1: 600

12 0 20 40 60m
1:600 (A1) 1:1200 (A3)

REV	DATE	DESCRIPTION	BY	CHK	APPD
E	1.11.20	FINAL CONCEPT LAYOUT	MC	PL	BP
D	18.8.20	NEW LAYOUT FOR APPROVAL	MC	PL	BP
C	23.6.20	BREAKWALL LAYOUT UPDATED	MC	PL	BP
B	15.6.20	CLIENT COMMENTS INCLUDED	MC	PL	BP
A	12.6.20	CONCEPT PLANS REV'D & STAGED	MC	PL	BP

REVISIONS

DRAWING FOR REVIEW

DIAL 1100
BEFORE YOU DIG

WARNING
ONLY VISIBLE SERVICES HAVE BEEN LOCATED BY SURVEY. LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND HAVE BEEN SCALED FROM VARIOUS SERVICE AUTHORITY PLANS. ALL SERVICES TO BE CONFIRMED ON SITE PRIOR TO ANY CONSTRUCTION OR INVESTIGATION WORKS.
"DIAL BEFORE YOU DIG" - 1100
IT IS ESSENTIAL THAT BEFORE ANY EXCAVATION WORK IS UNDERTAKEN, FURTHER INVESTIGATION INTO THE LOCATION OF SERVICES SHOULD BE CARRIED OUT WITH THE RELEVANT AUTHORITY.

CLIENT
NSW GOVERNMENT
Transport for NSW

SURVEY
SURVEY - NORTH COAST SURVEYS MARCH 2020
HORIZONTAL DATUM MGA 56 (1994) VERTICAL DATUM AHD 71

AUSTRALIAN HEIGHT DATUM

PROJECT:
COFFS HARBOUR,
BOAT RAMP UPGRADE
CONCEPT STAGING PLANS

TITLE:
STAGE 2
SITE MASTERPLAN

HASKONING AUSTRALIA PTY LTD
NEWCASTLE
Level 3
2 Market Street
Newcastle NSW 2300
Australia
+61 2 4926 9500
www.royalhaskoninghdv.com
Royal HaskoningDHV
Enhancing Society Together

DRAWN M.Collings DATE 20.03.2020 JOB No. PA2431
AUTOCAD REF. PA2341–STG
SCALE AT A1 AS SHOWN
DRAWING No. PA2341-STG- 002 REVISION E

C:\COFFS HARBOUR BOAT RAMP / PA2341

DRAWING No.
PA2431-STG- 001

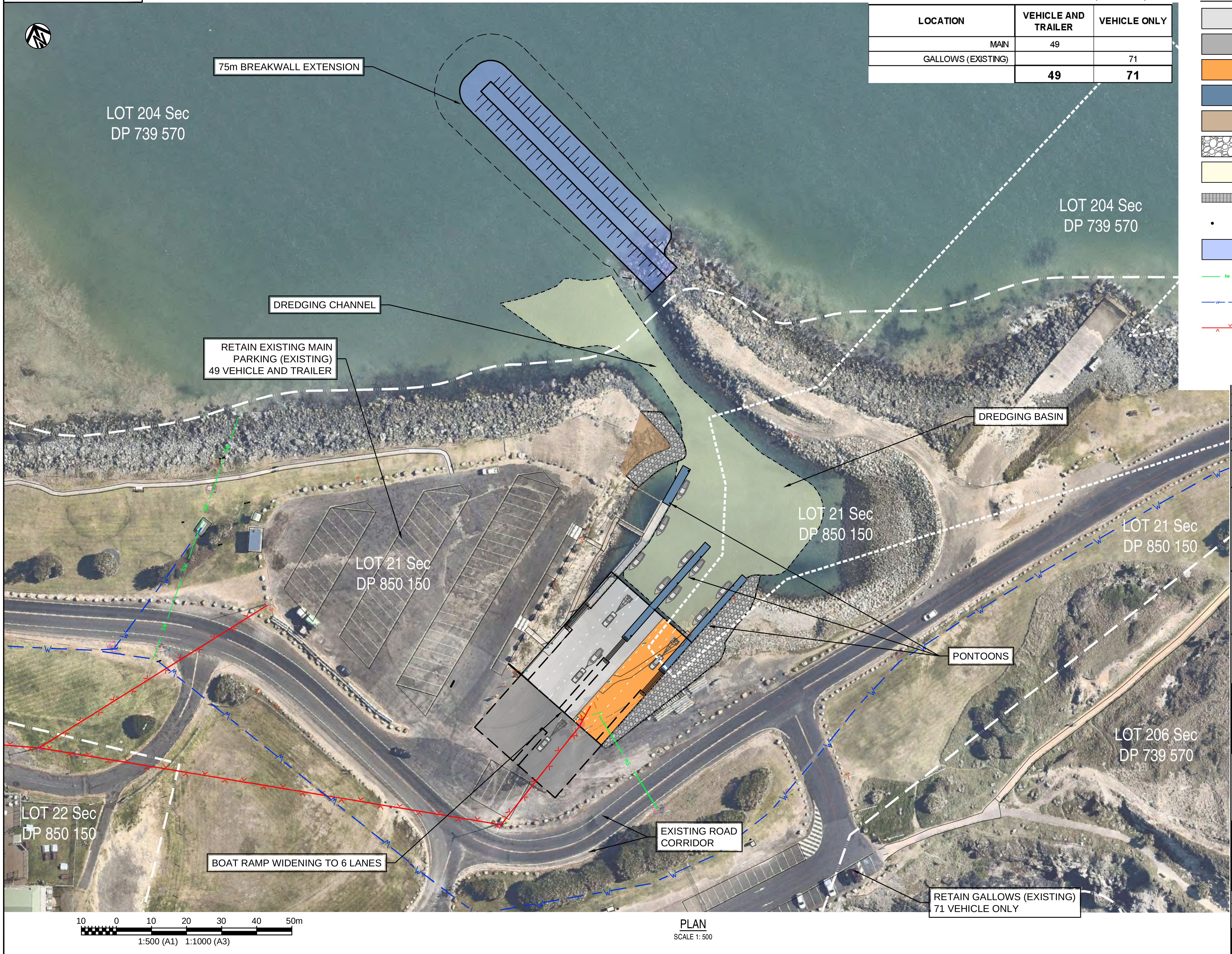
DO NOT SCALE

EXISTING (STAGE 1)

LOCATION	VEHICLE AND TRAILER	VEHICLE ONLY
MAIN	49	
GALLOWS (EXISTING)		71
	49	**71**

LEGEND

⬜	EXISTING CONCRETE RAMP
▨	NEW PAVEMENT (RAMP)
🟧	NEW RAMP (CONCRETE)
🟦	NEW PONTOON
🟫	LAND BASED EARTHWORKS
▩	NEW ROCK REVETMENT
🟨	HARBOUR DREDGING
▥	PONTOON GANTRY
• •	⌀300 PILES (INDICATIVE LOCATIONS ONLY)
🟦	BREAKWALL (ABOVE WATER)
—SW—	EXISTING STORMWATER
—W—	EXISTING WATER MAIN
—V—	EXISTING O/H ELECTRICAL



PLAN
SCALE 1: 500

REV	DATE	DESCRIPTION	BY	CHK	APPD
E	1.11.20	FINAL CONCEPT LAYOUT	MC	PL	BP
D	18.8.20	NEW LAYOUT FOR APPROVAL	MC	PL	BP
C	23.6.20	BREAKWALL LAYOUT UPDATED	MC	PL	BP
B	15.6.20	CLIENT COMMENTS INCLUDED	MC	PL	BP
A	12.6.20	CONCEPT PLANS REV'D & STAGED	MC	PL	BP

REVISIONS

DRAWING FOR REVIEW

WARNING

ONLY VISIBLE SERVICES HAVE BEEN LOCATED BY SURVEY. LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND HAVE BEEN SCALED FROM VARIOUS SERVICE AUTHORITY PLANS. ALL SERVICES TO BE CONFIRMED ON SITE PRIOR TO ANY CONSTRUCTION OR INVESTIGATION WORKS.

"DIAL BEFORE YOU DIG" - 1100

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DIAL 1100
BEFORE YOU DIG

CLIENT

NSW GOVERNMENT | Transport for NSW

SURVEY

SURVEY - NORTH COAST SURVEYS   MARCH 2020
HORIZONTAL DATUM MGA 56 (1994)   VERTICAL DATUM AHD 71

AUSTRALIAN HEIGHT DATUM

PROJECT:

COFFS HARBOUR,
BOAT RAMP UPGRADE
CONCEPT STAGING PLANS

TITLE:

STAGE 1
SITE MASTERPLAN

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DRAWN M.Collings | DATE 20.03.2020 | JOB No. PA2431

AUTOCAD REF. PA2341–STG

SCALE AT A1 AS SHOWN

DRAWING No.
PA2341-STG- 001

REVISION
E

C:\COFFS HARBOUR BOAT RAMP / PA2341

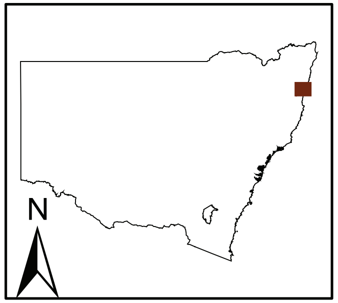
Appendix 2: Existing Mapping of Ecological Constraints

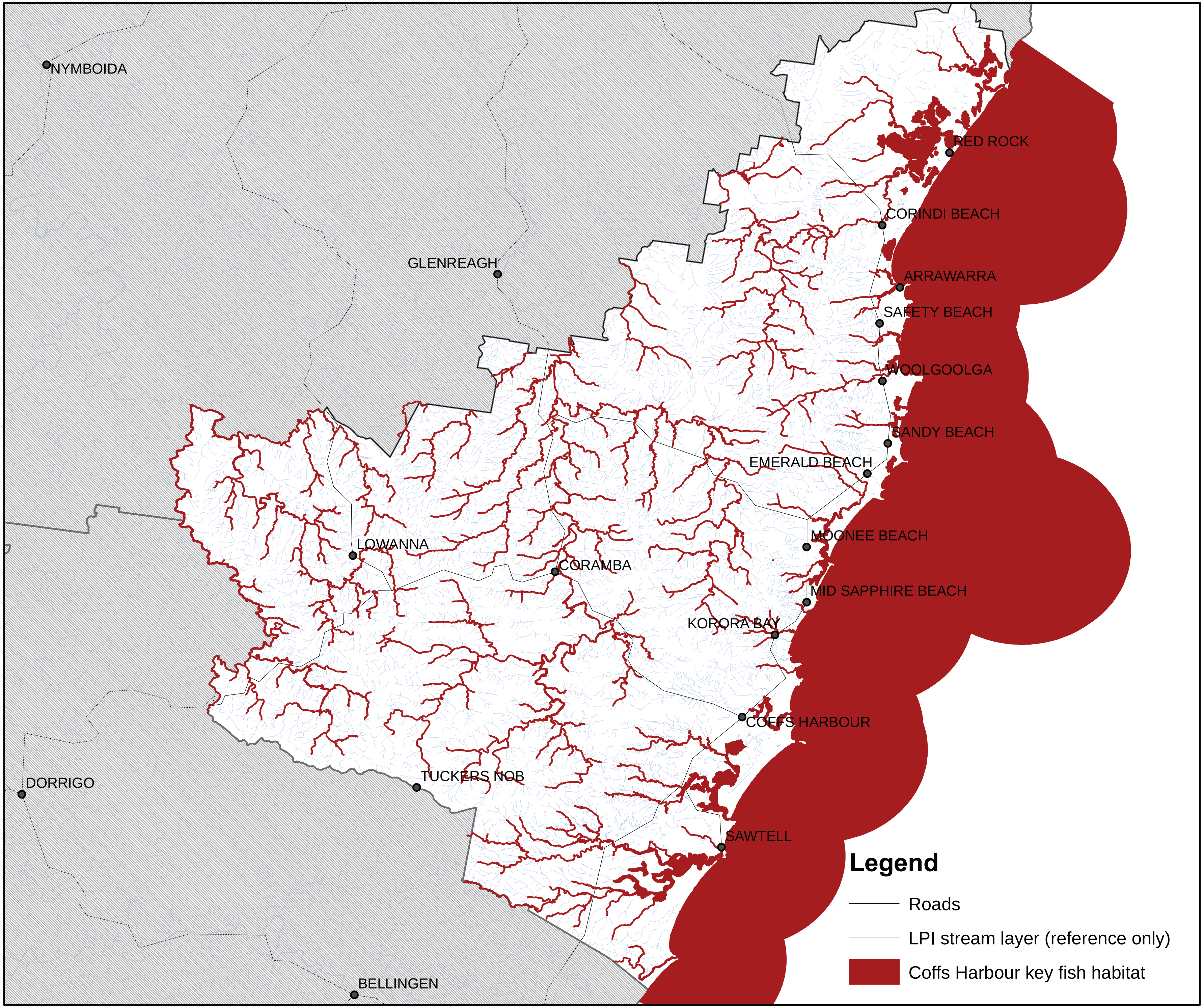
A2.1: Key fish habitat map.

A2.2: Coastal management mapping

A2.3: Biodiversity values map

Key Fish Habitat
COFFS HARBOUR LGA





Source: data from the Australian Geoscience, NSW DPI, NSW DECC and NSW LPI
Datum: Geocentric Datum of Australia (GDA)
Grid: Mapping Grid of Australia (MGA94)

The State of New South Wales, the Department of Primary ndustries, its employees, officers, agents or servants are not esponsible for the result of any actions taken on the basis of the information contained on the map, or for any errors, omissions or inaccuracies that may occur on this map.

Prepared by GIS section, Fisheries Ecosystems Branch, Division of Agriculture & Fisheries, NSW DPI.

0 2 4 8
Kilometres

NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Coastal Management SEPP 2018

Legend

Coastal Environment Area Map

🟦

Coastal Use Area Map

🟧

Notes:

Map created: 12-Nov-2020

Imagery © Department of Finance Services & Innovation Basemap © OpenStreetMap

Biodiversity Offset Scheme (BOS) Entry Threshold Map

983.7 0 491.83 983.7 Metres

WGS_1984_Web_Mercator_Auxiliary_Sphere

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Legend

🟪	Biodiversity Values that have been mapped for more than 90 days
🟪	Biodiversity Values added within last 90 days

Notes

Appendix 3: Threatened Species Searches

Data from the BioNet Atlas website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1°C; ^^ rounded to 0.01°C. Copyright the State of NSW through the Department of Planning, Industry and Environment. Search criteria : Public Report of all Records of Threatened (listed on BC Act 2016) ,Commonwealth listed ,CAMBA listed ,JAMBA listed or ROKAMBA listed Entities in selected area [North: -30.25 West: 153.09 East: 153.19 South: -30.35] recorded since 01 Jan 2000 until 11 Aug 2020 returned a total of 19,495 records of 80 species.

Report generated on 11/08/2020 8:04 AM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Amphibia	Myobatrachidae	3137	*Crinia tinnula*		Wallum Froglet	V,P		19	ℹ
Animalia	Amphibia	Myobatrachidae	3075	*^Mixophyes iteratus*		Giant Barred Frog	E1,P,2	E	1	ℹ
Animalia	Reptilia	Cheloniidae	2007	*Chelonia mydas*		Green Turtle	V,P	V	42	ℹ
Animalia	Reptilia	Cheloniidae	2008	*Eretmochelys imbricata*		Hawksbill Turtle	P	V	5	ℹ
Animalia	Aves	Phaethontidae	0108	*Phaethon lepturus*		White-tailed Tropicbird	P	C,J	1	
Animalia	Aves	Columbidae	0025	*Ptilinopus magnificus*		Wompoo Fruit-Dove	V,P		6	ℹ
Animalia	Aves	Columbidae	0021	*Ptilinopus regina*		Rose-crowned Fruit-Dove	V,P		5	ℹ
Animalia	Aves	Columbidae	0023	*Ptilinopus superbus*		Superb Fruit-Dove	V,P		1	ℹ
Animalia	Aves	Podargidae	0314	*Podargus ocellatus*		Marbled Frogmouth	V,P		1	ℹ
Animalia	Aves	Apodidae	0335	*Apus pacificus*		Fork-tailed Swift	P	C,J,K	1	
Animalia	Aves	Apodidae	0334	*Hirundapus caudacutus*		White-throated Needletail	P	V,C,J,K	7	ℹ
Animalia	Aves	Diomedeidae	0091	*Thalassarche cauta*		Shy Albatross	V,P	V	1	ℹ
Animalia	Aves	Diomedeidae	0088	*Thalassarche melanophris*		Black-browed Albatross	V,P	V	1	ℹ
Animalia	Aves	Procellariidae	0069	*Ardenna pacifica*		Wedge-tailed Shearwater	P	J	18481	
Animalia	Aves	Procellariidae	0071	*Ardenna tenuirostris*		Short-tailed Shearwater	P	C,J,K	42	
Animalia	Aves	Procellariidae	0937	*Macronectes halli*		Northern Giant-Petrel	V,P	V	1	ℹ
Animalia	Aves	Sulidae	0105	*Sula dactylatra*		Masked Booby	V,P	J,K	1	ℹ
Animalia	Aves	Sulidae	0102	*Sula leucogaster*		Brown Booby	P	C,J,K	1	
Animalia	Aves	Ciconiidae	0183	*Ephippiorhynchus asiaticus*		Black-necked Stork	E1,P		3	ℹ
Animalia	Aves	Ardeidae	0196	*Ixobrychus flavicollis*		Black Bittern	V,P		1	ℹ
Animalia	Aves	Accipitridae	0226	*Haliaeetus leucogaster*		White-bellied Sea-Eagle	V,P		7	ℹ
Animalia	Aves	Accipitridae	0225	*Hieraaetus morphnoides*		Little Eagle	V,P		1	ℹ
Animalia	Aves	Accipitridae	0230	*^^Lophoictinia isura*		Square-tailed Kite	V,P,3		9	ℹ
Animalia	Aves	Accipitridae	8739	*^^Pandion cristatus*		Eastern Osprey	V,P,3		25	ℹ
Animalia	Aves	Rallidae	0053	*Amaurornis moluccana*		Pale-vented Bush-hen	V,P		1	ℹ
Animalia	Aves	Burhinidae	0174	*Burhinus grallarius*		Bush Stone-curlew	E1,P		3	ℹ
Animalia	Aves	Burhinidae	0175	*Esacus magnirostris*		Beach Stone-curlew	E4A,P		1	ℹ
Animalia	Aves	Haematopodidae	0131	*Haematopus fuliginosus*		Sooty Oystercatcher	V,P		14	ℹ
Animalia	Aves	Haematopodidae	0130	*Haematopus longirostris*		Pied Oystercatcher	E1,P		8	ℹ
Animalia	Aves	Charadriidae	0138	*Thinornis rubricollis*		Hooded Plover	E4A,P	V	1	ℹ
Animalia	Aves	Scolopacidae	0168	*Gallinago hardwickii*		Latham's Snipe	P	J,K	1	
Animalia	Aves	Scolopacidae	0149	*Numenius madagascariensis*		Eastern Curlew	P	CE,C,J,K	1	ℹ
Animalia	Aves	Laridae	0120	*Onychoprion fuscata*		Sooty Tern	V,P		7	ℹ
Animalia	Aves	Laridae	0953	*Sterna hirundo*		Common Tern	P	C,J,K	1	
Animalia	Aves	Laridae	0117	*Sternula albifrons*		Little Tern	E1,P	C,J,K	4	ℹ
Animalia	Aves	Laridae	0115	*Thalasseus bergii*		Crested Tern	P	J	4	
Animalia	Aves	Cacatuidae	8857	*^Calyptorhynchus banksii samueli*		Red-tailed Black-Cockatoo (inland subspecies)	V,P,2		2	ℹ
Animalia	Aves	Cacatuidae	0265	*^Calyptorhynchus lathami*		Glossy Black-Cockatoo	V,P,2		21	ℹ
Animalia	Aves	Psittacidae	0260	*Glossopsitta pusilla*		Little Lorikeet	V,P		6	ℹ
Animalia	Aves	Psittacidae	0309	*^^Lathamus discolor*		Swift Parrot	E1,P,3	CE	1	ℹ
Animalia	Aves	Strigidae	0246	*^^Ninox connivens*		Barking Owl	V,P,3		1	ℹ
Animalia	Aves	Strigidae	0248	*^^Ninox strenua*		Powerful Owl	V,P,3		10	ℹ
Animalia	Aves	Tytonidae	0252	*^^Tyto longimembris*		Eastern Grass Owl	V,P,3		1	ℹ
Animalia	Aves	Tytonidae	0250	*^^Tyto novaehollandiae*		Masked Owl	V,P,3		3	ℹ
Animalia	Aves	Climacteridae	8127	*Climacteris picumnus victoriae*		Brown Treecreeper (eastern subspecies)	V,P		1	ℹ
Animalia	Aves	Meliphagidae	0603	*Anthochaera phrygia*		Regent Honeyeater	E4A,P	CE	1	ℹ
Animalia	Aves	Neosittidae	0549	*Daphoenositta chrysoptera*		Varied Sittella	V,P		1	ℹ
Animalia	Aves	Campephagidae	0428	*Coracina lineata*		Barred Cuckoo-shrike	V,P		2	ℹ
Animalia	Mammalia	Dasyuridae	1008	*Dasyurus maculatus*		Spotted-tailed Quoll	V,P	E	5	ℹ
Animalia	Mammalia	Dasyuridae	1017	*Phascogale tapoatafa*		Brush-tailed Phascogale	V,P		1	ℹ
Animalia	Mammalia	Phascolarctidae	1162	*Phascolarctos cinereus*		Koala	V,P	V	388	ℹ
Animalia	Mammalia	Petauridae	1136	*Petaurus australis*		Yellow-bellied Glider	V,P		1	ℹ
Animalia	Mammalia	Petauridae	1137	*Petaurus norfolcensis*		Squirrel Glider	V,P		14	ℹ
Animalia	Mammalia	Potoroidae	1175	*Potorous tridactylus*		Long-nosed Potoroo	V,P	V	1	ℹ
Animalia	Mammalia	Pteropodidae	1280	*Pteropus poliocephalus*		Grey-headed Flying-fox	V,P	V	105	ℹ
Animalia	Mammalia	Pteropodidae	1294	*Syconycteris australis*		Common Blossom-bat	V,P		6	ℹ
Animalia	Mammalia	Vespertilionidae	1357	*Myotis macropus*		Southern Myotis	V,P		2	ℹ
Animalia	Mammalia	Vespertilionidae	1336	*Nyctophilus bifax*		Eastern Long-eared Bat	V,P		5	ℹ
Animalia	Mammalia	Muridae	1455	*Pseudomys novaehollandiae*		New Holland Mouse	P	V	1	ℹ
Animalia	Mammalia	Otariidae	1882	*Arctocephalus pusillus doriferus*		Australian Fur-seal	V,P		1	ℹ
Animalia	Mammalia	Balaenidae	1561	*Eubalaena australis*		Southern Right Whale	E1,P	E	2	ℹ
Animalia	Mammalia	Balaenopteridae	1575	*Megaptera novaeangliae*		Humpback Whale	V,P	V	4	ℹ
Animalia	Insecta	Hesperiidae	I023	*Ocybadistes knightorum*		Black Grass-dart Butterfly	E1		92	ℹ
Animalia	Insecta	Petaluridae	I138	*Petalura litorea*		Coastal Petaltail	E1		1	ℹ
Plantae	Flora	Cyperaceae	2423	*Eleocharis tetraquetra*		Square-stemmed Spike-rush	E1		2	ℹ
Plantae	Flora	Fabaceae (Faboideae)	11644	*Pultenaea maritima*		Coast Headland Pea	V		34	ℹ
Plantae	Flora	Fabaceae (Faboideae)	3032	*Sophora tomentosa*		Silverbush	E1		2	ℹ
Plantae	Flora	Lindsaeaceae	8128	*^^Lindsaea incisa*		Slender Screw Fern	E1,3		2	ℹ
Plantae	Flora	Myrtaceae	4283	*Rhodamnia rubescens*		Scrub Turpentine	E4A		12	ℹ
Plantae	Flora	Myrtaceae	4284	*Rhodomyrtus psidioides*		Native Guava	E4A		9	ℹ
Plantae	Flora	Myrtaceae	4293	*Syzygium paniculatum*		Magenta Lilly Pilly	E1	V	1	ℹ
Plantae	Flora	Orchidaceae	4480	*^Phaius australis*		Southern Swamp Orchid	E1,P,2	E	1	ℹ
Plantae	Flora	Poaceae	8979	*Alexfloydia repens*		Floyd's Grass	E1		10	ℹ
Plantae	Flora	Proteaceae	5446	*Macadamia tetraphylla*		Rough-shelled Bush Nut	V	V	1	ℹ
Plantae	Flora	Rutaceae	6457	*Acronychia littoralis*		Scented Acronychia	E1	E	2	ℹ
Plantae	Flora	Santalaceae	5871	*Thesium australe*		Austral Toadflax	V	V	1	ℹ
Plantae	Flora	Sapindaceae	8291	*Lepiderema pulchella*		Fine-leaved Tuckeroo	V		1	ℹ
Plantae	Flora	Sapotaceae	11957	*Niemeyera whitei*		Rusty Plum, Plum Boxwood	V		6	ℹ
Animalia	Mammalia	Miniopteridae	1346	*Miniopterus australis*		Little Bent-winged Bat	V,P		15	ℹ
Animalia	Mammalia	Miniopteridae	3330	*Miniopterus orianae oceanensis*		Large Bent-winged Bat	V,P		8	ℹ

Australian Government
Department of the Environment and Energy

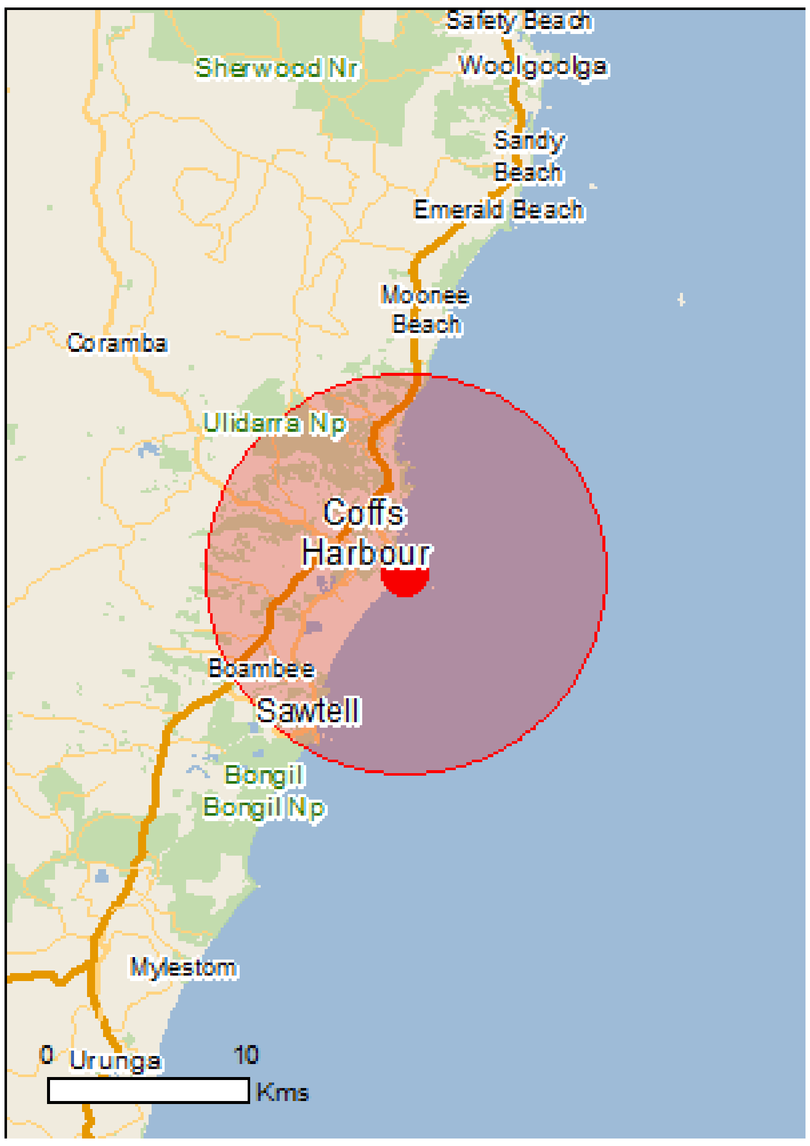
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

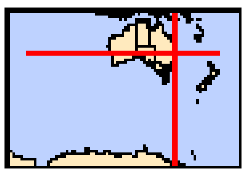
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/08/20 08:15:44



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	86
Listed Migratory Species:	64

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	6
Commonwealth Heritage Places:	None
Listed Marine Species:	97
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	9
Regional Forest Agreements:	1
Invasive Species:	41
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
Temperate East

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Atrichornis rufescens Rufous Scrub-bird [655]	Endangered	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis cucullatus cucullatus Hooded Plover (eastern), Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat may occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area
Litoria olongburensis Wallum Sedge Frog [1821]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Insects		
Argynnis hyperbius inconstans Australian Fritillary [88056]	Critically Endangered	Species or species habitat may occur within area
Phyllodes imperialis smithersi Pink Underwing Moth [86084]	Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Acronychia littoralis Scented Acronychia [8582]	Endangered	Species or species habitat known to occur within area
Allocasuarina thalassoscopica [21927]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat known to occur within area
Corynocarpus rupestris subsp. rupestris Glenugie Karaka [19303]	Vulnerable	Species or species habitat known to occur within area
Cryptocarya foetida Stinking Cryptocarya, Stinking Laurel [11976]	Vulnerable	Species or species habitat may occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Endiandra hayesii Rusty Rose Walnut, Velvet Laurel [13866]	Vulnerable	Species or species habitat may occur within area
Haloragis exalata subsp. velutina Tall Velvet Sea-berry [16839]	Vulnerable	Species or species habitat may occur within area
Hicksbeachia pinnatifolia Monkey Nut, Bopple Nut, Red Bopple, Red Bopple Nut, Red Nut, Beef Nut, Red Apple Nut, Red Boppel Nut, Ivory Silky Oak [21189]	Vulnerable	Species or species habitat may occur within area
Macadamia integrifolia Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat known to occur within area
Macadamia tetraphylla Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut [6581]	Vulnerable	Species or species habitat known to occur within area
Marsdenia longiloba Clear Milkvine [2794]	Vulnerable	Species or species habitat likely to occur within area
Parsonsia dorrigoensis Milky Silkpod [64684]	Endangered	Species or species habitat likely to occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat known to occur within area
Plectranthus nitidus Nightcap Plectranthus, Silver Plectranthus [55742]	Endangered	Species or species habitat may occur within area
Samadera sp. Moonee Creek (J.King s.n. Nov. 1949) [86885]	Endangered	Species or species habitat known to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat known to occur within area
Tylophora woollsii [20503]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Zieria prostrata Headland Zieria [56782]	Endangered	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Coeranoscincus reticulatus Three-toed Snake-tooth Skink [59628]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area
Sharks		
Carcharias taurus (east coast population) Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Breeding known to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Ardenna tenuirostris Short-tailed Shearwater [82652]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour may occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Crested Tern [83000]		Breeding known to occur within area

Name	Threatened	Type of Presence
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Australian Telecommunications Corporation
Commonwealth Land - Telstra Corporation Limited
Defence - Training Depot

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur

Name	Threatened	Type of Presence
		within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour may occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma nigripennis Black-winged Petrel [1038]		Breeding known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Breeding known to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Puffinus tenuirostris Short-tailed Shearwater [1029]		Breeding known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding likely to occur within area

Name	Threatened	Type of Presence
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable*	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Campichthys tryoni Tryon's Pipefish [66193]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys ocellatus Orange-spotted Pipefish, Ocellated Pipefish [66203]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus kelloggi Kellogg's Seahorse, Great Seahorse [66723]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat likely to occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Micrognathus andersonii Anderson's Pipefish, Shortnose Pipefish [66253]		Species or species habitat may occur within area
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		Species or species habitat may occur within area
Microphis manadensis Manado Pipefish, Manado River Pipefish [66258]		Species or species habitat may occur within area
Solegnathus dunckeri Duncker's Pipehorse [66271]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area

Name	Status	Type of Presence
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks

[Resource Information]

Name	Label
Solitary Islands	Special Purpose Zone (Trawl) (IUCN VI)

Extra Information

State and Territory Reserves

[Resource Information]

Name	State
Bongil Bongil	NSW
Bruxner Park	NSW
Coffs Coast	NSW
Kororo	NSW
LNE Special Management Zone No1	NSW
Muttonbird Island	NSW
Split Solitary Island	NSW
UNE Special Management Zone No1	NSW
Ulidarra	NSW

Regional Forest Agreements

[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-30.31081 153.14319

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix 4: Threatened Species Assessments

Threatened Shore Birds

Review of Species

Name /Species	Status BC Act	Status EPBC Act
Sooty Oystercatcher (Haematopus fuliginosus) –	Vulnerable	
Pied Oystercatcher (H. longirostris) –	Endangered	

Species	Distribution	Habitat and Prey	Breeding
H. fuliginosus	Found around the entire Australian coast, including offshore islands, being most common in Bass Strait. Small numbers of the species are evenly distributed along the NSW coast.	Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries, where they forage on intertidal invertebrates such as limpets and mussels.	Breeds in spring and summer amongst pebbles and shells on rocky shores or cliffs located almost exclusively on offshore islands, but occasionally on isolated promontories.
H. longirostris	Distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria. In NSW the species is thinly scattered along the entire coast.	Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide for molluscs, worms, crabs and small fish.	Nests between August and January, mostly on coastal or estuarine beaches, although occasionally they use saltmarsh or grassy areas.

Sources: DPIE (2020)

5-Part Test – BC Act

Threatened Shore Birds – BC Act
(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
Sooty Oystercatchers are known to forage amongst intertidal habitat at low tide within and adjacent to the proposal footprint. Breeding is unlikely to occur in the Study Area. Construction works will likely result in disturbance to a very small amount of habitat this species uses in the locality. These disturbances will likely include removal and modification of habitat, while increased noise during construction that may reduce the availability and quality of foraging habitat at low tide. These disturbances are unlikely to have any adverse effects on the lifecycle of any individuals that may use this location at times. It is likely that individuals will still forage at low tide when construction works are not being undertaken, and will use nearby areas with similar habitat when construction works are occurring. Given this, it is unlikely that the proposed action has potential to adversely affect the life cycle of the species such that local populations are likely to be placed at risk of extinction. The Pied Oystercatcher typically uses sandy habitats, which may include those associated with Jetty Beach. Modelling indicates that changes in coastal processes attributable to the proposal may result in some moderate rates of negative sand accretion on the southern end of Jetty Beach (MHL 2020). The habitat in and adjacent to the Study Area is only marginal and not considered to be of importance to the life cycle of the local population of this species.
(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Not Applicable

(c) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

I. The rocky intertidal habitat that will be modified as a result of this proposal is limited to a small amount of the head of the breakwater as the extension is constructed, and the corner of the seawall inside the basin. These modifications will not result in any net habitat loss.
Indirect impacts on the adjacent Jetty Beach as a result of negative rates of sand accretion may reduce beach width at the southern end of Jetty Beach, with this predicted to affect up to an 80m stretch of the beach (MHL 2020).

II. No habitat is expected to become fragmented or isolated as a result of the proposal.

III. Modifications to the existing rocky intertidal habitat will result in minimal change, but there will be a substantial net increase in habitat over the longer term. Consequently, there is minimal potential to impact the long-term survival of any Sooty Oystercatchers that use this habitat.
Adjacent areas of sandy intertidal habitat on Jetty Beach only represent a small area of beaches in the locality that may be used by Pied Oystercatchers. Furthermore, the species is only considered to have a moderate likelihood of occurrence in the Study Area, and so the habitat is not recognised to be of significance to the long-term survival of the species in the locality.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

No

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

NSW KTPs with potential to be exacerbated by the proposed development do not have potential to impact on these shore birds

Conclusion	Sooty Oystercatchers that utilise habitat in the vicinity of the Study Area are unlikely to be significantly affected by the proposed activity. The proposal will result in some disturbances during construction, as well as modifications to a very small area of rocky shoreline. These modifications are expected to result in additional potential habitat for the Sooty Oystercatcher once construction is completed. The Pied Oystercatchers that may potentially at times utilise habitat in the vicinity of Study Area are unlikely to be significantly affected by the proposed activity. The species only has a moderate likelihood of occurrence in the Study Area, while the adjacent sandy shoreline areas associated with Jetty Beach only provide marginal habitat.

Marine Birds

Review of Species

Name /Species	Status BC Act	Status EPBC Act
Flesh-footed Shearwater (***Ardenna carneipes***)	Vulnerable	Migratory
Sooty Shearwater (***A. grisea***)		Migratory
Wedge-tailed Shearwater (***A. pacifica***)		Migratory
Short-tailed Shearwater (***A. tenuirostris***)		Migratory
Lesser Frigatebird (***Fregata ariel***)		Migratory
Common Tern (***Sterna hirundo***)		Migratory
Crested Tern (***Thalasseus bergii***)		Migratory
Little Tern (***S. albifrons***)	Endangered	Migratory

Species	Distribution	Habitat and Prey	Breeding
A. carneipes	A trans-equatorial migrant and locally common visitor to waters of the continental shelf and slope off southern Australia and around Lord Howe Island.	Occurs in the subtropics over continental shelves and slopes and occasionally inshore waters. Individuals also pass through the tropics and over deeper waters when on migration. Feeds on small fish, cephalopod molluscs (squid, cuttlefish, nautilus and argonauts), crustaceans (barnacles and shrimp), other soft-bodied invertebrates and offal.	Breeds on islands off southern Australia and on Lord Howe Island. May breed and nest on offshore islands in the adjacent SIMP between August and May.
A. grisea	Migrates from the North Pacific and North Atlantic Oceans to the southern hemisphere during summer, where they range from breeding islands off south-eastern Australia south to Antarctic waters.	Forages in pelagic (open ocean) sub-tropical, sub-Antarctic and Antarctic waters and may forage inshore occasionally, especially during rough weather. Feeds on a wide variety of pelagic prey, including cephalopods, fish and crustaceans.	Breeds on islands off NSW and Tasmania. May breed and nest on offshore islands in the adjacent SIMP between August and May.
A. pacifica	Widespread across the Indian and Pacific Ocean, spending non-breeding season in the tropics.	Found in association with tropical and subtropical waters, and offshore waters over the continental slope of eastern Victoria and southern NSW, mostly associated with sea-surface temperatures of 13.9–24.4 °C	Breeds and nests on offshore islands including Muttonbird Island and other offshore Islands in the adjacent SIMP.
A. tenuirostris	Migrates from wintering grounds in the northern hemisphere to the southern hemisphere to breed during summer.	Very common in NSW coastal waters during migration periods. Feeds on krill, small fish and other small marine creatures. Food is caught mostly at the surface of the water but sometimes birds are seen diving for food.	Breeds and nests mainly on small islands in Bass Strait and Tasmania. May breed and nest on offshore islands in the adjacent SIMP between August and May.
F. ariel	Primarily found in the southwest Pacific and Indian oceans. Common in tropical seas.	Found in association with tropical and subtropical seas, breeding on small, remote islands in mangroves or bushes/scrub and can even nest on ground. Feeds in adjoining ocean, usually in waters over 22°C in the pelagic zone. Diet consists mostly of fish, especially flying fish, and squid, but also may include seabird eggs and chicks, carrion and fish scraps. Surface-dipping is the main method for obtaining food.	Breeds on offshore islands in tropical waters between May and December in Australia.
S. hirundo	Non-breeding migrant to Australia, where it is widespread and common on the east coast (including the NSW north coast), extending south to eastern Victoria. Arrives in NSW from late September to October.	Uses marine, pelagic and coastal marine zones, including near-coastal waters, ocean beaches, rock platforms and headlands, and in sheltered waters, such as bays, harbours and estuaries with muddy, sandy or rocky shores. Typically forage opportunistically at sea in the day on small fish, crustaceans or insects, and occasionally squid, before returning to land to roost at night.	Breeds in the northern hemisphere between May and September.
T. bergii	Found along the entire Australian coastline. Many	Most common on tropical and subtropical coasts and oceanic islands. Nests on offshore islands,	Breeds in colonies on small offshore islands.

Species	Distribution	Habitat and Prey	Breeding
	populations are more or less resident around breeding areas. Australian birds disperse several hundred kilometres around colony.	low-lying coral, sandy or rocky islets, coastal spits, lagoons, and recently on artificial islets in saltpans and sewage works. Forages in shallow waters of lagoons and barrier reefs, in estuaries, along beaches, and well out to sea. Rests on buoys or on rocks and sandbars, often with other terns and gulls.	
S. albifrons	Migrates from eastern Asia, and is found on the north, east and south-east Australian coasts. In NSW, they arrive from September to November, occurring mainly north of Sydney with most departing by May.	Almost exclusively coastal, preferring sheltered environments; however, may occur several kilometres from the sea in harbours, inlets and rivers. Feeds on small fish, crustaceans, insects, worms and molluscs, typically by diving while aerially foraging.	Nests in small, scattered colonies in low dunes or on sandy beaches (especially sand spits along the NSW coast), just above high tide mark near estuary mouths or adjacent to coastal lakes and islands. Breeds in spring and summer.

Sources: DAW (2020). DPIE (2020), Billerman et al (2020) and NPWS (2004)

5 Part Test: Marine Birds

Threatened Marine Birds – BC Act
(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
Flesh-footed Shearwaters are known to forage over large areas of coastal and offshore waters, which on occasions may include waters within the Study Area. Breeding does not occur in the Study Area but may occur nearby on the Solitary Islands. Dredging works have potential to result in some short-term and very localised disturbances to water quality, which in turn can impact on foraging habitat quality for this species. Given that this species forages over large areas and the proposal only has potential for very short-term and localised impacts, the proposal is unlikely to have any ecologically significant impact with potential to adversely affect the life cycles of the species such that local populations are likely to be placed at risk of extinction. The Little Tern typically uses sandy habitats that on rare occasions has included Jetty Beach to roost. At times this species may also attempt to use stockpiles to roost. Modelling indicated that changes in coastal processes attributable to the proposal may result in some moderate rates of negative sand accretion on the southern end of Jetty Beach (MHL 2020). The habitat in and adjacent to the Study Area is only marginal and not considered to be of importance to the life cycle of the local population of this species.
(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Not Applicable
(c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

i)	Some rocky intertidal habitat used for roosting and resting will be removed or modified. The proposal will include some temporary removal and minor modifications of artificial habitat. These modifications will include removal and replacement in places, as well as the potential for some increased light at night. The proposal will, however, result in a net gain in potential habitat within the Study Area. Other disturbances will be restricted to some potential short-term and localised impacts on habitat quality as a result of reduced water quality. Indirect impacts on the adjacent Jetty Beach as a result of negative rates of sand accretion may reduce beach width at the southern end of Jetty Beach, with this predicted to affect up to an 80m stretch of the beach (MHL 2020).
ii)	No habitat is expected to become fragmented or isolated as a result of the proposal.
iii)	Marine bird habitat that may be impacted represents only a very small amount of that available, and is considered marginal roosting/resting and foraging habitat for these species within the locality. These areas of habitat within and adjacent to the Study Area are not recognised to be of significance to the long-term survival of these species in the locality.
(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).	
No	
(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	
KTPs with potential to be exacerbated by the proposed development do not have potential to impact on theses marine birds	
Conclusion	Flesh-footed Shearwaters that may at times utilise habitat in the vicinity of Study Area are unlikely to be significantly affected by the proposed activity. The proposal is limited to some minor habitat modifications, as well as some potential short-term and very localised impacts on water quality, which may result in periods of reduced foraging habitat quality within the Study Area. Given the large areas of ocean this species forages across, these disturbances are not expected to be ecologically significant to this species. The Little Terns that may potentially at times utilise habitat in the vicinity of Study Area are unlikely to be significantly affected by the proposed activity. The Little Tern only has a moderate likelihood of occurrence in this area, while the adjacent sandy shoreline areas associated with Jetty Beach and waters within and adjacent to the Study Area only provide marginal habitat.

Significant Impact Criteria: Migratory Marine Birds

Significant Impact Criteria: Migratory Marine Birds (EPBC Act)	**Likelihood of Impact**
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:	
1. Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	
The roosting and resting habitat associated with the seawalls and breakwater only provides marginal habitat for marine birds. Impacts on this habitat will be confined to some minor modifications to extend the breakwater and potential for additional lighting at night. Other disturbances, such as those to foraging habitat, will be typically short-term, confined to a very small area of this habitat in relation to the harbour, and will ultimately result in a net gain in the amount of this artificial habitat within the Study Area. Adjacent areas of sandy shoreline at the southern end of Jetty Beach provides only very marginal roosting and nesting habitat for marine birds such as the Little Tern. Only very occasional sightings of the species have occurred on Jetty Beach and it is not considered a breeding site (NPWS 2004). This area is also beyond the Study Area where direct impacts are expected, and any indirect impacts on habitat in this area are expected to be minimal. The foraging habitat in the Study Area is very close to shore, high in boat traffic and very shallow, so it provides only very marginal foraging habitat for marine birds. Disturbances to this habitat will also be short-term and typically confined to potential indirect impacts in the form of reduced habitat quality as a result of noise and water quality during some of the construction works. Any water quality and noise disturbances are expected to be confined to the south-west corner of the harbour. The habitat and adjacent water associated with important migratory bird habitat on nearby Muttonbird Island are not expected to be impacted by this proposal. The proposed works are not expected to substantially modify, destroy or isolate any important habitat for migratory species.	Unlikely

2. Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or	
No known invasive species harmful to migratory marine birds are likely to be released or have their populations enhanced in an area of important habitat as a result of this proposal. Construction works will be confined to areas in the Study Area and well outside important migratory marine bird habitat associated with nearby Muttonbird Island.	Unlikely
3. seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	
The habitat in the Study Area is not considered of importance to the lifecycles of the populations of migratory marine bird species that occur in the locality. Breeding and nesting of these migratory marine birds is not expected to occur in the Study Area. Impacts with potential to disrupt the lifecycle of these species will be confined to short-term disturbances in habitat quality in the Study Area and are not expected to impact on important migratory marine bird habitat associated with nearby Muttonbird Island.	Unlikely
Conclusion	
Potential impacts on migratory marine birds from this proposal are confined to areas of marginal habitat inside the Study Area. These impacts are likely to be restricted to some minor modifications of artificial habitat and short-term construction disturbances. It is not expected these impacts will affect important migratory marine bird habitat associated with nearby Muttonbird Island. The action is unlikely to have any significant impacts on these migratory marine bird species.	

Australian Fur Seal

Species Review

Name /Species	Status BC Act	Status EPBC Act
Australian Fur-seal ***(Arctocephalus pusillus doriferus***)	Vulnerable	

Species	Distribution	Habitat and Prey	Breeding
Arctocephalus pusillus doriferus	The majority of the population is around the islands of Bass Strait, parts of Tasmania and southern Victoria. They are regularly seen hauling out in southern NSW, such as at Montague Island, while on occasions as far north as the Queensland border.	Often seen in the water near the coast or around offshore islands where they may haul out. Prefers rocky parts of islands with flat, open terrain. May also haul out inside harbours and on protected areas of the coastline. Skilful hunters that prey on bony fish, squid and octopus.	Typically breeds at colonies in southern Australia. Reported to have bred at Seal Rocks, near Port Stephens, and Montague Island in southern NSW. Pups are typically born between October and December.

Sources: DPIE (2020) and Australian Museum (2020).

5-Part Test – BC Act

Threatened Australian Fur-seal – BC Act
(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
The Australian Fur-seal may enter Coffs Harbour to forage in subtidal habitats within and adjacent to the Study Area. They may also potentially haul out and rest in intertidal areas that may include rocks associated with seawalls and the breakwater within the harbour, and within the Study Area. However, waters inside Coffs Harbour are not recognised as a known haul-out site for Australian Fur-seals, while currently no breeding locations occur in NSW. Given the above, any potential for disturbances of foraging habitat or resting in intertidal areas during construction is unlikely to adversely impact the lifecycle of the individuals of the species that may occur within the locality.
(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Not Applicable
(c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality
I. The rocky intertidal habitat that will be modified as a result of this proposal is limited to a small amount of the head of the breakwater as the extension is constructed, and the corner of the seawall inside the basin. These modifications will not result in any net intertidal habitat loss. Other disturbances will be restricted to some potential short-term and localised impacts on habitat quality as a result of reduced water quality. II. No habitat is expected to become fragmented or isolated as a result of the proposal. III. Modifications to the existing rocky intertidal habitat will result in minimal change, but there will be a substantial net increase in habitat over the longer term. Consequently, there is minimal potential to impact the long-term survival of any Australian Fur-seals that may at times utilise habitat within or adjacent to the Study Area.
(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).
No

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	
NSW KTPs with potential to be exacerbated by the proposed development do not have potential to impact on the Australian Fur-seal.	
Conclusion	Australian Fur-seals that may potentially utilise habitat in the vicinity of the proposal are unlikely to be significantly affected by the proposed activity. Habitat use in the vicinity of the Study Area is likely to be very occasional, if at all, and likely restricted to occasional individual visits during transient movement along the coast.

Marine Turtles

Species Review

Name /Species	Status BC Act	Status EPBC Act
Green Turtle (***Chelonia mydas***)	Vulnerable	Vulnerable, Migratory
Hawksbill Turtle (***Eretmochelys imbricata***)		Vulnerable, Migratory
Loggerhead Turtle (***Caretta caretta***)	Endangered	Endangered, Migratory

Species	Distribution	Habitat and Prey	Breeding
C. mydas	Widely distributed throughout tropical and sub-tropical waters and will occur at times in temperate waters. In coastal waters of NSW it is generally seen on the north and central coasts. Can migrate more than 2600 km between feeding and nesting grounds.	Hatchlings spend their pelagic phase drifting in ocean current until reaching 30-40cm size, when they will settle in shallow benthic foraging habitats such as tropical tidal and sub-tidal coral and rocky reef habitat or inshore seagrass beds. Adults eat mainly seagrass and algae, although they will occasionally eat other items including mangroves, fish-egg cases, and sponges. Young turtles tend to be more carnivorous than adults. During their pelagic stage they feed on plankton.	Breeding and nesting can occur all year round in some areas of the tropics. Typically nest on isolated beaches or offshore coral cays in tropical regions. Some nesting occurs on beaches in northern NSW between November and May.
E. imbricata	Found in tropical, subtropical and temperate waters in all the oceans of the world. Occasionally found in northern NSW waters. Migrates up to 2400 km between foraging areas and nesting beaches.	Hatchlings spend their pelagic phase drifting in ocean currents until reaching 30-40cm size, when they will settle and forage in tropical tidal and sub-tidal coral and rocky reef habitat. Less frequently utilise seagrass habitats of coastal waters. Adults feed on sponges and algae.	Breeding animals move from their feeding grounds to areas near nesting beaches for mating. Nesting occurs in the northern Great Barrier Reef and the Torres Strait between January and April.
C. caretta	In Australia, it occurs in areas of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia, including temperate waters of NSW where it is seen as far south as Jervis Bay	Small Loggerhead Turtles live at or near the surface of the ocean and move with the ocean currents. As they grow, they remain typically ocean-dwellers, foraging in deeper water for fish, jellyfish and bottom-dwelling animals, before recruiting to their chosen inshore or neritic feeding area at approximately 70cm or more in size. In their juvenile stage they feed on algae, pelagic crustaceans, molluscs, flotsam and anthropogenic debris. As they grow they become more carnivorous, feeding primarily on benthic invertebrates and smaller amounts of jellyfish, starfish, corals, crabs and fish.	Nests on open, sandy beaches in tropical areas. Low density and sporadic nesting also occurs southwards into northern NSW. Breeds from November to March with nesting possible through to May.

Sources: DPIE (2020) and DAWE (2020).

5-Part Test – BC Act

Threatened Marine Turtles– BC Act
(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
Marine turtles may forage in subtidal habitats within and adjacent to the Study Area. Areas of reef associated with the seawalls and breakwater and the offshore reef are likely to provide some marginal foraging habitat for marine turtles, should they enter the harbour. The foraging grounds that marine turtles utilise in the locality are likely to widely spread along the coastline and throughout the adjacent SIMP. Jetty Beach is within the more southern extent within which some sporadic nesting may occur, however rare nesting events in these areas are typically confined to more isolated beaches. Unless some nesting was to occur during construction works on adjacent sections of Jetty Beach, the proposal has minimal potential to affect the life cycle of any marine turtles in the locality.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	
Not Applicable	
(c) in relation to the habitat of a threatened species or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	
i) The rocky subtidal habitat that will be disturbed as a result of this proposal is limited to a small amount of the head of the breakwater as the extension is constructed, and the corner of the seawall inside the basin. These modifications will not result in any net subtidal habitat loss. Changes in coastal process may also result in some changes in sediment accretion. Modelling indicates a minor negative rate may occur towards the reef, while moderate negative levels of accretion may occur along the southern end of Jetty Beach as a result of the proposal (MHL 2020). Other disturbances will be restricted to some potential short-term and localised impacts on habitat quality as a result of reduced water quality, vessel movements associated with construction and underwater noise. ii) No habitat is expected to become fragmented or isolated as a result of the proposal. iii) Reef habitats within the Study Area are considered only marginal for foraging by marine turtles. Modifications to the existing rocky subtidal habitat associated with the seawall and breakwater will result in minimal change, but there will be a substantial net increase in habitat over the longer term. Other indirect modifications to reef habitat from sediment accretion are expected to be minimal. Reef habitat and pelagic areas inside and adjacent to the Study Area provide only very marginal foraging habitat for marine turtles due to high potential for human and artificial disturbances, so successful turtle nesting on Jetty Beach is unlikely. Given this, habitat within and adjacent to the Study Area is considered to be of minimal importance to the long-term survival of marine turtles that may utilise resources in the locality.	
(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).	
No	
(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	
NSW KTPs with potential to be exacerbated by the proposed development do not have potential to impact on marine turtles	
Conclusion	Marine turtles that may potentially utilise habitat in the vicinity of the proposal are unlikely to be significantly affected by the proposed activity. Habitat use in the vicinity of the subject site is likely to be very occasional, with any nesting considered unlikely on adjacent areas of Jetty Beach.

Significant Impact Criteria: Threatened and Migratory Marine Turtles

Significant Impact Criteria: Migratory Marine Birds (EPBC Act)	**Likelihood of Impact**
An action is likely to have a significant impact on a threatened or migratory species if there is a real chance or possibility that it will:	
1. lead to a long-term decrease in the size of a population.	
The action is not expected to lead to any long-term decrease in the size of a population of marine turtles as: • The foraging grounds that marine turtles utilise in the locality are likely to be widely spread along the coastline and throughout the adjacent SIMP. The Study Area only provides very marginal potential foraging grounds, which are not of a size of ecologically relevance to the areas that marine turtles forage across in northern NSW waters. • Nesting by marine turtles in northern NSW is sporadic and of low density, while Jetty Beach is unlikely to be suitable due to the highly modified environment and high levels of potential human disturbance.	Unlikely
2. reduce the area of occupancy of the species	

The proposal will be limited to some short-term disturbances that may reduce habitat quality in the Study Area and potentially some adjacent areas at times (e.g. underwater noise, construction vessel movements and water quality). Disturbances with potential to impact occupancy will likely be very short-term and limited to construction works that may impact on habitat quality. These short-term disturbances are not expected to impact the area of occupancy of marine turtles at any ecologically significant scales.	Unlikely
3. fragment an existing population into two or more populations	
The proposal is not expected to result in any habitat that marine turtles may use to become fragmented or isolated from other areas of habitat.	Unlikely
4. adversely affect habitat critical to the survival of a species	
The habitat is not considered to be critical to the survival of marine turtles.	Unlikely
5. disrupt the breeding cycle of a population of an endangered species or seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	
The habitat is not considered to be critical to the life cycles (including breeding and nesting) of marine turtles.	Unlikely
6. modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline or an area of important habitat for a migratory species	
Reef habitats within the Study Area are considered only marginal for foraging by marine turtles. Modifications to the existing rocky subtidal habitat associated with the seawall and breakwater will result in minimal change, but there will be a substantial net increase in habitat over the longer term. Other indirect modifications to reef habitat from sediment accretion are expected to be minimal. Short-term disturbances from construction and associated underwater noise, vessel movements and reduced water quality may impact on habitat quality over very short-periods. However, given the very low density of marine turtles and likely rare use of habitats within the harbour, these indirect impacts on habitat quality have minimal potential to result in any species decline for marine turtles.	Unlikely
7. result in invasive species that are harmful to a critically endangered, endangered or migratory species becoming established in the critically endangered, endangered or migratory species' habitat	
No known invasive species harmful to the endangered and/or migratory marine turtles are likely to be released or have their populations enhanced as a result of this proposal.	Unlikely
8. introduce disease that may cause the species to decline, or	
The proposed action is unlikely to result in the introduction of disease that may cause a decline of marine turtles.	Unlikely
9. interfere with the recovery of the species.	
The proposed action is unlikely to substantially interfere with the recovery of marine turtles.	Unlikely
Conclusion	
The proposal is unlikely to result in a significant impact on marine turtles. Impacts will be confined to short disturbances that may reduce habitat quality during construction, such as disturbances to artificial habitat, generation of underwater noise, construction vessel movements or reduced water quality. This habitat represents only a very small area the species forages across and is not critical to their lifecycle, while nesting is unlikely to occur on nearby Jetty Beach.	

Black Rockcod

Species Review

Name /Species	Status FM Act	Status EPBC Act
Black Rockcod (***Epinephelus daemelii***)	Vulnerable	Vulnerable

Species	Distribution	Habitat and Prey	Breeding
E. daemelii	Black Rockcod is now mostly found from southern Queensland to eastern Victoria, with the NSW coastline forming its main range. Adults are territorial and often occupy a particular cave for life.	Adult Black Rockcod are usually found in caves, gutters and beneath bommies on rocky reefs, from nearshore environments to depths of at least 50m. Small juveniles are often found in coastal rock pools, and larger juveniles around rocky shores in estuaries. Black Rockcod are opportunistic carnivores, eating mainly other fish and crustaceans.	The Black Rockcod is a protogynous hermaphrodite, first developing as a sexually mature female and then changing into a male later in life at a length of approximately 100–110cm.

Source: DPI (2015a).

7-Part Test – FM Act

Threatened Black Rockcod –FM Act
(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
The Black Rockcod is known to be common on coastal reefs along the northern NSW coast and adjacent SIMP. Juveniles are also known to occur amongst rocks and cracks along the edges of break walls inside estuaries and harbours. Adults will typical frequent caves and overhangs on coastal reefs. The offshore reef in the Study Area provides potential Black Rockcod habitat, while juveniles could use cracks and crevices associated with the breakwater. Inspection of these areas during the survey did not find any Black Rockcod, and their use of these areas, if any, is unlikely to be permanent in nature. Furthermore, any use would only be by a very small part of the local population. Given this, the proposal is unlikely to have an adverse effect on the life cycle of the Black Rockcod such that a viable local population of the species is likely to be placed at risk of extinction.
(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.
Not applicable
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Not applicable
(d) in relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality
i) The rocky subtidal habitat that will be disturbed as a result of this proposal is limited to a small amount of the head of the breakwater as the extension is constructed, and the corner of the seawall inside the basin. These modifications will not result in any net intertidal habitat loss. Changes in coastal process may also result in some changes in sediment accretion. Modelling indicates a minor negative rate of sediment accretion may occur towards the reef (MHL 2020). Other disturbances will be restricted to some potential short-term and localised impacts on habitat quality as a result of reduced water quality and potential for underwater noise. ii) No habitat is expected to become fragmented or isolated as a result of the proposal. iii) The habitat represents only a very small area of marginal Black Rockcod habitat. Use, if any, would only be by a very small part of the local population of Black Rockcod, while the habitat is unlikely to be significant to the long-term survival of the species in the locality.

(e) Whether the proposed development or activity is likely to have an adverse effect on any critical habitat (either directly or indirectly)	
This question is not applicable, as no critical habitat has been listed for Black Rockcod	
(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.	
A Black Rockcod Recovery Plan has been prepared by the NSW DPI Fisheries (DPI, 2012). The objectives or actions of the recovery plan are: • Determine the distribution and abundance of Black Rockcod in NSW. • Initiate and support research into the biology and ecology of Black Rockcod. • Initiate and support research into the impacts of high and moderate risks to Black Rockcod. • Identify important areas of Black Rockcod habitat and implement appropriate actions to recover Black Rockcod. • Improve the collection of data on interactions between Black Rockcod and fishers. • Increase community awareness and support for Black Rockcod issues and recovery actions. • Ensure that management authorities carry out appropriate planning and impact assessment and make management decisions which minimise impacts on Black Rockcod habitats. • Mitigate the impacts of water pollution on Black Rockcod. Works during construction should be designed, implemented and managed to minimise potential for impacts on Black Rockcod. Impacts of disturbance to habitat and habitat quality from underwater noise and reduced water quality will require further consideration should Black Rockcod be found to be present at the subject site during construction works.	
(g) Whether the proposed development constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	
KTPs with potential to be exacerbated by the proposed development do not have potential to impact on Black Rockcod.	
Conclusion	The viability of the Black Rockcod population that utilise habitat in the vicinity of the proposal is unlikely to be significantly affected by the proposed activity. Potential Black Rockcod habitat inside the Study Area is marginal habitat only and is not expected to be significant to the local population. Impacts from the proposal are restricted to some potential disturbances during construction works that may have some localised and short-term influence on habitat quality if they are present in the Study Area at this time.

Significant Impact Criteria: Black Rockcod

Significant Impact Criteria: Black Rockcod (EPBC Act)	Likelihood of Impact
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
1. lead to a long-term decrease in the size of an important population of a species	
The proposed action is limited to disturbances of marginal habitat associated with the offshore reef and breakwater that Black Rockcod. Given the species was not found during the site survey and it has a high level of site fidelity, it is unlikely to occur in this area, however some new juveniles may recruit to these areas in the future. Disturbances may include some modification of habitat associated with the breakwater as a direct result of the proposed action, and modification of the offshore reef via indirect impacts from changes in coastal processes as a result of changes in sediment accretion. Inspection of these areas during the survey did not find any individual Black Rockcod and their use, if any, of these areas is unlikely to be permanent in nature. Furthermore, any use by Black Rockcod would only be by a very small part of the local population. Given this, the proposal is unlikely to lead to a long-term decrease in the size of an important population of Black Rockcod in the locality.	Unlikely
2. reduce the area of occupancy of an important population	
The proposal is not expected to reduce any area of occupancy important to the Black Rockcod population in the locality. Survey of the site as part of this assessment did not find any Black Rockcod in the Study Area. This indicates it is unlikely that Black Rockcod permanently occupy these areas, and that any permanent occupancy or core habitat would be impacted.	Unlikely
3. fragment an existing important population into two or more populations	
The proposal is not expected to result in any habitat that Black Rockcod may use to become fragmented or isolated from other areas of habitat.	Unlikely
4. adversely affect habitat critical to the survival of a species	
The Study Area includes only a very small amount of marginal habitat that may be used by Black Rockcod at times. This habitat is unlikely to be critical to the survival of the species in the locality, while any disturbances will be minimal and short-term.	Unlikely
5. disrupt the breeding cycle of an important population	

The types of habitat in the Study Area and adjacent areas are not identified to be of importance for spawning by the population.	Unlikely
6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	
Modification of potential habitat will be minimal and not be expected to impact to an ecologically significant degree that would have potential to result in a likely decline of Black Rockcod. Following construction, the additional artificial subtidal structure may provide additional habitat for the species.	Unlikely
7. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable, endangered, or critically endangered habitat or habitat for migratory species'	
No known invasive species harmful to Black Rockcod are likely to be released or have their populations enhanced as a result of this proposal.	Unlikely
8. introduce disease that may cause the species to decline, or	
The proposed action is unlikely to result in the introduction of disease that may cause a decline in the local Black Rockcod population.	Unlikely
9. interfere substantially with the recovery of the species.	
The proposed action is unlikely to substantially interfere with the recovery of Black Rockcod.	Unlikely
Conclusion	
Habitat in the Study Area is not considered significant habitat for Black Rockcod or likely to be utilised by a significant part of the local population. Any impacts on Black Rockcod will be dependent on their occurrence at the time of construction works and, if the species is present, will typically be confined to short-term disturbances to habitat quality during periods of reduced water quality or generation of underwater noise.	

White Shark

Species Review

Name /Species	Status FM Act	Status EPBC Act
White Shark (***Carcharodon carcharias***)	Vulnerable	Vulnerable, Migratory

Species	Distribution	Habitat and Prey	Breeding and Life History
C. ***carcharias***	The White Shark is widespread globally in temperate and subtropical oceans with a preference for cooler waters. Movements are extensive, covering thousands of kilometres, and seem highly directed. After moving hundreds or thousands of kilometres at a steady speed, White Sharks may suddenly stop for periods of days to months. In Australia they typically move up the east coast in autumn–winter to areas as far north as central Queensland, and then return south during spring.	White Sharks may forage close inshore around rocky reefs, surf beaches and shallow coastal bays, to the outer continental shelf and slope areas. They feed on a variety of prey including finfish, other sharks and rays, marine mammals such as seals, sea lions, dolphins and whales, as well as squid, crustaceans and seabirds. Seasonal feeding around seal colonies is considered to be an important feeding event for the species, while they regularly follow and prey on calves during the annual whale migration along the NSW coast and are known to follow schooling pelagic fish.	Parturition is believed to occur in spring through to summer throughout temperate waters worldwide. They give birth to live young and the gestation period may be up to 18 months with a three-year reproductive cycle. In NSW, areas north of Newcastle around Stockton Beach and Hawks Nest have also been found to be sites where juvenile White Sharks appear to aggregate at times.

Source: DPI (2015b).

7-Part Test – FM Act

Threatened White Shark –FM Act
(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
White Sharks may utilise habitat in the Study Area or adjacent areas inside the harbour to forage for or pursue prey. Short-term disturbances to the quality of both soft sediment and reef habitats may negatively impact the local fish assemblage, thereby reducing prey items for White Sharks, over a very localised scale inside the harbour. During construction works underwater noise during piling may also reduce habitat quality in the Study Area and adjacent habitat. White Sharks forage over large areas and their occurrence in the Study Area is likely to be rare and transient, with the habitat inside Coff Harbour not considered to be core habitat for White Sharks. Given this, the proposal is not expected to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.
Not applicable
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Not applicable
(d) in relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

Whites Sharks may utilise habitat in the Study Area or adjacent estuarine habitat to forage for or pursue prey, however the Study Area and adjacent habitat is not considered core habitat for White Sharks. i) Modification and removal of habitat is confined to areas of soft sediments that will require dredging and potential minor modifications to reef habitats. This may attract fish and other prey items and provide some foraging habitat. Disturbance to habitat quality as a result of underwater noise is expected to be short-term, minimal and very localised to areas near the boat ramp basin. ii) The proposal is not expected to result in any habitat that White Sharks may use to become fragmented or isolated from other areas of habitat. iii) The habitat represents only a small area of non-core habitat that White Sharks may forage within, and is not considered important in the long-term survival of White Sharks in the locality.	
(e) Whether the proposed development or activity is likely to have an adverse effect on any critical habitat (either directly or indirectly)	
This question is not applicable, as no critical habitat has been listed for White Shark.	
(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.	
A White Shark Recovery Plan has been prepared by the Commonwealth Government (SEWPAC, 2013). The objectives of the recovery plan are: • Monitor and reduce the impact of commercial fishing on White Sharks. • Investigate and evaluate the impact of recreational fishing on White Sharks. • Monitor and reduce the impact of shark control activities on White Sharks. • Identify and manage the impact of tourism on White Sharks. • Monitor and reduce the impact of trade in White Shark products. • Develop research programs toward the conservation of White Sharks. • Identify habitat critical to the survival of White Sharks and establish suitable protection of this habitat from threatening activities. • Promote community education and awareness in relation to White Sharks. • Develop a quantitative framework to assess the recovery of the White Shark. The Study Area and adjacent habitats are not considered core habitats for White Sharks and as such the proposal would be consistent with the objectives of this Recovery Plan.	
(g) Whether the proposed development constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	
KTPs with potential to be exacerbated by the proposed development do not have potential to impact on White Sharks.	
Conclusion	The viability of the White Shark population that may utilise habitat in the vicinity of the Study Area is unlikely to be significantly affected by the proposed activity. Impacts from the proposal are restricted to some minor modifications of foraging habitat and potential disturbances during construction works in a small amount of non-core habitat.

Significant Impact Criteria: White Shark

Significant Impact Criteria: White Shark (EPBC Act)	**Likelihood of Impact**
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
1. lead to a long-term decrease in the size of a population or important population of a species	
The proposed action is limited to some minor modifications of habitat and short-term disturbances within non-core habitat that White Sharks may use at times to forage for or pursue prey. Habitat modification will be limited to some dredging of shoaling sands and extension of the breakwater, and has potential for facilitating increased sediment accreditation on the nearby offshore reef. Short-term disturbances are confined to reduced habitat quality as a result of reduced water quality, generation of underwater noise and the potential for reduced prey availability in the Study Area. Given that White Sharks forage over very large areas, and the Study Area is not considered core habitat, there is no evidence that White Sharks are dependent on habitat within the Study Area or adjacent areas at a scale of ecological relevance to the local population.	Unlikely
2. reduce the area of occupancy of an important population	
White Sharks are likely to utilise habitat resources widely spread along the coastline and throughout the adjacent SIMP. The proposal will be limited to some minor habitat modifications and some short-term disturbances that may have short-term impacts on habitat quality in the Study Area and adjacent areas at times (e.g. generation of underwater noise and reduced water quality). Disturbances with potential to impact any occupancy will likely be very short-term and limited to construction works that require pilling. These short-term disturbances are not expected to impact the area of occupancy of White Sharks at any ecologically significant scale.	Unlikely
3. fragment an existing important population into two or more populations	

The proposal is not expected to result in any habitat that White Sharks may use to become fragmented or isolated from other areas of habitat.	Unlikely
4. adversely affect habitat critical to the survival of a species	
The habitat inside the Study Area is not considered critical to the survival of White Sharks.	Unlikely
5. disrupt the breeding cycle of an important population or seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	
The habitat in the Study Area or any adjacent areas is not core habitat of White Sharks. Given this, it is not considered to be of importance for breeding of White Sharks.	Unlikely
6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline or an area of important habitat for a migratory species	
Modification of potential habitat will be minimal and not be expected to impact to an ecologically significant degree that would have potential to result in a likely decline of White Sharks.	Unlikely
7. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable, endangered, or critically endangered habitat or habitat for migratory species'	
No known invasive species harmful to White Sharks are likely to be released or have their populations enhanced as a result of this proposal.	Unlikely
8. introduce disease that may cause the species to decline, or	
The proposed action is unlikely to result in the introduction of disease that may cause a decline of White Sharks.	Unlikely
9. interfere substantially with the recovery of the species.	
A White Shark Recovery Plan has been prepared by the Commonwealth Government (SEWPAC 2013). The objectives of the recovery plan are: • Monitor and reduce the impact of commercial fishing on White Sharks. • Investigate and evaluate the impact of recreational fishing on White Sharks. • Monitor and reduce the impact of shark control activities on White Sharks. • Identify and manage the impact of tourism on White Sharks. • Monitor and reduce the impact of trade in White Shark products. • Develop research programs toward the conservation of White Sharks. • Identify habitat critical to the survival of White Sharks and establish suitable protection of this habitat from threatening activities. • Promote community education and awareness in relation to White Sharks. • Develop a quantitative framework to assess the recovery of the White Shark. The Study Area and adjacent habitats are not considered core habitats for White Sharks and as such the proposal would be consistent with the objectives of this Recovery Plan.	Unlikely
For listed migratory species	
10. substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	
NA	Unlikely
11. seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	
NA	Unlikely
Conclusion	
The proposal is unlikely to result in a significant impact on White Sharks. The habitat in the Study Area and adjacent areas inside the harbour are not considered core habitat for White Sharks. Impacts will be confined to some minor modifications of potential foraging habitat and short disturbances, such as generation of underwater noise or decreases in water quality, that may temporarily reduce habitat quality and possibly prey availability during construction.	

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Targeted survey for the critically endangered marine brown alga *Nereia lophocladia* on patch reefs inside Coffs Harbour (2020)

November 2020

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Targeted survey for *Nereia* on patch reefs inside Coffs Harbour

Executive Summary

The Coffs Harbour boat ramp supports a vibrant boating and fishing culture. The use of this boat ramp has been compromised by excessive sedimentation, which has been addressed through dredging and infrastructure modification. As sedimentation remains an ongoing issue for the Coffs Harbour boat ramp, there is constant public pressure to improve access and safety.

The Coffs Harbour boat ramp is close to a population of the critically endangered marine brown alga, *Nereia lophocladia* (hereafter called *Nereia*), which is found on the north side of Muttonbird Island. The potential occurrence of this threatened alga and suitability of habitat is an important consideration for improvements to the Coffs Harbour boat ramp. While much of the natural reef and subtidal infrastructure inside Coffs Harbour have been surveyed for *Nereia*, it was recently noted that surveys have not been undertaken on patch reefs within 200 m of the boat ramp. The objective of this study was to undertake the first targeted survey for *Nereia* sporophytes on these patch reefs.

Divers did not find any *Nereia* sporophytes on the patch reefs near the Coffs Harbour boat ramp, which is similar to a number of previous assessments for *Nereia* on the inside of Coffs Harbour since 2002. Although there was only a small swell from the south and light winds, water clarity during the survey was poor. The survey also took place in early November, which was past the peak sporophyte season for *Nereia*. While factors reduced the chance of finding *Nereia*, the expert dive team would still have likely found the alga, if it had been present.

In summary, no *Nereia* sporophytes were found on the patch reefs near Coffs Harbour boat ramp. This snap-shot survey cannot, however, rule out that *Nereia* may occur on these reefs from time to time. Given the closest population of *Nereia* at Muttonbird Island has persisted through a period of extensive anthropogenic and natural disturbance from 2015 – 2020 and that there are now seven known *Nereia* populations spread over 65 km of coastline (Mamo et al. in review), minor construction works on the Coffs Harbour boat ramp are unlikely to pose a significant global extinction risk for this critically endangered alga.

Contents

Introduction

Background

The Coffs Harbour boat ramp supports a significant fishing and boating culture, which has socio-economic importance for the region. The functioning of this boat ramp has been impacted by sedimentation and, as a result, has been subject to dredging and substantial infrastructure modification. As sedimentation remains an ongoing concern for boat ramp users, there is public pressure to further modify the boat ramp infrastructure to improve access and safety.

The Australian endemic macroalga *Nereia lophocladia* (Order: Sporochnales; hereafter called *Nereia*) is listed as critically endangered under the *New South Wales Fisheries Management Act 1994*, due to its limited distribution and putative population declines (FSC, 2008). In the last century, *Nereia* has only been found near Coffs Harbour (Mamo et al. 2018, Yee et al. 2017). *Nereia*'s type locality is adjacent to the north side of Muttonbird Island (Fig. 1, Yee et al. 2017), where *Nereia* sporophytes have been consistently found each year since 2015 (Kelaher and Mamo 2020). In the last 3 years, it has also been found at Diggers Camp, Minnie Water, Woolgoolga, Charlesworth Bay, Little Muttonbird Island, Muttonbird Island and Sawtell (Mamo et al. in review). The distribution of *Nereia* is highly fragmented within sites, sometimes occurring as isolated individuals or in extensive patches (Kelaher and Mamo 2019a). *Nereia* sporophytes have been found from 1.5 – 12.0 m water depth (Mamo et al. in review).

The hard marine substrata around the Coffs Harbour boat ramp is predominantly shore-based natural rocky reefs and coastal protection infrastructure. A recent survey of these areas did not find any *Nereia* and, based on environmental characteristics, it was concluded that the habitat was not ideal to support *Nereia* sporophytes (Kelaher and Mamo 2019b). Furthermore, numerous surveys by qualified marine biologists over the last 15 years have failed to find *Nereia* inside Coffs Harbour (Yee et al. 2017, Kelaher and Mamo 2019b). To our knowledge, no one has specifically looked for *Nereia* on patch reef situated within 200 m of the Coffs Harbour boat ramp (Fig. 1). Given these patch reefs are within 800 m of where *Nereia* is routinely found (Fig. 1) and in an appropriate depth range (~3 – 8 m) (Mamo et al. in review), it is possible they support *Nereia*.

Objective

The objective of this study was to undertake the first targeted survey for *Nereia* sporophytes on the permanent patch reefs within 200 m of the Coffs Harbour boat ramp.

Figure 1 Map of the inside of Coffs Harbour. The red area highlights the location of permanent patch reefs. The yellow areas are reefs that can temporarily emerge following sand scouring (reef locations provided by Dr David Cummings). The purple area highlights the closest population of *Nereia*. The green dot shows the place where the dive survey began and the red dot shows where it finished.

Experimental Design and Data Collection

Sampling methods

To estimate the distribution and abundance of *Nereia* on the permanent patch reefs near the Coffs Harbour boat ramp, we surveyed for sporophytes on the 4th of November 2020 (Fig. 2). Careful searches on SCUBA were carried out by divers who were expert with the identification of *Nereia*. The divers towed a time-synced GPS to track their dive paths and to mark the location of any observed *Nereia* (Fig. 2). Surveys involved carefully searching of the rock/sand interface, which is key habitat for *Nereia*. Following this, the divers undertook a haphazard search over the entire patch reef (Fig. 2). The search was impacted by poor water clarity, with visibility ranging between 0.0 – 0.5 m.

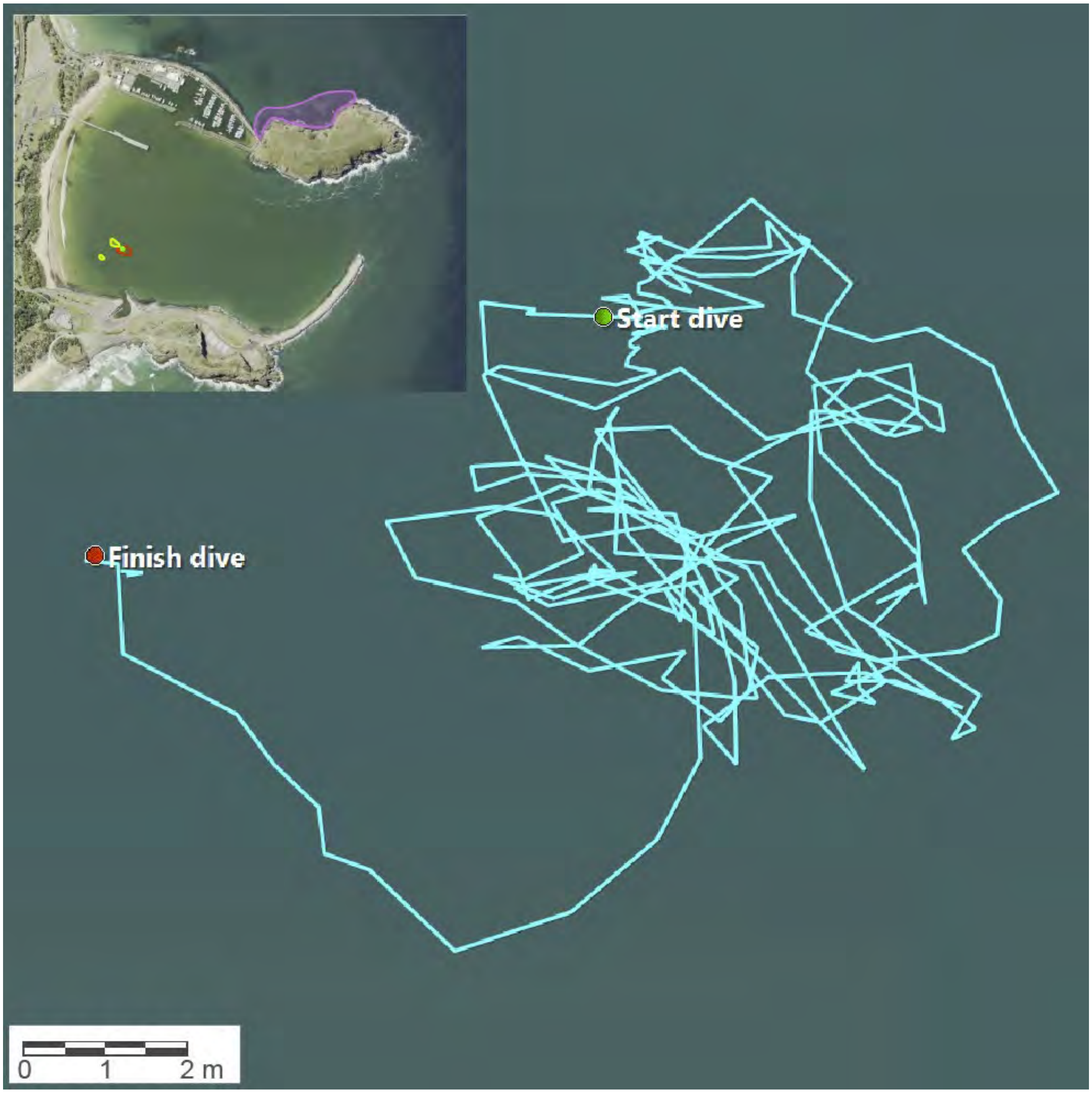

Figure 2 GPS track (blue line) of the survey for *Nereia* on the permanent patch reefs near the Coffs Harbour boat ramp. The green dot show the place where the dive survey began and the red dot shows where it finished. The haphazard search pattern included all of the reef-sand interface, which is the habitat that *Nereia* is most commonly found (Kelaher and Mamo 2019a).

Results and Discussion

Nereia sporophytes were not found on the patch reefs. This is consistent with assessments for *Nereia* inside Coffs Harbour since 2002, which also never observed a living sporophyte (Yee et al. 2017, Kelaher and Mamo 2019b). Past assessments have included the southern side of Muttonbird Island, the eastern wall of the marina the jetty and the inside of the eastern breakwater and the southern shores between the breakwall and the boat ramp (Yee et al. 2017, Kelaher and Mamo 2019b). In contrast, *Nereia* has been routinely found on the north side of Muttonbird Island and the Coffs Harbour Northern Breakwater since 2015, as well as at Diggers Camp, Minnie Water, Woolgoolga, Charlesworth Bay, Little Muttonbird Island, Coffs Harbour and Sawtell (Mamo et al. in review). Given that *Nereia* is found north and south of Coffs Harbour but not inside the harbour itself, it could be reasonably hypothesised that the available habitat and environmental conditions inside Coffs Harbour may not be appropriate for this critically endangered species.

Although ocean conditions at the time of the survey were reasonable (i.e. a small swell from the south and light winds), underwater visibility was poor (0.0 – 0.5 m). These challenging conditions would have made it harder to observe *Nereia* sporophytes if they were present. Importantly, the divers were highly skilled at locating *Nereia* and have previously identified it when water clarity was very poor. Moreover, the divers identified hundreds of *Nereia* sporophytes earlier in the year on the north side of Muttonbird Island and the lead diver has consistently observed it since its rediscovery in 2015. Consequently, there was a high probability that *Nereia* sporophytes would have been found, if they were present, even considering the challenging diving conditions.

Nereia's life history involves alternation of heteromorphic generations, where there is a microscopic gametophyte and a seasonal macroscopic sporophyte stage (Yee et al. 2017). To date, no one has observed a *Nereia* gametophyte. Assessments of the distribution and abundance of *Nereia* are, therefore, based on surveys of sporophytes. *Nereia* sporophytes have been observed in the field from July to February (Mamo and Kelaher, unpublished data), with a peak in late August and September (Kelaher and Mamo 2019b). The survey of patch reefs in the present study was done in November, which is after peak season for *Nereia* sporophytes. This would have made it difficult to find *Nereia* sporophytes if they were present, although they are still routinely found at this time of year on the north side of Muttonbird Island (~800 m away).

This one-off survey cannot provide conclusive evidence that *Nereia* is never present on the patch reefs near the Coffs Harbour boat ramp. Given that repeated surveys have failed to find

Nereia inside Coffs Harbour (e.g. Yee et al. 2017, Kelaher and Mamo 2019b), it is unlikely these patch reefs are an important habitat for this critically endangered alga. Since its rediscovery in 2015, a *Nereia* population has persisted around the northside of Muttonbird Island, which is the closest identified population to the boat ramp (Fig. 1, Kelaher and Mamo 2020). At the same time, there have been major upgrades to the adjacent breakwaters, modifications to the marina, and work on and around the boat ramp, as well as a significant storm event in 2016. This suggests that the minor construction works in the inner part of Coffs Harbour, to date, have had little influence on the *Nereia* populations on north side of Muttonbird Island.

Conclusion

This report describes a targeted survey for the critically endangered marine brown alga, *Nereia lophocladia*, on patch reefs near the Coffs Harbour boat ramp. No *Nereia* sporophytes were found, despite researchers having extensive experience identifying *Nereia* in the field. Although this snap-shot survey cannot rule out that *Nereia* may occur on these reefs from time to time, this critically endangered species has not been found inside Coffs Harbour since 2002. Given there are at least seven known *Nereia* populations spread over 65 km of coastline (Mamo et al. in review) and the closest *Nereia* population has persisted through a period of extensive anthropogenic and natural disturbance, minor construction works on the boat ramp may not represent a significant global extinction risk for this critically endangered alga.

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Appendix G

Concept Design Report

REPORT

Coffs Harbour Boat Ramp Upgrade

Concept Design Report

Client:	Transport for NSW (MIDO)
Reference:	PA2341-RHD-R-001-R-C-001
Status:	01/Final
Date:	09 October 2020

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Document title: Coffs Harbour Boat Ramp Upgrade

Document short title: Coffs Harbour Boat Ramp Concept Design Report
Reference: PA2341-RHD-R-001-R-C-001
Status: 01/Final
Date: 09 October 2020
Project name: Coffs Harbour Boat Ramp
Project number: PA2341
Author(s): Patrick Lawless, Ben Patterson

Drafted by: Ben Patterson, Patrick Lawless

Checked by: Ben Patterson

Date: 9/10/20

Approved by: Ben Patterson

Date: 9/10/20

Classification
Project related

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Appendices

1 Introduction

1.1 Background

Royal HaskoningDHV (RHDHV) was engaged by Transport for NSW (TfNSW) in March 2020 to investigate recreational boating needs at the Coffs Harbour Boat Ramp. The investigation has been proposed to address several issues including:

- entrance and channel navigability and safety;
- manoeuvrability of vessels;
- degradation of the existing boat launching facilities;
- balancing the needs of passive recreation users (particularly other users of the Southern Coffs Harbour peninsula, such as surfers, picnickers, walkers and cyclists) and motorised watercraft;
- ease of foreshore access; and,
- car parking and amenities.

Figure 1 provides a summary of the key features within the study area for the investigation.

Figure 1 Coffs Harbour Boat Ramp Study Area

1.2 Objectives

The objectives of the investigation are to:

- identify opportunities to better meet current and future recreational boating needs of the community;
- develop three (3) concept options for boating infrastructure improvements; and,
- determine how the boating infrastructure options integrate with the surrounding area and would be accessed, utilised and capitalised by the community.

1.3 Scope of Work

The scope of work completed as part of the investigation included the following main tasks:

- Stage 1 – Preliminary Investigations, including:
  - Kick-off Meeting (with Crown Lands);
  - Collation and review of background information;
  - Service location and preparation of Survey Brief;
  - Detailed Topographic and Bathymetric Survey (by sub-consultants)
  - Development of Preliminary Options for consultation purposes
  - Stakeholder Meeting #1, including the presentation of some preliminary options. This meeting was held by teleconference due to COVID-19 restrictions on 8 May 2020 (refer to Presentation Slides in **Appendix A**);
- Stage 2 – Concept Design, including
  - Opportunities and Constraints Assessment including review and feedback on detailed physical model testing undertaken by Manly Hydraulics Laboratory (MHL).
  - Concept Design Option Development and Drawings (three options);
  - Preliminary Cost Estimates of options;
  - Multi-Criteria Analysis of the options;
  - Stakeholder Meeting #2, including presentation of the concept design options. Again, this meeting was held via teleconference, due to COVID-19 restrictions on 29 May 2020 (refer to Presentation Slides in **Appendix B**).

Subsequent to the second workshop, due to feedback from various stakeholders, particularly Coffs Harbour City Council, further concept design development was deemed warranted, and the following further tasks were undertaken:

1	Traffic Engineering – Data Collection and Collation	RHDHV engaged Bitzios Consulting (Bitzios) to provide traffic engineering services for the project. Bitzios undertook the following activities: 1. Site visit and observation of traffic and pedestrian patterns and safety issues. 2. Meeting with Council officers to discuss road and pedestrian conditions and future planning and their feedback on the concept design. 3. Sourcing of relevant traffic, pedestrian, cycling and parking data from Council, and the undertaking of two rounds of traffic and parking surveys. 4. Document site traffic/parking/active transport/safety observations.

2	Traffic Engineering – Concept Design Advice	Bitzios reviewed the concept plans and undertake the following activities: 1. Review of car park design in accordance with AS2890 and Council's Parking Code. 2. Completion of turn path assessments for car and trailer movements and any service vehicle requirements (e.g. Refuse collection of Waste Bins). 3. Review functionality of car park for operations and safety. 4. Review traffic circulation between boat ramp and car parks and potential traffic conflicts (including conflicts with pedestrians/cyclists). 5. Assess intersection design including turn warrants, manoeuvrability and sight lines. 6. Review proposed pedestrian facility design for functionality, safety and inclusiveness. 7. Prepare a brief technical note that details the Concept Design traffic assessment with recommendation where necessary.
3	Landscape Architecture - Concept Design Review	We engaged RedBelly Landscape and Urban Design consultants to provide landscape architecture services for the project. RedBelly reviewed the Stage 1 concept plans and undertook the following activities: 1. Site visit. 2. Review and assessment of background information and previous RHDHV design proposals. 3. Workshop with consultant team and key staff of CHCC and TfNSW. 4. Prepared alternative concept design ideas for discussion 5. Further consultant team / stakeholder coordination meetings (on site, carried out on Thursday 6th August 2020, refer below)
4	Workshop with stakeholders to discuss required design modifications	We undertook a stakeholder workshop with key personnel from TfNSW - MIDO, and Coffs Harbour City Council at the conclusion of this Concept Design review.
5	Revision of concept designs to reflect revised approach	Develop concept sketches based on feedback from workshop and discuss with client prior to re-drafting. Revised cost estimates for the preferred option.
6	Concept design report	Above tasks to be described in concept design report

1.4 Acknowledgements

RHDHV gratefully acknowledges the assistance provided by Transport for NSW – Maritime Infrastructure Delivery Office, Coffs Harbour City Council, and Manly Hydraulic Laboratory staff in facilitating access to background information and reviewing the deliverables for the investigation.

We also wish to acknowledge the very valuable inputs from Mr Garry Murray of Red Belly Design, and Mr Julius Walden-Goodlet from Bitzios, in the development of the preferred concept designs.

1.4.1 Consultation

Several stakeholders were consulted as part of the investigation to establish current issues and demands and future needs for boating infrastructure, and to provide feedback on the development of concept options. These stakeholders have included:

- Transport for NSW (Maritime Infrastructure Development Office) (‘MIDO’) – represented by Patrick Smyth, and Tony Johansson, and Andrew Mogg.
- The Coffs Harbour Regional Boat Ramp Precinct Enhancement Committee (CHRBRPEC) – principally represented by Mr John Lawler
- Coffs Harbour City Council represented by:
    - Andrew Beswick (Director Business Services)
    - Rebecca Doblo (Open Space Assets)
    - Josh King (Strategic Asset Management)
    - Terry Thorn (Operations – e.g. roads, current dredging practices)
- NSW Property, represented by:
    - Akwasi Agyei
    - Tahlee Smith

RHDHV wish to thank the above stakeholders for their valuable contributions to the preparation of the concept plans.

2 Review of Background Information

As part of the investigation, a wide range of background information was reviewed to establish an understanding of the existing environment and opportunities and constraints associated with boating infrastructure. The information that was compiled as part of the investigation is listed below.

Council GIS data layers:

- cadastral boundaries and Lot / DP Numbers;
- Council-controlled Crown Land;
- Land zoning;
- stormwater drainage;
- aerial photography.

Topographic and Bathymetric Survey:

- engaged by RHDHV and supplied by North Coast Surveys – dated 30 March 2020, (refer **Appendix C**);

Other Relevant Background Data:

- Coffs Harbour City Council - Boat Ramp Upgrade, Jordan Esplanade, Coffs Harbour NSW - Geotechnical Assessment (Regional Geotechnical Solutions, Report No. RGS30472.1-AB , 5 May 2014)
- Coffs Harbour Jetty Boat Ramp Improvements, Boat Ramp Road Re-Alignment Plan of Works End Jordan Esplanade, Coffs Harbour Jetty (CHCC, Survey and Design Branch, August 2014)
- Boat Ramp Basin Extension, NSW Public Works for Coffs Harbour City Council (NSW Public Works, 13 April 2015)
- Jetty Precinct Preliminary Concept Plan (GHD for CHJFP, 2018)
- Jetty Beach Boat Ramp, Coffs Harbour – Bathymetry and Dredge Volumes (North Coast Surveys for NSW Crown Lands, Bathymetric Survey undertaken 12 September 2018, Plan Issued 22 February 2019)
- Coffs Harbour Boat Ramp – Sediment Assessment, (GHD for Coffs Harbour City Council, 6 March 2019)
- Asbestos Management Documentation (Asbestos Register, and Clearance Certificate) – (Ballpark Environmental, October 2019)
- “Final Report – Enhancements for the Coffs Harbour Regional Boat Ramp Precinct” (CHRBRPEC, December 2018).

Key Technical Background Reports:

- Coffs Harbour Physical Model - Boat Ramp Basin and Breakwater Testing - Report MHL2746 October 2020 Prepared for: Department of Planning, Industry and Environment – Crown Lands);

Design Standards and Guidelines:

- AS 3962-2001 Guidelines for Design of Marinas
- AS 1428.1-2001 Design for access and mobility Part 1: General requirements for access – New building work
- AS 2890 Parking Facilities
- Coastal Engineering Manual (USACE, 2008)
- NSW Boat Ramp Facility Guidelines (RMS, 2015)

Council planning documents:

- Coffs Harbour Local Environment Plan (LEP) 2013
- Coffs Harbour Development Control Plan (DCP) 2015

Full reference listings for key documents are provided in **Section 7**.

3 Existing Environment

3.1 Planning Context

3.1.1 Land Ownership

A review of Council's LEP (2013) Mapping indicates that the majority of foreshore land along the southern foreshore of Coffs Harbour is Crown Land under the care and control of Coffs Harbour City Council, apart from Lot 22, Sec DP 850150, the former Deep Sea Fishing Club, which is currently under the control of the NSW Department of Property and is the subject of potential redevelopment plans.

Any works proposed to be undertaken on Crown Land would require approval under Part 5 of the EP&A Act. For all works below Mean High Water Springs (boat ramp, pontoons, dredging and breakwater extension), approval is required from NSW Crown Lands (DPIE).

3.1.2 Local Government

As shown on Council LEP Mapping (2013) the southern foreshores of Coffs Harbour are for the most part zoned RE1 Public Recreation under the *Coffs Harbour Local Environmental Plan (LEP) 2013*. The Boat Ramp, Harbour and Main Carpark is zoned SP2 Infrastructure.

Figure 2 Coffs Harbour LEP (2013), Land Zoning

3.1.3 State Environmental Planning Policies

Under *State Environmental Planning Policy (Infrastructure) 2007*, consent is not required for development of wharf or boating facilities carried out by or on behalf of a public authority on any land. Furthermore, Division 25, Clause 25 of *SEPP (Infrastructure) 2007 - Waterway or foreshore management activities* states that "development for the purpose of waterway or foreshore management activities may be carried out by or on behalf of a public authority without consent on any land". This includes construction works (including dredging and land reclamation, if it is required for the construction of facilities) and routine maintenance works.

3.1.4 State and Federal Legislation

Vegetation surveys will be required to determine whether the study area includes endangered ecological communities (EECs) including seagrasses and saltmarsh. These and any other threatened or endangered species listed under the *Threatened Species Conservation Act 1995* (TSC Act) would require assessment in accordance with the requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act) as part of any proposed developments in the study area.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires that proposals for development or "actions" that have, will have, or are likely to have a significant impact on any matter of national environmental significance are to be referred to the Commonwealth Environment Minister for consideration and approval.

The EPBC Act identifies the following matters of national environmental significance (MNES):

- World heritage;
- National heritage;
- Wetlands of international importance (Ramsar);
- Listed threatened species and communities;
- Listed migratory species;
- Protection of the environment from nuclear actions;
- Marine environment.

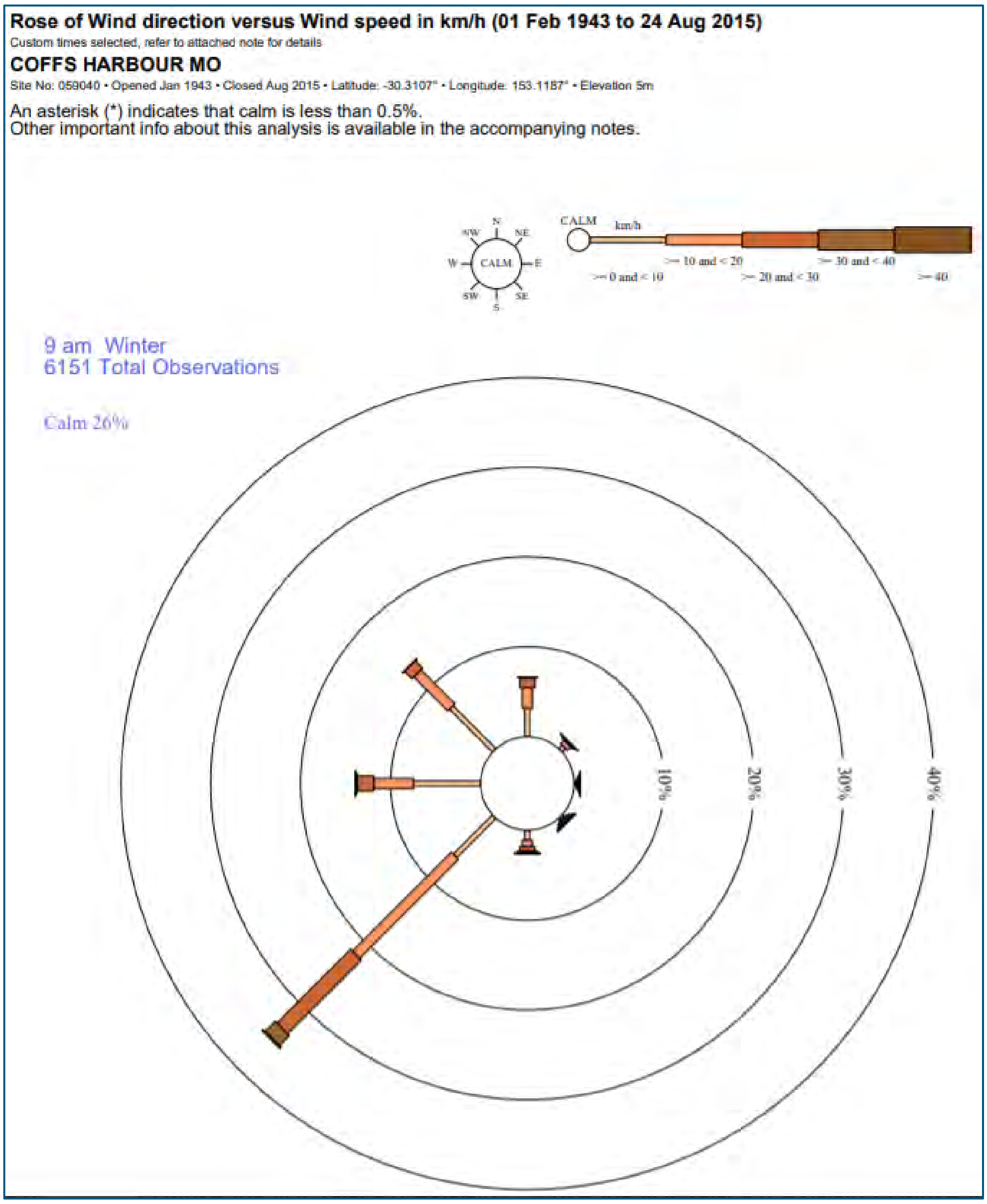
Threatened and migratory species may occur within the study area. Any proposal to undertake works would therefore require (as a minimum) Assessments of Significance for those species, populations and endangered ecological communities that have the potential to be impacted.

3.2 Coastal Processes

3.2.1 Wind Climate

The wind climate within Coffs Harbour is best represented by the Bureau of Meteorology (BoM) weather station at Coffs Harbour airport (Station No. 059040). This station is located approximately 2 km due west from the Coffs Harbour boat ramp. A review of monthly wind roses available on the BoM website (accessed 20 August 2020, refer **Figure 3** and **Figure 4** that indicate that winds are seasonal. This seasonality is characterised following a typical NSW coastal trend of:

- stronger southerly and south- westerly winds in winter;
- northerly winds in summer, and
- both southerly and northerly winds common in autumn and spring.



Rose of Wind direction versus Wind speed in km/h (01 Feb 1943 to 24 Aug 2015)

Custom times selected, refer to attached note for details

COFFS HARBOUR MO

Site No: 059040 • Opened Jan 1943 • Closed Aug 2015 • Latitude: -30.3107° • Longitude: 153.1187° • Elevation 5m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.

9 am Winter
6151 Total Observations

Calm 26%

Figure 3: Winter wind rose at Coffs Harbour weather station

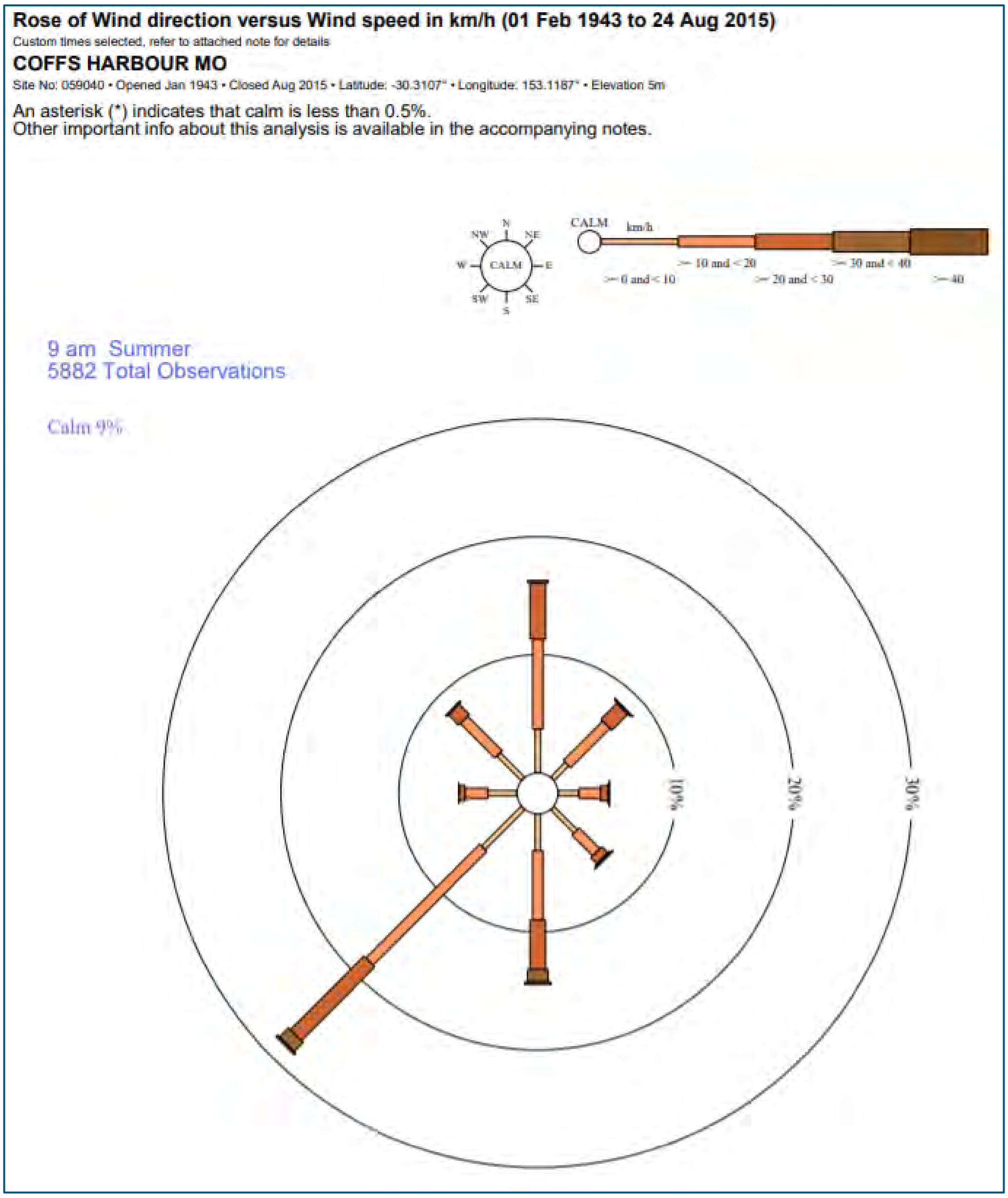


Figure 4: Summer wind rose at Coffs Harbour weather station

3.2.2 Water Depths

All reference to Reduced Level (RL) in this report is given in metres above, or below, Australian Height Datum (AHD). AHD is a local datum which is approximately equal to current Mean Sea Level at the coastline of mainland Australia.

A hydrographic survey of the study area was undertaken by North Coast Surveys, dated 20 March 2020. The survey coverage and results are indicated on the survey plan provided in **Appendix C**.

Based on the current survey, it is assessed that existing bed levels are around RL -2 at the toe of the ramp. Variable levels occur within the remainder of the basin, with some deeper areas up to around RL -3, while the entrance is quite shallow with areas at around RL -1.7. This means that water depths of around 1 to 1.3 m occur at Mean Low Water Springs (MLWS) tidal level. MLWS occurs at around RL -0.7.

It should be noted that existing water depths in the boat ramp basin and entrance are influenced by periodic dredging undertaken by Council.

AS 3692 *Guidelines for design of marinas* provides guidance on design depth, which needs to account for the following:

- Design WL (taken at ISLW) = **RL -0.97** at Coffs Harbour (refer **Section 3.2.3**)
- Vessel Draught = **0.9 m** (for 8 m power boats, have been adopted to represent the design vessel)
- Wave Height (H), with a recommended allowance of 0.5 x H = **0.25 m** (adopting a 0.5 m seiche wave as the design condition, refer **Section 3.2.4**)
- Under keel clearance (soft bottom) = **0.3 m**
- **Design Bed Level = RL -2.42 (say RL -2.5)**

A design bed level of RL -2.5 has been adopted for the proposed boat ramp upgrade. The hydrodynamic effect of undertaking the proposed deepening of the boat ramp basin and entrance channel was assessed as part of a physical model testing program undertaken by MHL (refer **Section 5.3**). MHL concluded that the proposed deepening would typically result in milder wave conditions in the boat ramp basin and would not have an adverse impact on existing seiche behaviour in the basin and at the boat ramp. Therefore, this dredging work will be carried forward into the final design.

3.2.3 Water Levels

Water levels within Coffs Harbour vary primarily in response to astronomical tides, although storm surge (barometric and wind set-up), and seiching also influence water levels from time to time. Sea level rise will have a long-term effect on water levels.

The study area is subject to semi-diurnal tides (i.e. two high tides and two low tides per day) that propagate through the Coffs Harbour entrance. An analysis of data collected from the tide gauge at Coffs Harbour between August 1990 and 2010 was carried out by Manly Hydraulics Laboratory (MHL, 2012) to determine tidal planes. The annual average (1990-2010) tidal planes are summarised below in **Table 1**.

Table 1: Tidal Planes at Coffs Harbour (MHL, 2012)

Tidal Plane	Water Level (m AHD)
High High-Water Spring Solstice (HHWSS)	1.077
Mean High Water Springs (MHWS)	0.687

Tidal Plane	Water Level (m AHD)
Mean High Water (MHW)	0.539
Mean High Water Neaps (MHWN)	0.391
Mean Sea Level (MSL)	-0.002
Mean Low Water Neaps (MLWN)	-0.395
Mean Low Water (MLW)	-0.543
Mean Low Water Springs (MLWS)	-0.691
Indian Springs Low Water (ISLW)	-0.969

3.2.4 Wave Action

Due to its position within the boat harbour, the existing boat ramp is generally well sheltered from swell waves that penetrate into Coffs Harbour. During significant easterly and north-easterly swell events, waves may enter the harbour and cause significant navigational issues at the bar that typically forms at the northern tip of the boat ramp entrance breakwater. The shoaling that occurs here is driven by longshore sediment transport along the southern foreshore of Coffs Harbour, and is described further in **Section 3.2.5**.

Wind waves that are generated from winds blowing over the surface of the harbour are generally small in height (relative to swell waves) and have a relatively short period (usually between 2 and 3 seconds). The wave height experienced at a particular site depends on fetch length (waterway distance over which the wind blows), water depth, and the wind conditions (speed, direction and duration). Due to the relatively small harbour, and protection from the existing boat ramp entrance breakwater, wind fetches within the study area would not be expected to allow the generation of significant wave action as a result of wind energy. However, wind waves may develop in the entrance channel and result in unfavourable conditions for vessel navigation, particularly during strong north-easterly wind events.

Long period oscillations (or seiching) of the harbour can drive water level oscillations within both the inner harbour (on the north side of the main harbour) and the boat ramp basin (MHL, 2019). In 2015 the boat ramp basin was extended following numerical and physical modelling studies (undertaken by MHL) that indicated seiche action in the boat ramp basin could be reduced by up to 30%.

Wave monitoring instruments deployed in the boat ramp basin before and after the extension works indicated a reduction in seiche action was achieved by the 2015 basin extension and reports and observations from mariners using the boat ramp indicate that seiche action has decreased since basin extension was completed (MHL, 2019). **Figure 5** presents wave data collected by MHL immediately following the basin extension work that was completed in early August 2015. These plots indicate that the maximum seiche height is typically up to around 0.5 m, although there was an event in late February 2016 with a maximum seiche height of around 0.8 m.

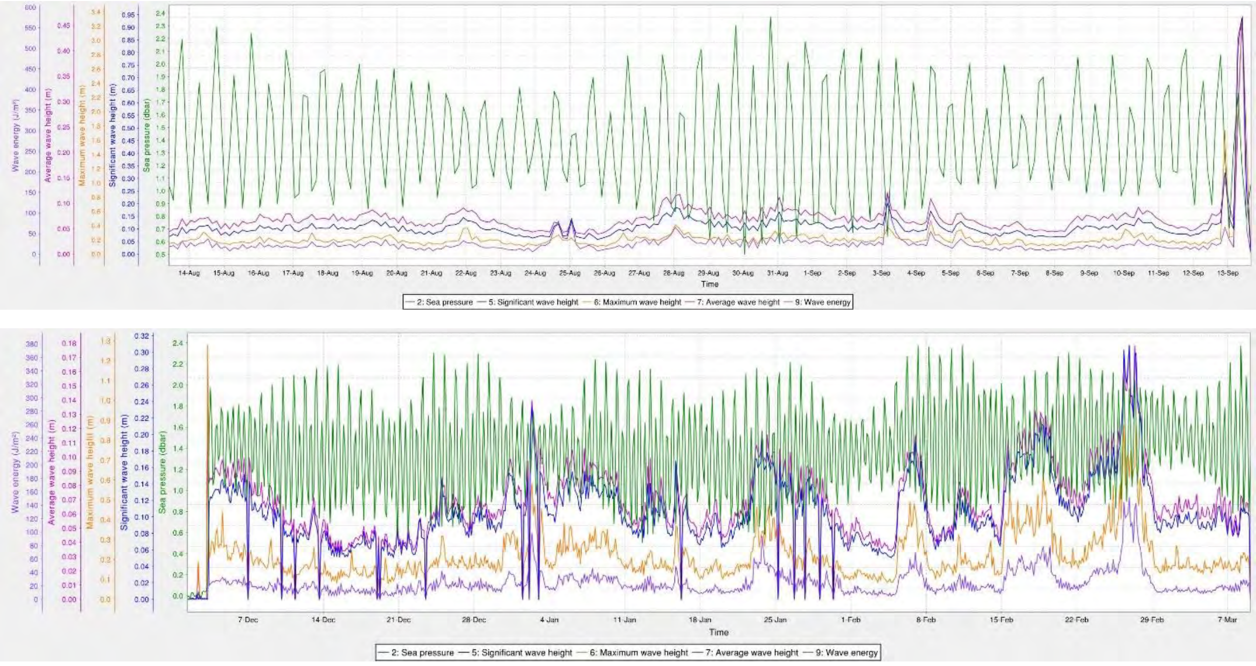


Figure 5: Wave data collected by MHL to monitor seiche activity after the basin extension work was completed in early August 2015. Top: August to September 2015, Bottom: December 2015 to March 2016

In addition, due to periodic significant boating use, vessel movements have the potential to generate reasonably significant boat wake within the boat ramp basin. Typically, large boats travelling at low speeds may generate boat wake with wave heights up to 0.5 m with short wave periods of 2 to 3 seconds.

3.2.5 Sediment Transport

No information regarding tidal currents is available for the study area. However, it should be noted that a sediment transport pathway occurs along the southern foreshore of Coffs Harbour towards the southern end of Jetty Beach (**Figure 6**), which in turn causes significant sand shoaling to occur in and around the entrance to the boat ramp basin. This longshore sediment transport rate is currently estimated to be between 4,000 – 6,000 m^3/year and results in the need for the regular removal of sediment from the entrance to the boat ramp basin by a dredge and/or long reach excavator (MHL, 2019).

Figure 6: Existing sediment transport pathway along southern shoreline of Coffs Harbour (Source: MHL 2019)

This sedimentation (when combined with significant swell conditions and low water levels) has led to several boats broaching / running aground, with numerous injuries, and boats subsequently being washed up on the rocks on the western side of the boat ramp basin. Video footage of a number of these groundings was supplied by John Lawler of the CHRBRPEC, refer **Figure 7**.

Figure 7: Images of boats grounding on the entrance shoal at Coffs Harbour boat ramp, and also being subsequently washed onto the rock revetment on the western side of the boat ramp basin entrance.

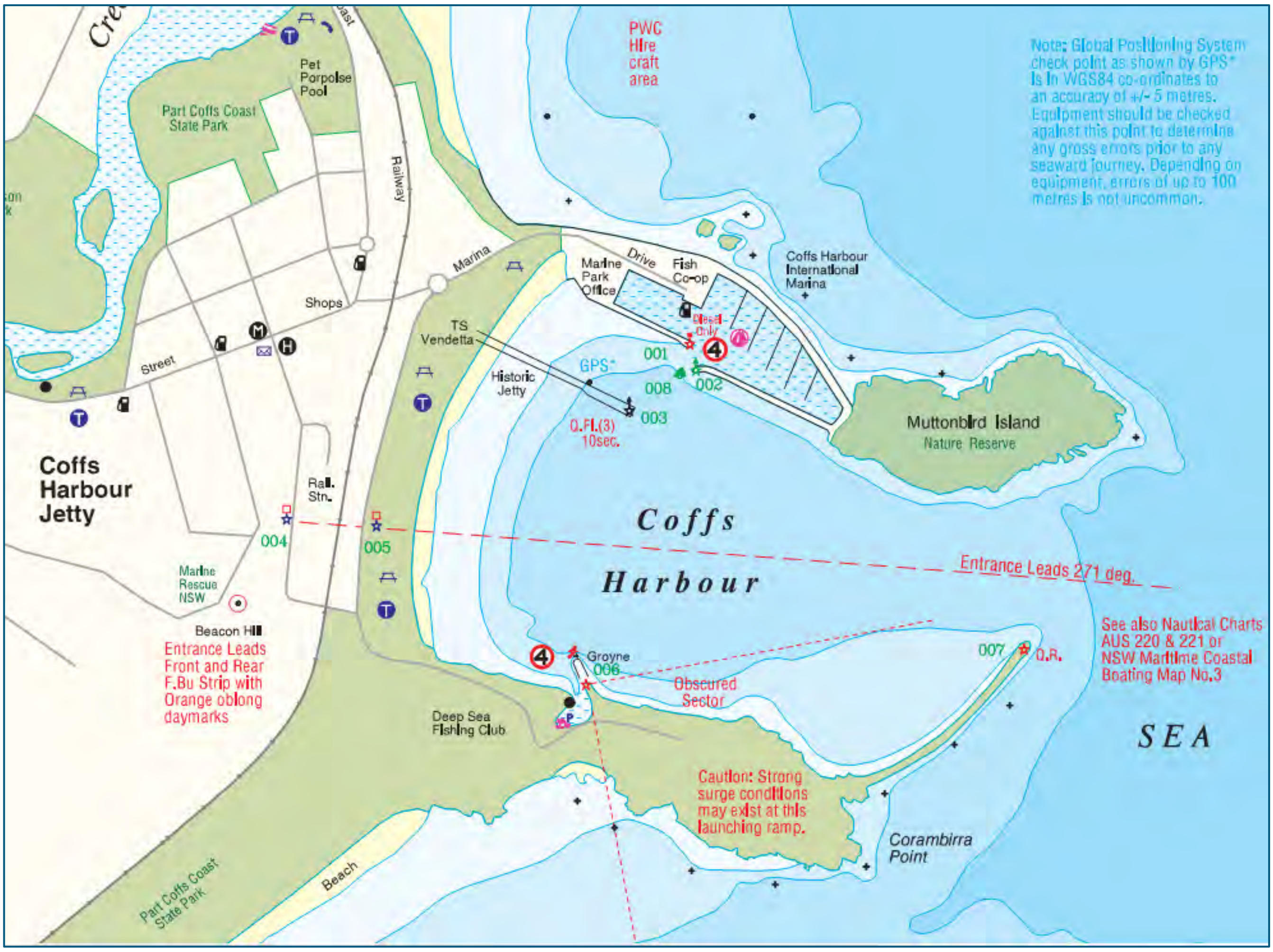
3.3 Navigation

A review of RMS boating maps for Coffs Harbour (refer **Figure 8**) was undertaken to assess navigation within Coffs Harbour and into the boat ramp basin. Coffs Harbour is marked with navigation aids in several areas including:

- Coffs Harbour entrance lead markers / and lights at a bearing of 271 degrees;
- a lit port beacon lateral mark at the north-eastern end of the southern breakwater; and,
- a lit port beacon lateral mark at the entrance to the boat ramp basin (boat ramp basin breakwater).

In addition to physical markers, the RMS Boating Map warns that the “Strong surge conditions may exist at this launching ramp”. There is no marked speed restriction, however, it would be implied that a restriction of 4 knots is in place towards the entrance to the boat ramp basin.

The sedimentation issue described in **Section 3.2.5** limits navigability for recreational vessels within the entrance channel, particularly during times of low tide levels combined with wave action. This causes problems with vessel stability and limits the number of days per year that light vessels can safely access the boat ramp.



Note: Global Positioning System check point as shown by GPS* is in WGS84 co-ordinates to an accuracy of +/- 5 metres. Equipment should be checked against this point to determine any gross errors prior to any seaward journey. Depending on equipment, errors of up to 100 metres is not uncommon.

Figure 8: RMS boating map – Coffs Harbour

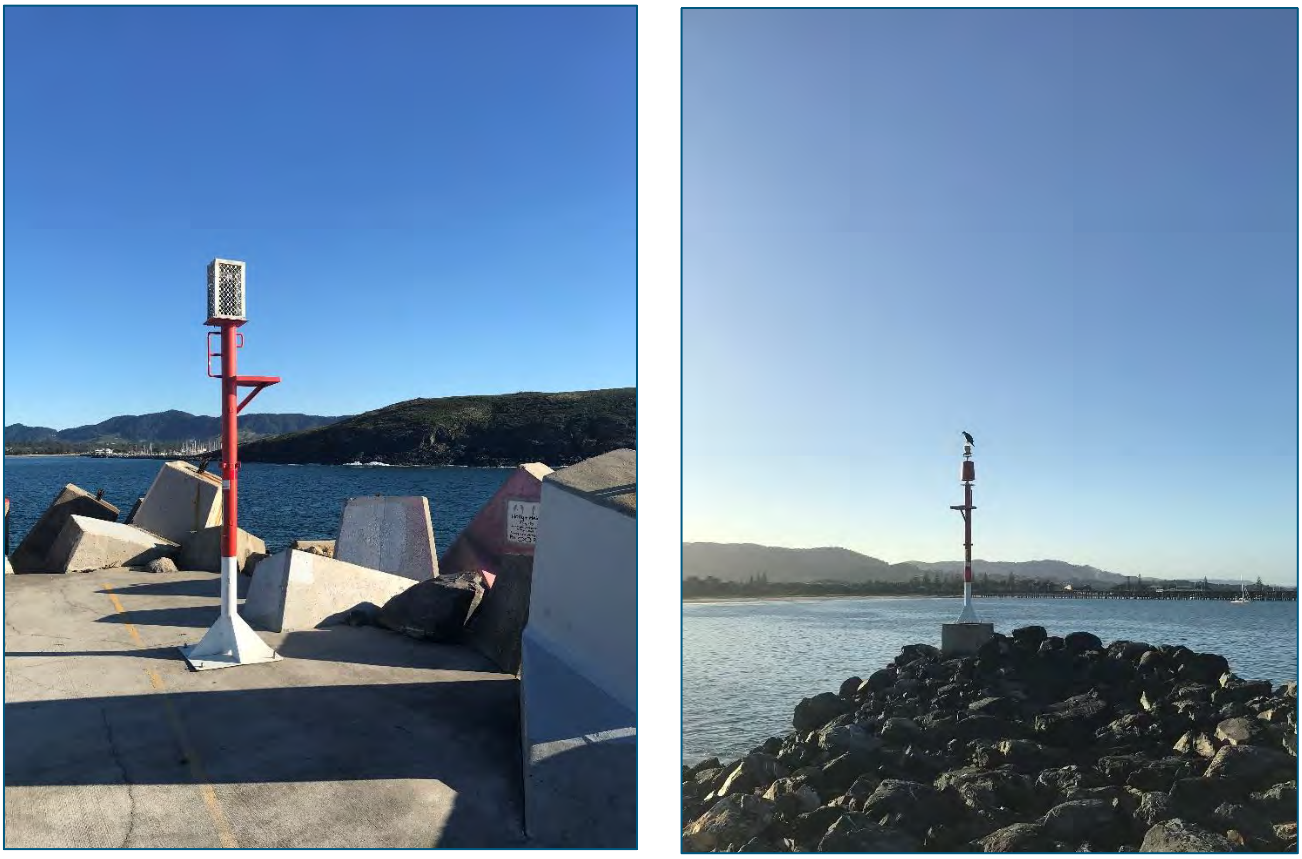


Figure 9: Coffs Harbour – Port beacon lateral marks (Left) Southern breakwater and (Right) Boat ramp basin entrance

3.4 Shoreline Structures

The boat ramp and pontoon located within the basin are the primary shoreline structures that facilitate boating access at the site. The facility is a four-lane grooved concrete ramp. Under low swell conditions, the ramp is well protected by the main Coffs Harbour and boat ramp basin breakwaters, and is subject to relatively low swell and nearly zero tidal velocities which facilitates single person launching. However, on occasions use of the boat ramp is problematic, most notably by vessels entering the ramp basin during times of low tide levels combined with easterly wave action.

A large cleared and sealed area is available behind the ramp for access/manoeuvring. The main sealed carpark directly to west of the ramp can accommodate around 49 car/trailer spaces (**Figure 10**).

A single pontoon extending along the western side of the boat ramp basin facilitates dry launching and retrieval for users (**Figure 11**). The pontoon can hold a maximum of four vessels.

In 2015, NSW Crown Lands (DPIE) commission NSW Public Works to construct an extension of the boat ramp basin to facilitate the dissipation of seiching energy, to reduce the impacts of surge at the ramp. MHL report that through monitoring (pre and post construction), the basin extension has reduced Seiching effects at the ramp by up to 30%. A photo of the structure is shown in **Figure 12**.

Figure 10: Photo of the Main Carpark

Figure 11: Coffs Harbour Boat Ramp and Pontoon, showing user "dry" launching, utilising the existing western pontoon

Figure 12: Photo of the Boat Ramp Basin extension constructed in 2015 to dissipate Seiching energy

3.5 Services

Essential services (power and water) are available at the site. Light poles are located along Jordan Esplanade, as well as one single light at the boat ramp (which will require relocation), and one adjacent to Jordan Esplanade near the boat ramp (which will likely remain in place).

In addition, a recently constructed automated RMS Boating Safety Information Sign exists on the eastern side of the boat ramp (**Figure 13**). This sign and its electrical feed will need to be relocated as part of the boat ramp upgrade works.

Figure 13: Photo of the automated RMS Boating Safety Information Sign

3.6 Heritage

The entire site is listed as a locally significant heritage item in the CHCC LEP (2013), based on the following specific items of interest:

- Buried trestle bridge;
- tramway line site; and
- World War II gun turret.

The WWII gun turret is located outside the proposed works area, close to Gallows Beach. However, the trestle bridge and tramway line are closer to the foreshore and may be located within the overall works area.

It will be necessary to further investigate these heritage items and how the proposed works might be constrained, and recommended mitigation measures. This should be included in the environmental assessment (REF). The CHCC LEP (2013) lists requirements for heritage assessment of locally significant items.

3.7 Foreshore Access and Traffic

The existing boat ramp facility comprises 49 marked car and trailer parking spaces with access provided to Jordan Esplanade via an unformalised crossover which is approximately 33 m wide. Jordan Esplanade is a two-lane road with a 50 km/h posted speed and no kerb and channel.

The surrounding area includes Gallows Beach to the south, Jetty Beach to the north and the Southern Breakwater to the east. There is existing public car parking south and east of the boat ramp.

The existing pedestrian path network terminates on the north-western side of the boat ramp car park, directing pedestrians through the car park and past the manoeuvring area for the boat ramp. A key pedestrian and cycle desire line is to the Coffs Harbour Southern Breakwater located east of the boat ramp. An existing shared path connection is located east of the boat ramp on the northern side of Jordan Esplanade however no connection currently exists through or past the boat ramp.

It should also be noted that while there is no formal Pedestrian / Cycle Plan for the area, discussions with Coffs Harbour City Council indicate that Council proposes a shared pedestrian/ cycleway linking the Jetty Precinct with the boat ramp, Gallows Beach and the Southern Breakwater.

4 Boating Demand Assessment

The demand for boating infrastructure in the Coffs Harbour area is being driven by population growth and the dependence of the town on tourism for business and growth.

Due to its location, Coffs Harbour is a major attraction for tourism especially in the summer months. It could also be said that recreational fishing contributes to tourism within the area as Coffs Harbour seasonally produces exceptional fishing opportunities. Available tourism data from Destination NSW (2020) indicates that the annual average for the number of visitors to the North Coast of NSW between 2011-2017 was in the range of 10 to 12 million visitors per annum by 2017. However, in more recent years, these numbers have jumped up to between 13 to 15 million visitors per annum (year ending March 2020 peaking at 15.3 million visitors).

The tourism generated from overnight and day trips was estimated to result in an annual spend of $5,195 million. As such, it is evident that businesses in the Coffs Harbour LGA benefit significantly from the tourism industry.

4.1 Boating Trends

The Coffs Harbour Boat Ramp is considered a Regional Facility. Therefore, it is important to consider the region surrounding Coffs Harbour, as during certain times of year this region would add considerably to boating demand for the study area. The Mid North Coast has a combined 42,000 boat licence holders which represents 8% of all boating licences in NSW. The *Regional Boating Plan: Mid North Coast Region* (Transport for NSW, 2015) has identified that for the Mid North Coast region there are 20,000 registered recreational vessels, with open runabouts comprising 70% of registered vessels. The majority of vessels are between 2 m and 6 m in length and therefore classed as trailerable vessels. This regional demand places further pressure on existing boat ramps and parking spaces.

According to the *NSW Boat Ownership and Storage Growth Forecast to 2026* (NSW Maritime, 2010), boat ownership in NSW is expected to grow by 2.9% annually. The report also identified that the North Coast region (inclusive of Coffs Harbour) would have a 4% growth rate in vessel ownership, exceeding the state-wide growth rate. It also indicated that the North Coast would have greater growth in trailerable vessels. This growth further increases pressure on existing boating infrastructure and heightens demand for new infrastructure.

Further development and increased tourism in the Coffs Harbour region would only increase the demand for boating infrastructure.

4.2 Current Usage and Future Needs

The existing boat ramp at Coffs Harbour is primarily used by boat owners as an access point into Coffs Harbour but also for deep sea fishing. The boat ramp is important as it is located close to town and provides direct all-weather access to the open ocean.

Feedback provided by CHRBRPEC during the consultation process indicated that the existing boat ramp needs to be widened to allow for the addition of a double and single sided pontoon. It is considered that the existing single sided pontoon is inadequate, and often results in congestion of vessels within the basin whilst waiting for retrieval as well as delays for vessels waiting to launch.

Bitzios assessed parking demand at the boat ramp site, as detailed in **Appendix D**. In determining parking requirements for the boat ramp, the following was considered:

- The parking ratios nominated in the NSW Boat Ramp Facility Guidelines (RMS, 2015)
- Parking demands for normal weekend usage based on parking surveys undertaken over two weekends in July and August 2020 (refer **Figure 14**)
- Historical 'point in time' parking demands based on NearMap imagery.

Key outcomes of the parking demand assessment included:

- While RMS (2015) nominates in the order of 240 to 300 car and trailer parking spaces for the proposed 6-lane facility, it is noted that this does not consider actual parking demands at the existing site or expected utilisation[1].
- The traffic surveys show that the typical parking demands for the boat ramp are usually within the available supply of 50 spaces with an average occupancy of 30 spaces. Instances of higher peak demands were observed (up to 82 spaces), however these were not necessarily all because of boat and trailer parking.
- There may also be seasonal peaks in which higher than typical parking demands occur. For example, CHRBRPEC (2018) noted that up to around 300 boats may use the ramp in a single day during peak summer and Easter holiday periods. During this type of event, overflow parking is reported to occur on almost all available grassed surface in and around the facility, even past the large rock bollards provided by Council to prevent cars parking outside of the designated parking areas.
- Bitzios considered the proposed total of 128 boat and trailer parking spaces as well as 10 vehicle only parking spaces (refer **Section 6.5**), and concluded that this would be sufficient to cater for demand. This will also cater for an additional 47 spaces more than the highest recorded peak.

It must be stated that use of the existing boat ramp facility is constrained by the available parking, lack of pontoons (only the single pontoon), and navigation safety issues primarily associated with the shoaling of the entrance channel under certain conditions (high swell, low tide). RHDHV conclude that should the boat ramp upgrades occur, additional demand will eventuate.

Figure 14: Photo of the Main Carpark, 10:00am, Sunday 2nd August – peak of 77 Car and Trailer or Car only parking (capacity 49 Car and Trailer)

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[1] *The parking numbers nominated in RMS (2015) are considered to be aspirational targets rather than design standards. In particular, RMS (2015) notes that the number of car and trailer spaces provided should be sufficient to meet the demand of normal weekend usage during the boating season. RMS (2015) also notes that provision for overflow parking at peak times may be considered at regional facilities.*

5 Key Inputs to the Concept Design Option Development

5.1 Coffs Harbour Regional Boat Ramp Precinct Enhancement Committee (CHRBRPEC) Report

In December 2018, CHRBRPEC tabled a report to Coffs Harbour City Council entitled “Final Report – Enhancements for the Coffs Harbour Regional Boat Ramp Precinct”.

This report outlined a history of the development of the boat ramp precinct, identified several issues and outlined areas for significant improvement.

The committee’s vision is to develop the boat ramp precinct into a world class facility to meet the high demand for present day and future use of the boat ramp by local and visiting mariners. Following regular boating safety incidents, in particular over the 2018 Easter holiday period, where over a dozen boats were washed onto rocks at the entrance to the boat ramp basin, safety and congestion issues have been identified by the committee to be addressed as a high priority.

Council endorsed the committee’s vision of a world class boat ramp facility and supported its proposal to deliver a report on the enhancements required to meet this vision. The report proposed ten enhanced outcomes for the boat ramp facility, including:

1. Enhanced boat ramp entrance (75 m breakwater extension)
2. Widened bay and ramp area
3. Six boat environmental wash down facility
4. More parking for cars, boats and trailers
5. Toilet and shower / change room facility
6. Increased capacity for boat rigging and derigging
7. Security camera, lighting and signage
8. Enhanced environmental fish cleaning facility
9. Recreational seating, tables and barbeques
10. Redesign of the walking path.

CHRBRPEC have recommended that extra boat ramp lanes and pontoons be provided to meet peak demand periods, the extension of the boat harbour breakwater and the consideration of additional overflow parking and amenities such as fish cleaning tables, boat rig / de-rigging areas, and an amenities block. In addition, the committee noted the need to better cater for pedestrian and cyclists that often-times wander through the boat ramp carpark.

5.2 Key coastal processes to be examined affecting vessel safety

As noted previously, there are several coastal processes that have the potential to adversely affect boating safety at the Coffs Harbour boat ramp facility, as indicated in **Figure 15** and summarised below.

1. **Surge (seiching) waves** – results in surging/sloshing motions throughout harbour and basin, i.e. very sudden variation in the basin water level – this can affect the loading and unloading of vessels from trailers, can cause the pontoons to rise or drop suddenly, and either of these effects can result in damage to trailers or vessels, as well as the potential to harm boat ramp users (refer **Section 3.2.4**). This issue has been investigated extensively by MHL (refer **Section 5.3**).

2. **Swell and wind wave action within the boat harbour** – occasionally, when the offshore ocean swell direction is predominantly from the east, some ground swell can penetrate the boat harbour, causing waves to roll up the ramp, and to affect the pontoons (refer **Section 3.2.4**). This issue was also investigated by MHL (refer **Section 5.3**).

3. **Shoaling / breaking waves in the entrance to the boat ramp basin** – due to the sediment transport pathway that occurs along the southern foreshore of Coffs Harbour which causes significant sand shoaling to occur in and around the entrance area. This sand has been shown to accumulate at the entrance to the boat ramp basin, and also to penetrate into the boat ramp basin, causing dangerous conditions at the entrance particularly during low tide and high offshore swell conditions. This shoaling is observed to produce breaking waves which can be a significant hazard to vessels entering or leaving the harbour, particularly if other vessels have run aground on the entrance shoal.

4. **Lack of Navigation ("Sea-Room") –** There is a short distance between the seaward end of the breakwater and the rocky revetment on the leeward (western shoreline). In conditions of low tide, and large swell waves, vessels have been swept onto the rocky revetment on the western side of the boat ramp basin entrance. Therefore, as well as the potential to reduce seiching and swell penetration into the boat harbour, the desire to extend the breakwater is also to allow "sea room", i.e. navigational space to recover from a broaching or grounding, to allow the vessel to enter the boat ramp basin safely without running aground on the rocky shoreline.

Figure 15: Key Coastal Processes affecting Boating Safety at the Coffs Harbour Boat Ramp facility

5.3 Breakwater Extension and Dredged Sediment Sink Investigations

Physical model testing has been completed by MHL on behalf of Transport for NSW to assess the effect on wave conditions in the boat ramp basin of proposed options to extend the boat ramp basin breakwater, as described in MHL (2020). Four breakwater extension options were considered, including 40 m, 60 m, 75 m, and 75m with a “hook” at the end of the breakwater (refer **Figure 16**).

Due to the significant sedimentation that occurs in the entrance area, MHL also modelled the hydrodynamic effects of creating a large sediment sink off the north-eastern side of the existing breakwater (refer also **Figure 16**). Physical model testing was also undertaken to determine if the proposed deepening of the boat ramp basin and entrance channel to RL -2.5 would have an adverse impact on swell wave penetration into the basin and on seiche action in the basin and at the boat ramp. A photograph of the physical model is provided in **Figure 17**.

Results by MHL are summarised below:

- The addition of the dredged sediment sink did not have a significant impact on wave conditions in the vicinity of the 75 m breakwater extension and did not change the level of damage to the breakwater experienced by the structure (which was less than 1%). Previous testing using the 2015 Coffs Harbour physical model, with higher water levels representing the 100-year ARI water level and the 100-year ARI water level with an allowance of 0.4 m for future sea level rise, resulted in higher damage (of up to 3%) due to wave overtopping of the structure. This level of damage for the breakwater is acceptable for a structure of this type and the wave climate at the location

- In general, as the breakwater extension length increased, swell wave heights within the boat ramp basin decreased. The reduction in wave height typically was up to 40% for the 75 m and 60 m extensions. However, the reduction in wave height for the 40 m extension was minimal, with a maximum wave height reduction of about 12% compared to the existing boat ramp basin and entrance channel configuration.

- The addition of the 20 m ‘hook’ on the end of the 75 m breakwater extension generally reduced wave heights in the boat ramp basin, although some tests indicated the opposite with an increase in wave height, suggesting minimal benefit would be achieved with the construction of a hook. Furthermore, RHDHV believe that the ‘hook’ may in fact reduce navigational safety, particularly for night-time conditions.

- Widening the entrance channel width by 10 m when combined with the 75 m and 60 m breakwater extensions produced mixed results, with some tests indicating increased wave heights within the boat ramp basin and other tests indicating a decrease in wave height.

- The test results and review of testing video indicated that seiche action within the boat ramp basin and the associated surge action at the boat ramp did not increase for the breakwater configurations modelled when compared to the results obtained during the 2015 Coffs Harbour physical model testing.

- The results indicate that deepening the boat ramp basin and entrance channel will typically result in milder wave conditions within the boat ramp basin and will not have an adverse impact on existing seiche behaviour in the basin and at the boat ramp. Furthermore, the proposed deepening has the benefit of improved navigation and serviceability for vessels using the boat ramp.

- For sea conditions when the boat ramp is typically used by recreational mariners, there is an insignificant difference in wave conditions in the boat ramp basin and entrance channel if a 60 m extension to the breakwater was constructed rather than the longer 75 m extension promoted by CHRBRPEC (2018).

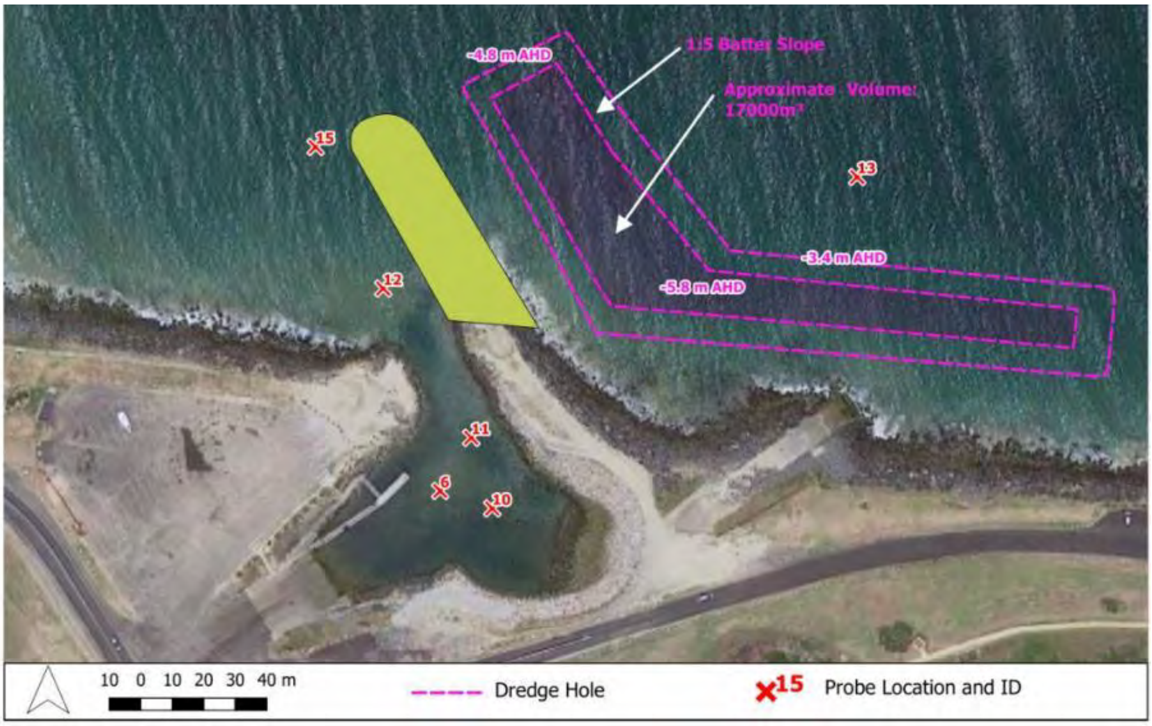


Figure 16: Proposed Breakwater Extension Option (75 m) and Offshore Dredged Sediment Sink Concept (MHL, 2020)

Figure 17: Physical Model at Manly Hydraulics Laboratory of Proposed Coffs Harbour Boat Ramp Breakwater Extension and Offshore Dredged Sediment Sink Concept (MHL, 2020)

5.4 Further Observations of the Operational Status of the Coffs Harbour Boat Ramp by RHDHV staff

The following observations were made by RHDHV staff during an inspection of the existing Coffs Harbour boat ramp facility in July 2020 (refer **Figure 18**):

- The facility is a four-lane grooved concrete boat ramp with approximately 16 m usable width and measured slopes of 12.5 percent (i.e. approximately 1V:8H throughout). This slope is consistent with the recommended range of 1V:9H to 1V:7H (RMS, 2015).
- The existing ramp has experienced a possible settlement at joints, and spalling at the joints. The concrete surface of the ramp is also in poor condition. RHDHV recommend placement of a topping slab over the existing concrete ramp.
- Overall, the existing pontoon facility is considered to be in a serviceable condition and is generally adequate for meeting the needs of user groups. However, there are a number of “wear and tear” repairs that are needed including missing sections of decking, missing nuts and bolts and damage to the edges of some of the plastic pontoons (**Figure 19**).
- The entrance channel between the boat ramp and main harbour appears to be quite shallow and would be expected to present a hazard to safe navigation, particularly around low tide.
- A fish cleaning table is provided on the western side of the carpark. It is a relatively old structure but is still serviceable.
- Good manoeuvring space is available at the head of the ramp.

- No formalised vehicle and trailer wash-down bays are provided although there was evidence of wash-down occurring on the hardstand area immediately to the east of the ramp. Wash-down drainage ponds there and runs back into the basin with no collection pit or treatment.
- Rubbish bins are available along the foreshore adjacent to the ramp.
- A large sealed area is available behind the ramp for access/manoeuvring. The carpark area can accommodate around 49 car/trailer spaces on the sealed area, with formal line marking. Overflow parking occurs in the grassed and unsealed verge areas in the area surrounding the basin, including on the opposite side of Jordan Esplanade (in the grassed area in front of the former Deep Sea Fishing Club).
- Embankments on both sides of the boat ramp are protected with basalt rock and old rubber tyres encased in concrete (**Figure 20**). These embankments are in disrepair and RHDHV would advise removal of the western concrete embankment, and replacement with rock revetment works. The eastern concrete revetment will be removed as part of the planned boat ramp widening works.
- Several picnic tables are provided on the grassed area to the far west of the boat ramp carpark.
- Opinions expressed by fisherman using the ramp at time of inspection included:
  - ramp has poor navigational access (entrance shoals);
  - extension of the breakwater (with a hook) was needed to improve navigation;
  - could have additional carparking;
  - between boat ramp and entrance, need to tilt motor up to get out due to shallow water;
  - sand extraction is not undertaken frequently enough;
  - vessels generally cannot navigate the entrance at low tide, however when there is no roll (waves) vessels can idle out;
  - more pontoons are needed;
  - every upgrade of the facility has been well received, one user recalled having to launch boats from Jetty Beach straight into the swell, significant improvement since then.

Figure 18: Coffs Harbour Boat Ramp

Figure 19: Existing Pontoon – minor repair works required

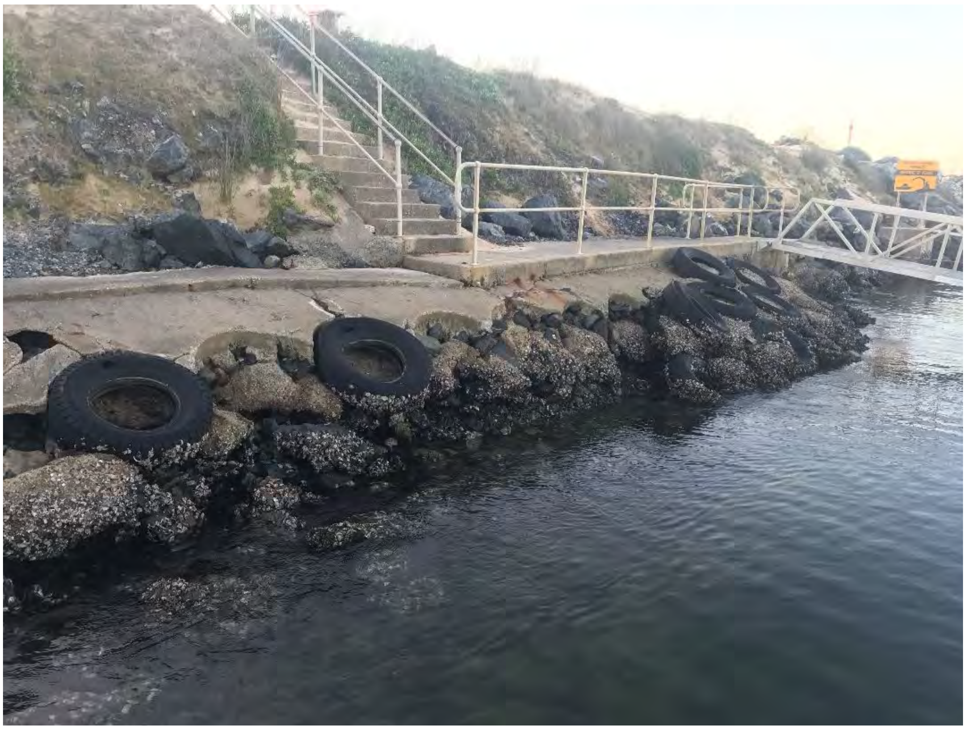


Figure 20: Existing concrete and tyre revetment in state of significant disrepair

5.5 Further Observations of the Operational Status of the Coffs Harbour Boat Ramp Breakwater by RHDHV staff

The following observations were made by RHDHV staff during an inspection of the existing Coffs Harbour boat ramp breakwater in September 2020 (refer to):

There is a large area of damaged armour and underlayer at the edge of the existing material offloading ramp and the eastern end of the existing breakwater. RHDHV suggest repairs to this section of the existing breakwater.

Figure 21: Damaged area west of existing Material Offloading Ramp

Figure 22: Damaged area adjacent to the existing Material Offloading Ramp

Figure 23: Clear transition between very small core material (purple) exposed and some scattered underlayer. Foreground shows "Floating" larger armour remaining (outside red dashed line).

Figure 24: Damaged area – ramp shows "wash-over" material from eastern side of ramp, indicates damage also occurring on eastern side of ramp

6 Boating Improvement Concept Options

6.1 Initial Option Development

RHDHV initially considered several boat ramp and carpark upgrade options and undertook initial consultation on these options with stakeholders on 8 May 2020, including CHRBRPEC, Coffs Harbour City Council, and Crown Lands (Property Group). Presentation slides related to this consultation are provided in **Appendix A**.

Based on feedback from these initial options, several concept design options were developed and costed, and were presented back to the external stakeholder group at a workshop in the last week of May 2020. Presentation slides related to this consultation are provided in **Appendix B**.

At the time of the initial option development, physical model testing was being undertaken by MHL on behalf of Crown Lands to assess the proposed extension of the boat ramp basin breakwater (refer **Section 5.3**). Preliminary results by MHL at the time indicated that the proposed breakwater extension would be effective at reducing wave energy in the basin, and as such, concept designs for the boat ramp upgrade developed by RHDHV assumed that at least a 40 m breakwater extension be included in the overall works package.

The initial options were broken down into:

- **Boat Ramp / Basin Options** (referred to as "Boat Ramp" Options – including the boat ramp, pontoons and breakwater extension.
- **Carpark / Road Alignment Options** (referred to as "Masterplan" Options) – including formal and informal carparking, adjustments to Jordan Esplanade and other improvements such as amenities, footpaths, etc

Initially, three (3) Masterplan options, and four (4) Boat ramp options were developed, as outlined below in **Table 2**, with a fourth "hybrid" Masterplan Option 4 subsequently added, such that there was a total of four (4) Masterplan and four (4) Boat Ramp Options considered. These options are described in detail in the following sections.

Table 2: Initial Concept Options Considered (Stakeholder Meeting Presentation, RHDHV, 8 May 2020)

Masterplan Options	Boat Ramp Options
1 – Western Rd Diversion	1 – 6 Lanes, 3 pontoons
2 – No Road Diversion	2 – 4 Lanes, 2 pontoons
3 – Eastern Rd Diversion	3 – 5 Lanes, 2 pontoons
4 – Hybrid Central / Eastern Rd Diversion	4 - 5 Lanes, 3 pontoons

6.1.1 Masterplan Options

Masterplan Option 1 – Western Rd Diversion

Masterplan Option 1 (**Figure 25**) was developed with a view to diverting Jordan Esplanade to the south on the western side of the of the boat ramp facility. The objective of this approach was to maximise the space available within the main carpark. The option also included carpark upgrades to approximately 100 carparking spaces in the main carpark, which has the obvious advantage of maximising the number of boat and trailer parking spots available immediately adjacent to the boat ramp.

The key disadvantage of this option is that it would require a significant retaining wall along the southern side of Jordan Esplanade, which would be costly and possibly unsightly. The other main disadvantage is that it would encroach significantly towards the former Deep Sea Fishing Club site, which is ear-marked for redevelopment by Property NSW. The option included ancillary overflow parking in the areas to the south of Jordan Esplanade, both to the west and east of the existing Gallows Beach carpark.

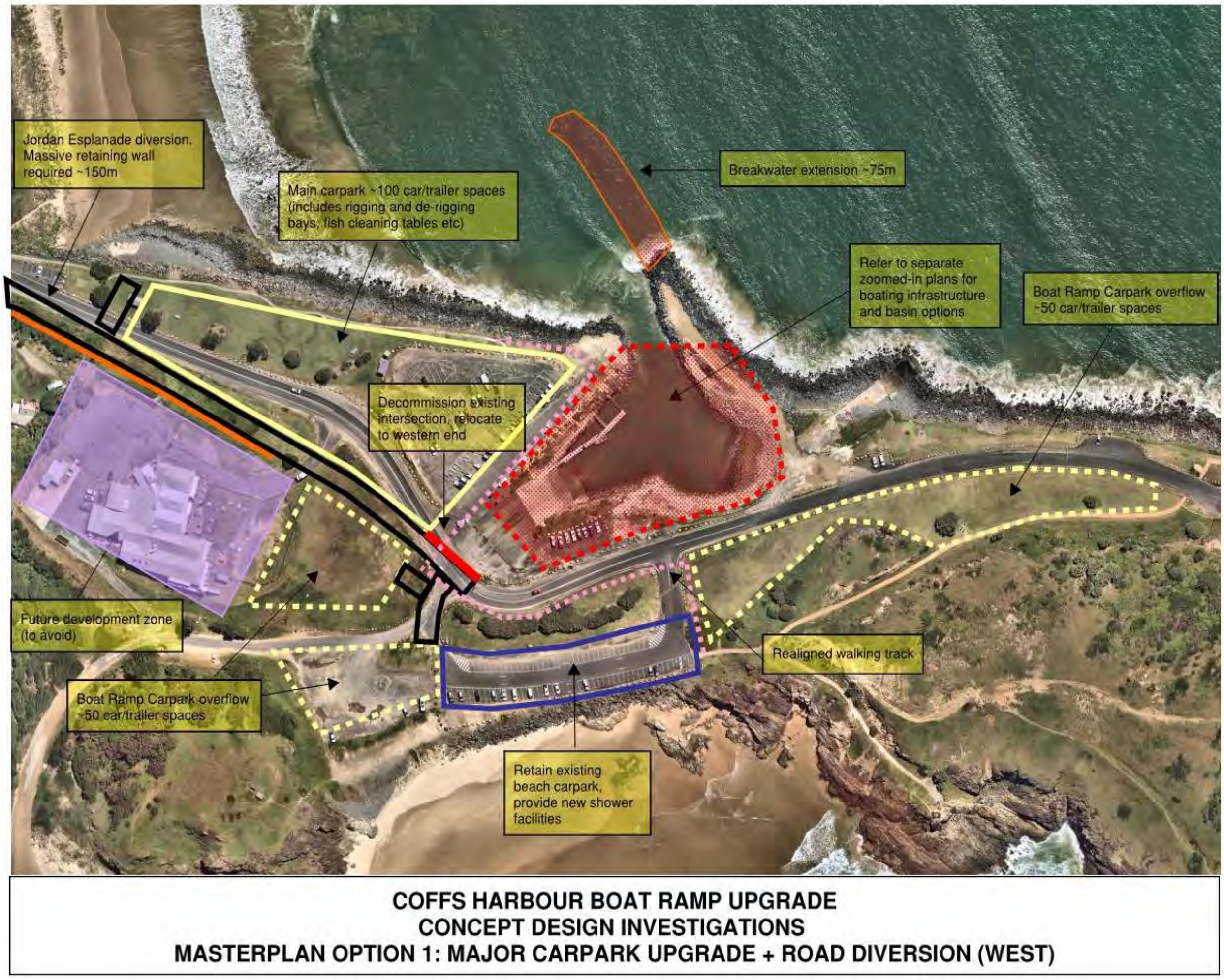


Figure 25: Masterplan Option 1

Masterplan Option 2 – No Road Diversion

Masterplan Option 2 (**Figure 26**) was developed with a view to avoiding any diversion of Jordan Esplanade. The objective of this approach was to maximise the space available within the main carpark, without road diversion. This option also included carpark upgrades to approximately 65 carparking spaces in the main carpark, however this would require further encroachment into the existing grassed area to the west.

The key advantages of this option are that it would not require any road diversion or significant retaining walls, and that it would not encroach significantly towards the former Deep Sea Fishing Club site. The option also included ancillary overflow parking in the areas to the south of Jordan Esplanade, both to the west and east of the existing Gallows Beach carpark. The disadvantage is that it encroaches a long way to the west, over valuable foreshore passive open space recreational land, with picnic tables.

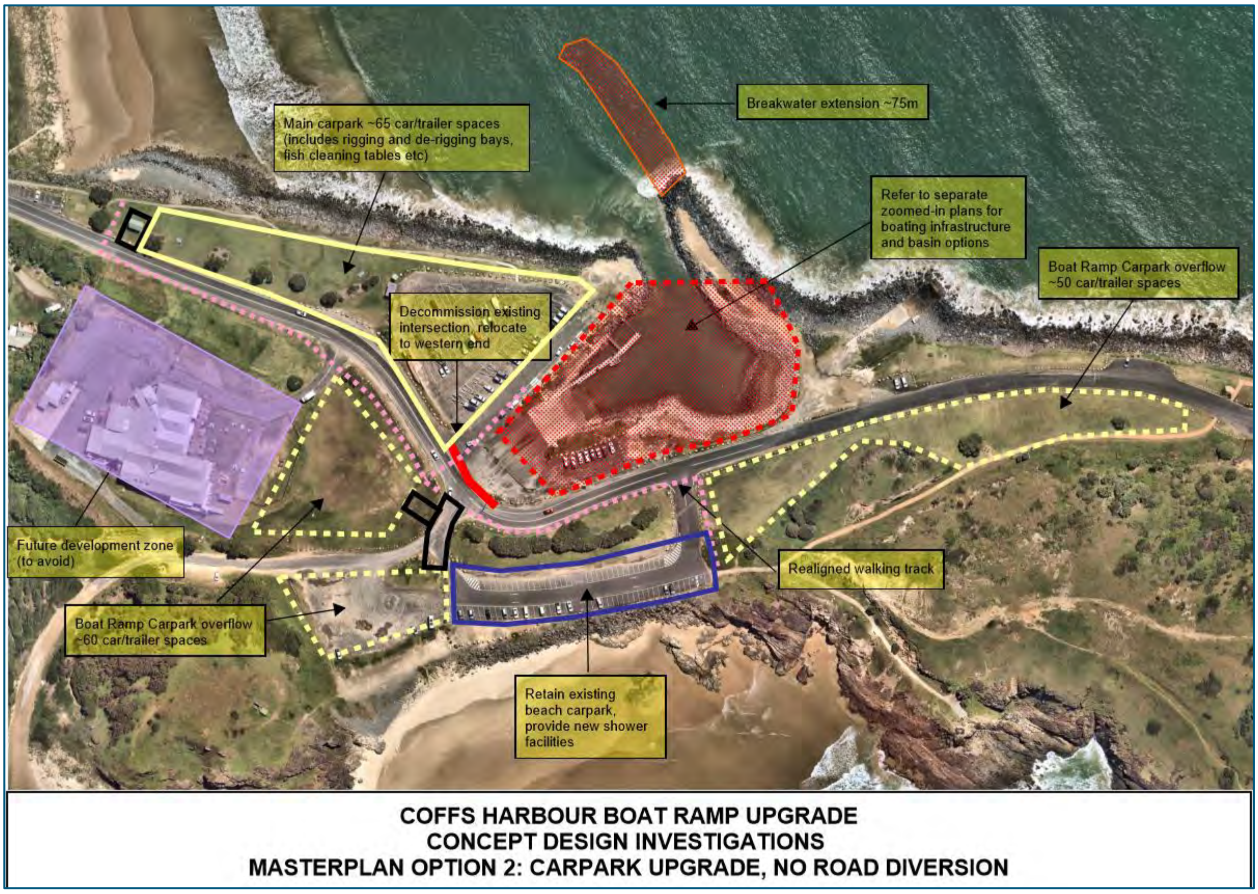


Figure 26: Masterplan Option 2

Masterplan Option 3 – Eastern Road Diversion

Masterplan Option 3 (**Figure 27**) was developed with a view to diverting Jordan Esplanade to the south on the eastern side of the of the boat ramp facility. The objective of this approach was to provide a formalised overflow carpark on the eastern side of the boat ramp, while also making more space available within the main carpark. The option also included carpark upgrades to approximately 65 carparking spaces in the main carpark, and a further 50-100 formalised car and trailer spaces in the eastern carpark.

The key disadvantage of this option is that it would require a significant length of diversion for Jordan Esplanade, which would be costly and possibly unsightly. This option would also reduce significantly the amount of grassed open space foreshore land, converting almost all of the foreshore to paved carparking. The only advantage is that it would not encroaching significantly towards the former Deep Sea Fishing Club site. The option also included ancillary overflow parking in the areas to the south of Jordan Esplanade, on the western side of the existing Gallows Beach carpark.

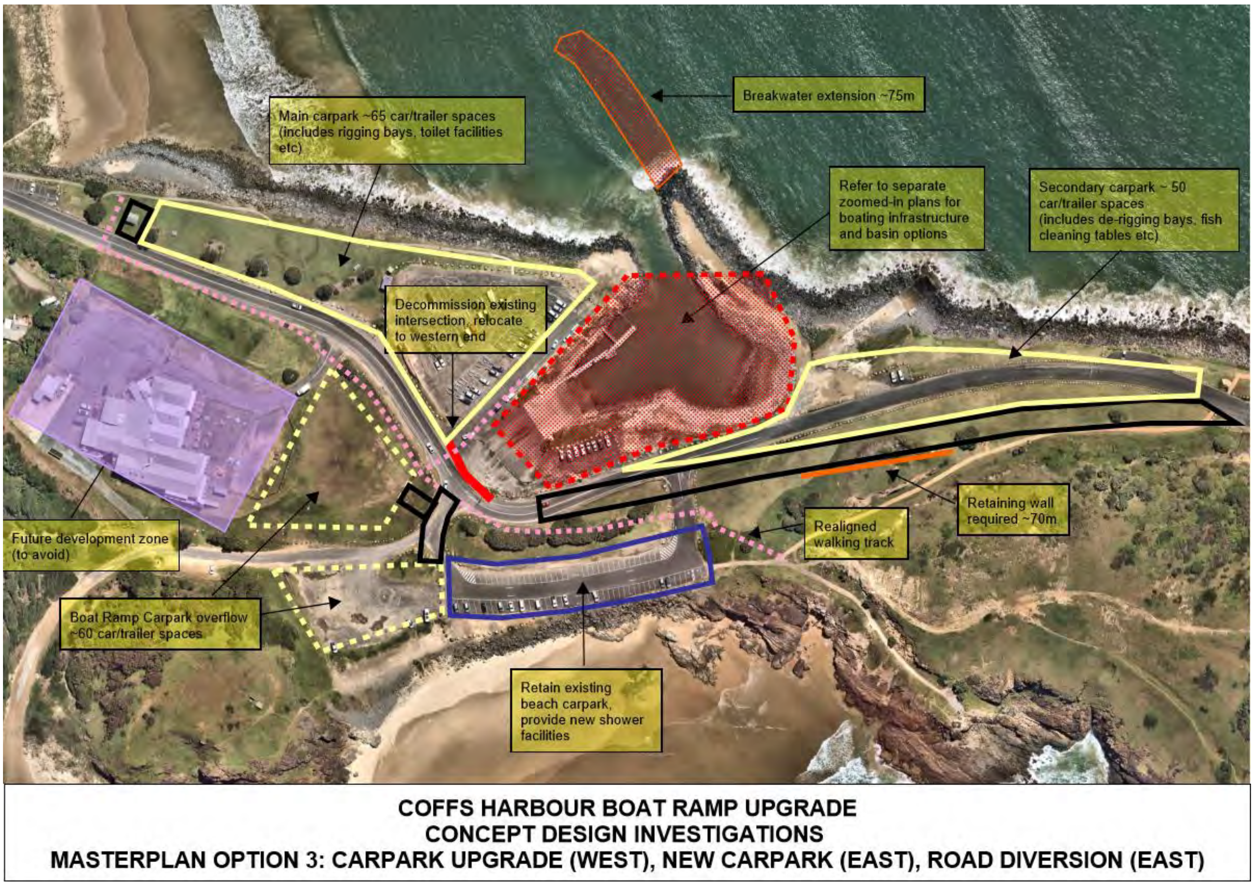


Figure 27: Masterplan Option 3

Masterplan Option 4 – Central / East Road Diversion

Masterplan Option 4 (**Figure 28**) was developed with a view to diverting Jordan Esplanade to the south immediately adjacent to the boat ramp (to make room for a main carpark upgrade), but also on the eastern side of the of the boat ramp to provide additional formalised carparking. The objective of this approach was that the area to the west of the main carpark was considered valuable open space, and it was considered that encroaching into this area would be problematic for Council.

The option included carpark upgrades to approximately 75 carparking spaces in the main carpark, and a further 50-100 formalised car and trailer spaces in the eastern carpark. This option had the advantage of not encroaching significantly towards the former Deep Sea Fishing Club site, although a minor encroachment would be required into the unused grassed area to north-east of the former Deep Sea Fishing Club. The downside of this option is that it would require a significant length of diversion for Jordan Esplanade, which would be costly and possibly unsightly, leading to a significant length of the foreshore being converted to paved carparking, The option also included ancillary overflow parking in the areas to the south of Jordan Esplanade, on the western side of the existing Gallows Beach carpark.

COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
MASTERPLAN OPTION 4: CARPARK UPGRADE (WEST), NEW CARPARK (EAST), ROAD DIVERSION (CENTRAL/EAST)

Figure 28: Masterplan Option 4

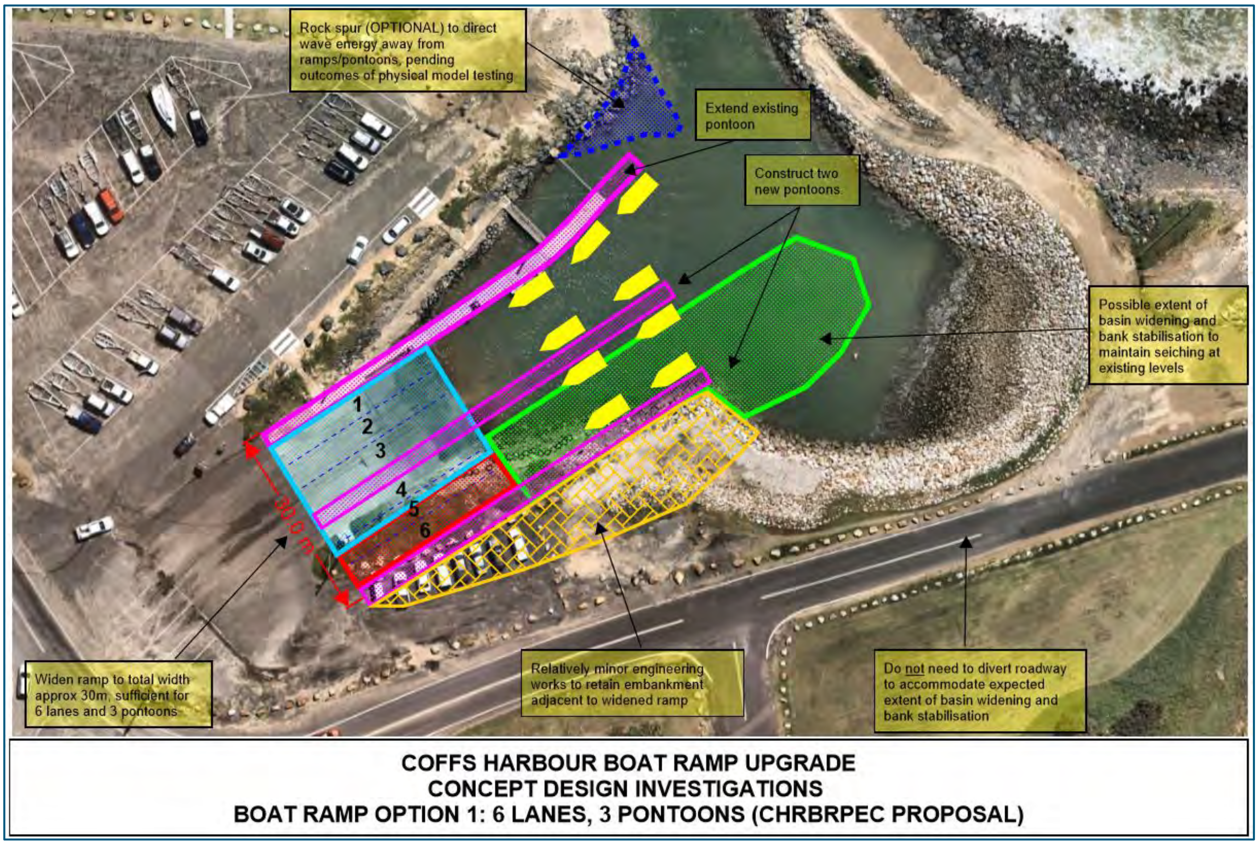
6.1.2 Boat Ramp Options

Boat Ramp Option 1 – 6 Lanes, 3 Pontoons

Boat Ramp Option 1 (**Figure 29**) was developed with six (6) boat ramps lanes (i.e. two additional lanes to the east of the existing four-lane ramp). In addition, a total of three (3) pontoons was proposed (i.e. two additional pontoons, one in the middle, and one on the eastern end.

In addition, this option considered the extension of the breakwater by up to 75m (based on the preliminary advice at the time from MHL).

Furthermore, this option included the construction of a rock spur on the western side of the basin to direct wave energy that propagates through the entrance channel towards the spending beach on the eastern side of the basin, i.e. away from the vessel berthing and launching area. The potential benefit of this structure is discussed further in **Section 6.6**.



Rock spur (OPTIONAL) to direct wave energy away from ramps/pontoons, pending outcomes of physical model testing

Extend existing pontoon

Construct two new pontoons

Possible extent of basin widening and bank stabilisation to maintain seiching at existing levels

Widen ramp to total width approx 30m, sufficient for 6 lanes and 3 pontoons

Relatively minor engineering works to retain embankment adjacent to widened ramp

Do not need to divert roadway to accommodate expected extent of basin widening and bank stabilisation

COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
BOAT RAMP OPTION 1: 6 LANES, 3 PONTOONS (CHRBRPEC PROPOSAL)

Figure 29: Boat Ramp Option 1

Boat Ramp Option 2 – Minor Ramp Widening

Boat Ramp Option 2 (**Figure 30**) was developed with a widening of the existing four lane ramps, to accommodate a second pontoon on the eastern side of the ramp, and providing the standard 4 x 4m wide lanes.

The option also considered the potential to adjust the western pontoon, to bring it closer to the western revetment of the basin, to reduce congestion in the basin.

As per Boat Ramp Option 1, this option considered the extension of the breakwater by up to 75m, and included construction of a rock spur on the western side of the basin.

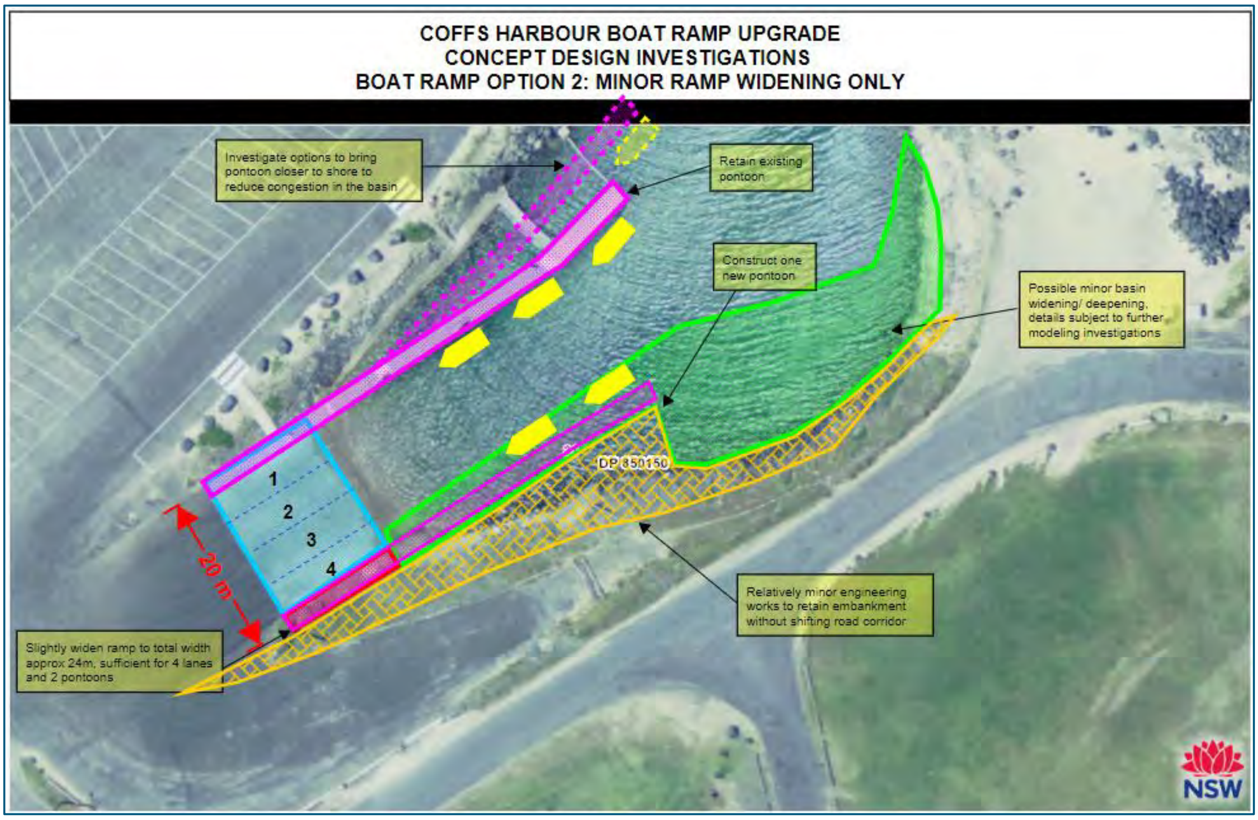


Figure 30: Boat Ramp Option 2

Boat Ramp Option 3 – 5 Lanes, 2 Pontoons

Boat Ramp Option 3 (**Figure 31**) was developed with five (5) boat ramps lanes (i.e. one additional lane to the east of the existing four-lane ramp). In addition, a second pontoon was proposed to the east of the third lane (i.e. roughly centrally on the ramp).

As per the previous boat ramp options, this option considered the extension of the breakwater by up to 75m and included construction of a rock spur on the western side of the basin.

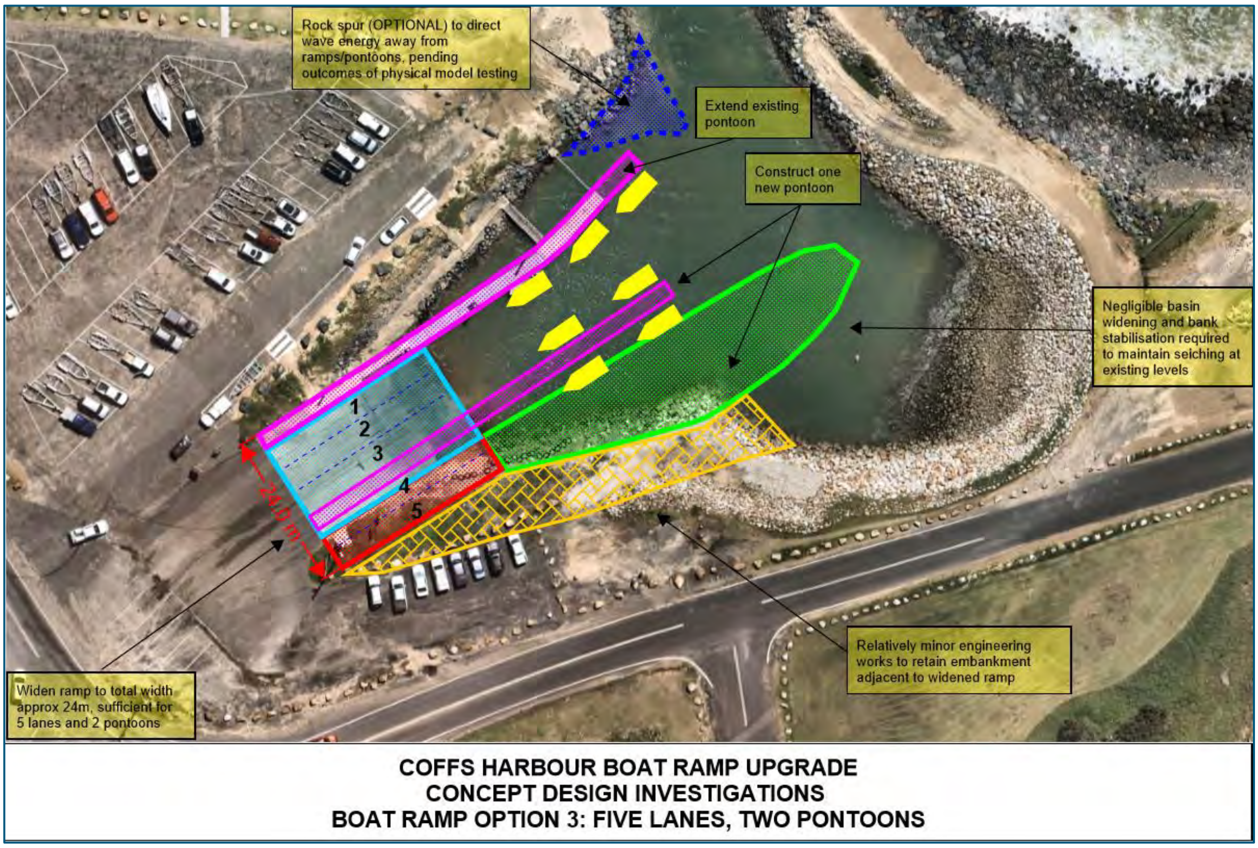


Figure 31: Boat Ramp Option 3

Boat Ramp Option 4 – 5 Lanes, 3 Pontoons

Boat Ramp Option 4 (**Figure 32**) was developed with five (5) boat ramps lanes (i.e. one additional lane to the east of the existing four-lane ramp). In addition, a total of three (3) pontoons was proposed (i.e. two additional pontoons, one to the east of the third lane – i.e. roughly in the middle, and one on the eastern end.

As per the previous boat ramp options, this option considered the extension of the breakwater by up to 75m, and included construction of a rock spur on the western side of the basin

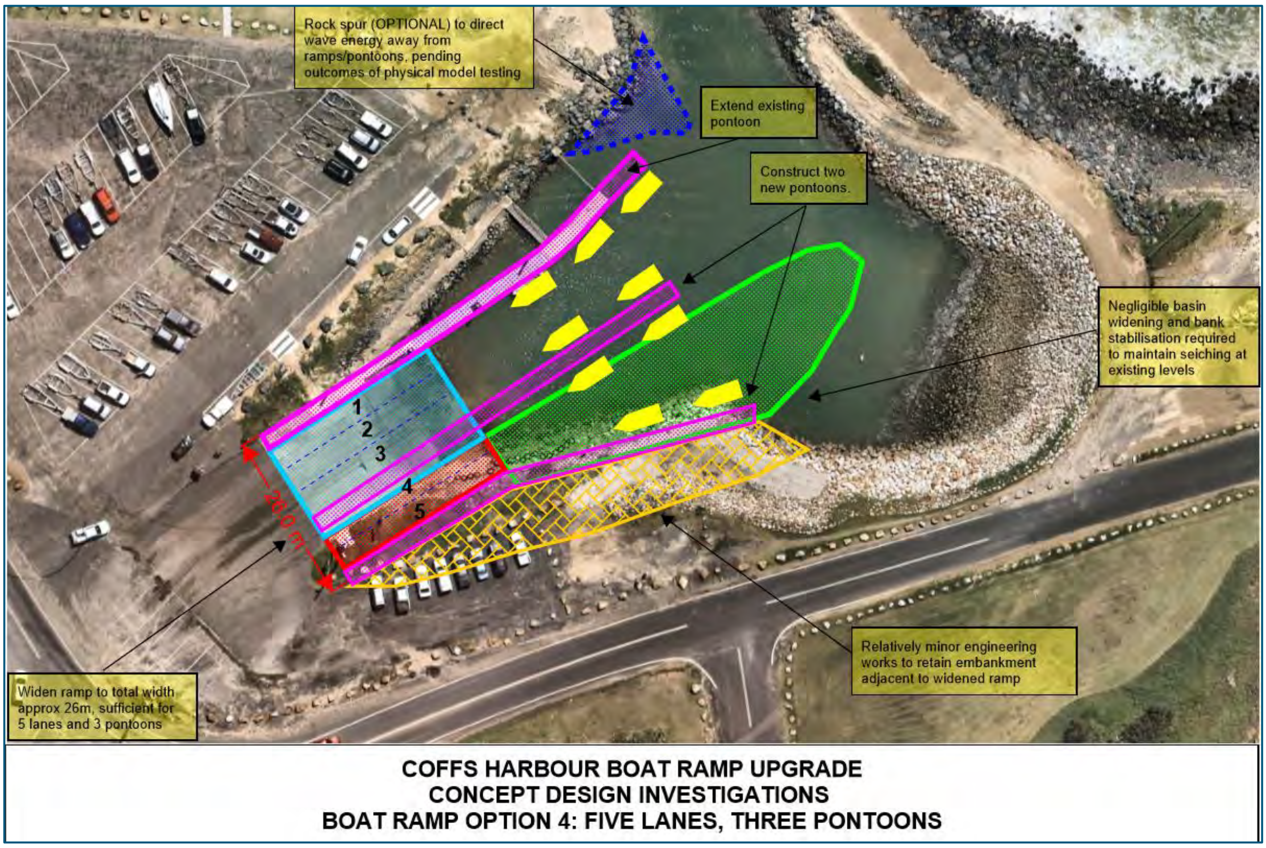


Figure 32: Boat Ramp Option 4

6.2 Stakeholder Feedback on Initial Option Development and Shortlisting of Options

Initial stakeholder feedback obtained at a meeting on 8 May 2020 was that Masterplan Option 1 and Masterplan Option 3 were not preferred. Masterplan Option 1 was considered by NSW Property to be a significant constraint on the potential to redevelop the former Deep Sea Fishing Club site. In addition, Masterplan Option 1 required a large retaining wall which was considered to be too costly and unsightly.

Masterplan Option 3 was discounted as the main carpark extension was considered to encroach too far to the west, over the top of a highly valued passive recreational foreshore area (picnic tables and BBQs etc.)

Furthermore, Boat Ramp Option 2 was rejected by CHRBRPEC as not adequately addressing the requirements of their brief to significantly increasing the boat ramp capacity. CHRBRPEC advised that retaining a four-lane ramp and only two pontoons was not a significant improvement to warrant the significant investment in the site and was not considered sufficient to cater for potential future boating demands.

The options carried forward into the Multi-Criteria Assessment (MCA) of options are outlined in **Table 3**, i.e. three boat ramp options, paired with either the Masterplan Option 4 (Central / Eastern Road diversion) or the Masterplan Option 2 (No Road Diversion).

All of the options costed also allowed for the inclusion of a 17,000 m^3 dredge pocket, as per MHL (2020). The purpose of the dredge pocket would be to intercept sand from the sediment transport pathway before it can significantly accumulate around the seaward end of the breakwater and result in shoaling issues similar to present day hazards. A provisional cost of $1 million was allowed for the dredge pocket in each of the options.

Table 3: Initial Options Short-Listed for Multi-Criteria Analysis

Selected Concept Design Options	Preliminary Boating Option	Preliminary Masterplan Option
Option 1a	Boat Ramp Option 1 (6 lanes, 3 pontoons)	MP Option 4 (Road Diversion)
Option 1b		MP Option 2 (No Road Diversion)
Option 2a	Boat Ramp Option 4 (5 lanes, 3 pontoons)	MP Option 4 (Road Diversion)
Option 2b		MP Option 2 (No Road Diversion)
Option 3a	Boat Ramp Option 3 (5 lanes, 2 pontoons)	MP Option 4 (Road Diversion)
Option 3b		MP Option 2 (No Road Diversion)

6.3 Assessment of initial options using Multiple Criteria Assessment

In order to assess the initial short-listed options, a Multi-Criteria Assessment (MCA) was undertaken. The MCA used a range or pertinent criteria to try to differentiate between the options, in order to get a balanced opinion on which option may be the best to take forward into further design development. Seven (7) criteria were selected to initially assess the options, as outlined below. To inform the relative cost criteria, detailed cost estimates for each option were prepared by quantity surveyors, Vasey Consulting.

6.3.1 Adopted Criteria

Seven (7) criteria were used in the MCA as follows:

- A - Environment / Heritage – related to impacts on environmental or heritage values.
- B - Safety (Navigation) - related to number of ramps/pontoons
- C - Safety (Road) – related to the effectiveness of any road / intersection access improvements achieved.
- D - Cost
- E - Land Tenure / Impact on Adjacent Properties
- F - Functionality (landside 1) related to carparking numbers only – i.e. the closer to the NSW Boating Guidelines achieved, the higher the score
- G - Functionality (landside 2) related to manoeuvring, rigging, access/intersections (not carparking) – i.e. the option scored high if it addressed the concerns of users in terms of manoeuvring space, rigging / de-rigging areas, number of intersections with Jordan Esplanade etc.
- H - Functionality (maritime) including berthing, vessel manoeuvring, vessel waiting times in the basin

Other aspects considered in the MCA were the potential constructability issues with each option, and Pedestrian / Cyclist Safety i.e. the provision of pedestrian movements through or around the carpark facility.

6.3.2 Option Cost Estimates

Transport for NSW had applied and received confirmation of a $10 million budget for the project, which was to cover the maritime aspects of the project, and any essential carpark and amenities upgrades to support the boat ramp facility upgrade. Therefore, it was essential that the preferred option was at least close to this budget. Therefore, the cost criterion was weighted to score higher those options that met this budget, and score lower those options that were higher than the budget allowance.

The cost estimates prepared by the quantity surveyor are summarised in **Table 4**.

Table 4: Summary of Cost Estimates for each option

Option	Boating Option	Masterplan Option	Cost Estimate (ex GST)
1a	6 lanes, 3 pontoons	Road Diversion	$11,900,000
1b		No Road Diversion	$9,500,000
2a	5 lanes, 3 pontoons	Road Diversion	$11,800,000
2b		No Road Diversion	$9,300,000
3a	5 lanes, 2 pontoons	Road Diversion	$11,400,000
3b		No Road Diversion	$8,900,000

6.3.3 Adopted Weighting

The adopted weighting of the criteria used in the MCA is summarised in **Table 5**.

The cost weighting was elevated (40%), to take into account the number of criteria that highlighted the benefits of each option. Should the cost weighting only be 5-15%, then there is a tendency to select options that provide more benefits, without meeting the budget.

Table 5: Initial Option Weighting

Criteria	Adopted Weighting
A - Environment / Heritage	5%
B - Safety (Navigation) - related to number of ramps/pontoons	15%
C - Safety (Road)	10%
D - Cost	40%
E - Land Tenure / Impact on Adjacent Properties	10%
F - Functionality (landside 1) related to carparking numbers only	5%
G - Functionality (landside 2) related to manoeuvring, rigging, access/intersections (not carparking)	5%
H - Functionality (maritime) including berthing, vessel manoeuvring, vessel waiting times in basin	10%

6.3.4 Multi-Criteria Assessment

The results of the initial MCA are summarised in **Table 6**.

Table 6: Initial Multi-Criteria Analysis of the Options

Criteria		Option 1a		Option 1b		Option 2a		Option 2b		Option 3a		Option 3b	
	Weight	**Score**	**Weighted score**	**Score**	**Weighted score**	**Score**	**Weighted score**	**Score**	**Weighted score**	**Score**	**Weighted score**	**Score**	**Weighted score**
A - Environment / Heritage	5%	2.0	0.10	2.5	0.13	2.0	0.10	2.5	0.13	2.0	0.10	2.5	0.13
B - Safety (Navigation) - related to number of ramps/pontoons	15%	5.0	0.75	5.0	0.75	4.0	0.60	4.0	0.60	2.0	0.30	2.0	0.30
C - Safety (Road)	10%	4.5	0.45	2.0	0.20	4.5	0.45	2.0	0.20	4.5	0.45	2.0	0.20
D - Cost	40%	1.1	0.43	3.5	1.41	1.2	0.49	3.7	1.47	1.6	0.65	4.1	1.64
		$11,900,000		*$9,500,000*		*$11,800,000*		*$9,300,000*		*$11,400,000*		*$8,900,000*	
E - Land Tenure / Impact on Adjacent Properties	10%	1.0	0.10	3.0	0.30	1.0	0.10	3.0	0.30	1.0	0.10	3.0	0.30
F - Functionality (landside 1) related to carparking numbers only	5%	2.5	0.13	1.6	0.08	3.4	0.17	2.0	0.10	4.3	0.22	2.7	0.14
G - Functionality (landside 2) related to manoeuvreing, rigging, access/intersections (not carparking)	5%	4.0	0.20	2.0	0.10	4.0	0.20	2.0	0.10	4.0	0.20	2.0	0.10
H - Functionality (maritime) including berthing, vessel manoeuvreing, vessel waiting times in basin	10%	4.0	0.40	2.0	0.20	4.0	0.40	3.0	0.30	3.5	0.35	2.5	0.25
Others? Constructability?													
Total Weighted Score	**100%**	**Option 1a**	**2.55**	**Option 1b**	**3.17**	**Option 2a**	**2.51**	**Option 2b**	**3.20**	**Option 3a**	**2.37**	**Option 3b**	**3.05**
Score		2.55		3.17		2.51		3.20		2.37		3.05	
Rank		4		2		5		1		6		3	

It is evident that Option 2b ranked the highest (i.e. 5 lane, 3 pontoon boat ramp with no road diversion, with a total cost estimate of $9.3 million), based on the criteria selected. However, Option 1b (i.e. 6 lane, 3 pontoon boat ramp with no road diversion, with a total cost estimate of $9.5 million) scored similarly. Based on feedback at the workshop held on 29 May 2020, CHRBRPEC and Transport for NSW preferred to adopt Option 1b, as it was still within the $10 million budget allocation, and gave a more robust boat ramp facility to cater for potential future boating demands for this regional facility.

All parties agreed that the ‘maritime’ works proposed as part of **Option 1b** should be adopted, that is as follows:

(i) 6 lane, 3 pontoon boat ramp;
(ii) 75 m breakwater extension;
(iii) Dredging to a depth of RL -2.5 to ensure that the existing boat ramp basin and entrance channel complied with design bed levels; and
(iv) Consideration of the need to undertake ongoing maintenance dredging to control ongoing shoaling of the end of the extended breakwater, entrance channel and boat ramp basin.

However, at the same workshop on 29 May 2020, and subsequently, officers from Coffs Harbour City Council expressed some concerns with the preferred option in terms of the 'land-based' works. Council officers were concerned that the amount of formalised carparking being proposed far exceeded Councils expectations, as the southern peninsula of Coffs Harbour is currently zoned for Open Space Recreation. Council's preference, if additional parking needs are to be provided, would be to provide informal (i.e. grassed) overflow parking along the verges of Jordan Esplanade. Specifically, Council officers expressed that the proposed eastern Jordan Esplanade diversion and provision of formalised carparking along the foreshore was a step too far in terms of the extent of removal of existing grassed open space areas on the peninsula.

Council requested that RHDHV engage a traffic consultant to undertake a parking / traffic count survey to help inform the carparking aspects and pedestrian / cycleway aspects of the design, and also to engage a landscape architect to help inform the open space and visual amenity of the proposed facility.

Based on this advice, RHDHV engaged the services of Bitzios traffic / transport planning consultants to undertake traffic and parking surveys, and to provide input into a revision of the preferred option. RHDHV also engaged RedBelly Landscape / Urban Designers to undertake a review of the landscape / urban design aspects of the preferred concept.

An outline of the revisions to the land-based concept masterplan are described below in **Section 6.4**.

6.4 Revision of the Preferred Option

6.4.1 Traffic and pedestrian / cycle movement review

As outlined above, parking numbers, traffic management and the needs of other users of the peninsula (particularly pedestrian / cyclist movements) were seen to require further detailed consideration.

Bitzios traffic / transport planning consultants were commissioned, and they carried out the following tasks:

- Review parking demands at the boat ramp and surrounding area
- Assessment of car park design in accordance with AS2890 and the NSW Boat Ramp Facility Guidelines (RMS, 2015)
- Swept path assessment of key manoeuvring areas
- Review of car park functionality, operations and safety
- Assess access design including turn warrants, manoeuvrability and sight lines
- Review proposed pedestrian facility design for functionality, safety and inclusiveness.

The Traffic and Parking Assessment carried out by Bitzios is provided in **Appendix D**.

Key recommendations from their investigations were that the traffic surveys indicated that the proposed total numbers of parking spaces should be sufficient to meet current and future demands, and that it is likely that they would be only exceeded during seasonal peaks (e.g. Easter / Australia Day / Christmas holiday periods). They also noted that while the main carpark has been observed to reach capacity, a large proportion of this was due to cars parking in the main carpark without a trailer. Bitzios noted that during this peak event, the other surrounding carparks were not at capacity, indicating that the was adequate provision for overflow parking in the other surrounding areas.

Bitzios also reviewed the carpark concept designs to ensure that the turning paths complied with Australian Standards, as well as providing advice regarding pedestrian and cycle movement within and past the site. Bitzios have concluded that the majority of the geometry complies with Australian Standards, with some minor inconsistencies, that can be easily dealt with at the detailed design stage.

A review by Bitzios of the proposed Stage 2 access to the main carpark for Jordan Esplanade indicates that specific turning treatments (e.g. slip lanes etc) are not warranted.

6.4.2 Landscape / Open Space Amenity

As requested by Council, a full landscape / open space and access review was undertaken by RedBelly Landscape designers (Garry Murray). RedBelly Design identified a need for further detailed consideration of the following aspects:

- Separation of pedestrian / cyclist from vehicle movements along the peninsular is key to ensuring the amenity and safety of these users.
- Vegetation screening of the main carpark from Jordan Esplanade and the former Deep Sea Fishing Club is a priority to enable the preservation and enhancement of the user experience along the peninsula.
- Encouragement of through pedestrian linkages to the southern side of the peninsular in the long terms, to connect to views over Gallows Beach, and then on to the end of the peninsular, where users enjoy the experience of the Coffs Harbour Southern Breakwater.
- Emphasising the amenity of the small peninsular on the western side of the boat harbour, to create a visually appealing, architecturally designed kiosk / amenities block.
- Consider relocating part of Jordan Esplanade to achieve sufficient room for access past the carpark, (i.e. shared pedestrian / cycleway – 2.5 to 3m wide) and sufficient width to provide screening vegetation and vegetation buffers within the main carpark
- Avoidance of unconsolidated gravel carparks that encourage unsociable vehicular behaviour and are unsightly. Grassed overflow area should be sufficient for infrequently accessed overflow areas (i.e. areas only utilised during seasonal peak periods. e.g. Garry suggested the rehabilitation of the existing gravel carpark immediately to the west of the Gallows Carpark, to provide a grassed picnic area with some trees, as this sits on eth top of the ridgeline.

Feedback from TfNSW on these comments was that the works should be staged to initially focus primarily on the maritime works (boat ramp, pontoons and gangways, dredging and breakwater extension works) as part of a Stage 1, with the carpark upgrades, Jordan Esplanade Diversion, shared pedestrian / cycleway and amenities block pushed back to a Stage 2, that would follow on almost immediately behind the Stage 1 works. This staging would allow TfNSW to commence works on the boat ramp basin, while providing more time for Council to seek funding to assist with the pedestrian and open space provisions. This approach would also allow Council more time to refine its design objectives for the areas external to the boat ramp basin, including open space requirements, other carpark treatments (such as Gallows Beach), other linkages such as the proposed future Howard Street connection, and pedestrian / cycleway linkages to the greater Jetty Precinct plan that is currently in the process of being scoped.

A series of conceptual landscape design sketches were developed by RedBelly and are provided in **Appendix E**. These sketches have been provided in date order to show the progression of ideas, with the latest landscape design sketch dated 8 August 2020 most informing the preferred concept design for Stage 2. It is noted that several elements shown on the landscape plans have not been included in the preferred Stage 2 Concept Masterplan due to TfNSW budgetary constraints. These elements would need to be funded separately, either from Council or other state government grants.

6.5 Preferred Breakwater Extension Option

The physical model testing undertaken by MHL concluded that for sea conditions when the boat ramp is typically used by recreational mariners there is an insignificant difference in wave conditions in the boat ramp basin and entrance channel if a 60 m or 75 m breakwater extension is present (refer **Section 5.3**). Therefore, MHL (2020) recommended that a 60 m extension to the boat ramp entrance breakwater be constructed rather than the longer 75 m extension promoted by CHRBRPEC (2018).

However, MHL (2020) noted that an increase in the length of the breakwater to 75 m would result in a marginal improvement to vessel navigation safety from the rocky shoreline to the west of the boat ramp entrance by slightly increasing the area for vessels to manoeuvre in the lee of the breakwater as they enter or leave the boat ramp entrance channel. MHL (2020) also noted that a 75 m extension would include some additional contingency between maintenance dredging works due to the longer time for a shoal to form at the head of the breakwater.

In consideration of the MHL findings outlined above, and CHRBRPEC's stated preference for a 75 m breakwater extension, the 75 m extension option has been adopted in the preferred concept design.

6.6 Preferred Concept Design – Stages 1 & 2

The preferred Concept Design was broken into Stage 1 and Stage 2 as shown in **Figure 33** and **Figure 34** respectively. Full A3 size drawings are included in **Appendix F**.

This was the preferred option for a number of reasons including that Council's preference was to concentrate as much car parking into the existing area rather than have multiple small areas scattered across the passive open space area. Concentration of boat traffic onto the northern side of Jordan Esplanade in a succinct "boating precinct" is seen as an essential outcome, to ensure that other users can still enjoy the peninsula.

Furthermore, shifting of Jordan Esplanade through the "pinch point" between the former Deep Sea Fishing Club and the existing carpark was seen as essential to ensure the provision of space for future shared path, the provision of space for site landscaping, for better traffic flow and manoeuvring space within the carpark, and to improve the entrance/exit lines. A drawing was developed to provide additional clarity around the proposed offsets of Jordan Esplanade, which are shown on the Road Realignment Plan provided in **Appendix F**.

RHDHV, through consultation with TfNSW, have deferred the decision to include the dredge pocket, due to concerns that it may only work if it is very close to the shoreline, and in doing so, may cause instability of the existing (and / or proposed future) breakwater extension. However, the sand management is still a critical ongoing management issue, and the recommendation from RHDHV is to undertake further sediment transport modelling (currently being undertaken by MHL) and for TfNSW to undertake a staged monitoring programme (including bathymetric survey on an annual basis) to inform the proposed maintenance dredge design going forward. It should be also be noted that MHL (2020) recommended that a sand management plan for the boat ramp basin entrance be developed as part of the overall sediment management for the Coffs Harbour port area.

It is noted that the proposed construction of a rock spur on the western side of the basin may not provide significant additional benefits in terms of mitigating wave conditions inside the boat ramp basin. This is because the adopted 75 m breakwater extension would be expected to provide a suitable level of wave attenuation in the boat ramp basin without the need for further improvements. This may not have necessarily been the case if a lesser breakwater extension was adopted. While the rock spur has been included in the preferred concept design, it is recommended that this be assessed further during detailed design.

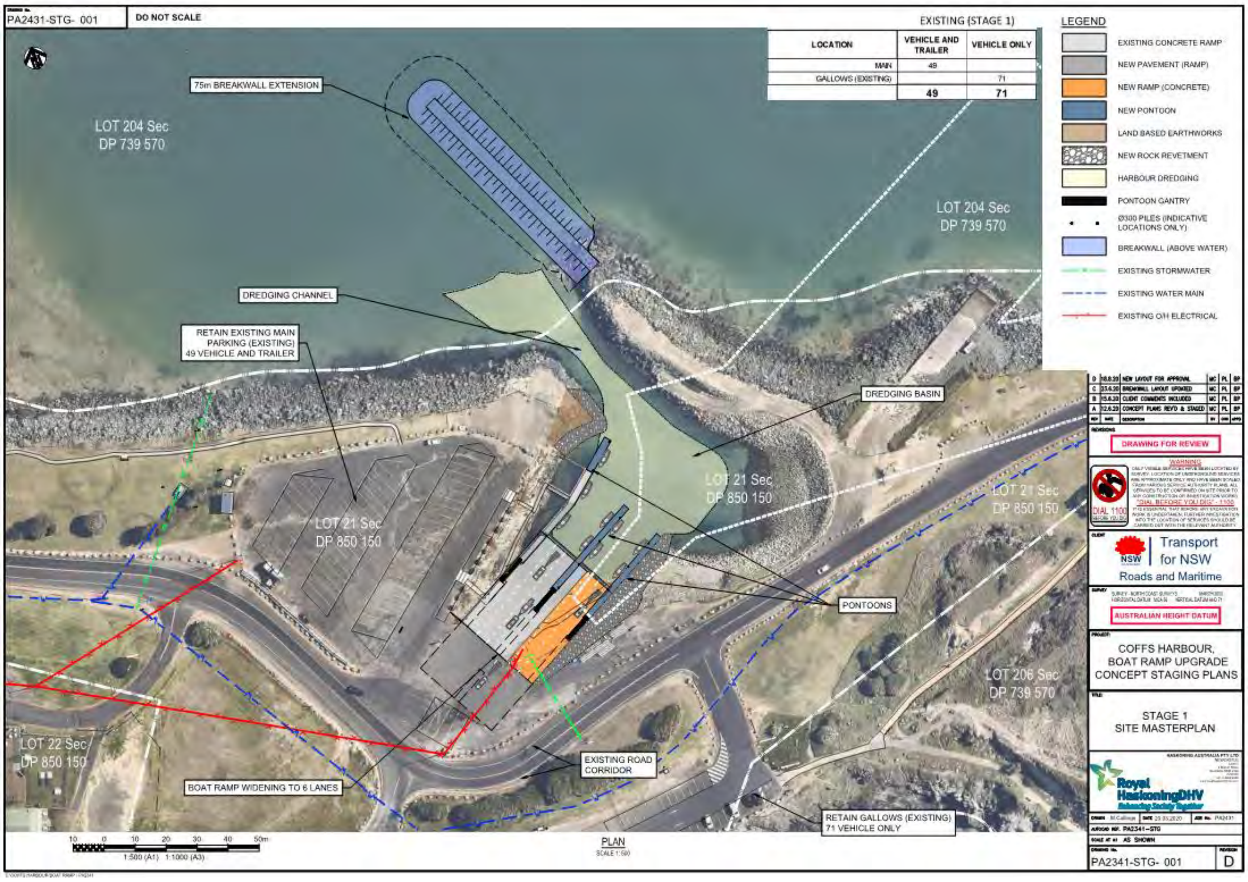
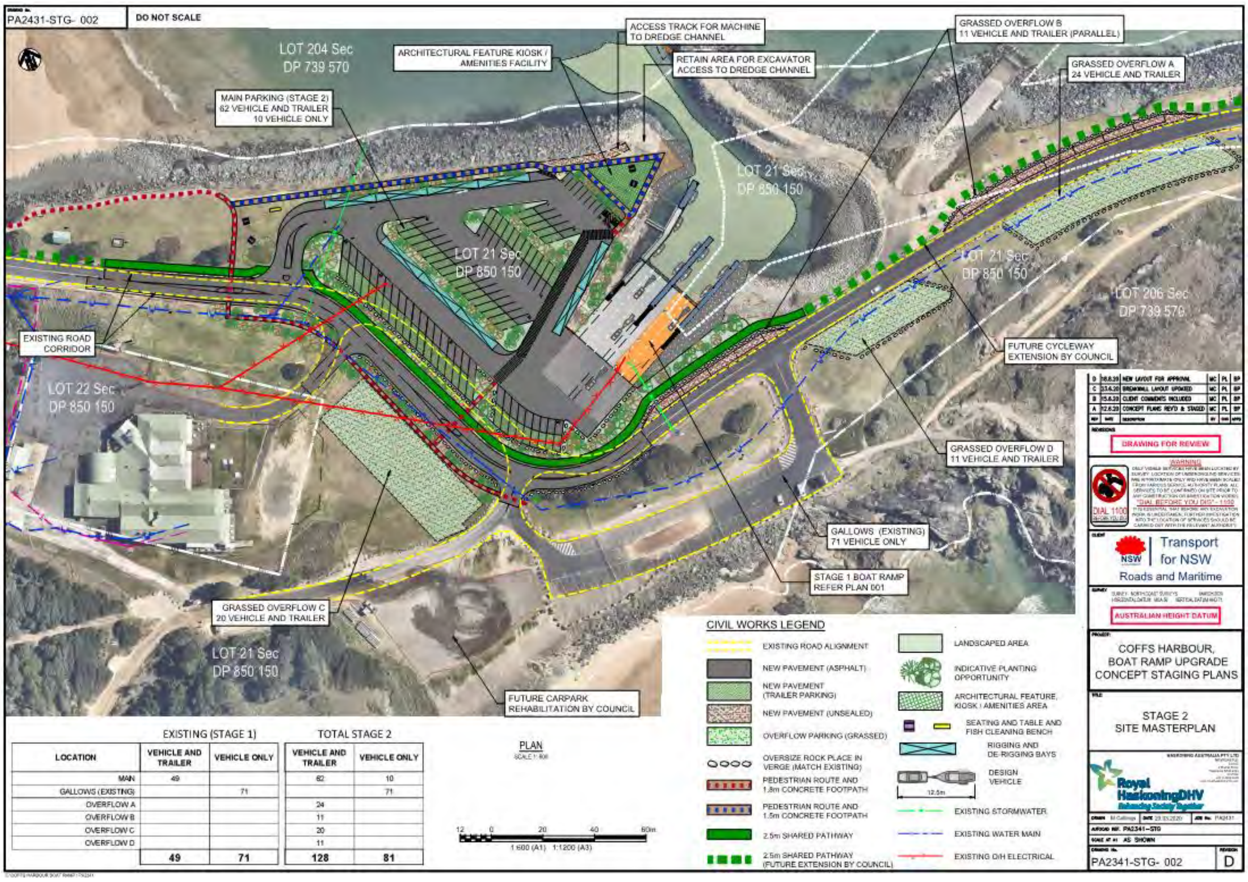


Figure 33: Preferred Concept Design – Stage 1



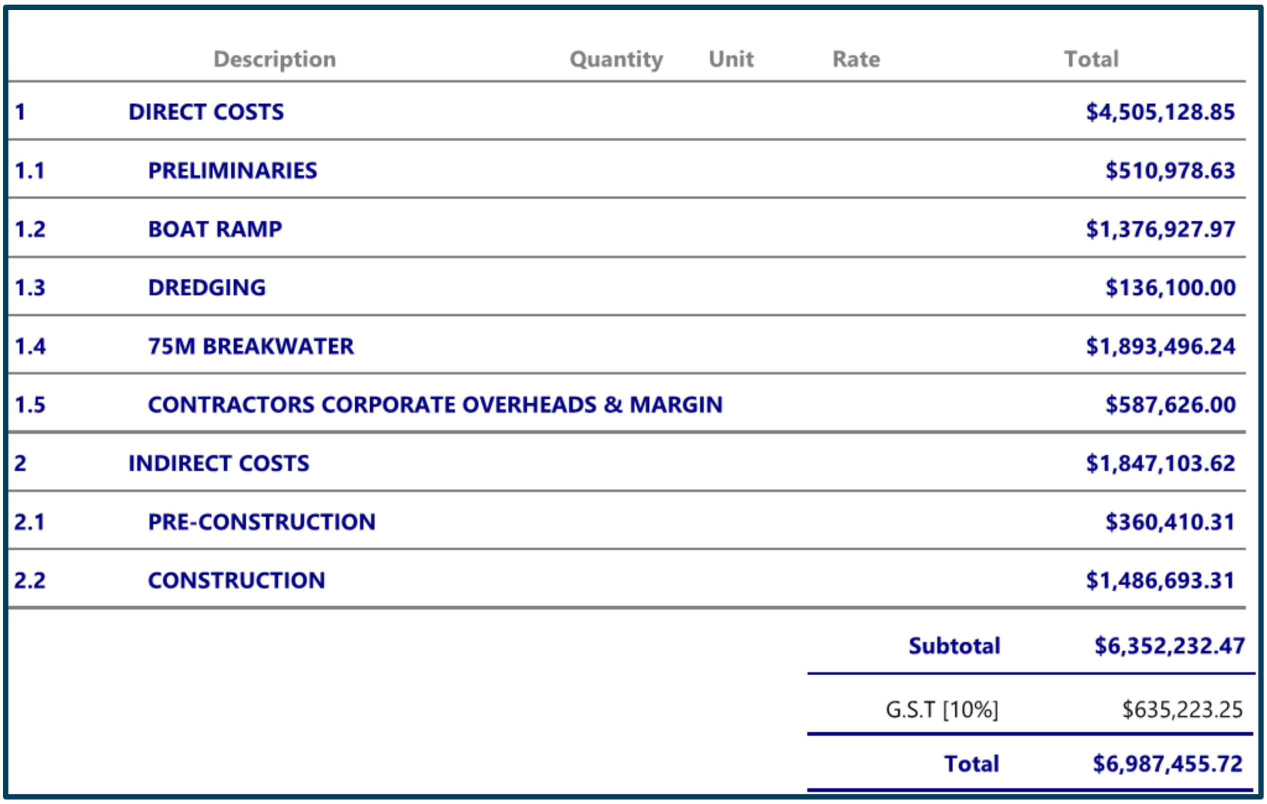
	EXISTING (STAGE 1)		TOTAL STAGE 2	
LOCATION	VEHICLE AND TRAILER	VEHICLE ONLY	VEHICLE AND TRAILER	VEHICLE ONLY
MAIN	49		62	10
GALLOWS (EXISTING)		71		71
OVERFLOW A			24	
OVERFLOW B			11	
OVERFLOW C			20	
OVERFLOW D			11	
	49	71	128	81

Figure 34: Preferred Concept Design – Stage 2

6.7 Preferred Concept Cost Estimates

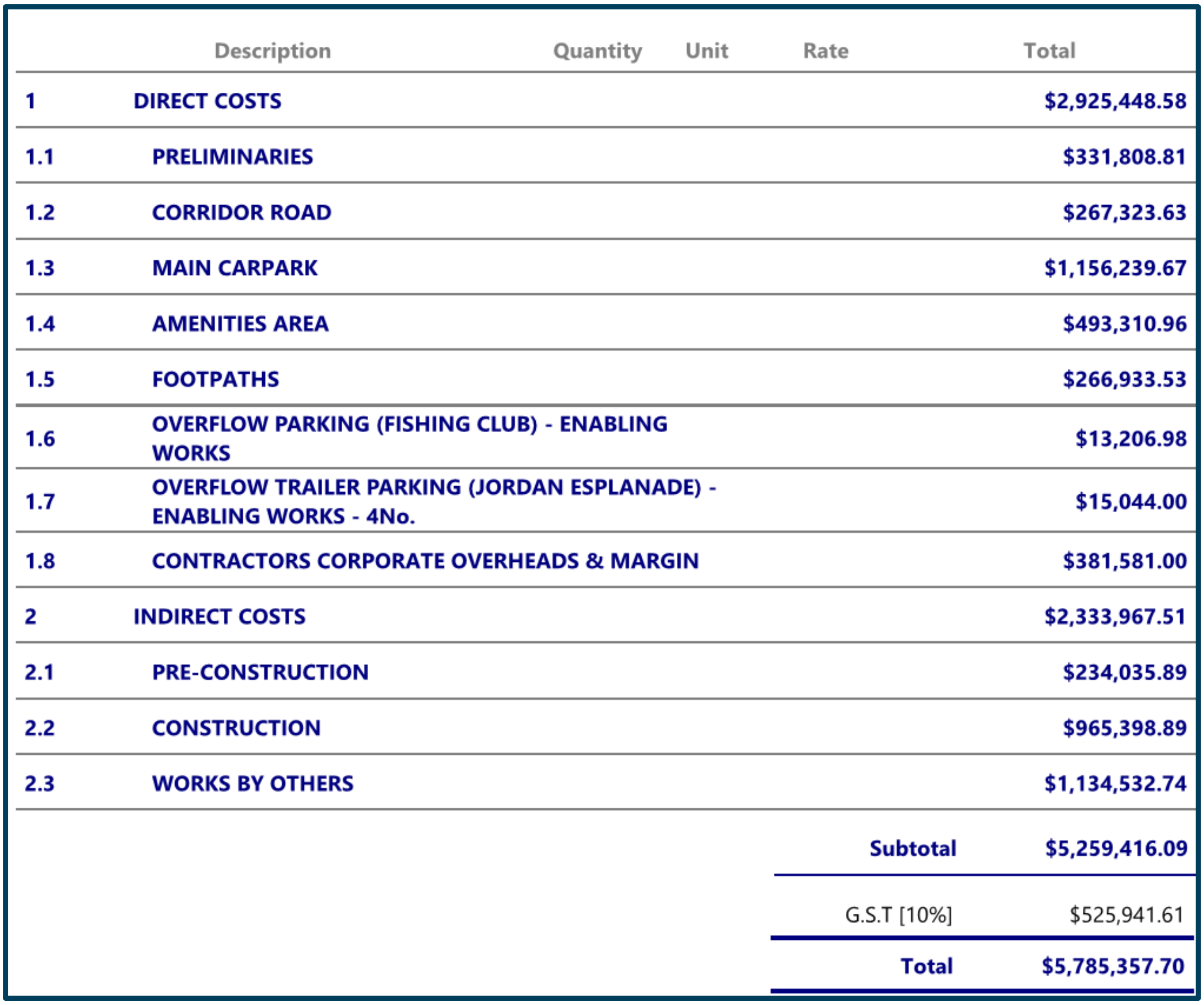
The preferred Stage 1 and Stage 2 concept designs were costed by a qualified quantity surveyor, Vasey Consulting. A breakdown of the cost estimates are provided below in **Table 7** and **Table 8** below, while a detailed breakdown of these cost estimates are provided in **Appendix G**. While the total cost estimate (i.e. $11.6 Million, excluding GST) slightly exceeds the available $10 Million budget, it is considered that there may be opportunities to find additional funding for some of the Stage 2 works through Council or other NSW Government sources.

Table 7: Stage 1 Cost Estimates



	Description	Quantity	Unit	Rate	Total
1	**DIRECT COSTS**				**$4,505,128.85**
1.1	**PRELIMINARIES**				**$510,978.63**
1.2	**BOAT RAMP**				**$1,376,927.97**
1.3	**DREDGING**				**$136,100.00**
1.4	**75M BREAKWATER**				**$1,893,496.24**
1.5	**CONTRACTORS CORPORATE OVERHEADS & MARGIN**				**$587,626.00**
2	**INDIRECT COSTS**				**$1,847,103.62**
2.1	**PRE-CONSTRUCTION**				**$360,410.31**
2.2	**CONSTRUCTION**				**$1,486,693.31**
				Subtotal	**$6,352,232.47**
				G.S.T [10%]	$635,223.25
				Total	**$6,987,455.72**

Table 8: Stage 2 Cost Estimates



	Description	Quantity	Unit	Rate	Total
1	**DIRECT COSTS**				**$2,925,448.58**
1.1	**PRELIMINARIES**				**$331,808.81**
1.2	**CORRIDOR ROAD**				**$267,323.63**
1.3	**MAIN CARPARK**				**$1,156,239.67**
1.4	**AMENITIES AREA**				**$493,310.96**
1.5	**FOOTPATHS**				**$266,933.53**
1.6	**OVERFLOW PARKING (FISHING CLUB) - ENABLING WORKS**				**$13,206.98**
1.7	**OVERFLOW TRAILER PARKING (JORDAN ESPLANADE) - ENABLING WORKS - 4No.**				**$15,044.00**
1.8	**CONTRACTORS CORPORATE OVERHEADS & MARGIN**				**$381,581.00**
2	**INDIRECT COSTS**				**$2,333,967.51**
2.1	**PRE-CONSTRUCTION**				**$234,035.89**
2.2	**CONSTRUCTION**				**$965,398.89**
2.3	**WORKS BY OTHERS**				**$1,134,532.74**
				Subtotal	**$5,259,416.09**
				G.S.T [10%]	$525,941.61
				Total	**$5,785,357.70**

6.8 Recommended Further Studies and Investigations

The following further investigations and design development is recommended:

1. MHL to complete physical model testing (now completed)
2. Sediment transport modelling to aid environmental assessment of breakwater extension (MHL has commenced)
3. Environmental Assessment (REF, underway for TfNSW)
4. Geotechnical Investigations (underway for TfNSW)
5. Detailed Design of Stage 1 (commenced by RHDHV)
6. Tender and Award
7. Construction

7 References

1. Coffs Harbour City Council – LEP (2013) – Public Mapping – Council website
2. NSW Roads & Maritime Services [RMS] (2015), NSW Boat Ramp Facility Guidelines, September.
3. North Coast Surveys – dated 30 March 2020 - Coffs Harbour Boat Ramp Upgrade – Topographic and Bathymetric Surveys
4. Coffs Harbour City Council - Boat Ramp Upgrade, Jordan Esplanade, Coffs Harbour NSW - Geotechnical Assessment (Regional Geotechnical Solutions, Report No. RGS30472.1-AB , 5 May 2014)
5. Coffs Harbour Jetty Boat Ramp Improvements, Boat Ramp Road Re-Alignment Plan of Works End Jordan Esplanade, Coffs Harbour Jetty (CHCC, Survey and Design Branch, August 2014)
6. Boat Ramp Basin Extension, NSW Public Works for Coffs Harbour City Council (NSW Public Works, 13 April 2015)
7. Jetty Precinct Preliminary Concept Plan (GHD for CHJFP, 2018)
8. Jetty Beach Boat Ramp, Coffs Harbour – Bathymetry and Dredge Volumes (North Coast Surveys for NSW Crown Lands, Bathymetric Survey undertaken 12 September 2018, Plan Issued 22 February 2019)
9. Coffs Harbour Boat Ramp – Sediment Assessment, (GHD for Coffs Harbour City Council, 6 March 2019)
10. Asbestos Management Documentation (Asbestos Register, and Clearance Certificate) – (Ballpark Environmental, October 2019)
11. Coffs Harbour Boat Ramp – Breakwater Physical Modelling Report (Manly Hydraulics Laboratory, August 2020);
12. Manly Hydraulics Laboratory [MHL] (2012) – OEH NSW Tidal Planes Analysis, 1990-2010 Harmonic Analysis, MHL Report 2053, October 2012. Prepared for: NSW Office of Environment and Heritage
13. Manly Hydraulics Laboratory [MHL] (2019) – Coffs Harbour Southern Marine Precinct Study – Stage 1, Boat Ramp Operational Improvements, MHL Report 2715, December 2019. Prepared for: Department of Planning, Industry and Environment – Crown Lands
14. Manly Hydraulics Laboratory [MHL] (2020) - Coffs Harbour Physical Model - Boat Ramp Basin and Breakwater Testing - Report MHL2746 October 2020 Prepared for: Department of Planning, Industry and Environment – Crown Lands;
15. Destination NSW, Travel to North Coast NSW Tourism Region Year ended March 2020. Source: National and International Visitor Surveys, TRA. https://www.destinationnsw.com.au/wp-content/uploads/2020/08/north-coast-time-series-ye-mar-2020.pdf

16. Transport for NSW (2015), Regional Boating Plan: Mid North Coast Region, February. https://maritimemanagement.transport.nsw.gov.au/documents/mid-north-coast-reg-boating-plan.pdf

17. NSW Maritime (2010), NSW Boat Ownership and Storage: Growth Forecasts to 2026, July.

Appendix A: Presentation Slides – Stakeholder Meeting 8 May 2020

Royal
HaskoningDHV
Enhancing Society Together

Coffs Harbour Boat Ramp Upgrade - Options Assessment

Ben Patterson, Pat Lawless (RHDHV)
Pat Smyth (Crown Lands – Department of Planning Industry and Environment DPIE)

08 May 2020

Coffs Harbour Boatramp Upgrade - Background

- Coffs Harbour boat ramp is located in a small basin on the southern side of the harbour.
- Since the original boat ramp was constructed in mid-1970s, there has been a history of reports of difficulties launching and retrieving boats and navigating vessels in the entrance channel to the boat ramp.
- Following construction of the basin and ramp, water level surges and operational difficulties were also experienced at the boat ramp during times that north-easterly swell entered the harbour.

July 2013

- In 2015 the boat ramp basin was extended following numerical and physical modelling studies by Manly Hydraulics Laboratory (MHL) indicated seiche action in the boat ramp basin could be reduced by up to 30%.
- Wave monitoring instruments deployed by MHL indicated a reduction in seiche action was achieved and reports and observations from mariners using the facilities indicate that seiche action has decreased since basin extension was completed.
- However, on occasions, use of the boat ramp remains problematic, most notably by vessels entering the ramp basin during times of low tide levels combined with wave action.

March 2020

Coffs Harbour Boatramp Upgrade – Modelling

- A group of stakeholders that use the Coffs Harbour boat ramp formed the Coffs Harbour Regional Boat Ramp Precinct Enhancement Committee (CHRBRPEC) with a vision to develop the boat ramp precinct into a world class facility to meet the high demand for present day and future use of the boat ramp by local and visiting mariners.
- Following regular boating safety incidents, in particular over the 2018 Easter holiday period, where over a dozen boats were washed onto rocks at the entrance to the boat ramp basin, safety and congestion issues have been identified by CHRBRPEC to be addressed as a priority.
- The safety and congestion issues raised by CHRBRPEC have been endorsed by the Coffs Harbour City Council with the intention to seek funding sources to undertake improvement works at the boat ramp facility.
- CHRBRPEC have requested extra boat ramp lanes and pontoons, the extension of the boatharbour breakwater and the consideration of additional overflow parking and amenities such as cleaning tables, boat rig / de-rigging areas, and an amenities block (amongst other requests).

- Stage 2 physical model testing is currently being undertaken by MHL on behalf of Crown Lands to assess the proposed extension of the boat ramp basin breakwater. Three Options are being considered 40m, 60m and 75m (and including a “hook” at eth end of the breakwater).
- Preliminary results by MHL indicate that the proposed breakwater extension will be quite effective.
- As such, concept designs for the boat ramp upgrade developed by RHDHV assuming that at least a 40m breakwater extension be included in the overall works package.

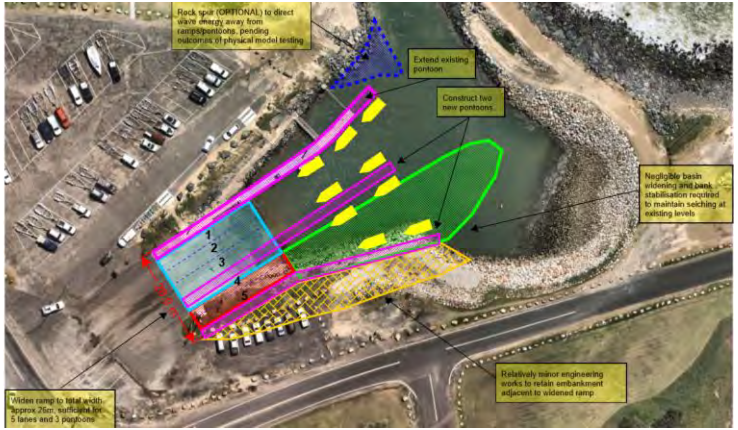
MHL
Physical
Modelling

Coffs Harbour Boatramp Upgrade – Initial Options

- RHDHV initially looked at a number of ramp and carpark options and undertook initial consultation of these options with Stakeholders including CHRBRPEC, Coffs Harbour City Council, and Crown Lands (Property Group).
- Based on Feedback from these initial Options, a Number of Concept Design Options have been developed and are currently in the process of being costed, to be presented back to the external stakeholder group at a workshop planned for the last week of May 2020.
- All initial Options assumed a 75m Breakwater Extension

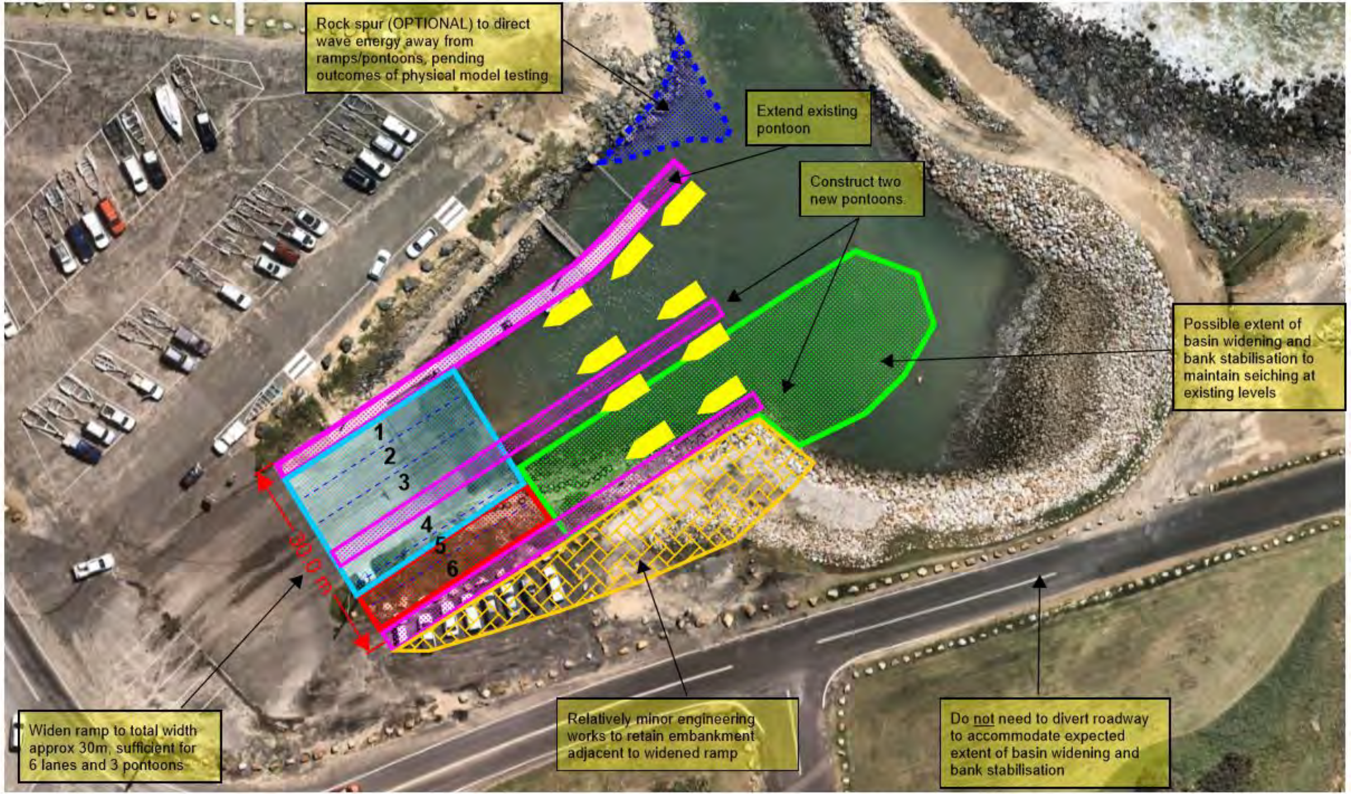
- The initial Options were broken down into:
  - Boat Ramp / Basin Options
  - Carpark / Road Alignment Options

Masterplan Options	Boat Ramp Options
1 – Western Rd Diversion	1 – 6 Lanes, 3 pontoons
2 – No Road Diversion	2 – 4 Lanes, 2 pontoons
3 – Eastern Rd Diversion	3 – 5 Lanes, 2 pontoons
	4 - 5 Lanes, 3 pontoons



Coffs Harbour Boatramp Upgrade - Boat Ramp Option 1

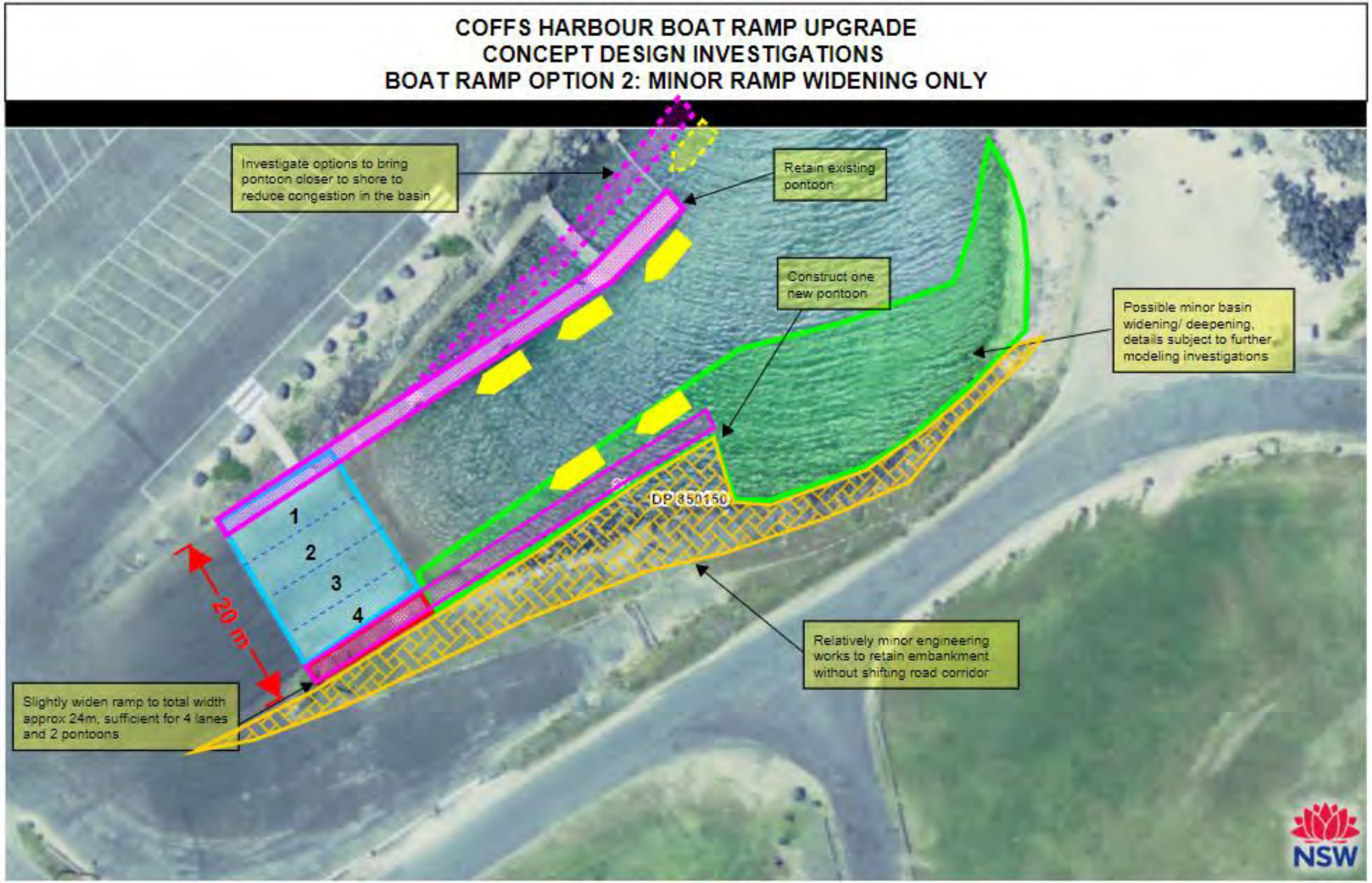
- 6 Ramp Lanes
- 3 Pontoons



COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
BOAT RAMP OPTION 1: 6 LANES, 3 PONTOONS (CHRBRPEC PROPOSAL)

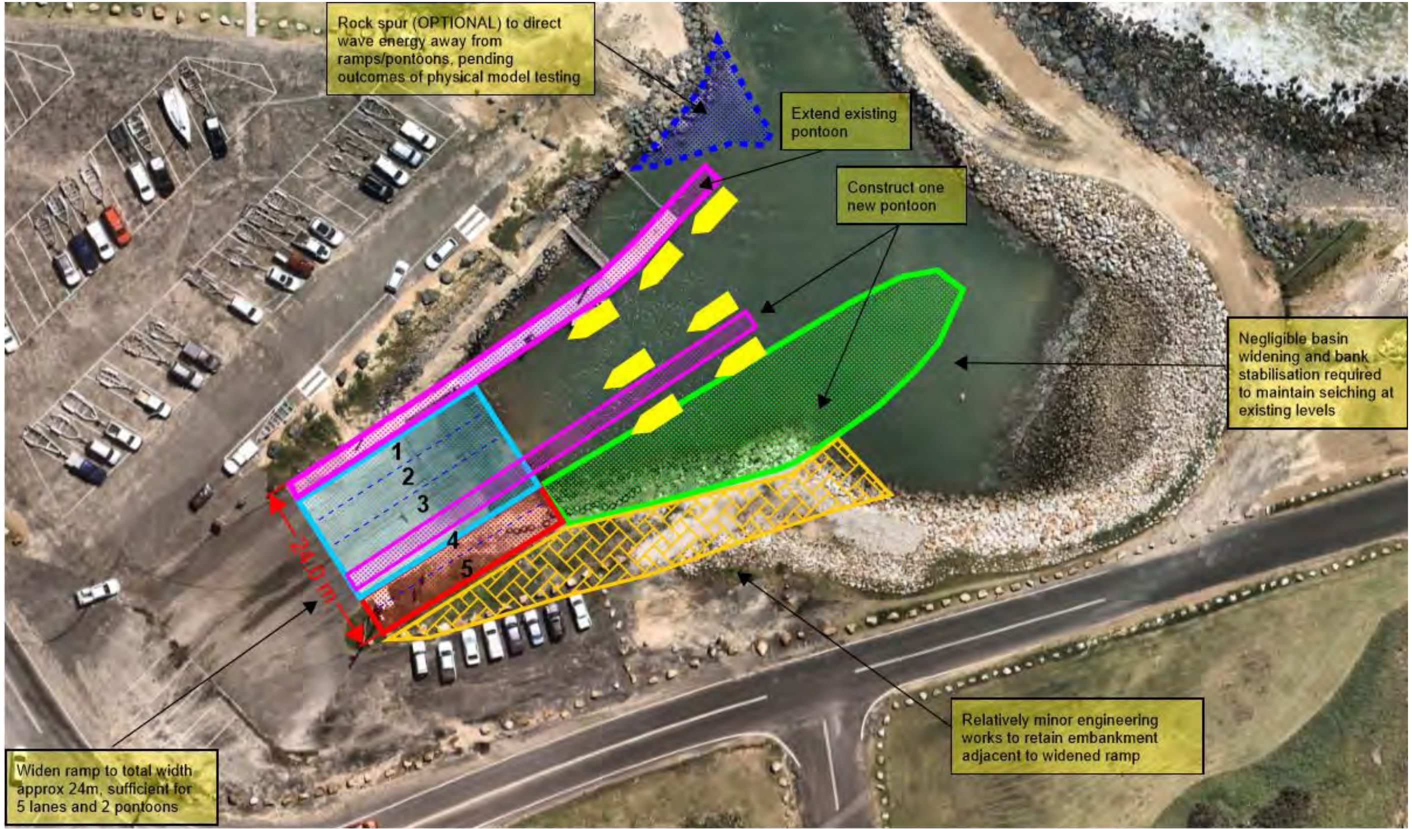
Coffs Harbour Boatramp Upgrade - Boat Ramp Option 2

- 4 Ramp Lanes
- 2 Pontoons adjacent to shore
- Not supported by community stakeholders
- Not considered further



Coffs Harbour Boatramp Upgrade - Boat Ramp Option 3

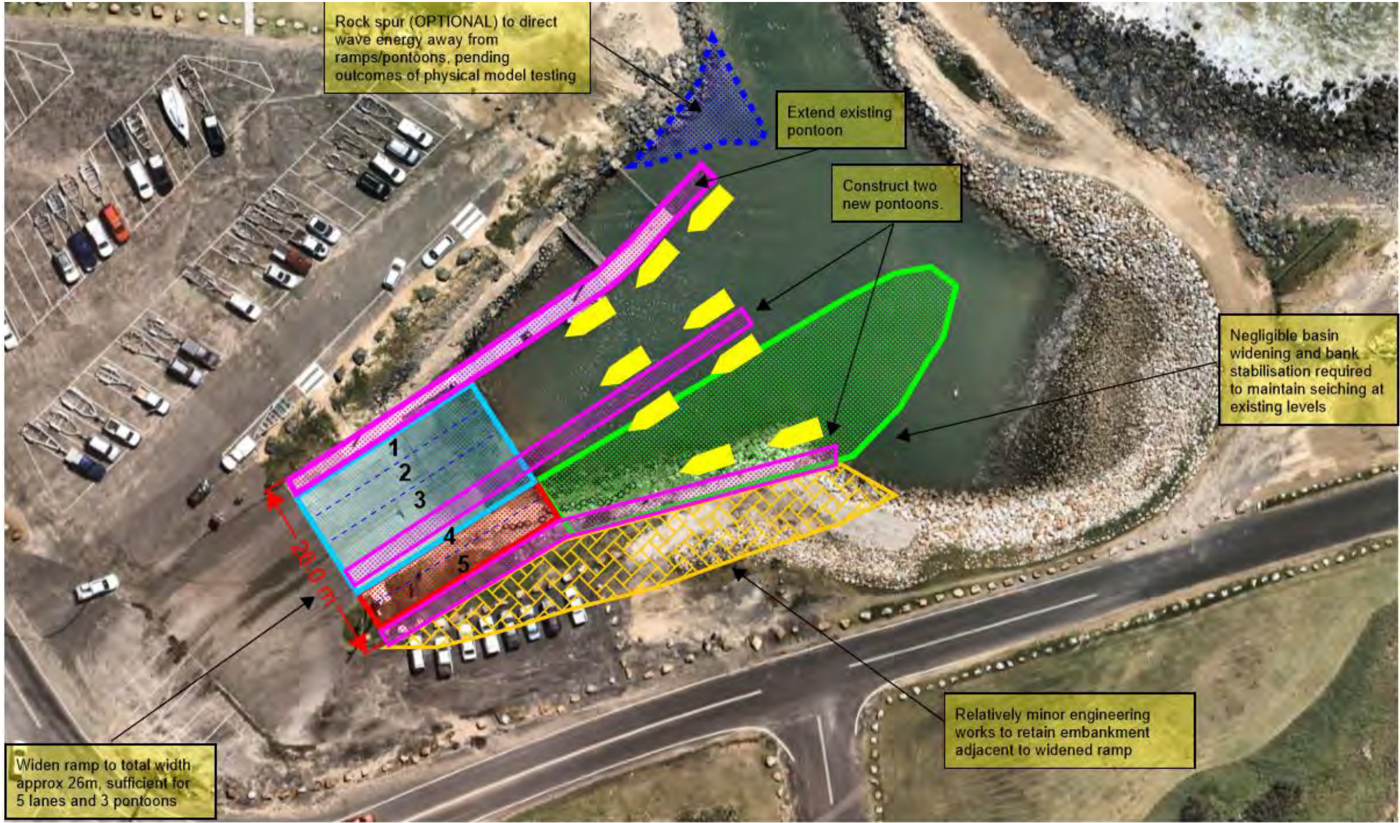
- 5 Ramp Lanes
- 2 Pontoons



COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
BOAT RAMP OPTION 3: FIVE LANES, TWO PONTOONS

Coffs Harbour Boatramp Upgrade - Boat Ramp Option 4

- 5 Ramp Lanes
- 3 Pontoons



COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
BOAT RAMP OPTION 4: FIVE LANES, THREE PONTOONS

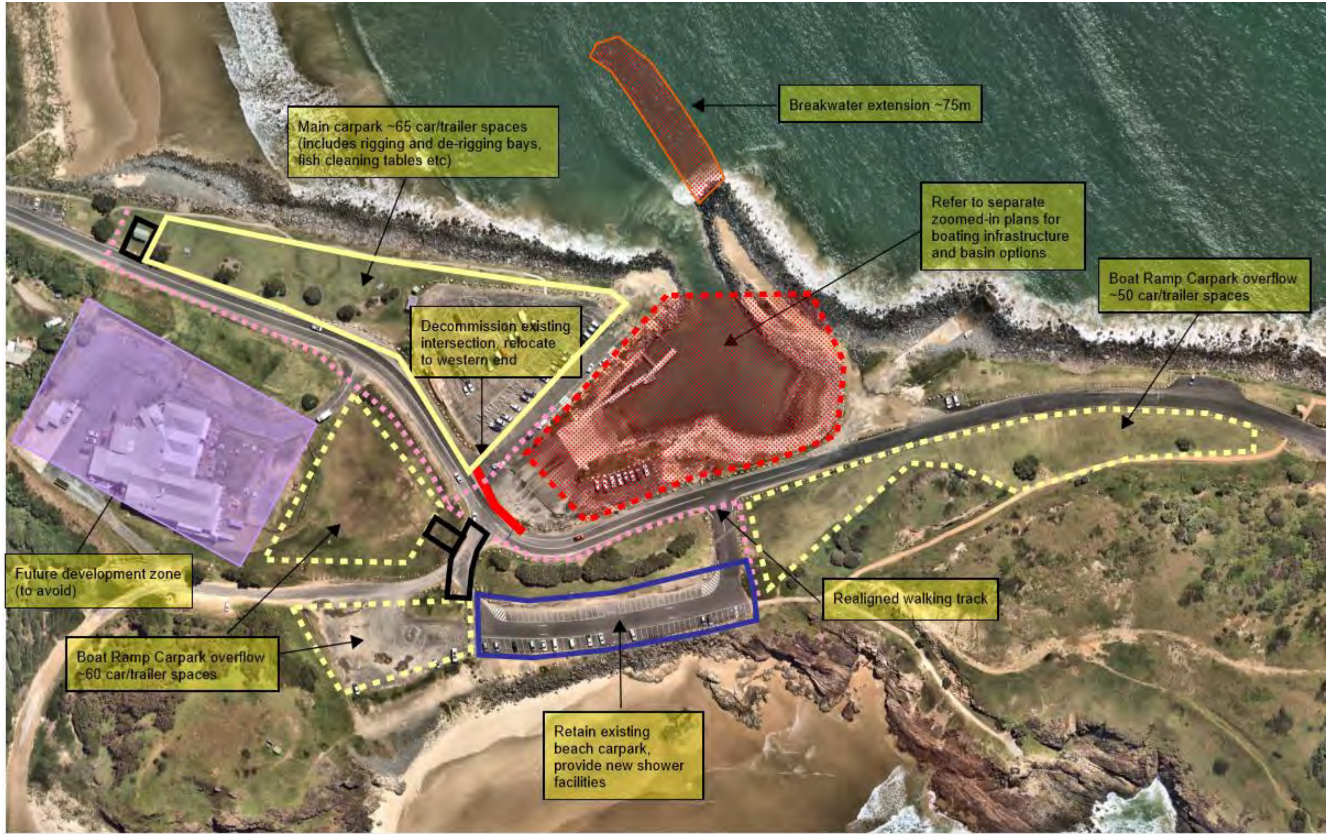
Coffs Harbour Boatramp Upgrade – Masterplan Option 1

- Jordan Esplanade Diversion (West)
- Major Carpark Upgrades
- Major retaining wall required
- Encroachment towards former Fishing Club site

COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
MASTERPLAN OPTION 1: MAJOR CARPARK UPGRADE + ROAD DIVERSION (WEST)

Coffs Harbour Boatramp Upgrade – Masterplan Option 2

- No Road Diversion
- Major Carpark Upgrades



COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
MASTERPLAN OPTION 2: CARPARK UPGRADE, NO ROAD DIVERSION

Coffs Harbour Boatramp Upgrade – Masterplan Option 3

- Jordan Esplanade Diversion (East)
- Major Carpark Upgrades

COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
MASTERPLAN OPTION 3: CARPARK UPGRADE (WEST), NEW CARPARK (EAST), ROAD DIVERSION (EAST)

Coffs Harbour Boatramp Upgrade – Masterplan Option 4

- Jordan Esplanade Diversion (central region, avoiding high scarps)
- Major Carpark Upgrades

COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
MASTERPLAN OPTION 4: CARPARK UPGRADE (WEST), NEW CARPARK (EAST), ROAD DIVERSION (CENTRAL/EAST)

Coffs Harbour Boatramp Upgrade – Design Options

- The final concept design options are summarised below:

Selected Concept Design Options	Preliminary Boating Option	Preliminary Masterplan Option
Option 1a	Boat Ramp Option 1 (6 lane, 3 pontoons)	MP Option 4 (Road Diversion)
Option 1b		MP Option 2 (No Road Diversion)
Option 2a	Boat Ramp Option 4 (5 lanes, 3 pontoons)	MP Option 4 (Road Diversion)
Option 2b		MP Option 2 (No Road Diversion)
Option 3a	Boat Ramp Option 3 (5 lanes, 2 pontoons)	MP Option 4 (Road Diversion)
Option 3b		MP Option 2 (No Road Diversion)

Current Options – Option 1a - Ramp

- 6 Lanes
- 3 Pontoons

Common:

- Rock Spur
- Dredging
- Breakwater Extension

Current Options – Option 1a – Road and Carpark

- Significant Road Diversions
- 1 Large carpark
- Overflow carpark to South and East
- 224 car/trailer spaces (48 currently)

Current Options – Option 1b – Boat ramp as per 1a

- As per Option 1a

- 6 Lanes
- 3 Pontoons

Common:
- Rock Spur
- Dredging
- Breakwater Extension

Current Options – Option 1b – Road and Carpark

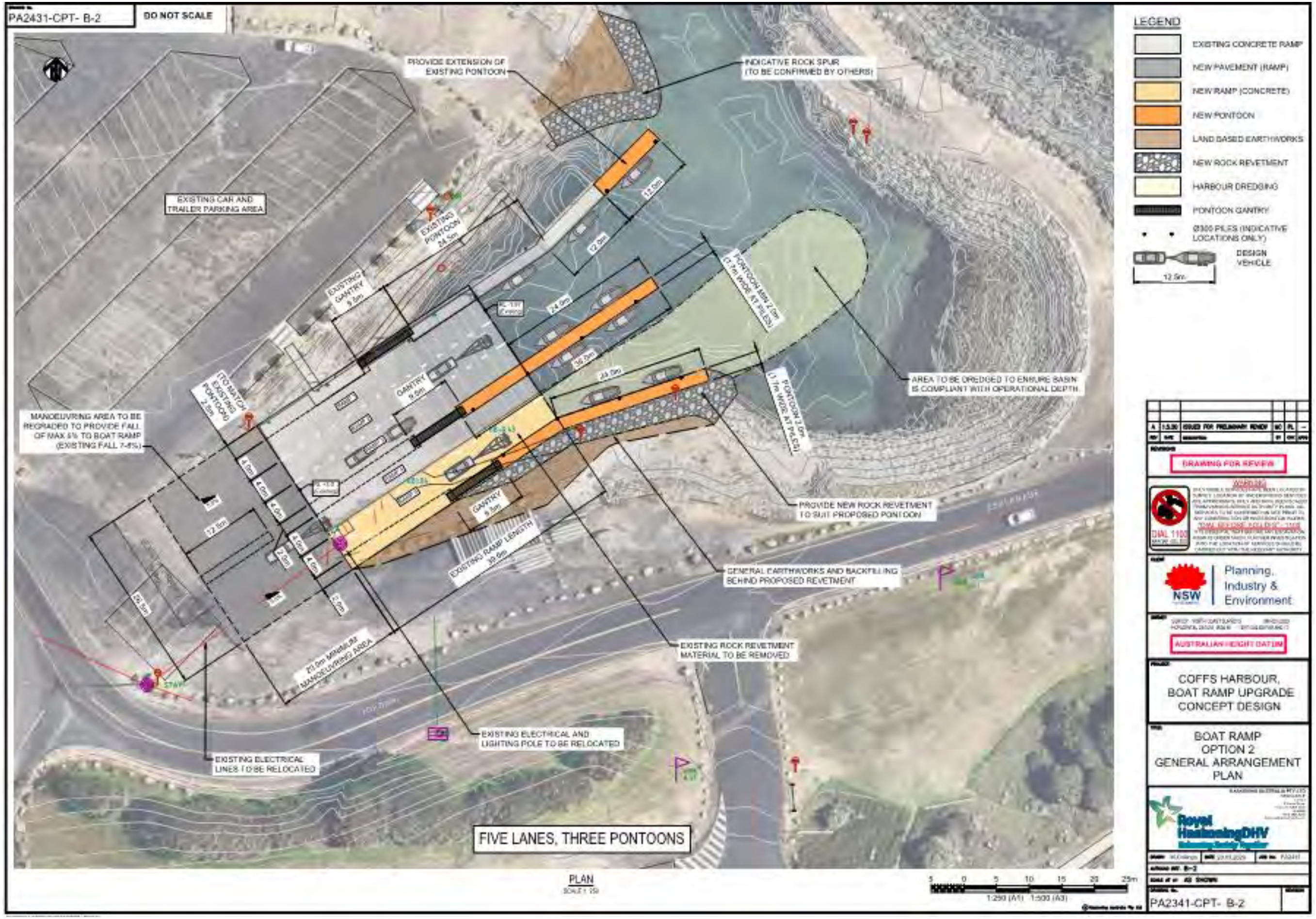
- No Road Diversions
- 1 Large carpark
- Overflow carparks to South and East
- 156 car/trailer spaces (48 currently)

Current Options – Option 2a – Boat ramp

- 5 Lanes
- 3 Pontoons

Common:

- Rock Spur
- Dredging
- Breakwater Extension



Current Options – Option 2a – Road and Carpark

- As per Option 1a

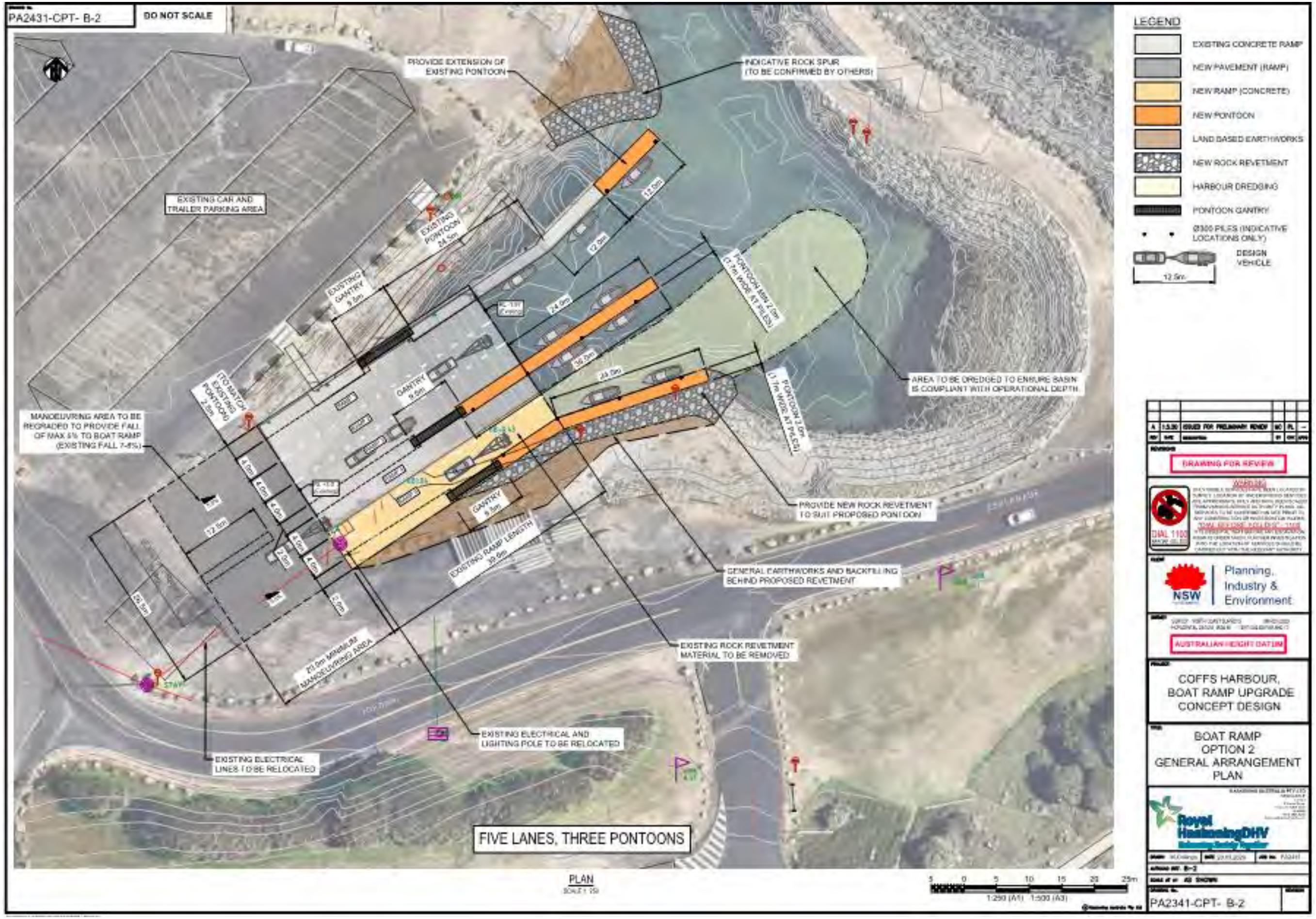
- Significant Road Diversions
- 1 Large carpark
- Overflow carpark to South and East
- 224 car/trailer spaces (48 currently)

Current Options – Option 2b – Boat ramp – as per 2a

- Ramp as per 2a

- 5 Lanes
- 3 Pontoons

Common:
- Rock Spur
- Dredging
- Breakwater Extension



Current Options – Option 2b – Road and Carpark

- As per 1b

- No Road Diversions
- 1 Large carpark
- Overflow carpark to South and East
- 156 car/trailer spaces (48 currently)

Current Options – Option 3a – Boat ramp

- 5 Lanes
- 2 Pontoons

Common:

- Rock Spur
- Dredging
- Breakwater Extension

Current Options – Option 3a – Road and Carpark

- As per Option 1a and 2a

- Significant Road Diversions
- 1 Large carpark
- Overflow carpark to South and East
- 224 car/trailer spaces (48 currently)

Current Options – Option 3b – Boat ramp – as per 3a

- Ramp as per 3a

- 5 Lanes
- 2 Pontoons

Common:
- Rock Spur
- Dredging
- Breakwater Extension

Current Options – Option 3b – Road and Carpark

- As per 1b and 2b

- <u>No</u> Road Diversions
- 1 Large carpark
- Overflow carpark to South and East
- 156 car/trailer spaces (48 currently)

Current Options – Carparking Numbers per Options

- Comparison of Carparking Numbers against NSW Boat Ramp Guidelines (NSWBRG) and a Lower bound criteria set by RHDHV
- Lower Bound criteria set at 35 spaces per Lane
- Upper Bound criteria set at 50 spaces per Lane

	No. of carparking spaces				
Option	**Available Carparking Spaces**	**Required @ 35 No. Per Lane (RHDHV)**	**Required @ 50 No. Per Lane (NSWBRG)**	**Ratio agianst Required (RHDHV)**	**Ratio against Required (NSWBRG)**
1a	224	210	300	1.07	0.75
1b	156	210	300	0.74	0.52
2a	224	175	250	1.28	0.90
2b	156	175	250	0.89	0.62
3a	224	150	225	1.49	1.00
3b	156	150	225	1.04	0.69

Current Options – Prelim. Multi-Criteria Assessment (MCA)

- 8 Criteria, No Firm Costs Yet, but relative Cost Scoring
- Weighted Criteria
- Scored by Project Team only at this stage
- Preferred is Option 2a

Criteria		Option 1a		Option 1b		Option 2a		Option 2b		Option 3a		Option 3b	
	Weight	**Score**	**Weighted score**	**Score**	**Weighted score**	**Score**	**Weighted score**	**Score**	**Weighted score**	**Score**	**Weighted score**	**Score**	**Weighted score**
A - Environment / Heritage	5%	2.0	0.10	2.5	0.13	2.0	0.10	2.5	0.13	2.0	0.10	2.5	0.13
B - Safety (Navigation) - related to number of ramps/pontoons	15%	5.0	0.75	5.0	0.75	4.0	0.60	4.0	0.60	2.0	0.30	2.0	0.30
C - Safety (Road)	10%	4.5	0.45	2.0	0.20	4.5	0.45	2.0	0.20	4.5	0.45	2.0	0.20
D - Cost	40%	1.5	0.60	3.0	1.20	2.0	0.80	3.5	1.40	2.5	1.00	4.0	1.60
E - Land Tenure / Impact on Adjacent Properties	10%	1.0	0.10	3.0	0.30	1.0	0.10	3.0	0.30	1.0	0.10	3.0	0.30
F - Functionality (landside 1) related to carparking numbers only	5%	4.0	0.20	1.0	0.05	4.5	0.23	2.5	0.13	5.0	0.25	4.0	0.20
G - Functionality (landside 2) related to manoeuvreing, rigging, access/intersections (not carparking)	5%	4.0	0.20	2.0	0.10	4.0	0.20	2.0	0.10	4.0	0.20	2.0	0.10
H - Functionality (maritime) including berthing, vessel manoeuvreing, vessel waiting times in basin	10%	4.0	0.40	2.0	0.20	4.0	0.40	3.0	0.30	3.5	0.35	2.5	0.25
Total Weighted Score	**100%**	**Option 1a**	**2.80**	**Option 1b**	**2.93**	**Option 2a**	**2.88**	**Option 2b**	**3.15**	**Option 3a**	**2.75**	**Option 3b**	**3.08**
Score		2.80		2.93		2.88		3.15		2.75		3.08	
Rank		5		3		4		1		6		2	

Preferred Option - Option 2b – Boat ramp

- Preferred:

- 5 Lanes
- 3 Pontoons

Common:
- Rock Spur
- Dredging
- Breakwater Extension

Preferred Option – Option 2b – Road and Carpark

- Preferred:

- <u>No</u> Road Diversions
- 1 Large carpark
- Overflow carpark to South and East

QUESTIONS?

Appendix B: Presentation Slides – Stakeholder Meeting 29 May 2020

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Enhancing Society Together

Coffs Harbour Boat Ramp Upgrade - Options Assessment

Ben Patterson, Pat Lawless (RHDHV)
Pat Smyth (Crown Lands – Department of Planning Industry and Environment DPIE)

29 May 2020

Coffs Harbour Boatramp Upgrade - Agenda

1. Background
2. Key issues / processes affecting vessel safety
3. Broad Options to address key issues
4. Masterplan and Boating Options – Preliminary
5. Masterplan and Boating Options – Concept Design
6. Assessment of Concept Design Options
7. Preferred Option
8. Recent feedback from CHRBRPEC
9. Where to from here?
10. Questions

Coffs Harbour Boatramp Upgrade - Background

- Coffs Harbour boat ramp is located in a small basin on the southern side of the harbour.
- Since the original boat ramp was constructed in mid-1970s, there has been a history of reports of difficulties launching and retrieving boats and navigating vessels in the entrance channel to the boat ramp.
- Following construction of the basin and ramp, water level surges and operational difficulties were also experienced at the boat ramp during times that north-easterly swell entered the harbour.

July 2013

- In 2015 the boat ramp basin was extended to include a “spending beach” following numerical and physical modelling studies by Manly Hydraulics Laboratory (MHL) indicated seiche action in the boat ramp basin could be reduced by up to 30%.
- Wave monitoring instruments deployed by MHL indicated a reduction in seiche action was achieved and reports and observations from mariners using the facilities indicate that seiche action has decreased since basin extension was completed.
- However, on occasions, use of the boat ramp remains problematic, most notably by vessels entering the ramp basin during times of low tide levels combined with swell wave action.

March 2020

Coffs Harbour Boatramp Upgrade – Background (2)

- A group of stakeholders that use the Coffs Harbour boat ramp formed the Coffs Harbour Regional Boat Ramp Precinct Enhancement Committee (CHRBRPEC) with a vision to develop the boat ramp precinct into a world class facility to meet the high demand for present day and future use of the boat ramp by local and visiting mariners.
- Following regular boating safety incidents, in particular over the 2018 Easter holiday period, where over a dozen boats either ran aground or were washed onto rocks at the entrance to the boat ramp basin, safety and congestion issues have been identified by CHRBRPEC to be addressed as a priority.
- The safety and congestion issues raised by CHRBRPEC have been endorsed by the Coffs Harbour City Council with the intention to seek funding sources to undertake improvement works at the boat ramp facility.
- CHRBRPEC have requested extra boat ramp lanes and pontoons, the extension of the breakwater and the consideration of additional overflow parking and amenities such as cleaning tables, boat rigging / de-rigging areas, and an amenities block (amongst other requests).

- RHDHV have reviewed the report from the committee, previous modelling by MHL and our own observations of the video footage and direct reports of vessels being in trouble, and have taken these into account for option identification.

Coffs Harbour Boatramp Upgrade –

Key Issues / Processes affecting vessel safety

There are three key issues / processes that can affect boating safety:

1. ‘Long’ waves (seiching) – results in surging/sloshing motions throughout harbour and basin
2. ‘Short’ waves (swell and wind wave action)
3. Shoaling / breaking waves (due to long-shore sand movement) – **most important**

3. Shoaling / breaking waves (due to sand accumulation at the entrance)

2. ‘Short’ wave penetration through entrance due to wind and swell

1. ‘Long’ waves (seiching) - can result in dangerous berthing and mooring conditions

Coffs Harbour Boatramp Upgrade –
Broad options to address key issues / processes

A number of potentially viable solutions that have been previously investigated include:

1. Extend the Breakwater
2. Extend the Spending Beach / Basin further
3. Dredge Pocket to intercept sand arriving at the end of the breakwater (and potentially refract swell wave energy)

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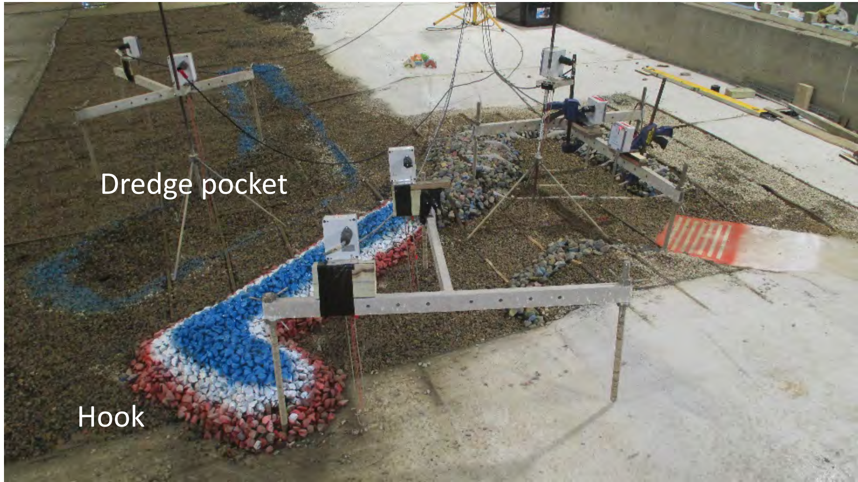
Coffs Harbour Boatramp Upgrade – MHL Modelling

- Stage 2 physical model testing is currently being undertaken by MHL to assess the proposed breakwater extension, including the following options:
  - 40m breakwater extension;
  - 60m breakwater extension;
  - 75m breakwater extension;
  - 75m breakwater extension including a “hook” at the end of the breakwater;
  - Widening of the entrance channel; and
  - A dredge pocket on the outside of the breakwater.

- So far the testing has focussed on the effects of the above options on Seiching behaviour – results indicate that a breakwater extension would produce a negligible reduction in seiche action with or without the sand removed from the basin and channel.

- Ongoing investigations including:
  - More detailed results for the above tests to assess ‘short’ waves (i.e. swell and wind waves)
  - Effect of deepening of the basin and entrance channel

MHL
Physical
Modelling



Coffs Harbour Boatramp Upgrade –

How do the broad options address the key issues?

Issue	Broad Options		
	Breakwater Extension*	Extension of the Basin #	Dredge Pocket
Long waves (seiching)	No Benefit	Small Benefit	No Benefit
Short waves (swell penetration)	Benefit (TBC by ongoing physical model testing)	No Benefit	Benefit**
Shoaling (due to sand movement)	Short-term benefit only, as the breakwater will extend into deeper water, however, eventually shoaling will continue	No Benefit	Benefit
	* Primary benefit: improve navigational safety by providing additional protection at the entrance to the boat ramp basin	# No modelling to date, other than previous (2015) basin extension investigations.	** Only if configuration dredging is undertaken

Coffs Harbour Boatramp Upgrade –
1. Extension of Breakwater

- Previous results of physical model tests conducted by MHL in 2014, concluded that breakwater extension would result in negligible reduction in seiche action in the present-day boat ramp basin configuration. This appears to have been confirmed by the latest testing (May 2020).
- RHDHV currently awaiting results from MHL to assess effect of breakwater extension on 'short' wave penetration due to wind and swell.
- CHRBRPEC (2018) stated that an extension of the breakwater will improve navigational safety by moving the location at which vessels broach upon leaving or entering the basin further offshore into deeper water and away from the rocky shoreline to the west of the existing basin entrance where numerous boat grounding incidents have occurred.
- Following construction, the end of the breakwater would be located at 4 to 5m water depth, eliminating the shoaling issue in the short-term. However, RHDHV are concerned that shoaling will become a problem once sand levels build up to the point where broaching of boats occurs again.
- The conclusion is that some form of ongoing sand management (dredging) will still be required with an extended breakwater.

Extension of the breakwater will improve navigational safety by moving the location at which vessels broach further offshore into deeper water and away from the rocky shoreline to the west of the existing boat ramp entrance.

RHDHV / MHL are concerned that shoaling will continue to be a hazard once the breakwater is extended.

Coffs Harbour Boatramp Upgrade –

1. Extension of Breakwater (continued)

- Any breakwater extension will change sand movement and deposition processes.
- A breakwater extension will also probably have a significant impact on a popular surf break at the southern end of Jetty Beach that breaks during major storm events that make the open coast beach breaks too large to surf for the majority of the surfing community.
- Recommendations:

1. Sediment transport modelling to better understand potential implications of breakwater extension on sand movement and potential re-shoaling of entrance area
2. Consultation with surfing community

Image: Google Earth 2019

Coffs Harbour Boatramp Upgrade –
2. Extension of the Spending Beach / Basin

- The option of extending the Spending Beach was not examined, as it is likely to have an adverse effect on Jordan Esplanade
- However, the proposed widening of the boat ramp and deepening of the basin and entrance channel was found by MHL to not significantly impact on Seiching
- MHL will provide data on whether the wider boat ramp and deeper basin/channel will have any significant impact on ‘short’ waves (i.e. swell and wind waves)

Widening of the Boat Ramp area and Deepening of the entrance channel do not have any significant impact on Seiching

Extension of the Spending Beach Basin would adversely impact Jordan Esplanade

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Coffs Harbour Boatramp Upgrade –
3. Sand Management

- RHDHV consider that the biggest driver for the dangerous conditions during Easter 2018 (and likely other) events was the accumulation of sand at the entrance.
- An extension of the breakwater will push the entrance into deeper water, so there will be a temporary reprieve, perhaps lasting a number of years, but then we would expect the entrance shoal to reform at the end of the breakwater extension – possibly a shallower entrance than we have today although with more wave protection around the actual entrance throat.
- That is, the breakwater extension is <u>not</u> a long term solution to shoaling.
- **Conclusion**: some form of ongoing sand management program will be needed operationally to maintain a safe and navigable boat harbour entrance.


Dredge pocket does not have any impact on Seiching in the basin

Dredge Pocket to intercept sand before it can affect shoaling at the basin entrance and to refract swell wave energy

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Coffs Harbour Boatramp Upgrade –
3. Sand Management - Continued

Sand Management options include:

1. **Regular dredging of the entrance channel (current practice).**
   - Undertaken when depths reduce below 1m (reactive approach)
   - Somewhat limited by reach of excavator
   - From our understanding of sediment dynamics at the site, the entrance could shoal with a sand lobe appearing over a matter of days, or even during an event, so this approach can be problematic and risky.
2. **Dredge pocket** – refer following slide
3. **Sand Bypassing system** – possible long-term solution requiring further investigation.

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Coffs Harbour Boatramp Upgrade – Summary of Recommended Outer Basin Works

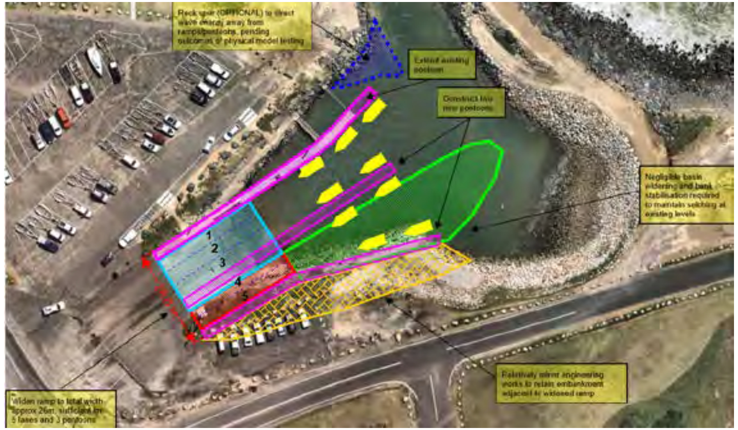
- **Dredge Pocket**
  - Primary objective: intercept incoming sand from harbour to reduce potential for shoaling
  - RHDHV suggest that this is the most important aspect of the proposed Maritime Works.
  - Configuration dredging could provide additional benefits of swell wave refraction and energy dissipation.
- **Breakwater extension (length to be determined)**
  - Added protection at the throat of the entrance
  - Protection from NE waves/wind
  - Additional manoeuvring room away from the western rocky shoreline in the event of broaching.
  - Sediment transport modelling recommended to better understand potential implications of breakwater extension on sand movement and potential re-shoaling of entrance area
  - Consultation with local surfing community

Coffs Harbour Boatramp Upgrade – Previous Options

- RHDHV initially looked at a number of ramp and carpark options and undertook initial consultation of these options with Stakeholders including CHRBRPEC, Coffs Harbour City Council, and Crown Lands (Property Group).
- Based on Feedback from these initial Options, a Number of Concept Design Options have been developed and are currently in the process of being costed, to be presented back to the external stakeholder group at a workshop planned for the last week of May 2020.
- All initial Options assumed a 75m Breakwater Extension

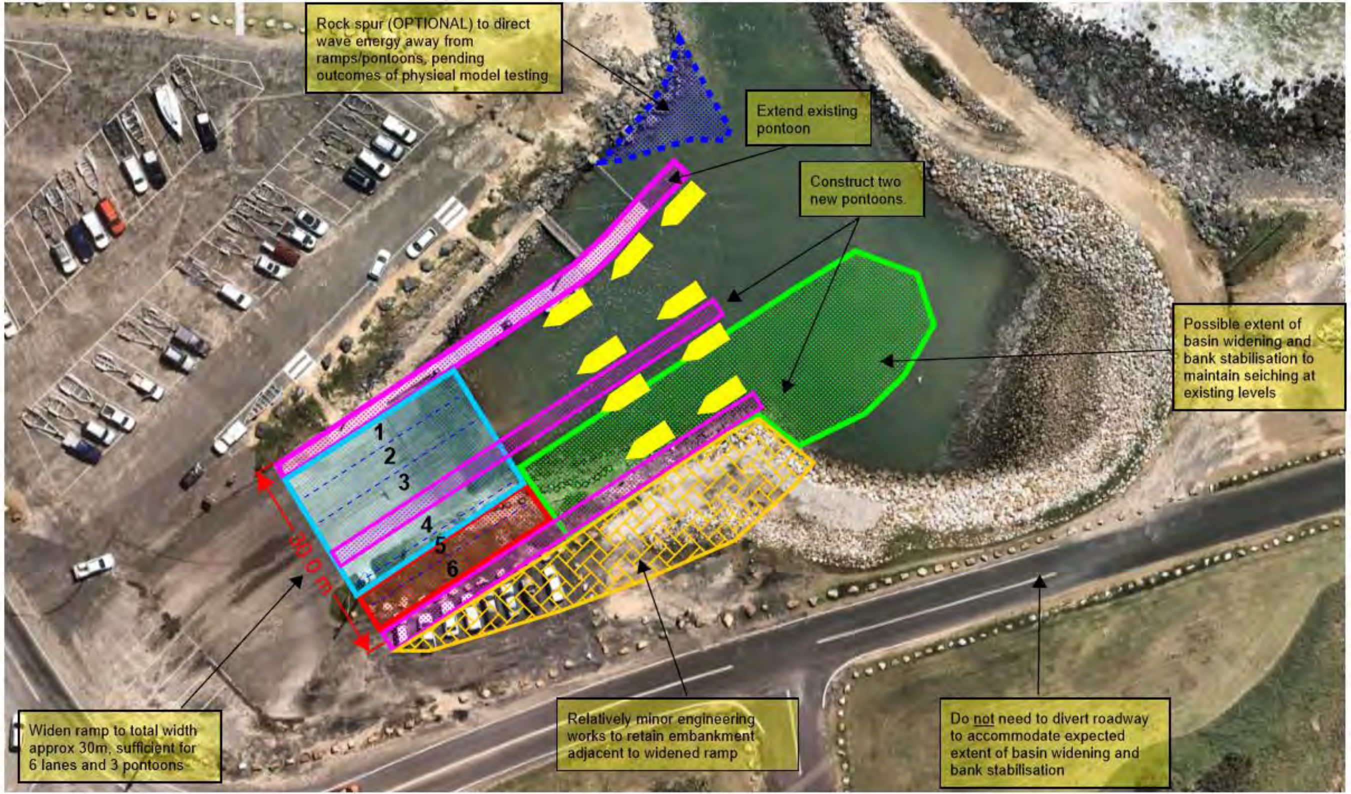
- The initial Options were broken down into:
  - Boat Ramp / Basin Options
  - Carpark / Road Alignment Options

Masterplan Options	Boat Ramp Options
1 – Western Rd Diversion	1 – 6 Lanes, 3 pontoons
2 – No Road Diversion	2 – 4 Lanes, 2 pontoons
3 – Eastern Rd Diversion	3 – 5 Lanes, 2 pontoons
	4 - 5 Lanes, 3 pontoons



Coffs Harbour Boatramp Upgrade - Boat Ramp Option 1

- 6 Ramp Lanes
- 3 Pontoons



Rock spur (OPTIONAL) to direct wave energy away from ramps/pontoons, pending outcomes of physical model testing

Extend existing pontoon

Construct two new pontoons

Possible extent of basin widening and bank stabilisation to maintain seiching at existing levels

Widen ramp to total width approx 30m, sufficient for 6 lanes and 3 pontoons

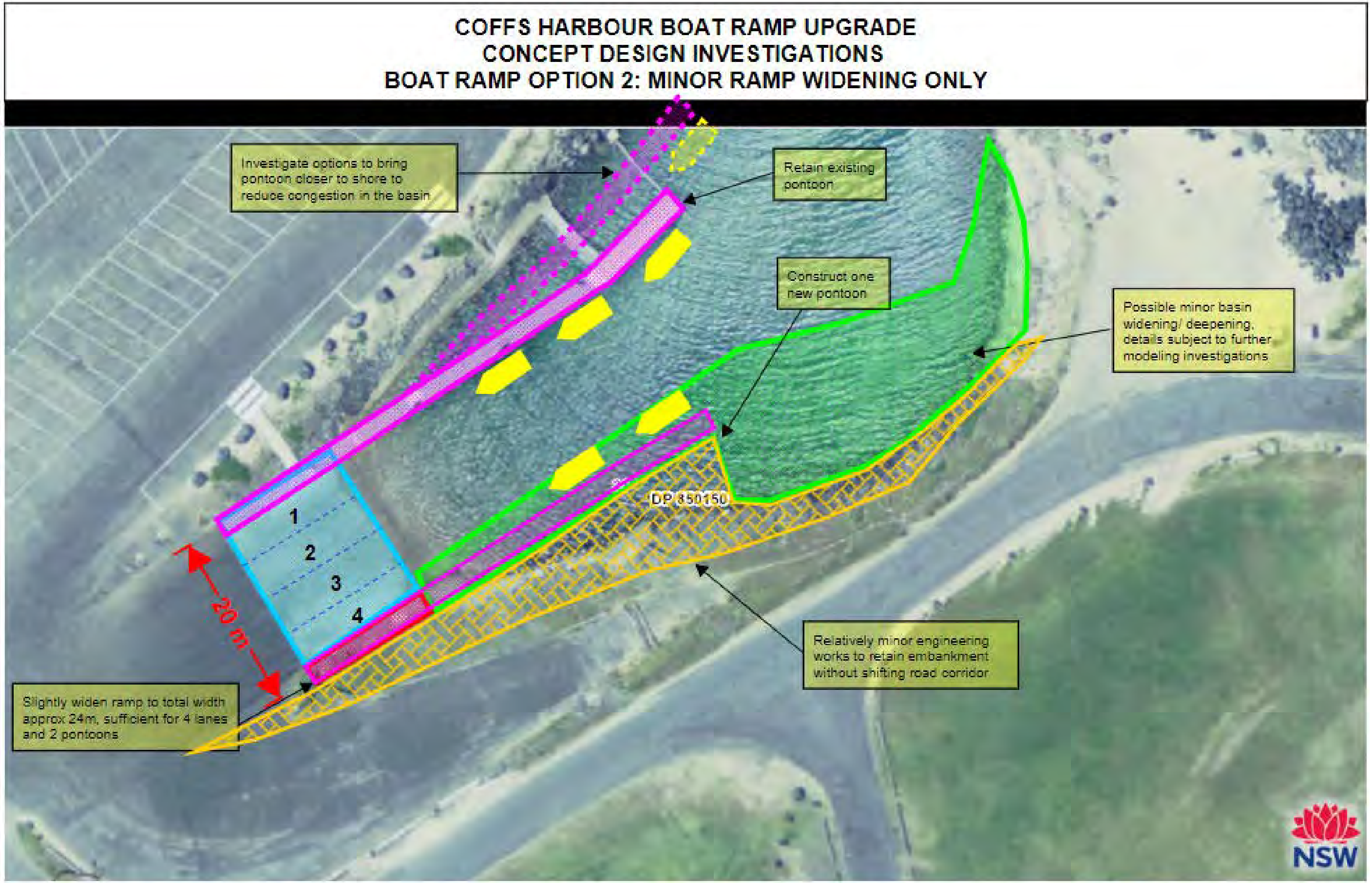
Relatively minor engineering works to retain embankment adjacent to widened ramp

Do not need to divert roadway to accommodate expected extent of basin widening and bank stabilisation

COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
BOAT RAMP OPTION 1: 6 LANES, 3 PONTOONS (CHRBRPEC PROPOSAL)

Coffs Harbour Boatramp Upgrade - Boat Ramp Option 2

- 4 Ramp Lanes
- 2 Pontoons adjacent to shore
- Not supported by community stakeholders
- Not considered further



COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
BOAT RAMP OPTION 2: MINOR RAMP WIDENING ONLY

Investigate options to bring pontoon closer to shore to reduce congestion in the basin

Retain existing pontoon

Construct one new pontoon

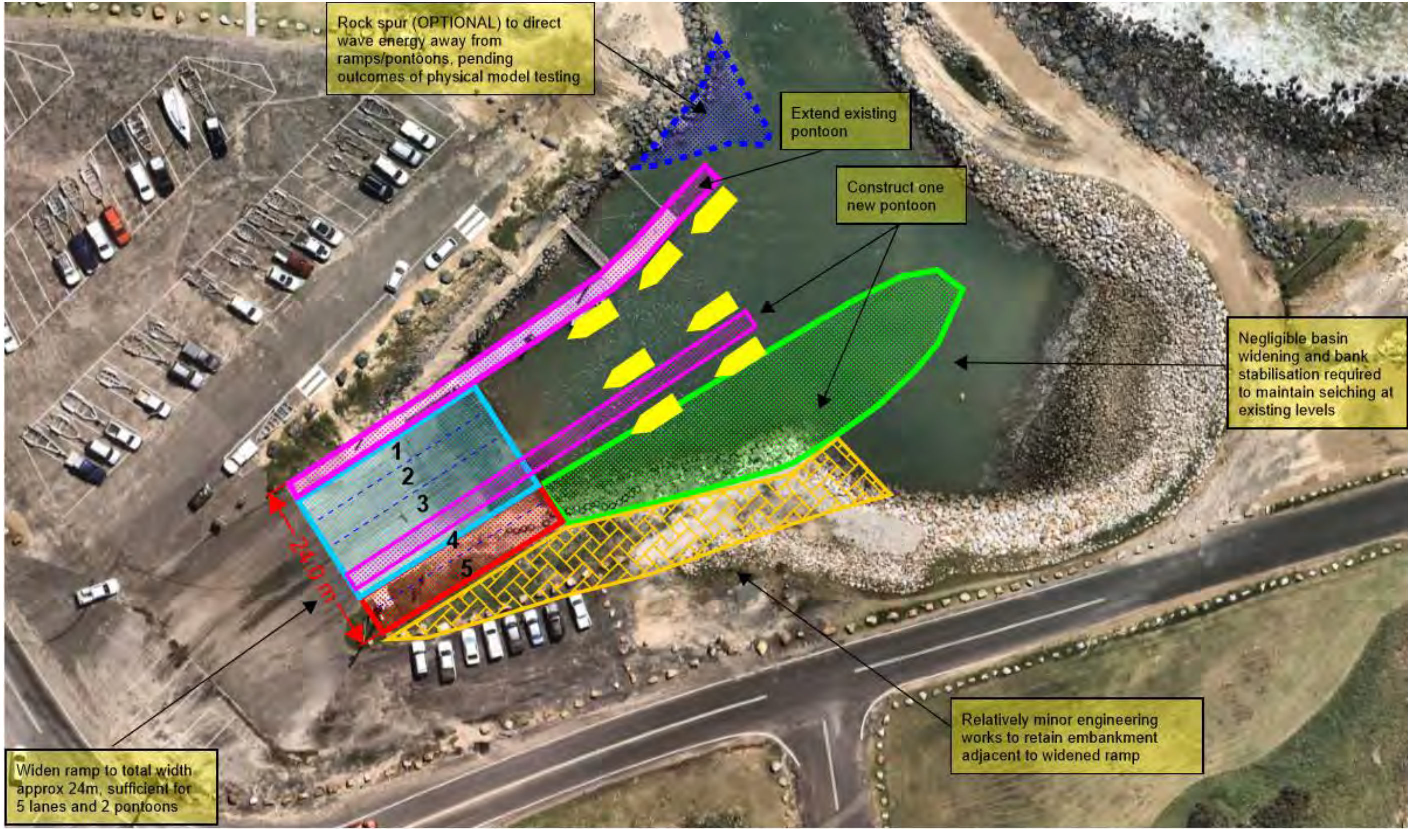
Possible minor basin widening/ deepening, details subject to further modeling investigations

Relatively minor engineering works to retain embankment without shifting road corridor

Slightly widen ramp to total width approx 24m, sufficient for 4 lanes and 2 pontoons

Coffs Harbour Boatramp Upgrade - Boat Ramp Option 3

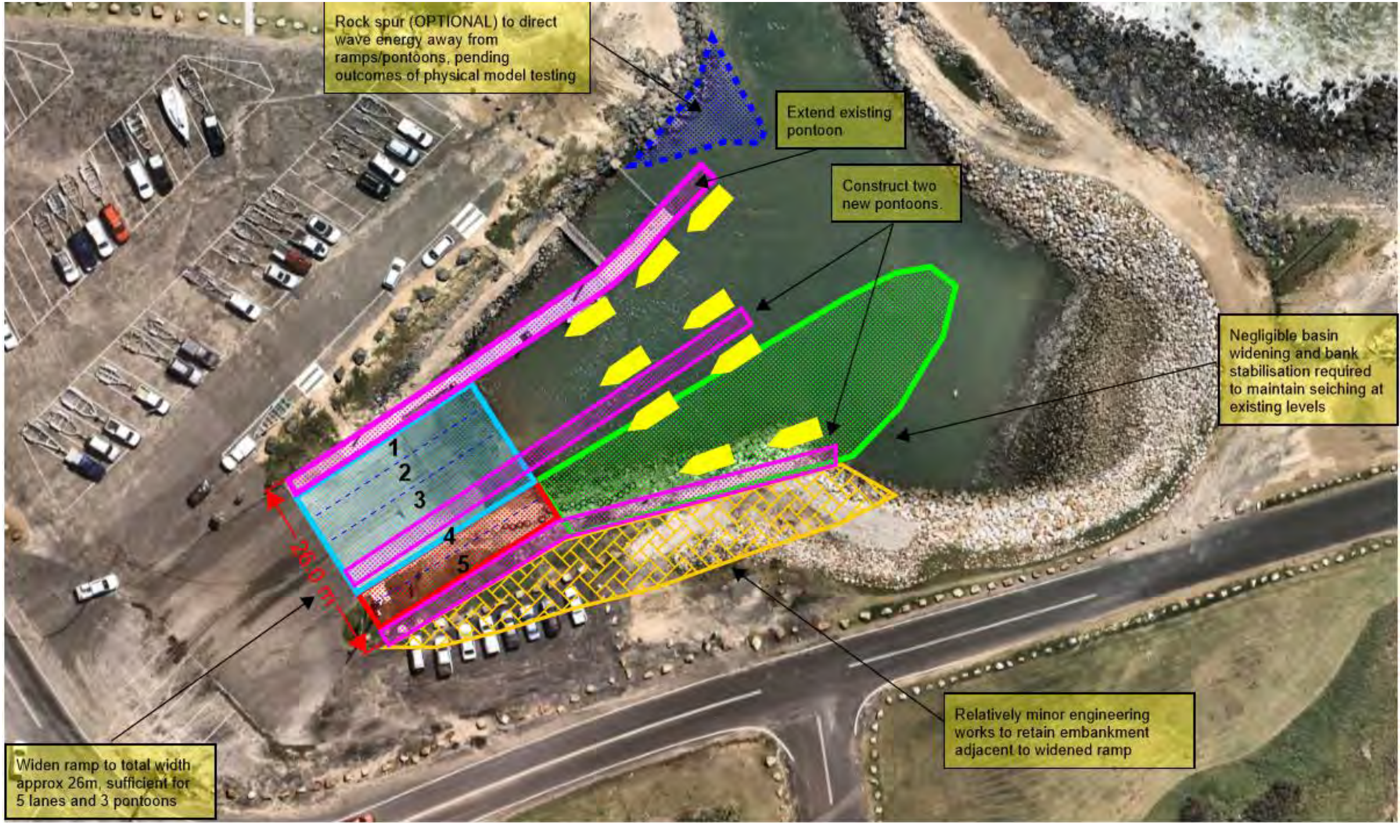
- 5 Ramp Lanes
- 2 Pontoons



COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
BOAT RAMP OPTION 3: FIVE LANES, TWO PONTOONS

Coffs Harbour Boatramp Upgrade - Boat Ramp Option 4

- 5 Ramp Lanes
- 3 Pontoons



COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
BOAT RAMP OPTION 4: FIVE LANES, THREE PONTOONS

Coffs Harbour Boatramp Upgrade – Masterplan Option 1

- Jordan Esplanade Diversion (West)
- Major Carpark Upgrades
- Major retaining wall required
- Encroachment towards former Fishing Club site

COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
MASTERPLAN OPTION 1: MAJOR CARPARK UPGRADE + ROAD DIVERSION (WEST)

Coffs Harbour Boatramp Upgrade – Masterplan Option 2

- No Road Diversion
- Major Carpark Upgrades

COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
MASTERPLAN OPTION 2: CARPARK UPGRADE, NO ROAD DIVERSION

Coffs Harbour Boatramp Upgrade – Masterplan Option 3

- Jordan Esplanade Diversion (East)
- Major Carpark Upgrades

COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
MASTERPLAN OPTION 3: CARPARK UPGRADE (WEST), NEW CARPARK (EAST), ROAD DIVERSION (EAST)

Coffs Harbour Boatramp Upgrade – Masterplan Option 4

- Jordan Esplanade Diversion (central region, avoiding high scarps)
- Major Carpark Upgrades

COFFS HARBOUR BOAT RAMP UPGRADE
CONCEPT DESIGN INVESTIGATIONS
MASTERPLAN OPTION 4: CARPARK UPGRADE (WEST), NEW CARPARK (EAST), ROAD DIVERSION (CENTRAL/EAST)

Coffs Harbour Boatramp Upgrade – Design Options

- The final concept design options are summarised below:

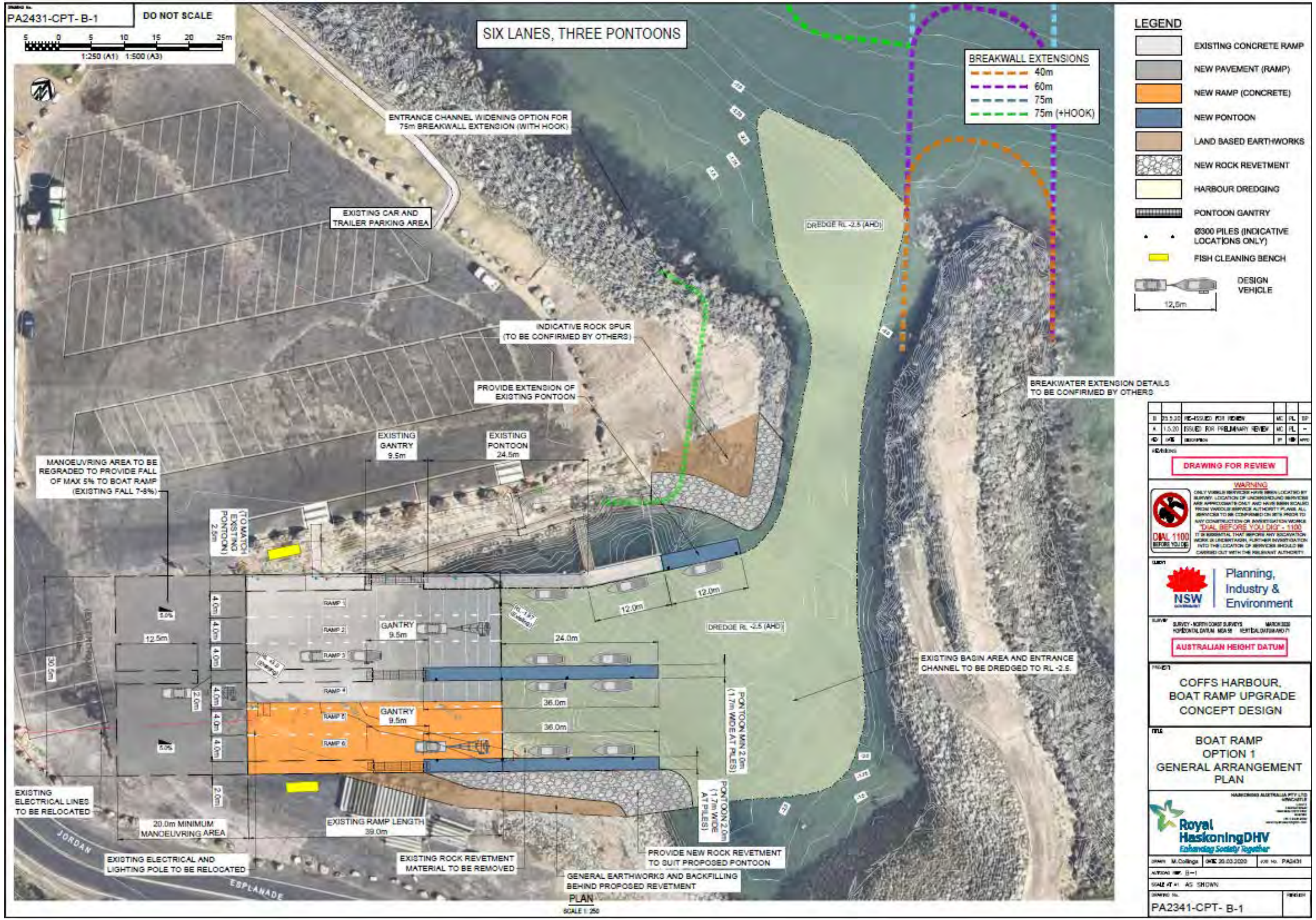
Selected Concept Design Options	Preliminary Boating Option	Preliminary Masterplan Option
Option 1a	Boat Ramp Option 1 (6 lane, 3 pontoons)	MP Option 4 (Road Diversion)
Option 1b		MP Option 2 (No Road Diversion)
Option 2a	Boat Ramp Option 4 (5 lanes, 3 pontoons)	MP Option 4 (Road Diversion)
Option 2b		MP Option 2 (No Road Diversion)
Option 3a	Boat Ramp Option 3 (5 lanes, 2 pontoons)	MP Option 4 (Road Diversion)
Option 3b		MP Option 2 (No Road Diversion)

Current Options – Option 1a - Ramp

- 6 Lanes
- 3 Pontoons

Common:

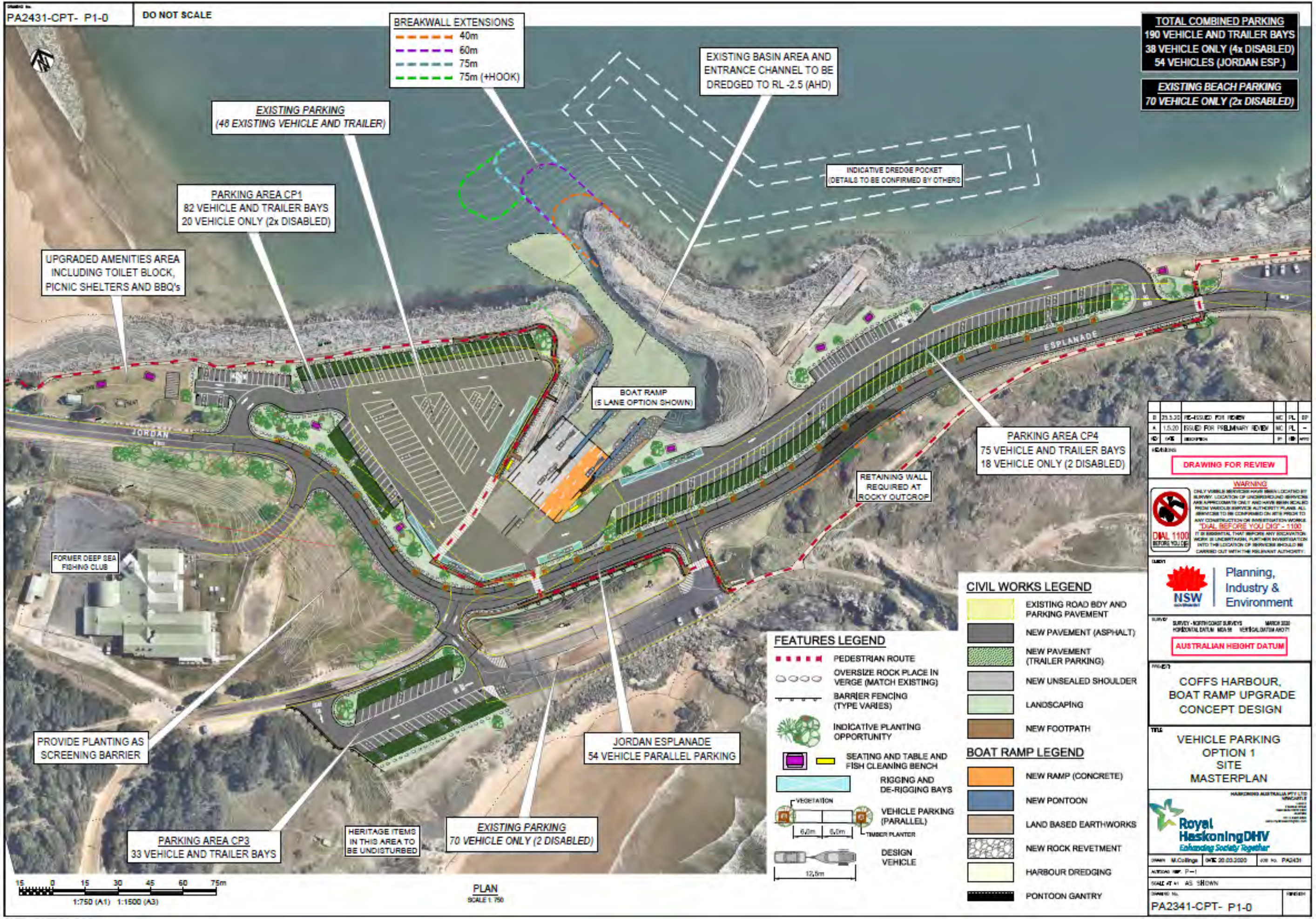
- Rock Spur
- Dredging
- Breakwater Extension



Current Options – Option 1a – Road and Carpark

- Significant Road Diversions
- 1 Large carpark
- Overflow carpark to South and East

- 190 car/trailer spaces (48 currently)
- 38 Additional Offline car only spaces
- 54 Car-Only Spaces (Jordan Esplanade)

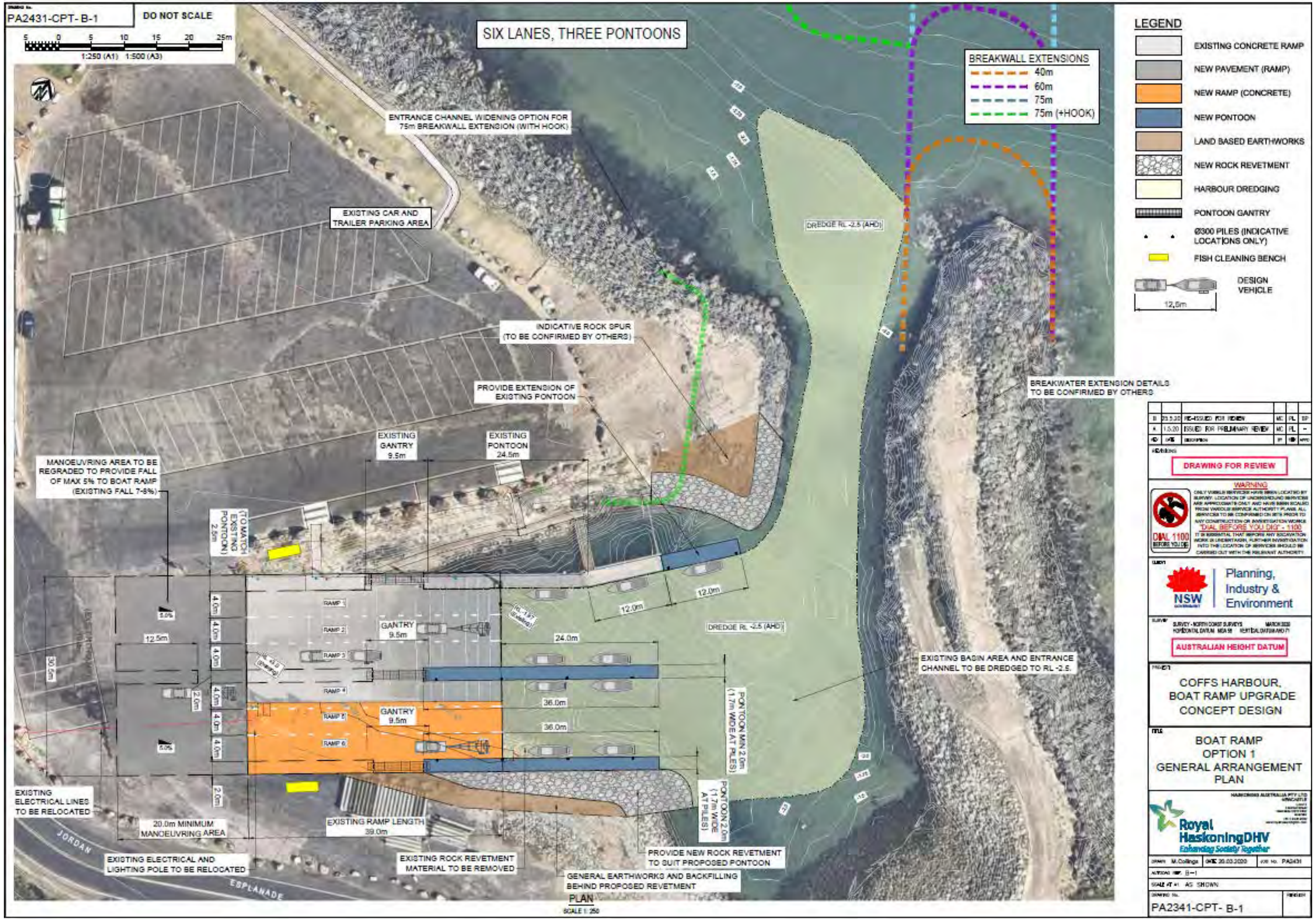


Current Options – Option 1b – Boat ramp as per 1a

- As per Option 1a

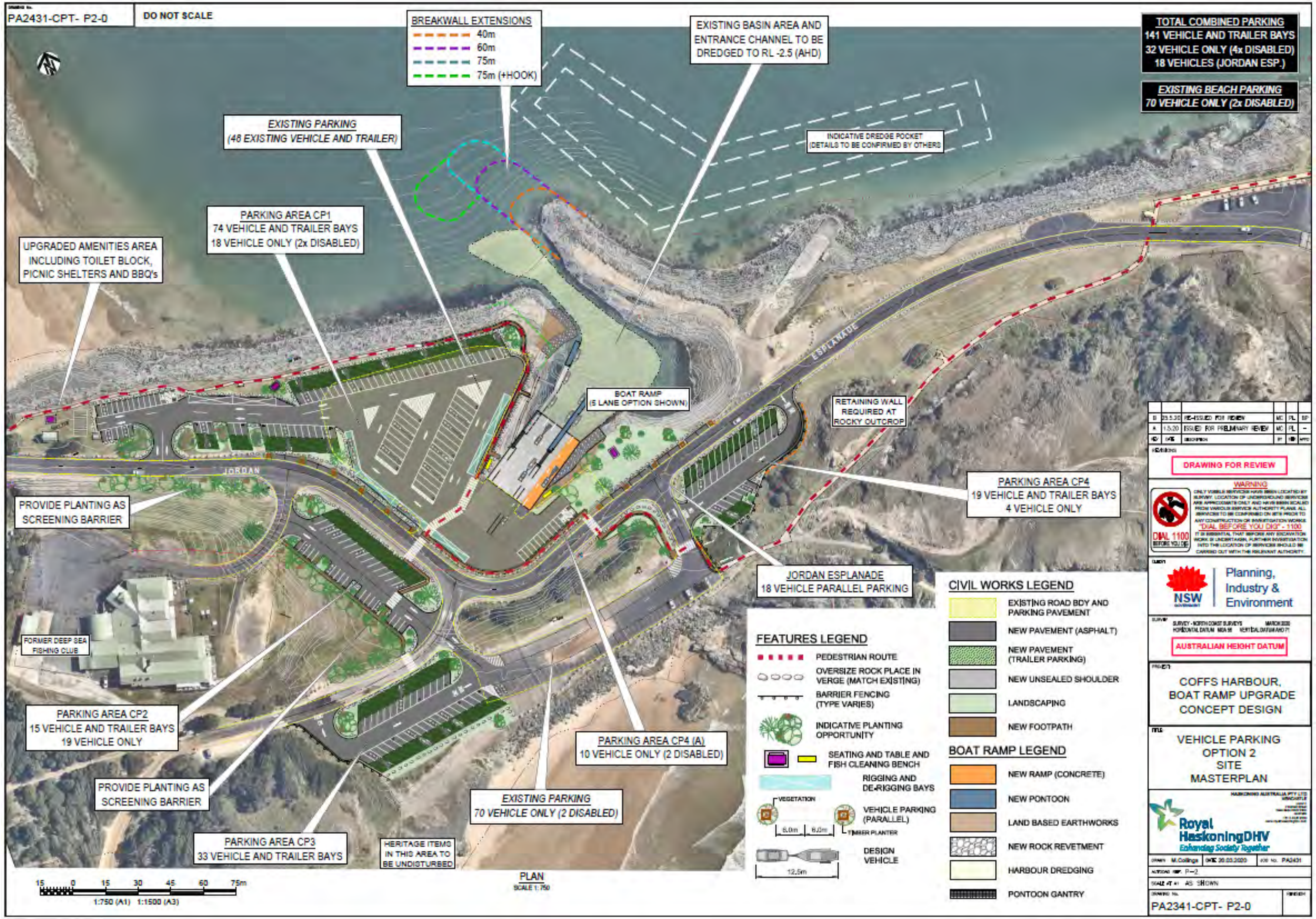
- 6 Lanes
- 3 Pontoons

Common:
- Rock Spur
- Dredging
- Breakwater Extension



Current Options – Option 1b – Road and Carpark

- No Road Diversions
- 1 Large carpark
- Overflow carparks to South and East
- 141 car/trailer spaces (48 currently)

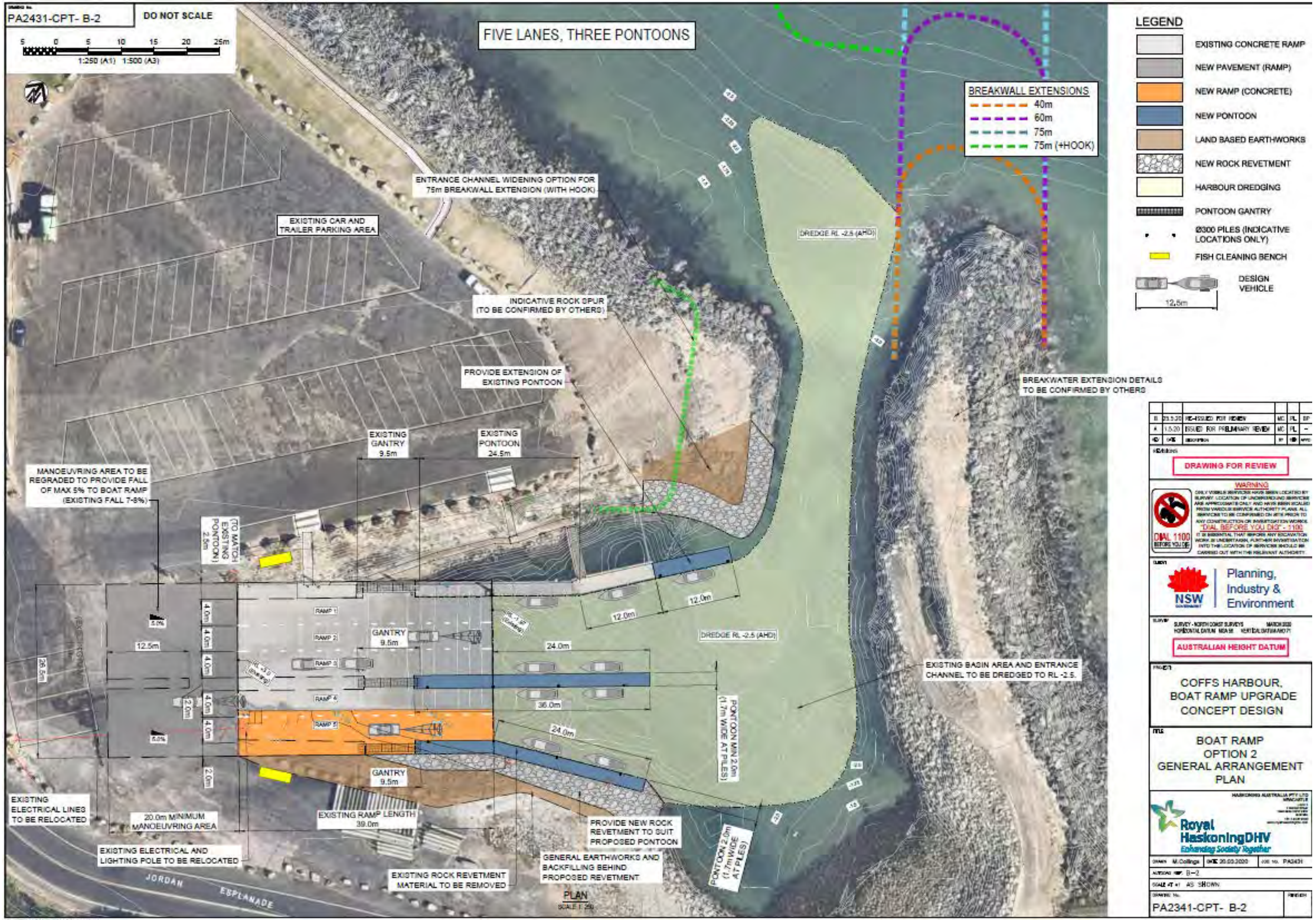


Current Options – Option 2a – Boat ramp

- 5 Lanes
- 3 Pontoons

Common:

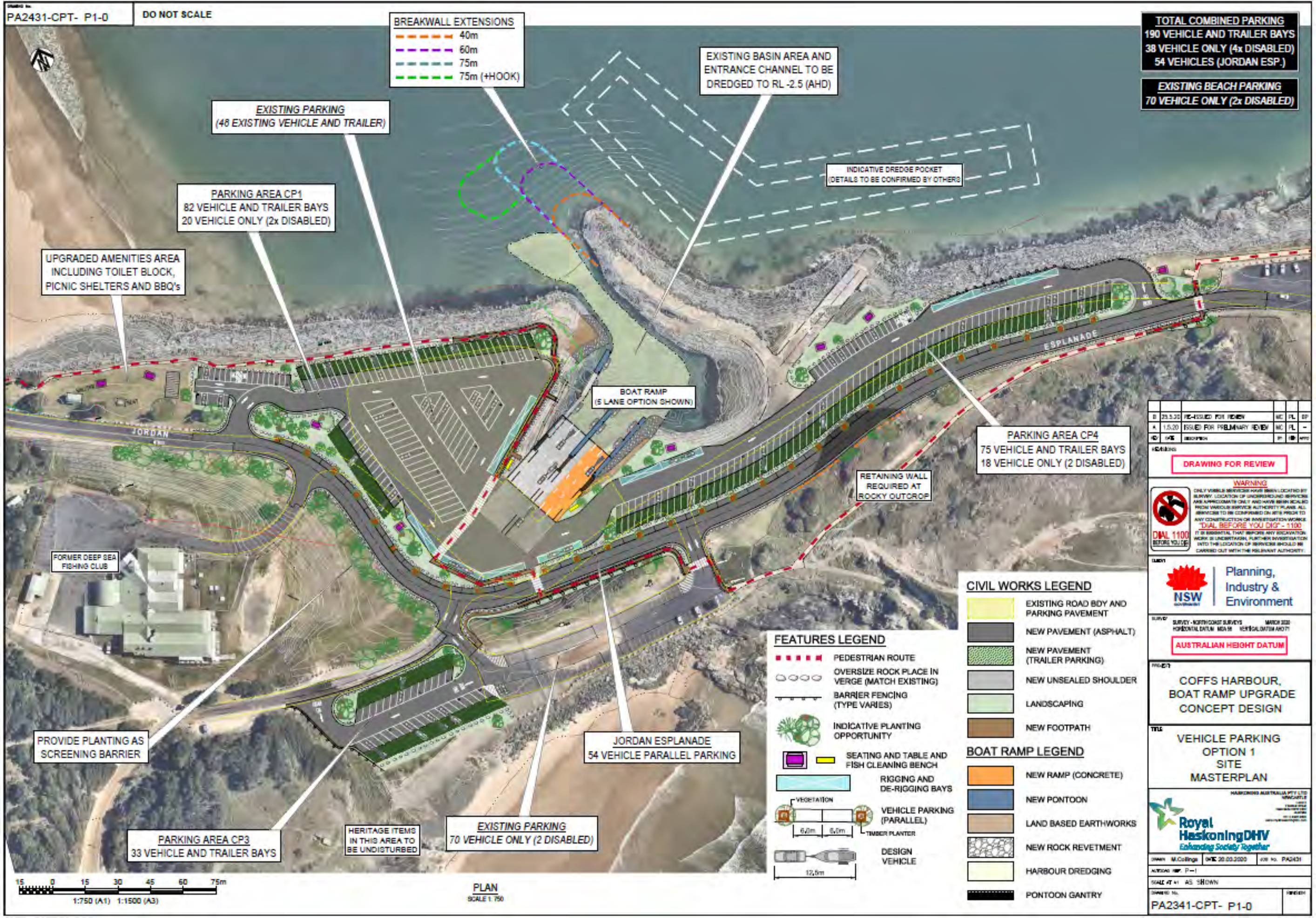
- Rock Spur
- Dredging
- Breakwater Extension



Current Options – Option 2a – Road and Carpark

- As per Option 1a

- Significant Road Diversions
- 1 Large carpark
- Overflow carpark to South and East
- 190 car/trailer spaces (48 currently)



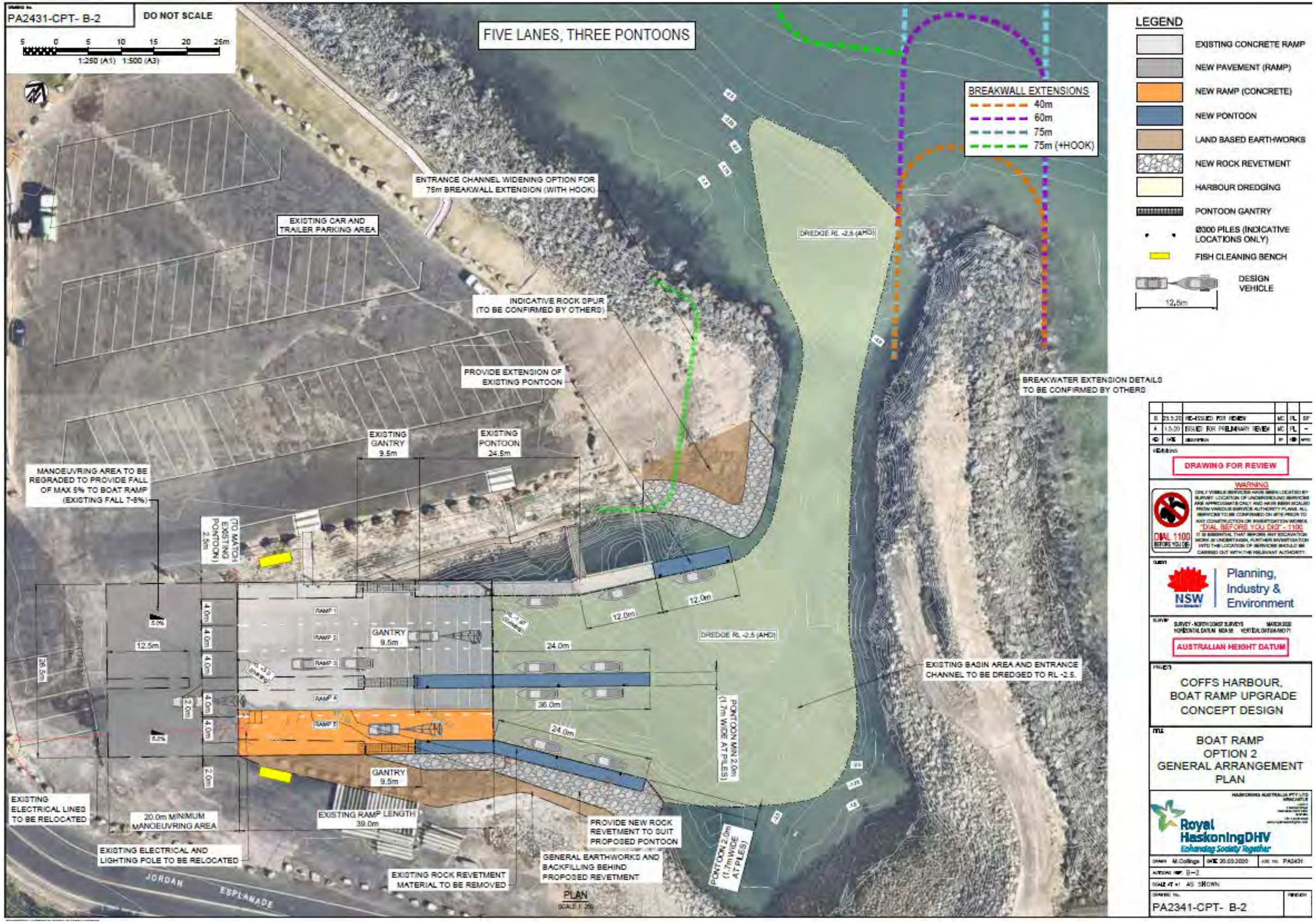
Current Options – Option 2b – Boat ramp – as per 2a

- Ramp as per 2a

- 5 Lanes
- 3 Pontoons

Common:

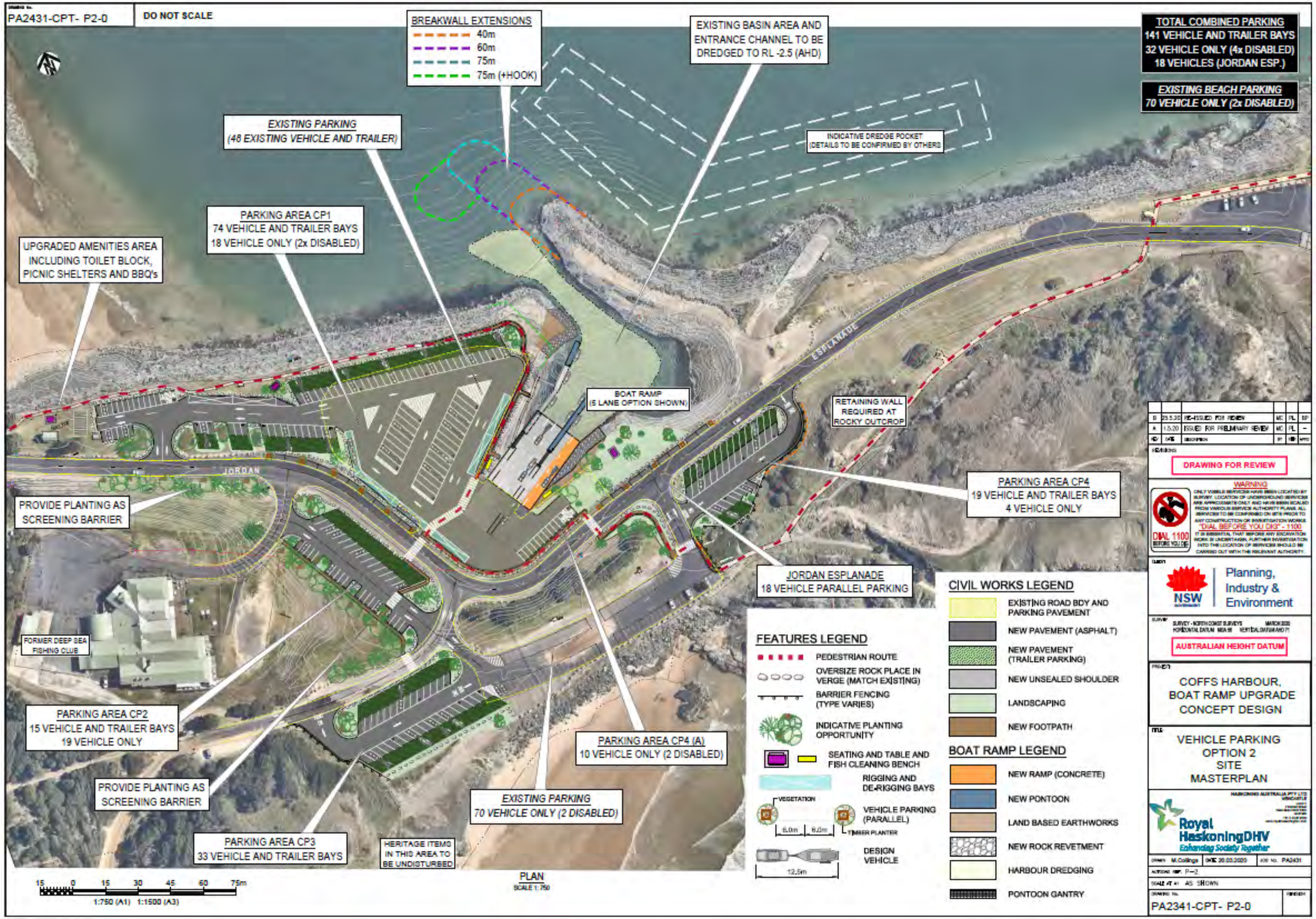
- Rock Spur
- Dredging
- Breakwater Extension



Current Options – Option 2b – Road and Carpark

- As per 1b

- <u>No</u> Road Diversions
- 1 Large carpark
- Overflow carpark to South and East
- 141 car/trailer spaces (48 currently)

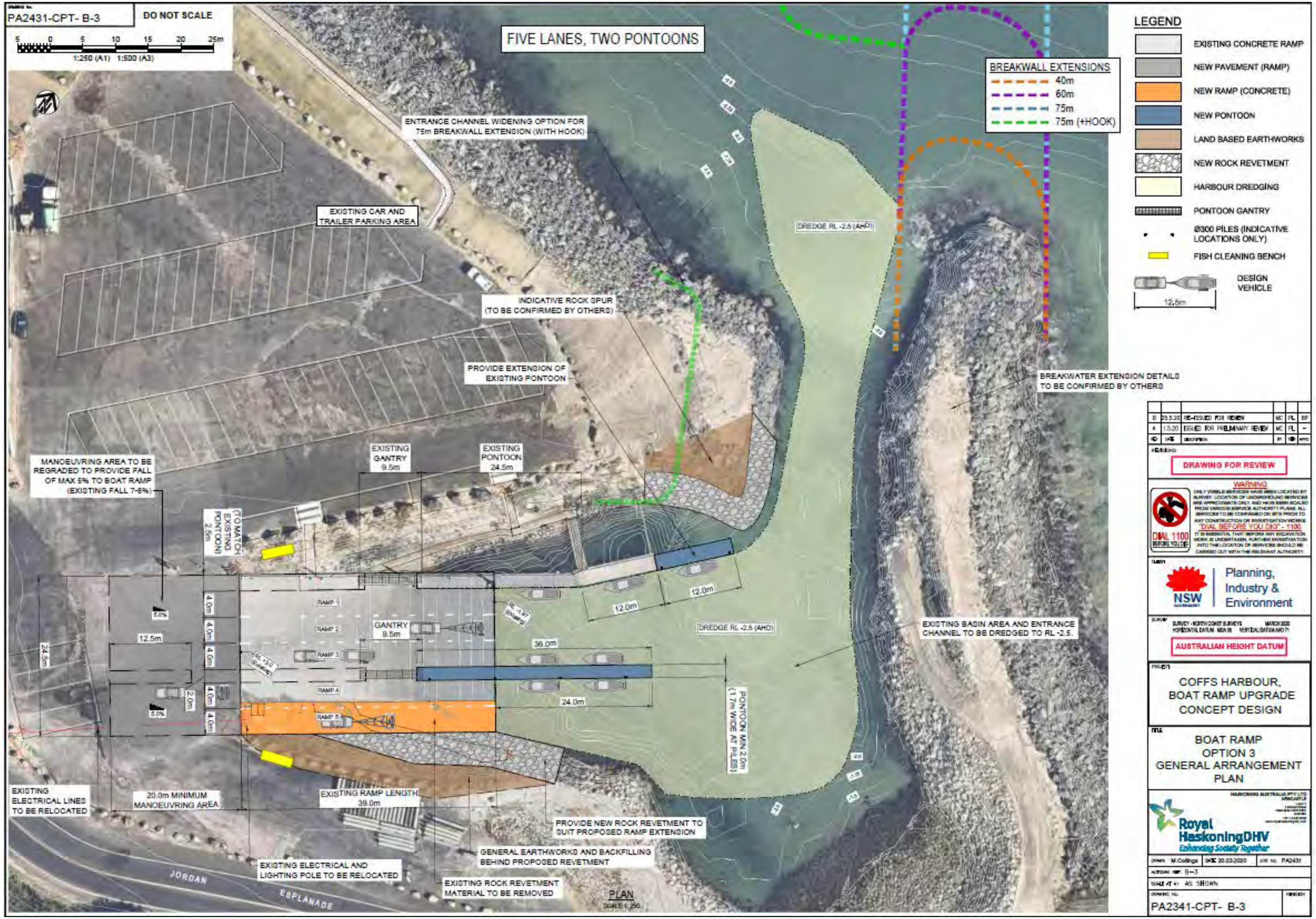


Current Options – Option 3a – Boat ramp

- 5 Lanes
- 2 Pontoons

Common:

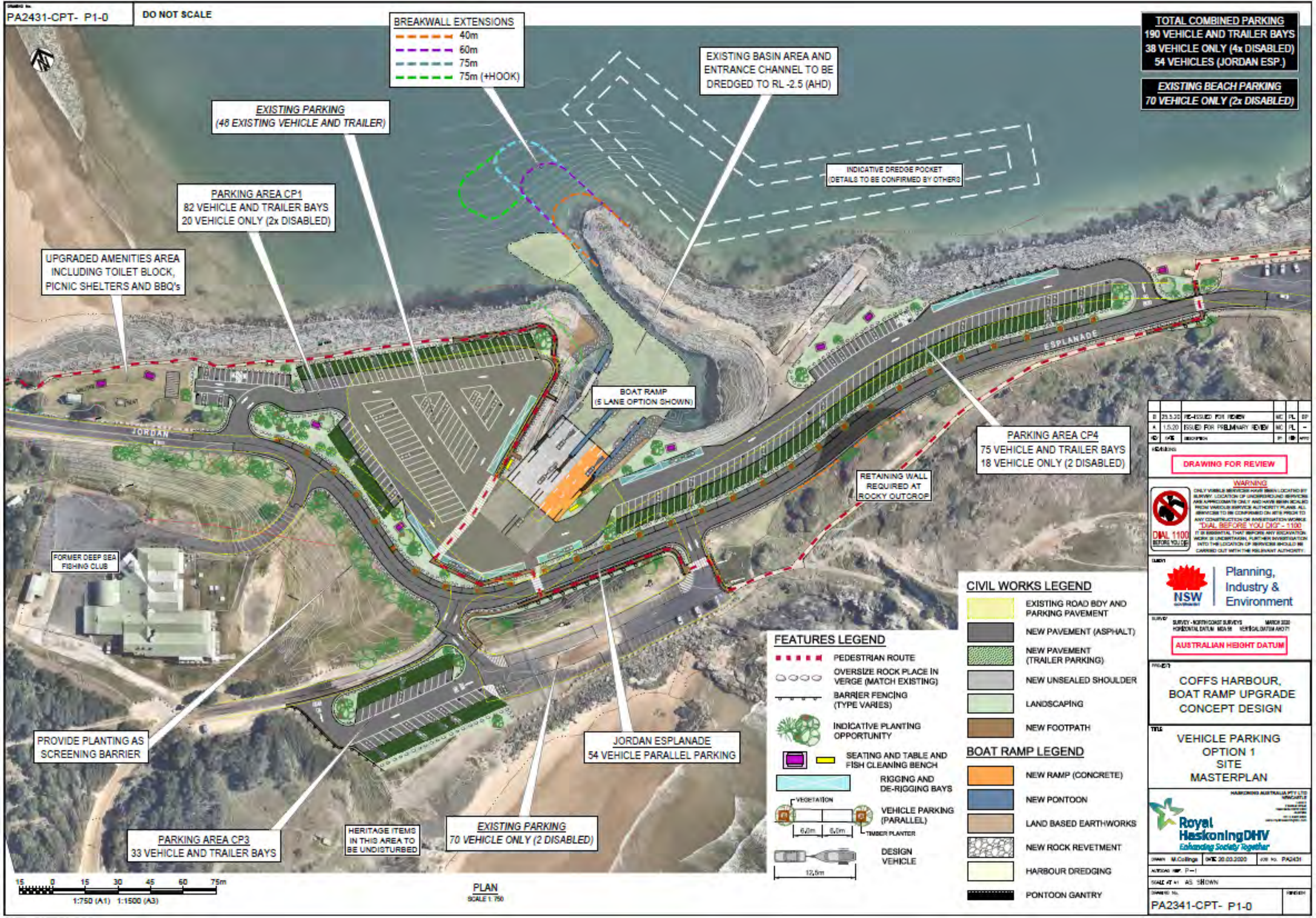
- Rock Spur
- Dredging
- Breakwater Extension



Current Options – Option 3a – Road and Carpark

- As per Option 1a and 2a

- Significant Road Diversions
- 1 Large carpark
- Overflow carpark to South and East
- 190 car/trailer spaces (48 currently)

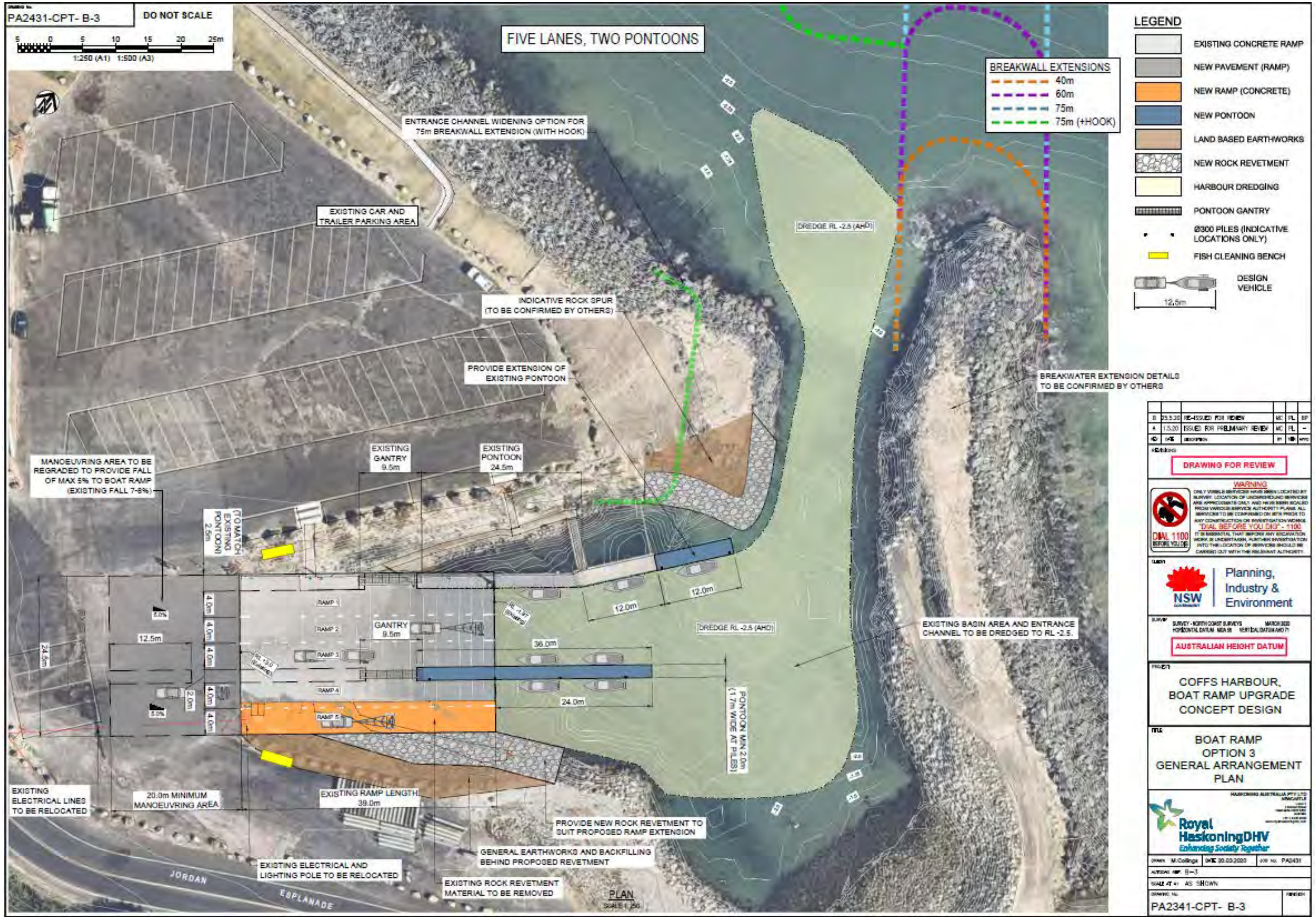


Current Options – Option 3b – Boat ramp – as per 3a

- Ramp as per 3a

- 5 Lanes
- 2 Pontoons

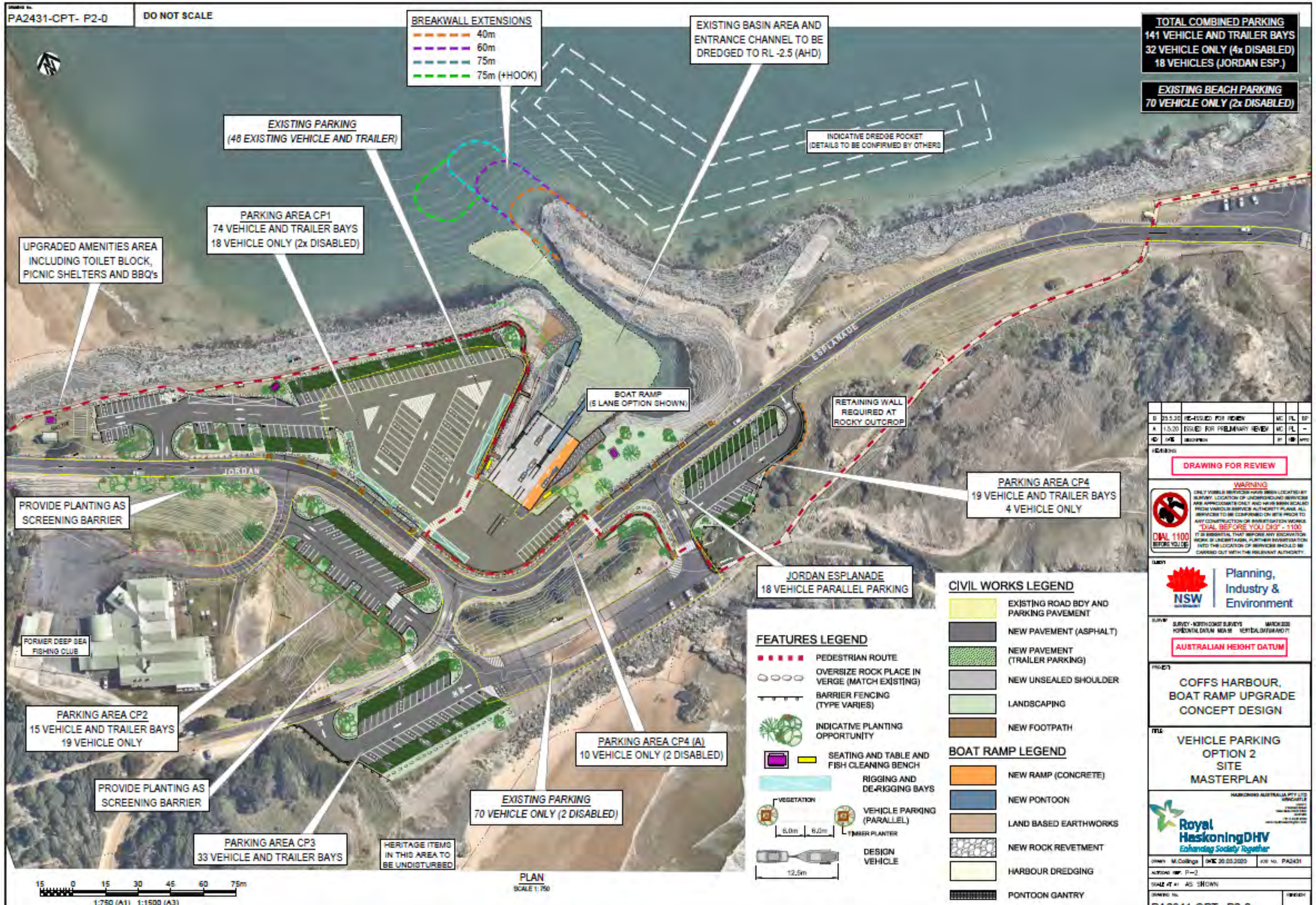
Common:
- Rock Spur
- Dredging
- Breakwater Extension



Current Options – Option 3b – Road and Carpark

- As per 1b and 2b

- <u>No</u> Road Diversions
- 1 Large carpark
- Overflow carpark to South and East
- 141 car/trailer spaces (48 currently)



Current Options – Carparking Numbers per Options

- Comparison of Carparking Numbers against NSW Boat Ramp Guidelines (NSWBRG) and a Lower bound criteria set by RHDHV

- Lower Bound criteria set at:
  - 35 spaces per Lane (3 pontoons)
  - 30 spaces per lane (2 pontoons)
  - 25 spaces per lane (1 pontoon)

- Upper Bound criteria set at 50 spaces per Lane

	No. of carparking spaces				
Option	**Available Carparking Spaces**	**Required @ 25 to 35 No. Per Lane (RHDHV)**	**Required @ 50 No. Per Lane (NSWBRG)**	**Ratio agianst Required (RHDHV)**	**Ratio against Required (NSWBRG)**
1a	190	210	300	0.90	0.63
1b	141	210	300	0.67	0.47
2a	190	175	250	1.09	0.76
2b	141	175	250	0.81	0.56
3a	190	150	225	1.27	0.84
3b	141	150	225	0.94	0.63
Current	***48***	***100***	***200***	***0.48***	***0.24***

Current Options – Cost Estimates

- Masterplan Options
  - Option 1 (Road Diversion) – $5.5 million
  - Option 2 (without road diversion) - $3.1 million
- Boating Options:
  - Option 1 - $1.8 million
  - Option 2 - $1.7 million
  - Option 3 - $1.3 million
- Breakwater Extension:
  - 75m option - $3.6 million
  - 60m option - $2.9 million
  - 40m option - $1.9 million
- Berth Pocket Dredging:
  - 17,000m^3 dredge volume
  - $1 million (approx.)

Assumes 75m breakwater extension, $1 million for berth pocket dredging

Option	Boating Option	Masterplan Option	Cost Estimate (ex GST)
1a	6 lanes, 3 pontoons	Road Diversion	$11,900,000
1b		No Road Diversion	$9,500,000
2a	5 lanes, 3 pontoons	Road Diversion	$11,800,000
2b		No Road Diversion	$9,300,000
3a	5 lanes, 2 pontoons	Road Diversion	$11,400,000
3b		No Road Diversion	$8,900,000

Note:
1.The cost estimates are at 'concept level' only, which is typically associated with accuracy of +/-40%.
2. The cost estimates do not currently include project management and contingency allowances.

Current Options – Prelim. Multi-Criteria Assessment (MCA)

- 8 Weighted Criteria
- Cost weighted highest (40%) – weightings relative to $10m budget
- Scored by Project Team only at this stage
- Highest scores: Option 2b (3.20) and Option 1b (3.17) – almost identical
- Option 1b preferred by CHRBRPEC
- **<u>Preferred: Option 1b – 6 lanes, 3 pontoons, no road diversion</u>**

Criteria		Option 1a		Option 1b		Option 2a		Option 2b		Option 3a		Option 3b	
	Weight	**Score**	**Weighted score**	**Score**	**Weighted score**	**Score**	**Weighted score**	**Score**	**Weighted score**	**Score**	**Weighted score**	**Score**	**Weighted score**
A - Environment / Heritage	5%	2.0	0.10	2.5	0.13	2.0	0.10	2.5	0.13	2.0	0.10	2.5	0.13
B - Safety (Navigation) - related to number of ramps/pontoons	15%	5.0	0.75	5.0	0.75	4.0	0.60	4.0	0.60	2.0	0.30	2.0	0.30
C - Safety (Road)	10%	4.5	0.45	2.0	0.20	4.5	0.45	2.0	0.20	4.5	0.45	2.0	0.20
D - Cost	40%	1.1	0.43	3.5	1.41	1.2	0.49	3.7	1.47	1.6	0.65	4.1	1.64
		$11,900,000		*$9,500,000*		*$11,800,000*		*$9,300,000*		*$11,400,000*		*$8,900,000*	
E - Land Tenure / Impact on Adjacent Properties	10%	1.0	0.10	3.0	0.30	1.0	0.10	3.0	0.30	1.0	0.10	3.0	0.30
F - Functionality (landside 1) related to carparking numbers only	5%	2.5	0.13	1.6	0.08	3.4	0.17	2.0	0.10	4.3	0.22	2.7	0.14
G - Functionality (landside 2) related to manoeuvreing, rigging, access/intersections (not carparking)	5%	4.0	0.20	2.0	0.10	4.0	0.20	2.0	0.10	4.0	0.20	2.0	0.10
H - Functionality (maritime) including berthing, vessel manoeuvreing, vessel waiting times in basin	10%	4.0	0.40	2.0	0.20	4.0	0.40	3.0	0.30	3.5	0.35	2.5	0.25
Others? Constructability?													
Total Weighted Score	**100%**	**Option 1a**	**2.55**	**Option 1b**	**3.17**	**Option 2a**	**2.51**	**Option 2b**	**3.20**	**Option 3a**	**2.37**	**Option 3b**	**3.05**
Score		2.55		3.17		2.51		3.20		2.37		3.05	
Rank		4		2		5		1		6		3	

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Preferred Option - Option 1b – Boat ramp

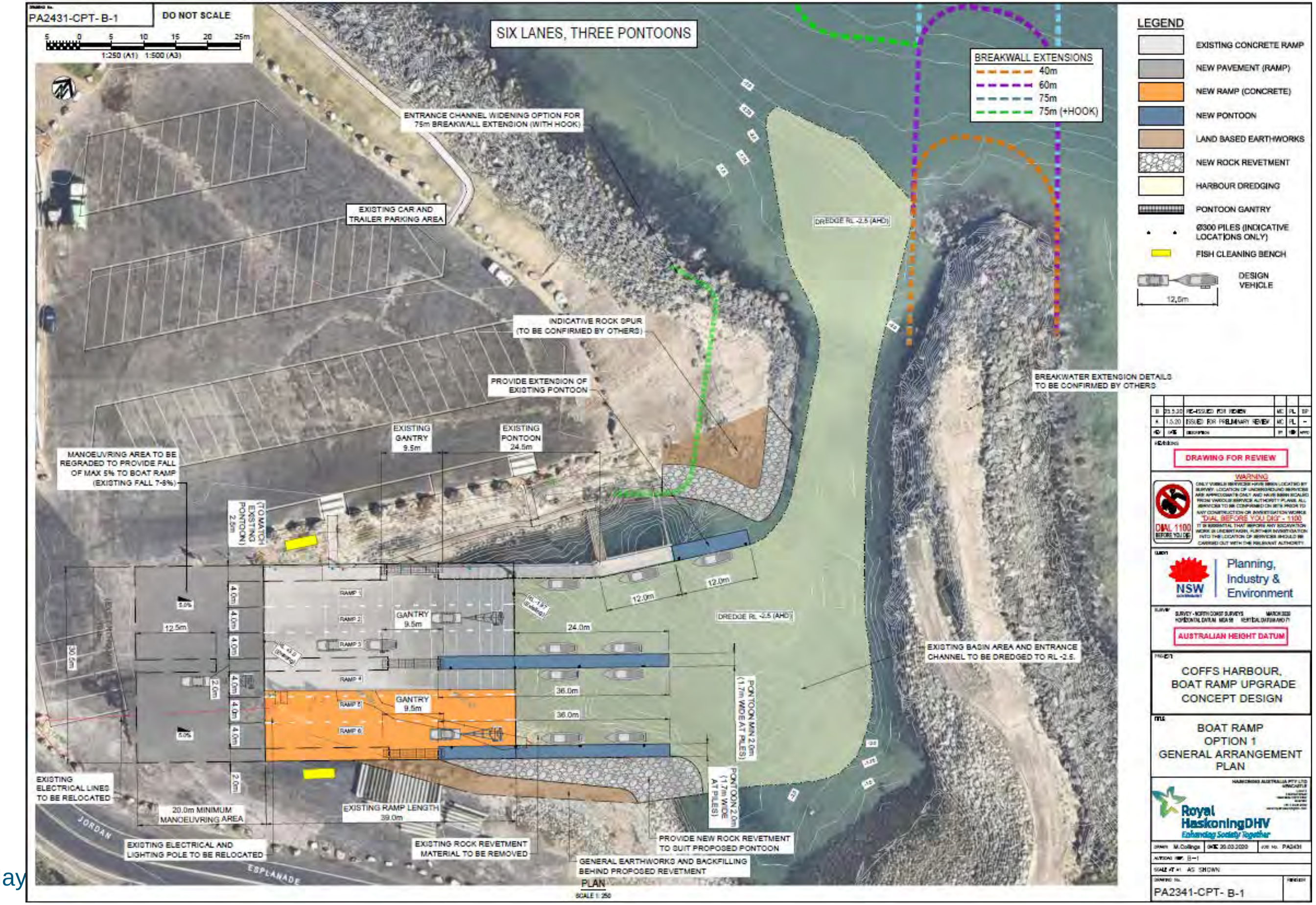
- **Preferred:**

- 6 Lanes
- 3 Pontoons

Common:

- Rock Spur
- Dredging
- Breakwater Extension (length TBC)

- Satisfies a key criterion of CHRBRPEC in maximising the treatment of congestion in the inner basin and significantly improving capacity to safely launch and retrieve vessels



Specific Q & A

- **KEY POINTS that the CHRBRPEC has agreed internally:**
- We support the assessment of the breakwater extension and believe its length should be 75 metres noting further technical testing information from MHL is required. (page 12).
- RHDHV would comment that it is understood that the Committee’s preference is for 75m, but there are a number of factors that need to be considered (including effect on sediment transport, benefits for Seiching etc) that still need to be confirmed
- We support Boat Ramp Option 1 (Page 14) which satisfies a key criterion of CHRBRPEC in maximising the treatment of congestion in the inner basin and significantly improving capacity to safely launch and retrieve vessels.
- I think RHDHV could support Option 1b, subject to final Costings
- We support Masterplan Option 2 (Page 19). A key element is that it does not require any road diversions as seen in the other options. Road diversions were not funded in CHRBRPEC’s enhancements and whilst some may have considerable merit, if there was an unlimited budget, it cannot be justified in the current budgetary environment. Separate work on the realignment of Jordan Esplanade may be achieved with the much broader Jetty Foreshore development.
- Agreed
- We support the concept design option 1b (page 22) noting that it does not fully meet the NSWBRG guidelines on car parking numbers but nonetheless provides for a significant increase in capacity from the current state.
- Agreed
- We note option 1b is within the budget envelope as known at this point. (page 36).
- Note that the cost estimates are at 'concept level' which is typically associated with accuracy of +/-40%
- We note it is the second preferred option from the preliminary Multi Criteria Assessment but only misses on the number one ranking by .03% (Page 37).
- Noted and Agreed, very little difference at this stage of the design process.

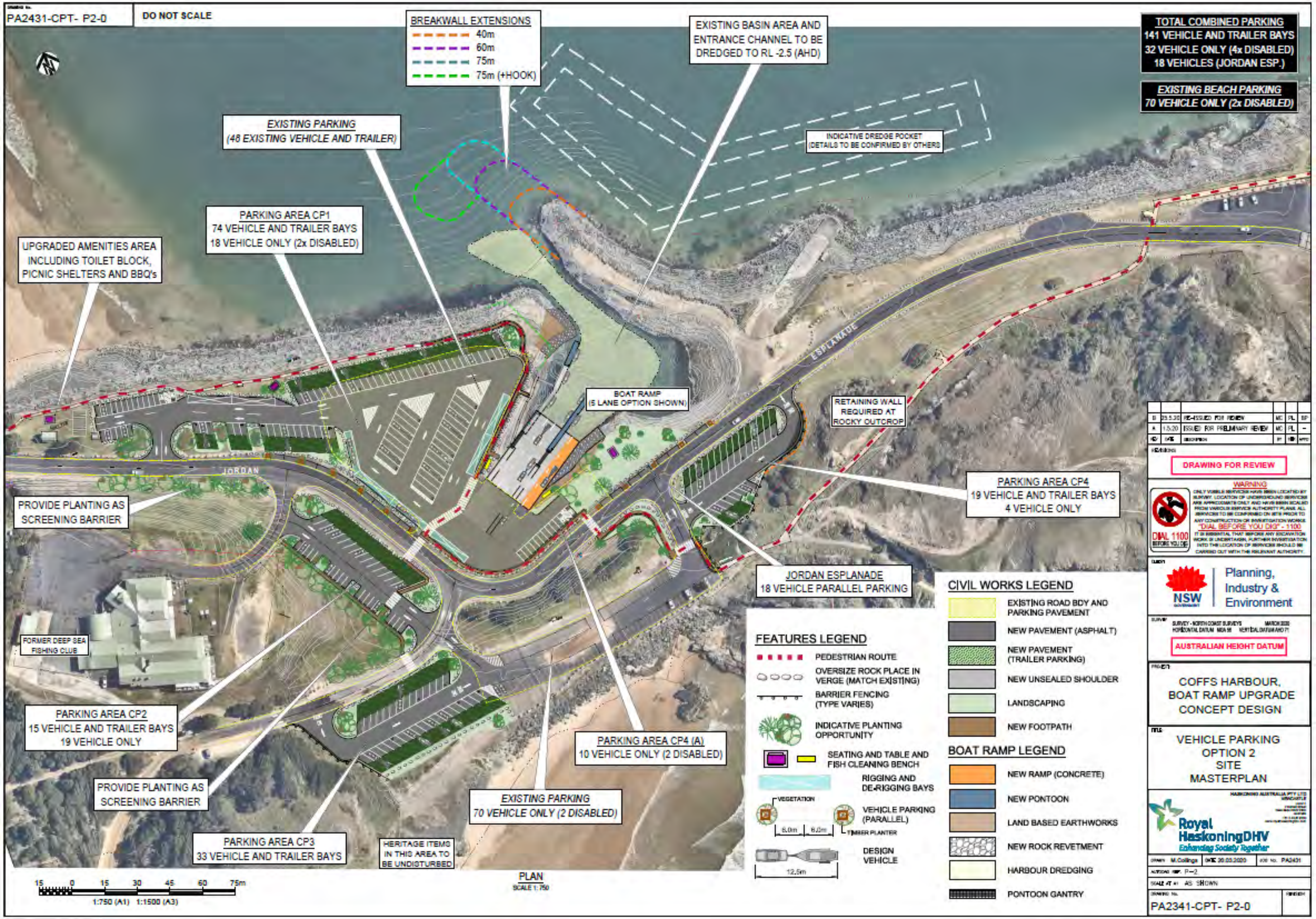
Specific Q & A

- **ADDITIONAL MATTERS: (to be discussed and settled outside of the meeting on 28 May 2020)**
- The route of the walkway needs to be rethought, so as to ensure, the many pedestrians who use the walking track to the south wall, are kept away, for safety reasons, from vehicles using the ramp and carpark, to the fullest extent possible.
- RHDHV have provided alternative examples (see upcoming slide)
- The single-entry point to the ramp and carpark needs to be reconsidered with two entrances proposed one being at the top of the ramp to allow vehicles direct access to leave the ramp precinct, the other at the western end of the carpark.
- RHDHV do not wish to support a second exit at the tight bend in Jordan Esplanade due to safety (site distance) considerations. (see upcoming slide)
- The fish cleaning facilities are not in the right location as currently proposed would cause additional congestion in the immediate area of the ramp and needs to be linked preferably with the wash down facility at the Western end of the carpark.
- Noted. Can the committee suggest if any additional locations are required?
- Consider moving the existing pontoon in hard against the existing wall to maximise the water available to manoeuvre boats in the basin. The cost of such an activity would need to be considered relative to the benefit.
- This could be subject to Geotechnical investigations and bathymetry survey in the area between the pontoon at the foreshore
- Not pursue the additional pontoon segment to the current existing pontoon, if the matter directly above is advanced.
- Noted
- Consider moving the toilet onto the grassed area on the southern side of the basin to make it readily accessible, nearly equidistant to walkers, boaters, and surfers. Noted
- A flow chart of likely car and trailer movements both before and after entering the ramp precinct needs to be re-examined including those wanting to wash down boats to ensure maximum safety, convenience, amenity and efficiency. Noted.
-

Preferred Option – Option 1b – Road and Carpark

- **<u>Preferred:</u>**

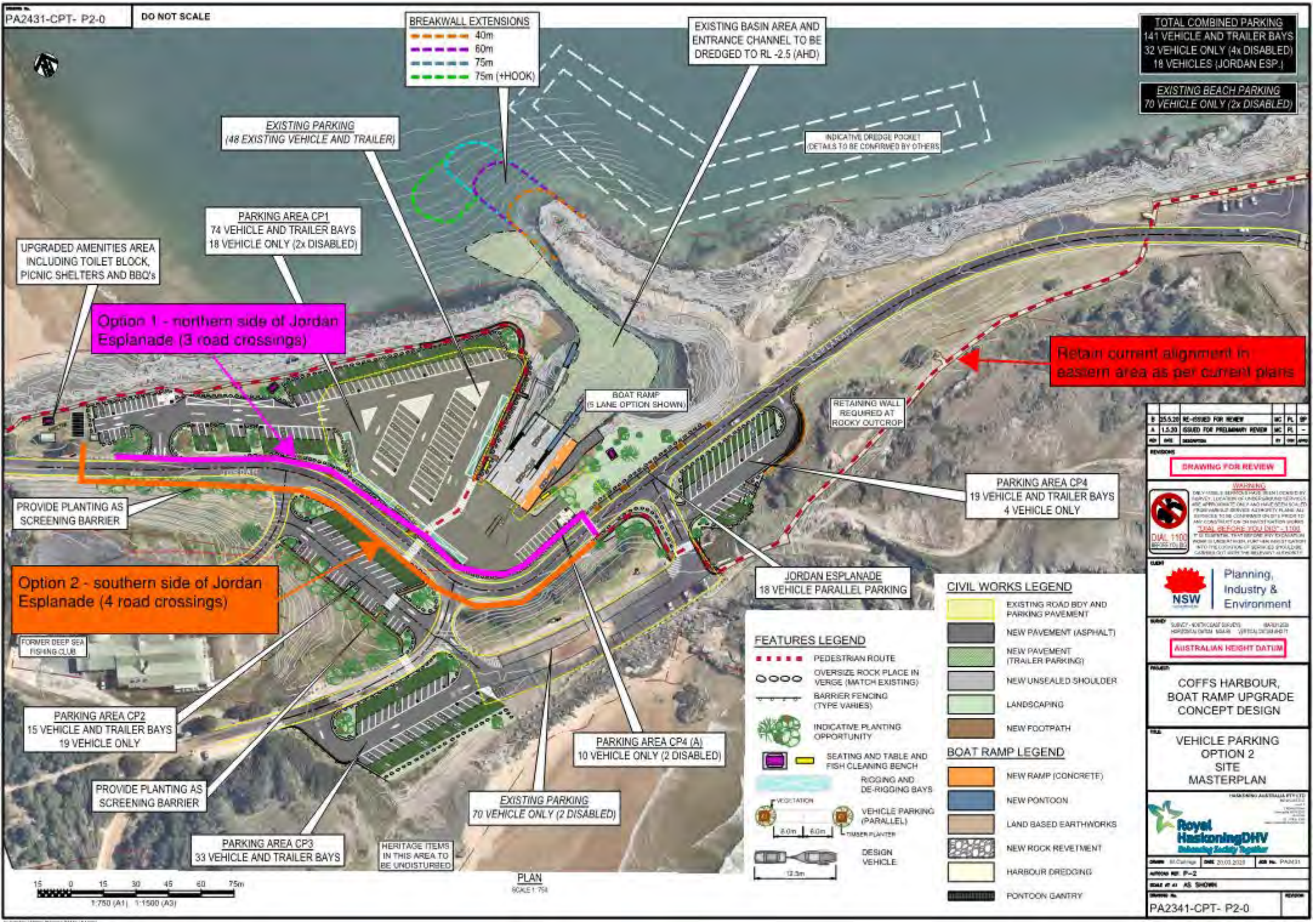
- <u>No</u> Road Diversions
- 1 Large carpark
- Overflow carpark to South and East
- 141 trailer spaces (48 currently)
- **Total cost - $9.5 million**



Pedestrian Access – Alternative Options

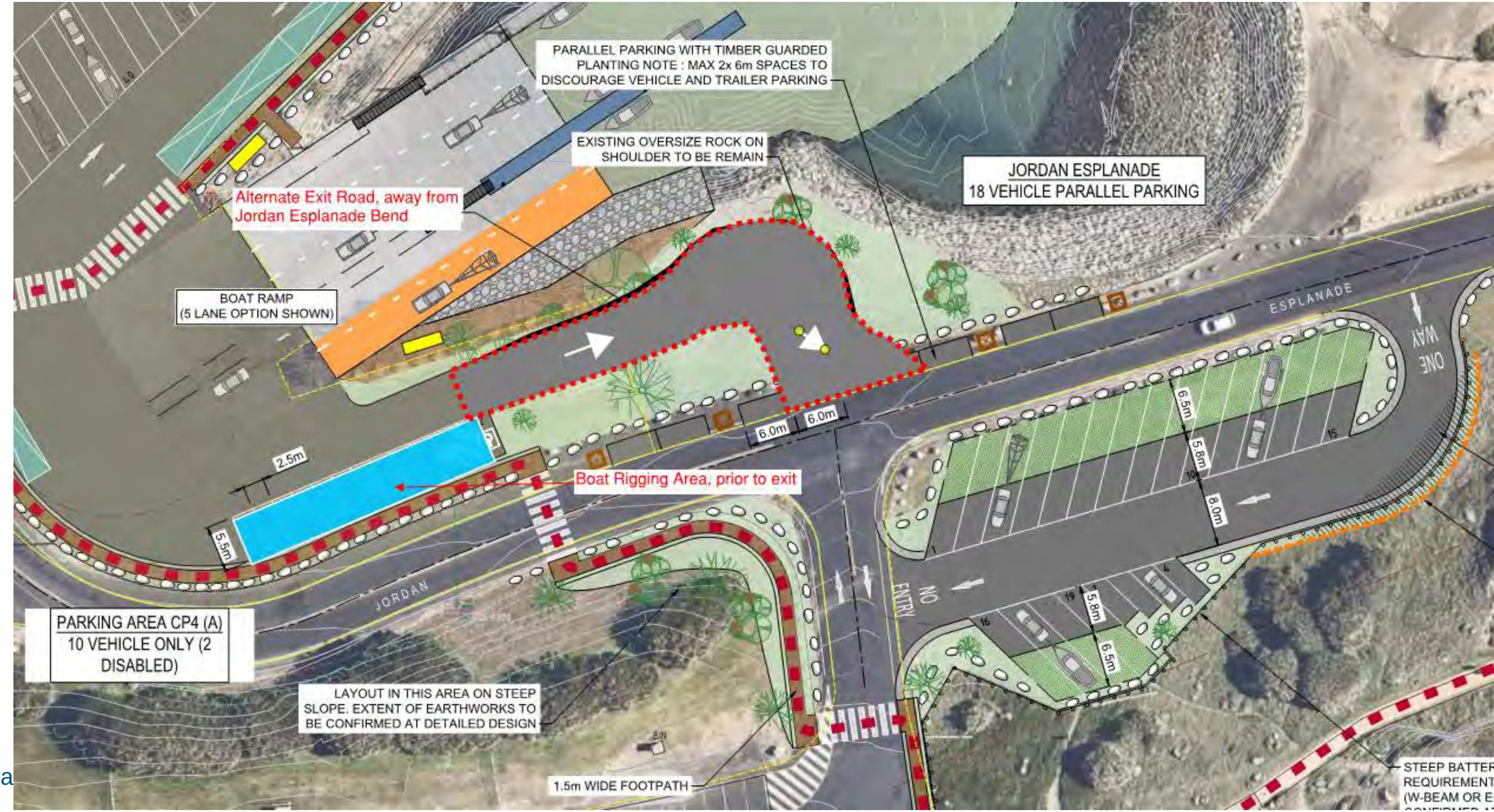
- Recent feedback from CHRBRPEC: *The route of the walkway needs to be rethought, so as to ensure, the many pedestrians who use the walking track to the south wall, are kept away, for safety reasons, from vehicles using the ramp and carpark, to the fullest extent possible.*

- Two options shown for discussion
- Other possibilities



Second Main Carpark Exit

- **<u>Preferred Second Main Carpark Exit</u>**
- <u>No</u> Entry / Exit at sharp bend in Jordan Esplanade (Safety – Site Distance Issue)
- 2nd exit could be located to the East of the Ramp
- Boat Rigging Areas provided prior to exit



Coffs Harbour Boatramp Upgrade –
Where to from here?

1. RHDHV to finalise concept designs and report
2. MHL to complete physical model testing
3. Sediment transport modelling to aid assessment of breakwater extension
4. Undertake consultation with surfing community regarding breakwater extension
5. Environmental Assessment (REF)
6. Geotechnical Investigations
7. Detailed Design
8. Tender and Award
9. Construction

Royal HaskoningDHV

QUESTIONS?

Proposed Upgrade of Coffs Harbour Regional Boat Ramp Stages 1 and 2

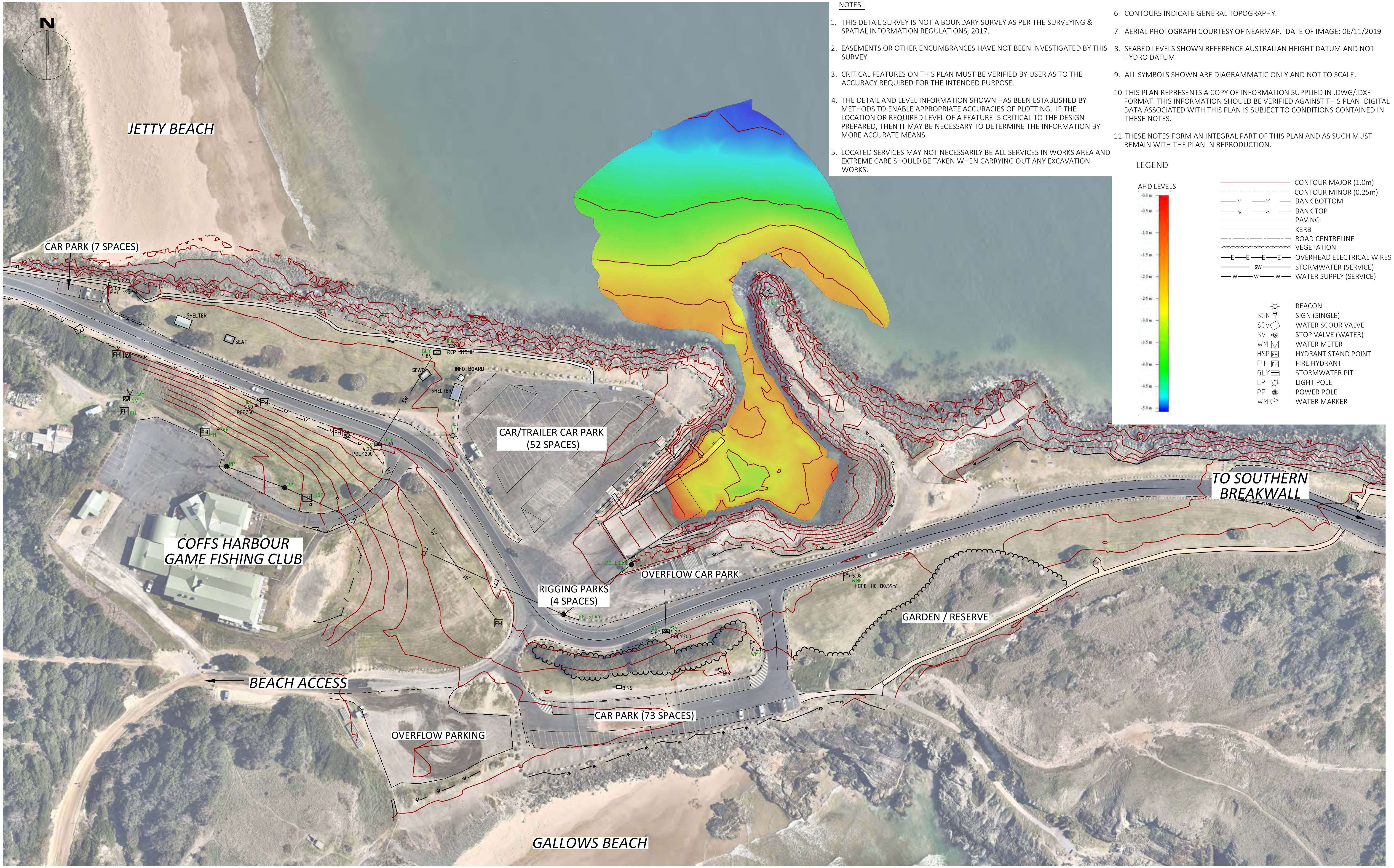
Review of Environmental Factors

Transport for NSW

Book 2 of 2

November 2020

Appendix C: Topographic and Bathymetric Survey by North Coast Surveys



NOTES :

1. THIS DETAIL SURVEY IS NOT A BOUNDARY SURVEY AS PER THE SURVEYING & SPATIAL INFORMATION REGULATIONS, 2017.
2. EASEMENTS OR OTHER ENCUMBRANCES HAVE NOT BEEN INVESTIGATED BY THIS SURVEY.
3. CRITICAL FEATURES ON THIS PLAN MUST BE VERIFIED BY USER AS TO THE ACCURACY REQUIRED FOR THE INTENDED PURPOSE.
4. THE DETAIL AND LEVEL INFORMATION SHOWN HAS BEEN ESTABLISHED BY METHODS TO ENABLE APPROPRIATE ACCURACIES OF PLOTTING. IF THE LOCATION OR REQUIRED LEVEL OF A FEATURE IS CRITICAL TO THE DESIGN PREPARED, THEN IT MAY BE NECESSARY TO DETERMINE THE INFORMATION BY MORE ACCURATE MEANS.
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7. AERIAL PHOTOGRAPH COURTESY OF NEARMAP. DATE OF IMAGE: 06/11/2019
8. SEABED LEVELS SHOWN REFERENCE AUSTRALIAN HEIGHT DATUM AND NOT HYDRO DATUM.
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LEGEND

AHD LEVELS

-0.1 m
-0.5 m
-1.0 m
-1.5 m
-2.0 m
-2.5 m
-3.0 m
-3.5 m
-4.0 m
-4.5 m
-5.0 m

CONTOUR MAJOR (1.0m)
CONTOUR MINOR (0.25m)
BANK BOTTOM
BANK TOP
PAVING
KERB
ROAD CENTRELINE
VEGETATION
—E—E—E— OVERHEAD ELECTRICAL WIRES
—SW— STORMWATER (SERVICE)
—W—W—W— WATER SUPPLY (SERVICE)

	BEACON
SGN	SIGN (SINGLE)
SCV	WATER SCOUR VALVE
SV	STOP VALVE (WATER)
WM	WATER METER
HSP	HYDRANT STAND POINT
FH	FIRE HYDRANT
GLY	STORMWATER PIT
LP	LIGHT POLE
PP	POWER POLE
WMK	WATER MARKER

NORTH COAST SURVEYS

Web: northcoastsurveys.com.au
Email: office@northcoastsurveys.com.au
Phone: (02) 6696 3758

REV	DATE	DESCRIPTION
0	30/03/20	ORIGINAL ISSUE

SCALE 1:1500

15 0 15 30 45 60 75

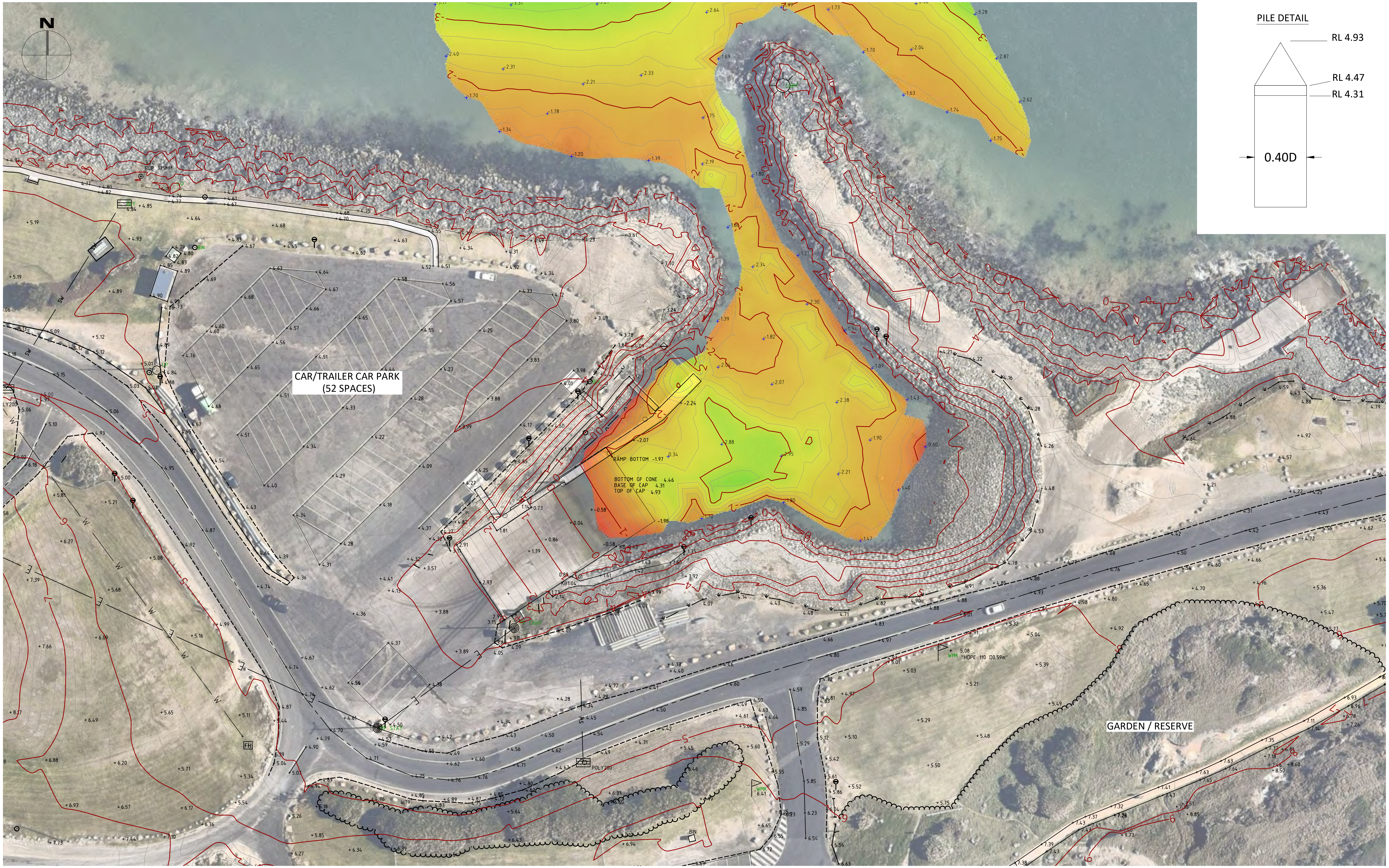
CAUTION: THE ORIGINAL SCALE OF THIS DRAWING MAY HAVE BEEN ALTERED BY REDUCTION, ENLARGEMENT AND/OR PRINTING. THE SCALE SHOULD BE VERIFIED PRIOR TO TO USING THE DRAWING.

JOB No.	20039
SURVEYED BY	JS
CHECKED BY	DC
DATE OF SURVEY	20/03/2020
Vz DATUM	AHD71
ORIGIN	PM82044
Hz DATUM	MGA56 (1994)

ORIGINAL SHEET SIZE A3

TITLE: PLAN SHOWING CONTOURS & DETAIL - OVERVIEW
SITE: COFFS HARBOUR BOAT RAMP
COFFS HARBOUR NSW 2450
CLIENT: RHDHV

DWG No: 20039A BOAT RAMP.DWG SHEET 1 OF 3 REV 0



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REV	DATE	DESCRIPTION
0	30/03/20	ORIGINAL ISSUE

SCALE 1:750

7.5 0 7.5 15 22.5 30 37.5

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JOB No.	20039
SURVEYED BY	JS
CHECKED BY	DC
DATE OF SURVEY	20/03/2020
Vz DATUM	AHD71
ORIGIN	PM
Hz DATUM	MGA56 (1994)

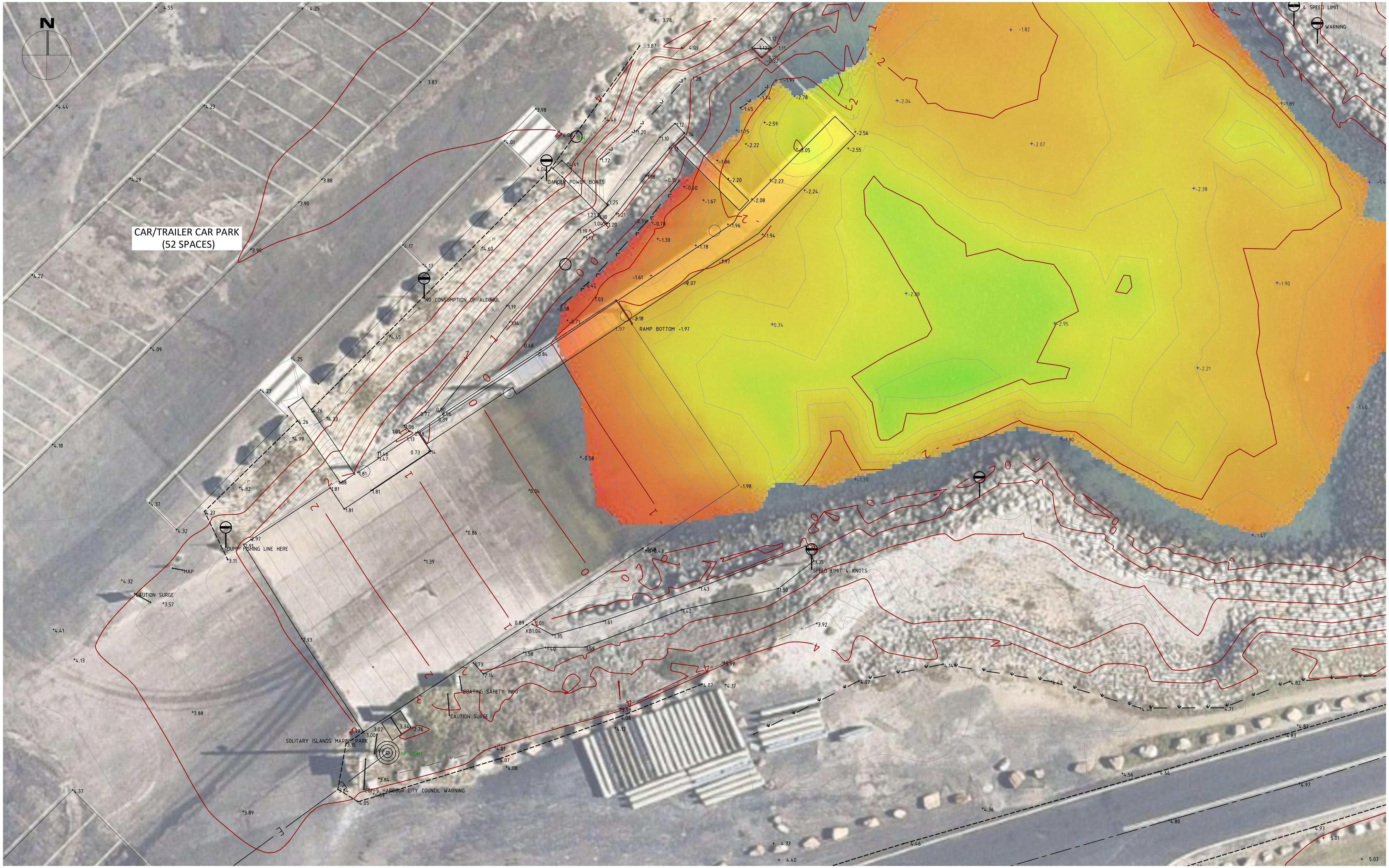
ORIGINAL SHEET SIZE A3

TITLE: PLAN SHOWING CONTOURS & DETAIL - SHEET 2

SITE: COFFS HARBOUR BOAT RAMP
COFFS HARBOUR NSW 2450

CLIENT: RHDHV

DWG No: 20039A BOAT RAMP.DWG SHEET 1 OF 3 REV 0



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REV	DATE	DESCRIPTION
0	30/03/20	ORIGINAL ISSUE

SCALE 1:300

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JOB No.	20039
SURVEYED BY	JS
CHECKED BY	DC
DATE OF SURVEY	20/03/2020
Vz DATUM	AHD71
ORIGIN	PM
Hz DATUM	MGA56 (1994)
ORIGINAL SHEET SIZE	A3

TITLE: PLAN SHOWING CONTOURS & DETAIL - SHEET 3
SITE: COFFS HARBOUR BOAT RAMP
COFFS HARBOUR NSW 2450
CLIENT: RHDHV

DWG No: 20039A BOAT RAMP.DWG SHEET 1 OF 3 REV 0

Appendix D: Traffic and Parking Assessment (Bitzios Consulting)

Issue History

File Name	Prepared	Reviewed	Issued by	Date	Issued to
P4701.001T Coffs Harbour Boat Ramp - Traffic and Parking Assessment	J. Walden-Goodlet	I.Surname	J. Walden-Goodlet	24/08/20	ben.patterson@rhdhv.com

Coffs Harbour Boat Ramp Concept Design

Traffic and Parking Assessment

1. Introduction

1.1 Background

Bitzios Consulting has been engaged by Haskoning Australia Pty Ltd to undertake a traffic and parking assessment for the concept design of the Coffs Harbour Boat Ramp Upgrade. The subject site is located on the northern side of Jordan Esplanade, in Coffs Harbour NSW. The subject site is shown in Figure 1.1 and the concept plans are presented in **Attachment 1**.

Source: Nearmap

Figure 1.1: Subject Site Locality

1.2 Scope

The scope of this assessment is as follows:

- Review parking demands at the boat ramp and surrounding area
- Assessment of car park design in accordance with AS2890 and TfNSW's NSW Boat Ramp Facility Guidelines
- Swept path assessment of key manoeuvring areas
- Review of car park functionality, operations and safety
- Assess access design including turn warrants, manoeuvrability and sight lines
- Review proposed pedestrian facility design for functionality, safety and inclusiveness.

2. Existing Conditions

The existing Coffs Harbour boat ramp comprises of a three-lane boat ramp with a single pontoon. There are 50 marked car and trailer parking spaces with access provided to Jordan Esplanade via an unformalised crossover which is approximately 33m wide.

Jordan Esplanade is a two-lane road with a 50km/h posted speed and no kerb and channel.

The surrounding area includes Gallows Beach to the south, Jetty Beach to the north and the South Breakwall to the east. There is existing public car parking south and east of the boat ramp.

The existing pedestrian path network terminates on the northern side of the boat ramp car park, directing pedestrians through the car park and past the manoeuvring area for the boat ramp. A key pedestrian and cycle desire line is to the South Breakwall located east of the boat ramp. An existing shared path connection is located east of the boat ramp on the northern side of Jordan Esplanade however no connection currently exists through or past the boat ramp.

3. Proposed Upgrade

The boat ramp upgrade comprises of two main stages as follows:

- **Stage 1** – This includes upgrades to the boat ramp to include six ramp lanes, additional pontoons, dredging and extension of the breakwall. Stage 1 does not include any changes to parking or access arrangements
- **Stage 2** – This includes upgrade of the main boat ramp car parking area to include 62 car and trailer spaces, 10 car only spaces (including two PWD spaces) and nine rigging and de-rigging spaces. Access to the boat ramp will be relocated and formalised. Stage 2 also includes 66 overflow car and trailer parking spaces access via Jordan Esplanade as well as new pedestrian pathway connections.

Concept plans for Stage 1 and Stage 2 are included in **Attachment 1** for reference. This technical note relates to Stage 2 other than assessment of the boat ramp lanes and manoeuvring which is consistent between Stages 1 and 2.

4. Parking Assessment

4.1 Parking Demand

4.1.1 Overview

In determining car and trailer parking requirements for boat ramp facilities, TfNSW's NSW Boat Ramp Facility Guidelines states "*a sufficient number of car and trailer spaces should be provided to meet the demand of normal weekend usage during the boating season. Provision for overflow parking at peak times may be considered at regional facilities*."

In determining parking requirements for the boat ramp the following was considered:

- The parking rates nominated in TfNSW's NSW Boat Ramp Facility Guidelines
- Parking demands for normal weekend usage based on parking surveys undertaken by Traffic Data and Control (TDC)
- Historical 'point in time' parking demands based on Nearmap imagery.

4.1.2 Car and Trailer Parking Requirements – TfNSW Guidelines

Table 4.1 details the car parking requirements nominated in the TfNSW Guidelines for the boat ramp.

Table 4.1: Parking Requirements (TfFNSW Guidelines)

No. Of Lanes	Area / Type	Parking Rate	No. of Bays
6	Urban / With Separate Rigging and De-rigging areas	40-50 spaces per lane	240-300 spaces

As demonstrated TfFNSW Guidelines nominates in the order of 240-300 parking spaces are required for the boat ramp facility. It is noted that this does not consider actual parking demands at the existing site or expected utilisation.

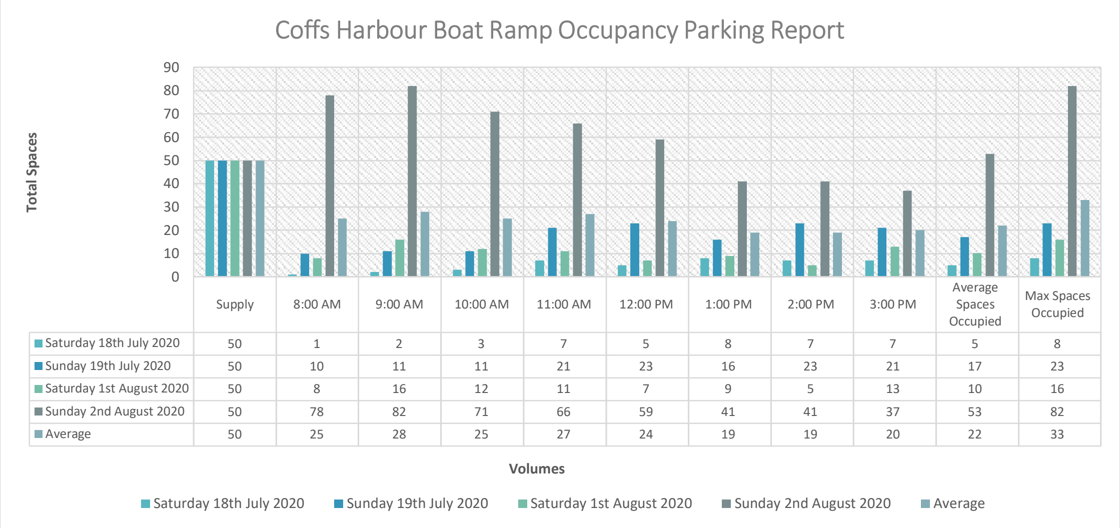
TfFNSW Guidelines also recommends car only parking should be included at a rate of one car park per five car and trailer spaces and that at least one car only PWD parking bay should be provided.

4.1.3 Surveyed Boat Ramp Car Parking Demands

Parking surveys were undertaken by TDC to assess existing parking demands for the boat ramp car park and the surrounding car parking areas on Jordan Esplanade. Parking surveys were undertaken over separate weekend periods and were scheduled to occur during optimal boating conditions (fine and sunny weather). Parking surveys were undertaken for the following periods:

- Saturday 18th July 2020
- Sunday 19th July 2020
- Saturday 1st August 2020
- Sunday 2nd August 2020.

The existing supply of car and trailer parking spaces is 50 marked spaces. The results of the parking survey specifically within the existing boat ramp car park are summarised in Figure 4.1.



	Supply	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	Average Spaces Occupied	Max Spaces Occupied
Saturday 18th July 2020	50	1	2	3	7	5	8	7	7	5	8
Sunday 19th July 2020	50	10	11	11	21	23	16	23	21	17	23
Saturday 1st August 2020	50	8	16	12	11	7	9	5	13	10	16
Sunday 2nd August 2020	50	78	82	71	66	59	41	41	37	53	82
Average	50	25	28	25	27	24	19	19	20	22	33

Figure 4.1: Existing Boat Ramp Parking Demands

As demonstrated the existing boat ramp parking demands varied with an average parking occupancy of 22 spaces (44%) across all the surveyed periods. Demands varied with an occupancy of between five (5) and 53 spaces.

The peak parking demands varied between eight (8) and 82 spaces. It is noted that the peak demands occurred on Sunday 2nd August and exceeded the supply of 50 spaces. TDC identified that this was because of vehicles without trailers informally parking around the main parking area and instances of multiple vehicles (i.e. without trailers) occupying car and trailer bays. There was no specific event on at this time and other surrounding parking areas were underutilised (refer Section 4.1.5). An example of this parking behaviour is shown in a photo taken at the time of the parking survey is presented in Figure 4.2.

Figure 4.2: **Coffs Harbour Ramp (9am 02/08/2020)**

The traffic surveys show that the typical parking demands for the boat ramp are usually within the available supply of 50 spaces with an average occupancy of 30 spaces. Instances of higher peak demands were observed (up to 82 spaces), however these were not necessarily all because of boat and trailer parking.

It is noted that there may also be seasonal peaks in which higher than typical parking demands occur.

The parking survey data is included as **Attachment 2**.

4.1.4 Historical Boat Ramp Car Parking Demands

Historical Nearmap imagery for the period between Sunday 31st July 2011 and Friday 22nd May 2020 was also reviewed to further understand typical historical parking demands. The available Nearmap imagery provided parking demands for 21 point-in-time periods. Observed parking occupancy in the boat ramp car park from the Nearmap imagery is summarised in Figure 4.3.

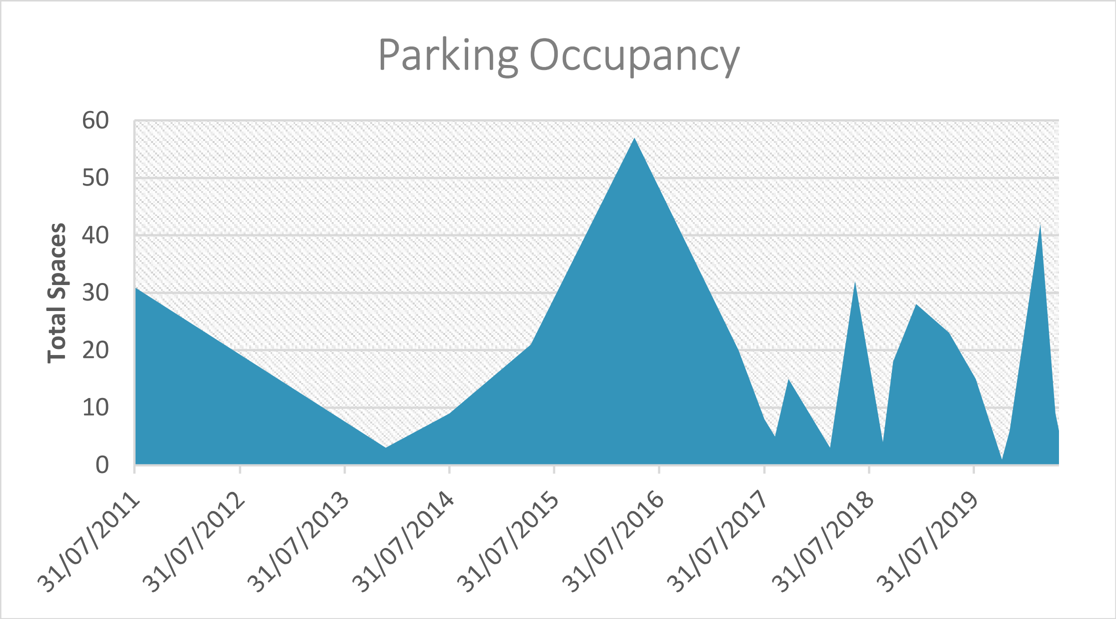


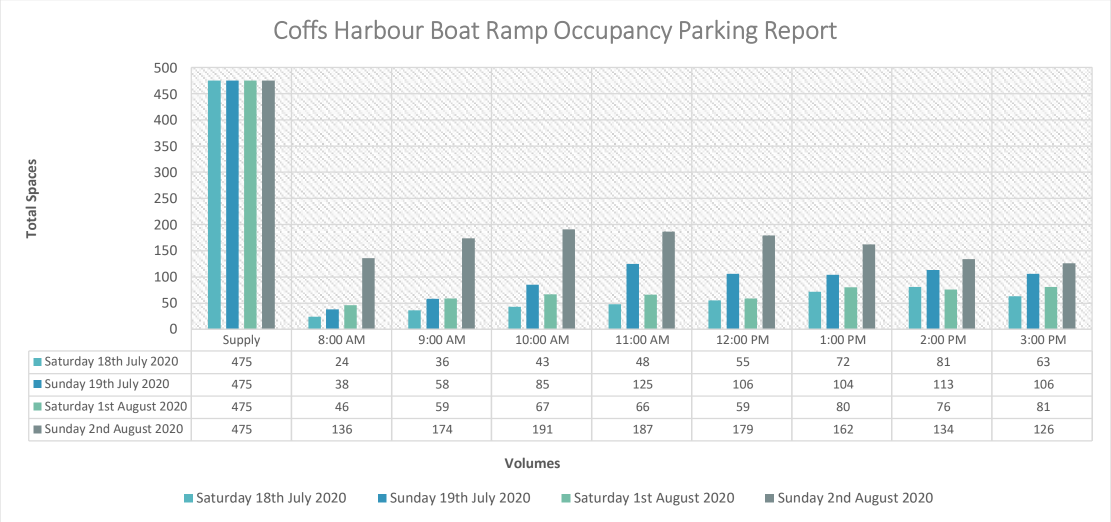
Figure 4.3: **Parking Occupancy – Near Map Imagery**

As demonstrated, the historical imagery showed a parking demand ranging between one and 57 spaces. The average occupancy was 17 spaces.

4.1.5 Extended Study Area Parking Demands

The scope of parking surveys undertaken by TDC (as detailed in Section 4.1) included the broader parking area along Jordan Esplanade including parking for the South Breakwall and the Gallows Beach off-street parking area (full extent of surveys included in **Attachment 2**). The total supply for the survey was 475 parking spaces (including the 50 spaces provided for the boat ramp).

The results of the parking survey specifically within the existing boat ramp car park are summarised in Figure 4.4.



	Supply	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM
Saturday 18th July 2020	475	24	36	43	48	55	72	81	63
Sunday 19th July 2020	475	38	58	85	125	106	104	113	106
Saturday 1st August 2020	475	46	59	67	66	59	80	76	81
Sunday 2nd August 2020	475	136	174	191	187	179	162	134	126

Figure 4.4: **Existing Parking Demands – Broader Jordan Esplanade Area**

As demonstrated the existing car parking demands along Jordan Esplanade varied with an average parking occupancy of 89 spaces (19%) across all of the surveyed periods.

Average demands varied between an occupancy of between 53 and 143 spaces. The peak demand was 191 spaces (40%).

Even when the boat ramp car park occupancy exceeded the marked supply, the overall parking demands in the area had available capacity, including the adjacent Gallows Beach car park which had a peak occupancy 36 spaces (48%). Noting that much of the additional demand during the recorded peak period for the boat ramp was due to vehicles without trailers, the surveys indicate that sufficient parking was available in the immediate area.

4.2 Proposed Parking Supply

The parking supply proposed as part of the Stage 2 concept design is summarised in Table 4.2.

Table 4.2: **Parking Provision**

Main Parking (Boat and Trailer)	Overflow Parking (Boat and Trailer)	Total Boat and Trailer Parking	Main Parking (Vehicle Only)
62	66	128	10

A total of 128 boat and trailer parking spaces are proposed as well as 10 vehicle only parking spaces. Considering the average surveyed demand of 22 spaces and peak demand of 81 spaces, the proposed parking supply is considered sufficient to cater for demand. This will also cater for an additional 47 spaces more than the highest recorded peak.

The provision of car only parking equates to slightly less than one space per six car and trailer spaces which generally aligns with TfNSW recommendations. It is noted that the surrounding area also includes a significant supply of existing car only parking spaces which can be utilised.

Two PWD parking spaces are included in the provision which exceeds the TfNSW recommendation to provide at least one PWD space.

5. Car Parking Geometry and Layout Assessment

The off-street parking geometric layout and boat ramp layout has been assessed against the relevant sections of TfNSW's NSW Boat Ramp Facility Guidelines and Australian Standards AS2890 with key features outlined in Table 5.1.

Table 5.1: **Parking and Boat Ramp Geometric Layout Assessment**

Design Element	Requirement	Proposed	Compliant
Angled Parking	3m x 12.5m	3m wide x 11.9-13.1m	No (See Note 1)
Parallel Boat and Trailer Parking	3.5m x 20m	4m x 12.4m	No (See Note 2)
Rigging / De-rigging bays	3.5m x 20m	3.5m x 20m	Yes
Aisle	8m	Min. 8m	Yes See Note 3

Design Element	Requirement	Proposed	Compliant
User Class 2 Parking Space	2.5m x 5.4m	2.5m x 5.5m	Yes
Parking aisle	Min. 5.8m	9m	Yes
Grades (parking modules)	1:20 measured parallel to the angle of parking 1:16 (max.) in any other direction	Not annotated	Shall comply
PWD Parking Space	2.4m x 5.4m with shared area of the same dimensions	2.5m x 5.5m with shared area of the same dimensions	Yes
Boat Ramp Lane Width (multi-lane ramp)	4m	4m	Yes
Boat Ramp Grade	1:8 (preferred)	Not annotated	Shall comply
Ramp Crest	Vertical Curve with minimum radius 6m	Not annotated	Shall comply
Approach Manoeuvring Area	20m long for the width of ramp with a grade of 1-5%	20m long for the width of the ramp. Grade not annotated	Yes (Grades shall comply)

The notes referred to in Table 5.1 are as follows:

1. Some bays are provided with a total available parking length of 11.9m (bays 6-17) or 12.4m (bays 18-34). These should be amended during detailed design to ensure a minimum parking length of 12.5m is provided to comply with Section 6.2 of the TfNSW Boat Ramp Facility Guidelines. Sufficient landscaping width along each parking module is available to achieve this
2. Parallel bays are provided at 12.4m long. TfNSW Boat Ramp Facility Guidelines do not specify parallel parking lane lengths. As such it is recommended that bays be amended during detailed design to comply with length requirements for parallel rigging / de-rigging bays, or bay markings removed
3. Bays 6-17 have a parking angle of 75 degrees. This exceeds the angle at which the 8m is suitable for. Either the aisle should be increased to 9m or the parking angle reduced to between 45 and 60 degrees to comply with Section 6.2 of the TfNSW Boat Ramp Facility Guidelines,

Swept paths for key design vehicle movements are included in **Attachment 3**. The design vehicle was based on the boat and trailer details specified in Section 2 and Figure 1 of TfNSW's NSW Boat Ramp Facility Guidelines and a B99 design vehicle as specified in AS2890.1.

6. Traffic Assessment

6.1 Background Traffic Volumes

Seven-day tube count surveys were undertaken by TDC to determine the existing average daily traffic volumes, peak hour volumes and 85th percentile speed for Jordan Esplanade. Tube counts were undertaken at two locations for the following periods:

- 18-24th July 2020
- 29th July – 4th August 2020.

Peak hourly volumes for the southern count location (approximately 140m north of Camperdown Street) are presented in Figure 6.1. Average hourly volumes throughout the day were in the order of 600 vehicles per day, although on some days exceeded 800 vehicles per hour. The traffic profile is relatively constant between 8am and 5pm. The traffic survey data is included in **Attachment 4**.

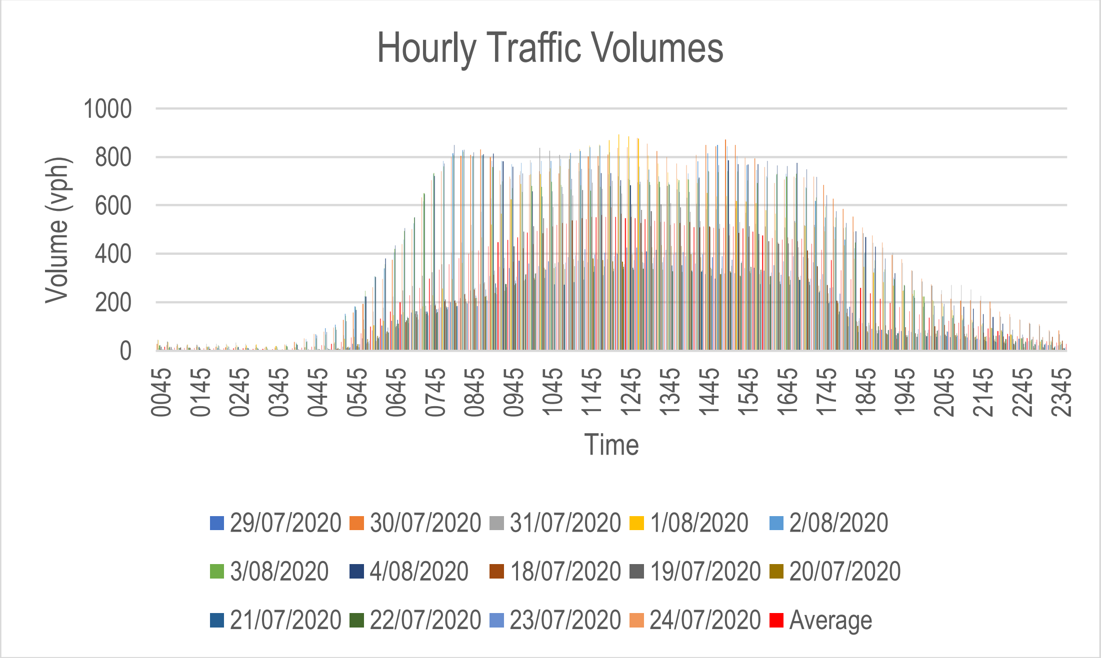


Figure 6.1: Hourly Traffic Volumes – Jordan Esplanade

6.2 Boat Ramp Traffic Generation

A first principles approach was used to determine the peak hourly traffic that could be generated by the boat ramp. This assumed one boat could be launched or retrieved from each lane of the boat ramp every five minutes (12 trips per lane per hour). The estimated traffic generation is summarised in Table 6.1.

Table 6.1: Boat Ramp Peak Hour Traffic Generation

No. of Ramp Lanes	Peak hour Trip Rate (trips / lane)	Peak Hourly Traffic Generation (vph)
6	12	72

Based on the above, it is estimated that the boat ramp has the potential to generate up to 72 trips per hour. This is considered conservative and assumes constant launches and retrievals from each lane.

Trip generation is expected to vary between an even distribution of vehicles entering and exiting, and a 'tidal' movement of vehicles (e.g. higher ingress movements during optimal boating or launch conditions). As Jordan Esplanade is a no through road, most trips will travel to and from the west. Movements to and from the east will only occur at times when overflow parking is used.

Traffic generated by the boat ramp is not expected to result in adverse impacts to the operations of the surrounding road network with an estimated 1-2 vehicles entering or exiting the boat ramp car park during peak periods.

It is understood that the boat ramp may on occasion have peak or seasonal spikes, in which utilisation of the boat ramp may increase significantly. Additional traffic may be generated during these times however, this is not considered consistent with typical day to day operations.

7. Access Assessment

7.1 Access Form

Stage 2 of the concept design includes a new all movements access to Jordan Esplanade. The access location has been moved to the west to maximise separation between the top of the boat ramp and the access, minimising conflicts at the top of the boat ramp.

Under AS2890.1 a minimum Category 2 access is required (6-9m wide, no separation). The access has been designed to cater for design vehicle swept paths and exceeds the minimum requirements of AS890.1. The access includes a separated entry and exit lane (minimum 4m wide each) with a central pedestrian refuge and kerb returns of approximately 12m radius.

Considering the low speed environment of Jordan Esplanade (50km/h), relatively low peak traffic generation of the boat ramp and traffic distribution (the majority of vehicles travel from the west and turn left-in), turning treatments are not considered appropriate for the access. This is also consistent with Austroads Guide to Traffic Management Part 6A which notes turn warrants are not specifically intended for driveways and accesses.

7.2 Sight Distance

The sight distance to the east and west along Jordan Esplanade exceeds the desirable 69m for a 50km/h road frontage as per the requirements of AS2890.1.

8. Active Transport Considerations

The boat ramp concept includes:

- A 2.5m wide shared path on the northern side of Jordan Esplanade. This connects to the existing pathway at the western extent of the boat ramp. The shared path terminates on the eastern side of the boat ramp allowing for future connection to the existing pathway network further east which continues to the South Breakwall. This pathway caters for the key east-west pedestrian and cyclist desire lines on the northern side of Jordan Esplanade. It also provides connection between the boat ramp and other parking facilities accessed from Jordan Esplanade, including overflow parking proposed as part of part of the boat ramp upgrade
- A 1.8m wide pedestrian path along the southern side of Jordan Esplanade. This provides connection between the existing car park and proposed overflow parking areas on the southern side of Jordan Esplanade and the boat ramp
- A 1.5m wide pedestrian connecting the existing pathway network (west of the boat ramp) to the boat ramp
- Two refuge crossings across Jordan Esplanade.

The above active transport facilities are considered a key design element of the boat ramp, providing both pedestrian connection to and from the boat ramp and allowing safe pedestrian movements past the boat ramp.

It is noted that a pedestrian connection is included through the boat ramp, marked with zebra crossing line marking. It is recommended that the zebra line marking is removed at the detail design stage to avoid creating a false sense of security for pedestrians walking along parking aisles and behind parked cars. Zebra markings as shown are not consistent with typical car park module design.

Attachment 1: Concept Plans

DRAWING No.
PA2431-STG- 001

DO NOT SCALE

EXISTING (STAGE 1)

LOCATION	VEHICLE AND TRAILER	VEHICLE ONLY
MAIN	49	
GALLOWS (EXISTING)		71
	49	**71**

LEGEND

▨	EXISTING CONCRETE RAMP
▨	NEW PAVEMENT (RAMP)
▨	NEW RAMP (CONCRETE)
▨	NEW PONTOON
▨	LAND BASED EARTHWORKS
▨	NEW ROCK REVETMENT
▨	HARBOUR DREDGING
▨	PONTOON GANTRY
• •	Ø300 PILES (INDICATIVE LOCATIONS ONLY)
▨	BREAKWALL (ABOVE WATER)

PLAN
SCALE 1: 500

REV	DATE	DESCRIPTION	BY	CHK	APPD
D	18.8.20	NEW LAYOUT FOR APPROVAL	MC	PL	BP
C	23.6.20	BREAKWALL LAYOUT UPDATED	MC	PL	BP
B	15.6.20	CLIENT COMMENTS INCLUDED	MC	PL	BP
A	12.6.20	CONCEPT PLANS REV'D & STAGED	MC	PL	BP

REVISIONS

DRAWING FOR REVIEW

WARNING

DIAL 1100
BEFORE YOU DIG

ONLY VISIBLE SERVICES HAVE BEEN LOCATED BY SURVEY. LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND HAVE BEEN SCALED FROM VARIOUS SERVICE AUTHORITY PLANS. ALL SERVICES TO BE CONFIRMED ON SITE PRIOR TO ANY CONSTRUCTION OR INVESTIGATION WORKS.

"DIAL BEFORE YOU DIG" - 1100

IT IS ESSENTIAL THAT BEFORE ANY EXCAVATION WORK IS UNDERTAKEN, FURTHER INVESTIGATION INTO THE LOCATION OF SERVICES SHOULD BE CARRIED OUT WITH THE RELEVANT AUTHORITY.

CLIENT
NSW GOVERNMENT
Transport for NSW
Roads and Maritime

SURVEY
SURVEY - NORTH COAST SURVEYS MARCH 2020
HORIZONTAL DATUM MGA 56 VERTICAL DATUM AHD 71

AUSTRALIAN HEIGHT DATUM

PROJECT:

COFFS HARBOUR,
BOAT RAMP UPGRADE
CONCEPT STAGING PLANS

TITLE:

STAGE 1
SITE MASTERPLAN

HASKONING AUSTRALIA PTY LTD
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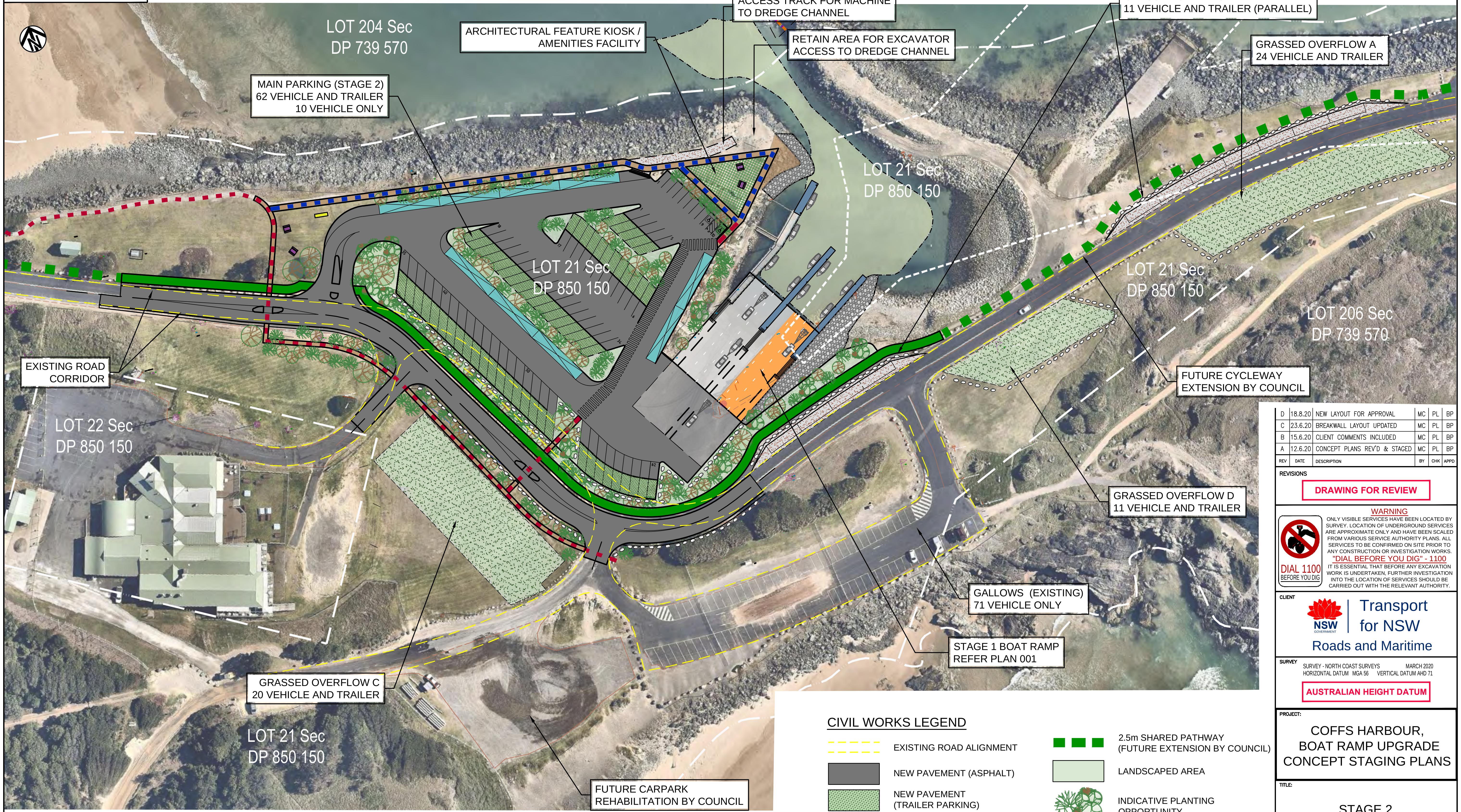
Enhancing Society Together

DRAWN M.Collings | DATE 20.03.2020 | JOB No. PA2431
AUTOCAD REF. PA2341–STG
SCALE AT A1 AS SHOWN
DRAWING No. PA2341-STG- 001
REVISION D

DRAWING No.
PA2431-STG- 002

DO NOT SCALE



	EXISTING (STAGE 1)		TOTAL STAGE 2	
LOCATION	VEHICLE AND TRAILER	VEHICLE ONLY	VEHICLE AND TRAILER	VEHICLE ONLY
MAIN	49		62	10
GALLOWS (EXISTING)		71		71
OVERFLOW A			24	
OVERFLOW B			11	
OVERFLOW C			20	
OVERFLOW D			11	
	49	71	128	81

PLAN
SCALE 1: 600

12 0 20 40 60m
1:600 (A1) 1:1200 (A3)

CIVIL WORKS LEGEND

- EXISTING ROAD ALIGNMENT
- NEW PAVEMENT (ASPHALT)
- NEW PAVEMENT (TRAILER PARKING)
- NEW PAVEMENT (UNSEALED)
- OVERFLOW PARKING (GRASSED)
- OVERSIZE ROCK PLACE IN VERGE (MATCH EXISTING)
- PEDESTRIAN ROUTE AND 1.8m CONCRETE FOOTPATH
- PEDESTRIAN ROUTE AND 1.5m CONCRETE FOOTPATH
- 2.5m SHARED PATHWAY
- 2.5m SHARED PATHWAY (FUTURE EXTENSION BY COUNCIL)
- LANDSCAPED AREA
- INDICATIVE PLANTING OPPORTUNITY
- ARCHITECTURAL FEATURE, KIOSK / AMENITIES AREA
- SEATING AND TABLE AND FISH CLEANING BENCH
- RIGGING AND DE-RIGGING BAYS
- DESIGN VEHICLE (12.5m)

REV	DATE	DESCRIPTION	BY	CHK	APPD
D	18.8.20	NEW LAYOUT FOR APPROVAL	MC	PL	BP
C	23.6.20	BREAKWALL LAYOUT UPDATED	MC	PL	BP
B	15.6.20	CLIENT COMMENTS INCLUDED	MC	PL	BP
A	12.6.20	CONCEPT PLANS REV'D & STAGED	MC	PL	BP

REVISIONS

DRAWING FOR REVIEW

WARNING
ONLY VISIBLE SERVICES HAVE BEEN LOCATED BY SURVEY. LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND HAVE BEEN SCALED FROM VARIOUS SERVICE AUTHORITY PLANS. ALL SERVICES TO BE CONFIRMED ON SITE PRIOR TO ANY CONSTRUCTION OR INVESTIGATION WORKS.
"DIAL BEFORE YOU DIG" - 1100
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DIAL 1100 BEFORE YOU DIG

CLIENT
NSW GOVERNMENT
Transport for NSW
Roads and Maritime

SURVEY
SURVEY - NORTH COAST SURVEYS MARCH 2020
HORIZONTAL DATUM MGA 56 VERTICAL DATUM AHD 71

AUSTRALIAN HEIGHT DATUM

PROJECT:
COFFS HARBOUR,
BOAT RAMP UPGRADE
CONCEPT STAGING PLANS

TITLE:
STAGE 2
SITE MASTERPLAN

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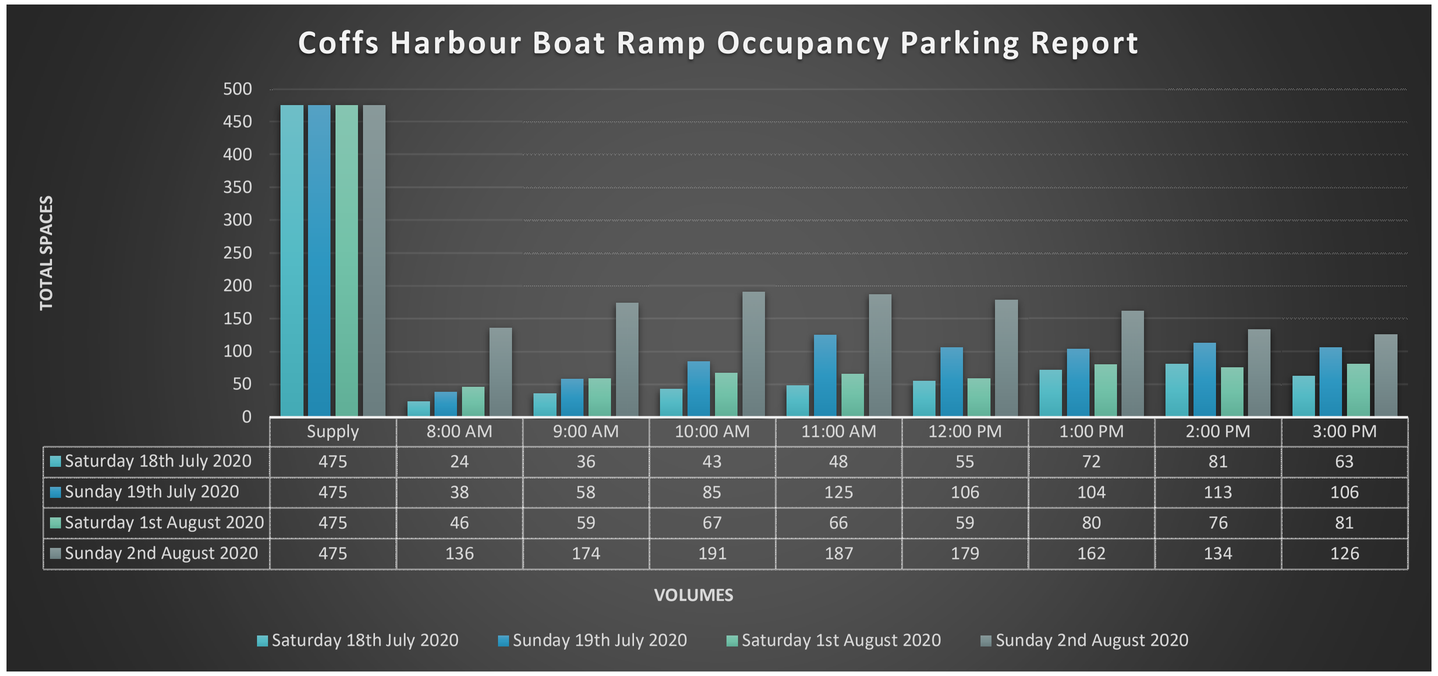
Royal HaskoningDHV
Enhancing Society Together

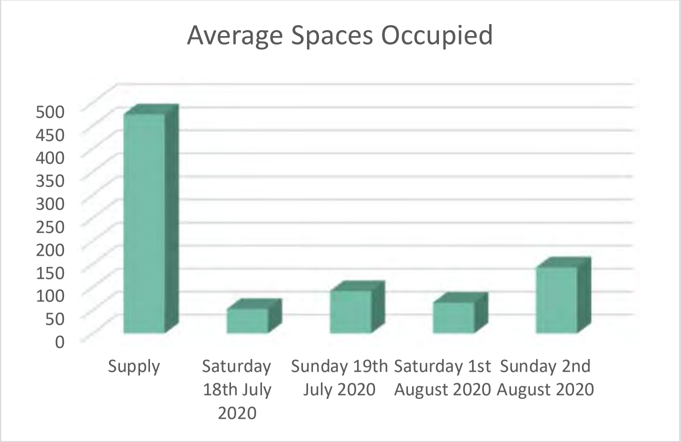
DRAWN M.Collings | DATE 20.03.2020 | JOB No. PA2431
AUTOCAD REF. PA2341–STG
SCALE AT A1 AS SHOWN
DRAWING No. PA2341-STG- 002
REVISION D

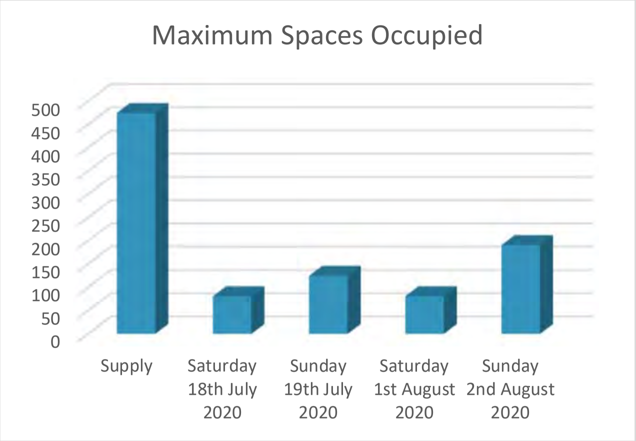
C:\COFFS HARBOUR BOAT RAMP / PA2341

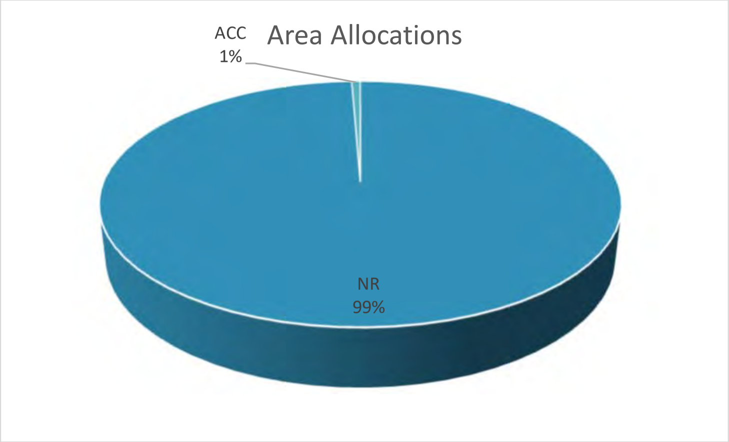
Attachment 2: Parking Survey Data

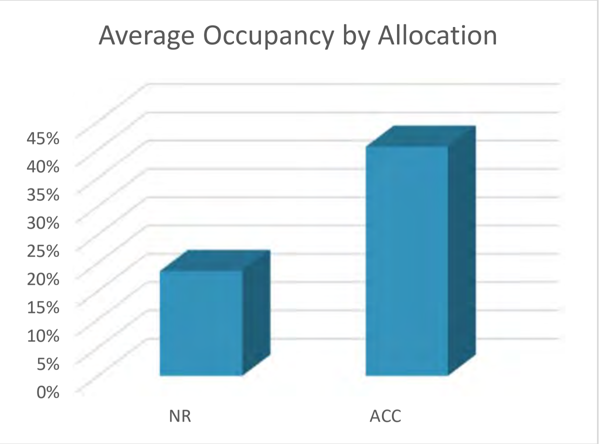
Day/Date	Supply	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	Average Spaces Occupied	Max Spaces Occupied
Saturday 18th July 2020	475	24	36	43	48	55	72	81	63	53	81
Sunday 19th July 2020	475	38	58	85	125	106	104	113	106	92	125
Saturday 1st August 2020	475	46	59	67	66	59	80	76	81	67	81
Sunday 2nd August 2020	475	136	174	191	187	179	162	134	126	143	191











Street Section ID	Saturday 18th July 2020			8:00 AM		9:00 AM		10:00 AM		11:00 AM		12:00 PM		1:00 PM		2:00 PM		3:00 PM		Average Spaces Occupied	Max Spaces Occupied
	Description	Allocation	Supply	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%		
1	Jordan Esplanade at Jetty Beach access	NR	6	4	67%	4	67%	2	33%	3	50%	4	67%	6	100%	7	117%	5	83%	4	7
2	Jordan Esplanade at Jetty Beach access	Acc	1	1	100%	1	100%	0	0%	0	0%	0	0%	1	100%	1	100%	0	0%	1	1
3	Jordan Esplanade roadside parking west of boat ramp	NR	15	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0
4	Jordan Esplanade boat trailer carpark at boat ramp	NR	50	1	2%	2	4%	3	6%	7	14%	5	10%	8	16%	7	14%	7	14%	5	8
5	Jordan Esplanade roadside parking from boat ramp to large carpark	NR	15	0	0%	0	0%	3	20%	3	20%	4	27%	0	0%	4	27%	3	20%	2	4
6	Large carpark prior to Southern Break Wall carpark	NR	30	1	3%	1	3%	6	20%	3	10%	2	7%	13	43%	7	23%	12	40%	6	13
7	Roadside parking beachside between large carpark & Southern Break Wall	NR	12	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0
8	Carpark at Southern Break Wall	NR	35	2	6%	7	20%	8	23%	6	17%	9	26%	9	26%	15	43%	13	37%	9	15
9	Roadside parking between Southern Break Wall & Gallows Beach	NR	33	0	0%	0	0%	0	0%	1	3%	1	3%	1	3%	0	0%	0	0%	0	1
10	Gallows Beach Carpark	NR	75	8	11%	15	20%	14	19%	20	27%	17	23%	19	25%	28	37%	15	20%	17	28
11	Gallows Beach Carpark	Acc	2	0	0%	1	50%	0	0%	0	0%	2	100%	2	100%	2	100%	1	50%	1	2
12	Grassed parking area next to Gallows Beach carpark	NR	58	7	12%	4	7%	3	5%	5	9%	11	19%	11	19%	8	14%	5	9%	7	11
13	Jordan Esplanade roadside parking outside Fishing Club	NR	8	0	0%	0	0%	4	50%	0	0%	0	0%	0	0%	0	0%	0	0%	1	4
14	Grassed area in front of Fishing Club	NR	100	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0
15	Roadside parking between Camperdown St & Fishing Club	NR	35	0	0%	1	3%	0	0%	0	0%	0	0%	2	6%	2	6%	2	6%	1	2
Grand Total			475	24	5%	36	8%	43	9%	48	10%	55	12%	72	15%	81	17%	63	13%	53	81

Street Section ID	Sunday 19th July 2020			8:00 AM		9:00 AM		10:00 AM		11:00 AM		12:00 PM		1:00 PM		2:00 PM		3:00 PM		Average Spaces Occupied	Max Spaces Occupied
	Description	Allocation	Supply	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%		
1	Jordan Esplanade at Jetty Beach access	NR	6	2	33%	5	83%	4	67%	4	67%	5	83%	5	83%	3	50%	2	33%	4	5
2	Jordan Esplanade at Jetty Beach access	Acc	1	0	0%	0	0%	1	100%	1	100%	0	0%	1	100%	0	0%	0	0%	0	1
3	Jordan Esplanade roadside parking west of boat ramp	NR	15	0	0%	0	0%	0	0%	0	0%	0	0%	3	20%	1	7%	0	0%	1	3
4	Jordan Esplanade boat trailer carpark at boat ramp	NR	50	10	20%	11	22%	11	22%	21	42%	23	46%	16	32%	23	46%	21	42%	17	23
5	Jordan Esplanade roadside parking from boat ramp to large carpark	NR	15	0	0%	2	13%	5	33%	6	40%	7	47%	8	53%	6	40%	11	73%	6	11
6	Large carpark prior to Southern Break Wall carpark	NR	30	3	10%	7	23%	11	37%	22	73%	20	67%	17	57%	14	47%	13	43%	13	22
7	Roadside parking beachside between large carpark & Southern Break Wall	NR	12	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0
8	Carpark at Southern Break Wall	NR	35	6	17%	10	29%	23	66%	33	94%	14	40%	18	51%	29	83%	27	77%	20	33
9	Roadside parking between Southern Break Wall & Gallows Beach	NR	33	1	3%	1	3%	0	0%	5	15%	1	3%	1	3%	3	9%	2	6%	2	5
10	Gallows Beach Carpark	NR	75	12	16%	17	23%	21	28%	25	33%	25	33%	25	33%	23	31%	22	29%	21	25
11	Gallows Beach Carpark	Acc	2	0	0%	1	50%	1	50%	2	100%	1	50%	2	100%	2	100%	1	50%	1	2
12	Grassed parking area next to Gallows Beach carpark	NR	58	4	7%	4	7%	7	12%	6	10%	10	17%	7	12%	8	14%	6	10%	7	10
13	Jordan Esplanade roadside parking outside Fishing Club	NR	8	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0
14	Grassed area in front of Fishing Club	NR	100	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0
15	Roadside parking between Camperdown St & Fishing Club	NR	35	0	0%	0	0%	1	3%	0	0%	0	0%	1	3%	1	3%	1	3%	1	1
Grand Total			475	38	8%	58	12%	85	18%	125	26%	106	22%	104	22%	113	24%	106	22%	92	125

Street Section ID	Saturday 1st August 2020			8:00 AM		9:00 AM		10:00 AM		11:00 AM		12:00 PM		1:00 PM		2:00 PM		3:00 PM		Average Spaces Occupied	Max Spaces Occupied
	Description	Allocation	Supply	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%		
1	Jordan Esplanade at Jetty Beach access	NR	6	2	33%	1	17%	2	33%	4	67%	2	33%	5	83%	3	50%	2	33%	3	5
2	Jordan Esplanade at Jetty Beach access	Acc	1	1	100%	1	100%	0	0%	0	0%	1	100%	0	0%	1	100%	0	0%	1	1
3	Jordan Esplanade roadside parking west of boat ramp	NR	15	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0
4	Jordan Esplanade boat trailer carpark at boat ramp	NR	50	8	16%	16	32%	12	24%	11	22%	7	14%	9	18%	5	10%	13	26%	10	16
5	Jordan Esplanade roadside parking from boat ramp to large carpark	NR	15	1	7%	1	7%	5	33%	5	33%	4	27%	6	40%	8	53%	5	33%	4	8
6	Large carpark prior to Southern Break Wall carpark	NR	30	6	20%	12	40%	13	43%	18	60%	9	30%	14	47%	10	33%	17	57%	12	18
7	Roadside parking beachside between large carpark & Southern Break Wall	NR	12	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	8%	0	0%	0	1
8	Carpark at Southern Break Wall	NR	35	7	20%	10	29%	10	29%	11	31%	14	40%	22	63%	19	54%	22	63%	14	22
9	Roadside parking between Southern Break Wall & Gallows Beach	NR	33	0	0%	1	3%	1	3%	1	3%	1	3%	3	9%	2	6%	2	6%	1	3
10	Gallows Beach Carpark	NR	75	15	20%	13	17%	20	27%	11	15%	15	20%	15	20%	21	28%	17	23%	16	21
11	Gallows Beach Carpark	Acc	2	0	0%	0	0%	0	0%	0	0%	0	0%	1	50%	0	0%	0	0%	0	1
12	Grassed parking area next to Gallows Beach carpark	NR	58	6	10%	4	7%	4	7%	4	7%	6	10%	4	7%	6	10%	0	0%	4	6
13	Jordan Esplanade roadside parking outside Fishing Club	NR	8	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0
14	Grassed area in front of Fishing Club	NR	100	0	0%	0	0%	0	0%	1	1%	0	0%	1	1%	0	0%	2	2%	1	2
15	Roadside parking between Camperdown St & Fishing Club	NR	35	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	3%	0	1
	Grand Total		475	46	10%	59	12%	67	14%	66	14%	59	12%	80	17%	76	16%	81	17%	67	81

Street Section ID	Sunday 2nd August 2020			8:00 AM		9:00 AM		10:00 AM		11:00 AM		12:00 PM		1:00 PM		2:00 PM		3:00 PM		Average Spaces Occupied	Max Spaces Occupied
	Description	Allocation	Supply	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%	Occ	%		
1	Jordan Esplanade at Jetty Beach access	NR	6	1	17%	4	67%	5	83%	2	33%	4	67%	5	83%	5	83%	1	17%	3	5
2	Jordan Esplanade at Jetty Beach access	Acc	1	0	0%	0	0%	0	0%	0	0%	0	0%	1	100%	0	0%	0	0%	0	1
3	Jordan Esplanade roadside parking west of boat ramp	NR	15	4	27%	5	33%	5	33%	2	13%	3	20%	2	13%	1	7%	0	0%	2	5
4	Jordan Esplanade boat trailer carpark at boat ramp	NR	50	78	156%	82	164%	71	142%	66	132%	59	118%	41	82%	41	82%	37	74%	53	82
5	Jordan Esplanade roadside parking from boat ramp to large carpark	NR	15	1	7%	6	40%	11	73%	9	60%	9	60%	5	33%	7	47%	9	60%	6	11
6	Large carpark prior to Southern Break Wall carpark	NR	30	2	7%	11	37%	16	53%	17	57%	19	63%	27	90%	15	50%	14	47%	13	27
7	Roadside parking beachside between large carpark & Southern Break Wall	NR	12	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0
8	Carpark at Southern Break Wall	NR	35	10	29%	13	37%	23	66%	20	57%	22	63%	23	66%	18	51%	15	43%	16	23
9	Roadside parking between Southern Break Wall & Gallows Beach	NR	33	0	0%	0	0%	1	3%	1	3%	2	6%	1	3%	1	3%	1	3%	1	2
10	Gallows Beach Carpark	NR	75	18	24%	23	31%	26	35%	36	48%	25	33%	26	35%	23	31%	27	36%	23	36
11	Gallows Beach Carpark	Acc	2	0	0%	0	0%	1	50%	2	100%	2	100%	1	50%	2	100%	1	50%	1	2
12	Grassed parking area next to Gallows Beach carpark	NR	58	6	10%	9	16%	10	17%	12	21%	16	28%	13	22%	8	14%	9	16%	9	16
13	Jordan Esplanade roadside parking outside Fishing Club	NR	8	3	38%	3	38%	3	38%	4	50%	2	25%	0	0%	0	0%	0	0%	2	4
14	Grassed area in front of Fishing Club	NR	100	11	11%	16	16%	18	18%	14	14%	13	13%	14	14%	11	11%	8	8%	12	18
15	Roadside parking between Camperdown St & Fishing Club	NR	35	2	6%	2	6%	1	3%	2	6%	3	9%	3	9%	2	6%	4	11%	2	4
	Grand Total		475	136	29%	174	37%	191	40%	187	39%	179	38%	162	34%	134	28%	126	27%	143	191


Coffs Harbour Southern Break Wall
8
7
6
9
5
11
Beach
bour
10
4
13
3
14
12
Gallows
15
12
Coffs Coast Camels

Attachment 3: Swept Path Assessment

BITZIOS consulting

REVISIONS

Issue	Revisions/Descriptions	Drawn	Date
001	Version 1	J.W-G	21/08/20

Scale @ A3 0 5 10 15 20 25 1:500

Project
Coffs Harbour Boat Ramp Upgrade

Title
Boat & Trailer Swept Path

CONCEPT ONLY

Project Number	Date
P4071	21/08/20

Sheet Number	Issue
1	001

BITZIOS consulting

REVISIONS

Issue	Revisions/Descriptions	Drawn	Date
001	Version 1	J.W-G	21/08/20

Scale @ A3 0 5 10 15 20 25 1:500

Project
Coffs Harbour Boat Ramp Upgrade

Title
Boat & Trailer Swept Path

CONCEPT ONLY

Project Number
P4071

Date
21/08/20

Sheet Number
2

Issue
001

BITZIOS consulting

REVISIONS

Issue	Revisions/Descriptions	Drawn	Date
001	Version 1	J.W-G	21/08/20

Scale @ A3 0 5 10 15 20 25 1:500

Project
Coffs Harbour Boat Ramp Upgrade

Title
Boat & Trailer Swept Path

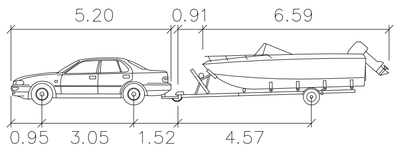
CONCEPT ONLY

Project Number
P4071

Date
21/08/20

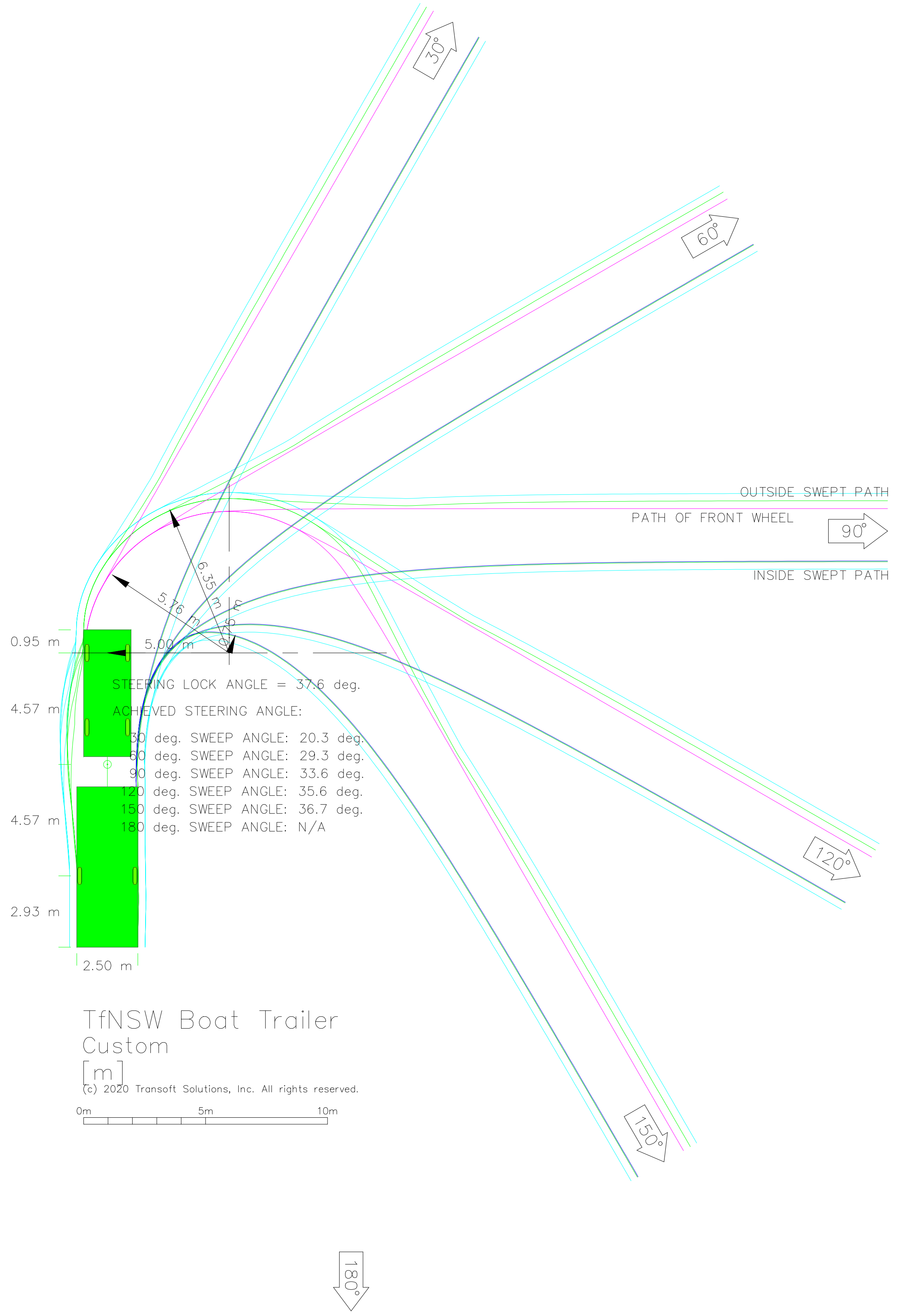
Sheet Number
3

Issue
001



TfNSW Boat Trailer

	meters
Car Width	: 1.94
Trailer Width	: 2.50
Car Track	: 1.84
Trailer Track	: 2.44
Lock to Lock Time	: 6.0
Steering Angle	: 37.6
Articulating Angle	: 70.0



BITZIOS consulting

REVISIONS

Issue	Revisions/Descriptions	Drawn	Date
001	Version 1	J.W-G	21/08/20

Scale @ A3 1:250

Project
Coffs Harbour Boat Ramp Upgrade

Title
Vehicle Profile

CONCEPT ONLY

Project Number	Date
P4071	21/08/20
Sheet Number	Issue
4	001

Attachment 4: Traffic Surveys

Northbound

29/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	0	0	0	0	-	-	0000
0015	0	0	0	0	-	-	0015
0030	0	0	0	0	-	-	0030
0045	0	0	0	0	-	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	0	0	0	0	-	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	1	1	0	0	47.5	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	1	1	0	0	44.9	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	0	0	0	0	-	-	0445
0500	0	0	0	0	-	-	0500
0515	0	0	0	0	-	-	0515
0530	2	2	0	0	47.8	-	0530
0545	3	2	1	0	42.9	-	0545
0600	3	3	0	0	34.2	-	0600
0615	4	4	0	0	38.1	-	0615
0630	10	8	2	0	40.6	-	0630
0645	6	6	0	0	35.3	-	0645
0700	8	8	0	0	35.1	-	0700
0715	12	9	2	1	37	48.8	0715
0730	6	6	0	0	34.2	-	0730
0745	9	9	0	0	38.5	-	0745
0800	6	6	0	0	39.9	-	0800
0815	10	10	0	0	36.4	-	0815
0830	11	11	0	0	35.4	43.5	0830
0845	13	11	2	0	45.4	51.9	0845
0900	12	11	0	1	35.6	44.8	0900
0915	24	22	2	0	37	41.7	0915
0930	21	21	0	0	38.5	44.6	0930
0945	12	11	1	0	37.7	50	0945
1000	22	22	0	0	39.4	43.9	1000
1015	21	20	1	0	37.1	47.5	1015
1030	28	26	2	0	36.5	43.4	1030
1045	24	20	4	0	37.7	44.8	1045
1100	28	26	2	0	37.2	41.7	1100
1115	23	23	0	0	35.3	43.7	1115
1130	31	28	3	0	37.3	43.3	1130
1145	11	9	2	0	37	50.1	1145
1200	25	22	3	0	35.9	45.7	1200
1215	20	16	4	0	40	47.3	1215
1230	25	24	1	0	37.3	48.3	1230
1245	29	28	1	0	38.8	46.8	1245
1300	19	19	0	0	39.9	48.2	1300
1315	26	26	0	0	38.3	44.6	1315
1330	28	26	2	0	37	42.2	1330
1345	29	29	0	0	40.8	47.6	1345
1400	23	22	1	0	39.2	44.4	1400
1415	19	18	1	0	40.4	47.9	1415

1430	16	16	0	0	36.5	43.6
1445	29	29	0	0	40.1	46
1500	21	20	1	0	39.2	54
1515	24	23	1	0	37.5	48.6
1530	24	23	1	0	38.6	47.1
1545	22	21	1	0	38.1	46
1600	26	26	0	0	39	49.1
1615	18	17	1	0	40.2	48.2
1630	23	22	1	0	40	49.3
1645	38	38	0	0	41.2	51.2
1700	27	26	1	0	37.9	44
1715	28	26	2	0	39.6	48.6
1730	18	17	1	0	43.3	54
1745	19	18	1	0	46.2	53.8
1800	17	17	0	0	44.5	52.1
1815	6	6	0	0	48	-
1830	8	8	0	0	46.4	-
1845	6	6	0	0	49.1	-
1900	9	9	0	0	45.2	-
1915	8	7	1	0	41.7	-
1930	6	6	0	0	38	-
1945	5	5	0	0	47.5	-
2000	7	7	0	0	46.9	-
2015	9	9	0	0	46.5	-
2030	5	5	0	0	48.1	-
2045	3	3	0	0	48	-
2100	3	3	0	0	52.1	-
2115	4	4	0	0	58.8	-
2130	2	2	0	0	47.6	-
2145	6	6	0	0	46.3	-
2200	3	3	0	0	46.3	-
2215	8	7	1	0	42.2	-
2230	2	2	0	0	46.3	-
2245	0	0	0	0	-	-
2300	3	3	0	0	53.2	-
2315	3	3	0	0	60	-
2330	2	2	0	0	62.8	-
2345	2	2	0	0	55.2	-
07-09	**75**	**70**	**4**	**1**	**38.1**	**46.1**
09-16	**636**	**601**	**34**	**1**	**38**	**45.2**
16-18	**197**	**190**	**7**	**0**	**40.7**	**49.3**
00-00	**1065**	**1013**	**50**	**2**	**39.6**	**47.7**

1430
1445
1500
1515
1530
1545
1600
1615
1630
1645
1700
1715
1730
1745
1800
1815
1830
1845
1900
1915
1930
1945
2000
2015
2030
2045
2100
2115
2130
2145
2200
2215
2230
2245
2300
2315
2330
2345
07-09
09-16
16-18
00-00

Southbound

TDC
Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	42.1	-
1	1	0	0	51.1	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	58	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
3	3	0	0	50.6	-
7	6	1	0	45.8	-
10	9	0	1	39.3	-
4	4	0	0	48	-
8	6	2	0	41.3	-
8	7	1	0	40.4	-
6	6	0	0	35.1	-
10	8	1	1	44.8	-
8	8	0	0	37.3	-
7	6	1	0	48.4	-
6	5	1	0	41.6	-
15	12	2	1	46.3	51.7
10	10	0	0	42.1	-
18	14	2	2	40.1	48.8
20	18	2	0	43.3	51
29	27	1	1	42.1	48.9
24	24	0	0	42.8	50
19	18	1	0	43.8	56
29	29	0	0	39.3	48.1
20	16	4	0	41.2	49.1
23	22	1	0	40	48.1
29	27	2	0	39	47.9
18	17	1	0	43	48.1
26	24	2	0	44.8	50.7
24	20	4	0	43.2	49.2
22	21	1	0	41.1	48.6
16	12	4	0	39.3	43.5
27	25	2	0	40.6	47.8
26	23	3	0	42.6	49.9
27	21	6	0	41.4	49.8
23	20	3	0	42.8	52.8
24	23	1	0	38.1	42.8
27	25	2	0	45.1	54
27	25	2	0	43.3	49.5
22	20	2	0	41.9	46.3
27	27	0	0	45.6	56

22	19	3	0	40.4	48.8	
21	20	1	0	40.7	45.7	
19	18	1	0	43.3	52.4	
26	23	3	0	43.8	52.6	
22	20	2	0	41.3	50.7	
17	16	1	0	41.4	46.3	
21	19	2	0	45.9	54	
24	22	2	0	43.8	49.8	
36	35	1	0	45.2	55.8	
42	40	2	0	45	52.2	
26	25	1	0	42.7	51.2	
17	16	1	0	40.4	50.6	
10	9	0	1	52.5	-	
17	17	0	0	52	60.8	
9	8	1	0	49.1	-	
7	7	0	0	51.3	-	
8	7	1	0	53.4	-	
6	6	0	0	53.2	-	
9	9	0	0	43.9	-	
6	5	1	0	46.8	-	
6	6	0	0	51.7	-	
6	6	0	0	53.7	-	
8	8	0	0	51.8	-	
6	6	0	0	52.8	-	
4	3	1	0	51.3	-	
3	3	0	0	52.2	-	
3	3	0	0	52	-	
6	6	0	0	60.5	-	
5	4	1	0	58	-	
2	2	0	0	60.7	-	
3	3	0	0	46.1	-	
7	6	1	0	45.4	-	
1	0	1	0	46.7	-	
0	0	0	0	-	-	
6	6	0	0	58	-	
3	3	0	0	56.8	-	
2	2	0	0	53.6	-	
0	0	0	0	-	-	
80	**69**	**7**	**4**	**42.3**	**50.5**	
656	**600**	**55**	**1**	**42**	**49.4**	
193	**183**	**9**	**1**	**45.3**	**53.8**	
1089	**1000**	**82**	**7**	**43.7**	**51.5**	

Northbound

30/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	0	0	0	0	-	-	0000
0015	1	1	0	0	48.7	-	0015
0030	1	1	0	0	43.5	-	0030
0045	0	0	0	0	-	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	0	0	0	0	-	-	0130
0145	2	2	0	0	34.5	-	0145
0200	0	0	0	0	-	-	0200
0215	0	0	0	0	-	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	0	0	0	0	-	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	1	1	0	0	35.3	-	0445
0500	1	1	0	0	13.5	-	0500
0515	0	0	0	0	-	-	0515
0530	2	2	0	0	56.8	-	0530
0545	4	3	0	1	38.5	-	0545
0600	3	3	0	0	38.2	-	0600
0615	4	4	0	0	34.8	-	0615
0630	11	10	1	0	37.9	48.9	0630
0645	9	9	0	0	40.7	-	0645
0700	15	14	1	0	42.3	52.5	0700
0715	8	8	0	0	35.3	-	0715
0730	11	10	1	0	34.3	41.5	0730
0745	10	9	1	0	38.1	-	0745
0800	7	6	1	0	38.5	-	0800
0815	10	10	0	0	39.6	-	0815
0830	17	17	0	0	34.8	43.2	0830
0845	13	11	2	0	35.9	41.7	0845
0900	18	14	4	0	40.6	45.7	0900
0915	23	22	1	0	38.7	46.8	0915
0930	16	16	0	0	36.9	45.5	0930
0945	24	23	1	0	33.9	40.5	0945
1000	14	13	1	0	38.2	44.9	1000
1015	29	27	2	0	37.8	45.5	1015
1030	22	21	1	0	38.4	46.9	1030
1045	15	14	1	0	35.8	43.4	1045
1100	28	28	0	0	37	43.8	1100
1115	33	33	0	0	36	45.1	1115
1130	19	19	0	0	38.4	45.9	1130
1145	25	23	2	0	34.7	39.6	1145
1200	18	18	0	0	39.2	51.8	1200
1215	25	22	3	0	36.9	46.3	1215
1230	23	21	2	0	39.3	46.5	1230
1245	16	16	0	0	34.5	43.8	1245
1300	22	20	2	0	34.4	42.3	1300
1315	24	22	2	0	38.5	44	1315
1330	26	25	1	0	38	44.7	1330
1345	20	20	0	0	41.7	50.3	1345
1400	19	19	0	0	39.6	49.5	1400
1415	17	17	0	0	40	45.3	1415

1430	27	27	0	0	41.2	46.4	1430
1445	30	29	1	0	37	43.2	1445
1500	19	19	0	0	36.8	46.8	1500
1515	18	17	1	0	38.9	45.4	1515
1530	20	20	0	0	39.8	51.9	1530
1545	13	13	0	0	45	51.1	1545
1600	22	22	0	0	39.5	46.4	1600
1615	17	16	1	0	38.7	50	1615
1630	19	18	1	0	42.7	50.4	1630
1645	27	26	1	0	38.8	45.4	1645
1700	22	22	0	0	40.6	48.8	1700
1715	25	25	0	0	36.4	43.1	1715
1730	16	15	1	0	41.5	48	1730
1745	16	16	0	0	39.5	50.2	1745
1800	12	11	1	0	38.5	47.3	1800
1815	9	8	1	0	47.1	-	1815
1830	7	6	1	0	48.5	-	1830
1845	4	4	0	0	47.6	-	1845
1900	8	8	0	0	39	-	1900
1915	4	4	0	0	42.5	-	1915
1930	6	6	0	0	44.6	-	1930
1945	9	9	0	0	46.8	-	1945
2000	10	9	1	0	47.6	-	2000
2015	1	0	1	0	33.5	-	2015
2030	4	3	1	0	42.6	-	2030
2045	5	5	0	0	49.4	-	2045
2100	7	6	1	0	48.7	-	2100
2115	4	4	0	0	40.6	-	2115
2130	7	7	0	0	51.4	-	2130
2145	5	5	0	0	47.6	-	2145
2200	3	3	0	0	51.7	-	2200
2215	3	3	0	0	40.5	-	2215
2230	7	7	0	0	46.3	-	2230
2245	2	2	0	0	53.4	-	2245
2300	4	4	0	0	49	-	2300
2315	0	0	0	0	-	-	2315
2330	0	0	0	0	-	-	2330
2345	2	2	0	0	57.5	-	2345
07-09	**91**	**85**	**6**	**0**	**37.4**	**45**	**07-09**
09-16	**603**	**578**	**25**	**0**	**37.9**	**45.5**	**09-16**
16-18	**164**	**160**	**4**	**0**	**39.5**	**47.6**	**16-18**
00-00	**1020**	**976**	**43**	**1**	**39.1**	**47.3**	**00-00**

Southbound

TDC
Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	41.9	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	38.3	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	21.8	-
2	2	0	0	64.1	-
1	1	0	0	31.4	-
0	0	0	0	-	-
1	1	0	0	24.5	-
0	0	0	0	-	-
1	1	0	0	44.6	-
7	5	1	1	47	-
6	6	0	0	46.1	-
9	9	0	0	41.1	-
10	8	1	1	41.1	-
10	8	2	0	41.5	-
9	6	3	0	37	-
10	7	3	0	39	-
11	11	0	0	44.8	54
13	11	2	0	47.1	56.1
7	6	1	0	43.5	-
12	9	3	0	44.4	54.3
18	16	2	0	44	52
15	11	4	0	43.7	53.1
19	17	2	0	43.4	49
26	22	4	0	38.1	46.4
17	17	0	0	40.1	46.6
23	20	3	0	42.4	49.5
17	15	2	0	40.6	47.7
28	26	2	0	43.8	49
22	20	2	0	42.5	49.6
15	14	1	0	45.1	52.1
25	22	3	0	40.1	44.8
32	31	1	0	42	47.3
21	21	0	0	48.9	64.2
25	20	5	0	39.1	44
24	23	1	0	42	52.2
24	20	4	0	41	49.3
23	22	1	0	38.9	45.3
21	20	1	0	40.2	47.6
17	15	2	0	45	51.8
24	22	2	0	41.9	49.5
21	20	1	0	44.1	53.9
14	11	3	0	44.9	53.2
27	25	2	0	42.8	49.8
19	16	3	0	44.3	49.9

29	26	3	0	42.8	49.1	
24	23	1	0	42.4	49.9	
21	20	1	0	41.2	53	
16	15	1	0	45.4	54.7	
21	21	0	0	45.9	54.4	
20	19	1	0	44.3	50.5	
18	18	0	0	43.8	50.1	
18	14	4	0	44.4	50.4	
22	20	2	0	39.9	49.2	
24	23	1	0	43.8	50.5	
23	21	2	0	44.8	51.7	
17	17	0	0	44.6	53.7	
13	11	2	0	44.8	53.2	
15	14	1	0	49.6	67.4	
9	8	1	0	46.1	-	
9	7	2	0	48.4	-	
8	8	0	0	49.5	-	
2	2	0	0	41.7	-	
5	4	1	0	45.2	-	
7	6	1	0	46.7	-	
6	6	0	0	56.9	-	
11	10	1	0	49	60.7	
6	5	1	0	50.3	-	
1	1	0	0	57.3	-	
9	9	0	0	52.2	-	
4	4	0	0	51.4	-	
6	5	1	0	47.6	-	
7	6	1	0	59.7	-	
5	5	0	0	51.9	-	
4	4	0	0	51.9	-	
2	2	0	0	49.3	-	
4	3	1	0	42.8	-	
7	6	1	0	49.8	-	
1	1	0	0	49.6	-	
1	1	0	0	58.7	-	
1	1	0	0	40	-	
0	0	0	0	-	-	
1	1	0	0	54.8	-	
95	**77**	**18**	**0**	**43.3**	**52.4**	
615	**563**	**52**	**0**	**42.5**	**49.7**	
150	**138**	**12**	**0**	**44.2**	**51.1**	
1026	**927**	**97**	**2**	**43.6**	**51.8**	

Northbound

31/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	1	1	0	0	51	-	0000
0015	0	0	0	0	-	-	0015
0030	0	0	0	0	-	-	0030
0045	2	2	0	0	40.8	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	0	0	0	0	-	-	0130
0145	0	0	0	0	-	-	0145
0200	1	1	0	0	44.6	-	0200
0215	1	1	0	0	49	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	1	1	0	0	48	-	0300
0315	0	0	0	0	-	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	0	0	0	0	-	-	0445
0500	0	0	0	0	-	-	0500
0515	1	1	0	0	38	-	0515
0530	2	2	0	0	52.4	-	0530
0545	3	2	1	0	35.2	-	0545
0600	2	2	0	0	36.6	-	0600
0615	5	4	1	0	40.5	-	0615
0630	10	10	0	0	36	-	0630
0645	11	10	1	0	34	43.9	0645
0700	9	9	0	0	38.6	-	0700
0715	13	12	1	0	31.1	39.1	0715
0730	11	10	1	0	36.3	43.4	0730
0745	9	9	0	0	34.8	-	0745
0800	15	15	0	0	38.7	46.2	0800
0815	12	10	2	0	39.2	44.4	0815
0830	11	10	1	0	37.2	45.3	0830
0845	14	12	2	0	36.8	41.9	0845
0900	16	16	0	0	35.8	44.5	0900
0915	18	17	1	0	37.8	45.1	0915
0930	18	18	0	0	35.3	41.9	0930
0945	19	19	0	0	41	49.3	0945
1000	17	17	0	0	37.4	43.2	1000
1015	26	24	2	0	38.4	48.3	1015
1030	30	29	1	0	38.9	45.2	1030
1045	24	24	0	0	38.6	46.3	1045
1100	23	22	1	0	38.6	44.2	1100
1115	22	22	0	0	36	41.1	1115
1130	25	22	3	0	37.4	44.6	1130
1145	16	14	2	0	38.5	47.8	1145
1200	15	15	0	0	35.5	42.9	1200
1215	21	21	0	0	38.3	51	1215
1230	21	21	0	0	35.1	46.2	1230
1245	14	13	1	0	41.4	50.1	1245
1300	17	17	0	0	35.2	41.4	1300
1315	20	19	1	0	38.9	46.6	1315
1330	24	23	1	0	36.6	43.5	1330
1345	24	24	0	0	36.7	44.2	1345
1400	24	22	2	0	42.8	52.2	1400
1415	22	22	0	0	39.5	47.2	1415

1430	19	18	1	0	38.9	49	1430
1445	18	17	1	0	35.1	44.3	1445
1500	10	10	0	0	36.9	-	1500
1515	16	15	1	0	37.8	44.7	1515
1530	20	19	1	0	39.6	49.8	1530
1545	17	16	1	0	37.2	50.4	1545
1600	14	14	0	0	39.4	49.9	1600
1615	21	18	3	0	38	42.6	1615
1630	19	19	0	0	41.5	48.4	1630
1645	18	18	0	0	40.1	45.3	1645
1700	21	21	0	0	39.2	45.2	1700
1715	22	21	1	0	39.3	49.5	1715
1730	18	17	1	0	40.1	51.9	1730
1745	7	7	0	0	38.8	-	1745
1800	7	7	0	0	52	-	1800
1815	7	7	0	0	49.4	-	1815
1830	6	5	1	0	42.6	-	1830
1845	7	6	1	0	45	-	1845
1900	8	8	0	0	41.1	-	1900
1915	10	7	3	0	41	-	1915
1930	8	8	0	0	38.9	-	1930
1945	3	2	1	0	55.4	-	1945
2000	7	7	0	0	42.6	-	2000
2015	3	3	0	0	44	-	2015
2030	12	11	1	0	40.2	47.7	2030
2045	10	10	0	0	46.5	-	2045
2100	11	11	0	0	44.7	52.2	2100
2115	9	8	1	0	43.6	-	2115
2130	3	3	0	0	35.4	-	2130
2145	6	6	0	0	46	-	2145
2200	8	8	0	0	49.2	-	2200
2215	5	5	0	0	45	-	2215
2230	3	3	0	0	48.7	-	2230
2245	0	0	0	0	-	-	2245
2300	4	4	0	0	43.5	-	2300
2315	2	2	0	0	41.4	-	2315
2330	2	2	0	0	44.8	-	2330
2345	2	2	0	0	58.8	-	2345
07-09	**94**	**87**	**7**	**0**	**36.6**	**42.8**	**07-09**
09-16	**556**	**536**	**20**	**0**	**37.9**	**45.8**	**09-16**
16-18	**140**	**135**	**5**	**0**	**39.6**	**47**	**16-18**
00-00	**973**	**930**	**43**	**0**	**39**	**47**	**00-00**

Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
1	1	0	0	56.9	-
0	0	0	0	-	-
1	1	0	0	38.4	-
1	1	0	0	56.6	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	81.1	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	51	-
0	0	0	0	-	-
1	1	0	0	56.1	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	57	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	41.9	-
5	4	1	0	44.2	-
6	5	1	0	38.3	-
7	6	1	0	42.9	-
7	7	0	0	44.8	-
7	6	1	0	41.2	-
12	10	2	0	41.1	53.4
5	5	0	0	41.9	-
9	8	1	0	39.1	-
14	11	3	0	46.8	57.6
6	3	3	0	42.6	-
11	10	1	0	45	57.4
12	10	2	0	48.1	59.3
18	17	1	0	44.2	56.1
15	13	2	0	39.6	50
20	17	3	0	43.9	51.8
21	21	0	0	41.2	49.1
13	11	2	0	40.9	45.7
18	18	0	0	42.8	49.8
19	18	1	0	40.3	48.2
32	29	3	0	43.2	48.5
33	33	0	0	40.7	46.9
15	14	1	0	43.3	52.5
19	18	1	0	43.5	47.7
26	24	2	0	41.2	48.4
22	17	5	0	42.1	50.5
18	16	2	0	43.4	48.9
20	20	0	0	44	50.4
25	24	1	0	41.5	50.6
14	11	3	0	39.5	49.3
9	8	1	0	43.3	-
24	22	2	0	42.1	48.3
14	14	0	0	44.3	53.2
27	26	1	0	41.9	48.6
25	24	1	0	45.1	53.7
24	22	2	0	44.6	52.4
19	16	3	0	48	52.7

19	16	3	0	41	48.8	
13	12	1	0	46.3	54.2	
14	14	0	0	42.3	48.8	
20	18	2	0	42.2	46.8	
14	13	1	0	44.8	51	
15	15	0	0	37.5	50.9	
17	17	0	0	41.4	49.4	
23	19	4	0	44.1	57.3	
17	16	1	0	41.7	48.4	
28	27	1	0	44.7	53.6	
21	21	0	0	43.7	51.9	
13	11	2	0	43.7	50.5	
9	8	1	0	50.3	-	
8	8	0	0	49.8	-	
10	10	0	0	49.1	-	
10	9	1	0	50.5	-	
7	6	1	0	43.3	-	
6	5	1	0	48.6	-	
7	5	2	0	47	-	
5	5	0	0	53.5	-	
9	8	1	0	46.4	-	
5	3	2	0	45.7	-	
6	5	1	0	49.7	-	
7	7	0	0	43.5	-	
14	13	1	0	49.7	62.6	
4	4	0	0	51.8	-	
15	15	0	0	49.3	58.1	
8	7	1	0	47.1	-	
3	3	0	0	48.7	-	
3	3	0	0	54.2	-	
9	9	0	0	51.2	-	
3	3	0	0	47.6	-	
1	1	0	0	55.2	-	
0	0	0	0	-	-	
6	5	1	0	49.1	-	
1	1	0	0	43.1	-	
4	4	0	0	57.3	-	
2	2	0	0	56.5	-	
90	**77**	**13**	**0**	**43.7**	**52.8**	
552	**511**	**41**	**0**	**42.6**	**49.5**	
136	**127**	**9**	**0**	**44.3**	**53.4**	
977	**896**	**81**	**0**	**44**	**51.9**	

Northbound

1/08/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	0	0	0	0	-	-	0000
0015	4	4	0	0	51.8	-	0015
0030	0	0	0	0	-	-	0030
0045	1	1	0	0	56.6	-	0045
0100	3	3	0	0	59.7	-	0100
0115	1	1	0	0	69	-	0115
0130	2	2	0	0	51.7	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	1	0	1	0	46.8	-	0215
0230	1	1	0	0	47.2	-	0230
0245	1	1	0	0	50.3	-	0245
0300	1	1	0	0	33.9	-	0300
0315	0	0	0	0	-	-	0315
0330	1	1	0	0	31	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	0	0	0	0	-	-	0445
0500	1	1	0	0	15.9	-	0500
0515	0	0	0	0	-	-	0515
0530	1	1	0	0	41.8	-	0530
0545	1	1	0	0	36	-	0545
0600	5	4	1	0	42.1	-	0600
0615	4	3	1	0	30.9	-	0615
0630	9	9	0	0	42.5	-	0630
0645	5	4	1	0	43.3	-	0645
0700	8	8	0	0	40.9	-	0700
0715	3	3	0	0	34.7	-	0715
0730	8	6	2	0	39.6	-	0730
0745	12	12	0	0	37.1	43.4	0745
0800	8	6	2	0	36	-	0800
0815	9	7	2	0	37.9	-	0815
0830	16	14	2	0	38.8	51.1	0830
0845	16	15	1	0	32.4	38.3	0845
0900	24	22	2	0	39.2	47.5	0900
0915	12	11	1	0	35.1	45.2	0915
0930	35	34	1	0	38.2	46.3	0930
0945	30	27	3	0	38.5	46.7	0945
1000	30	28	2	0	37.7	48.8	1000
1015	24	21	3	0	35.2	43.9	1015
1030	28	27	1	0	37.3	44.8	1030
1045	30	26	4	0	36.5	43.9	1045
1100	31	31	0	0	36.3	42.3	1100
1115	35	33	2	0	39.1	43.5	1115
1130	49	47	1	1	37.8	42.6	1130
1145	32	32	0	0	37.4	42.9	1145
1200	28	28	0	0	35	45.6	1200
1215	24	23	1	0	38	45.6	1215
1230	30	28	2	0	36.8	45	1230
1245	49	47	2	0	36.5	42.8	1245
1300	31	31	0	0	34.8	45.2	1300
1315	32	31	1	0	37.2	44.1	1315
1330	35	35	0	0	38.1	45.2	1330
1345	30	27	3	0	37.6	51.5	1345
1400	35	32	3	0	36.3	40	1400
1415	37	35	2	0	37.3	46	1415

1430	33	32	1	0	39.3	43.3	1430
1445	35	35	0	0	41.1	53.4	1445
1500	31	30	1	0	37.5	44.1	1500
1515	37	35	2	0	38.1	43.9	1515
1530	26	24	2	0	36.5	44.9	1530
1545	39	37	2	0	40.8	49.9	1545
1600	29	26	3	0	36.4	43	1600
1615	37	36	1	0	37	43.4	1615
1630	19	17	2	0	41	50.9	1630
1645	31	30	1	0	38.5	48.6	1645
1700	30	28	2	0	37.4	44.5	1700
1715	34	29	4	1	34.8	42.2	1715
1730	22	21	1	0	38.9	48.2	1730
1745	17	16	1	0	38.4	44.1	1745
1800	10	10	0	0	42.8	-	1800
1815	11	11	0	0	44.1	55.8	1815
1830	6	6	0	0	40.6	-	1830
1845	7	7	0	0	34.5	-	1845
1900	5	5	0	0	38.3	-	1900
1915	6	6	0	0	43.1	-	1915
1930	5	4	1	0	41.3	-	1930
1945	6	6	0	0	44.4	-	1945
2000	6	6	0	0	40	-	2000
2015	8	7	1	0	41.2	-	2015
2030	8	7	1	0	46.8	-	2030
2045	8	8	0	0	41.2	-	2045
2100	4	3	1	0	34.6	-	2100
2115	4	3	1	0	41.8	-	2115
2130	3	3	0	0	39.8	-	2130
2145	4	4	0	0	47.4	-	2145
2200	6	6	0	0	37	-	2200
2215	2	2	0	0	36.5	-	2215
2230	2	2	0	0	44.2	-	2230
2245	2	2	0	0	52.3	-	2245
2300	3	3	0	0	56.7	-	2300
2315	4	4	0	0	41.8	-	2315
2330	2	2	0	0	21.7	-	2330
2345	2	2	0	0	41.6	-	2345
07-09	**80**	**71**	**9**	**0**	**37**	**45.5**	**07-09**
09-16	**892**	**849**	**42**	**1**	**37.6**	**44.8**	**09-16**
16-18	**219**	**203**	**15**	**1**	**37.5**	**45.2**	**16-18**
00-00	**1357**	**1280**	**75**	**2**	**38.1**	**46.1**	**00-00**

Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
1	1	0	0	79.2	-
4	4	0	0	60	-
0	0	0	0	-	-
1	1	0	0	66.5	-
1	0	1	0	56.8	-
2	2	0	0	47.6	-
1	1	0	0	59	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	52.1	-
1	1	0	0	38.4	-
1	1	0	0	35.2	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	52.4	-
0	0	0	0	-	-
1	1	0	0	25.7	-
2	2	0	0	61.4	-
2	2	0	0	44.4	-
3	2	1	0	41.2	-
11	8	2	1	34.5	46.4
7	6	1	0	42.5	-
6	5	1	0	43.8	-
4	4	0	0	48.3	-
6	6	0	0	44.5	-
6	4	2	0	48	-
8	7	1	0	41.4	-
14	11	2	1	39.9	48.7
12	10	2	0	42.2	49.7
12	7	5	0	42.3	54.5
15	13	2	0	42.7	47.6
26	23	3	0	42.8	47.7
25	22	3	0	38.8	45.8
14	14	0	0	44.9	51.6
32	28	4	0	40.7	49.1
34	29	5	0	42	48.3
30	26	4	0	43	49.7
31	27	4	0	41.3	49.7
26	23	3	0	41.7	47
28	24	4	0	41.7	47.9
35	31	4	0	41.7	50
45	43	2	0	41.9	52.4
34	33	1	0	38.8	46.4
37	33	4	0	39.7	49.1
33	29	4	0	40	46.7
33	31	2	0	40.7	48.6
37	31	6	0	39.4	46.2
40	38	2	0	38.5	45.1
29	29	0	0	40.6	49.9
28	28	0	0	42.6	49.1
33	28	5	0	43.5	48.7
33	26	7	0	38.1	45.9
42	39	3	0	40.3	46.8
37	34	3	0	42.2	50.4

36	34	2	0	39.3	45.4	
37	34	3	0	41.5	50.7	
32	30	2	0	42.6	50.3	
38	35	3	0	41	51.2	
25	23	2	0	38.9	46.1	
33	29	4	0	42.2	49.9	
32	28	4	0	40.2	48	
27	26	1	0	40.5	47.7	
33	29	4	0	43.8	51.7	
24	23	1	0	43.5	51.6	
32	29	2	1	46.2	55.1	
22	19	3	0	41.1	46.2	
15	15	0	0	45.8	56.6	
9	9	0	0	41.9	-	
8	6	2	0	51.5	-	
6	6	0	0	48.1	-	
4	4	0	0	50.8	-	
7	7	0	0	43.1	-	
4	4	0	0	51.7	-	
5	5	0	0	36.7	-	
8	6	2	0	48.1	-	
8	8	0	0	46.4	-	
4	4	0	0	48	-	
8	7	1	0	50.1	-	
4	2	2	0	55.5	-	
8	8	0	0	41.9	-	
2	1	1	0	39.3	-	
4	3	1	0	45.8	-	
5	5	0	0	47.2	-	
6	6	0	0	44.3	-	
2	2	0	0	50.2	-	
4	3	1	0	42.9	-	
1	1	0	0	40.1	-	
3	3	0	0	65.6	-	
3	2	1	0	47.9	-	
3	3	0	0	36.8	-	
2	2	0	0	37.3	-	
1	1	0	0	44.7	-	
99	**81**	**17**	**1**	**42.6**	**49**	
917	**831**	**86**	**0**	**40.9**	**48.1**	
194	**178**	**15**	**1**	**42.9**	**50.5**	
1370	**1232**	**135**	**3**	**41.9**	**49.7**	

Northbound

2/08/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	2	2	0	0	37.6	-	0000
0015	1	1	0	0	63.9	-	0015
0030	0	0	0	0	-	-	0030
0045	0	0	0	0	-	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	0	0	0	0	-	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	0	0	0	0	-	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	0	0	0	0	-	-	0315
0330	1	1	0	0	34.3	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	0	0	0	0	-	-	0445
0500	1	1	0	0	48.7	-	0500
0515	0	0	0	0	-	-	0515
0530	1	1	0	0	37.5	-	0530
0545	1	1	0	0	18.3	-	0545
0600	4	4	0	0	35.1	-	0600
0615	8	6	2	0	37.5	-	0615
0630	8	7	1	0	37.7	-	0630
0645	8	8	0	0	43.5	-	0645
0700	10	10	0	0	36.7	-	0700
0715	7	7	0	0	40.4	-	0715
0730	9	9	0	0	35.8	-	0730
0745	7	5	2	0	35.7	-	0745
0800	11	11	0	0	39.5	49.2	0800
0815	10	8	2	0	37.9	-	0815
0830	11	11	0	0	41.5	47.5	0830
0845	19	17	2	0	37	43	0845
0900	25	24	1	0	33.3	40.8	0900
0915	19	19	0	0	37	45.4	0915
0930	24	23	1	0	33.3	37.8	0930
0945	33	31	2	0	36.6	41.5	0945
1000	23	20	3	0	33	39.6	1000
1015	40	38	2	0	32.9	37.6	1015
1030	46	45	1	0	34.9	42.6	1030
1045	53	48	5	0	31.4	38.1	1045
1100	57	54	3	0	35	41.2	1100
1115	48	45	3	0	34.4	39.7	1115
1130	49	47	2	0	35.3	42.7	1130
1145	39	36	3	0	34.4	41.8	1145
1200	39	37	2	0	34.6	39.1	1200
1215	44	42	2	0	36.6	41.6	1215
1230	44	41	3	0	37.9	43.6	1230
1245	42	38	4	0	36.8	44.3	1245
1300	42	39	2	1	38	45.8	1300
1315	33	33	0	0	34.9	41	1315
1330	46	43	3	0	37	44.4	1330
1345	28	24	4	0	35.9	42.1	1345
1400	38	38	0	0	36.6	43.4	1400
1415	37	33	4	0	43.7	50	1415

1430	35	33	2	0	37.9	47.2
1445	36	35	1	0	37.1	44
1500	41	39	2	0	38.4	44.3
1515	29	29	0	0	37.9	45.4
1530	37	35	2	0	37.4	43.7
1545	36	34	2	0	39.4	47.6
1600	37	34	3	0	38.2	45.2
1615	44	41	3	0	40	49.5
1630	34	33	1	0	44.1	51.1
1645	35	34	1	0	40.4	50
1700	17	17	0	0	45.9	54.4
1715	28	27	1	0	41.9	50.2
1730	28	27	1	0	42.1	48.6
1745	16	16	0	0	41.7	50.9
1800	11	10	1	0	36.7	47.6
1815	14	13	1	0	45.3	57.7
1830	3	3	0	0	50.6	-
1845	11	10	1	0	40.5	56.8
1900	7	7	0	0	46.8	-
1915	6	6	0	0	43.9	-
1930	7	7	0	0	39.2	-
1945	6	6	0	0	52.1	-
2000	2	2	0	0	43.1	-
2015	3	3	0	0	50.2	-
2030	5	5	0	0	46.9	-
2045	5	5	0	0	45.3	-
2100	7	7	0	0	45	-
2115	1	1	0	0	33.5	-
2130	3	3	0	0	44.2	-
2145	3	3	0	0	47.1	-
2200	2	2	0	0	48.6	-
2215	1	1	0	0	41.1	-
2230	1	1	0	0	39.3	-
2245	0	0	0	0	-	-
2300	2	2	0	0	49.4	-
2315	0	0	0	0	-	-
2330	0	0	0	0	-	-
2345	1	1	0	0	32.7	-
07-09	**84**	**78**	**6**	**0**	**38**	**45.7**
09-16	**1063**	**1003**	**59**	**1**	**36.1**	**42.9**
16-18	**239**	**229**	**10**	**0**	**41.4**	**49.3**
00-00	**1522**	**1440**	**81**	**1**	**37.6**	**45.4**

1430
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2315
2330
2345
07-09
09-16
16-18
00-00

Southbound

TDC
Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
2	2	0	0	50.9	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	45.7	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	51.4	-
1	1	0	0	53.3	-
4	4	0	0	44.8	-
2	2	0	0	33.3	-
10	9	1	0	43.5	-
9	8	1	0	41.9	-
10	9	1	0	40.4	-
7	6	1	0	38	-
7	6	1	0	40.7	-
8	8	0	0	36.8	-
13	13	0	0	37.1	44.4
9	8	1	0	42	-
8	7	1	0	43.8	-
12	9	3	0	40.6	47.6
15	15	0	0	41.8	53.8
24	22	1	1	39	45.5
31	26	5	0	37.7	43.3
24	23	1	0	41.2	50.4
34	30	4	0	37.5	44.6
38	31	7	0	38.1	44.2
43	40	3	0	37.5	46.9
35	30	5	0	35.7	45.7
47	41	6	0	34.8	43
51	47	4	0	35.5	44.7
58	52	6	0	36.2	41.8
41	40	1	0	35.2	43
50	43	7	0	40.4	47.3
35	30	5	0	39.1	45.8
46	43	3	0	38.4	45.7
46	43	3	0	39.6	46.2
51	44	7	0	37.8	44
46	41	5	0	39.3	43.4
34	32	2	0	39.5	45.6
36	35	1	0	38.3	45.4
27	24	3	0	36.9	43.8
31	24	7	0	41.9	50.8
36	36	0	0	40.6	47.8
37	35	2	0	41.8	47.6

36	29	7	0	39.2	46.7
36	33	3	0	38.6	45.2
39	36	3	0	41.8	49.3
24	23	1	0	41.8	48.9
39	36	3	0	44.8	52.4
40	38	2	0	43.6	49.2
29	28	1	0	43	48.6
43	41	2	0	45.6	51.3
33	30	3	0	46.4	50.5
37	36	1	0	41.8	48.9
18	18	0	0	45	54.9
19	18	1	0	45.4	52
18	17	1	0	46	56.8
5	5	0	0	48.1	-
11	9	2	0	46.1	55
13	12	1	0	51.7	59.1
10	8	2	0	49.1	-
5	5	0	0	45.2	-
5	5	0	0	46.8	-
6	6	0	0	49.9	-
7	7	0	0	50.3	-
2	2	0	0	41.5	-
2	2	0	0	50.9	-
4	4	0	0	57.2	-
8	8	0	0	43.7	-
7	6	1	0	55.4	-
4	4	0	0	56.1	-
0	0	0	0	-	-
3	3	0	0	46.6	-
2	2	0	0	51.8	-
1	1	0	0	54.5	-
0	0	0	0	-	-
2	2	0	0	49	-
1	1	0	0	52.1	-
1	1	0	0	59.2	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	50.9	-
96	**88**	**7**	**1**	**40**	**47.1**
1091	**985**	**106**	**0**	**38.9**	**45.9**
202	**193**	**9**	**0**	**44.7**	**50.3**
1532	**1399**	**132**	**1**	**40.5**	**48.2**

Northbound

3/08/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	0	0	0	0	-	-	0000
0015	0	0	0	0	-	-	0015
0030	2	2	0	0	33.6	-	0030
0045	0	0	0	0	-	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	0	0	0	0	-	-	0130
0145	0	0	0	0	-	-	0145
0200	1	1	0	0	46.1	-	0200
0215	0	0	0	0	-	-	0215
0230	2	2	0	0	48.1	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	0	0	0	0	-	-	0315
0330	3	3	0	0	61.1	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	0	0	0	0	-	-	0445
0500	0	0	0	0	-	-	0500
0515	0	0	0	0	-	-	0515
0530	1	1	0	0	32.8	-	0530
0545	3	3	0	0	35.6	-	0545
0600	4	4	0	0	31.7	-	0600
0615	4	4	0	0	37.7	-	0615
0630	13	13	0	0	39	49.7	0630
0645	14	14	0	0	36.4	46.5	0645
0700	3	3	0	0	32.8	-	0700
0715	8	7	1	0	41.6	-	0715
0730	8	7	1	0	36.6	-	0730
0745	8	8	0	0	39.8	-	0745
0800	6	5	1	0	34.1	-	0800
0815	12	12	0	0	34.7	43.6	0815
0830	7	6	1	0	36.6	-	0830
0845	13	12	1	0	34.8	43.1	0845
0900	16	15	1	0	39.9	46.4	0900
0915	7	6	1	0	42.9	-	0915
0930	25	25	0	0	34.8	43.7	0930
0945	14	13	1	0	42	48.5	0945
1000	20	19	1	0	39.3	45.5	1000
1015	22	20	2	0	34.7	43.2	1015
1030	25	24	1	0	37.7	44.7	1030
1045	25	25	0	0	40.3	46.4	1045
1100	30	28	2	0	36.1	44.7	1100
1115	26	26	0	0	37	44	1115
1130	30	30	0	0	37.1	44	1130
1145	20	20	0	0	38.6	45.3	1145
1200	18	17	1	0	35	39.8	1200
1215	18	17	1	0	36.8	46.1	1215
1230	28	28	0	0	38.2	45	1230
1245	24	23	1	0	41.4	48.8	1245
1300	21	20	1	0	38.2	45.6	1300
1315	22	19	3	0	37.2	44.1	1315
1330	19	19	0	0	38.4	47.2	1330
1345	31	29	2	0	38.5	47.2	1345
1400	21	19	2	0	37.7	48.9	1400
1415	29	29	0	0	41.3	48.8	1415

1430	13	13	0	0	42.2	49.3	1430
1445	16	14	2	0	38.8	45.9	1445
1500	20	20	0	0	40.6	50.8	1500
1515	18	18	0	0	38.8	48	1515
1530	22	22	0	0	39.8	46.5	1530
1545	22	21	1	0	45.6	55.1	1545
1600	26	25	1	0	42.8	53.2	1600
1615	25	25	0	0	43.4	50.7	1615
1630	22	21	1	0	41.5	53	1630
1645	22	21	1	0	45.5	53.6	1645
1700	27	27	0	0	41.6	51.3	1700
1715	30	28	2	0	36.8	45.6	1715
1730	22	22	0	0	37.5	46.2	1730
1745	9	9	0	0	38.1	-	1745
1800	14	14	0	0	43.8	52.3	1800
1815	6	6	0	0	50.9	-	1815
1830	7	6	1	0	40.4	-	1830
1845	5	4	1	0	41.8	-	1845
1900	7	7	0	0	49	-	1900
1915	4	4	0	0	41.8	-	1915
1930	4	3	1	0	42.7	-	1930
1945	9	9	0	0	47.8	-	1945
2000	4	4	0	0	40.4	-	2000
2015	2	2	0	0	44.8	-	2015
2030	8	8	0	0	44.2	-	2030
2045	1	1	0	0	51.9	-	2045
2100	2	2	0	0	49.1	-	2100
2115	5	5	0	0	50.5	-	2115
2130	6	6	0	0	44.8	-	2130
2145	2	2	0	0	41.9	-	2145
2200	3	3	0	0	39.9	-	2200
2215	0	0	0	0	-	-	2215
2230	2	2	0	0	37.6	-	2230
2245	2	2	0	0	37.9	-	2245
2300	0	0	0	0	-	-	2300
2315	2	2	0	0	43.9	-	2315
2330	3	3	0	0	48.9	-	2330
2345	1	1	0	0	51.8	-	2345
07-09	**65**	**60**	**5**	**0**	**36.5**	**45.6**	**07-09**
09-16	**602**	**579**	**23**	**0**	**38.7**	**46**	**09-16**
16-18	**183**	**178**	**5**	**0**	**41**	**50.8**	**16-18**
00-00	**996**	**960**	**36**	**0**	**39.6**	**47.9**	**00-00**

Southbound

TDC
Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0	0	0	0	-	-
2	2	0	0	37.1	-
2	2	0	0	63.1	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	0	1	0	43.8	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	42.3	-
0	0	0	0	-	-
8	6	2	0	43.8	-
8	8	0	0	45.8	-
7	7	0	0	47.8	-
10	9	0	1	42.8	-
9	9	0	0	34.6	-
1	1	0	0	40.5	-
10	7	3	0	42.9	-
10	9	1	0	43.1	-
5	5	0	0	37.7	-
12	11	1	0	40.9	49.7
9	9	0	0	43.8	-
13	12	1	0	46.7	52.2
20	17	3	0	43.1	55
15	12	3	0	39.4	55.4
16	16	0	0	41.5	48.7
18	17	1	0	40.8	47.1
17	15	2	0	40.1	49.5
23	20	3	0	40.1	46.5
29	27	2	0	38.8	48.9
24	22	2	0	39.9	46.6
27	25	2	0	41.6	48.1
22	21	1	0	40.4	48.4
29	27	2	0	43.6	49.1
22	22	0	0	41.9	47.5
22	20	2	0	43.4	51.4
23	23	0	0	41.9	49.9
18	18	0	0	39.5	46.3
28	25	3	0	42.5	53.5
19	17	2	0	44.8	56.2
24	23	1	0	44.6	51.3
22	19	3	0	40.4	46.2
17	17	0	0	42.5	49.4
30	26	4	0	42.3	49.5
20	16	4	0	40.8	49.2
27	27	0	0	43.4	50.5

14	14	0	0	43.9	54.2	
24	22	2	0	46.9	57.1	
14	12	2	0	44.9	52.5	
21	20	1	0	43.2	51.3	
24	21	3	0	47.2	59	
17	15	2	0	45.3	53	
23	21	2	0	43	51.2	
32	30	2	0	45.4	53.3	
27	24	3	0	43.8	53	
24	20	4	0	46.7	58.5	
22	21	1	0	39.7	44.2	
25	22	2	1	37.2	46.4	
14	14	0	0	46.7	57	
10	9	1	0	43.3	-	
8	6	2	0	44.8	-	
9	8	1	0	47.8	-	
8	5	3	0	47.6	-	
8	7	1	0	49.6	-	
7	6	1	0	51	-	
2	2	0	0	48.5	-	
5	5	0	0	53.9	-	
4	4	0	0	48	-	
6	6	0	0	52.6	-	
4	4	0	0	40.5	-	
7	7	0	0	48.2	-	
4	4	0	0	55.3	-	
2	2	0	0	54.4	-	
2	2	0	0	60.9	-	
1	1	0	0	53.1	-	
5	5	0	0	42.2	-	
1	1	0	0	54.8	-	
2	1	1	0	42.8	-	
0	0	0	0	-	-	
1	1	0	0	48.8	-	
0	0	0	0	-	-	
3	2	1	0	59.7	-	
2	2	0	0	49.4	-	
0	0	0	0	-	-	
80	**71**	**9**	**0**	**43**	**52.2**	
606	**559**	**47**	**0**	**42.3**	**49.9**	
177	**161**	**15**	**1**	**43.1**	**52.4**	
1003	**917**	**84**	**2**	**43.2**	**51.4**	

Northbound

4/08/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	1	1	0	0	42.8	-	0000
0015	1	1	0	0	44.9	-	0015
0030	0	0	0	0	-	-	0030
0045	0	0	0	0	-	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	1	1	0	0	57.3	-	0130
0145	1	0	1	0	53	-	0145
0200	0	0	0	0	-	-	0200
0215	1	1	0	0	31.2	-	0215
0230	3	3	0	0	43.8	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	0	0	0	0	-	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	0	0	0	0	-	-	0445
0500	2	2	0	0	32.5	-	0500
0515	0	0	0	0	-	-	0515
0530	1	1	0	0	42.4	-	0530
0545	2	2	0	0	37.1	-	0545
0600	4	4	0	0	37.4	-	0600
0615	2	2	0	0	39.5	-	0615
0630	12	12	0	0	44	52.5	0630
0645	11	10	1	0	38.9	51	0645
0700	7	6	1	0	29.3	-	0700
0715	5	5	0	0	37.3	-	0715
0730	6	6	0	0	33.4	-	0730
0745	8	7	1	0	39.5	-	0745
0800	8	7	1	0	45.3	-	0800
0815	19	18	1	0	34.4	40.5	0815
0830	15	15	0	0	41.7	53.7	0830
0845	15	15	0	0	38.6	51	0845
0900	12	12	0	0	35.1	43.7	0900
0915	22	21	1	0	36	45.5	0915
0930	25	23	2	0	37.3	43.3	0930
0945	22	19	2	1	39.9	49.3	0945
1000	18	14	4	0	40.3	48.3	1000
1015	19	17	2	0	35.1	42.5	1015
1030	23	23	0	0	38.2	48.2	1030
1045	18	17	1	0	40.2	47.2	1045
1100	22	21	1	0	36.2	44.1	1100
1115	22	21	1	0	35.5	45.5	1115
1130	25	24	1	0	37.8	45.1	1130
1145	20	20	0	0	38	48.8	1145
1200	25	24	1	0	38.2	47	1200
1215	23	22	1	0	39.2	49.2	1215
1230	25	24	1	0	38.2	50.6	1230
1245	23	23	0	0	40.5	46.8	1245
1300	19	19	0	0	38.6	45.9	1300
1315	17	16	1	0	37.5	45.5	1315
1330	22	21	1	0	38.3	45	1330
1345	26	25	1	0	36.4	42.8	1345
1400	19	18	1	0	38.9	44.6	1400
1415	9	9	0	0	39.6	-	1415

1430	18	17	1	0	39.1	42.6	1430
1445	26	23	3	0	37.1	46.2	1445
1500	25	24	1	0	37.7	43.9	1500
1515	17	15	2	0	37.6	42.2	1515
1530	24	23	1	0	42.3	51.8	1530
1545	21	21	0	0	47.4	60.9	1545
1600	25	22	3	0	42.4	49.2	1600
1615	30	27	3	0	38.9	48.5	1615
1630	17	15	2	0	45.6	55.6	1630
1645	26	26	0	0	44	52.5	1645
1700	27	26	1	0	41.8	52.7	1700
1715	24	23	1	0	39.7	49.4	1715
1730	26	26	0	0	42.1	50.9	1730
1745	23	22	1	0	43.1	52.6	1745
1800	14	13	1	0	37.6	47.5	1800
1815	7	6	1	0	36.8	-	1815
1830	5	5	0	0	44.5	-	1830
1845	7	7	0	0	35.9	-	1845
1900	9	9	0	0	43.5	-	1900
1915	6	6	0	0	51.2	-	1915
1930	10	9	1	0	38.1	-	1930
1945	2	2	0	0	48.9	-	1945
2000	4	4	0	0	42.3	-	2000
2015	3	3	0	0	49.5	-	2015
2030	5	5	0	0	38.1	-	2030
2045	5	5	0	0	42.7	-	2045
2100	4	4	0	0	52.4	-	2100
2115	3	2	1	0	40	-	2115
2130	10	10	0	0	51.7	-	2130
2145	6	6	0	0	42.6	-	2145
2200	2	2	0	0	32.3	-	2200
2215	1	1	0	0	38.7	-	2215
2230	3	3	0	0	45.6	-	2230
2245	0	0	0	0	-	-	2245
2300	3	3	0	0	56.1	-	2300
2315	5	4	1	0	40.9	-	2315
2330	2	2	0	0	36.4	-	2330
2345	1	1	0	0	36	-	2345
07-09	**83**	**79**	**4**	**0**	**37.7**	**47.1**	**07-09**
09-16	**587**	**556**	**30**	**1**	**38.4**	**45.8**	**09-16**
16-18	**198**	**187**	**11**	**0**	**42**	**50.8**	**16-18**
00-00	**1027**	**974**	**52**	**1**	**39.6**	**47.7**	**00-00**

Southbound

Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0	0	0	0	-	-
1	1	0	0	54.9	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
2	1	1	0	56.1	-
2	2	0	0	54.5	-
0	0	0	0	-	-
1	1	0	0	35.8	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	39.2	-
0	0	0	0	-	-
2	2	0	0	34.2	-
7	6	1	0	43.4	-
6	5	1	0	47.7	-
5	5	0	0	46.4	-
8	8	0	0	43.9	-
10	9	1	0	37.9	-
6	6	0	0	36.8	-
6	6	0	0	40.1	-
13	13	0	0	44.4	51.1
9	8	1	0	41.5	-
8	6	2	0	49.2	-
20	18	2	0	42.2	50
17	16	1	0	42.6	50.8
18	18	0	0	43.6	51.3
26	25	1	0	40.7	52.6
24	20	4	0	38.5	49.5
16	11	5	0	41.8	46.2
21	16	5	0	43.5	50.7
19	17	2	0	40.4	49
17	15	2	0	41.7	52.7
23	21	2	0	42.7	50.5
26	26	0	0	39.7	50.7
20	14	6	0	43.2	46.7
20	19	1	0	41.1	46.7
27	25	2	0	40.6	46.6
20	19	1	0	42	45.1
19	18	1	0	41.3	50.8
19	19	0	0	43.1	47.5
23	20	3	0	39.4	50.4
17	16	1	0	45	55.2
22	20	2	0	42.8	48.4
23	21	2	0	38.4	45.9
22	19	3	0	42	52.1
16	15	1	0	40.4	45.7
17	16	1	0	41.3	46.9
13	13	0	0	47.8	56.6

26	23	3	0	40.8	46.8
22	20	2	0	42.6	50.2
20	20	0	0	42.7	49.2
27	22	5	0	39.4	51.4
24	20	4	0	41.8	50.5
23	22	1	0	45.7	55.6
24	23	1	0	46.5	52.2
31	26	5	0	46.1	55.2
17	16	1	0	46.6	53.4
23	22	1	0	44.4	51.8
24	22	1	1	43.1	49.7
30	27	3	0	41.7	50.5
21	20	1	0	45.7	54
11	10	1	0	44	50.9
9	9	0	0	45.3	-
5	5	0	0	41.4	-
7	6	1	0	44.6	-
10	10	0	0	43.9	-
7	6	1	0	51.2	-
8	7	1	0	49.4	-
4	4	0	0	38.6	-
1	1	0	0	68.2	-
6	5	1	0	45.2	-
4	4	0	0	51.2	-
5	5	0	0	41.7	-
9	9	0	0	50.4	-
4	4	0	0	47.4	-
6	5	1	0	53.2	-
6	5	1	0	43.1	-
2	2	0	0	54.7	-
2	2	0	0	51.9	-
2	2	0	0	49.3	-
1	1	0	0	52.4	-
2	2	0	0	43.2	-
2	1	1	0	67	-
5	5	0	0	49.3	-
0	0	0	0	-	-
0	0	0	0	-	-
97	**91**	**6**	**0**	**42.9**	**50.3**
592	**532**	**60**	**0**	**41.6**	**49.7**
181	**166**	**14**	**1**	**44.7**	**52.1**
1023	**931**	**91**	**1**	**43**	**50.9**

Northbound

18/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	0	0	0	0	-	-	0000
0015	1	1	0	0	45.1	-	0015
0030	1	1	0	0	56.5	-	0030
0045	2	2	0	0	59.6	-	0045
0100	0	0	0	0	-	-	0100
0115	3	3	0	0	48.1	-	0115
0130	0	0	0	0	-	-	0130
0145	1	1	0	0	49	-	0145
0200	0	0	0	0	-	-	0200
0215	0	0	0	0	-	-	0215
0230	1	1	0	0	53.9	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	0	0	0	0	-	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	0	0	0	0	-	-	0445
0500	1	1	0	0	12.6	-	0500
0515	2	2	0	0	41.8	-	0515
0530	0	0	0	0	-	-	0530
0545	2	2	0	0	40.1	-	0545
0600	5	5	0	0	40.3	-	0600
0615	4	3	1	0	48.4	-	0615
0630	9	9	0	0	41.7	-	0630
0645	7	7	0	0	38.5	-	0645
0700	15	14	0	1	43.1	59	0700
0715	12	12	0	0	41	51.1	0715
0730	11	10	1	0	37	44.9	0730
0745	14	10	4	0	39.2	48.4	0745
0800	9	8	1	0	37.2	-	0800
0815	9	8	1	0	39.1	-	0815
0830	19	16	3	0	41.3	46.6	0830
0845	22	19	3	0	36.8	43.5	0845
0900	17	16	1	0	36.2	45.5	0900
0915	16	16	0	0	39.5	46.7	0915
0930	22	21	1	0	39.1	47.8	0930
0945	32	29	3	0	37.1	42.9	0945
1000	35	32	3	0	36.9	41.1	1000
1015	28	27	1	0	38	44	1015
1030	36	33	3	0	38	44.6	1030
1045	39	38	1	0	35	41.6	1045
1100	35	32	3	0	35.8	42.2	1100
1115	28	26	2	0	36.6	42.1	1115
1130	31	29	2	0	36.3	46.2	1130
1145	34	33	1	0	35.6	42.1	1145
1200	43	42	1	0	38.5	47.2	1200
1215	31	31	0	0	38	46.2	1215
1230	40	39	1	0	37.1	43.6	1230
1245	26	24	2	0	37.8	45.3	1245
1300	40	38	2	0	37.3	43	1300
1315	35	34	1	0	35.2	39.7	1315
1330	47	46	1	0	38.2	43.5	1330
1345	35	34	1	0	36.6	44.1	1345
1400	34	33	1	0	35.8	41	1400
1415	40	37	3	0	36.7	43.9	1415

1430	35	33	2	0	37	44
1445	29	28	1	0	35.9	43.7
1500	25	25	0	0	34.8	41.3
1515	39	39	0	0	36.6	42.5
1530	40	40	0	0	35.6	45.3
1545	39	39	0	0	36.6	42.1
1600	31	29	2	0	40.7	48.9
1615	32	32	0	0	39	43.6
1630	41	39	2	0	35.8	44.1
1645	31	31	0	0	36.3	41.1
1700	29	26	3	0	36.4	44.9
1715	17	16	1	0	34.6	42.6
1730	13	13	0	0	44.8	54.1
1745	15	15	0	0	45.3	59.1
1800	9	9	0	0	36.5	-
1815	4	4	0	0	44	-
1830	5	5	0	0	48.3	-
1845	3	3	0	0	36.5	-
1900	12	11	1	0	37.2	49
1915	7	7	0	0	46.2	-
1930	3	3	0	0	45.2	-
1945	6	6	0	0	40.5	-
2000	4	4	0	0	40	-
2015	7	7	0	0	51.9	-
2030	7	7	0	0	38.9	-
2045	6	6	0	0	45.5	-
2100	5	5	0	0	35.2	-
2115	3	3	0	0	41.8	-
2130	9	8	1	0	45.7	-
2145	4	4	0	0	45.9	-
2200	4	4	0	0	54.3	-
2215	5	3	2	0	42.9	-
2230	3	3	0	0	42.5	-
2245	5	5	0	0	52.2	-
2300	0	0	0	0	-	-
2315	3	2	1	0	48.5	-
2330	10	10	0	0	44.7	-
2345	4	4	0	0	44.7	-
07-09	**111**	**97**	**13**	**1**	**39.4**	**47.1**
09-16	**931**	**894**	**37**	**0**	**36.8**	**43.4**
16-18	**209**	**201**	**8**	**0**	**38.3**	**45.4**
00-00	**1418**	**1353**	**64**	**1**	**38**	**45.2**

1430
1445
1500
1515
1530
1545
1600
1615
1630
1645
1700
1715
1730
1745
1800
1815
1830
1845
1900
1915
1930
1945
2000
2015
2030
2045
2100
2115
2130
2145
2200
2215
2230
2245
2300
2315
2330
2345
07-09
09-16
16-18
00-00

Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
1	1	0	0	57.9	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	59.1	-
0	0	0	0	-	-
4	4	0	0	57.6	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	45.7	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	21.6	-
2	2	0	0	45.1	-
2	2	0	0	49.3	-
2	2	0	0	43.2	-
5	5	0	0	48.6	-
8	7	1	0	45.5	-
11	10	1	0	42.8	50.5
7	5	2	0	39.5	-
7	5	2	0	43.6	-
15	14	1	0	41.3	48
11	9	2	0	40.7	48.7
13	12	1	0	35.6	41.6
10	10	0	0	39.6	-
14	12	2	0	42.6	53
25	17	8	0	41.8	46.1
17	15	2	0	41.4	48.5
19	16	3	0	40.6	49
22	19	2	1	39.5	47.3
25	22	3	0	42.1	54.8
38	31	7	0	39	48.7
38	32	6	0	40.7	47
24	23	1	0	42.9	47.1
47	45	2	0	39.5	46
32	29	3	0	37.5	45.6
31	26	5	0	41.8	50.3
37	32	5	0	41.9	50.2
32	32	0	0	40.7	50.8
34	31	3	0	39.7	47.5
44	43	1	0	41.1	47.5
34	34	0	0	41.9	47.3
33	31	2	0	38.3	44.4
42	35	7	0	39.5	45.6
33	31	2	0	39.2	45.1
40	39	1	0	40.1	45.9
37	35	2	0	41.4	48.5
35	34	1	0	39.5	45
37	34	3	0	40.1	47.3
39	36	3	0	39.6	47.9

31	30	1	0	39.2	44.7
36	35	1	0	41.9	49.4
31	27	4	0	38	44.3
36	35	1	0	40.1	45.9
47	45	2	0	41.8	49
33	32	1	0	41	46
23	21	2	0	43.6	53.4
37	35	2	0	42.5	50.9
36	34	2	0	42.7	48.8
29	26	3	0	43.2	52.1
23	20	3	0	41.4	48.1
9	9	0	0	45.5	-
7	7	0	0	46.2	-
15	15	0	0	47.5	55.3
7	7	0	0	51.4	-
2	2	0	0	41	-
5	5	0	0	43.1	-
7	6	1	0	40.1	-
13	10	3	0	43	51.2
3	3	0	0	46	-
5	4	1	0	44.8	-
10	10	0	0	52.3	-
3	3	0	0	46.3	-
2	2	0	0	47.6	-
10	10	0	0	47.4	-
4	4	0	0	47.8	-
8	7	1	0	38.4	-
8	7	1	0	50.8	-
4	4	0	0	51.6	-
4	4	0	0	48.2	-
3	3	0	0	50.7	-
1	1	0	0	52.9	-
2	2	0	0	48.6	-
5	5	0	0	49.9	-
9	9	0	0	66	-
3	1	2	0	53.1	-
3	3	0	0	47.7	-
2	2	0	0	52.9	-
112	**94**	**18**	**0**	**40.8**	**48.3**
967	**894**	**72**	**1**	**40.3**	**46.9**
179	**167**	**12**	**0**	**43.4**	**50.9**
1427	**1311**	**115**	**1**	**41.6**	**49**

Northbound

19/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	1	1	0	0	44.3	-	0000
0015	2	2	0	0	44.7	-	0015
0030	1	1	0	0	58	-	0030
0045	1	1	0	0	42	-	0045
0100	1	1	0	0	65.3	-	0100
0115	2	2	0	0	46.7	-	0115
0130	0	0	0	0	-	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	0	0	0	0	-	-	0215
0230	0	0	0	0	-	-	0230
0245	1	1	0	0	68.9	-	0245
0300	0	0	0	0	-	-	0300
0315	0	0	0	0	-	-	0315
0330	0	0	0	0	-	-	0330
0345	1	1	0	0	42.3	-	0345
0400	1	1	0	0	69.1	-	0400
0415	1	1	0	0	37.1	-	0415
0430	0	0	0	0	-	-	0430
0445	1	1	0	0	40.6	-	0445
0500	1	1	0	0	37.7	-	0500
0515	1	1	0	0	45.1	-	0515
0530	0	0	0	0	-	-	0530
0545	1	1	0	0	37.6	-	0545
0600	3	3	0	0	39.5	-	0600
0615	3	3	0	0	37.6	-	0615
0630	4	4	0	0	40	-	0630
0645	6	6	0	0	36.8	-	0645
0700	7	6	1	0	48.5	-	0700
0715	6	6	0	0	41.7	-	0715
0730	10	9	1	0	39.7	-	0730
0745	7	7	0	0	36.4	-	0745
0800	9	9	0	0	38.2	-	0800
0815	12	11	1	0	33.6	38.4	0815
0830	18	16	2	0	38.9	47.6	0830
0845	14	13	1	0	36.9	43.3	0845
0900	19	18	1	0	34.7	43	0900
0915	18	18	0	0	35.9	45.1	0915
0930	29	29	0	0	36.8	41.9	0930
0945	33	31	2	0	37.3	46.4	0945
1000	31	29	2	0	35.2	39.8	1000
1015	28	27	1	0	36.2	42.7	1015
1030	42	38	4	0	36.4	43.8	1030
1045	42	39	3	0	36	41	1045
1100	49	45	4	0	36.3	41.8	1100
1115	33	30	3	0	33.8	41.4	1115
1130	51	50	1	0	35.8	42.9	1130
1145	53	53	0	0	34.8	39.9	1145
1200	44	40	4	0	34.9	41	1200
1215	38	36	2	0	35.1	42.6	1215
1230	39	37	2	0	34.2	42.7	1230
1245	34	33	1	0	36.5	41.8	1245
1300	33	31	2	0	37.8	46.4	1300
1315	42	40	2	0	36.2	42.9	1315
1330	35	34	1	0	37.2	45.4	1330
1345	40	39	1	0	36.2	40.5	1345
1400	42	40	2	0	37.2	44.5	1400
1415	32	32	0	0	33.9	41.6	1415

1430	34	32	2	0	36.2	42.6	1430
1445	33	33	0	0	35.8	45.2	1445
1500	34	33	1	0	36.6	43.3	1500
1515	37	36	1	0	38.2	46.5	1515
1530	42	40	2	0	35.5	44.1	1530
1545	28	26	2	0	39.4	44.2	1545
1600	28	26	2	0	38.1	45.9	1600
1615	28	28	0	0	40.4	47.9	1615
1630	30	29	1	0	38.3	44.6	1630
1645	40	39	1	0	40.6	49.7	1645
1700	32	32	0	0	40.3	47.7	1700
1715	17	17	0	0	36	45.4	1715
1730	26	26	0	0	36.5	43.9	1730
1745	7	7	0	0	42.6	-	1745
1800	9	9	0	0	46	-	1800
1815	9	9	0	0	43.9	-	1815
1830	6	5	1	0	44.5	-	1830
1845	4	4	0	0	44.4	-	1845
1900	3	3	0	0	43.6	-	1900
1915	3	3	0	0	51.3	-	1915
1930	6	6	0	0	49.2	-	1930
1945	6	6	0	0	50.6	-	1945
2000	6	5	1	0	41.2	-	2000
2015	8	8	0	0	42.8	-	2015
2030	5	5	0	0	41.9	-	2030
2045	6	5	1	0	39.8	-	2045
2100	4	4	0	0	61.1	-	2100
2115	2	2	0	0	41.5	-	2115
2130	5	4	1	0	45.2	-	2130
2145	2	2	0	0	50.6	-	2145
2200	2	2	0	0	29	-	2200
2215	1	1	0	0	54.9	-	2215
2230	3	3	0	0	50.4	-	2230
2245	2	2	0	0	44.1	-	2245
2300	1	1	0	0	48.8	-	2300
2315	0	0	0	0	-	-	2315
2330	1	1	0	0	44.1	-	2330
2345	0	0	0	0	-	-	2345
07-09	**83**	**77**	**6**	**0**	**38.6**	**46.9**	**07-09**
09-16	**1015**	**969**	**46**	**0**	**36**	**42.8**	**09-16**
16-18	**208**	**204**	**4**	**0**	**39**	**46.9**	**16-18**
00-00	**1432**	**1372**	**60**	**0**	**37.4**	**44.6**	**00-00**

Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0	0	0	0	-	-
2	2	0	0	52.7	-
1	1	0	0	75.3	-
2	2	0	0	47.7	-
1	1	0	0	67.3	-
1	1	0	0	38.8	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	61.5	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	46.2	-
1	1	0	0	51.5	-
1	1	0	0	49	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	47.4	-
1	1	0	0	56.2	-
2	2	0	0	49.5	-
5	5	0	0	46.7	-
4	4	0	0	43.3	-
1	1	0	0	47.7	-
7	7	0	0	45.8	-
3	3	0	0	44.1	-
6	3	3	0	41.8	-
9	9	0	0	46.2	-
10	9	1	0	40.1	-
11	11	0	0	42.7	51.4
15	12	3	0	37.1	44.5
12	10	2	0	38.6	49.5
25	23	2	0	40.7	49.6
17	14	3	0	40.3	50.1
24	20	4	0	36.3	46.8
31	30	1	0	38.2	44.9
37	36	1	0	41.6	46.8
33	29	4	0	41	48.7
29	28	1	0	39	47.5
32	31	1	0	40.8	46.4
48	42	6	0	38.8	46
49	45	4	0	38.9	45.8
52	45	7	0	38.8	44.5
39	36	3	0	39	45.2
43	36	7	0	39.7	45.9
48	41	7	0	39.1	46.5
36	30	6	0	39.2	45.9
38	35	3	0	40.4	47.2
35	32	3	0	37.3	46.7
31	30	1	0	43.1	51.2
34	32	2	0	41.2	49.1
52	48	4	0	40.2	48.4
36	32	4	0	41.9	49.2
45	41	4	0	38.4	45.2
33	29	4	0	39.6	49.4
34	32	2	0	35.4	44.1

38	35	3	0	36.1	43.3	
30	30	0	0	40.3	50	
42	38	4	0	42.3	49.4	
37	35	2	0	40	46.2	
30	24	6	0	38.1	48.3	
19	19	0	0	39.8	45.2	
32	31	1	0	42.5	50.4	
30	29	1	0	40.6	47.2	
33	32	1	0	42.1	49.6	
27	26	1	0	40.3	48.6	
18	17	1	0	42.9	53.3	
14	14	0	0	41.4	52.2	
19	19	0	0	41.7	52.2	
8	8	0	0	47.3	-	
6	6	0	0	57.4	-	
8	8	0	0	50	-	
3	2	1	0	55.3	-	
5	5	0	0	50.4	-	
3	3	0	0	55	-	
6	6	0	0	52.1	-	
4	4	0	0	65.7	-	
4	4	0	0	51.5	-	
8	6	2	0	48.4	-	
6	6	0	0	50.6	-	
6	6	0	0	52.4	-	
5	4	1	0	49.2	-	
2	2	0	0	35.6	-	
4	4	0	0	40.8	-	
5	4	1	0	46.6	-	
2	2	0	0	64.8	-	
2	2	0	0	38.4	-	
1	1	0	0	59.8	-	
1	1	0	0	41.9	-	
1	1	0	0	39.3	-	
1	1	0	0	58.9	-	
0	0	0	0	-	-	
1	1	0	0	51.6	-	
0	0	0	0	-	-	
105	**91**	**14**	**0**	**40.5**	**49.5**	
1035	**941**	**94**	**0**	**39.5**	**46.4**	
181	**176**	**5**	**0**	**41.9**	**50**	
1441	**1323**	**118**	**0**	**40.7**	**48.8**	

Northbound

20/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	0	0	0	0	-	-	0000
0015	0	0	0	0	-	-	0015
0030	0	0	0	0	-	-	0030
0045	2	2	0	0	57.1	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	0	0	0	0	-	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	0	0	0	0	-	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	0	0	0	0	-	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	1	1	0	0	20.7	-	0430
0445	0	0	0	0	-	-	0445
0500	1	1	0	0	19.7	-	0500
0515	1	1	0	0	29	-	0515
0530	0	0	0	0	-	-	0530
0545	2	2	0	0	40.8	-	0545
0600	5	5	0	0	34.3	-	0600
0615	1	1	0	0	35.9	-	0615
0630	8	8	0	0	37.9	-	0630
0645	11	10	1	0	42.7	50.4	0645
0700	6	6	0	0	46.1	-	0700
0715	9	9	0	0	38.8	-	0715
0730	10	10	0	0	40.7	-	0730
0745	11	11	0	0	40.4	49.4	0745
0800	11	9	2	0	36.6	45.3	0800
0815	7	5	1	1	39.6	-	0815
0830	12	11	1	0	37.6	45.1	0830
0845	11	9	2	0	37.5	44.1	0845
0900	13	10	3	0	39.6	46.8	0900
0915	14	12	1	1	35.2	43	0915
0930	14	10	3	1	35.6	47.7	0930
0945	22	22	0	0	38.1	47.7	0945
1000	30	27	3	0	37.4	45.1	1000
1015	16	16	0	0	37.2	44.6	1015
1030	20	19	1	0	36	41.8	1030
1045	21	21	0	0	39	44.6	1045
1100	27	26	1	0	39.6	44.2	1100
1115	34	33	1	0	35.3	44.4	1115
1130	22	21	1	0	36.4	45.2	1130
1145	17	15	2	0	37	46	1145
1200	30	28	2	0	36	43.9	1200
1215	22	20	2	0	39	47.1	1215
1230	18	17	1	0	42.5	49.5	1230
1245	26	24	2	0	39.9	43.7	1245
1300	31	28	3	0	38.8	46.8	1300
1315	34	34	0	0	39.4	44	1315
1330	30	28	2	0	42.4	49.8	1330
1345	23	21	2	0	39.7	48.5	1345
1400	31	30	1	0	37.4	41.3	1400
1415	17	16	1	0	41.1	46.6	1415

1430	23	21	2	0	39.2	45.6	1430
1445	23	21	2	0	43.1	52.6	1445
1500	24	23	1	0	39.2	44	1500
1515	21	20	1	0	40.7	48.9	1515
1530	22	22	0	0	41	53.2	1530
1545	20	18	2	0	40	48.6	1545
1600	20	19	1	0	40.8	49.8	1600
1615	19	19	0	0	42	51.7	1615
1630	31	27	4	0	41.7	52.5	1630
1645	18	17	1	0	41.6	47.3	1645
1700	19	17	2	0	44.4	50.9	1700
1715	21	21	0	0	39	48	1715
1730	23	21	2	0	40	44.3	1730
1745	14	14	0	0	42.3	51.4	1745
1800	7	7	0	0	46.2	-	1800
1815	6	6	0	0	37.6	-	1815
1830	4	4	0	0	53.6	-	1830
1845	3	2	1	0	47.1	-	1845
1900	2	2	0	0	53.3	-	1900
1915	1	1	0	0	50	-	1915
1930	1	1	0	0	35.4	-	1930
1945	4	4	0	0	55.4	-	1945
2000	4	4	0	0	34.3	-	2000
2015	7	7	0	0	40.8	-	2015
2030	7	7	0	0	54.1	-	2030
2045	5	5	0	0	51.7	-	2045
2100	4	3	1	0	42.4	-	2100
2115	3	3	0	0	45.5	-	2115
2130	7	7	0	0	48.5	-	2130
2145	3	2	1	0	48	-	2145
2200	4	4	0	0	49.1	-	2200
2215	0	0	0	0	-	-	2215
2230	0	0	0	0	-	-	2230
2245	0	0	0	0	-	-	2245
2300	2	2	0	0	61.9	-	2300
2315	0	0	0	0	-	-	2315
2330	0	0	0	0	-	-	2330
2345	1	1	0	0	47.2	-	2345
07-09	**77**	**70**	**6**	**1**	**39.2**	**47**	**07-09**
09-16	**645**	**603**	**40**	**2**	**38.8**	**45.7**	**09-16**
16-18	**165**	**155**	**10**	**0**	**41.4**	**48.6**	**16-18**
00-00	**994**	**931**	**60**	**3**	**39.9**	**47.2**	**00-00**

Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
2	2	0	0	71.7	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	32.9	-
0	0	0	0	-	-
3	3	0	0	43.1	-
1	1	0	0	32.1	-
0	0	0	0	-	-
2	2	0	0	46.7	-
3	3	0	0	45.7	-
6	6	0	0	39.3	-
5	4	0	1	39.3	-
5	5	0	0	41	-
11	10	1	0	49.4	59.4
6	6	0	0	48.4	-
10	9	1	0	43.2	-
12	11	1	0	34.3	46.6
13	12	1	0	42.5	49.2
12	11	1	0	46.4	52.9
3	3	0	0	43.8	-
13	12	1	0	40.9	44.6
15	10	5	0	47.7	55.9
23	20	2	1	38.8	50.3
14	12	1	1	38.1	46.3
27	22	5	0	41.2	50.3
17	17	0	0	42.6	48
18	17	1	0	40.1	45.7
16	16	0	0	43.7	49.7
39	35	4	0	40.1	46.6
20	20	0	0	42.4	53.5
33	31	2	0	40.9	49.4
20	19	1	0	45.1	54.2
28	26	2	0	40.9	46.9
19	15	4	0	41	45.9
25	23	2	0	40	49
16	14	2	0	42	46.4
26	23	3	0	42.1	47.1
24	22	2	0	43.6	47.2
27	25	2	0	43	49.9
37	35	2	0	43.7	50.7
28	26	2	0	44	50.6
30	27	3	0	40.2	48
26	24	2	0	40.1	46.4
18	14	4	0	39.8	48.2

27	25	2	0	44.5	51.8	
22	21	1	0	42.8	51.8	
20	20	0	0	41.6	51	
25	23	2	0	42.4	51	
17	17	0	0	45.8	53.6	
21	19	2	0	42.5	53.5	
24	23	1	0	45.4	50.5	
19	16	3	0	44.4	51.8	
19	16	3	0	42.2	53.5	
21	20	1	0	45.9	52.5	
21	18	3	0	44	52.5	
20	20	0	0	41.3	49.8	
18	16	2	0	42.2	50	
6	6	0	0	46.2	-	
7	7	0	0	44.4	-	
2	2	0	0	46.3	-	
6	6	0	0	49.9	-	
4	3	1	0	52.7	-	
3	3	0	0	45.6	-	
2	2	0	0	51.1	-	
0	0	0	0	-	-	
5	5	0	0	47.7	-	
4	4	0	0	46.6	-	
3	3	0	0	50.9	-	
8	8	0	0	54.9	-	
6	6	0	0	49.6	-	
4	3	1	0	48.6	-	
4	4	0	0	42.8	-	
4	3	1	0	58.5	-	
4	3	1	0	39.2	-	
4	4	0	0	49.1	-	
0	0	0	0	-	-	
0	0	0	0	-	-	
0	0	0	0	-	-	
2	2	0	0	54.8	-	
0	0	0	0	-	-	
0	0	0	0	-	-	
1	1	0	0	51.2	-	
84	**74**	**10**	**0**	**43.1**	**50.3**	
663	**608**	**53**	**2**	**41.9**	**49**	
148	**135**	**13**	**0**	**43.8**	**51.2**	
1007	**923**	**81**	**3**	**42.9**	**50.5**	

Northbound

21/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	0	0	0	0	-	-	0000
0015	3	3	0	0	46.5	-	0015
0030	0	0	0	0	-	-	0030
0045	3	3	0	0	52.8	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	0	0	0	0	-	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	1	1	0	0	52.9	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	0	0	0	0	-	-	0315
0330	1	0	1	0	47.8	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	1	1	0	0	43.1	-	0445
0500	0	0	0	0	-	-	0500
0515	0	0	0	0	-	-	0515
0530	0	0	0	0	-	-	0530
0545	2	2	0	0	48.1	-	0545
0600	2	2	0	0	42	-	0600
0615	0	0	0	0	-	-	0615
0630	16	15	1	0	45.3	52.2	0630
0645	14	14	0	0	43.2	56.3	0645
0700	5	5	0	0	41.8	-	0700
0715	8	8	0	0	38.5	-	0715
0730	9	8	1	0	40.1	-	0730
0745	3	3	0	0	35.9	-	0745
0800	12	12	0	0	37.4	45.5	0800
0815	12	10	2	0	37	42.5	0815
0830	11	11	0	0	41.2	50.2	0830
0845	15	13	2	0	37.2	46.7	0845
0900	14	12	2	0	39.3	45.6	0900
0915	11	8	2	1	35.8	47.8	0915
0930	26	21	5	0	37.6	42.3	0930
0945	24	22	2	0	38	43.6	0945
1000	19	18	1	0	38.1	45.5	1000
1015	14	12	2	0	35.3	42.1	1015
1030	21	20	1	0	37	44.8	1030
1045	20	19	1	0	39.4	44.2	1045
1100	22	20	2	0	37	44.3	1100
1115	15	15	0	0	37.6	51.1	1115
1130	24	24	0	0	37.7	46.7	1130
1145	36	36	0	0	38.1	44.9	1145
1200	18	17	1	0	38.8	44.5	1200
1215	25	24	1	0	36.8	41.7	1215
1230	24	23	1	0	39.7	45.5	1230
1245	24	24	0	0	38.5	44.7	1245
1300	23	22	1	0	36.5	43.6	1300
1315	16	15	1	0	41.5	56.4	1315
1330	27	27	0	0	36.8	41.4	1330
1345	31	31	0	0	35.8	41.7	1345
1400	23	21	2	0	40.8	46.6	1400
1415	17	17	0	0	41.2	49.5	1415

1430	20	19	1	0	39.2	45.9	1430
1445	21	21	0	0	36	44.1	1445
1500	25	25	0	0	40.6	48.2	1500
1515	20	20	0	0	37.5	44.1	1515
1530	28	25	3	0	38	44.4	1530
1545	20	19	1	0	41	50.4	1545
1600	14	14	0	0	37.8	46.5	1600
1615	25	22	3	0	41.5	50.9	1615
1630	19	17	2	0	42.1	49.7	1630
1645	22	21	1	0	41.4	46.2	1645
1700	16	15	1	0	37.8	44.5	1700
1715	25	24	1	0	39.4	46.7	1715
1730	14	14	0	0	41.5	50.5	1730
1745	6	6	0	0	41.6	-	1745
1800	3	3	0	0	45.5	-	1800
1815	11	10	1	0	41.8	57.4	1815
1830	3	2	1	0	41.1	-	1830
1845	4	4	0	0	40.7	-	1845
1900	6	6	0	0	40.8	-	1900
1915	6	6	0	0	40.5	-	1915
1930	4	4	0	0	44.6	-	1930
1945	4	4	0	0	37.8	-	1945
2000	3	3	0	0	40.2	-	2000
2015	5	5	0	0	42.2	-	2015
2030	6	6	0	0	43.4	-	2030
2045	6	6	0	0	50.7	-	2045
2100	3	3	0	0	40.2	-	2100
2115	4	4	0	0	52	-	2115
2130	3	2	1	0	31.3	-	2130
2145	2	2	0	0	50.3	-	2145
2200	2	2	0	0	57.7	-	2200
2215	4	4	0	0	47.8	-	2215
2230	7	7	0	0	45.1	-	2230
2245	2	1	1	0	46.8	-	2245
2300	3	3	0	0	44.4	-	2300
2315	1	1	0	0	58.3	-	2315
2330	0	0	0	0	-	-	2330
2345	0	0	0	0	-	-	2345
07-09	**75**	**70**	**5**	**0**	**38.5**	**46.7**	**07-09**
09-16	**608**	**577**	**30**	**1**	**38.2**	**44.3**	**09-16**
16-18	**141**	**133**	**8**	**0**	**40.4**	**46.6**	**16-18**
00-00	**959**	**909**	**49**	**1**	**39.4**	**46.6**	**00-00**

Southbound

TDC
Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
1	1	0	0	16.9	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	54.8	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	78.8	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	0	1	0	43.3	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
3	3	0	0	50.3	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
7	7	0	0	48.5	-
8	8	0	0	49.8	-
2	2	0	0	39.6	-
11	10	1	0	47.1	61.4
7	7	0	0	41.7	-
5	5	0	0	42.3	-
14	14	0	0	39.3	47.8
12	8	4	0	41.5	51.9
6	5	1	0	41.2	-
12	9	3	0	38.7	47.4
8	8	0	0	43.3	-
15	13	2	0	42.2	47.3
14	10	3	1	42	48.9
21	18	3	0	44	50.6
21	18	3	0	42	48.5
19	14	5	0	40.4	44.8
22	22	0	0	42	48
24	23	1	0	44.2	50.4
18	15	3	0	42.9	48.1
12	12	0	0	40.3	47.2
22	19	3	0	42	50.1
19	18	1	0	43.4	47.9
22	20	2	0	43.5	50.6
30	28	2	0	40.7	46.4
29	27	2	0	39.8	46.4
19	17	2	0	42.2	52.7
23	22	1	0	40.6	45.9
17	16	1	0	43.3	55.3
32	30	2	0	39.8	46.2
14	12	2	0	42	49.3
31	28	3	0	39.2	46.9
32	30	2	0	41.5	47.1
21	21	0	0	41.9	46.7
20	19	1	0	41.9	46.5
17	17	0	0	45.4	55.5

22	20	2	0	41.2	49.3	
15	14	1	0	43.2	50.1	
25	24	1	0	44.7	53.1	
19	19	0	0	40.2	49	
26	23	3	0	39.3	48.2	
22	22	0	0	43.4	51.7	
15	13	2	0	41.8	49.2	
23	21	2	0	45.1	52.2	
20	18	2	0	42.2	48.5	
21	16	5	0	45.5	50.9	
18	16	2	0	47.4	56.1	
19	19	0	0	44.2	59	
7	7	0	0	52.8	-	
5	5	0	0	43.5	-	
6	6	0	0	44.5	-	
8	6	2	0	45.1	-	
4	4	0	0	46.9	-	
7	7	0	0	41.7	-	
6	6	0	0	44.1	-	
7	7	0	0	39.2	-	
5	5	0	0	47.9	-	
2	2	0	0	35.3	-	
1	1	0	0	75.3	-	
5	5	0	0	46.9	-	
8	8	0	0	45.7	-	
3	3	0	0	62.9	-	
3	3	0	0	48.4	-	
6	6	0	0	57.5	-	
2	2	0	0	37.1	-	
2	2	0	0	59.1	-	
3	3	0	0	54.3	-	
2	2	0	0	54	-	
6	5	1	0	46.8	-	
1	0	1	0	36.6	-	
3	3	0	0	53.6	-	
1	1	0	0	26.7	-	
0	0	0	0	-	-	
0	0	0	0	-	-	
86	**72**	**13**	**1**	**41.2**	**47.7**	
614	**568**	**46**	**0**	**41.8**	**48.4**	
128	**115**	**13**	**0**	**44.9**	**50.9**	
962	**883**	**78**	**1**	**42.9**	**50.2**	

Northbound

22/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile		Time
0000	1	1	0	0	46.3	-		0000
0015	1	1	0	0	41.7	-		0015
0030	0	0	0	0	-	-		0030
0045	0	0	0	0	-	-		0045
0100	0	0	0	0	-	-		0100
0115	0	0	0	0	-	-		0115
0130	0	0	0	0	-	-		0130
0145	0	0	0	0	-	-		0145
0200	0	0	0	0	-	-		0200
0215	0	0	0	0	-	-		0215
0230	0	0	0	0	-	-		0230
0245	1	1	0	0	73.9	-		0245
0300	0	0	0	0	-	-		0300
0315	0	0	0	0	-	-		0315
0330	0	0	0	0	-	-		0330
0345	0	0	0	0	-	-		0345
0400	0	0	0	0	-	-		0400
0415	0	0	0	0	-	-		0415
0430	0	0	0	0	-	-		0430
0445	0	0	0	0	-	-		0445
0500	1	1	0	0	15.9	-		0500
0515	3	3	0	0	48.2	-		0515
0530	1	1	0	0	51.7	-		0530
0545	1	1	0	0	27.1	-		0545
0600	2	2	0	0	30.5	-		0600
0615	3	3	0	0	26.1	-		0615
0630	9	9	0	0	35.3	-		0630
0645	9	9	0	0	41	-		0645
0700	8	8	0	0	42.2	-		0700
0715	9	9	0	0	41.9	-		0715
0730	11	11	0	0	34.7	42.3		0730
0745	10	10	0	0	39.3	-		0745
0800	12	10	2	0	36.9	43.9		0800
0815	10	10	0	0	39.9	-		0815
0830	12	11	1	0	40.4	48.3		0830
0845	12	12	0	0	36.3	43.9		0845
0900	11	9	2	0	40.5	47.4		0900
0915	23	22	1	0	39.8	44.9		0915
0930	16	15	1	0	32.7	42.8		0930
0945	12	11	1	0	36.4	42.7		0945
1000	28	28	0	0	34.4	39.4		1000
1015	19	18	1	0	37.9	48.2		1015
1030	22	21	1	0	33.4	39.3		1030
1045	23	22	1	0	37	42.3		1045
1100	23	23	0	0	36.5	45.2		1100
1115	19	18	1	0	38.6	45.5		1115
1130	14	13	1	0	35	42.4		1130
1145	30	29	1	0	36.2	44		1145
1200	20	18	2	0	34.4	45.5		1200
1215	27	23	4	0	36.2	39.4		1215
1230	19	19	0	0	35.3	40		1230
1245	17	17	0	0	38.6	44.2		1245
1300	16	15	1	0	35.6	47.4		1300
1315	21	19	2	0	41.3	49.6		1315
1330	22	22	0	0	37.1	46.7		1330
1345	22	21	1	0	34.7	42.8		1345
1400	17	16	1	0	38.7	45.9		1400
1415	30	29	1	0	41.4	51.1		1415

1430	28	28	0	0	37.8	44.4	1430
1445	27	27	0	0	38.2	45.4	1445
1500	14	13	1	0	39.6	49.1	1500
1515	20	20	0	0	41	49	1515
1530	28	25	3	0	42.5	49.4	1530
1545	15	15	0	0	37.8	48.2	1545
1600	24	24	0	0	37.5	44.5	1600
1615	17	17	0	0	40.1	46.7	1615
1630	19	17	2	0	38.9	45.2	1630
1645	23	23	0	0	40.3	50.3	1645
1700	22	21	1	0	36	49.7	1700
1715	15	15	0	0	41.8	48.7	1715
1730	15	15	0	0	43.6	53.5	1730
1745	12	11	1	0	44.6	50.4	1745
1800	7	7	0	0	42.7	-	1800
1815	11	11	0	0	46.4	56.7	1815
1830	9	9	0	0	45.2	-	1830
1845	9	8	1	0	37.8	-	1845
1900	5	5	0	0	49.1	-	1900
1915	4	4	0	0	44.1	-	1915
1930	1	1	0	0	56.6	-	1930
1945	7	7	0	0	42.2	-	1945
2000	4	4	0	0	41.5	-	2000
2015	8	6	2	0	47.4	-	2015
2030	6	5	1	0	48.6	-	2030
2045	6	5	1	0	39.2	-	2045
2100	5	5	0	0	54.7	-	2100
2115	10	8	2	0	49.8	-	2115
2130	7	7	0	0	44.7	-	2130
2145	6	6	0	0	58.2	-	2145
2200	4	3	1	0	45.6	-	2200
2215	3	3	0	0	49	-	2215
2230	3	3	0	0	51.9	-	2230
2245	5	5	0	0	57.5	-	2245
2300	1	1	0	0	41.9	-	2300
2315	0	0	0	0	-	-	2315
2330	2	2	0	0	39.1	-	2330
2345	0	0	0	0	-	-	2345
07-09	**84**	**81**	**3**	**0**	**38.7**	**46.7**	**07-09**
09-16	**583**	**556**	**27**	**0**	**37.5**	**44.7**	**09-16**
16-18	**147**	**143**	**4**	**0**	**39.8**	**48.4**	**16-18**
00-00	**969**	**927**	**42**	**0**	**39.2**	**47.3**	**00-00**

Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
3	3	0	0	45.1	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	53.4	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	26.1	-
3	3	0	0	49.5	-
2	2	0	0	53.2	-
1	1	0	0	40.1	-
10	8	2	0	33.5	-
7	6	1	0	38.9	-
9	9	0	0	47.1	-
7	7	0	0	44.7	-
7	7	0	0	41.3	-
7	7	0	0	45.4	-
8	7	1	0	40.4	-
8	7	1	0	42	-
14	14	0	0	41.5	52.7
11	10	1	0	45.4	55.4
16	16	0	0	37.9	45.5
20	19	1	0	39.6	47.5
25	21	4	0	36.4	49
23	20	3	0	38	46.5
10	8	2	0	39.7	-
16	16	0	0	37.5	46.6
31	29	2	0	38.7	42.1
18	18	0	0	41.4	46.6
26	24	2	0	42.1	50.7
24	23	1	0	38.7	48.9
22	22	0	0	40.3	44.4
25	22	3	0	39.5	49.8
20	18	2	0	38.9	48.4
29	28	1	0	39.8	46.9
20	17	3	0	40.3	47
25	21	4	0	38.3	43.9
11	11	0	0	37.4	42.2
16	14	2	0	46.7	52.7
23	18	5	0	39.5	48.6
20	20	0	0	41.1	47.8
15	12	3	0	44.1	54.3
22	21	1	0	40.2	51.1
24	23	1	0	40.7	46.8
29	28	1	0	44.8	52.9

25	25	0	0	39.2	45	
18	16	2	0	44.9	53.4	
20	19	1	0	40.8	48.7	
19	18	1	0	43.6	51.3	
29	28	1	0	46	52.8	
29	28	1	0	42.6	48.3	
16	16	0	0	43.4	49.2	
19	19	0	0	46.2	53.8	
26	22	4	0	44.3	55.2	
24	22	2	0	41.1	49.3	
13	13	0	0	44.2	54.2	
9	9	0	0	45.9	-	
12	11	1	0	46.9	54.5	
8	8	0	0	47.5	-	
8	6	2	0	49.6	-	
9	8	1	0	50.1	-	
10	7	3	0	48.1	-	
6	5	1	0	47.1	-	
4	4	0	0	49.2	-	
4	4	0	0	52.2	-	
1	1	0	0	55.7	-	
6	6	0	0	52.9	-	
6	5	1	0	42.1	-	
10	9	1	0	48.9	-	
11	8	3	0	51.9	65.2	
6	6	0	0	52.1	-	
2	2	0	0	75.8	-	
8	5	3	0	53.1	-	
5	5	0	0	55	-	
4	4	0	0	47	-	
5	4	1	0	45.2	-	
3	3	0	0	56.2	-	
2	1	1	0	53.4	-	
3	3	0	0	55.1	-	
1	1	0	0	58.2	-	
0	0	0	0	-	-	
2	2	0	0	41.5	-	
0	0	0	0	-	-	
91	**87**	**4**	**0**	**41.1**	**49.4**	
614	**568**	**46**	**0**	**40.8**	**48.6**	
127	**120**	**7**	**0**	**44.4**	**52.6**	
992	**915**	**77**	**0**	**42.5**	**50.9**	

Northbound

23/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	0	0	0	0	-	-	0000
0015	0	0	0	0	-	-	0015
0030	1	1	0	0	33	-	0030
0045	0	0	0	0	-	-	0045
0100	1	1	0	0	41.7	-	0100
0115	0	0	0	0	-	-	0115
0130	1	1	0	0	40.4	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	0	0	0	0	-	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	1	1	0	0	46.1	-	0300
0315	0	0	0	0	-	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	1	1	0	0	42.6	-	0430
0445	0	0	0	0	-	-	0445
0500	0	0	0	0	-	-	0500
0515	2	2	0	0	29.5	-	0515
0530	0	0	0	0	-	-	0530
0545	4	3	1	0	43.3	-	0545
0600	2	1	1	0	36.7	-	0600
0615	0	0	0	0	-	-	0615
0630	10	9	1	0	36.6	-	0630
0645	5	5	0	0	36.5	-	0645
0700	14	14	0	0	41.3	50.9	0700
0715	6	6	0	0	38.6	-	0715
0730	8	8	0	0	39.8	-	0730
0745	14	14	0	0	37.7	44.6	0745
0800	13	10	3	0	38.3	45.4	0800
0815	9	9	0	0	37.7	-	0815
0830	13	12	1	0	39.3	46.9	0830
0845	10	10	0	0	36.1	-	0845
0900	12	12	0	0	43.5	49.3	0900
0915	11	11	0	0	37	43	0915
0930	18	18	0	0	40.5	46.3	0930
0945	22	21	1	0	38.2	46.2	0945
1000	25	21	4	0	40.9	48.4	1000
1015	21	21	0	0	39.8	49.5	1015
1030	25	22	3	0	39.1	44.5	1030
1045	21	18	3	0	40.5	46	1045
1100	23	23	0	0	38	43.6	1100
1115	27	27	0	0	37.2	42.3	1115
1130	38	37	1	0	38	42	1130
1145	23	22	1	0	37.7	45.6	1145
1200	28	28	0	0	38.4	43.8	1200
1215	20	20	0	0	40.9	47.4	1215
1230	17	16	1	0	38.1	45.9	1230
1245	21	21	0	0	38.7	46.1	1245
1300	16	16	0	0	39.5	46.9	1300
1315	26	26	0	0	38.3	46.8	1315
1330	14	14	0	0	36.4	49.4	1330
1345	36	36	0	0	40.4	47.1	1345
1400	33	32	1	0	38.5	45.9	1400
1415	23	23	0	0	38.3	49.5	1415

1430	27	26	1	0	38.2	45.6
1445	31	29	2	0	40.6	49.4
1500	30	27	3	0	40.6	50.8
1515	27	27	0	0	38.2	53
1530	16	16	0	0	37.2	41.7
1545	17	16	1	0	42.5	49.9
1600	25	24	1	0	42.2	48.3
1615	20	19	1	0	40.2	47.3
1630	16	14	2	0	41.9	50.1
1645	26	25	1	0	42.8	52.7
1700	18	18	0	0	42.7	54.5
1715	20	18	2	0	35.9	41.9
1730	26	24	1	1	40.7	49.8
1745	16	16	0	0	42.5	54.2
1800	11	9	2	0	49.5	76.9
1815	4	4	0	0	38.2	-
1830	5	5	0	0	42.9	-
1845	8	8	0	0	44.4	-
1900	11	11	0	0	39.9	51
1915	3	3	0	0	39.3	-
1930	4	4	0	0	33.4	-
1945	5	5	0	0	41.7	-
2000	9	9	0	0	49.4	-
2015	9	9	0	0	41.9	-
2030	3	3	0	0	47.4	-
2045	10	10	0	0	48	-
2100	9	9	0	0	51.9	-
2115	1	1	0	0	56.4	-
2130	4	4	0	0	49.2	-
2145	4	4	0	0	53	-
2200	1	0	1	0	39.3	-
2215	3	3	0	0	44.9	-
2230	8	8	0	0	48	-
2245	4	4	0	0	53.1	-
2300	7	7	0	0	57.2	-
2315	1	1	0	0	42.8	-
2330	0	0	0	0	-	-
2345	0	0	0	0	-	-
07-09	**87**	**83**	**4**	**0**	**38.7**	**45.7**
09-16	**648**	**626**	**22**	**0**	**39.1**	**46.6**
16-18	**167**	**158**	**8**	**1**	**41.1**	**48.6**
00-00	**1054**	**1013**	**40**	**1**	**40.2**	**48.1**

1430
1445
1500
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1600
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1800
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1900
1915
1930
1945
2000
2015
2030
2045
2100
2115
2130
2145
2200
2215
2230
2245
2300
2315
2330
2345
07-09
09-16
16-18
00-00

Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0	0	0	0	-	-
1	1	0	0	45.1	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	51.5	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
3	3	0	0	52.2	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	53	-
1	1	0	0	24.5	-
1	1	0	0	53.5	-
5	3	2	0	48.5	-
4	4	0	0	39.8	-
5	5	0	0	42.3	-
13	9	2	2	37.9	48.9
4	4	0	0	38.7	-
8	8	0	0	33.8	-
10	8	2	0	38	-
11	11	0	0	44.2	51.3
15	14	1	0	41	48.3
13	11	2	0	44.4	50.8
11	9	2	0	41.8	56.4
11	11	0	0	45.3	49.1
14	14	0	0	45.6	56
12	12	0	0	46.3	52
18	17	1	0	40.3	44.7
24	23	1	0	39.3	46
28	25	3	0	42.1	49.4
19	17	2	0	44.1	50
24	21	2	1	37.5	46.9
24	24	0	0	40.9	51.6
31	27	4	0	42.4	48.4
24	23	1	0	41.6	50.4
32	30	2	0	43.4	53.6
33	33	0	0	39.8	45.2
21	19	2	0	40.2	46.4
24	23	1	0	41.9	47.9
19	18	1	0	42	49.1
25	23	2	0	42.5	49.8
21	21	0	0	42.9	51
19	19	0	0	43.4	51.3
26	25	1	0	41	47.5
17	16	1	0	41	47.5
33	32	1	0	40.1	49.4
25	25	0	0	48.2	60.6
26	26	0	0	43.5	52

25	22	3	0	40.9	51	
29	29	0	0	39.6	49.9	
32	29	3	0	42.5	53	
19	18	1	0	43.2	51.5	
26	25	1	0	41.5	48.2	
23	22	1	0	47.5	63.3	
22	18	4	0	43.5	53.3	
23	22	1	0	44.6	53.2	
18	15	3	0	42.2	51.5	
17	14	3	0	46.1	56.3	
18	16	2	0	47.4	58.3	
21	17	3	1	41.1	49.3	
13	13	0	0	44.7	49.8	
9	8	1	0	45.4	-	
17	13	4	0	55.5	70.6	
1	1	0	0	43.9	-	
9	9	0	0	46.2	-	
6	6	0	0	46	-	
6	6	0	0	44	-	
4	4	0	0	36.8	-	
4	4	0	0	45.9	-	
7	7	0	0	51.5	-	
9	8	1	0	48	-	
10	9	1	0	45.4	-	
8	8	0	0	49.5	-	
8	7	1	0	53.6	-	
3	3	0	0	55.8	-	
4	4	0	0	55.4	-	
4	4	0	0	53.9	-	
2	2	0	0	56.8	-	
6	4	2	0	54.4	-	
4	4	0	0	51.9	-	
3	3	0	0	53.1	-	
4	4	0	0	55.2	-	
2	2	0	0	52.5	-	
1	1	0	0	49.3	-	
1	1	0	0	45.4	-	
1	1	0	0	53.7	-	
93	**86**	**7**	**0**	**42.2**	**50.3**	
679	**644**	**34**	**1**	**42**	**49.7**	
141	**123**	**17**	**1**	**44.2**	**53.1**	
1077	**1002**	**71**	**4**	**43.3**	**51.5**	

Northbound

24/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	1	1	0	0	44.3	-	0000
0015	0	0	0	0	-	-	0015
0030	1	1	0	0	43.9	-	0030
0045	1	1	0	0	49.1	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	3	3	0	0	55.5	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	0	0	0	0	-	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	1	1	0	0	40.2	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	1	1	0	0	67.5	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	0	0	0	0	-	-	0445
0500	2	2	0	0	37.5	-	0500
0515	0	0	0	0	-	-	0515
0530	0	0	0	0	-	-	0530
0545	2	2	0	0	30.2	-	0545
0600	1	1	0	0	41.2	-	0600
0615	2	2	0	0	50.7	-	0615
0630	6	6	0	0	40.9	-	0630
0645	7	7	0	0	40.7	-	0645
0700	7	7	0	0	45.6	-	0700
0715	9	8	1	0	39.5	-	0715
0730	13	13	0	0	38.2	44	0730
0745	7	7	0	0	36.5	-	0745
0800	10	10	0	0	35.8	-	0800
0815	10	10	0	0	38.2	-	0815
0830	13	12	1	0	40.1	56.5	0830
0845	11	10	1	0	42	49.8	0845
0900	22	19	3	0	36.5	42.7	0900
0915	23	23	0	0	37.5	41.8	0915
0930	17	16	1	0	36.5	42.4	0930
0945	19	19	0	0	39.9	45.7	0945
1000	20	20	0	0	37.6	43.1	1000
1015	23	23	0	0	37.3	42.2	1015
1030	29	27	2	0	37.2	43.7	1030
1045	23	19	4	0	37.7	44.2	1045
1100	17	15	2	0	36.4	43.6	1100
1115	20	19	1	0	34.8	42.6	1115
1130	23	20	3	0	39.1	46.8	1130
1145	23	23	0	0	35.9	45	1145
1200	27	26	1	0	36.9	42.7	1200
1215	18	16	2	0	41	47.8	1215
1230	22	19	3	0	37.6	44.3	1230
1245	18	18	0	0	36.4	44.9	1245
1300	22	22	0	0	39.1	45.8	1300
1315	11	11	0	0	41.2	51	1315
1330	23	22	1	0	36.7	41.2	1330
1345	19	19	0	0	37.6	46.1	1345
1400	27	24	3	0	39.1	48.6	1400
1415	27	26	1	0	37.7	42.3	1415

1430	18	17	1	0	38.1	43.6	1430
1445	30	30	0	0	40.5	50.3	1445
1500	21	21	0	0	38.9	47.8	1500
1515	19	18	1	0	40.3	46.6	1515
1530	21	18	3	0	37.2	43.2	1530
1545	14	13	1	0	38.5	46.5	1545
1600	20	17	3	0	42	49.3	1600
1615	24	24	0	0	42.9	53.8	1615
1630	26	25	1	0	40.1	47.2	1630
1645	25	23	2	0	37.7	45.2	1645
1700	32	31	0	1	41	48.8	1700
1715	11	11	0	0	42.5	51.6	1715
1730	12	12	0	0	40.4	52.3	1730
1745	12	12	0	0	37.2	45.2	1745
1800	7	6	1	0	41.2	-	1800
1815	6	6	0	0	44.6	-	1815
1830	6	6	0	0	45.3	-	1830
1845	9	8	1	0	40.5	-	1845
1900	8	8	0	0	48.7	-	1900
1915	4	4	0	0	36.9	-	1915
1930	10	9	1	0	42.6	-	1930
1945	4	4	0	0	50.4	-	1945
2000	7	7	0	0	43.4	-	2000
2015	2	2	0	0	45.2	-	2015
2030	8	7	1	0	46.5	-	2030
2045	9	9	0	0	39.9	-	2045
2100	2	2	0	0	42.4	-	2100
2115	11	11	0	0	44.5	52.3	2115
2130	4	4	0	0	49.1	-	2130
2145	9	9	0	0	46.1	-	2145
2200	6	5	1	0	39.4	-	2200
2215	5	5	0	0	46.6	-	2215
2230	5	5	0	0	44.6	-	2230
2245	4	4	0	0	46.1	-	2245
2300	5	5	0	0	58.3	-	2300
2315	2	2	0	0	41.8	-	2315
2330	4	4	0	0	49	-	2330
2345	2	2	0	0	39.8	-	2345
07-09	**80**	**77**	**3**	**0**	**39.4**	**47.2**	**07-09**
09-16	**596**	**563**	**33**	**0**	**37.9**	**44.6**	**09-16**
16-18	**162**	**155**	**6**	**1**	**40.5**	**48.3**	**16-18**
00-00	**1005**	**957**	**47**	**1**	**39.5**	**47**	**00-00**

Southbound

TDC
Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0	0	0	0	-	-
2	2	0	0	53	-
1	1	0	0	52.3	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	52.2	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	85.7	-
0	0	0	0	-	-
1	1	0	0	38.8	-
0	0	0	0	-	-
1	1	0	0	47.4	-
0	0	0	0	-	-
2	2	0	0	50.8	-
2	2	0	0	39.6	-
2	2	0	0	47.6	-
3	3	0	0	47.2	-
8	8	0	0	45.3	-
8	8	0	0	39.6	-
8	8	0	0	46.9	-
6	5	1	0	33.7	-
12	12	0	0	39	44.3
12	12	0	0	39.4	47.2
13	10	3	0	40.1	45.6
11	9	2	0	42.2	52.7
13	12	1	0	47.9	55
15	12	3	0	38.4	49
26	24	2	0	40.8	46.2
22	22	0	0	41.5	50.8
19	16	3	0	42.1	51.1
17	14	3	0	43	51.5
25	25	0	0	42.4	48.5
22	21	1	0	37.7	45.8
24	19	5	0	38.2	44
20	17	3	0	39.8	44.9
16	15	1	0	37	45.4
26	24	2	0	37.7	46.4
32	29	3	0	42.4	46.2
19	18	1	0	38	43.4
27	27	0	0	41.1	47.1
14	12	2	0	43.9	49.3
18	16	2	0	40.9	53
24	24	0	0	40.7	48.8
14	12	2	0	43.9	56.6
18	15	3	0	43.2	49.6
24	23	1	0	40.3	48.3
22	19	3	0	40.6	45.2
24	21	3	0	42.1	47.6
28	27	1	0	42.3	52.8

17	16	1	0	42.9	49.1	
26	26	0	0	38.9	47.3	
25	24	1	0	44.6	53.3	
23	21	2	0	40.1	50.4	
22	19	3	0	44.1	48.6	
17	17	0	0	39.9	47.3	
23	20	3	0	45.5	52.6	
19	19	0	0	42.4	52.2	
26	23	3	0	42	47.7	
24	20	4	0	44.8	53.6	
27	26	0	1	40.5	45.6	
10	9	1	0	44.7	-	
9	8	1	0	49.1	-	
7	7	0	0	46.1	-	
6	5	1	0	46.4	-	
10	10	0	0	49.9	-	
8	8	0	0	53.8	-	
4	3	1	0	49.6	-	
6	6	0	0	44	-	
4	4	0	0	53.4	-	
11	10	1	0	47.7	54.9	
5	5	0	0	46.6	-	
6	5	1	0	50.4	-	
3	3	0	0	50.8	-	
11	9	2	0	53	60.6	
3	3	0	0	52	-	
8	8	0	0	52.4	-	
7	7	0	0	46.3	-	
7	6	1	0	50.2	-	
6	5	1	0	50.2	-	
5	5	0	0	52.7	-	
6	6	0	0	51.6	-	
3	3	0	0	50.5	-	
9	9	0	0	49.9	-	
2	2	0	0	52.1	-	
1	1	0	0	54.4	-	
5	4	1	0	48.7	-	
1	1	0	0	57.7	-	
90	**80**	**10**	**0**	**41.1**	**49**	
611	**563**	**48**	**0**	**41**	**47.9**	
145	**132**	**12**	**1**	**43.6**	**50.9**	
1015	**935**	**79**	**1**	**42.8**	**50.6**	

Northbound

29/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	0	0	0	0	-	-	0000
0015	0	0	0	0	-	-	0015
0030	0	0	0	0	-	-	0030
0045	0	0	0	0	-	-	0045
0100	0	0	0	0	-	-	0100
0115	2	2	0	0	52	-	0115
0130	0	0	0	0	-	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	1	1	0	0	52.2	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	1	1	0	0	44.9	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	1	1	0	0	28.2	-	0445
0500	0	0	0	0	-	-	0500
0515	0	0	0	0	-	-	0515
0530	3	3	0	0	44	-	0530
0545	6	5	1	0	48.7	-	0545
0600	8	6	2	0	27.5	-	0600
0615	16	15	1	0	44	53.2	0615
0630	17	16	1	0	44.8	50	0630
0645	16	14	2	0	45.8	51.6	0645
0700	31	28	3	0	42.3	48.8	0700
0715	20	15	5	0	42.7	50.4	0715
0730	28	27	1	0	42.5	50	0730
0745	24	23	1	0	42.4	48.8	0745
0800	19	18	1	0	43.5	46.8	0800
0815	26	24	2	0	44.7	50.3	0815
0830	34	32	2	0	40.9	46.3	0830
0845	39	36	2	1	44.8	50	0845
0900	30	27	2	1	41.8	47.5	0900
0915	43	42	1	0	43.4	48.7	0915
0930	55	54	0	1	42.3	48.3	0930
0945	37	33	4	0	42.1	48.2	0945
1000	39	35	4	0	42.6	49.1	1000
1015	47	44	3	0	42.6	47.3	1015
1030	51	50	1	0	41.4	46.9	1030
1045	49	41	8	0	42.7	47.3	1045
1100	50	48	2	0	43.1	49.1	1100
1115	47	45	1	1	43.3	47.3	1115
1130	50	48	2	0	43.7	47.8	1130
1145	34	29	5	0	42.9	47.5	1145
1200	57	54	3	0	43.2	48.4	1200
1215	43	40	3	0	44.6	50.1	1215
1230	52	48	4	0	43.4	47.9	1230
1245	59	56	3	0	43.1	48.4	1245
1300	56	54	2	0	44	49	1300
1315	47	47	0	0	42.9	47.1	1315
1330	63	61	2	0	43.2	47.8	1330
1345	61	58	3	0	45.4	50.7	1345
1400	57	52	5	0	42.6	48	1400
1415	35	33	2	0	44.4	49.1	1415

1430	35	34	1	0	42.2	47.3	1430
1445	42	42	0	0	43.1	46.7	1445
1500	35	31	3	1	43.6	49.3	1500
1515	52	48	4	0	42	48.8	1515
1530	40	39	1	0	42.8	47.5	1530
1545	53	50	3	0	43.5	49.6	1545
1600	40	38	2	0	45	53.6	1600
1615	39	38	1	0	43.2	51.1	1615
1630	45	42	3	0	42.3	46.3	1630
1645	53	51	2	0	44.1	49.5	1645
1700	52	49	3	0	44.1	50.8	1700
1715	53	51	2	0	44.4	49.6	1715
1730	53	50	3	0	42.4	48.5	1730
1745	35	30	5	0	44.8	50.9	1745
1800	30	28	2	0	45	50.2	1800
1815	15	14	1	0	44.5	51	1815
1830	12	12	0	0	44	50.2	1830
1845	9	8	1	0	46.3	-	1845
1900	13	12	1	0	48.2	55.9	1900
1915	12	12	0	0	42.8	49.5	1915
1930	14	13	1	0	44.6	48.8	1930
1945	6	6	0	0	44.7	-	1945
2000	6	6	0	0	46.2	-	2000
2015	12	12	0	0	48.5	54	2015
2030	6	6	0	0	45.8	-	2030
2045	7	7	0	0	47.2	-	2045
2100	5	5	0	0	47	-	2100
2115	5	5	0	0	44.1	-	2115
2130	4	4	0	0	46.7	-	2130
2145	9	9	0	0	46.2	-	2145
2200	10	10	0	0	47.5	-	2200
2215	13	13	0	0	47.5	56.3	2215
2230	4	4	0	0	49.7	-	2230
2245	3	3	0	0	49.9	-	2245
2300	2	2	0	0	56	-	2300
2315	2	2	0	0	55.9	-	2315
2330	5	4	1	0	51	-	2330
2345	2	2	0	0	45.7	-	2345
07-09	**221**	**203**	**17**	**1**	**43**	**49.1**	**07-09**
09-16	**1319**	**1243**	**72**	**4**	**43.1**	**48.2**	**09-16**
16-18	**370**	**349**	**21**	**0**	**43.8**	**49.7**	**16-18**
00-00	**2187**	**2058**	**124**	**5**	**43.5**	**49.1**	**00-00**

Southbound

TDC
Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
1	1	0	0	45.8	-
1	1	0	0	49.3	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	53.2	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	45	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	50.1	-
2	2	0	0	54.6	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	43.5	-
2	2	0	0	44.6	-
10	9	0	1	48.1	-
7	7	0	0	44.9	-
17	16	0	1	43.7	52.2
23	19	4	0	47.3	54.8
19	15	4	0	43.9	50
19	17	2	0	43.4	47.3
19	19	0	0	43	47.9
24	23	1	0	43.1	51.6
22	21	1	0	45.7	53.5
26	24	2	0	46.4	52.1
22	20	1	1	45.6	52
39	37	1	1	44.4	50.4
36	33	3	0	45.6	48.3
48	41	6	1	41.8	49.8
37	36	1	0	43.7	49.6
58	53	4	1	41.4	47.5
52	49	3	0	43.5	49.7
41	39	2	0	43.9	49.4
60	57	3	0	42.7	48
38	36	2	0	43.3	49.3
45	43	2	0	43.8	48.7
52	46	6	0	43.5	48.2
44	43	1	0	43.2	48.6
61	58	3	0	46.1	50.7
31	28	3	0	44.3	49.1
59	55	4	0	43.4	49.5
51	49	2	0	45.3	49.6
64	62	2	0	45.2	51.1
51	48	3	0	44.9	49.6
60	56	4	0	43.8	48.9
52	50	2	0	44.6	51.3
45	43	2	0	45.8	50.3
46	43	3	0	46.1	50.9
58	54	4	0	46.1	51.9
38	38	0	0	45	48.7
42	39	3	0	46.6	50.5

42	40	2	0	43.9	48.1	
34	31	2	1	42.7	48.8	
45	41	4	0	44.7	51.8	
48	43	5	0	45.5	50.2	
37	37	0	0	45.5	52.3	
44	41	3	0	45.2	50.3	
39	37	2	0	43.3	50.6	
45	45	0	0	45	52.4	
56	53	3	0	44.7	49.4	
61	56	5	0	44.4	51.1	
49	47	2	0	45.2	51.2	
29	29	0	0	46.8	52.5	
26	22	3	1	45.8	49.7	
28	26	2	0	48.8	56.2	
16	15	1	0	48.4	52.3	
11	11	0	0	45.9	50.8	
13	12	1	0	48.8	58	
10	10	0	0	50.5	-	
10	9	1	0	44.1	-	
10	10	0	0	45.1	-	
14	12	2	0	46.7	54.5	
6	6	0	0	55.5	-	
11	11	0	0	50.6	55.8	
8	8	0	0	50.5	-	
7	7	0	0	49.8	-	
6	6	0	0	49	-	
5	5	0	0	50.4	-	
7	7	0	0	49	-	
5	5	0	0	49.2	-	
6	6	0	0	48.1	-	
9	9	0	0	49.7	-	
9	9	0	0	53.1	-	
1	1	0	0	38.7	-	
1	1	0	0	53	-	
6	6	0	0	56.4	-	
4	3	1	0	55.3	-	
2	2	0	0	52.1	-	
0	0	0	0	-	-	
236	**218**	**15**	**3**	**44.3**	**50.6**	
1335	**1258**	**75**	**2**	**44.4**	**49.7**	
333	**315**	**17**	**1**	**45.2**	**51.3**	
2187	**2056**	**123**	**8**	**45**	**50.8**	

Northbound

30/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0000	11	11	0	0	59.9	66.3
0015	8	8	0	0	59.8	-
0030	5	4	1	0	65.3	-
0045	4	3	1	0	52	-
0100	5	5	0	0	54.3	-
0115	6	5	1	0	61	-
0130	4	4	0	0	62.2	-
0145	1	1	0	0	57.6	-
0200	3	3	0	0	57.9	-
0215	6	3	3	0	64.7	-
0230	2	2	0	0	64	-
0245	4	4	0	0	63.9	-
0300	1	0	0	1	64.5	-
0315	5	3	2	0	59.5	-
0330	3	3	0	0	52.2	-
0345	4	3	1	0	69	-
0400	13	12	1	0	57.9	61.9
0415	13	11	2	0	61.4	71.1
0430	15	14	1	0	58.4	64.2
0445	24	23	1	0	62.1	69.8
0500	19	18	1	0	61.4	69.1
0515	33	30	3	0	59.3	63.5
0530	45	40	5	0	58.5	61.1
0545	48	38	9	1	59.9	67.2
0600	48	45	3	0	61.1	66.6
0615	83	70	12	1	59.8	65.7
0630	67	63	4	0	61.4	66.1
0645	110	100	9	1	59.7	64.9
0700	101	95	6	0	59.5	64.4
0715	145	134	9	2	58.3	62.1
0730	184	162	22	0	56.5	62.3
0745	179	167	10	2	56.9	61.6
0800	144	131	11	2	58	63
0815	196	180	14	2	54.7	59.7
0830	192	180	12	0	56.3	61.7
0845	175	159	16	0	56	62.3
0900	144	131	11	2	56.3	61.2
0915	142	126	13	3	56.8	62.6
0930	131	123	8	0	57	60.7
0945	143	136	6	1	56.8	61.4
1000	154	141	12	1	56.2	60.6
1015	135	126	8	1	56.7	61.6
1030	136	122	11	3	56.7	61.9
1045	143	130	12	1	56.1	61.1
1100	139	127	11	1	56.8	61.4
1115	151	139	10	2	54.9	59.6
1130	163	153	7	3	56.8	62.1
1145	148	135	11	2	57.8	63.1
1200	141	127	11	3	57.6	63.4
1215	167	153	14	0	55.3	59.9
1230	180	167	13	0	55.5	61
1245	151	138	11	2	57.5	62.1
1300	152	138	12	2	58	63.5
1315	128	120	7	1	58.5	63.5
1330	143	130	11	2	57.2	61.6
1345	144	133	9	2	57.8	62.9
1400	141	124	16	1	58	63.7
1415	151	135	15	1	59.4	63.9

Time
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1430	191	179	10	2	56.4	61.2
1445	180	164	16	0	57.5	61.7
1500	151	132	18	1	56.7	61.4
1515	171	158	13	0	57.2	61.2
1530	174	163	10	1	56.4	60.5
1545	136	125	11	0	57.2	62.5
1600	153	139	14	0	56.8	61
1615	140	131	9	0	57.7	62.8
1630	123	111	12	0	57.4	62.5
1645	146	140	6	0	57.2	62.5
1700	157	144	12	1	56.9	60.8
1715	140	130	10	0	57.2	61.6
1730	129	126	3	0	56.6	60.5
1745	121	108	13	0	54.9	59.4
1800	123	115	7	1	57.8	61.9
1815	116	107	8	1	58.1	62.8
1830	116	115	1	0	56.1	60.1
1845	102	96	6	0	57.9	61.4
1900	99	96	3	0	58.1	62.6
1915	93	87	5	1	56.7	63.3
1930	63	62	1	0	58.4	63.1
1945	74	72	2	0	59.1	64
2000	54	51	3	0	58.8	62.2
2015	66	63	3	0	59	66.6
2030	37	37	0	0	59.3	64.5
2045	40	38	2	0	58.1	64.4
2100	42	38	4	0	59.1	65.7
2115	55	54	1	0	58.6	64
2130	45	42	3	0	59.8	65.4
2145	40	40	0	0	58.2	64.3
2200	40	36	4	0	58.9	64.4
2215	17	17	0	0	61.3	69.6
2230	32	31	1	0	56.6	61.4
2245	24	23	1	0	57.7	61.6
2300	27	23	3	1	58	63
2315	14	13	1	0	58	61.6
2330	15	15	0	0	61.4	64.9
2345	23	21	2	0	63.5	68.8
07-09	**1316**	**1208**	**100**	**8**	**56.8**	**61.9**
09-16	**4230**	**3875**	**317**	**38**	**56.9**	**61.9**
16-18	**1109**	**1029**	**79**	**1**	**56.9**	**61.6**
00-00	**8602**	**7930**	**617**	**55**	**57.3**	**62.3**

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16-18
00-00

Southbound

TDC
Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
1	1	0	0	51.1	-
0	0	0	0	-	-
1	1	0	0	44.5	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	36.4	-
1	1	0	0	68	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	45.8	-
0	0	0	0	-	-
3	3	0	0	52.3	-
2	2	0	0	43	-
0	0	0	0	-	-
2	2	0	0	42.8	-
2	2	0	0	48	-
4	3	0	1	44.9	-
6	6	0	0	48.8	-
8	8	0	0	48.9	-
25	21	4	0	43.2	47.9
17	16	0	1	41	49.7
25	23	2	0	43.2	47.6
23	20	3	0	42.3	48.6
22	20	2	0	45.9	50.8
34	31	3	0	43	48.1
27	23	4	0	45.3	51.5
17	15	2	0	46.8	51.2
31	28	3	0	46.3	51.5
29	27	2	0	46	50.6
35	31	4	0	44.5	51.8
43	38	5	0	44.2	47.9
52	50	2	0	42.9	47.7
35	33	2	0	41.5	45.6
41	38	3	0	45.1	50.8
36	34	2	0	43.7	47.8
63	57	6	0	42.8	46.7
46	44	2	0	43.6	47.9
40	36	4	0	44.3	50.6
44	42	2	0	42.5	47.1
64	59	5	0	45.1	51.3
46	43	3	0	44.5	50.5
58	56	2	0	44.6	49.5
45	41	4	0	47.1	52.7
56	51	5	0	43.4	48.5
53	52	1	0	42.4	47.5
60	56	4	0	45.8	50.7
76	70	6	0	44.8	49
67	66	1	0	44.7	50.6
58	57	1	0	46.1	50.7
41	40	1	0	45.7	52.3
56	53	3	0	43.8	48.5
39	38	1	0	44.7	50.2

51	50	1	0	44.4	48.9	
47	45	2	0	43.3	49.1	
42	38	4	0	46.5	52.5	
46	45	1	0	45.2	50.4	
45	45	0	0	45.3	50.3	
39	37	2	0	45.4	50.9	
39	33	5	1	46.7	51.7	
41	40	1	0	46	52.7	
31	30	1	0	43.8	50.1	
43	41	2	0	45.8	49.9	
46	42	4	0	45.7	49.1	
36	36	0	0	44.1	52.5	
28	27	1	0	46.4	52.6	
34	32	2	0	47.8	53.3	
19	19	0	0	46.5	51.8	
20	18	2	0	49.8	54.5	
9	9	0	0	49.4	-	
9	7	2	0	49.3	-	
9	9	0	0	47.8	-	
12	11	1	0	46.7	51.7	
11	11	0	0	46.2	53.1	
17	17	0	0	47.2	52.9	
10	10	0	0	46.3	-	
4	4	0	0	47.8	-	
13	13	0	0	48.1	55	
10	9	1	0	50	-	
5	4	1	0	51.4	-	
8	7	1	0	47	-	
6	6	0	0	48.8	-	
9	8	1	0	51	-	
2	2	0	0	52.4	-	
5	5	0	0	45.5	-	
9	8	1	0	49.6	-	
1	1	0	0	51.4	-	
2	2	0	0	40.9	-	
2	2	0	0	45.7	-	
1	1	0	0	49.5	-	
1	1	0	0	48.5	-	
218	**195**	**23**	**0**	**44.9**	**50.6**	
1389	**1314**	**75**	**0**	**44.4**	**49.5**	
298	**281**	**16**	**1**	**45.8**	**51.3**	
2199	**2066**	**130**	**3**	**45**	**50.4**	

Northbound

31/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	12	12	0	0	57.4	62.4	0000
0015	17	15	1	1	58.6	65.6	0015
0030	11	10	1	0	60.7	65.7	0030
0045	3	2	1	0	63.9	-	0045
0100	6	6	0	0	56.1	-	0100
0115	8	8	0	0	60.9	-	0115
0130	6	6	0	0	53	-	0130
0145	4	4	0	0	53.9	-	0145
0200	10	9	1	0	59.6	-	0200
0215	7	7	0	0	58.7	-	0215
0230	6	4	2	0	57.7	-	0230
0245	8	6	2	0	56.8	-	0245
0300	5	4	1	0	62.8	-	0300
0315	2	2	0	0	66.3	-	0315
0330	1	1	0	0	59.6	-	0330
0345	1	1	0	0	65.7	-	0345
0400	3	3	0	0	55.8	-	0400
0415	5	5	0	0	56.7	-	0415
0430	1	0	1	0	58.6	-	0430
0445	5	5	0	0	58.3	-	0445
0500	8	8	0	0	61.2	-	0500
0515	14	14	0	0	59.8	65.2	0515
0530	26	26	0	0	57.6	61.9	0530
0545	24	23	1	0	60.8	64.9	0545
0600	36	33	1	2	61.1	66.1	0600
0615	33	30	3	0	60.6	65.1	0615
0630	37	33	3	1	60.9	66.2	0630
0645	54	49	5	0	61.8	67.8	0645
0700	57	50	7	0	59.1	63.6	0700
0715	54	47	7	0	61.1	66.2	0715
0730	67	64	3	0	60.5	65.1	0730
0745	71	65	6	0	60.7	66.8	0745
0800	85	73	12	0	59	63.9	0800
0815	92	84	7	1	58.8	64.3	0815
0830	105	98	7	0	58.4	63.9	0830
0845	136	125	10	1	56.8	61.4	0845
0900	127	117	10	0	55.8	61.3	0900
0915	132	125	5	2	57.1	61.4	0915
0930	160	149	10	1	56.1	61.5	0930
0945	145	134	11	0	57.8	62.3	0945
1000	155	143	11	1	55	60.8	1000
1015	167	158	9	0	56.7	62.3	1015
1030	177	170	7	0	56.5	61	1030
1045	147	138	9	0	56.5	61.5	1045
1100	140	130	10	0	57.8	62.8	1100
1115	155	150	5	0	57.6	61.9	1115
1130	146	142	4	0	57.1	60.8	1130
1145	135	122	13	0	55.8	61.7	1145
1200	145	132	13	0	56.7	62.1	1200
1215	122	113	8	1	58.2	62.6	1215
1230	147	142	5	0	57.4	63.1	1230
1245	135	127	8	0	56.8	61.9	1245
1300	129	116	13	0	56.6	62.1	1300
1315	141	132	9	0	57.5	62.6	1315
1330	124	117	7	0	56.9	62.3	1330
1345	115	108	7	0	58.8	63	1345
1400	121	112	9	0	57.9	62.7	1400
1415	110	101	9	0	60	65	1415

1430	111	104	7	0	59	63.8
1445	111	104	7	0	58.9	63.4
1500	131	126	5	0	58.8	64.8
1515	122	117	4	1	60.2	64.6
1530	93	93	0	0	59.3	63.4
1545	96	89	6	1	59	64.4
1600	84	81	3	0	59.4	63.5
1615	109	98	11	0	59.7	64
1630	70	65	5	0	60.6	65.4
1645	90	86	4	0	60.2	64.1
1700	107	97	10	0	59.8	65.3
1715	112	106	6	0	59.4	64.1
1730	91	87	4	0	58.1	62.6
1745	109	105	4	0	56.9	61.6
1800	124	118	6	0	57.1	61.3
1815	108	101	7	0	56.7	61.2
1830	82	77	5	0	57.5	62.6
1845	103	97	6	0	57.5	61.5
1900	88	86	2	0	56.8	61
1915	83	78	4	1	57.5	61.4
1930	56	52	4	0	58.2	62.5
1945	65	59	6	0	58.9	64.2
2000	54	53	1	0	58.7	62.6
2015	47	47	0	0	57.6	62.4
2030	39	38	1	0	58.3	62.8
2045	51	49	1	1	58.9	63.2
2100	65	61	4	0	57.8	62.5
2115	48	44	2	2	57.9	63
2130	31	31	0	0	57.9	62.7
2145	23	21	2	0	59.3	62.7
2200	28	28	0	0	59.2	63.9
2215	23	23	0	0	60.8	66.4
2230	33	31	2	0	56.7	62.6
2245	16	16	0	0	62.1	67.1
2300	14	14	0	0	59.3	64.5
2315	16	15	1	0	62.2	70.1
2330	13	13	0	0	58.8	62
2345	7	7	0	0	64.5	-
07-09	**667**	**606**	**59**	**2**	**58.9**	**64.1**
09-16	**3739**	**3511**	**221**	**7**	**57.4**	**62.5**
16-18	**772**	**725**	**47**	**0**	**59.2**	**63.9**
00-00	**6748**	**6327**	**404**	**17**	**58**	**63**

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Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
1	1	0	0	46.8	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	51.8	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	73.3	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	48.5	-
1	1	0	0	41.8	-
1	1	0	0	42.6	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	46.4	-
0	0	0	0	-	-
3	3	0	0	48.1	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	47.1	-
2	2	0	0	44.3	-
10	9	1	0	47.3	-
7	6	1	0	42.8	-
13	12	1	0	45.9	49.1
18	16	1	1	45	48.7
14	13	1	0	44.6	51.5
25	22	3	0	43.5	49.2
19	17	2	0	44.6	50.6
15	13	2	0	46.4	57.3
29	26	3	0	46.6	51.4
21	19	2	0	46.8	56.2
22	21	1	0	44	49.5
26	24	2	0	45.6	51.1
34	30	3	1	44.2	49.4
26	26	0	0	40.5	47.5
41	33	8	0	41.8	47.9
40	40	0	0	42.8	47.8
31	31	0	0	44.8	48.9
42	41	1	0	45.2	49.3
39	37	2	0	43.6	48.6
56	52	4	0	44.1	48.3
66	62	4	0	44.1	48.7
29	28	1	0	44.1	49.5
40	36	4	0	45.7	49.1
50	46	4	0	43	47
47	43	4	0	44.9	48.5
52	50	2	0	44.5	48.6
45	44	1	0	43.3	49.5
44	43	1	0	43.1	48.3
36	34	2	0	43.7	49.2
40	39	1	0	45.3	50.4
47	45	2	0	44.7	49.7
38	35	3	0	45.5	52.2
41	40	1	0	44.6	51.6
51	50	1	0	46.1	51.9
44	40	4	0	46.2	50.9
34	32	2	0	45.2	50.5

30	27	3	0	46.4	52.3	
34	32	2	0	46	51.8	
32	30	2	0	44.9	49.7	
39	37	2	0	47.3	52.6	
34	33	1	0	45.2	49.7	
31	27	4	0	46.3	51.4	
31	31	0	0	46.1	50.8	
45	40	5	0	45.5	51.9	
41	41	0	0	44.1	48	
47	44	3	0	45.9	52.7	
39	34	4	1	46.2	52	
23	20	3	0	47.6	53.1	
23	22	1	0	48	51.6	
18	18	0	0	46	52.3	
17	16	1	0	49.6	55.5	
19	18	1	0	48	51.3	
17	15	2	0	45.9	52.8	
21	19	2	0	46.3	50.9	
13	12	1	0	49.3	54.6	
24	23	1	0	49.1	54	
22	21	1	0	46.9	54	
16	14	2	0	47.3	51.2	
17	14	3	0	48.8	53	
16	16	0	0	50.8	57.6	
22	20	2	0	46.4	51.9	
9	9	0	0	47.4	-	
24	24	0	0	48	52.5	
17	16	1	0	50.3	58.1	
9	9	0	0	52.8	-	
10	10	0	0	47.9	-	
11	11	0	0	50.9	58	
6	6	0	0	50	-	
6	6	0	0	50.9	-	
5	5	0	0	45.8	-	
9	9	0	0	47.1	-	
3	3	0	0	49.6	-	
4	4	0	0	53.1	-	
2	2	0	0	62	-	
192	**176**	**15**	**1**	**44.7**	**50**	
1153	**1087**	**66**	**0**	**44.7**	**49.7**	
267	**250**	**16**	**1**	**46**	**51.8**	
2031	**1906**	**122**	**3**	**45.5**	**50.8**	

Northbound

1/08/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0000	15	15	0	0	60.1	66.2
0015	9	8	1	0	54	-
0030	4	3	1	0	64.5	-
0045	7	6	1	0	65.5	-
0100	7	6	1	0	58.9	-
0115	3	3	0	0	64.8	-
0130	5	4	1	0	64.8	-
0145	3	3	0	0	58.2	-
0200	3	3	0	0	65	-
0215	2	2	0	0	58.3	-
0230	10	9	1	0	64.1	-
0245	1	1	0	0	66.4	-
0300	3	3	0	0	55.2	-
0315	8	7	1	0	60.9	-
0330	5	5	0	0	60	-
0345	3	3	0	0	56.9	-
0400	5	4	1	0	58.2	-
0415	1	1	0	0	67.6	-
0430	6	6	0	0	60.2	-
0445	6	6	0	0	67.8	-
0500	3	3	0	0	56.4	-
0515	12	11	1	0	60	65
0530	16	15	1	0	58.7	66.9
0545	11	8	3	0	59.9	70.4
0600	22	20	2	0	59.4	64.2
0615	18	17	1	0	61	67.6
0630	24	23	1	0	61.1	65.8
0645	28	26	2	0	62.3	67.5
0700	27	26	1	0	61.2	67.6
0715	26	23	3	0	62.1	69
0730	38	34	4	0	60.9	65
0745	48	44	4	0	61.9	66.6
0800	56	53	3	0	60.5	63.8
0815	53	49	4	0	60.1	67.6
0830	82	73	9	0	59.6	63
0845	88	84	3	1	58.1	62.8
0900	99	93	6	0	59.2	63.7
0915	93	89	4	0	59.3	64.2
0930	122	115	7	0	57.2	60.7
0945	139	130	8	1	58.4	64.4
1000	141	129	12	0	55.7	60.5
1015	121	117	4	0	59.1	62.9
1030	111	105	6	0	58.2	63.4
1045	158	151	7	0	57.2	62.1
1100	137	129	6	2	56.3	61.7
1115	142	137	5	0	56.1	61.7
1130	139	129	10	0	56.3	62.1
1145	137	131	6	0	57.6	62.6
1200	142	136	6	0	58.4	62.6
1215	165	154	11	0	57.9	62.3
1230	152	149	3	0	57.7	62.5
1245	161	156	4	1	58.6	62.2
1300	144	137	7	0	57.8	63
1315	105	100	5	0	59.5	64.5
1330	120	116	4	0	60	64.6
1345	118	115	3	0	58.6	62.7
1400	106	100	5	1	59.2	63.9
1415	106	97	9	0	58.1	63.3

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1430	108	102	5	1	58.7	62.8
1445	97	93	3	1	59.5	64.7
1500	110	105	5	0	59.7	63.7
1515	98	95	3	0	59.6	63.7
1530	104	100	4	0	59.3	62.9
1545	98	92	5	1	60.6	65.4
1600	87	80	7	0	57.8	62.2
1615	90	90	0	0	59.6	64
1630	78	76	2	0	59.9	64.1
1645	89	86	3	0	58.5	64
1700	86	81	4	1	58.2	62.6
1715	79	77	2	0	58.1	61.7
1730	90	89	1	0	57.9	64.4
1745	89	82	7	0	58	63
1800	85	77	6	2	58	62.3
1815	77	69	8	0	56.7	60.5
1830	68	64	4	0	58	62.6
1845	64	60	4	0	57.2	61.4
1900	66	65	1	0	58.8	64.4
1915	49	44	5	0	58.1	63.7
1930	49	47	2	0	56.6	62.9
1945	40	40	0	0	58.2	63.2
2000	44	41	3	0	57.9	62.1
2015	38	37	1	0	58.5	65.1
2030	36	35	1	0	57.2	62.4
2045	28	28	0	0	56.4	64.4
2100	27	26	1	0	56.8	63.2
2115	17	15	2	0	56.8	64.8
2130	18	16	2	0	58.4	62.1
2145	14	14	0	0	57.7	64.7
2200	13	13	0	0	60.1	65.1
2215	8	8	0	0	60.8	-
2230	9	9	0	0	63	-
2245	7	6	1	0	56.4	-
2300	7	7	0	0	60	-
2315	5	5	0	0	60.5	-
2330	7	7	0	0	60.3	-
2345	8	6	2	0	60.4	-
07-09	**418**	**386**	**31**	**1**	**60.1**	**64.1**
09-16	**3473**	**3302**	**163**	**8**	**58.2**	**63**
16-18	**688**	**661**	**26**	**1**	**58.5**	**63.2**
00-00	**5603**	**5309**	**282**	**12**	**58.4**	**63.4**

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Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
2	2	0	0	46.1	-
5	5	0	0	57.2	-
0	0	0	0	-	-
2	2	0	0	52.8	-
2	1	1	0	54.3	-
1	1	0	0	62.7	-
1	1	0	0	52.6	-
0	0	0	0	-	-
1	1	0	0	60	-
2	2	0	0	46	-
4	4	0	0	44.3	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	47.1	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	55.5	-
0	0	0	0	-	-
3	3	0	0	40.5	-
4	4	0	0	51.7	-
8	6	1	1	43.8	-
3	3	0	0	44.2	-
17	15	2	0	40.1	47.9
15	14	1	0	44.9	50.1
17	17	0	0	45.6	49.9
12	10	2	0	47.6	52
21	21	0	0	44.4	48.9
17	15	2	0	45.1	48.7
23	19	4	0	44.8	49.9
41	36	4	1	42.5	48.2
20	18	2	0	46.5	51.1
35	29	6	0	45.3	50
42	40	2	0	46.6	51.2
48	46	2	0	44.8	48.8
34	30	4	0	42.9	49.5
44	43	1	0	43.7	49.3
47	45	2	0	45.1	49.8
65	54	11	0	44.4	49.4
59	51	8	0	44.1	47.7
61	55	5	1	43.7	48.6
62	57	5	0	43.3	47.1
63	59	4	0	45.2	50
67	64	3	0	44.3	49.1
81	77	3	1	44.5	49.5
59	57	2	0	45.1	49.5
97	93	4	0	42.7	47.2
66	63	3	0	45.6	50.6
76	72	4	0	44.3	50
75	68	7	0	41.3	45.6
63	62	1	0	42.4	47.9
53	51	2	0	44.3	50.3
63	62	0	1	44.8	49.6
71	67	4	0	44.6	49.4
73	68	5	0	42.9	48
70	64	6	0	42.4	48.7
64	59	5	0	43.2	49.6

71	62	9	0	43.3	47.7	
53	49	4	0	45	49.3	
49	45	2	2	45.5	50	
71	69	2	0	45.3	50.4	
46	46	0	0	44.9	50.4	
51	46	4	1	45.4	49.5	
65	62	3	0	44.1	49	
48	47	1	0	44.1	49.5	
60	58	2	0	45.2	50	
38	38	0	0	45.4	49.4	
48	43	4	1	44.9	52	
47	44	3	0	44	48.7	
43	42	1	0	45.9	52.3	
20	20	0	0	46.8	53	
13	12	1	0	48.2	55.6	
19	19	0	0	45.4	50.2	
10	9	1	0	47.7	-	
13	13	0	0	46.9	52	
7	7	0	0	46	-	
8	8	0	0	44.3	-	
13	12	1	0	48	53	
17	17	0	0	45.7	49.5	
15	15	0	0	49.2	57.3	
9	8	1	0	50.1	-	
13	12	1	0	45.8	59.8	
16	16	0	0	46.6	50.7	
4	4	0	0	46.1	-	
8	7	1	0	48	-	
11	11	0	0	43.5	49.9	
12	11	1	0	49.6	54.4	
4	4	0	0	51	-	
5	5	0	0	54	-	
2	2	0	0	47.5	-	
6	4	2	0	45.5	-	
1	1	0	0	47	-	
3	3	0	0	34.5	-	
4	4	0	0	43.1	-	
1	1	0	0	52.6	-	
247	**224**	**22**	**1**	**44.9**	**49.6**	
1754	**1638**	**110**	**6**	**44**	**49**	
369	**354**	**14**	**1**	**44.8**	**50**	
2685	**2514**	**162**	**9**	**44.5**	**49.5**	

Northbound

2/08/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	4	4	0	0	61.6	-	0000
0015	3	3	0	0	78.8	-	0015
0030	1	1	0	0	41.1	-	0030
0045	1	1	0	0	51.7	-	0045
0100	4	4	0	0	57.9	-	0100
0115	5	3	2	0	66.6	-	0115
0130	2	2	0	0	55.2	-	0130
0145	4	3	0	1	63.9	-	0145
0200	1	1	0	0	51	-	0200
0215	4	3	1	0	60.3	-	0215
0230	3	3	0	0	59.1	-	0230
0245	5	4	1	0	59.3	-	0245
0300	0	0	0	0	-	-	0300
0315	8	7	1	0	61.7	-	0315
0330	3	2	1	0	65.9	-	0330
0345	6	6	0	0	59.8	-	0345
0400	5	4	0	1	59.1	-	0400
0415	11	11	0	0	57.9	70.4	0415
0430	14	13	1	0	62.1	68.6	0430
0445	16	16	0	0	62.5	67.8	0445
0500	20	18	2	0	63.5	70.8	0500
0515	16	15	1	0	59.1	66.3	0515
0530	43	39	4	0	60.2	65.5	0530
0545	48	41	7	0	60.5	65.7	0545
0600	54	46	7	1	62.3	68.9	0600
0615	88	81	6	1	60.6	65	0615
0630	81	75	5	1	58.9	63.7	0630
0645	106	99	7	0	61.5	66.2	0645
0700	106	98	8	0	59	64.2	0700
0715	155	136	17	2	57.8	62.2	0715
0730	165	149	16	0	57	61.6	0730
0745	210	190	18	2	53.8	60.4	0745
0800	156	139	17	0	56.5	61.6	0800
0815	170	158	11	1	57	61.6	0815
0830	164	150	11	3	56.5	62.3	0830
0845	162	153	8	1	56.4	60.4	0845
0900	130	119	10	1	56.6	61.4	0900
0915	132	119	11	2	56.9	60.7	0915
0930	141	133	8	0	57.1	62	0930
0945	131	123	7	1	55.3	61.6	0945
1000	120	104	13	3	55.2	59.8	1000
1015	115	110	5	0	57.2	62	1015
1030	125	115	10	0	57.5	61.9	1030
1045	114	102	11	1	57.2	61.2	1045
1100	104	90	13	1	56	61.2	1100
1115	144	134	9	1	57.4	62.7	1115
1130	125	114	10	1	56.3	61	1130
1145	124	109	13	2	57.3	61	1145
1200	110	100	9	1	57.8	62.2	1200
1215	118	106	11	1	58	63.2	1215
1230	115	103	10	2	58	62.2	1230
1245	126	116	10	0	56.9	62.6	1245
1300	110	101	8	1	58.8	63.5	1300
1315	102	90	11	1	59.1	63.6	1315
1330	112	103	9	0	58.1	61.9	1330
1345	114	108	6	0	59.1	63.7	1345
1400	107	95	10	2	58.6	63.5	1400
1415	142	132	10	0	57.2	62.4	1415

1430	156	150	4	2	56.5	62.3
1445	148	132	14	2	56.4	61.9
1500	134	117	14	3	55.4	61.6
1515	163	156	7	0	57.5	61.8
1530	126	119	7	0	57.4	62.1
1545	111	102	8	1	56.2	59.8
1600	128	121	7	0	57.3	61.1
1615	117	105	12	0	57.6	62.6
1630	134	125	9	0	58.1	63
1645	123	115	8	0	58.3	62.6
1700	128	123	5	0	56.6	59.8
1715	119	111	8	0	58.1	63.2
1730	98	96	2	0	58.5	62.5
1745	103	98	4	1	57.8	61.6
1800	105	100	5	0	58	63.2
1815	82	76	5	1	58.4	63.4
1830	76	74	2	0	57.2	61.7
1845	86	75	9	2	56.8	62.4
1900	54	53	1	0	58.4	62.4
1915	66	64	2	0	58	64.1
1930	59	56	3	0	58.2	63.5
1945	38	36	1	1	56.2	60.4
2000	33	31	2	0	59.7	66.4
2015	27	26	1	0	57.7	61.9
2030	27	22	5	0	58.9	62.6
2045	29	25	4	0	57.8	65.1
2100	22	22	0	0	58.4	64
2115	23	19	4	0	57	62.9
2130	20	19	0	1	59.6	68.6
2145	18	17	1	0	58	64.2
2200	19	19	0	0	58.6	65.7
2215	15	14	1	0	57.8	63.4
2230	2	1	0	1	62.7	-
2245	8	8	0	0	60.3	-
2300	5	5	0	0	55.5	-
2315	7	6	1	0	59.7	-
2330	3	3	0	0	65.6	-
2345	7	6	1	0	64.2	-
07-09	**1288**	**1173**	**106**	**9**	**56.5**	**61.6**
09-16	**3499**	**3202**	**268**	**29**	**57.1**	**61.9**
16-18	**950**	**894**	**55**	**1**	**57.8**	**62.1**
00-00	**7124**	**6551**	**523**	**50**	**57.5**	**62.5**

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Southbound

TDC
Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
3	3	0	0	51	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	46.8	-
2	1	1	0	46.8	-
1	1	0	0	46.6	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	47.2	-
5	2	1	2	47.4	-
3	2	1	0	50.5	-
4	3	1	0	50.6	-
6	6	0	0	49.5	-
11	11	0	0	48.8	54
12	12	0	0	49.1	52.9
14	13	0	1	49.5	53.1
26	23	1	2	44.2	49.3
9	9	0	0	48.1	-
20	19	1	0	44.8	52.5
25	24	1	0	46.4	51.5
19	18	0	1	44.8	49.1
18	16	1	1	42.5	48.5
21	19	2	0	47.3	53.1
27	25	1	1	44.7	51.8
29	25	4	0	44.6	49.7
25	24	1	0	43.7	46.7
28	23	5	0	45.7	49.8
47	42	4	1	44	49.1
43	39	3	1	42.9	48.5
47	45	1	1	44.6	50.4
59	55	4	0	42.6	47.9
59	56	3	0	43.9	50.8
67	62	5	0	41.1	46.9
68	63	5	0	42.8	46.1
77	71	6	0	42.5	48.5
81	74	7	0	41.9	47.5
93	84	9	0	40.3	45.4
86	80	5	1	41.9	47.7
104	95	9	0	41.1	47.3
77	70	7	0	42.9	48.3
100	91	9	0	43.7	47.5
95	87	5	3	42.1	46.2
96	94	2	0	43.3	47.4
75	70	5	0	42.6	47
93	85	8	0	43.8	49.8
83	79	4	0	41.9	45.5
63	56	7	0	42.2	47.2
80	74	5	1	45.6	49.1
68	61	6	1	41.2	47.5
70	66	4	0	43.3	48.3
63	59	3	1	42.4	47.3
73	71	2	0	43.6	48.2

71	67	4	0	43.2	47.9	
70	65	5	0	45	51	
72	66	6	0	43.4	48.5	
51	45	6	0	45.1	50.7	
61	56	5	0	46	51.6	
70	65	5	0	44.7	49.9	
51	51	0	0	44.9	49.5	
70	66	4	0	45.1	49.3	
53	52	1	0	48.1	52	
63	60	3	0	43.1	48.6	
32	32	0	0	45.6	52.4	
27	27	0	0	45.3	49.5	
32	31	1	0	47.5	55.6	
12	11	1	0	45.7	50.9	
17	17	0	0	48.6	57	
13	12	1	0	47.4	53.9	
17	16	1	0	47.1	51.9	
7	7	0	0	48.1	-	
7	7	0	0	46.3	-	
13	13	0	0	46.8	52.9	
9	9	0	0	50.5	-	
5	5	0	0	46.4	-	
4	4	0	0	47.2	-	
7	7	0	0	53	-	
8	8	0	0	47.4	-	
8	8	0	0	52.2	-	
7	7	0	0	51.5	-	
2	2	0	0	44.9	-	
5	5	0	0	49.9	-	
4	4	0	0	45.1	-	
2	2	0	0	60.3	-	
1	1	0	0	48.1	-	
6	6	0	0	48.6	-	
0	0	0	0	-	-	
1	1	0	0	50.5	-	
1	1	0	0	35.1	-	
0	0	0	0	-	-	
1	1	0	0	49.1	-	
267	**242**	**21**	**4**	**44.5**	**49.5**	
2125	**1967**	**151**	**7**	**42.9**	**47.9**	
340	**330**	**10**	**0**	**45.5**	**50.6**	
3057	**2847**	**192**	**18**	**43.8**	**49.1**	

Northbound

3/08/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	9	9	0	0	61.6	-	0000
0015	4	4	0	0	60.4	-	0015
0030	3	3	0	0	60.5	-	0030
0045	2	1	1	0	69.9	-	0045
0100	2	1	0	1	56.5	-	0100
0115	2	2	0	0	53.5	-	0115
0130	6	6	0	0	59.7	-	0130
0145	3	3	0	0	61	-	0145
0200	8	7	1	0	60.1	-	0200
0215	6	6	0	0	63.6	-	0215
0230	3	3	0	0	59.5	-	0230
0245	1	1	0	0	76.4	-	0245
0300	2	2	0	0	61.1	-	0300
0315	3	1	2	0	57.7	-	0315
0330	4	3	1	0	57	-	0330
0345	4	3	0	1	57.5	-	0345
0400	9	9	0	0	62.1	-	0400
0415	12	8	4	0	61.9	73	0415
0430	11	11	0	0	60.8	65.5	0430
0445	18	16	2	0	63.9	70.2	0445
0500	19	17	2	0	65	76.3	0500
0515	32	29	2	1	62	68	0515
0530	54	47	7	0	61.8	66.4	0530
0545	43	37	4	2	60.5	67.5	0545
0600	76	68	8	0	62.2	67.3	0600
0615	75	68	7	0	60.9	65	0615
0630	88	81	7	0	61.2	64.9	0630
0645	98	91	6	1	59.8	63.8	0645
0700	151	138	13	0	59.4	62.9	0700
0715	145	130	12	3	58.2	63.4	0715
0730	180	164	13	3	57	62.1	0730
0745	191	172	19	0	55.4	60.7	0745
0800	162	141	18	3	56.3	61.9	0800
0815	185	174	11	0	56.7	62.1	0815
0830	191	175	16	0	55.9	61.1	0830
0845	153	142	11	0	57	61.7	0845
0900	149	138	11	0	57.1	61.6	0900
0915	122	105	15	2	56.9	61.8	0915
0930	125	115	10	0	57.7	63.2	0930
0945	120	113	7	0	58	63.1	0945
1000	126	113	12	1	57.5	61.7	1000
1015	128	121	6	1	57.4	62.8	1015
1030	99	91	7	1	57.3	62.3	1030
1045	120	106	14	0	56.6	61.9	1045
1100	111	99	12	0	57.1	62.8	1100
1115	111	99	11	1	58.2	61.7	1115
1130	133	123	9	1	57.9	62.8	1130
1145	116	106	9	1	57.6	63	1145
1200	124	110	13	1	57.8	61.5	1200
1215	121	109	12	0	58.1	62.9	1215
1230	132	123	8	1	56.7	61.2	1230
1245	122	108	12	2	57.2	62.2	1245
1300	125	112	12	1	56	60.2	1300
1315	123	109	13	1	56.6	61.6	1315
1330	141	130	10	1	56.8	60.1	1330
1345	115	94	19	2	58	63.1	1345
1400	130	120	10	0	56.2	60.9	1400
1415	129	115	14	0	57.5	62	1415

1430	148	136	10	2	54.8	59.5
1445	166	147	18	1	56.5	61.7
1500	131	121	9	1	56.9	60.7
1515	137	121	16	0	56.1	61
1530	134	128	6	0	56.6	61.2
1545	130	119	9	2	56.1	61.6
1600	123	109	14	0	56.9	62
1615	152	141	11	0	54.7	59.8
1630	144	139	5	0	55.8	62
1645	113	104	9	0	56.7	61.4
1700	134	128	6	0	55.3	59.7
1715	103	99	4	0	57.7	62.1
1730	128	123	5	0	56.1	61.1
1745	94	90	4	0	57.6	62.2
1800	118	106	12	0	56.8	62.3
1815	92	83	8	1	57.4	61.6
1830	87	84	3	0	56.6	60.9
1845	68	66	2	0	56.9	62.2
1900	84	78	5	1	55.8	60.1
1915	61	57	4	0	58.9	64.1
1930	50	46	3	1	56.6	62.3
1945	46	40	6	0	58.5	65.1
2000	60	58	2	0	57.8	63
2015	34	30	4	0	58.2	65.3
2030	30	30	0	0	56	60.7
2045	28	25	3	0	59.6	66.7
2100	29	29	0	0	55.3	62.2
2115	19	17	2	0	59.1	63.9
2130	21	18	2	1	58.9	62.8
2145	22	22	0	0	60.7	66.2
2200	14	10	4	0	61.5	65.5
2215	9	9	0	0	59.8	-
2230	11	10	1	0	61.9	69.4
2245	12	12	0	0	63.2	70.7
2300	11	10	1	0	57.4	65
2315	7	5	1	1	64.8	-
2330	5	5	0	0	65	-
2345	7	6	1	0	61.4	-
07-09	**1358**	**1236**	**113**	**9**	**56.9**	**62.1**
09-16	**3568**	**3231**	**314**	**23**	**57**	**61.7**
16-18	**991**	**933**	**58**	**0**	**56.2**	**61.2**
00-00	**7439**	**6793**	**603**	**43**	**57.3**	**62.3**

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Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0	0	0	0	-	-
2	2	0	0	36.7	-
2	2	0	0	51.8	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	48.6	-
1	1	0	0	45.4	-
0	0	0	0	-	-
0	0	0	0	-	-
1	0	0	1	43.4	-
0	0	0	0	-	-
1	1	0	0	45.3	-
1	1	0	0	42.2	-
5	5	0	0	42.5	-
11	11	0	0	44.7	49.3
4	4	0	0	45.5	-
14	12	2	0	41.4	50.6
15	15	0	0	45.7	49.9
32	29	3	0	46.8	50.1
21	19	1	1	42.1	47.9
23	21	2	0	43	53
14	13	1	0	47.2	53.5
19	15	4	0	46.6	49.3
29	27	2	0	46.7	51.8
14	12	2	0	45.9	51.2
30	28	1	1	43.8	49.3
22	22	0	0	45.2	52.4
32	31	1	0	47	51.3
36	31	5	0	45	50.1
48	43	5	0	44	50.8
39	37	1	1	43.8	52.2
40	39	1	0	45.5	49.3
36	36	0	0	44.8	50.2
55	51	4	0	44.5	49.1
58	54	4	0	43.6	48.8
65	62	3	0	44.9	48.8
59	58	1	0	45	50
53	52	1	0	44.6	48.7
56	53	3	0	45.3	48.1
47	45	2	0	44.9	50.7
43	39	4	0	46.7	50.8
57	55	2	0	45.3	50.2
50	45	5	0	43.7	49
53	48	5	0	46.3	52
62	58	4	0	47	51.6
37	36	1	0	46	50.7
55	52	3	0	44.5	48.5
42	40	2	0	43.8	49.1
57	55	2	0	45.3	51
49	47	2	0	46.4	51.4
50	49	1	0	45.1	50.2

37	35	2	0	44.4	48.4	
40	39	1	0	47.5	53.1	
44	40	4	0	47.1	52.4	
47	45	2	0	46.5	51.6	
51	48	3	0	46.6	52.1	
40	37	3	0	48.1	54.1	
39	38	1	0	44.9	50.6	
57	52	5	0	45.3	52.3	
56	53	3	0	43.7	50.1	
48	44	4	0	47.5	51.4	
42	39	3	0	45.2	52	
43	41	2	0	45.5	49.6	
31	31	0	0	47.6	53.6	
28	26	2	0	47.4	50.6	
9	9	0	0	47	-	
14	12	2	0	44.4	51.3	
12	9	3	0	45.8	53.4	
12	11	1	0	46.6	51.7	
10	10	0	0	49.6	-	
6	6	0	0	47.3	-	
6	6	0	0	49	-	
9	9	0	0	47.5	-	
12	12	0	0	48.7	54.8	
6	6	0	0	43	-	
9	8	1	0	46.2	-	
5	5	0	0	53.1	-	
6	6	0	0	47.7	-	
7	7	0	0	50.9	-	
7	6	1	0	48.3	-	
3	3	0	0	49.3	-	
2	2	0	0	39	-	
2	2	0	0	40.3	-	
0	0	0	0	-	-	
1	1	0	0	43.4	-	
0	0	0	0	-	-	
3	3	0	0	47.6	-	
3	3	0	0	48.8	-	
0	0	0	0	-	-	
196	**179**	**16**	**1**	**45.8**	**50.7**	
1370	**1298**	**71**	**1**	**45.4**	**50.2**	
344	**324**	**20**	**0**	**45.7**	**51.3**	
2188	**2061**	**123**	**4**	**45.5**	**50.6**	

Northbound

4/08/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0000	11	11	0	0	59.7	67.6
0015	6	6	0	0	65.6	-
0030	4	3	1	0	58.2	-
0045	1	1	0	0	61.6	-
0100	4	4	0	0	62.3	-
0115	1	1	0	0	60.7	-
0130	5	5	0	0	58.1	-
0145	1	1	0	0	67.9	-
0200	6	5	1	0	60.9	-
0215	4	4	0	0	63.4	-
0230	4	3	1	0	54.9	-
0245	2	2	0	0	70.3	-
0300	0	0	0	0	-	-
0315	3	1	2	0	59.7	-
0330	2	1	1	0	58.2	-
0345	2	1	0	1	56.1	-
0400	9	8	1	0	58.8	-
0415	12	12	0	0	62.7	66.5
0430	17	15	2	0	59.5	65.9
0445	25	23	2	0	61.5	65.4
0500	18	17	1	0	61.3	68.6
0515	20	16	3	1	57.6	63.5
0530	43	37	6	0	59.8	64.4
0545	51	43	8	0	61.6	66.3
0600	58	54	4	0	62.7	66.9
0615	79	69	10	0	60.9	65.3
0630	107	95	12	0	60.9	65.8
0645	100	89	11	0	61.5	67.1
0700	136	117	16	3	58.3	62.7
0715	132	116	16	0	56.7	62.6
0730	193	178	15	0	57.2	62.6
0745	177	159	16	2	56.5	60.5
0800	179	160	18	1	56.8	60.5
0815	180	168	11	1	56	60.7
0830	169	159	8	2	55.4	59.9
0845	149	139	9	1	55.8	59.7
0900	149	140	9	0	56.6	60.8
0915	177	159	17	1	55.6	59.9
0930	144	135	8	1	56.6	61.6
0945	123	111	11	1	56.1	61.2
1000	125	105	18	2	55.6	61.6
1015	112	108	3	1	55.2	60.8
1030	111	105	5	1	56.6	61.9
1045	128	120	7	1	56.3	61
1100	134	119	15	0	55.7	59.5
1115	136	125	11	0	56.7	62.2
1130	145	132	13	0	56.4	62
1145	145	135	10	0	56.2	61.4
1200	126	113	12	1	57.1	61.7
1215	135	126	9	0	57.8	62.3
1230	112	102	9	1	57.3	61.9
1245	109	97	10	2	58.9	64.9
1300	124	113	10	1	57.8	61.4
1315	121	107	13	1	58.3	63.2
1330	107	95	12	0	58	63.5
1345	130	119	9	2	57.6	61.8
1400	115	100	14	1	57.5	62.5
1415	129	119	9	1	57.4	63.3

Time
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1415

1430	174	166	7	1	55.8	61.2	1430
1445	138	126	11	1	58.2	62.9	1445
1500	144	129	13	2	57.2	62.1	1500
1515	141	127	11	3	56.6	61.2	1515
1530	148	136	11	1	58.4	62.9	1530
1545	148	138	10	0	57	61.9	1545
1600	132	113	17	2	58.4	62.3	1600
1615	151	141	7	3	58.2	63.1	1615
1630	138	131	7	0	57.9	62.3	1630
1645	146	131	15	0	57.1	61.4	1645
1700	145	135	10	0	56.2	60.7	1700
1715	132	125	7	0	55.6	60.1	1715
1730	122	114	8	0	57.1	61.2	1730
1745	105	97	8	0	56.1	60.3	1745
1800	115	109	6	0	56.1	61	1800
1815	115	107	8	0	55.7	60.6	1815
1830	103	97	6	0	56.9	62.1	1830
1845	86	80	5	1	56	60.3	1845
1900	80	78	2	0	58.5	62.8	1900
1915	65	60	5	0	57.5	62.7	1915
1930	47	43	3	1	57.4	62.9	1930
1945	40	38	1	1	56.1	62.2	1945
2000	34	33	1	0	57.6	62.6	2000
2015	51	48	3	0	57.9	63.4	2015
2030	36	35	1	0	57.8	61.8	2030
2045	38	37	1	0	59	64.2	2045
2100	33	29	4	0	58.9	63.9	2100
2115	37	34	2	1	59.9	66.7	2115
2130	31	28	3	0	57.5	63.7	2130
2145	25	24	1	0	60.2	64.3	2145
2200	25	20	4	1	58.2	62.8	2200
2215	20	20	0	0	58	63.3	2215
2230	10	10	0	0	62.7	-	2230
2245	5	5	0	0	60.7	-	2245
2300	6	6	0	0	63.4	-	2300
2315	11	11	0	0	58	67	2315
2330	1	1	0	0	60.3	-	2330
2345	2	1	1	0	53.9	-	2345
07-09	**1315**	**1196**	**109**	**10**	**56.6**	**60.7**	**07-09**
09-16	**3730**	**3407**	**297**	**26**	**56.9**	**61.7**	**09-16**
16-18	**1071**	**987**	**79**	**5**	**57.1**	**61.7**	**16-18**
00-00	**7727**	**7071**	**608**	**48**	**57.3**	**62.1**	**00-00**

Southbound

TDC
Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0	0	0	0	-	-
1	1	0	0	47.5	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	41.3	-
0	0	0	0	-	-
3	2	1	0	53.4	-
2	2	0	0	52.8	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	0	1	0	63	-
0	0	0	0	-	-
1	0	0	1	37.1	-
0	0	0	0	-	-
2	0	1	1	48.7	-
5	5	0	0	42.1	-
4	3	0	1	45.1	-
9	8	0	1	44.4	-
22	20	2	0	47	52
23	21	2	0	49.8	55.5
25	24	1	0	46.5	49.5
23	21	2	0	46	50.3
25	24	1	0	43	52.6
16	16	0	0	44.6	53.1
18	15	3	0	45.7	56.2
31	30	1	0	44.9	48.5
25	23	2	0	46.2	52.2
30	24	5	1	47.5	53.9
43	42	1	0	45.2	51.7
38	36	2	0	44.7	49.5
42	40	1	1	42.3	48.4
49	46	3	0	44.3	49.7
50	47	2	1	42.7	46.8
34	30	4	0	42.3	47.1
50	43	7	0	42.9	50.2
46	43	3	0	43.4	48.4
42	37	5	0	44.2	49.3
53	43	9	1	44.6	50.6
61	59	2	0	44	50.1
53	52	1	0	44.5	49.1
49	47	2	0	44	49.9
51	49	2	0	43.6	47.9
42	41	1	0	43.4	47.9
46	44	2	0	46.2	51.3
49	48	1	0	45.1	49.7
58	53	4	1	44.1	48.8
56	55	1	0	46.1	51.7
65	61	4	0	45.5	50
54	49	5	0	45.9	51.6
53	49	4	0	45.6	50
47	43	4	0	46	51.4
44	42	2	0	45.4	49.6
43	41	2	0	46.3	51

43	40	3	0	45.4	49.8	
63	61	2	0	44	51.1	
40	40	0	0	45.9	51.5	
52	48	4	0	44.9	51.3	
53	49	4	0	46	49.5	
52	50	2	0	46.4	51.5	
57	54	3	0	47.9	53.1	
57	51	6	0	47.1	52.3	
45	41	3	1	48	55.6	
55	49	6	0	45.9	51.8	
56	54	2	0	46.3	52.8	
47	44	3	0	43.7	51	
25	25	0	0	45.9	51.7	
19	16	3	0	46.6	52.9	
18	17	1	0	48.1	54	
13	12	1	0	43.5	47.7	
11	10	1	0	48.5	57.2	
12	11	1	0	44.1	48.4	
14	13	1	0	47.6	52.3	
13	12	1	0	45.8	56.6	
7	7	0	0	46.9	-	
6	4	2	0	49.2	-	
10	10	0	0	48.7	-	
5	5	0	0	46.7	-	
6	6	0	0	47.5	-	
13	13	0	0	48.3	53.2	
6	6	0	0	43.8	-	
15	13	2	0	45.7	52.5	
5	4	1	0	46.4	-	
3	3	0	0	48.6	-	
2	2	0	0	53.4	-	
2	2	0	0	47	-	
1	1	0	0	43.5	-	
2	2	0	0	44.6	-	
3	2	1	0	43.8	-	
7	7	0	0	45.5	-	
1	1	0	0	54.8	-	
0	0	0	0	-	-	
243	**226**	**15**	**2**	**44.9**	**51.1**	
1398	**1310**	**85**	**3**	**44.8**	**50**	
361	**334**	**26**	**1**	**46.5**	**52.3**	
2324	**2165**	**149**	**10**	**45.3**	**50.6**	

Northbound

18/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	0	0	0	0	-	-	0000
0015	2	2	0	0	37.4	-	0015
0030	1	1	0	0	48.5	-	0030
0045	2	2	0	0	55.2	-	0045
0100	0	0	0	0	-	-	0100
0115	3	3	0	0	53.5	-	0115
0130	1	1	0	0	51.5	-	0130
0145	1	1	0	0	50.1	-	0145
0200	0	0	0	0	-	-	0200
0215	0	0	0	0	-	-	0215
0230	1	1	0	0	53.1	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	0	0	0	0	-	-	0315
0330	0	0	0	0	-	-	0330
0345	1	1	0	0	48.7	-	0345
0400	1	1	0	0	42.7	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	0	0	0	0	-	-	0445
0500	0	0	0	0	-	-	0500
0515	2	2	0	0	41.2	-	0515
0530	1	1	0	0	43.1	-	0530
0545	5	4	1	0	46.3	-	0545
0600	7	7	0	0	44.8	-	0600
0615	4	4	0	0	48.6	-	0615
0630	16	15	1	0	43.9	50.7	0630
0645	18	17	0	1	41.4	49.3	0645
0700	19	18	1	0	47.5	54.7	0700
0715	21	21	0	0	44.6	51.9	0715
0730	21	20	1	0	39.8	47.5	0730
0745	33	29	4	0	42.1	49.2	0745
0800	26	24	1	1	41.4	47	0800
0815	24	23	1	0	43.8	48.3	0815
0830	32	28	4	0	45.6	50.3	0830
0845	46	42	4	0	41.7	46.8	0845
0900	31	30	1	0	43.2	47.9	0900
0915	48	45	3	0	44.3	49.4	0915
0930	47	46	1	0	44.3	48.9	0930
0945	58	53	5	0	42.8	48.4	0945
1000	68	62	6	0	42.4	46	1000
1015	55	52	3	0	43.2	47.5	1015
1030	59	57	2	0	42.2	46.4	1030
1045	71	69	2	0	42.4	46.5	1045
1100	76	71	5	0	42.1	48	1100
1115	56	54	2	0	44.3	49	1115
1130	67	65	2	0	43.3	48.6	1130
1145	70	69	1	0	41.3	45.4	1145
1200	71	70	1	0	43.2	47.7	1200
1215	70	69	1	0	44.5	49.3	1215
1230	62	58	3	1	42.3	46.8	1230
1245	54	52	2	0	44.1	49.5	1245
1300	62	60	2	0	42	46.1	1300
1315	69	68	1	0	41.6	45.3	1315
1330	78	77	1	0	42.6	46.6	1330
1345	61	60	0	1	43.5	47.2	1345
1400	70	68	2	0	42.1	47	1400
1415	73	71	2	0	42.3	46.2	1415

1430	72	68	4	0	41.8	48.3
1445	64	60	4	0	42	47.5
1500	64	63	1	0	43.5	47.5
1515	62	58	4	0	42.4	47
1530	70	67	3	0	43.1	47.9
1545	51	50	1	0	42.1	47.6
1600	57	54	3	0	41.6	46.9
1615	55	55	0	0	41.4	48.2
1630	63	62	1	0	41.9	47
1645	62	62	0	0	41.4	45.6
1700	55	52	3	0	44	50.9
1715	51	49	2	0	44.1	49.5
1730	33	33	0	0	45.7	50.5
1745	24	23	1	0	46.9	53.5
1800	13	13	0	0	44.3	51.1
1815	13	12	1	0	41.7	51.8
1830	10	10	0	0	44.7	-
1845	9	9	0	0	43.4	-
1900	22	19	3	0	42.8	52.7
1915	12	12	0	0	45.5	50.8
1930	5	5	0	0	49.8	-
1945	11	11	0	0	43.4	46.8
2000	10	10	0	0	47.5	-
2015	18	18	0	0	47.5	51.2
2030	14	13	1	0	43.8	49.8
2045	21	20	1	0	45.3	54.8
2100	13	13	0	0	40	50.1
2115	7	7	0	0	46.7	-
2130	15	14	1	0	45.6	52.5
2145	7	7	0	0	44.2	-
2200	5	4	1	0	47.2	-
2215	8	6	2	0	44.1	-
2230	8	8	0	0	46.2	-
2245	14	14	0	0	46.3	49.8
2300	1	1	0	0	40.5	-
2315	5	4	1	0	50.2	-
2330	12	12	0	0	51.5	60.1
2345	5	5	0	0	45.3	-
07-09	**222**	**205**	**16**	**1**	**43.1**	**48.2**
09-16	**1759**	**1692**	**65**	**2**	**42.8**	**47.5**
16-18	**400**	**390**	**10**	**0**	**42.9**	**49**
00-00	**2705**	**2597**	**104**	**4**	**43.1**	**48.2**

1430
1445
1500
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1600
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1800
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1900
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1930
1945
2000
2015
2030
2045
2100
2115
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2145
2200
2215
2230
2245
2300
2315
2330
2345
07-09
09-16
16-18
00-00

Southbound

TDC
Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
1	1	0	0	49.5	-
1	1	0	0	24	-
0	0	0	0	-	-
2	2	0	0	54.5	-
0	0	0	0	-	-
4	4	0	0	50.9	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	51.9	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	58.9	-
0	0	0	0	-	-
1	1	0	0	52.8	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
4	4	0	0	40.1	-
3	2	0	1	46.8	-
3	3	0	0	43.2	-
5	4	1	0	43.8	-
7	7	0	0	51.9	-
11	10	1	0	43.8	50.9
18	18	0	0	45.8	47.9
20	18	2	0	45.4	49.4
17	16	1	0	45.2	51.2
29	28	1	0	41.8	47.2
26	22	4	0	44.8	49.7
31	28	3	0	40.8	48.3
26	25	1	0	41.3	47.9
32	28	4	0	44.8	51.3
39	36	3	0	46.4	50.2
39	36	3	0	42.8	48.2
46	44	2	0	44.2	48.8
49	41	7	1	42.5	48.4
53	48	5	0	43.6	49.6
57	50	7	0	44.6	50.1
69	62	7	0	43	46.5
54	53	1	0	44	47.4
88	81	7	0	42.2	46.7
68	64	4	0	43.9	48.7
71	68	3	0	43.1	47.7
67	62	5	0	44.4	48.9
85	82	2	1	43.7	48.1
75	72	3	0	42.9	47.4
83	80	3	0	43.6	48.3
85	80	5	0	44.4	49.2
66	61	4	1	42.4	46.8
79	75	4	0	44.1	49.1
69	63	6	0	41.7	46
70	68	2	0	43.8	47.9
67	63	4	0	45.3	49.8
56	56	0	0	42.6	47.4
66	62	4	0	43.8	49.3
71	69	2	0	43.7	48

53	47	6	0	44	49.5	
58	56	2	0	43.4	47.9	
59	58	1	0	43.8	48.6	
57	54	3	0	44.4	49.6	
60	59	1	0	44.8	47.3	
53	53	0	0	43.3	48.5	
52	50	2	0	43.3	48.4	
58	58	0	0	43	47.9	
60	59	1	0	43.3	46.9	
68	64	4	0	44.1	48.8	
39	37	2	0	45.3	51.1	
25	23	2	0	43	47.8	
25	24	1	0	48.3	52.6	
24	24	0	0	46.1	54.6	
16	15	1	0	50	55.4	
12	11	1	0	46.4	52.2	
14	14	0	0	44.8	49.9	
17	16	1	0	45.8	53	
20	20	0	0	46.8	51.7	
3	3	0	0	47.3	-	
10	10	0	0	49.3	-	
15	15	0	0	50.7	61.9	
7	7	0	0	47.2	-	
10	9	1	0	47.8	-	
17	17	0	0	49.1	55.1	
11	11	0	0	46.3	49.8	
10	9	1	0	45.8	-	
10	9	1	0	49.5	-	
9	9	0	0	49.3	-	
7	7	0	0	49.3	-	
4	4	0	0	52	-	
4	4	0	0	48.4	-	
5	5	0	0	51.3	-	
8	8	0	0	48.9	-	
10	10	0	0	62.6	-	
6	5	1	0	46.1	-	
3	3	0	0	48.1	-	
2	2	0	0	51.7	-	
239	**219**	**20**	**0**	**43.5**	**49.1**	
1834	**1731**	**100**	**3**	**43.6**	**48.2**	
351	**339**	**12**	**0**	**44.2**	**49**	
2736	**2589**	**143**	**4**	**44.2**	**49**	

Northbound

19/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	3	3	0	0	41.8	-	0000
0015	2	2	0	0	49.6	-	0015
0030	1	1	0	0	54.3	-	0030
0045	3	3	0	0	46.2	-	0045
0100	2	2	0	0	54.3	-	0100
0115	2	2	0	0	47.9	-	0115
0130	0	0	0	0	-	-	0130
0145	2	2	0	0	41.6	-	0145
0200	2	2	0	0	49.3	-	0200
0215	0	0	0	0	-	-	0215
0230	0	0	0	0	-	-	0230
0245	2	2	0	0	45.9	-	0245
0300	1	1	0	0	50.5	-	0300
0315	0	0	0	0	-	-	0315
0330	0	0	0	0	-	-	0330
0345	1	1	0	0	40.9	-	0345
0400	1	1	0	0	54.6	-	0400
0415	1	1	0	0	43.8	-	0415
0430	0	0	0	0	-	-	0430
0445	2	2	0	0	39.4	-	0445
0500	1	1	0	0	44.1	-	0500
0515	1	1	0	0	41.8	-	0515
0530	0	0	0	0	-	-	0530
0545	1	1	0	0	42.4	-	0545
0600	7	7	0	0	49.1	-	0600
0615	7	7	0	0	46.1	-	0615
0630	10	10	0	0	44.9	-	0630
0645	16	15	1	0	45.9	50.7	0645
0700	19	18	1	0	45.4	52	0700
0715	36	36	0	0	48.2	52.3	0715
0730	24	23	1	0	44.1	49.8	0730
0745	20	19	1	0	44.7	49.8	0745
0800	25	24	1	0	40.8	45	0800
0815	33	31	2	0	41.9	47.5	0815
0830	34	32	2	0	43.2	46.9	0830
0845	28	26	2	0	46	51.5	0845
0900	39	37	2	0	39.8	47.5	0900
0915	44	43	1	0	41	47.6	0915
0930	60	59	1	0	43.2	48	0930
0945	61	60	1	0	42.3	46.6	0945
1000	70	65	5	0	41.5	46.1	1000
1015	63	60	3	0	38.6	43.3	1015
1030	72	69	3	0	42.6	48.1	1030
1045	78	75	3	0	41.3	45.4	1045
1100	100	94	6	0	41.8	45.9	1100
1115	61	58	3	0	40.1	45.8	1115
1130	94	92	2	0	42.2	46.5	1130
1145	101	97	4	0	41.2	44.8	1145
1200	86	82	4	0	40.3	44.8	1200
1215	67	60	7	0	41.5	44.9	1215
1230	69	67	2	0	41	46.1	1230
1245	73	71	2	0	41.2	46	1245
1300	70	67	3	0	41.7	45.9	1300
1315	70	68	2	0	42.1	46.3	1315
1330	84	81	3	0	41.6	47.2	1330
1345	70	67	3	0	41.8	46.7	1345
1400	85	82	3	0	41.1	46.5	1400
1415	69	67	2	0	40.9	45	1415

1430	66	61	5	0	40.4	47.5	1430
1445	65	65	0	0	42.7	48.6	1445
1500	72	68	3	1	41	45.9	1500
1515	72	70	2	0	41.9	48.2	1515
1530	71	68	3	0	42.3	47.3	1530
1545	74	70	4	0	43	48.2	1545
1600	51	50	1	0	41.3	45.4	1600
1615	52	52	0	0	43.2	48.8	1615
1630	63	62	1	0	42.2	47.1	1630
1645	68	67	1	0	44.5	49.6	1645
1700	61	59	2	0	41.9	48.3	1700
1715	35	32	2	1	43.4	49.3	1715
1730	47	47	0	0	43.4	49.7	1730
1745	27	26	1	0	44.8	48.5	1745
1800	16	15	1	0	46.2	53.6	1800
1815	21	21	0	0	45.7	51.4	1815
1830	16	14	2	0	43.8	51.7	1830
1845	10	10	0	0	47.3	-	1845
1900	2	2	0	0	40.3	-	1900
1915	11	11	0	0	48.6	53.5	1915
1930	10	10	0	0	46.3	-	1930
1945	11	10	1	0	46.8	53.7	1945
2000	9	8	1	0	47.9	-	2000
2015	5	5	0	0	49.9	-	2015
2030	11	10	1	0	46.5	54.3	2030
2045	8	8	0	0	41.3	-	2045
2100	11	10	1	0	47.6	54.3	2100
2115	7	6	1	0	41.5	-	2115
2130	6	5	1	0	42	-	2130
2145	1	1	0	0	39.8	-	2145
2200	8	8	0	0	43.1	-	2200
2215	3	3	0	0	47	-	2215
2230	4	4	0	0	47.3	-	2230
2245	3	3	0	0	44.6	-	2245
2300	3	3	0	0	48.2	-	2300
2315	1	1	0	0	39.8	-	2315
2330	1	1	0	0	45.2	-	2330
2345	0	0	0	0	-	-	2345
07-09	**219**	**209**	**10**	**0**	**44.3**	**49.3**	**07-09**
09-16	**2006**	**1923**	**82**	**1**	**41.5**	**46.3**	**09-16**
16-18	**404**	**395**	**8**	**1**	**43**	**48.1**	**16-18**
00-00	**2875**	**2763**	**110**	**2**	**42.3**	**47.5**	**00-00**

Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
2	2	0	0	45.4	-
2	2	0	0	47.2	-
2	2	0	0	48.9	-
2	2	0	0	49.7	-
2	2	0	0	52.4	-
0	0	0	0	-	-
1	1	0	0	49.3	-
1	1	0	0	53	-
1	1	0	0	43.9	-
1	1	0	0	46.7	-
0	0	0	0	-	-
1	1	0	0	56.2	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	51.2	-
1	1	0	0	46.5	-
1	1	0	0	50.6	-
2	2	0	0	43.4	-
1	1	0	0	51.9	-
3	3	0	0	50.7	-
2	2	0	0	47.4	-
5	4	1	0	44.7	-
8	8	0	0	46.3	-
13	12	1	0	46.9	51
16	16	0	0	46.9	52.8
16	16	0	0	48.7	55.2
21	19	2	0	49.5	55
23	23	0	0	47.4	50.7
26	25	1	0	44.7	50.9
26	24	2	0	42.9	48.4
24	23	0	1	41.7	47
37	34	3	0	44.5	49.7
29	27	2	0	42.4	47.8
42	40	2	0	43.7	48.8
42	39	3	0	42.5	48
49	44	5	0	42.4	49.6
64	64	0	0	42.3	47
68	66	2	0	43.9	48
62	54	8	0	42.3	46.6
78	72	6	0	41.8	46.5
73	68	5	0	41.9	46.6
95	87	8	0	42.1	48.1
91	83	8	0	42.9	48.4
101	96	5	0	40.6	45.5
71	64	7	0	43.3	47.6
97	87	10	0	42.5	46.7
94	90	4	0	41.7	46.3
93	85	8	0	42.3	47.3
92	90	2	0	42	46.1
65	60	5	0	42.5	49.2
79	74	5	0	45	50
82	78	4	0	43.1	48.2
86	83	3	0	41.3	45.7
73	71	2	0	43.2	46.4
86	83	3	0	43.4	47.9
49	46	2	1	42.4	47.8
68	66	2	0	42.3	46.9

51	49	2	0	42.5	47.9	
66	65	1	0	43.8	50	
76	71	5	0	46.4	48.9	
65	63	2	0	43.4	49	
56	52	4	0	46.1	53.1	
41	39	2	0	45.7	50.7	
61	60	1	0	43.5	47.8	
56	54	2	0	43.3	48.3	
53	49	4	0	45.3	50.2	
49	47	2	0	44.6	50.5	
35	33	2	0	42.6	49.4	
26	26	0	0	45.7	51.6	
31	31	0	0	45.3	51.3	
12	12	0	0	46.4	54.1	
8	8	0	0	49.3	-	
13	12	1	0	49.1	51.1	
10	9	1	0	46.1	-	
9	9	0	0	47.2	-	
7	6	1	0	52.8	-	
9	9	0	0	50.9	-	
8	8	0	0	52.8	-	
9	8	1	0	48.3	-	
7	7	0	0	53.5	-	
7	7	0	0	51	-	
14	13	1	0	45.9	50.8	
7	6	1	0	48	-	
4	4	0	0	46.7	-	
9	9	0	0	48.2	-	
5	4	1	0	46.4	-	
4	4	0	0	49.2	-	
4	4	0	0	44.3	-	
3	3	0	0	48	-	
2	2	0	0	50.4	-	
2	2	0	0	42.2	-	
1	1	0	0	52.1	-	
0	0	0	0	-	-	
2	2	0	0	44.8	-	
0	0	0	0	-	-	
249	**235**	**13**	**1**	**43.7**	**48.8**	
2071	**1950**	**120**	**1**	**42.9**	**47.7**	
323	**312**	**11**	**0**	**44.3**	**49.7**	
2893	**2736**	**155**	**2**	**43.6**	**48.8**	

Northbound

20/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	0	0	0	0	-	-	0000
0015	0	0	0	0	-	-	0015
0030	0	0	0	0	-	-	0030
0045	2	2	0	0	56.4	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	1	1	0	0	44.4	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	0	0	0	0	-	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	0	0	0	0	-	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	1	1	0	0	43.6	-	0400
0415	0	0	0	0	-	-	0415
0430	1	1	0	0	37.5	-	0430
0445	0	0	0	0	-	-	0445
0500	0	0	0	0	-	-	0500
0515	1	1	0	0	38	-	0515
0530	2	2	0	0	36.3	-	0530
0545	5	5	0	0	41.8	-	0545
0600	5	5	0	0	35.6	-	0600
0615	7	7	0	0	43.7	-	0615
0630	13	10	3	0	40.7	49.7	0630
0645	24	22	2	0	44.6	49.3	0645
0700	16	15	1	0	43.1	47.2	0700
0715	15	14	1	0	44.8	49.6	0715
0730	19	18	1	0	46.5	53.8	0730
0745	28	26	2	0	41	48.1	0745
0800	32	27	5	0	42.2	46.3	0800
0815	28	26	2	0	44.1	49.4	0815
0830	27	26	1	0	42.8	47.1	0830
0845	28	25	3	0	43.2	47.3	0845
0900	30	28	2	0	42.5	50	0900
0915	33	28	5	0	39	45.7	0915
0930	30	25	5	0	39.3	47.7	0930
0945	36	35	1	0	40.2	45.9	0945
1000	46	42	4	0	39.9	46.9	1000
1015	38	37	1	0	42.1	49.9	1015
1030	45	41	4	0	41.3	46.1	1030
1045	34	34	0	0	42.6	48	1045
1100	51	50	1	0	42.4	48.3	1100
1115	56	54	2	0	41.7	47.1	1115
1130	51	47	4	0	43.1	48	1130
1145	43	41	2	0	41.3	45.9	1145
1200	50	48	2	0	40.7	46	1200
1215	55	53	2	0	42.7	47.4	1215
1230	36	34	2	0	42.5	46.4	1230
1245	55	53	2	0	44.6	49.4	1245
1300	57	54	3	0	44.1	48.9	1300
1315	54	53	1	0	44.4	48.7	1315
1330	61	54	5	2	42.7	47.1	1330
1345	52	49	3	0	41.4	46.3	1345
1400	64	60	4	0	39.7	44.7	1400
1415	37	35	2	0	42.4	46.8	1415

1430	48	46	2	0	41.2	46.7
1445	33	31	2	0	43.3	47.3
1500	44	44	0	0	42.2	46.4
1515	37	37	0	0	41.9	48.9
1530	51	50	1	0	42.1	47.6
1545	39	38	1	0	42.2	48.1
1600	36	35	1	0	42.3	48
1615	43	40	3	0	42.2	47.7
1630	53	48	5	0	43.9	51.5
1645	35	33	2	0	44.6	51.3
1700	35	35	0	0	45.7	50.8
1715	37	37	0	0	44.7	49.6
1730	38	35	3	0	44.4	49.5
1745	24	23	1	0	45.5	51.5
1800	17	17	0	0	47	50.1
1815	11	11	0	0	42.7	50.8
1830	10	10	0	0	45.2	-
1845	4	4	0	0	45.4	-
1900	7	7	0	0	45.2	-
1915	6	6	0	0	44	-
1930	8	8	0	0	46.5	-
1945	5	5	0	0	49.7	-
2000	10	10	0	0	43.7	-
2015	9	9	0	0	45.4	-
2030	12	12	0	0	46.4	53.9
2045	6	6	0	0	46.3	-
2100	11	10	1	0	44.8	49
2115	5	5	0	0	45.9	-
2130	12	12	0	0	49.7	58.3
2145	6	5	1	0	44.7	-
2200	5	5	0	0	46.1	-
2215	1	1	0	0	50.2	-
2230	0	0	0	0	-	-
2245	2	2	0	0	41.3	-
2300	3	3	0	0	53	-
2315	1	1	0	0	33.1	-
2330	0	0	0	0	-	-
2345	3	2	1	0	52.1	-
07-09	**193**	**177**	**16**	**0**	**43.2**	**48.6**
09-16	**1266**	**1201**	**63**	**2**	**42**	**47.3**
16-18	**301**	**286**	**15**	**0**	**44.1**	**49.5**
00-00	**1976**	**1872**	**102**	**2**	**42.8**	**48.2**

1430
1445
1500
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1600
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1800
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1900
1915
1930
1945
2000
2015
2030
2045
2100
2115
2130
2145
2200
2215
2230
2245
2300
2315
2330
2345
07-09
09-16
16-18
00-00

Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
2	2	0	0	59.1	-
0	0	0	0	-	-
1	1	0	0	47.9	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	47.4	-
2	2	0	0	41.8	-
1	1	0	0	45.6	-
3	3	0	0	44	-
1	1	0	0	40.5	-
4	4	0	0	39.8	-
7	7	0	0	43.8	-
8	8	0	0	42.4	-
17	16	0	1	43	48
14	12	2	0	43.3	47.8
16	14	2	0	43.5	49.9
22	20	2	0	46.6	51.5
17	17	0	0	43.4	49.7
21	20	1	0	44.4	50.3
26	22	4	0	39.3	49.7
22	18	4	0	43.8	50.9
34	31	3	0	44.3	52
20	20	0	0	43.8	46.8
32	30	2	0	43.4	48.6
29	21	8	0	45.2	50.6
43	39	4	0	40.8	48.3
35	31	4	0	38	46.8
41	36	5	0	41.3	48.3
36	36	0	0	41	46.2
42	42	0	0	40.9	48.6
39	36	3	0	44.7	50.2
68	64	4	0	42.2	48.2
39	37	2	0	44.1	49.3
52	52	0	0	41.4	47
42	39	2	1	42.7	48.8
54	52	2	0	43.9	49.5
39	36	3	0	42.6	47.3
48	47	1	0	42.5	48.2
37	35	2	0	44.5	49.5
69	65	4	0	44	49
56	54	2	0	44.5	50.8
57	52	5	0	43.3	50.1
57	54	2	1	45.2	49.4
54	49	5	0	45.8	50.9
58	54	4	0	41.4	46.3
47	45	2	0	41.9	47.6
36	36	0	0	44.3	48.9

52	50	2	0	44.3	49	
32	31	1	0	43.6	50.2	
39	38	1	0	46.1	50.6	
50	47	3	0	44.3	48.2	
30	30	0	0	45.2	51.4	
47	43	4	0	45.4	51.3	
34	33	1	0	45	48	
34	32	2	0	45.7	51.2	
47	44	3	0	45.4	50.7	
35	32	3	0	45.4	49.9	
34	30	4	0	46.9	51.1	
33	33	0	0	46.9	53.9	
31	29	2	0	44.2	49	
11	11	0	0	49.8	54.1	
7	7	0	0	49.1	-	
6	6	0	0	48	-	
17	17	0	0	50.2	54.2	
9	8	1	0	48	-	
9	9	0	0	49.3	-	
7	7	0	0	45.1	-	
1	1	0	0	44	-	
13	13	0	0	46.2	54.5	
7	7	0	0	48	-	
6	6	0	0	50.8	-	
9	9	0	0	49.1	-	
5	5	0	0	49.7	-	
8	7	1	0	47.5	-	
5	5	0	0	47.3	-	
7	6	1	0	47.6	-	
6	6	0	0	50.2	-	
4	4	0	0	50.5	-	
0	0	0	0	-	-	
1	1	0	0	53	-	
3	2	1	0	55.2	-	
2	2	0	0	48.7	-	
0	0	0	0	-	-	
0	0	0	0	-	-	
2	2	0	0	52	-	
201	**179**	**22**	**0**	**43.5**	**49.7**	
1299	**1230**	**67**	**2**	**43.2**	**49**	
259	**244**	**15**	**0**	**45.8**	**50.9**	
1992	**1875**	**114**	**3**	**44**	**49.7**	

Northbound

21/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	1	1	0	0	65.8	-	0000
0015	3	3	0	0	45.9	-	0015
0030	0	0	0	0	-	-	0030
0045	3	3	0	0	52.4	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	0	0	0	0	-	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	1	1	0	0	46.4	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	0	0	0	0	-	-	0315
0330	0	0	0	0	-	-	0330
0345	1	0	1	0	43.8	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	1	1	0	0	46.8	-	0445
0500	0	0	0	0	-	-	0500
0515	1	1	0	0	49.2	-	0515
0530	0	0	0	0	-	-	0530
0545	0	0	0	0	-	-	0545
0600	5	5	0	0	43.3	-	0600
0615	6	6	0	0	41.5	-	0615
0630	25	23	2	0	46.8	53.3	0630
0645	27	26	1	0	44.8	51.6	0645
0700	18	16	2	0	45.1	48.6	0700
0715	19	17	2	0	43.1	49	0715
0730	19	18	1	0	45.1	49.3	0730
0745	30	29	1	0	40.4	46.7	0745
0800	18	18	0	0	46.1	49.9	0800
0815	27	24	3	0	44	49	0815
0830	25	23	2	0	43.8	49.2	0830
0845	37	33	4	0	41.1	45.9	0845
0900	37	35	2	0	43.6	47.8	0900
0915	32	27	4	1	42.9	47.3	0915
0930	38	33	5	0	43.1	48.4	0930
0945	42	38	4	0	44.4	48.3	0945
1000	40	39	1	0	42.8	47.2	1000
1015	39	37	2	0	42.5	47.3	1015
1030	39	38	1	0	43	47	1030
1045	27	25	2	0	43.3	49.8	1045
1100	35	33	2	0	40.5	47.1	1100
1115	35	34	1	0	43.4	48.2	1115
1130	32	32	0	0	43.2	47.2	1130
1145	56	54	2	0	42.1	47.4	1145
1200	34	30	4	0	41.5	47.7	1200
1215	44	43	1	0	42.1	46.8	1215
1230	51	48	3	0	43.2	46.2	1230
1245	40	36	4	0	43.5	48.9	1245
1300	49	48	1	0	43.7	51.3	1300
1315	44	42	2	0	43.4	48.9	1315
1330	46	44	2	0	43.2	48.8	1330
1345	50	49	1	0	41.5	48.1	1345
1400	44	39	5	0	44.2	50.1	1400
1415	39	36	3	0	44.3	49.5	1415

1430	43	42	1	0	42.8	48.3	1430
1445	39	39	0	0	43.5	48.6	1445
1500	46	46	0	0	43.5	49.8	1500
1515	37	35	2	0	43.7	47.4	1515
1530	39	37	2	0	42	47	1530
1545	46	43	3	0	42.3	48.8	1545
1600	24	23	1	0	40.6	47.1	1600
1615	42	37	4	1	42.5	50.2	1615
1630	43	42	1	0	41.6	47.1	1630
1645	34	33	1	0	43.3	49.8	1645
1700	39	38	1	0	45.7	51.5	1700
1715	37	37	0	0	45.5	50.9	1715
1730	24	24	0	0	46.7	52.5	1730
1745	16	15	1	0	42	45.9	1745
1800	11	11	0	0	44.1	48.5	1800
1815	10	10	0	0	43.6	-	1815
1830	8	7	1	0	43.4	-	1830
1845	12	12	0	0	44.9	50	1845
1900	5	5	0	0	40.2	-	1900
1915	6	6	0	0	44.4	-	1915
1930	11	11	0	0	43.1	53.8	1930
1945	5	5	0	0	40	-	1945
2000	8	8	0	0	47.8	-	2000
2015	9	9	0	0	48.2	-	2015
2030	9	9	0	0	42.4	-	2030
2045	9	9	0	0	45.6	-	2045
2100	4	4	0	0	43	-	2100
2115	6	6	0	0	47.7	-	2115
2130	5	4	1	0	40.3	-	2130
2145	5	5	0	0	50	-	2145
2200	3	3	0	0	56.5	-	2200
2215	4	4	0	0	44.9	-	2215
2230	8	8	0	0	48.6	-	2230
2245	4	3	1	0	45.4	-	2245
2300	3	3	0	0	44.6	-	2300
2315	1	1	0	0	53.6	-	2315
2330	0	0	0	0	-	-	2330
2345	1	1	0	0	48.3	-	2345
07-09	**193**	**178**	**15**	**0**	**43.2**	**48.2**	**07-09**
09-16	**1143**	**1082**	**60**	**1**	**43**	**48.1**	**09-16**
16-18	**259**	**249**	**9**	**1**	**43.5**	**49.7**	**16-18**
00-00	**1816**	**1723**	**91**	**2**	**43.4**	**48.6**	**00-00**

Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	50.1	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	62.7	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	0	1	0	45.6	-
0	0	0	0	-	-
1	1	0	0	42.5	-
1	1	0	0	39	-
1	1	0	0	44	-
3	3	0	0	48.3	-
1	1	0	0	45.6	-
2	2	0	0	44.6	-
2	2	0	0	49.3	-
10	10	0	0	46	-
17	17	0	0	48.4	52.5
13	13	0	0	45.1	52.2
22	20	2	0	45.7	48.6
18	15	3	0	42.2	46.2
17	17	0	0	43.9	49.8
23	23	0	0	43.5	47.8
26	25	1	0	42.3	47
21	21	0	0	44.8	50
27	24	3	0	44.8	50.5
21	21	0	0	43.8	46.6
42	37	5	0	43.9	48.7
42	39	2	1	43.2	48.3
35	30	5	0	45.8	49.6
44	40	4	0	43.8	49.7
28	23	5	0	43.5	45.5
48	47	1	0	43.9	49.5
36	34	2	0	44.6	48.6
33	31	2	0	43.8	49.1
30	28	2	0	39.7	47.5
37	36	1	0	43.1	47
40	38	2	0	41.1	47.2
48	45	3	0	42.2	45.7
49	46	3	0	41.9	47.4
41	38	3	0	43.9	46.9
30	26	4	0	44	48.9
55	53	2	0	44.1	49.7
41	36	5	0	45.7	50.7
62	59	3	0	42.9	47.7
36	34	2	0	44.9	48.6
52	48	4	0	45.2	51
48	45	3	0	43.6	49.1
38	36	2	0	43.4	47
43	40	3	0	43.7	48.5
34	32	2	0	45.1	50.8

44	43	1	0	43.4	49.5	
33	30	3	0	43.7	49.6	
46	44	2	0	46.1	50.9	
42	40	2	0	44.6	50.1	
36	33	3	0	43.5	49.2	
37	36	1	0	44.6	51.7	
23	21	2	0	43.9	50.5	
37	34	3	0	45.5	49.4	
42	40	2	0	43.4	50.4	
36	35	1	0	46.9	51	
26	26	0	0	46.6	48.6	
32	31	1	0	47.6	54.8	
16	15	1	0	46.3	52.8	
9	9	0	0	47.8	-	
7	7	0	0	47	-	
10	9	1	0	46.9	-	
7	7	0	0	46.5	-	
11	11	0	0	45.7	52.5	
10	10	0	0	43.2	-	
8	8	0	0	40.7	-	
9	9	0	0	53.4	-	
4	4	0	0	50	-	
6	6	0	0	44.4	-	
8	8	0	0	48.1	-	
9	9	0	0	45.4	-	
3	3	0	0	51.1	-	
7	7	0	0	47.4	-	
7	7	0	0	52.8	-	
4	4	0	0	49.1	-	
3	3	0	0	48.8	-	
5	5	0	0	51.6	-	
2	2	0	0	48.9	-	
4	4	0	0	45.9	-	
2	1	1	0	41.6	-	
3	3	0	0	48.8	-	
2	2	0	0	49.8	-	
0	0	0	0	-	-	
0	0	0	0	-	-	
219	**207**	**11**	**1**	**43.7**	**49.1**	
1146	**1071**	**75**	**0**	**43.8**	**48.8**	
221	**211**	**10**	**0**	**45.8**	**50.8**	
1812	**1707**	**104**	**1**	**44.4**	**49.5**	

Northbound

22/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	2	2	0	0	61.6	-	0000
0015	0	0	0	0	-	-	0015
0030	1	1	0	0	41.2	-	0030
0045	0	0	0	0	-	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	0	0	0	0	-	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	0	0	0	0	-	-	0215
0230	0	0	0	0	-	-	0230
0245	1	1	0	0	41.1	-	0245
0300	0	0	0	0	-	-	0300
0315	0	0	0	0	-	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	0	0	0	0	-	-	0430
0445	0	0	0	0	-	-	0445
0500	1	1	0	0	17	-	0500
0515	2	2	0	0	49.7	-	0515
0530	1	1	0	0	51.4	-	0530
0545	1	1	0	0	25.5	-	0545
0600	4	3	0	1	36.1	-	0600
0615	6	6	0	0	39.9	-	0615
0630	12	11	1	0	42.7	49.2	0630
0645	24	24	0	0	43.5	49.1	0645
0700	21	21	0	0	44.1	47.4	0700
0715	21	21	0	0	42.1	48.6	0715
0730	18	18	0	0	45.2	50.1	0730
0745	25	23	2	0	43.8	49	0745
0800	26	24	2	0	41.6	47.3	0800
0815	24	22	2	0	44.3	51.4	0815
0830	25	22	3	0	42.4	49	0830
0845	29	26	2	1	40.7	46.9	0845
0900	23	23	0	0	43	51.3	0900
0915	39	37	2	0	41.6	47.5	0915
0930	38	36	2	0	42.3	48.6	0930
0945	29	27	2	0	37.6	46.7	0945
1000	46	45	1	0	42.6	47.5	1000
1015	46	44	2	0	43.3	47.7	1015
1030	36	35	1	0	42.9	48.8	1030
1045	47	43	4	0	41.3	46.3	1045
1100	40	38	2	0	43.9	49	1100
1115	49	46	3	0	41.9	46.6	1115
1130	38	35	3	0	42.2	49.4	1130
1145	52	52	0	0	41.6	46.1	1145
1200	40	38	2	0	40.3	45.3	1200
1215	45	38	7	0	43.9	47	1215
1230	48	48	0	0	43.7	48.2	1230
1245	44	44	0	0	42.6	47.1	1245
1300	34	34	0	0	43	49.2	1300
1315	50	46	4	0	44.3	48.2	1315
1330	45	43	2	0	42.3	47	1330
1345	39	36	3	0	43.6	47.3	1345
1400	43	43	0	0	41.6	46	1400
1415	42	38	4	0	43.9	48.7	1415

1430	52	50	1	1	44	48.1
1445	38	38	0	0	42.6	46.6
1500	41	40	1	0	46	52.8
1515	59	59	0	0	45.1	52.6
1530	51	49	2	0	44.6	49.3
1545	30	28	2	0	43.9	49.9
1600	34	32	1	1	44.5	49.5
1615	37	35	2	0	43.8	48.9
1630	29	27	2	0	44.6	48.7
1645	43	38	5	0	42.6	48.7
1700	44	41	3	0	39.8	48.7
1715	35	35	0	0	45.7	49.8
1730	25	24	1	0	46	50.2
1745	21	19	2	0	45.4	51.1
1800	19	17	2	0	45.4	52.7
1815	15	14	1	0	41.1	49.2
1830	14	14	0	0	44.4	51.3
1845	17	17	0	0	45.4	50.5
1900	9	9	0	0	45.8	-
1915	7	6	1	0	41.4	-
1930	8	8	0	0	47.7	-
1945	10	10	0	0	45.2	-
2000	12	11	1	0	44.5	52.9
2015	7	6	1	0	47.7	-
2030	12	11	1	0	43.6	51.4
2045	10	10	0	0	44.9	-
2100	7	7	0	0	48.6	-
2115	9	8	1	0	47.9	-
2130	9	9	0	0	44.6	-
2145	10	10	0	0	49.4	-
2200	9	8	1	0	43.1	-
2215	2	2	0	0	54	-
2230	3	3	0	0	48.9	-
2245	8	8	0	0	50.6	-
2300	2	2	0	0	47.9	-
2315	1	1	0	0	45.6	-
2330	1	1	0	0	47	-
2345	1	1	0	0	43.7	-
07-09	**189**	**177**	**11**	**1**	**42.9**	**48.6**
09-16	**1184**	**1133**	**50**	**1**	**42.9**	**48.1**
16-18	**268**	**251**	**16**	**1**	**43.7**	**49.3**
00-00	**1898**	**1807**	**87**	**4**	**43.3**	**48.8**

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16-18
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Southbound

TDC
Traffic Data & Control

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
3	3	0	0	47	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	47.7	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	0	0	1	39.7	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	35.1	-
2	2	0	0	53.2	-
4	4	0	0	46.8	-
4	2	2	0	41.6	-
18	15	2	1	38.9	49.2
19	18	1	0	43.3	49.3
21	18	3	0	44.1	51.2
15	15	0	0	44	50.1
22	22	0	0	42.3	51.1
18	18	0	0	46.6	51.5
18	16	2	0	43.9	49.3
20	19	1	0	40.6	47.2
31	29	2	0	39.1	48.4
24	23	1	0	45.2	49.7
26	26	0	0	40.8	50.7
40	37	3	0	40.4	47
42	39	3	0	43.7	51.3
46	43	3	0	42.5	48.1
31	28	3	0	43.2	50.8
42	38	2	2	39.8	47.5
55	54	1	0	43.5	48.2
42	41	1	0	44.4	49
48	46	2	0	42.6	47.3
49	45	4	0	42.5	48.4
39	36	3	0	42.7	47.5
53	51	2	0	43.4	50.3
43	39	4	0	43.6	47.7
47	44	3	0	43	47.6
39	35	3	1	44.6	50.8
50	46	4	0	43.7	47.1
38	36	2	0	44.3	49
42	41	1	0	45.9	50
48	45	3	0	42.7	48.8
40	39	1	0	45.7	49.7
43	37	5	1	43.3	49
41	40	1	0	46.3	51.1
33	32	0	1	43.7	47.9
51	48	2	1	44.6	50.4

38	37	1	0	43.3	47	
46	45	1	0	45.6	51.8	
39	38	1	0	48	56.5	
43	41	2	0	44.6	50.8	
50	49	1	0	47	53.5	
39	37	2	0	46.5	51.5	
35	34	1	0	46.7	52.7	
38	37	1	0	46.1	51.5	
41	38	3	0	48.3	53.1	
44	40	4	0	44.9	50.3	
26	25	1	0	46.6	54	
19	18	1	0	49	55.3	
17	17	0	0	47.3	52.3	
15	15	0	0	43.5	50.8	
13	13	0	0	47.8	55.1	
15	14	1	0	46	51.2	
13	12	1	0	47	50.4	
13	12	1	0	47.6	54	
9	8	1	0	48.4	-	
8	7	1	0	49.7	-	
5	5	0	0	47.3	-	
11	11	0	0	46.8	53	
10	10	0	0	47.6	-	
12	11	1	0	51.5	59.5	
12	10	2	0	53.2	60.3	
8	8	0	0	46.5	-	
7	7	0	0	53.9	-	
9	8	1	0	47.8	-	
6	6	0	0	52.5	-	
5	5	0	0	49.4	-	
7	6	1	0	48.7	-	
3	2	1	0	50.4	-	
4	4	0	0	48.3	-	
5	4	1	0	52.6	-	
2	2	0	0	48.6	-	
0	0	0	0	-	-	
1	1	0	0	51.1	-	
1	1	0	0	50.1	-	
199	**190**	**9**	**0**	**41.9**	**49.5**	
1217	**1150**	**61**	**6**	**44.1**	**49.4**	
235	**224**	**11**	**0**	**46.6**	**52.3**	
1920	**1811**	**101**	**8**	**44.6**	**50.4**	

Northbound

23/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	2	2	0	0	40.9	-	0000
0015	0	0	0	0	-	-	0015
0030	1	1	0	0	34.1	-	0030
0045	1	1	0	0	45	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	1	1	0	0	38.7	-	0130
0145	1	1	0	0	40.3	-	0145
0200	0	0	0	0	-	-	0200
0215	0	0	0	0	-	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	1	1	0	0	42.2	-	0300
0315	1	1	0	0	40.1	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	0	0	0	0	-	-	0400
0415	0	0	0	0	-	-	0415
0430	2	2	0	0	41.8	-	0430
0445	0	0	0	0	-	-	0445
0500	0	0	0	0	-	-	0500
0515	2	2	0	0	31.9	-	0515
0530	1	1	0	0	43.4	-	0530
0545	4	4	0	0	43.7	-	0545
0600	4	4	0	0	44	-	0600
0615	6	5	1	0	44.9	-	0615
0630	9	8	1	0	39.7	-	0630
0645	18	16	2	0	42.9	50	0645
0700	21	21	0	0	45.1	52.9	0700
0715	16	14	2	0	43.2	50	0715
0730	18	18	0	0	46.2	55.1	0730
0745	31	29	2	0	42.6	48.1	0745
0800	21	20	1	0	44	48.8	0800
0815	20	16	4	0	43.6	49	0815
0830	30	29	1	0	42.7	48.7	0830
0845	24	23	1	0	43.9	49.5	0845
0900	29	27	2	0	45.3	49.3	0900
0915	28	28	0	0	43.3	47.7	0915
0930	36	33	3	0	43.7	48.9	0930
0945	43	42	1	0	43.6	49.3	0945
1000	37	33	4	0	43.2	48.4	1000
1015	43	39	4	0	41.2	47.4	1015
1030	47	43	4	0	42.5	48.1	1030
1045	53	48	5	0	41.5	46.3	1045
1100	42	41	1	0	40.3	46.4	1100
1115	48	46	1	1	43.9	48.2	1115
1130	68	65	3	0	42.1	47.5	1130
1145	46	45	1	0	44.6	47.7	1145
1200	49	47	2	0	45	49.4	1200
1215	38	38	0	0	42.9	47	1215
1230	46	44	2	0	45.4	50.6	1230
1245	48	45	3	0	44.2	49.6	1245
1300	40	38	2	0	45.5	50.7	1300
1315	51	49	2	0	41.6	46.6	1315
1330	52	51	1	0	44.2	48.1	1330
1345	59	58	1	0	44	48.4	1345
1400	49	47	2	0	45.4	51.8	1400
1415	56	54	2	0	43.3	50.1	1415

1430	45	44	1	0	42.3	47
1445	51	49	2	0	43.2	48.9
1500	64	60	4	0	41.7	46.5
1515	49	46	2	1	42.1	46.1
1530	41	41	0	0	42.2	47.3
1545	32	29	3	0	47.5	53.8
1600	50	45	5	0	45.2	51.8
1615	35	33	2	0	42.8	48.6
1630	43	41	2	0	44.7	49
1645	48	46	2	0	44.3	50.1
1700	41	39	2	0	44.9	50
1715	38	36	2	0	40.9	44.6
1730	46	43	2	1	44.9	50.8
1745	30	29	1	0	46.7	52.4
1800	21	18	2	1	45.6	50.1
1815	12	11	1	0	42.1	48.1
1830	12	11	1	0	44.4	50.8
1845	16	16	0	0	44.5	51.5
1900	11	10	1	0	41.3	49.9
1915	9	9	0	0	43.4	-
1930	8	8	0	0	38.7	-
1945	9	9	0	0	45.4	-
2000	17	17	0	0	49.9	58.6
2015	10	10	0	0	46.4	-
2030	5	5	0	0	47.3	-
2045	10	10	0	0	45.8	-
2100	8	8	0	0	47.3	-
2115	5	5	0	0	50	-
2130	6	6	0	0	46.7	-
2145	4	4	0	0	53.5	-
2200	2	1	1	0	34.6	-
2215	4	4	0	0	46.4	-
2230	10	10	0	0	49.4	-
2245	2	2	0	0	61.3	-
2300	8	8	0	0	53.5	-
2315	1	1	0	0	30	-
2330	1	1	0	0	51.3	-
2345	0	0	0	0	-	-
07-09	**181**	**170**	**11**	**0**	**43.8**	**49.3**
09-16	**1290**	**1230**	**58**	**2**	**43.3**	**48.4**
16-18	**331**	**312**	**18**	**1**	**44.3**	**50.4**
00-00	**2047**	**1946**	**97**	**4**	**43.7**	**49.1**

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2230
2245
2300
2315
2330
2345
07-09
09-16
16-18
00-00

Southbound

Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0	0	0	0	-	-
1	1	0	0	41.8	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	46.8	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	50.9	-
0	0	0	0	-	-
1	1	0	0	44.5	-
0	0	0	0	-	-
0	0	0	0	-	-
4	4	0	0	50.4	-
0	0	0	0	-	-
0	0	0	0	-	-
2	2	0	0	46.8	-
4	3	0	1	37.7	-
7	6	1	0	45.5	-
10	10	0	0	48.2	-
13	12	0	1	47.4	55.2
14	14	0	0	44	51.6
23	18	4	1	37.7	46.2
13	13	0	0	44.7	53.4
16	15	1	0	42.9	49.5
21	19	2	0	39.6	48.7
27	26	1	0	46.6	50.3
32	28	4	0	42.7	47.7
22	21	1	0	44.3	49.5
24	22	2	0	45.1	47.7
23	22	1	0	46.2	50.3
26	25	1	0	44.5	49.1
37	36	1	0	46.5	50.3
44	39	5	0	43.1	47.2
47	45	2	0	42	49.1
53	50	3	0	43.2	47
41	38	3	0	44.5	50.6
35	29	5	1	42.4	48.6
48	47	1	0	42.2	48.5
57	53	4	0	45.3	49.7
52	50	1	1	44.4	48.8
59	54	5	0	45.7	52.6
52	51	1	0	44.2	47.8
39	38	1	0	44.5	50.9
51	51	0	0	44.4	49.2
51	50	1	0	44.8	51
40	39	1	0	44.9	50.6
56	54	2	0	45.2	49.9
51	48	2	1	45.4	50.5
61	59	2	0	43.6	48.6
37	35	2	0	42.2	46.5
56	54	2	0	44.8	49.1
50	49	1	0	45.8	49.9
43	43	0	0	46.2	52.2

49	44	5	0	42.7	50	
55	49	5	1	43.8	48.7	
41	37	4	0	44.3	49.3	
39	37	1	1	44.9	50.8	
44	41	3	0	44.5	51.2	
39	38	1	0	46.7	50.9	
41	37	4	0	47.4	52.3	
52	48	4	0	43.4	49.4	
31	31	0	0	44.9	48.7	
41	40	1	0	45.9	52	
24	24	0	0	47.2	52.5	
36	33	2	1	42.7	50	
26	26	0	0	46	49.3	
22	22	0	0	47.8	52.9	
22	20	2	0	48.1	57	
5	5	0	0	42.8	-	
12	12	0	0	48.9	53.9	
7	7	0	0	46.9	-	
11	11	0	0	46.7	51.8	
10	10	0	0	43.2	-	
8	8	0	0	45.6	-	
17	17	0	0	49.8	54.3	
11	11	0	0	50.1	59.5	
8	8	0	0	50.7	-	
11	11	0	0	51.6	61.8	
7	7	0	0	47.4	-	
4	4	0	0	52.2	-	
5	5	0	0	46.3	-	
5	5	0	0	49.4	-	
3	3	0	0	48.3	-	
6	5	1	0	51.4	-	
3	3	0	0	56.2	-	
4	4	0	0	49.5	-	
4	4	0	0	54.7	-	
1	1	0	0	46.3	-	
1	1	0	0	45.9	-	
2	2	0	0	45.4	-	
1	1	0	0	50.3	-	
191	**178**	**13**	**0**	**44.1**	**49.2**	
1327	**1258**	**64**	**5**	**44.4**	**49.5**	
273	**261**	**11**	**1**	**45.4**	**51.5**	
2054	**1949**	**96**	**9**	**44.8**	**50.4**	

Northbound

24/07/2020

Time	Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile	Time
0000	1	1	0	0	46.9	-	0000
0015	0	0	0	0	-	-	0015
0030	1	1	0	0	43.6	-	0030
0045	1	1	0	0	43.3	-	0045
0100	0	0	0	0	-	-	0100
0115	0	0	0	0	-	-	0115
0130	3	3	0	0	54.1	-	0130
0145	0	0	0	0	-	-	0145
0200	0	0	0	0	-	-	0200
0215	0	0	0	0	-	-	0215
0230	0	0	0	0	-	-	0230
0245	0	0	0	0	-	-	0245
0300	0	0	0	0	-	-	0300
0315	1	1	0	0	36.4	-	0315
0330	0	0	0	0	-	-	0330
0345	0	0	0	0	-	-	0345
0400	1	1	0	0	63	-	0400
0415	2	2	0	0	34.7	-	0415
0430	0	0	0	0	-	-	0430
0445	1	1	0	0	44.8	-	0445
0500	3	3	0	0	39.1	-	0500
0515	0	0	0	0	-	-	0515
0530	0	0	0	0	-	-	0530
0545	4	4	0	0	43.7	-	0545
0600	2	1	1	0	43.3	-	0600
0615	7	7	0	0	45.4	-	0615
0630	9	8	1	0	46.7	-	0630
0645	20	18	2	0	44.8	49.3	0645
0700	14	14	0	0	45.1	52.1	0700
0715	18	18	0	0	43	48.3	0715
0730	29	28	1	0	43.3	47.7	0730
0745	24	23	1	0	42.7	47.7	0745
0800	18	17	0	1	42.6	47.9	0800
0815	27	22	5	0	44.2	49.5	0815
0830	37	35	2	0	43.2	49.6	0830
0845	23	21	2	0	43.7	49.2	0845
0900	42	38	4	0	43	47.1	0900
0915	40	38	2	0	42.7	47.1	0915
0930	40	39	1	0	41.4	47.7	0930
0945	34	33	1	0	44.3	49.4	0945
1000	35	33	2	0	42.5	49.6	1000
1015	42	39	3	0	42.5	46.5	1015
1030	50	48	2	0	43.4	47.4	1030
1045	39	37	2	0	43.8	50.2	1045
1100	41	33	8	0	43.7	49.1	1100
1115	45	43	2	0	42.4	46.5	1115
1130	49	47	2	0	43	49.2	1130
1145	42	40	1	1	43.5	48.9	1145
1200	59	59	0	0	42.9	47.9	1200
1215	32	30	2	0	44.2	48.4	1215
1230	47	42	5	0	42.7	48.6	1230
1245	41	41	0	0	43.4	49.8	1245
1300	54	53	1	0	43.4	47.8	1300
1315	31	29	2	0	43.2	47.7	1315
1330	47	46	1	0	42.4	47.3	1330
1345	33	31	2	0	44.7	49.3	1345
1400	64	61	3	0	45.1	49.5	1400
1415	46	46	0	0	44.1	47.9	1415

1430	45	43	2	0	44	47.7
1445	47	46	1	0	44	48.6
1500	53	52	1	0	42.7	48
1515	45	44	1	0	43.6	50.1
1530	37	33	4	0	41.7	48
1545	48	45	3	0	43.7	48.1
1600	39	35	4	0	45.2	50
1615	39	37	2	0	45.4	51.5
1630	41	41	0	0	46.1	50.8
1645	38	37	1	0	45	49.2
1700	52	51	0	1	42.8	49.4
1715	41	37	3	1	44.4	51.9
1730	30	28	2	0	45	49.9
1745	22	21	1	0	44.1	49.5
1800	12	10	1	1	46.2	52.2
1815	14	14	0	0	47.3	50.4
1830	17	17	0	0	45.7	51.8
1845	17	16	1	0	44.5	51.5
1900	15	15	0	0	46.2	51.7
1915	9	9	0	0	40.6	-
1930	12	11	0	1	44.8	50.2
1945	22	21	1	0	45.6	49.3
2000	13	12	1	0	44.2	46.4
2015	14	14	0	0	45.2	55
2030	18	17	1	0	45.3	53.8
2045	17	16	1	0	44.9	51
2100	6	6	0	0	44.2	-
2115	21	21	0	0	47.9	53.8
2130	13	12	1	0	44.9	52.2
2145	11	11	0	0	48	57.2
2200	6	5	1	0	40.1	-
2215	9	9	0	0	47.6	-
2230	10	10	0	0	44.8	-
2245	7	7	0	0	49.7	-
2300	7	7	0	0	53.5	-
2315	4	4	0	0	49.6	-
2330	4	4	0	0	47	-
2345	2	2	0	0	43.7	-
07-09	**190**	**178**	**11**	**1**	**43.5**	**48.8**
09-16	**1228**	**1169**	**58**	**1**	**43.3**	**48.4**
16-18	**302**	**287**	**13**	**2**	**44.7**	**50**
00-00	**2056**	**1956**	**94**	**6**	**43.9**	**49.1**

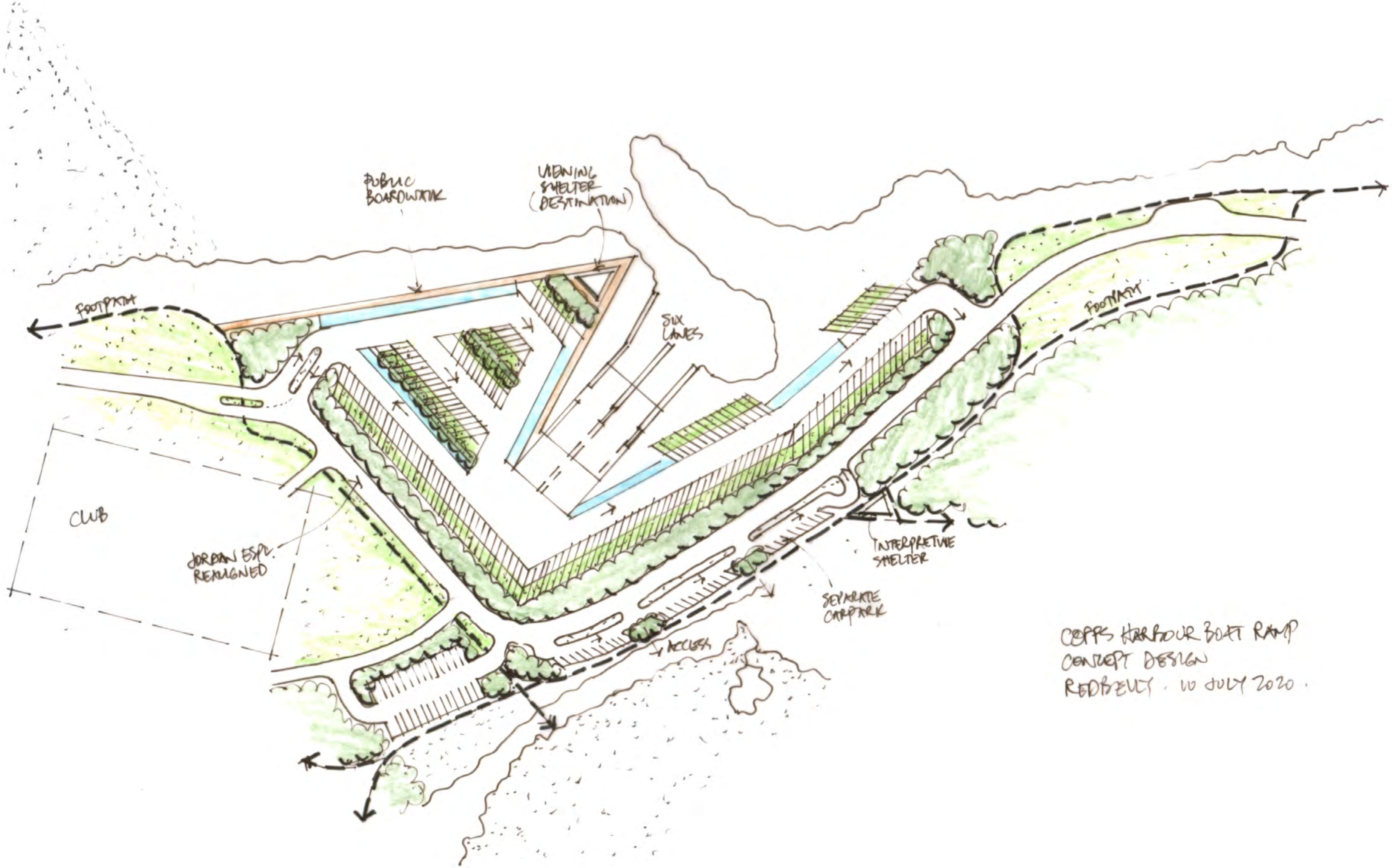
1430
1445
1500
1515
1530
1545
1600
1615
1630
1645
1700
1715
1730
1745
1800
1815
1830
1845
1900
1915
1930
1945
2000
2015
2030
2045
2100
2115
2130
2145
2200
2215
2230
2245
2300
2315
2330
2345
07-09
09-16
16-18
00-00

Southbound

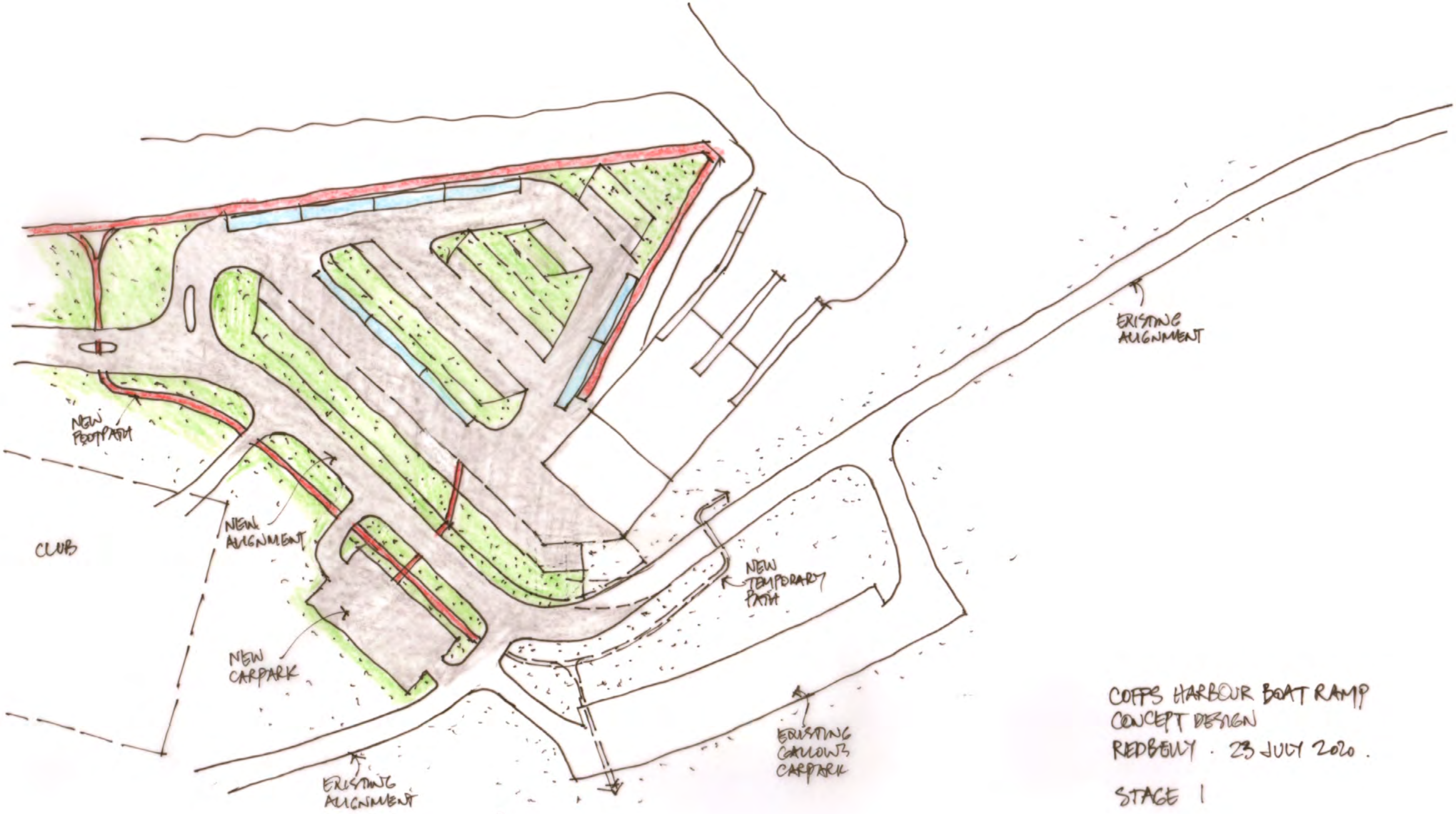
Total	Cars	Light Trucks	Heavy Trucks	Average Speed	85th %ile
0	0	0	0	-	-
3	3	0	0	50.2	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
0	0	0	0	-	-
1	1	0	0	41.1	-
0	0	0	0	-	-
1	1	0	0	39.8	-
1	1	0	0	75.4	-
1	1	0	0	37.6	-
3	3	0	0	46.5	-
1	1	0	0	51.4	-
4	4	0	0	45.4	-
3	3	0	0	46.6	-
6	6	0	0	44.2	-
5	5	0	0	39.8	-
11	8	3	0	46.5	52.2
10	9	1	0	45.6	-
20	18	2	0	44.3	50.3
16	16	0	0	42.7	45.9
17	17	0	0	44.7	51.7
19	18	1	0	45.3	49.5
31	30	1	0	44.9	50.8
24	22	2	0	43	45.8
22	20	2	0	45.2	51.6
35	30	5	0	44.1	48.9
25	25	0	0	44.2	50.2
34	31	3	0	43.4	48.2
60	57	3	0	42.1	47
39	39	0	0	44.3	49.9
34	33	1	0	45.2	50
34	34	0	0	44.6	49.2
44	42	2	0	44.6	48.3
51	47	4	0	43.4	48.3
41	36	5	0	44.3	48.3
41	39	2	0	44.4	48.2
40	35	5	0	44.1	49.5
54	51	3	0	43.1	47.7
53	50	3	0	44.3	49.4
56	55	1	0	43.2	47.6
55	54	1	0	44.3	48.9
47	44	3	0	45.5	50.3
52	46	6	0	44.2	49.9
45	43	2	0	44.6	48.4
41	37	4	0	45.9	49.6
28	26	2	0	43.9	48.9
39	39	0	0	45.2	50.6
49	43	5	1	45.1	49.2
54	52	1	1	45.9	49.6
34	33	1	0	44.3	48

49	49	0	0	45.9	51.1	
50	50	0	0	44.3	49.7	
35	33	2	0	45.1	50.8	
41	38	2	1	45.8	51.9	
47	44	3	0	43.8	48.2	
42	40	2	0	44.6	49.7	
45	41	4	0	47.9	53.1	
37	35	2	0	45.2	49.6	
40	38	2	0	45.7	50.4	
50	49	1	0	45.3	51	
42	41	1	0	44.6	51.9	
21	19	2	0	46.9	52.2	
18	17	1	0	46.4	53.3	
19	19	0	0	47.6	53.3	
11	11	0	0	49.1	54.6	
20	20	0	0	49.5	53.5	
22	22	0	0	50.8	59	
12	11	1	0	47.7	55.1	
10	10	0	0	42.5	-	
15	14	1	0	46.4	54.8	
14	13	1	0	48.3	53.6	
15	15	0	0	48.4	51.8	
12	12	0	0	47.2	52.1	
8	8	0	0	47.1	-	
16	15	1	0	49.4	55.3	
12	11	1	0	47.3	50.5	
11	11	0	0	48	54.3	
9	9	0	0	48.7	-	
11	11	0	0	50.1	59	
4	3	1	0	49.7	-	
7	7	0	0	45.8	-	
12	12	0	0	48.7	58.6	
4	4	0	0	52.3	-	
6	6	0	0	51.5	-	
3	3	0	0	47.2	-	
4	4	0	0	45	-	
5	5	0	0	45.1	-	
1	1	0	0	55.9	-	
207	**193**	**14**	**0**	**44.3**	**48.9**	
1255	**1189**	**63**	**3**	**44.5**	**49.1**	
272	**259**	**13**	**0**	**46**	**51.1**	
2064	**1959**	**102**	**3**	**45.1**	**50**	

Appendix E: Conceptual landscape design sketches (RedBelly Design)

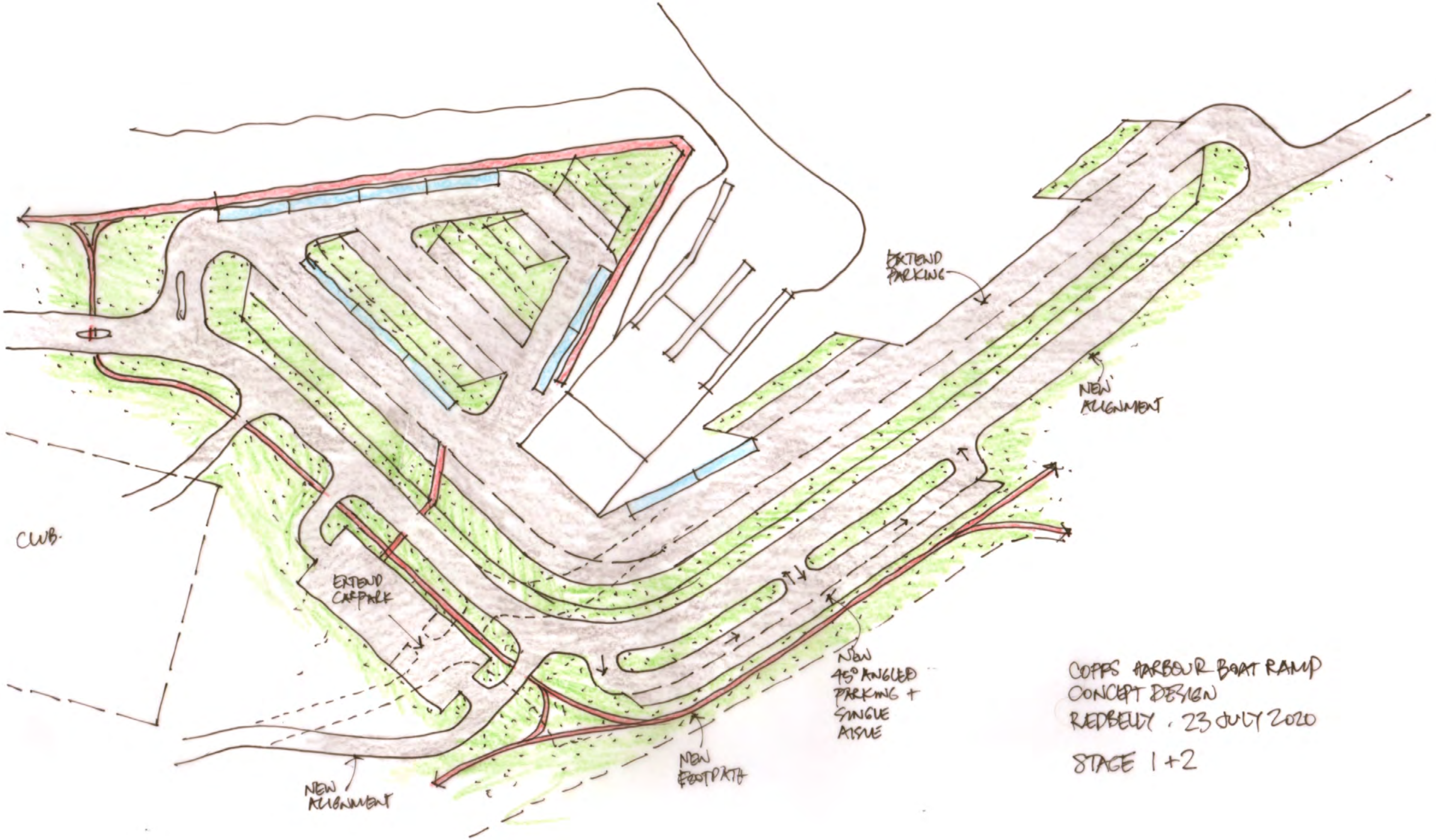


COFFS HARBOUR BOAT RAMP
CONCEPT DESIGN
REDBELLY · 10 JULY 2020.



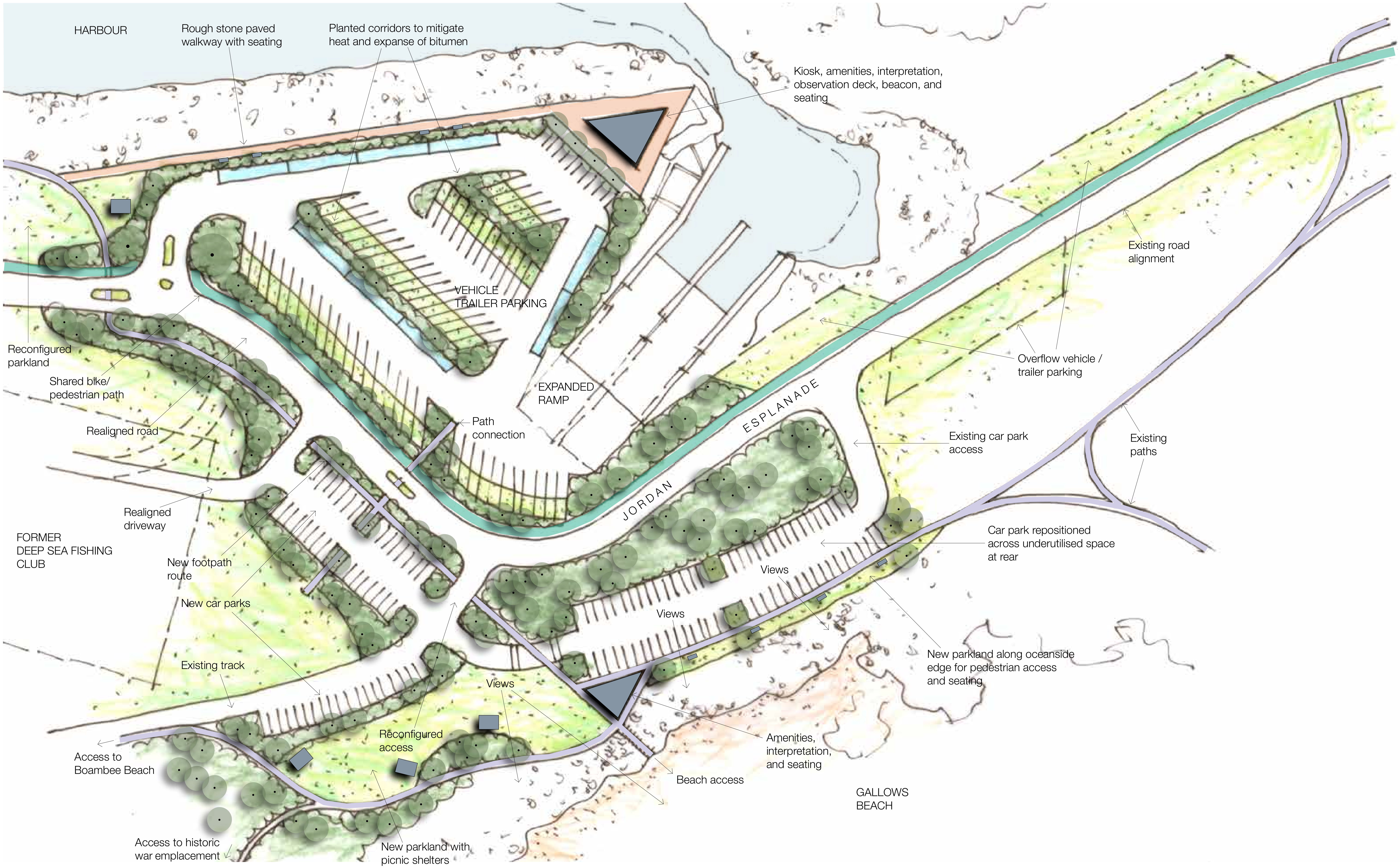
COFFS HARBOUR BOAT RAMP
CONCEPT DESIGN
REDBELLY . 23 JULY 2020 .

STAGE 1



COFFS HARBOUR BOAT RAMP
CONCEPT DESIGN
REDBELLY . 23 JULY 2020

STAGE 1 +2



redbelly

COFFS HARBOUR BOAT RAMP
EXPANSION AND REDEVELOPMENT

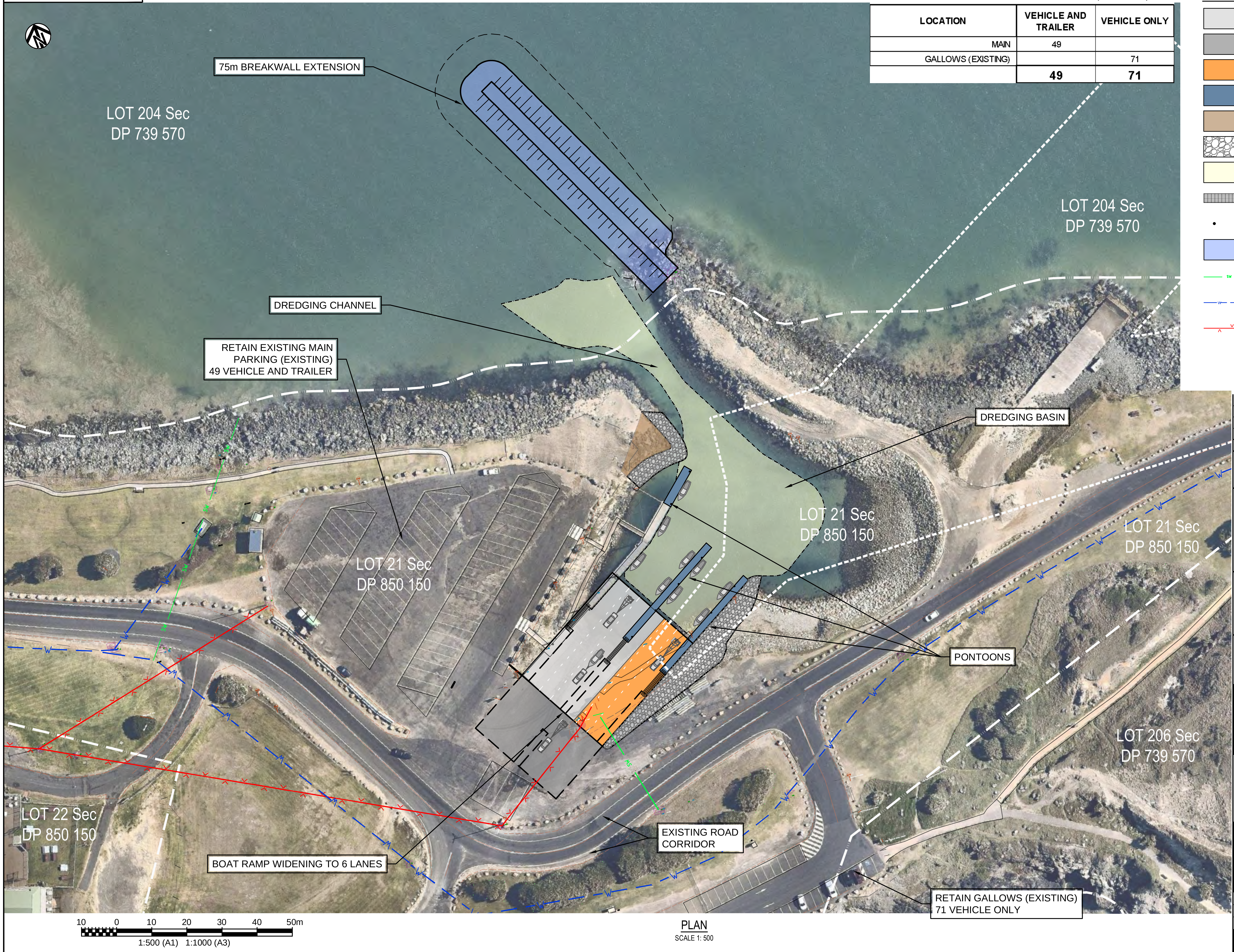
CONCEPT SITE MASTERPLAN
8 AUGUST 2020

NOT TO SCALE

Appendix F: Preferred Concept Design Drawings

DRAWING No.
PA2431-STG- 001

DO NOT SCALE



PLAN
SCALE 1: 500

EXISTING (STAGE 1)

LOCATION	VEHICLE AND TRAILER	VEHICLE ONLY
MAIN	49	
GALLOWS (EXISTING)		71
	49	**71**

LEGEND

▨	EXISTING CONCRETE RAMP
▨	NEW PAVEMENT (RAMP)
🟧	NEW RAMP (CONCRETE)
🟦	NEW PONTOON
🟫	LAND BASED EARTHWORKS
▨	NEW ROCK REVETMENT
▨	HARBOUR DREDGING
▨	PONTOON GANTRY
• •	Ø300 PILES (INDICATIVE LOCATIONS ONLY)
🟦	BREAKWALL (ABOVE WATER)
— sw —	EXISTING STORMWATER
— w —	EXISTING WATER MAIN
— v —	EXISTING O/H ELECTRICAL

REV	DATE	DESCRIPTION	BY	CHK	APPD
D	18.8.20	NEW LAYOUT FOR APPROVAL	MC	PL	BP
C	23.6.20	BREAKWALL LAYOUT UPDATED	MC	PL	BP
B	15.6.20	CLIENT COMMENTS INCLUDED	MC	PL	BP
A	12.6.20	CONCEPT PLANS REV'D & STAGED	MC	PL	BP

REVISIONS

DRAWING FOR REVIEW

DIAL 1100
BEFORE YOU DIG

WARNING
ONLY VISIBLE SERVICES HAVE BEEN LOCATED BY SURVEY. LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND HAVE BEEN SCALED FROM VARIOUS SERVICE AUTHORITY PLANS. ALL SERVICES TO BE CONFIRMED ON SITE PRIOR TO ANY CONSTRUCTION OR INVESTIGATION WORKS.
"DIAL BEFORE YOU DIG" - 1100
IT IS ESSENTIAL THAT BEFORE ANY EXCAVATION WORK IS UNDERTAKEN, FURTHER INVESTIGATION INTO THE LOCATION OF SERVICES SHOULD BE CARRIED OUT WITH THE RELEVANT AUTHORITY.

CLIENT
NSW GOVERNMENT | Transport for NSW
Roads and Maritime

SURVEY
SURVEY - NORTH COAST SURVEYS MARCH 2020
HORIZONTAL DATUM MGA 56 VERTICAL DATUM AHD 71

AUSTRALIAN HEIGHT DATUM

PROJECT:
COFFS HARBOUR,
BOAT RAMP UPGRADE
CONCEPT STAGING PLANS

TITLE:
STAGE 1
SITE MASTERPLAN

HASKONING AUSTRALIA PTY LTD
NEWCASTLE
Level 3
2 Market Street
Newcastle NSW 2300
Australia
+61 2 4926 9500
www.royalhaskoninghdv.com

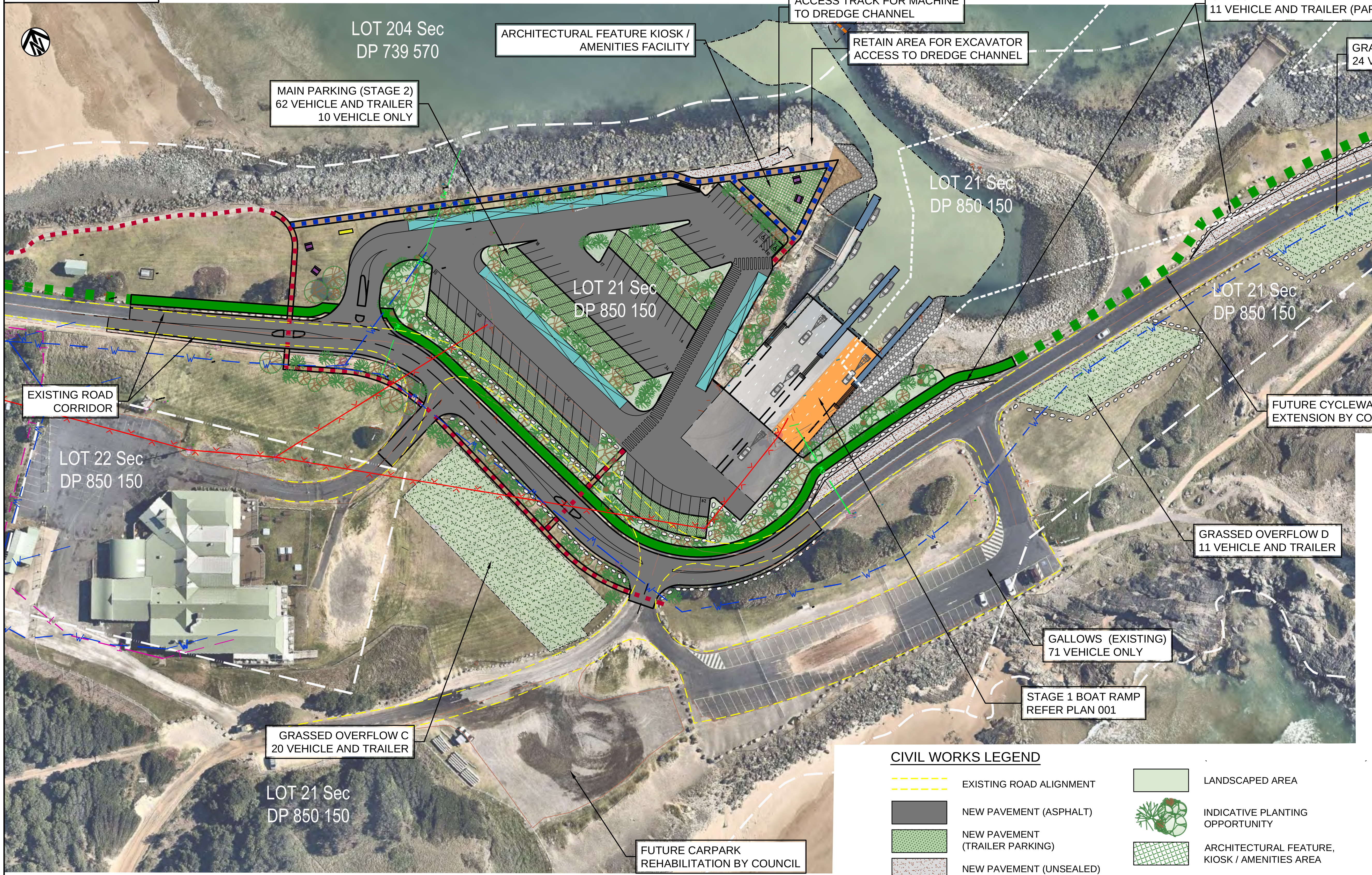
Royal HaskoningDHV
Enhancing Society Together

DRAWN M.Collings | DATE 20.03.2020 | JOB No. PA2431
AUTOCAD REF. PA2341–STG
SCALE AT A1 AS SHOWN
DRAWING No. PA2341-STG- 001
REVISION D

C:\COFFS HARBOUR BOAT RAMP / PA2341

DRAWING No.
PA2431-STG- 002

DO NOT SCALE



D	18.8.20	NEW LAYOUT FOR APPROVAL	MC	PL	BP
C	23.6.20	BREAKWALL LAYOUT UPDATED	MC	PL	BP
B	15.6.20	CLIENT COMMENTS INCLUDED	MC	PL	BP
A	12.6.20	CONCEPT PLANS REV'D & STAGED	MC	PL	BP
REV	DATE	DESCRIPTION	BY	CHK	APPD

REVISIONS

DRAWING FOR REVIEW

WARNING
ONLY VISIBLE SERVICES HAVE BEEN LOCATED BY SURVEY. LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND HAVE BEEN SCALED FROM VARIOUS SERVICE AUTHORITY PLANS. ALL SERVICES TO BE CONFIRMED ON SITE PRIOR TO ANY CONSTRUCTION OR INVESTIGATION WORKS.
"DIAL BEFORE YOU DIG" - 1100
IT IS ESSENTIAL THAT BEFORE ANY EXCAVATION WORK IS UNDERTAKEN, FURTHER INVESTIGATION INTO THE LOCATION OF SERVICES SHOULD BE CARRIED OUT WITH THE RELEVANT AUTHORITY.

DIAL 1100
BEFORE YOU DIG

CLIENT
NSW GOVERNMENT
Transport for NSW
Roads and Maritime

SURVEY
SURVEY - NORTH COAST SURVEYS MARCH 2020
HORIZONTAL DATUM MGA 56 VERTICAL DATUM AHD 71

AUSTRALIAN HEIGHT DATUM

PROJECT:
COFFS HARBOUR,
BOAT RAMP UPGRADE
CONCEPT STAGING PLANS

TITLE:
STAGE 2
SITE MASTERPLAN

HASKONING AUSTRALIA PTY LTD
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Newcastle NSW 2300
Australia
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www.royalhaskoninghdv.com

Royal HaskoningDHV
Enhancing Society Together

DRAWN M.Collings | DATE 20.03.2020 | JOB No. PA2431
AUTOCAD REF. PA2341–STG
SCALE AT A1 AS SHOWN
DRAWING No. PA2341-STG- 002
REVISION D

CIVIL WORKS LEGEND

- - -	EXISTING ROAD ALIGNMENT
■	NEW PAVEMENT (ASPHALT)
▨	NEW PAVEMENT (TRAILER PARKING)
▨	NEW PAVEMENT (UNSEALED)
▨	OVERFLOW PARKING (GRASSED)
○○○○	OVERSIZE ROCK PLACE IN VERGE (MATCH EXISTING)
▬	PEDESTRIAN ROUTE AND 1.8m CONCRETE FOOTPATH
▬	PEDESTRIAN ROUTE AND 1.5m CONCRETE FOOTPATH
🟩	2.5m SHARED PATHWAY
■ ■ ■	2.5m SHARED PATHWAY (FUTURE EXTENSION BY COUNCIL)
▭	LANDSCAPED AREA
✿	INDICATIVE PLANTING OPPORTUNITY
▨	ARCHITECTURAL FEATURE, KIOSK / AMENITIES AREA
■ ■	SEATING AND TABLE AND FISH CLEANING BENCH
☒	RIGGING AND DE-RIGGING BAYS
12.5m	DESIGN VEHICLE
— SW —	EXISTING STORMWATER
— W —	EXISTING WATER MAIN
— ^ —	EXISTING O/H ELECTRICAL

PLAN
SCALE 1: 600

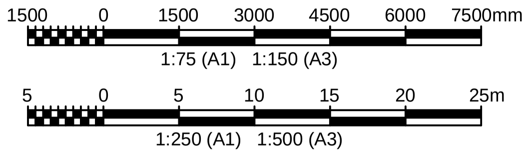
12 0 20 40 60m
1:600 (A1) 1:1200 (A3)

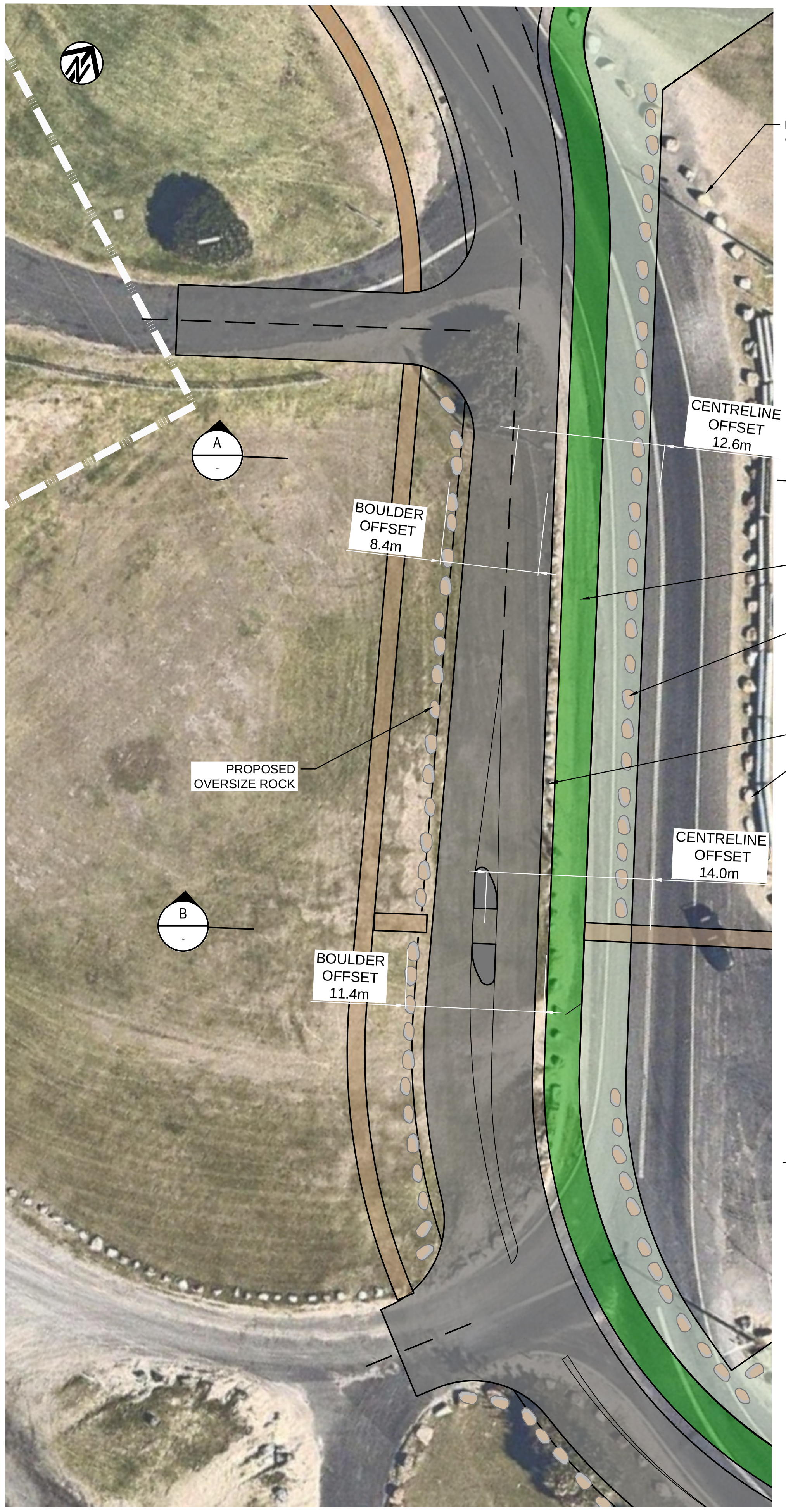
LOCATION	EXISTING (STAGE 1)		TOTAL STAGE 2	
	VEHICLE AND TRAILER	VEHICLE ONLY	VEHICLE AND TRAILER	VEHICLE ONLY
MAIN	49		62	10
GALLOWS (EXISTING)		71		71
OVERFLOW A			24	
OVERFLOW B			11	
OVERFLOW C			20	
OVERFLOW D			11	
	49	**71**	**128**	**81**

C:\COFFS HARBOUR BOAT RAMP / PA2341

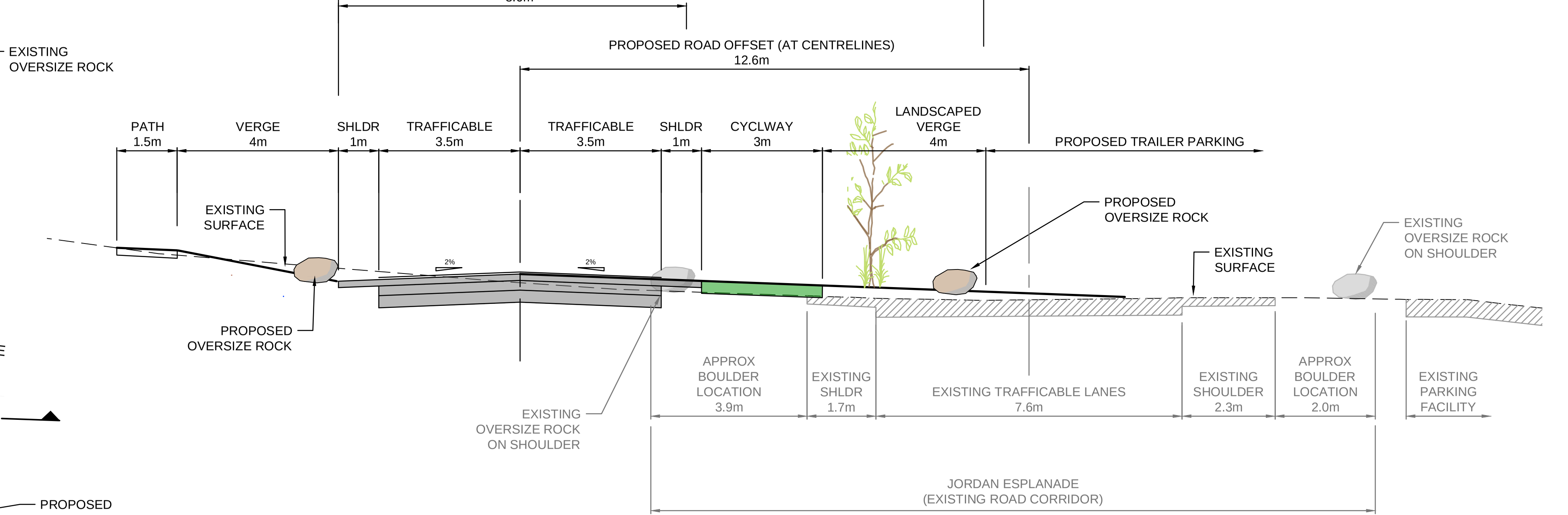
DRAWING No.
PA2431-STG- 003

DO NOT SCALE

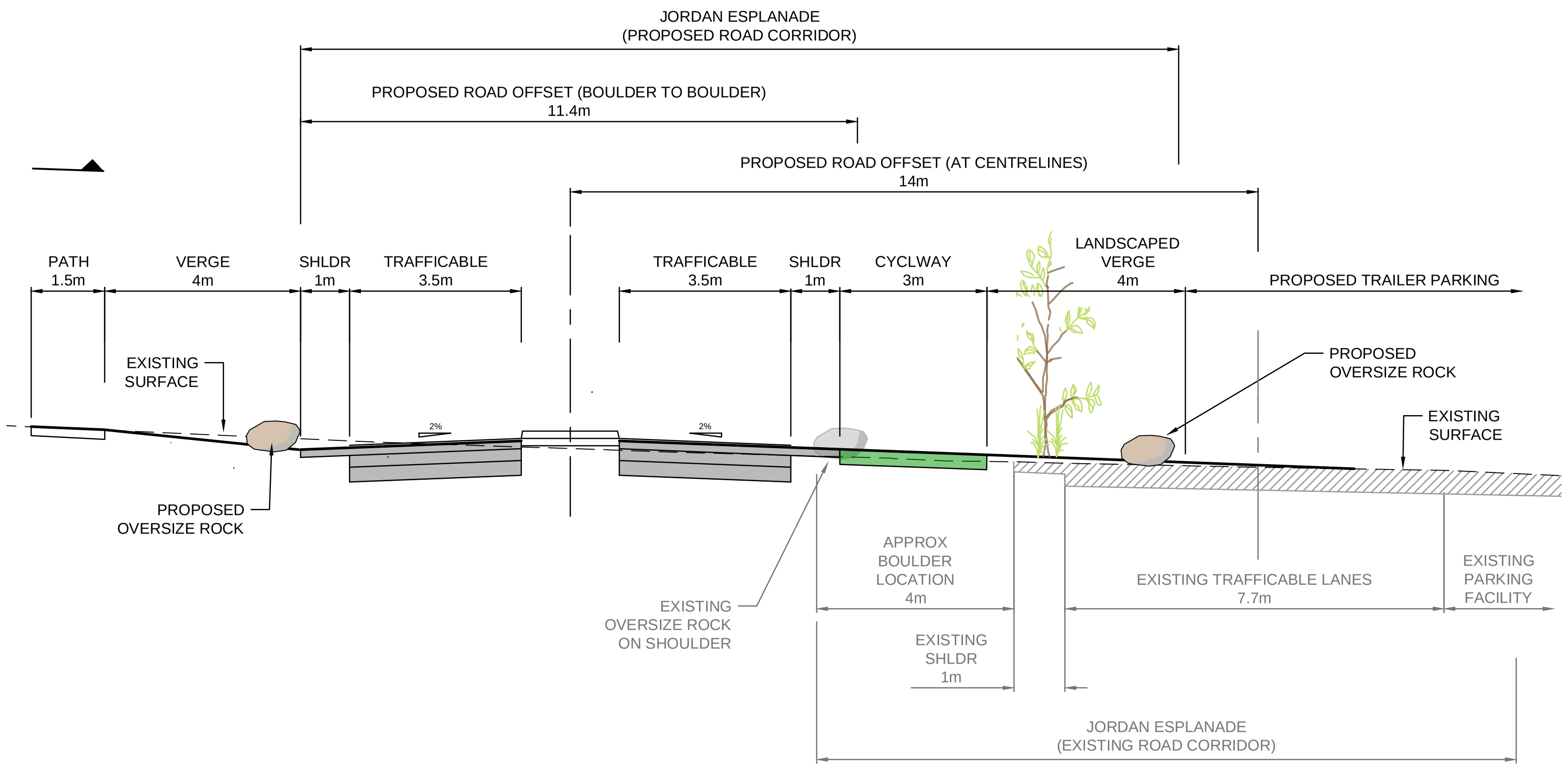




PLAN
SCALE 1: 250



SECTION A
SCALE 1:75



SECTION B
SCALE 1:75

REV	DATE	DESCRIPTION	BY	CHK	APPD
D	18.8.20	NEW LAYOUT FOR APPROVAL	MC	PL	BP
C	23.6.20	BREAKWALL LAYOUT UPDATED	MC	PL	BP
B	15.6.20	CLIENT COMMENTS INCLUDED	MC	PL	BP
A	12.6.20	CONCEPT PLANS REV'D & STAGED	MC	PL	BP

REVISIONS

DRAWING FOR REVIEW

DIAL 1100
BEFORE YOU DIG

WARNING

ONLY VISIBLE SERVICES HAVE BEEN LOCATED BY SURVEY. LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND HAVE BEEN SCALED FROM VARIOUS SERVICE AUTHORITY PLANS. ALL SERVICES TO BE CONFIRMED ON SITE PRIOR TO ANY CONSTRUCTION OR INVESTIGATION WORKS.

"DIAL BEFORE YOU DIG" - 1100

IT IS ESSENTIAL THAT BEFORE ANY EXCAVATION WORK IS UNDERTAKEN, FURTHER INVESTIGATION INTO THE LOCATION OF SERVICES SHOULD BE CARRIED OUT WITH THE RELEVANT AUTHORITY.

CLIENT
NSW GOVERNMENT
Transport for NSW
Roads and Maritime

SURVEY
SURVEY - NORTH COAST SURVEYS MARCH 2020
HORIZONTAL DATUM MGA 56 VERTICAL DATUM AHD 71

AUSTRALIAN HEIGHT DATUM

PROJECT:
COFFS HARBOUR,
BOAT RAMP UPGRADE
CONCEPT STAGING PLANS

TITLE:
STAGE 2
JORDAN ESPLANADE
ROAD REALIGNMENT
PLAN

HASKONING AUSTRALIA PTY LTD
NEWCASTLE
Level 3
2 Market Street
Newcastle NSW 2300
Australia
+61 2 4926 9500
www.royalhaskoninghdv.com

Royal HaskoningDHV
Enhancing Society Together

DRAWN M.Collings
DATE 20.03.2020
JOB No. PA2431
AUTOCAD REF. PA2341–ROAD
SCALE AT A1 AS SHOWN
DRAWING No. PA2341-STG- 003
REVISION D

C:\COFFS HARBOUR BOAT RAMP / PA2341

Appendix G: Preferred Concept Cost Estimates (Vasey Consulting)

Concept Budget Estimate

9/09/2020 **2020.041 Concept Budget - Stage 1 Rev 4 08.09.2020**

for **Royal HaskoningDHV**

Concept Budget Estimate Stage 1 (Rev 4)
Coffs Harbour Boat Ramp Upgrade

	Description	Quantity	Unit	Rate	Total
1	**DIRECT COSTS**				**$4,505,128.85**
1.1	**PRELIMINARIES**				**$510,978.63**
1.2	**BOAT RAMP**				**$1,376,927.97**
1.3	**DREDGING**				**$136,100.00**
1.4	**75M BREAKWATER**				**$1,893,496.24**
1.5	**CONTRACTORS CORPORATE OVERHEADS & MARGIN**				**$587,626.00**
2	**INDIRECT COSTS**				**$1,847,103.62**
2.1	**PRE-CONSTRUCTION**				**$360,410.31**
2.2	**CONSTRUCTION**				**$1,486,693.31**
2.3	**DESIGN FEES**				
2.4	**AUTHORITIES FEES & CHARGES**				
2.5	**ESCALATION**				
3	**SCHEDULE OF INFORMATION**				
3.1	Concept Staging Plan by Royal Haskoning DHV titled 'Stage 1 Site Masterplan' numbered PA2341-STG-P -1 Rev C, dated 23 June 2020		NOTE		
3.2	Email from Ben Patterson - Revised Scope 11.08.2020 & 13.08.2020		NOTE		
3.3	Markups from Pat Smyth received 31.08.2020		NOTE		
4	**SCHEDULE OF EXCLUSIONS**				
4.1	Dredge Pocket Works - EXCL.		NOTE		
4.2	Storm events & rework - EXCL.		NOTE		

	Description	Quantity	Unit	Rate	Total
4.3	Authorities Fees & Charges - EXCL.		NOTE		
4.4	Tendering Costs - EXCL.		NOTE		
4.5	Additional Staging Costs - EXCL.		NOTE		
4.6	Unknown steakholder requirements - EXCL.		NOTE		
4.7	Delay costs including Inclement Weather- EXCL.		NOTE		
4.8	Testing, treatment & management of contaminated material including buried rubbish on site - EXCL.		NOTE		
4.9	Testing, treatment & disposal of groundwater - EXCL.		NOTE		
4.10	Adjustments to Existing Utilities - EXCL.		NOTE		
4.11	Unknown ground conditions & engineers design - EXCL.		NOTE		
4.12	Electrical reticulation including lighting beyond that listed in foregoing estimate - EXCL.		NOTE		
4.13	Cost escalation beyond September 2020 - EXCL.		NOTE		

Subtotal	**$6,352,232.47**
Adjustment	$0.00
Post adjustment	$6,352,232.47
G.S.T [10%]	$635,223.25
Total	**$6,987,455.72**

Concept Budget Estimate

9/09/2020 **2020.041 Concept Budget - Stage 2 Rev 3 08.09.2020**

for **Royal HaskoningDHV**

Concept Budget Estimate Stage 2 (Rev 3)
Coffs Harbour Boat Ramp Upgrade

	Description	Quantity	Unit	Rate	Total
1	DIRECT COSTS				$2,925,448.58
1.1	PRELIMINARIES				$331,808.81
1.2	CORRIDOR ROAD				$267,323.63
1.3	MAIN CARPARK				$1,156,239.67
1.4	AMENITIES AREA				$493,310.96
1.5	FOOTPATHS				$266,933.53
1.6	OVERFLOW PARKING (FISHING CLUB) - ENABLING WORKS				$13,206.98
1.7	OVERFLOW TRAILER PARKING (JORDAN ESPLANADE) - ENABLING WORKS - 4No.				$15,044.00
1.8	CONTRACTORS CORPORATE OVERHEADS & MARGIN				$381,581.00
2	INDIRECT COSTS				$2,333,967.51
2.1	PRE-CONSTRUCTION				$234,035.89
2.2	CONSTRUCTION				$965,398.89
2.3	WORKS BY OTHERS				$1,134,532.74
2.4	DESIGN FEES				
2.5	AUTHORITIES FEES & CHARGES				
2.6	ESCALATION				
3	SCHEDULE OF INFORMATION				

	Description	Quantity	Unit	Rate	Total
3.1	Revised Concept Staging Plan by Royal Haskoning DHV titled 'Stage 2 Site Masterplan' numbered PA2341-STG-P-1 Rev C, dated 20 March 2020 Received 18.08.2020		NOTE		
3.2	Email from Ben Patterson - Revised Scope 11.08.2020		NOTE		
3.3	Markups from Pat Smyth received 31.08.2020		NOTE		
3.4	Phone Meeting with Ben Patterson 09.09.2020		NOTE		
4	**SCHEDULE OF EXCLUSIONS**				
4.1	Carpark Works to Gallows Beach - EXCL.		NOTE		
4.2	Storm events & rework - EXCL.		NOTE		
4.3	Authorities Fees & Charges - EXCL.		NOTE		
4.4	Design Fees - EXCL.		NOTE		
4.5	Tendering Costs - EXCL.		NOTE		
4.6	Additional Staging Costs - EXCL.		NOTE		
4.7	Unknown steakholder requirements - EXCL.		NOTE		
4.8	Delay costs including Inclement Weather- EXCL.		NOTE		
4.9	Testing, treatment & management of contaminated material including buried rubbish on site - EXCL.		NOTE		
4.10	Testing, treatment & disposal of groundwater - EXCL.		NOTE		
4.11	Adjustments to Existing Utilities other than that listed in foregoing estimate - EXCL.		NOTE		
4.12	Unknown ground conditions & engineers design - EXCL.		NOTE		
4.13	Electrical reticulation including lighting beyond that listed in foregoing estimate - EXCL.		NOTE		
4.14	Cost escalation beyond September 2020 - EXCL.		NOTE		

Subtotal	**$5,259,416.09**
Adjustment	$0.00
Post adjustment	$5,259,416.09
G.S.T [10%]	$525,941.61
Total	**$5,785,357.70**

Concept Budget Estimate

9/09/2020 **2020.041 Concept Budget - Stage 1 Rev 4 08.09.2020**

for **Royal HaskoningDHV**

Concept Budget Estimate Stage 1 (Rev 4)
Coffs Harbour Boat Ramp Upgrade

	Description	Quantity	Unit	Rate	Total
1	**DIRECT COSTS**				**$4,505,128.85**
1.1	**PRELIMINARIES**				**$510,978.63**
1.1.1	Allowance for preliminaries (15%)	1	Item	$510,978.63	$510,978.63
1.2	**BOAT RAMP**				**$1,376,927.97**
1.2.1	**CLEARING & DEMOLITION**				**$34,276.98**
1.2.1.1	**Clearing:**				**$9,827.20**
1.2.1.1.1	Ecologist supervision during clearing works - By Council		Item		EXCL
1.2.1.1.2	Clear existing vegetation and disposal offsite	233	m2	$42.18	$9,827.20
1.2.1.2	**Demolition:**				**$24,449.78**
1.2.1.2.1	Sawcut existing concrete footpath pavement not exceeding 100 thick	39	m	$15.00	$585.00
1.2.1.2.2	Saw Cut existing Roadway not exceeding 50 thick	71	m	$10.00	$710.00
1.2.1.2.3	**Demolish & remove from site the following:**				**$17,694.78**
1.2.1.2.3.1	Concrete batter not exceeding 100 thick	60	m2	$63.30	$3,798.20
1.2.1.2.3.2	Existing signs	1	Item	$1,000.00	$1,000.00
1.2.1.2.3.3	Existing road wearing course (Assume 30mm thick) and disposal offsite	616	m2	$20.94	$12,896.58
1.2.1.2.4	**Remove & stockpile onsite for reuse the following:**				**$5,460.00**
1.2.1.2.4.1	Existing rock revetment	120	m3	$45.50	$5,460.00
1.2.1.2.5	Removal of existing concrete Jersey kerb off site - EXCL.	1	Item		EXCL
1.2.2	**EARTHWORKS**				**$112,972.00**

	Description	Quantity	Unit	Rate	Total
1.2.2.1	**Bulk Earthworks**				**$112,972.00**
1.2.2.1.1	Allow to boxout for new manoeuvring area pavement (nom. 400 thick) and disposal offsite [PC Tip Fee $25/t]	247	m3	$61.00	$15,067.00
1.2.2.1.2	Allowance for excavation of new ramp and disposal offsite [PC Tip Fee $25/t]	1,605	m3	$61.00	$97,905.00
1.2.3	**PAVEMENTS**				**$59,060.57**
1.2.3.1	Trim & compact subgrade	616	m2	$4.73	$2,915.00
1.2.3.2	Allowance to remove & replace unsuitable subgrade (5% of existing pavement areas x 300 deep)	10	m3	$136.79	$1,367.89
1.2.3.3	**Asphalt Pavements**				**$54,777.67**
1.2.3.3.1	Rip and recompact existing surface (nom. 300mm deep)	616	m2	$3.42	$2,106.00
1.2.3.3.2	240mm thick DGS40 subbase course	616	m2	$27.79	$17,115.69
1.2.3.3.3	160mm thick DGB20 base course	616	m2	$20.29	$12,498.48
1.2.3.3.4	7mm primer seal	616	m2	$9.00	$5,544.00
1.2.3.3.5	30mm thick AC10 wearing course	616	m2	$28.43	$17,513.50
1.2.4	**NEW CONCRETE LAUNCHING RAMP**				**$309,001.27**
1.2.4.1	Trim and compact subgrade	427	m2	$10.40	$4,440.80
1.2.4.2	Removal & replacement of unsuitable subgrade - EXCL.	1	Item		EXCL
1.2.4.3	Supply & place geofabric separation layer	460	m2	$3.65	$1,677.08
1.2.4.4	Suppy and place 300mm thick bridging layer	427	m2	$47.19	$20,150.11
1.2.4.5	Supply and place Tensar Geogrid	427	m2	$19.53	$8,339.31
1.2.4.6	230mm thick DGB20 base course	427	m2	$28.11	$12,001.36
1.2.4.7	Form, Reinforce & Pour 220 thick N50MPa reinforced concrete ramp pavement including grooved finish	46	m3	$1,363.87	$62,738.16
1.2.4.8	Allowance for mass concrete toe at end of ramp (1No.)	5	m3	$669.32	$3,346.60
1.2.4.9	Allowance for N12 x 1200 long ss dowel to last	37	No.	$51.44	$1,903.15
1.2.4.10	Supply & install 3700 long x 700 wide x 220 thick reinforced precast concrete plank	105	No.	$1,371.96	$144,056.23
1.2.4.11	Allowance to grout fill voids to planks	5	m3	$1,890.00	$9,450.00
1.2.4.12	**Concrete Ramp**				**$40,898.47**

	Description	Quantity	Unit	Rate	Total
1.2.4.12.1	Allowance to form concrete access ramp, 400 high rise at the toe (2No.)	83	m2	$492.75	$40,898.47
1.2.5	**CONCRETE TOPPING SLAB**				**$157,576.02**
1.2.5.1	200 thick 50MPa concrete topping slab over existing boat ramp slab including N16 galvanised bar at 200cts both ways	670	m2	$233.48	$156,433.02
1.2.5.2	Allowance for 400 long SS dowels at 2m cts into existing slab	9	No.	$127.00	$1,143.00
1.2.6	**NEW PONTOON & GANGWAY**				**$529,000.00**
1.2.6.1	Budget Allowance supply & installation of piles, pontoons and gangways complete (Pacific Pontoon & Pier)	1	Item	$529,000.00	$529,000.00
1.2.7	**ROCK REVEMENT**				**$111,041.14**
1.2.7.1	**Rock Revetment to Boat Ramp**				**$68,908.55**
1.2.7.1.1	Allowance to supply & place 600 minus imported rock scour protection (Supply & Deliver $99.28/t)	514	t	$134.06	$68,908.55
1.2.7.2	**Rock Revetment [Spur]**				**$42,132.59**
1.2.7.2.1	Allowance to supply & place 600 minus imported rock scour protection (Supply & Deliver $99.28/t)	282	t	$134.06	$37,804.92
1.2.7.2.2	Allowance to win select material & backfill last	109	m3	$39.70	$4,327.67
1.2.8	**SIGNAGE & LINEMARKING**				**$14,000.00**
1.2.8.1	**Signage**				**$10,000.00**
1.2.8.1.1	Allowance for signage to Boat Ramp and Pontoons	1	Item	$10,000.00	$10,000.00
1.2.8.2	**Linemarking**				**$4,000.00**
1.2.8.2.1	**Allowance for waterborne linemarking as detailed to the following:**				**$4,000.00**
1.2.8.2.1.1	Linemarking Establishment	1	No.	$2,500.00	$2,500.00
1.2.8.2.1.2	Allowance for linemarking	1	Item	$1,500.00	$1,500.00
1.2.9	**SERVICES**				**$50,000.00**
1.2.9.1	**Electrical:**				**$50,000.00**
1.2.9.1.1	Provisional Allowance to relocate existing light poles & overhead lines (3No.)	1	PSUM	$50,000.00	$50,000.00
1.2.9.2	Allowance for additional lighting		NOTE		EXCL

	Description	Quantity	Unit	Rate	Total
1.2.9.3	Allowance for potable water		NOTE		EXCL
1.3	**DREDGING**				**$136,100.00**
1.3.1	**Dredging to Basin & Channel:**				**$136,100.00**
1.3.1.1	Allowance to mobilise Cutter Suction Dredge	1	No.	$60,100.00	$60,100.00
1.3.1.2	Allowance to demobilise Cutter Suction Dredge	1	No.	$54,100.00	$54,100.00
1.3.1.3	Allowance to dredge existing basin assuming sand material stockpiled onsite (Provisional Quantity)	800	m3	$27.38	$21,900.00
1.3.2	Dredging Pocket - EXCL.	1	Item		EXCL
1.4	**75M BREAKWATER**				**$1,893,496.24**
1.4.1	**TEMPORARY WORKS**				**$15,000.00**
1.4.1.1	Provisional Allowance to remove and take to store existing beacon and allow for temporary in water during breakwater extension works	1	PSUM	$15,000.00	$15,000.00
1.4.2	**BREAK WATER**				**$1,860,975.18**
1.4.2.1	**Supply Material**				**$1,318,756.66**
1.4.2.1.1	Supply Rip Rap Core comprising average 200mm rock (PC Supply Only $18/t)	3,500	m3	$78.00	$273,000.00
1.4.2.1.2	Assume 30% Waste to last	1,050	m3	$78.00	$81,900.00
1.4.2.1.3	Supply A64 Geotextile	1,756	m2	$4.07	$7,146.00
1.4.2.1.4	Assume 20% Waste to last	352	m2	$4.07	$1,432.46
1.4.2.1.5	Supply Secondary Rock Armour Layer comprising average 500 dia rock in two layers (PC Supply Only $26/t)	1,500	m3	$99.28	$148,926.21
1.4.2.1.6	Assume 20% Waste to last	300	m3	$99.28	$29,784.00
1.4.2.1.7	Supply Primary Rock Armour Layer comprising average 1400 dia rock in two layers (PC Supply & Deliver $75/t)	3,982	m3	$156.00	$621,192.00
1.4.2.1.8	Assume 25% Waste to last	996	m3	$156.00	$155,376.00
1.4.2.2	**Place Material**				**$542,218.52**
1.4.2.2.1	Allowance for adjustments to the existing breakwater to tie in new works	1	Item	$16,620.00	$16,620.00
1.4.2.2.2	Allow to place Rip Rap Core	4,550	m3	$31.19	$141,891.75
1.4.2.2.3	Allow to install A64 Geotextile	2,195	m2	$17.40	$38,193.00
1.4.2.2.4	Allow to place Secondary Rock Armour	1,800	m3	$44.27	$79,688.57

	Description	Quantity	Unit	Rate	Total
1.4.2.2.5	Allow to place Primary Rock Armour	4,978	m3	$53.40	$265,825.20
1.4.3	**ROAD**				**$7,521.06**
1.4.3.1	Supply & install A64 Geotextile	226	m2	$7.67	$1,733.30
1.4.3.2	240mm thick DGS40 subbase course	55	m3	$105.23	$5,787.76
1.4.4	**SERVICES**				**$10,000.00**
1.4.4.1	Provisional Allowance to reinstall beacon	1	PSUM	$10,000.00	$10,000.00
1.5	**CONTRACTORS CORPORATE OVERHEADS & MARGIN**				**$587,626.00**
1.5.1	Allowance for Contractors Corporate Overheads & Margin (15%)	1	Item	$587,626.00	$587,626.00
2	**INDIRECT COSTS**				**$1,847,103.62**
2.1	**PRE-CONSTRUCTION**				**$360,410.31**
2.1.1	Allowance for Project Management Allowance (8%)	1	Item	$360,410.31	$360,410.31
2.2	**CONSTRUCTION**				**$1,486,693.31**
2.2.1	Allowance for Construction Contingency (25%)	1	Item	$1,126,283.00	$1,126,283.00
2.2.2	Allowance for Construction Project Management Allowance (8%)	1	Item	$360,410.31	$360,410.31
2.3	**DESIGN FEES**				
2.3.1	Allowance for Design Fees - EXCL.	1	Item		EXCL
2.4	**AUTHORITIES FEES & CHARGES**				
2.4.1	Allowance for Authorities Fees & Charges - EXCL.	1	Item		EXCL
2.5	**ESCALATION**				
2.5.1	Allowance for Escalation beyond September 2020 - EXCL.	1	Item		EXCL
3	**SCHEDULE OF INFORMATION**				
3.1	Concept Staging Plan by Royal Haskoning DHV titled 'Stage 1 Site Masterplan' numbered PA2341-STG-P -1 Rev C, dated 23 June 2020		NOTE		
3.2	Email from Ben Patterson - Revised Scope 11.08.2020 & 13.08.2020		NOTE		
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4	**SCHEDULE OF EXCLUSIONS**				
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	Description	Quantity	Unit	Rate	Total
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4.8	Testing, treatment & management of contaminated material including buried rubbish on site - EXCL.		NOTE		
4.9	Testing, treatment & disposal of groundwater - EXCL.		NOTE		
4.10	Adjustments to Existing Utilities - EXCL.		NOTE		
4.11	Unknown ground conditions & engineers design - EXCL.		NOTE		
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4.13	Cost escalation beyond September 2020 - EXCL.		NOTE		

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G.S.T [10%]	$635,223.25
Total	**$6,987,455.72**

Concept Budget Estimate

9/09/2020 **2020.041 Concept Budget - Stage 2 Rev 3 08.09.2020**

for **Royal HaskoningDHV**

Concept Budget Estimate Stage 2 (Rev 3)
Coffs Harbour Boat Ramp Upgrade

	Description	Quantity	Unit	Rate	Total
1	**DIRECT COSTS**				**$2,925,448.58**
1.1	**PRELIMINARIES**				**$331,808.81**
1.1.1	Allowance for preliminaries (15%)	1	Item	$331,808.81	$331,808.81
1.2	**CORRIDOR ROAD**				**$267,323.63**
1.2.1	**DEMOLITION**				**$17,977.93**
1.2.1.1	Saw Cut existing Roadway not exceeding 50 thick	28	m	$10.00	$280.00
1.2.1.2	**Demolish & remove from site the following:**				**$16,193.06**
1.2.1.2.1	Existing road wearing course (Assume 40mm thick) and disposal offsite	472	m2	$34.31	$16,193.06
1.2.1.3	**Demolish & stockpile for reuse onsite the following:**				**$1,504.87**
1.2.1.3.1	Allow to remove and stockpile for reuse existing oversized rock barriers	61	No.	$24.67	$1,504.87
1.2.2	**TOPSOIL**				**$9,381.95**
1.2.2.1	Spray glyphosate to work area	2,747	m2	$0.50	$1,373.50
1.2.2.2	Strip topsoil not exceeding 150mm thick & stockpile onsite for reuse	413	m3	$17.51	$7,229.78
1.2.2.3	Allowance to respread topsoil on site to berms, batters and landscaped areas (not exceeding 300 thick)	32	m3	$24.33	$778.67
1.2.2.4	Screening of topsoil - EXCL.	1	Item		EXCL
1.2.2.5	Allowance to haul & dispose off site surplus topsoil - EXCL.	1	Item		NIL
1.2.2.6	Allowance to seed surplus topsoil stockpile	1	Item		NIL

	Description	Quantity	Unit	Rate	Total
1.2.3	**EARTHWORKS**				**$29,237.00**
1.2.3.1	Allow to boxout for new road pavement (nom. 300 thick) and disposal offsite [PC Tip Fee $25/t]	311	m3	$67.00	$20,837.00
1.2.3.2	Allowance to cut swale drain (nominal 1500 wide) adjacent to new road formation	240	m	$35.00	$8,400.00
1.2.3.3	Extra over allowance for excavation in rock - EXCL.	1	Item		EXCL
1.2.4	**PAVEMENTS**				**$118,796.30**
1.2.4.1	Trim & compact subgrade	1,034	m2	$3.13	$3,239.87
1.2.4.2	Rip and recompact existing surface (nom. 300mm deep)	472	m2	$3.34	$1,576.48
1.2.4.3	Allowance to remove & replace unsuitable subgrade (5% of existing pavement areas x 300 deep)	23	m3	$136.79	$3,146.17
1.2.4.4	240mm thick DGS40 subbase course	1,034	m2	$27.79	$28,734.86
1.2.4.5	160mm thick DGB20 base course	1,412	m2	$20.29	$28,648.12
1.2.4.6	7mm primer seal	1,412	m2	$4.50	$6,354.00
1.2.4.7	40mm thick AC10 wearing course	1,412	m2	$32.07	$45,276.80
1.2.4.8	Allowance for pavement tie ins between new/existing interface (4No.)	28	m	$65.00	$1,820.00
1.2.5	**STORMWATER**				**$40,475.00**
1.2.5.1	Allowance for 450 Dia Class 4 culvert under road (3No.)	54	m	$450.00	$24,300.00
1.2.5.2	Allowance for V-grate surface inlet pit	3	No.	$2,400.00	$7,200.00
1.2.5.3	Allowance for Surcharge pit	3	No.	$2,700.00	$8,100.00
1.2.5.4	Rock check Dams to swales	5	No.	$175.00	$875.00
1.2.5.5	Subsoil drainage - EXCL.	1	Item		EXCL
1.2.6	**SERVICES & UTILITIES**				**$37,989.76**
1.2.6.1	**Electrical services:**				**$16,250.00**
1.2.6.1.1	Provisional Allowance for electrical reticulation to road	1	PSUM	$16,250.00	$16,250.00
1.2.6.2	**Lighting:**				**$10,700.00**
1.2.6.2.1	Allowance for light pole, luminaire & reticulation to pedestrian road crossings	2	PSUM	$5,350.00	$10,700.00
1.2.6.3	Communications services - EXCL.	1	Item		EXCL
1.2.6.4	Potable water reticulation - EXCL.	1	Item		EXCL
1.2.6.5	Allowance for services conduits under roads (4No.)	72	m	$153.33	$11,039.76

	Description	Quantity	Unit	Rate	Total
1.2.7	**ROAD FURNITURE, SIGNAGE & LINEMARKING**				**$8,606.70**
1.2.7.1	**Site Furniture**				**$1,504.87**
1.2.7.1.1	Allowance to take from stockpile and place existing oversize rocks	61	No.	$24.67	$1,504.87
1.2.7.2	**Signage**				**$2,800.00**
1.2.7.2.1	Allowance for signage	1	Item	$2,800.00	$2,800.00
1.2.7.3	**Linemarking**				**$4,301.83**
1.2.7.3.1	**Allowance for waterborne linemarking as detailed to the following:**				**$4,301.83**
1.2.7.3.1.1	Linemarking Establishment	1	No.	$2,500.00	$2,500.00
1.2.7.3.1.2	Line Type BB	154	m	$1.50	$231.00
1.2.7.3.1.3	Line Type S1	57	m	$1.25	$71.25
1.2.7.3.1.4	Line Type E1	455	m	$1.35	$614.25
1.2.7.3.1.5	Line Type E5	78	m	$1.35	$105.30
1.2.7.3.1.6	Line Tip TB	19	m	$7.50	$142.50
1.2.7.3.1.7	Raised pavement markers - EXCL.	75.003	No.	$8.50	$637.53
1.2.8	**LANDSCAPING & REMEDIATION**				**$4,859.00**
1.2.8.1	**Turfed Areas**				**$3,859.00**
1.2.8.1.1	Allowance to respread topsoil on site to regrade areas and swale drain (not exceeding 300 thick) [Taken Elsewhere - Refer to Topsoil]	454	m2		INCL
1.2.8.1.2	Supply and place turf to last	454	m2	$8.50	$3,859.00
1.2.8.2	Allowance for maintenance of revegetated areas (12 months beyond practical completion)	1	Item	$1,000.00	$1,000.00
1.2.8.3	Irrigation to turfed areas - EXCL.	1	Item		EXCL
1.3	**MAIN CARPARK**				**$1,156,239.67**
1.3.1	**DEMOLITION**				**$92,759.91**
1.3.1.1	Saw Cut existing Roadway not exceeding 50 thick	172	m	$10.00	$1,720.00
1.3.1.2	**Demolish & remove from site the following:**				**$89,090.98**
1.3.1.2.1	Existing carpark & road wearing course (Assume 30mm thick) and disposal offsite	6,185	m2	$14.40	$89,090.98
1.3.1.3	**Demolish & stockpile for reuse onsite the following:**				**$1,948.93**
1.3.1.3.1	Allow to remove and stockpile for reuse existing oversized rock barriers	79	No.	$24.67	$1,948.93

	Description	Quantity	Unit	Rate	Total
1.3.2	**TOPSOIL**				**$9,381.95**
1.3.2.1	Spray glyphosate to work area	2,747	m2	$0.50	$1,373.50
1.3.2.2	Strip topsoil not exceeding 150mm thick & stockpile onsite for reuse	413	m3	$17.51	$7,229.78
1.3.2.3	Allowance to respread topsoil on site to berms, batters and landscaped areas (not exceeding 300 thick)	32	m3	$24.33	$778.67
1.3.2.4	Screening of topsoil - EXCL.	1	Item		EXCL
1.3.2.5	Allowance to haul & dispose off site surplus topsoil - EXCL.	1	Item		NIL
1.3.2.6	Allowance to seed surplus topsoil stockpile	1	Item		NIL
1.3.3	**EARTHWORKS**				**$145,387.45**
1.3.3.1	**Bulk Earthworks**				**$145,387.45**
1.3.3.1.1	Allow to boxout for new road pavement (nom. 300 thick) and disposal offsite [PC Tip Fee $25/t]	594	m3	$67.00	$39,798.00
1.3.3.1.2	Allow to boxout for new trailer parking pavement (nom. 150 thick) and disposal offsite [PC Tip Fee $25/t]	435	m3	$67.00	$29,145.00
1.3.3.1.3	Allow to boxout for planting (nom. 400 thick) and disposal offsite [PC Tip Fee $25/t]	697	m3	$67.00	$46,699.00
1.3.3.1.4	Extra over allowance for excavation in rock - EXCL.	1	Item		EXCL
1.3.3.1.5	Extra over allowance for removal and disposal asbestos contaminated material at nominated ACM capped location	41	m3	$664.52	$27,245.45
1.3.3.1.6	Allowance for materials classification of last	1	No.	$2,500.00	$2,500.00
1.3.4	**PAVEMENTS**				**$480,155.68**
1.3.4.1	**Asphalt Pavements**				**$268,842.11**
1.3.4.1.1	Trim & compact subgrade	1,978	m2	$3.13	$6,197.73
1.3.4.1.2	Rip and recompact existing surface (nom. 300mm deep)	3,898	m2	$3.34	$13,019.32
1.3.4.1.3	Allowance to remove & replace unsuitable subgrade (5% of existing pavement areas x 300 deep)	86	m3	$136.79	$11,763.94
1.3.4.1.4	240mm thick DGS40 subbase course	1,978	m2	$27.79	$54,968.62

	Description	Quantity	Unit	Rate	Total
1.3.4.1.5	160mm thick DGB20 base course	1,798	m2	$20.29	$36,479.69
1.3.4.1.6	7mm primer seal	5,696	m2	$4.50	$25,632.00
1.3.4.1.7	30mm thick AC10 wearing course	5,696	m2	$21.20	$120,780.80
1.3.4.2	**Trailer Parking**				**$211,313.58**
1.3.4.2.1	Rip and recompact existing surface (nom. 300mm deep)	735	m2	$3.34	$2,454.90
1.3.4.2.2	150mm thick DGS40 sub-base course	735	m2	$17.84	$13,112.40
1.3.4.2.3	50mm thick fine crushed rock	735	m2	$21.58	$15,861.30
1.3.4.2.4	90mm thick lightly compacted sand/ soil mix	735	m2	$16.70	$12,274.50
1.3.4.2.5	Supply and place turf to last	735	m2	$7.50	$5,512.50
1.3.4.2.6	Allowance for Trihex permiable pavement on & including 150 thick DGB20 base course (Trailer Parking Adjacent to Existing Road Corridor)	723	m2	$224.20	$162,097.98
1.3.5	**STORMWATER**				**$85,440.00**
1.3.5.1	Provisional Allowance for stormwater drainage to sealed pavements (Allowance for Stormwater Drainage to New & Existing Carpark Areas)	5,696	m2	$15.00	$85,440.00
1.3.6	**SERVICES & UTILITIES**				**$55,000.00**
1.3.6.1	**Electrical services:**				**$7,000.00**
1.3.6.1.1	Provisional Allowance for electrical reticulation to carpark	1	PSUM	$7,000.00	$7,000.00
1.3.6.2	**Lighting:**				**$24,000.00**
1.3.6.2.1	Allowance for light pole, luminaire & reticulation to carpark entry point	1	PSUM	$5,350.00	$5,350.00
1.3.6.2.2	Allowance for light pole, luminaire & reticulation to centre of carpark	1	PSUM	$5,350.00	$5,350.00
1.3.6.2.3	Allowance for light pole, luminaire & reticulation to centre of boat ramp	2	PSUM	$5,350.00	$10,700.00
1.3.6.2.4	Allowance for luminaire & reticulation to fish cleaning area	1	PSUM	$2,600.00	$2,600.00
1.3.6.3	**Communications services:**				**$3,500.00**
1.3.6.3.1	Provisional Allowance for Communications service to RMS sign	1	PSUM	$3,500.00	$3,500.00
1.3.6.4	**Potable Water reticulation:**				**$20,500.00**

	Description	Quantity	Unit	Rate	Total
1.3.6.4.1	Provisional Allowance to tap existing 100mm potable water line & reticulation to carpark	1	PSUM	$20,500.00	$20,500.00
1.3.6.5	Allowance for services conduits under pavements - EXCL.	1	Item		EXCL
1.3.7	**CONCRETE WORKS**				**$62,751.00**
1.3.7.1	Kerb & Gutter to Carpark	768	m	$65.00	$49,920.00
1.3.7.2	Concrete layback to last (1No.)	6	m	$66.00	$396.00
1.3.7.3	Kerb Only	30	m	$65.00	$1,950.00
1.3.7.4	Concrete edge strip	233	m	$45.00	$10,485.00
1.3.7.5	Concrete footpath - Refer Footpath Trade		NOTE		
1.3.8	**ROAD FURNITURE, SIGNAGE & LINEMARKING**				**$23,629.28**
1.3.8.1	**Site Furniture**				**$6,948.93**
1.3.8.1.1	Provisional Allowance for 4500 long stainless steel fish cleaning table [No Details Provided]	1	No.	$5,000.00	$5,000.00
1.3.8.1.2	Allowance to take from stockpile and place existing oversize rocks	79	No.	$24.67	$1,948.93
1.3.8.2	**Signage**				**$5,000.00**
1.3.8.2.1	Allowance for signage	1	Item	$5,000.00	$5,000.00
1.3.8.3	**Linemarking**				**$11,680.35**
1.3.8.3.1	**Allowance for waterborne linemarking as detailed to the following:**				**$11,680.35**
1.3.8.3.1.1	Linemarking Establishment	1	No.	$2,500.00	$2,500.00
1.3.8.3.1.2	Carpark Lines	689	m	$1.25	$861.25
1.3.8.3.1.3	Line Type E4	66	m	$1.35	$89.10
1.3.8.3.1.4	Line Tip TB	12	m	$7.50	$90.00
1.3.8.3.1.5	Directional Arrows	16	No.	$55.00	$880.00
1.3.8.3.1.6	Chevron	132	m2	$55.00	$7,260.00
1.3.8.3.1.7	Raised pavement markers - EXCL.	1	Item		EXCL
1.3.9	**LANDSCAPING & REMEDIATION**				**$201,734.39**
1.3.9.1	**Turfed Areas**				**$909.50**
1.3.9.1.1	Allowance to respread topsoil on site (not exceeding 300 thick) [Taken Elsewhere - Refer to Topsoil]	107	m2		INCL
1.3.9.1.2	Supply and place turf to last	107	m2	$8.50	$909.50
1.3.9.2	**Planting**				**$180,824.89**
1.3.9.2.1	**Mass Planting:**				**$166,024.89**

	Description	Quantity	Unit	Rate	Total
1.3.9.2.1.1	Cultivate subgrade	1,659	m2	$0.75	$1,244.25
1.3.9.2.1.2	Place 400 thick imported garden soil to garden beds	664	m3	$101.00	$67,064.00
1.3.9.2.1.3	Supply & place 75 thick mulch to last	125	m3	$115.36	$14,419.64
1.3.9.2.1.4	Tube stock (4/m2)	6,636	No.	$8.75	$58,065.00
1.3.9.2.1.5	200mm plant (2/5m2)	664	No.	$38.00	$25,232.00
1.3.9.2.2	**Feature Trees:**				**$14,800.00**
1.3.9.2.2.1	Supply & place 150ltr feature tree	14	No.	$350.00	$4,900.00
1.3.9.2.2.2	Supply & place 400ltr feature tree	9	No	$1,100.00	$9,900.00
1.3.9.3	Allowance for maintenance of revegetated areas (12 months beyond practical completion)	1	Item	$20,000.00	$20,000.00
1.3.9.4	Irrigation to turf & garden areas - EXCL.	1	Item		EXCL
1.4	**AMENITIES AREA**				**$493,310.96**
1.4.1	**DEMOLITION:**				**$2,408.00**
1.4.1.1	Saw Cut existing Roadway not exceeding 50 thick	39	m	$10.00	$390.00
1.4.1.2	Allowance for sundry demolition of existing structures on site	1	Item	$1,500.00	$1,500.00
1.4.1.3	**Remove & stockpile for reuse onsite the following:**				**$518.00**
1.4.1.3.1	Allow to remove and stockpile for reuse existing oversized rock barriers	21	No.	$24.67	$518.00
1.4.2	**TOPSOIL**				**$5,690.09**
1.4.2.1	Strip topsoil not exceeding 150mm thick & stockpile onsite for reuse	136	m3	$17.51	$2,380.75
1.4.2.2	Allowance to respread topsoil on site to berms, batters and landscaped areas (not exceeding 300 thick)	136	m3	$24.33	$3,309.33
1.4.2.3	Screening of topsoil - EXCL.	1	Item		EXCL
1.4.2.4	Allowance to haul & dispose off site surplus topsoil - EXCL.	1	Item		NIL
1.4.2.5	Allowance to seed surplus topsoil stockpile	1	Item		NIL
1.4.3	**EARTHWORKS**				**$24,167.13**
1.4.3.1	**Bulk Earthworks**				**$24,167.13**
1.4.3.1.1	Allowance to supply & place select fill to site (nominal 300 thick)	222	m3	$75.00	$16,650.00

	Description	Quantity	Unit	Rate	Total
1.4.3.1.2	Allow to boxout for planting (nom. 600 thick) and disposal offsite [PC Tip Fee $25/t]	50	m3	$67.00	$3,350.00
1.4.3.1.3	Extra over allowance for rock/oversize (assumes 5% of boxout material)	3	m3	$54.00	$162.00
1.4.3.1.4	Allowance for machine access track for channel dredging	97	m2	$41.29	$4,005.13
1.4.3.1.5	Removal of last at completion of works - EXCL.	1	Item		EXCL
1.4.4	**STORMWATER**				**$7,500.00**
1.4.4.1	Provisional Allowance for stormwater drainage from amenities	1	Item	$7,500.00	$7,500.00
1.4.5	**CONCRETE WORKS**				**$91,419.88**
1.4.5.1	Allowance for 3000 wide x 150 thick reinforced concrete shared path on & including 150 FCR bedding	207	m2	$152.63	$31,594.88
1.4.5.2	Extra Over allowance for Feature Paving to last	207	m2	$150.00	$31,050.00
1.4.5.3	Allowance for edge barrier	69	m	$400.00	$27,600.00
1.4.5.4	Pram Ramp	1	No	$900.00	$900.00
1.4.5.5	Tactile Indicators to last	1	m2	$275.00	$275.00
1.4.6	**ROAD FURNITURE, SIGNAGE & LINEMARKING**				**$15,500.00**
1.4.6.1	**Site Furniture**				**$10,500.00**
1.4.6.1.1	Allowance for picnic tables including slab	3	No.	$3,500.00	$10,500.00
1.4.6.2	**Signage**				**$5,000.00**
1.4.6.2.1	Allowance for signage	1	Item	$5,000.00	$5,000.00
1.4.7	**LANDSCAPING & REMEDIATION**				**$37,313.87**
1.4.7.1	**Turfed Areas**				**$10,758.87**
1.4.7.1.1	Allowance to respread topsoil on site (not exceeding 300 thick) [Taken Elsewhere - Refer to Topsoil]	543	m2		INCL
1.4.7.1.2	Cultivate subgrade	487	m2	$0.75	$365.25
1.4.7.1.3	Allowance to supply & place imported turf underlay (nominal 100 thick)	487	m2	$12.84	$6,254.12
1.4.7.1.4	Supply and place turf to last	487	m2	$8.50	$4,139.50
1.4.7.2	**Planting**				**$16,555.00**
1.4.7.2.1	**Mass Planting:**				**$11,555.00**
1.4.7.2.1.1	Cultivate subgrade	82	m2	$0.75	$61.50

	Description	Quantity	Unit	Rate	Total
1.4.7.2.1.2	Place 600 thick imported garden soil to garden beds	50	m3	$101.00	$5,050.00
1.4.7.2.1.3	Supply & place 75 thick mulch to last	7	m3	$126.36	$884.50
1.4.7.2.1.4	Tube stock (6/m2)	492	No.	$8.75	$4,305.00
1.4.7.2.1.5	200mm plant (2/5m2)	33	No.	$38.00	$1,254.00
1.4.7.2.2	**Feature Trees:**				**$5,000.00**
1.4.7.2.2.1	Supply & place 150ltr feature tree	9	No.	$350.00	$3,150.00
1.4.7.2.2.2	Supply & place 400ltr feature tree	1	No	$1,100.00	$1,100.00
1.4.7.2.2.3	Allowance for mulch ring	6	No.	$125.00	$750.00
1.4.7.3	Allowance for maintenance of revegetated areas (12 months beyond practical completion)	1	Item	$10,000.00	$10,000.00
1.4.7.4	Irrigation to turf & garden areas - EXCL.	1	Item		EXCL
1.4.8	**AMENITIES BUILDING**				**$309,312.00**
1.4.8.1	Provisional Allowance to supply and install Amenities Building [Approx 9m x 8m] including services and associated items [No Details provided]	1	PSUM	$309,312.00	$309,312.00
1.5	**FOOTPATHS**				**$266,933.53**
1.5.1	**2500 WIDE FOOTPATH (RED)**				**$129,929.04**
1.5.1.1	**Demolition:**				**$288.00**
1.5.1.1.1	Allowance for sundry demolition of existing structures	192	m	$1.50	$288.00
1.5.1.2	**Topsoil:**				**$5,456.50**
1.5.1.2.1	Spray glyphosate to work area	864	m2	$0.50	$432.00
1.5.1.2.2	Strip topsoil not exceeding 150mm thick & stockpile onsite for reuse	130	m3	$14.32	$1,861.17
1.5.1.2.3	Allowance to respread topsoil on site to berms, batters and landscaped areas (not exceeding 300 thick)	130	m3	$24.33	$3,163.33
1.5.1.2.4	Screening of topsoil - EXCL.	1	Item		EXCL
1.5.1.2.5	Allowance to haul & dispose off site surplus topsoil - EXCL.	1	Item		EXCL
1.5.1.3	**Earthworks:**				**$4,556.00**
1.5.1.3.1	Allow to boxout for new footpath (nom. 100 thick) and disposal offsite [PC Tip Fee $25/t]	68	m3	$67.00	$4,556.00

	Description	Quantity	Unit	Rate	Total
1.5.1.3.2	Extra over allowance for rock - EXCL.	1	Item		EXCL
1.5.1.4	**Concrete Works:**				**$79,344.54**
1.5.1.4.1	Allowance for 2500 wide x 125 thick reinforced concrete footpath on & including 100 FCR bedding	480	m2	$131.86	$63,294.54
1.5.1.4.2	Pram Ramp	8	No	$1,800.00	$14,400.00
1.5.1.4.3	Tactile Indicators to last	6	m2	$275.00	$1,650.00
1.5.1.5	**Road Furniture, Signage & Linemarking:**				**$27,520.00**
1.5.1.5.1	Allowance for bicycle hold rail at road road crossings	8	No.	$1,200.00	$9,600.00
1.5.1.5.2	Allowance for pedestrian shelter at road crossings	2	No.	$8,000.00	$16,000.00
1.5.1.5.3	Allowance for wayfinding signage	192	m	$10.00	$1,920.00
1.5.1.6	**Landscaping & Remediation:**				**$12,764.00**
1.5.1.6.1	**Turfed Areas**				**$3,264.00**
1.5.1.6.1.1	Allowance to respread topsoil on site (not exceeding 300 thick) [Taken Elsewhere - Refer to Topsoil]	384	m2		INCL
1.5.1.6.1.2	Supply and place turf to last	384	m2	$8.50	$3,264.00
1.5.1.6.2	**Planting**				**$7,000.00**
1.5.1.6.2.1	Allowance for 75ltr feature trees	20	No.	$275.00	$5,500.00
1.5.1.6.2.2	Allowance for mulch rings	20	No.	$75.00	$1,500.00
1.5.1.6.3	Allowance for maintenance of revegetated areas (12 months beyond practical completion)	1	Item	$2,500.00	$2,500.00
1.5.1.6.4	Irrigation to turf & garden areas - EXCL.	1	Item		EXCL
1.5.2	**3000 WIDE FEATURE SHARED PATH (BLUE)**				**$137,004.49**
1.5.2.1	**Demolition:**				**$475.00**
1.5.2.1.1	Allowance for sundry demolition of existing structures	95	m	$5.00	$475.00
1.5.2.2	**Topsoil:**				**$3,020.30**
1.5.2.2.1	Spray glyphosate to work area	475	m2	$0.50	$237.50
1.5.2.2.2	Strip topsoil not exceeding 150mm thick & stockpile onsite for reuse	72	m3	$14.32	$1,030.80
1.5.2.2.3	Allowance to respread topsoil on site to berms, batters and landscaped areas (not exceeding 300 thick)	72	m3	$24.33	$1,752.00

	Description	Quantity	Unit	Rate	Total
1.5.2.2.4	Screening of topsoil - EXCL.	1	Item		EXCL
1.5.2.2.5	Allowance to haul & dispose off site surplus topsoil - EXCL.	1	Item		EXCL
1.5.2.3	**Earthworks:**				**$3,819.00**
1.5.2.3.1	Allow to boxout for new footpath (nom. 150 thick) and disposal offsite [PC Tip Fee $25/t]	57	m3	$67.00	$3,819.00
1.5.2.3.2	Extra over allowance for rock - EXCL.	1	Item		EXCL
1.5.2.4	**Concrete Works:**				**$124,250.19**
1.5.2.4.1	Allowance for 3000 wide x 150 thick reinforced concrete shared path on & including 150 FCR bedding	285	m2	$152.63	$43,500.19
1.5.2.4.2	Extra Over allowance for Feature Paving to last	285	m2	$150.00	$42,750.00
1.5.2.4.3	Allowance for edge barrier	95	m	$400.00	$38,000.00
1.5.2.5	**Road Furniture, Signage & Linemarking:**				**$2,375.00**
1.5.2.5.1	Allowance for wayfinding signage	95	m	$25.00	$2,375.00
1.5.2.6	**Landscaping & Remediation:**				**$3,065.00**
1.5.2.6.1	**Turfed Areas**				**$1,615.00**
1.5.2.6.1.1	Allowance to respread topsoil on site (not exceeding 300 thick) [Taken Elsewhere - Refer to Topsoil]	190	m2		INCL
1.5.2.6.1.2	Supply and place turf to last	190	m2	$8.50	$1,615.00
1.5.2.6.2	**Planting**				**$950.00**
1.5.2.6.2.1	Supply & place 400ltr feature tree	2	No	$350.00	$700.00
1.5.2.6.2.2	Allowance for mulch ring	2	No.	$125.00	$250.00
1.5.2.6.3	Allowance for maintenance of revegetated areas (12 months beyond practical completion)	1	Item	$500.00	$500.00
1.5.2.6.4	Irrigation to turf & garden areas - EXCL.	1	Item		EXCL
1.6	**OVERFLOW PARKING (FISHING CLUB) - ENABLING WORKS**				**$13,206.98**
1.6.1	**DEMOLITION**				**$933.64**
1.6.1.1	Saw Cut existing Roadway not exceeding 50 thick	16	m	$10.00	$160.00
1.6.1.2	**Demolish & remove from site the following:**				**$378.98**

	Description	Quantity	Unit	Rate	Total
1.6.1.2.1	Existing road wearing course (Assume 30mm thick) and disposal offsite	16	m2	$23.69	$378.98
1.6.1.3	**Remove & stockpile for reuse onsite the following:**				**$394.67**
1.6.1.3.1	Allow to remove and stockpile for reuse existing oversized rock barriers	16	No.	$24.67	$394.67
1.6.2	**ROAD FURNITURE, SIGNAGE & LINEMARKING**				**$12,273.33**
1.6.2.1	**Site Furniture**				**$7,273.33**
1.6.2.1.1	Allowance to take from stockpile and place existing oversize rocks	16	No.	$27.50	$440.00
1.6.2.1.2	Allowance for supply & placement of additional rocks	100	No.	$68.33	$6,833.33
1.6.2.2	**Signage**				**$5,000.00**
1.6.2.2.1	Allowance for signage	1	Item	$5,000.00	$5,000.00
1.7	**OVERFLOW TRAILER PARKING (JORDAN ESPLANADE) - ENABLING WORKS - 4No.**				**$15,044.00**
1.7.1	**DEMOLITION**				**$6,090.67**
1.7.1.1	Saw Cut existing Roadway not exceeding 50 thick	318	m	$10.00	$3,180.00
1.7.1.2	**Remove & stockpile for reuse onsite the following:**				**$2,910.67**
1.7.1.2.1	Allow to remove and stockpile for reuse existing oversized rock barriers	118	No.	$24.67	$2,910.67
1.7.2	**ROAD FURNITURE, SIGNAGE & LINEMARKING**				**$8,953.33**
1.7.2.1	**Site Furniture**				**$4,953.33**
1.7.2.1.1	Allowance to take from stockpile and place existing oversize rocks	118	No.	$27.50	$3,245.00
1.7.2.1.2	Allowance for supply & placement of additional rocks	25	No.	$68.33	$1,708.33
1.7.2.2	**Signage**				**$4,000.00**
1.7.2.2.1	Allowance for signage	1	Item	$4,000.00	$4,000.00
1.8	**CONTRACTORS CORPORATE OVERHEADS & MARGIN**				**$381,581.00**
1.8.1	Allowance for Contractors Corporate Overheads & Margin (15%)	1	Item	$381,581.00	$381,581.00
2	**INDIRECT COSTS**				**$2,333,967.51**
2.1	**PRE-CONSTRUCTION**				**$234,035.89**
2.1.1	Allowance for Project Management Allowance (8%)	1	Item	$234,035.89	$234,035.89

	Description	Quantity	Unit	Rate	Total
2.2	**CONSTRUCTION**				**$965,398.89**
2.2.1	Allowance for Construction Contingency (25%)	1	Item	$731,363.00	$731,363.00
2.2.2	Allowance for Construction Project Management Allowance (8%)	1	Item	$234,035.89	$234,035.89
2.3	**WORKS BY OTHERS**				**$1,134,532.74**
2.3.1	**PRELIMINARIES**				**$128,680.40**
2.3.1.1	Allowance for preliminaries (15%)	1	Item	$128,680.40	$128,680.40
2.3.2	**KIOSK BUILDING**				**$196,000.00**
2.3.2.1	Provisional Allowance to supply and install Kiosk Building (attached to Amenities) [7m x 8m] including services and associated items [No Details provided] - Excludes Fitout & FF&E	1	PSUM	$196,000.00	$196,000.00
2.3.3	**FOOTPATHS**				**$171,220.01**
2.3.3.1	**3000 WIDE SHARED PATH (GREEN)**				**$171,220.01**
2.3.3.1.1	**Demolition:**				**$20,540.00**
2.3.3.1.1.1	Allowance for sundry demolition of existing structures	316	m	$65.00	$20,540.00
2.3.3.1.2	**Topsoil:**				**$2,013.20**
2.3.3.1.2.1	Spray glyphosate to work area	316	m2	$0.50	$158.00
2.3.3.1.2.2	Strip topsoil not exceeding 150mm thick & stockpile onsite for reuse	48	m3	$14.32	$687.20
2.3.3.1.2.3	Allowance to respread topsoil on site to berms, batters and landscaped areas (not exceeding 300 thick)	48	m3	$24.33	$1,168.00
2.3.3.1.2.4	Screening of topsoil - EXCL.	1	Item		EXCL
2.3.3.1.2.5	Allowance to haul & dispose off site surplus topsoil - EXCL.	1	Item		EXCL
2.3.3.1.3	**Earthworks:**				**$12,730.00**
2.3.3.1.3.1	Allow to boxout for new footpath (nom. 150 thick) and disposal offsite [PC Tip Fee $25/t]	190	m3	$67.00	$12,730.00
2.3.3.1.3.2	Extra over allowance for rock - EXCL.	1	Item		EXCL
2.3.3.1.4	**Concrete Works:**				**$118,712.81**

	Description	Quantity	Unit	Rate	Total
2.3.3.1.4.1	Allowance for 3000 wide x 125 thick reinforced concrete footpath on & including 150 FCR bedding	843	m2	$134.24	$113,162.81
2.3.3.1.4.2	Pram Ramp	2	No	$2,500.00	$5,000.00
2.3.3.1.4.3	Tactile Indicators to last	2	m2	$275.00	$550.00
2.3.3.1.5	**Road Furniture, Signage & Linemarking:**				**$14,290.00**
2.3.3.1.5.1	Allowance for bicycle hold rail at road road crossings	2	No.	$1,200.00	$2,400.00
2.3.3.1.5.2	Allowance for pedestrian shelter at road crossings	1	No.	$8,000.00	$8,000.00
2.3.3.1.5.3	Allowance for wayfinding signage	316	m	$5.00	$1,580.00
2.3.3.1.5.4	Allowance for linemarking to pedestrain crossings (carparks)	42	m2	$55.00	$2,310.00
2.3.3.1.6	**Landscaping & Remediation:**				**$2,934.00**
2.3.3.1.6.1	**Turfed Areas**				**$1,734.00**
2.3.3.1.6.1.1	Allowance to respread topsoil on site (not exceeding 300 thick) [Taken Elsewhere - Refer to Topsoil]	204	m2		INCL
2.3.3.1.6.1.2	Supply and place turf to last	204	m2	$8.50	$1,734.00
2.3.3.1.6.2	**Planting**				**$700.00**
2.3.3.1.6.2.1	Allowance for 75ltr feature trees	2	No.	$275.00	$550.00
2.3.3.1.6.2.2	Allowance for mulch rings	2	No.	$75.00	$150.00
2.3.3.1.6.3	Balance of Landscaping Works - See Main Carpark		NOTE		
2.3.3.1.6.4	Allowance for maintenance of revegetated areas (12 months beyond practical completion)	1	Item	$500.00	$500.00
2.3.3.1.6.5	Irrigation to turf & garden areas - EXCL.	1	Item		EXCL
2.3.4	**OVERFLOW PARKING (FISHING CLUB) - BALANCE OF WORKS**				**$168,784.90**
2.3.4.1	**TOPSOIL**				**$9,484.16**
2.3.4.1.1	Spray glyphosate to work area	1,396	m2	$0.50	$698.00
2.3.4.1.2	Strip topsoil not exceeding 150mm thick & stockpile onsite for reuse	210	m3	$17.51	$3,676.16
2.3.4.1.3	Allowance to respread topsoil on site to berms, batters and landscaped areas (not exceeding 300 thick)	210	m3	$24.33	$5,110.00

	Description	Quantity	Unit	Rate	Total
2.3.4.1.4	Screening of topsoil - EXCL.	1	Item		EXCL
2.3.4.1.5	Allowance to haul & dispose off site surplus topsoil - EXCL.	1	Item		NIL
2.3.4.1.6	Allowance to seed surplus topsoil stockpile	1	Item		NIL
2.3.4.2	**EARTHWORKS**				**$14,070.00**
2.3.4.2.1	**Bulk Earthworks**				**$14,070.00**
2.3.4.2.1.1	Allow to boxout in OTR for overflow parking area (nom. 150 thick) and disposal offsite [PC Tip Fee $25/t]	210	m3	$67.00	$14,070.00
2.3.4.3	**PAVEMENT**				**$25,157.12**
2.3.4.3.1	Trim & compact subgrade	1,396	m2	$2.75	$3,839.00
2.3.4.3.2	Supply & place 125 thick road base	1,396	m2	$15.27	$21,318.12
2.3.4.4	**LANDSCAPING & REMEDIATION**				**$120,073.62**
2.3.4.4.1	**Turfed Areas**				**$106,573.62**
2.3.4.4.1.1	Allowance for supply & placement of turf reinforcement	1,396	m2	$55.00	$76,780.00
2.3.4.4.1.2	Allowance to supply & place imported turf underlay (nominal 100 thick)	1,396	m2	$12.84	$17,927.62
2.3.4.4.1.3	Supply and place turf to last	1,396	m2	$8.50	$11,866.00
2.3.4.4.2	Allowance for maintenance of revegetated areas (12 months beyond practical completion)	1	Item	$10,000.00	$10,000.00
2.3.4.4.3	Allowance for tap points to turf areas	1	No.	$3,500.00	$3,500.00
2.3.5	**OVERFLOW TRAILER PARKING (JORDAN ESPLANADE) - BALANCE OF WORKS - 4No.**				**$321,864.42**
2.3.5.1	**TOPSOIL**				**$18,427.26**
2.3.5.1.1	Spray glyphosate to work area	2,714	m2	$0.50	$1,357.00
2.3.5.1.2	Strip topsoil not exceeding 150mm thick & stockpile onsite for reuse	408	m3	$17.51	$7,142.26
2.3.5.1.3	Allowance to respread topsoil on site to berms, batters and landscaped areas (not exceeding 300 thick)	408	m3	$24.33	$9,928.00
2.3.5.1.4	Screening of topsoil - EXCL.	1	Item		EXCL
2.3.5.1.5	Allowance to haul & dispose off site surplus topsoil - EXCL.	1	Item		NIL
2.3.5.1.6	Allowance to seed surplus topsoil stockpile	1	Item		NIL
2.3.5.2	**EARTHWORKS**				**$27,336.00**

	Description	Quantity	Unit	Rate	Total
2.3.5.2.1	**Bulk Earthworks**				**$27,336.00**
2.3.5.2.1.1	Allow to boxout in OTR for overflow parking area (nom. 150 thick) and disposal offsite [PC Tip Fee $25/t]	408	m3	$67.00	$27,336.00
2.3.5.3	**PAVEMENT**				**$48,908.61**
2.3.5.3.1	Trim & compact subgrade	2,714	m2	$2.75	$7,463.50
2.3.5.3.2	Supply & place 125 thick road base	2,714	m2	$15.27	$41,445.11
2.3.5.4	**LANDSCAPING & REMEDIATION**				**$227,192.56**
2.3.5.4.1	**Turfed Areas**				**$207,192.56**
2.3.5.4.1.1	Allowance for supply & placement of turf reinforcement	2,714	m2	$55.00	$149,270.00
2.3.5.4.1.2	Allowance to supply & place imported turf underlay (nominal 100 thick)	2,714	m2	$12.84	$34,853.56
2.3.5.4.1.3	Supply and place turf to last	2,714	m2	$8.50	$23,069.00
2.3.5.4.2	Allowance for maintenance of revegetated areas (12 months beyond practical completion)	1	Item	$20,000.00	$20,000.00
2.3.5.4.3	Allowance for tap points to turf areas - EXCL.	1	No.		EXCL
2.3.6	**CONTRACTORS CORPORATE OVERHEADS & MARGIN**				**$147,983.00**
2.3.6.1	Allowance for Contractors Corporate Overheads & Margin (15%)	1	Item	$147,983.00	$147,983.00
2.3.7	CONTINGENCY ALLOWANCE - EXCL.	1	Item		EXCL
2.3.8	DESIGN FEES - EXCL.	1	Item		EXCL
2.3.9	AUTHORITIES FEES & CHARGES - EXCL.	1	Item		EXCL
2.4	**DESIGN FEES**				
2.4.1	Allowance for Design Fees - EXCL.	1	Item		EXCL
2.5	**AUTHORITIES FEES & CHARGES**				
2.5.1	Allowance for Authorities Fees & Charges - EXCL.	1	Item		EXCL
2.6	**ESCALATION**				
2.6.1	Allowance for Escalation beyond September 2020 - EXCL.	1	Item		EXCL
3	**SCHEDULE OF INFORMATION**				

	Description	Quantity	Unit	Rate	Total
3.1	Revised Concept Staging Plan by Royal Haskoning DHV titled 'Stage 2 Site Masterplan' numbered PA2341-STG-P-1 Rev C, dated 20 March 2020 Received 18.08.2020		NOTE		
3.2	Email from Ben Patterson - Revised Scope 11.08.2020		NOTE		
3.3	Markups from Pat Smyth received 31.08.2020		NOTE		
3.4	Phone Meeting with Ben Patterson 09.09.2020		NOTE		
4	**SCHEDULE OF EXCLUSIONS**				
4.1	Carpark Works to Gallows Beach - EXCL.		NOTE		
4.2	Storm events & rework - EXCL.		NOTE		
4.3	Authorities Fees & Charges - EXCL.		NOTE		
4.4	Design Fees - EXCL.		NOTE		
4.5	Tendering Costs - EXCL.		NOTE		
4.6	Additional Staging Costs - EXCL.		NOTE		
4.7	Unknown steakholder requirements - EXCL.		NOTE		
4.8	Delay costs including Inclement Weather- EXCL.		NOTE		
4.9	Testing, treatment & management of contaminated material including buried rubbish on site - EXCL.		NOTE		
4.10	Testing, treatment & disposal of groundwater - EXCL.		NOTE		
4.11	Adjustments to Existing Utilities other than that listed in foregoing estimate - EXCL.		NOTE		
4.12	Unknown ground conditions & engineers design - EXCL.		NOTE		
4.13	Electrical reticulation including lighting beyond that listed in foregoing estimate - EXCL.		NOTE		
4.14	Cost escalation beyond September 2020 - EXCL.		NOTE		

Subtotal	**$5,259,416.09**
Adjustment	$0.00
Post adjustment	$5,259,416.09
G.S.T [10%]	$525,941.61
Total	**$5,785,357.70**

Appendix H

Sediment Sampling Results

Transport for NSW

Coffs Harbour Boat Ramp Upgrade and Precinct Development

Jordan Esplanade, Coffs Jetty

Geotechnical Report

Report No. RGS32282.1 - AB

10 November 2020

REGIONAL
GEOTECHNICAL
SOLUTIONS

REGIONAL
GEOTECHNICAL
SOLUTIONS

Manning-Great Lakes
Port Macquarie
Coffs Harbour

RGS32282.1 - AB

10 November 2020

Crown Lands - Transport for NSW
437 Hunter Street
NEWCASTLE NSW 2300

Attention: Patrick Smyth

Dear Patrick

RE: Coffs Harbour Boat Ramp Upgrade and Precinct Development– Jordan Esplanade, Coffs Jetty

Geotechnical Report

Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken geotechnical investigations and assessment for the Coffs Harbour Boat Ramp Upgrade and Jetty Precinct Development.

This report presents the results of the investigations and provides comments and recommendations for the design and reconstruction of the boat ramp and surrounding infrastructure.

If you have any questions regarding this project, please contact the undersigned.

For and on behalf of
Regional Geotechnical Solutions Pty Ltd

Prepared by	Reviewed by
Matt Rowbotham	Adam Holzhauser
Associate Engineering Geologist	Associate Geotechnical Engineer

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Figures

Appendices

1 INTRODUCTION

Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken geotechnical investigations and assessment for the Coffs Harbour Boat Ramp Upgrade and Jetty Precinct Development.

Based on our understanding of the area the eastern break wall began construction in 1917 to protect the jetty from damage during storm events, an image below from 1954 shows the majority of the wall completed with ongoing works occurring.

The existing boat ramp area was developed in the 1970s and involved construction of the boat ramp basin and break wall. The site has a history of difficulties with launching and retrieval of boats and navigation of the entrance. The break wall had minor extension works undertaken between 2004 and 2010. In 2015 the boat ramp basin was widened to manage issues such as wave surge.

Recently a grant has been given to further upgrade the boat ramp and surrounding infrastructure. As part of the development the following is proposed;

- Widening of the boat ramp and construction of two new floating docks;
- Extension of the existing break wall by 75m;
- Dredging of the basin area and entrance channel;
- Construction of an amenities area and upgrading of the boat ramp car park;
- Road realignment works to Jordan Esplanade; and
- New sealed car parking area to the south of the existing Gallows Beach car park.

The purpose of the geotechnical assessment was to provide:

- A description of the surface and subsurface conditions to inform the design of the boat ramp, break wall and pavement design.
- Soil parameters to inform design of the boat ramp, break-wall extension, piled floating docks, car park and road pavement. Parameters to include but not limited to:
    - γ – Unit weight of soil (dry & saturated)
    - φ – Internal angle of friction / shear strength
    - CBR – California Bearing Ratio (for pavement designs)
    - Particle Size Distribution
- Stability analysis (slip circle analysis) for the proposed break wall design.
- Foundation design parameters for the break wall extension, floating dock piles etc.
- Assessment of acid sulfate soils.
- Pavement construction requirements including pavement thickness designs and subgrade preparation.
- Preliminary chemical analysis (contamination) of sediments that may be dredged.

2 FIELD WORK

Field work was carried out between September and October 2020 and comprised a site walkover assessment together with various intrusive investigations. The site walkover included observation of pavement conditions (surface features), pavement performance and pavement drainage.

Intrusive investigations included:

- Excavation of thirteen (13) test pits to depths of about 1m for the assessment of subgrade and pavement conditions. Dynamic Cone Penetrometer (DCP) testing was undertaken where practical.
- Drilling of nine (8) boreholes at the nominated locations including three (3) land based to encounter rock and five (5) overwater locations drilled from a "jack up" barge. The holes were drilled until refusal was encountered on rock. Standard Penetration Test (SPT) were undertaken throughout the boreholes in the soil and weathered rock profile at about 1.5m spacing to assess soils strength profiles.
- Sampling from a long reach excavator of the sediments in the boat ramp basin.

The fieldwork was undertaken by Geotechnical Engineers and Engineering Geologists from RGS. Engineering logs of the test pits and boreholes are presented in Appendix A. The approximate locations of the test pits and boreholes are presented on Figures 2 to 5. The investigations were undertaken at the locations generally nominated by TfNSW.

3 SURFACE CONDITIONS

3.1 Boat Ramp and Break Wall Area

The boat ramp and break wall structures are located in an area of reclaimed land and therefore significant earthworks have been undertaken over the years to develop and modify the area. The boat ramp surface comprises a reinforced concrete slab and is about 14m in width. The ramp is formed at a grade of about 1V to 7H. The ramp experiences significant wave surge to boat users when launching and retrieving vessels. On the western side of the boat ramp a floating dock exists which extends about 40m northwards into the water. The dock is supported (anchored) by piles.

The break wall and boat ramp basin berms are constructed of rockfill materials won from local quarries. The initial construction of the ramp was undertaken using argillite (dark grey colour rock), more recent works associated with widening of the basin were undertaken using the Valla Granite (pale grey coloured rock). Visual assessment of the materials shows both rockfill types to be strong, very high strength be durable. The majority of the rock walls are formed at about 1.5H to 1V. Block sizes of the rocks typically range between 0.5m and 2.0m in dimension.

Photo 1: Image of the Boat Ramp Basin

Photo 2: Image of the Break Wall (Right of Photo)

3.1.1 Car Park and Pavements

Boat Ramp Car Park

The boat ramp car park is located in an area or reclaimed land, the pavement beneath the car park comprises high to very high strength bridging rock (Argillite) with a spray seal finish. The car park surface seal was in average condition with numerous localised areas of potholing noted. Surface drainage from the car park has been shaped towards the north west and discharges into the boat ramp basin.

Photo 3: Image of the Boat Ramp Car Park Looking South West

<u>Jordan Esplanade</u>

The pavement along Jordan Esplanade has an Asphaltic Concrete surface. The subgrade comprises mixed fill associated with raising the site levels to reclaim the land. The road surface was in gool condition at the time of the investigation.

Drainage comprises sealed and unsealed surface drains which are connected to stormwater pits that discharge northwards to the Jetty Harbour and Jetty Boat Ramp basin.

Photo 4: Looking West Along Jordan Esplanade

Unsealed Car Park and Access Roads (South of Gallows Beach Car Park)

The unsealed car park pavement has a sandy gravel surface, the subgrade comprises mixed fill associated with raising the site levels during the reclamation works. Boambee Beach access roads is located adjacent and west of the unsealed car park. The road is sealed and in poor condition with numerous repatched potholes and pavement deformation.

Photo 5: Looking South Across the Unsealed Car Park Area at Gallows Beach

Photo 6: Looking North West from the Unsealed Car Park Towards the Boat Ramp Car Park

4 SUBSURFACE CONDITIONS

The 1:250,000 geological series sheet of Dorrigo – Coffs Harbour indicates the area to be underlain for marine sand which in turn is underlain by metamorphosed siltstone.

Summaries of the subsurface conditions encountered in the test pits and boreholes are summarised in tables below.

Table 1: Summary of Test Pit Conditions Encountered

Location	Test Pit	Depth to Base of Unit (m)					
		Seal	Existing Pavement Materials (Sandy Gravel)	Rockfill – High to Very High Strength Argillite (Metasiltstone) Comprising Gravel and Cobbles	Fill – Sand and Silty Sand, Fine to Medium Grained	Fill – Clay, Low to High Plasticity	Fill – Sandy Gravel / Clayey Gravel
Boat Ramp Car Park	TP4	0.02 (Spray Seal)	≥1.0	--	--	--	--
	TP5	0.03 (Spray Seal)	≥1.0	--	--	--	--
	TPC	0.03 (Spray Seal)	≥1.0	--	--	--	--
	TPD	0.03 (Spray Seal)	≥1.0	--	--	--	--
	TPE	--	≥1.0	--	--	--	--
	TPF	0.02 (Spray Seal)	≥1.0	--	--	--	--
Unsealed Car Park (Gallows Beach)	TP6	--	0.25	--	0.6	≥1.0	--
	TP7	--	--	--	0.55	≥1.0	--
Jordan Esplanade and Adjacent Alignment Pits	TP1	0.15	0.4	--	--	0.7	≥1.0-
	TP3	--	--	--	--	0.6	≥1.0
	TPA	--	--	--	≥1.0	--	--
	TPB	--	--	--		0.6	≥1.0
Existing Fish Cleaning Amenities	TP2	--	--	--	≥1.0	--	--

Note: -- Indicates unit not encountered

Table 2: Summary of Borehole Conditions Encountered

Unit	Depth to Base of Unit (m)							
	Over Water Holes for Break Wall Extension		Over Water Holes for Northern End of Floating Dock			Land Based Holes at Southern End of Boat Ramp (Floating Dock)		
	BH1	BH2	BH3	BH5	BH8	BH4	BH6	BH7
Surface Level (mRL,AHD)	-5.0	-6.0	-2.0	-2.0	-3.0	0.8	4.1	1.4
Fill: Concrete Reinforced Slab	--	--	--	--	--	0.2	--	--
Rockfill: Comprising Gravel, Cobbles and Boulders of Very High Strength Argillite	--	--	1.5	--	--	2.45	5.0	2.0
Marine Sediments: Sand, fine to Medium Grained, Loose to Medium Dense	2.5	2.5	--	2.2	0.4	--	--	--
Marine Sediments: Sand, fine to Medium Grained, Very Dense	--	--	3.2	--	--	4.8	7.0	5.0
Residual Soil: Clay, high plasticity, Pale Grey and Pale Green	6.5	4.0	6.5	2.6	--	--	--	--
Extremely Weathered Argillite: Pale Grey and Pale Green, Estimated Very Low Strength	7.0	5.0	7.6	4.35	--	≥5.3	≥7.3	5.77
Highly to Moderately Weathered Argillite: Brown and Grey, Estimated Low to Medium Strength	≥7.5	≥5.7	7.9	5.2	--	--	--	--
Slightly Weathered to Fresh Argillite: Dark Grey, Estimated High to Very High Strength	--	--	≥10.12	≥6.36	≥1.86	--	--	≥6.3

Note: -- Indicates unit not encountered

Interpretive geotechnical sections across key areas of the boat ramp upgrade works have been developed for the boreholes drilled. These sections are presented in Figures 6 to 9.

Samples collected during the fieldwork were sent to NATA registered contract laboratories where the following testing was undertaken:

Pavement Assessment Works

- 2 California Bearing Ratio (CBR)
- 4 Atterberg limits
- 4 Particle Size Distribution (PSD)

Boat Ramp Widening Works

- Point load strength index testing on recovered rock core

The results of the pavement testing are presented in Appendix B and summarised in Tables 3 and 4.

Table 3: Laboratory CBR Test Results for Subgrade Materials

Location	Test Pit	Depth (m)	Material	Field Moisture Content %	Standard Optimum Moisture Content %	Maximum Dry Density (t/m³)	Swell %	CBR % (4.5kg surcharge, 4 days soak)
Jordan Esplanade Realignment	TP3	0.0 to 0.6	Subgrade	14.5	16.5	1.76	1.0	7.0
	TPB	0.0 to 0.6	Subgrade	20.3	20.0	1.69	0.5	4.5

The results of the CBR testing indicate the residual clays along the road to be realigned have soaked CBR values ranging between 4.5% and 7.0%. The clay soils encountered at subgrade level in the area of the unsealed Gallows Beach car park .

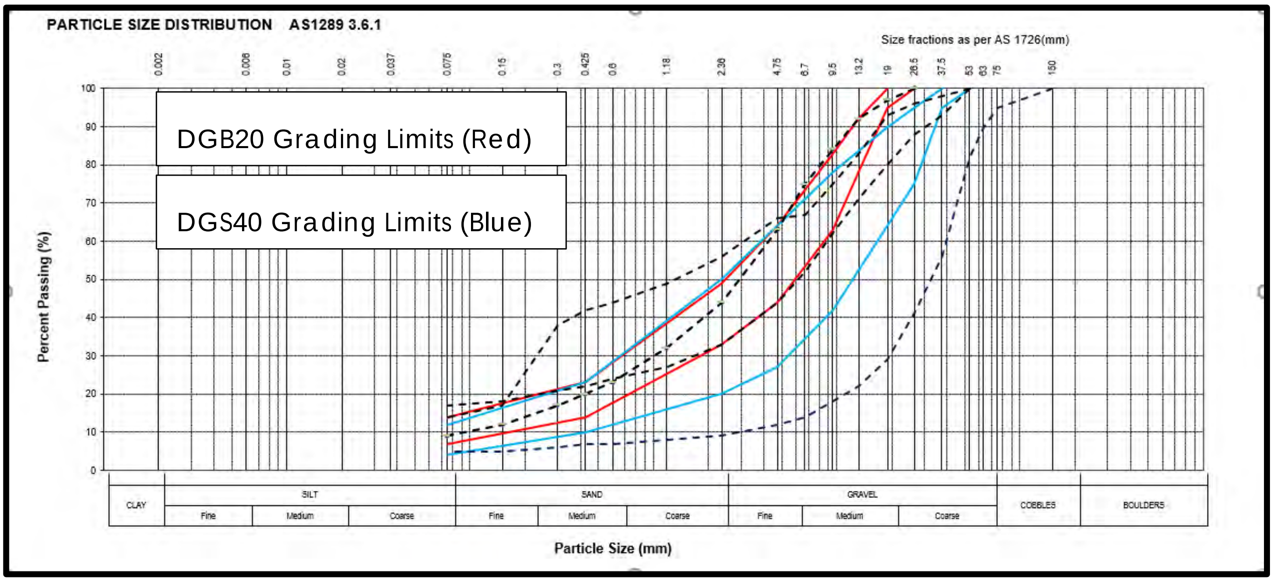
Table 4: Atterberg Limits Test Results - Existing Pavement Materials

Location	Test Pit	Depth (m)	Material	Atterberg Limits		
				LL	PL	PI
Jordan Esplanade	TP1	0.15 to 0.4	Existing Pavement Material	25	18	7
Unsealed Car Park at Gallows Beach	TP6	0.0 to 0.25	Existing Pavement Material	NO	NO	NP
Boat Ramp Car Park	TP4	0.02 to 0.75	Bridging Rock - Existing Pavement Material	28	19	9
	TP5	0.02 to 0.75	Bridging Rock - Existing Pavement Material	28	18	10

Note: NO indicated test not obtainable, NP indicates material non plastic.

The results of the Atterberg Limits testing indicate the pavement materials are of low plasticity and would meet the criteria for DGS40 materials.

Graph 1: Comparison of Existing Pavement Materials to DGB20 and DGS40



Excluding the pavement materials encountered in TP1 on Jordan Esplanade, the grading of the pavement materials within the car park areas are outside the limits typically used pavement construction materials such as DGB20 and DGS40.

In terms of reuse of materials, the existing pavement materials and rockfill bridging beneath the car parks would be suitable for reuse as a select subgrade material. A photo of the bridging rock encountered beneath the boat ramp car park is presented in Photo 7 below.

Photo 7: Image of Bridging Rock Beneath the Boat Ramp Car Park

5 PAVEMENTS

5.1 Pavement Design Traffic

Based on our discussions with council the roads and car parks for the upgrades are to be designed for a design traffic of 1 x 10^6 ESAs.

The recommended pavement reconstruction details are presented in the tables below and are also provided in the appendices.

5.2 Pavement Conditions and Preliminary Recommendations

Presented in Table 5 is a summary of the pavement conditions and recommendations to rehabilitate or construct the pavements. For the pavement designs provided it is assumed that the new pavement levels are not constrained by kerb and gutter levels and that pavement overlay options will be achievable.

Table 4: Summary of Pavement Conditions and Pavement Recommendations

Area	Test Pit	Depth to Base of Existing Pavement Gravel (m)	Existing Subgrade	Pavement Comments	Subgrade Comments	Site Constraints	Pavement Recommendations
Jordan Esplanade Road	TP1	0.4m (includes Asphalt Concrete Layer)	Fill Comprising Very Stiff to Hard Gravelly Clay	Pavement material quality meets DGB and DGS standards	Subgrade soaked CBR value of 5 to be adopted	Non Assumed	Pavement thickness meets the requirements for proposed design traffic. No pavement reconstruction required.
Jordan Esplanade Realignment	TP3, TPA and TPB	No Pavement Encountered	Fill Comprising Hard Silty Clay and Medium Dense to Dense Sand	None Pavement Encountered	Subgrade soaked CBR value of 4.5 to be adopted	Non Assumed	Full pavement construction required for realignment works
Unsealed Car Park at Gallows Beach	TP6 and TP7	Varies Between 0.25m Depth to No Pavement	Fill Comprising Medium Dense Sand and Very Stiff Clay	Material quality does not meet DGB and DGS standards. Material suitable for reuse as select layer	Subgrade insitu CBR value of 5 to be adopted	None Assumed	Southern end of car park does not have adequate pavement thickness for proposed design traffic. Recommend overlay of the pavement reusing existing pavement as select layer. No pavement materials encountered in northern area of car park, therefore new pavement construction recommended.
Boat Ramp Car Park	TP4 and TP5 and TPC to TPF	>1.0m Comprising Bridging Rock	Bridging Rock	Material quality does not meet DGB and DGS standards. Material suitable for reuse as select layer	Subgrade insitu CBR value of 15 to be adopted	Non Assumed	Inadequate pavement quality material across existing car park. Reconstruct with a pavement overlay.

5.3 Pavement Designs

In consideration of budgetary constraints, the recommended pavement options for most of the road consist of reusing the existing pavement materials as a select layer prior to placing the subbase, base and seal.

Pavement thickness designs have been summarised in Table 5 and are presented in the Appendices.

Table 5: Pavement Design Recommendations

Location	Adopted Subgrade CBR	Imported Material Thickness			Reuse Thickness	Total Pavement Thickness (mm)	Pavement Recommendation
		AC Seal Thickness (mm) to Councils Recommendation	Base Thickness (mm)	Subbase Thickness (mm)	Select Layer Thickness (mm)		
Jordan Esplanade	5	NR	NR	NR	NR	NR	No Reconstruction of Pavement Required
Jordan Esplanade Realignment	4.5	30	120	270	NR	420	New Pavement Construction Required
Unsealed Car Park at Gallows Beach	5	30	150	NR	220 (Assumes reuse of Existing)	400	Overlay Design (Southern End)
		30	120	250	NR	400	New Construction Required (Northern End)
Boat Ramp Car Park	15	30	170	NR	100 (Assumes reuse of Existing)	300	Overlay Design (Assumes Minimum Pavement Thickness of 300mm)

Note: NR indicates not required.

6 PAVEMENT CONSTRUCTION

6.1 Flexible Pavement Reconstruction Recommendations

The following construction methodology is recommended for the pavements:

- Remove the existing pavement materials and stockpile for reuse.
- Box out the new pavement to design level.
- Place the site won pavement materials as a select material as per design in the pavement thickness design sheets.
- Place and compact imported DGS20 and DGB20 as per design in the pavement thickness design sheets.
- Where final sealing cannot be undertaken within a few days of completion of the base course, a primer seal should be used to protect the pavement and maintain equilibrium moisture content.

6.2 Other Construction Considerations

The following recommendations are provided for pavement construction:

- Fill batters and road shoulders should be over-placed and compacted, prior to trimming back to the design batter to ensure that compaction is achieved to the edge of batter;
- Where new construction joins onto existing pavements the existing pavement layers should be benched to avoid a vertical joint extending through the pavements at the interface. Pavement seals must extend at least 0.3m over the existing seal;
- Pavement gravels should be placed and maintained at 60% to 90% of Optimum Moisture Content. Should wet weather occur prior to final sealing, the base course should be allowed to dry back to not more than 90% of Optimum Moisture Content prior to sealing. Trapping of excess moisture below the final seal will significantly reduce pavement life;
- Traffic should be prevented from travelling on partially completed pavement sections.
- Sealing should be avoided during winter months or at times when pavement temperatures of less than 15 degrees are likely, due to the potential for microcracking of the pavement surface, which can lead to water ingress, pumping of fines, and flushing or embedment of aggregate within wheel paths within a very short time frame.
- If sealing during winter or cold weather is required, consideration should be given to placing a 7mm primer seal that can remain in place for several weeks, with placement of the two-coat seal then able to be undertaken at a time when the pavement can be dried to remove excess moisture from the upper part of the base course and the microcracking in the primer can be sealed over.

Pavement construction, including sealing, should extend at least 1ml beyond the outer wheel path of the pavement to provide lateral restraint to the outer wheel path and to assist in preventing ingress of moisture through the road shoulder.

7 PAVEMENT DRAINAGE

The provision of adequate surface and subsurface drainage is critical to long term pavement performance and should be considered in the design and construction of all pavements. Water ingress on the edge of the pavement is a major contributor to the failures currently visible in the road. As a minimum, suitable cross-falls should be maintained both during and following construction. Table drains should be constructed along both sides of the pavements where appropriate. Invert levels of table drains should be constructed below the level of the pavement profile. All drains should be constructed in a manner to promote rapid drainage and discharge away from the pavement.

Swale drains (or similar) are likely to be feasible along the northern side of the road, where it is not possible to construct swale drains or they are not the preferred option, alternatives such as subsoil drains can be used. Subsoil drains should be constructed along the upslope side of the road where it traverses the slope and on both sides where the road is constructed at grade or oriented up / down slope. The invert level of the drains should be similar to the thickness of the pavement profile. Subsoil drains should discharge to an appropriate storm water drain down slope of the pavement formation.

Where kerb and guttering is not provided for the road, it is recommended that the pavement and pavement seal extend at least 1m onto the shoulder beyond the outer edge of the traffic lane to provide lateral confinement and limit inflows at the pavement edge.

8 CONSTRUCTION OF AMENITIES BLOCK

8.1 Site Classification

Details of the amenities block are unknown, however the buildings are commercial structures and therefore AS2870-2011 "*Residential Slabs and Footings*" does not strictly apply. Where the structures are similar in construction and loading to a typical domestic building, the guidance provided in AS2870-2011 could be used in assessing footing and slab requirements, provided the performance expectations presented in AS2870-2011 are acceptable.

Based on the presence of fill at the site, and in the absence of any earthworks documentation, a class P site classification is assessed. Two options are available to found the structure including:

- Removal and replacement of the fill (reduced risk of long term differential settlement issues), or
- Partial removal and replacement of the fill (increased risk of long term differential settlements).

Based on the site conditions it is impractical to remove all of the fill and therefore it is expected that for construction of an amenities block that a partial removal and replacement of the fill will be adopted. Partial removal and replacement of the fill will be beneficial as it will allow some compaction control beneath the building together with providing a material which will be easier to excavate for footings and services trenches. The works should involve:

- Over excavation of the rockfill and sandy materials to a depth of at least 600mm below the underside of floor slabs;
- Inspection and proof roll of the exposed subgrade by a suitable qualified engineer;
- Placement of an A34 Geofabric layer or equivalent;

- Placement and compaction of non reactive granular earthfill (subbase material or similar) in tested layers no greater than 200mm compacted thickness to achieve a minimum of 98% standard compaction.

Where the above earthworks recommendations are adopted a characteristic surface movement of y_s = 20 to 40mm is calculated with the site classified as Class M.

Site maintenance must comply with the recommendations and advice provided in CSIRO Sheet BTF18 "*Foundation Maintenance and Footing Performance: A Homeowners Guide*" a copy of which can be obtained from www.publish.csiro.au/pid/7076.htm.

8.2 Foundation Options & Design Parameters

Foundations for the amenities blocks could involve slab on ground construction using waffle pods or slab thickenings. The use of different footing systems and the founding of structures within different materials should be avoided to reduce the potential damage results from differential movements.

Footings founded within the engineered fill may be designed based on an Allowable Bearing Pressure (ABP) of 150kPa may be adopted. For the assessment of settlements a Youngs Modulus value of 30MPa should be adopted.

9 FOUNDATION RECOMMENDATIONS FOR FLOATING DOCKS

It is assumed that the new floating docks will be supported by either driven piles or bored piles that extend into the marine sand and possibly into weathered Argillite bedrock. The geotechnical sections provided in the appendices indicate:

- Southern End of Floating Docks) - The subsurface conditions in this area generally comprises rockfill up to 2m to 5m depth overlying marine sand and weathered argillite.
- Northern End of Floating Docks - the subsurface conditions in this area generally comprise sand extending to depths of between 2m to 3m below ground surface. In the area of BH8 only 0.4m of sand was encountered overlying very high strength argillite.

For the design of piles to withstand the lateral loads, a combination of both bored and driven piles may be required. Where bored piles are proposed to be used it is recommended that an allowance be made for the use of steel liners to manage "fall in" and seepage inflows.

Design parameters for bored and driven piles are presented in Table 6.

Table 6: Pile Design Parameters

Material Name		Ultimate End Bearing Pressure, fb	Ultimate Skin Friction (Compression), fs	Effective Vertical **Young's Modulus, E'v**	Effective Horizontal **Young's Modulus, E'h**	Limiting Lateral Yield Pressure, py
Rockfill	Driven	4.5 MPa	0.05 MPa	60 MPa	40MPa	0.3MPa* 1.0MPa+
	Bored	3.0 MPa	0.02 MPa	30 MPa	20 MPa	
Marine Sand (Loose to Medium Dense)	Driven	2.0 MPa	0.035 MPa	20 MPa	15 MPa	0.15 MPa* 0.4 MPa+
	Bored	1.0 MPa	0.02 MPa	10 MPa	7.5 MPa	
Marine Sand (Very Dense)	Driven	5.0 MPa	0.05 MPa	60 MPa	45 MPa	0.3MPa* 1.0MPa+
	Bored	2.7 MPa	0.02 MPa	30 MPa	20 MPa	
Residual Soil		1.8 MPa	0.05MPa	30 MPa	20 MPa	0.1 MPa
Extremely Weathered Argillite (Very Low Strength)		3.0 MPa	0.15 MPa	70 MPa	50 MPa	1.0MPa
Moderately to Highly Weathered Argillite (Low to Medium Strength)		6.0 MPa	0.35 MPa	250 MPa	200 MPa	2.0MPa*
Slightly Weathered to Fresh Argillite (High to Very High Strength)		10.0 MPa	0.5 MPa	500 MPa	500 MPa	4.0MPa+

Note: 2.5MPa Indicates parameters for piles socketed less than 1.0m into the unit. 4.0MPa+ indicates parameters for piles socketed greater than 1.0m into the unit.*

Where footings are founded within different materials consideration should also be given by the designer to the potential for differential movements.

In accordance with AS2159-2009, when assessing the geotechnical reduction factor (Φ_g) an assignment of an Average Risk Rating (ARR) is required which takes into account the redundancy of the pile system and the quantity and type of pile testing. This process necessarily requires the consideration of a number of factors which are beyond the direct control of a geotechnical consultant during the site investigation stage. In order for a recommendation to be provided the assumptions listed below have been made. In the event that these assumptions change, the geotechnical reduction factor would need to be modified in accordance with the requirements of AS2159-2009 Clause 4.3. Further details are presented in the calculation summary in Appendix C.

- Design of piles and pile groups will be undertaken in accordance with the recommendations presented in this report;

- Neither static, rapid or dynamic load testing is undertaken on any of the piles;
- Limited degree of professional geotechnical involvement in the supervision of the installation of the piles; and
- No performance monitoring of the supported structure during or after construction.

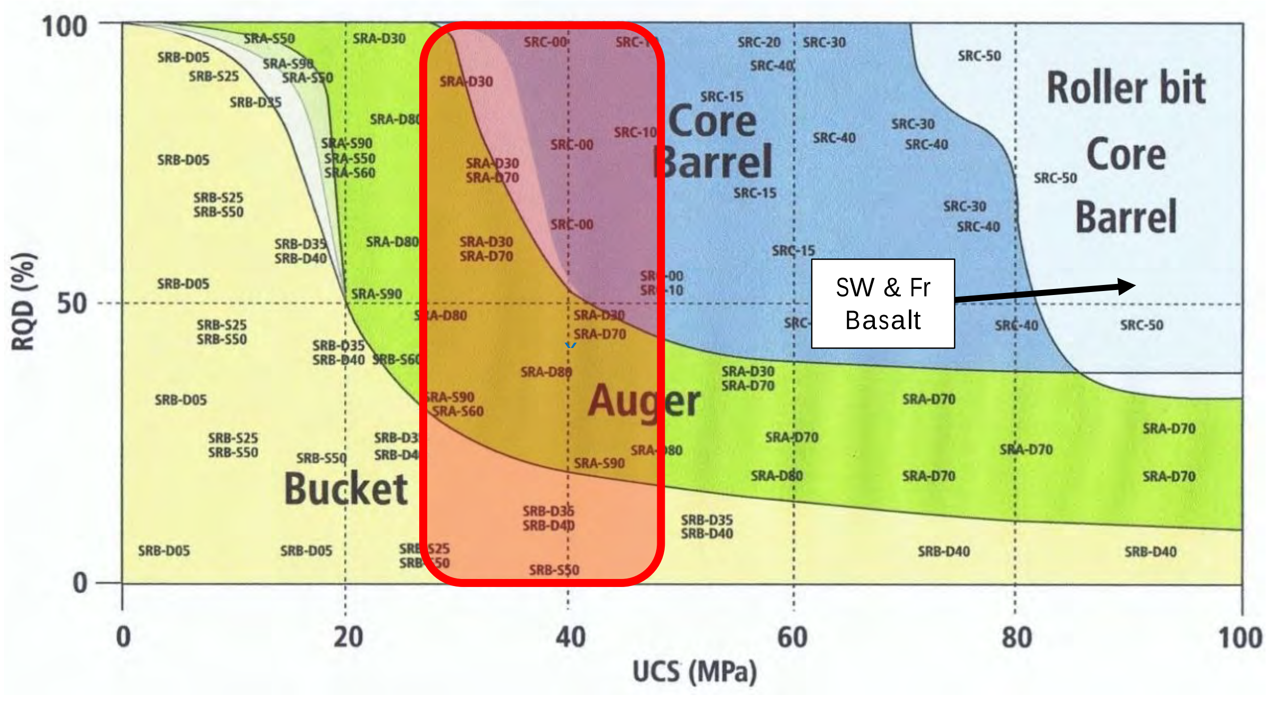
Based on the above and in accordance with AS2159-2009 a risk rating of 2.72 is estimated. Therefore, assuming the pile configuration will have low redundancy a Geotechnical Strength Reduction Factor of Φ_g=0.52 would be appropriate for the site.

At least the initial stages of pile installation should be observed by a suitably experienced geotechnical engineer to assess that the recommended founding material has been reached and to check initial assumptions about foundation conditions and possible variations between borehole locations.

9.1 Excavation Conditions for Bored Piles

The excavation of open bored piles is likely to be achievable, however, it is recommended that a provisional allowance be included for temporary or permanent liners.

Soilmec provides a guideline for bored pile tool selection based on typical RQD and UCS, as shown below. The indicative UCS and RQD values indicate that excavation of the slightly weathered to fresh argillite will require an auger and coring barrel.

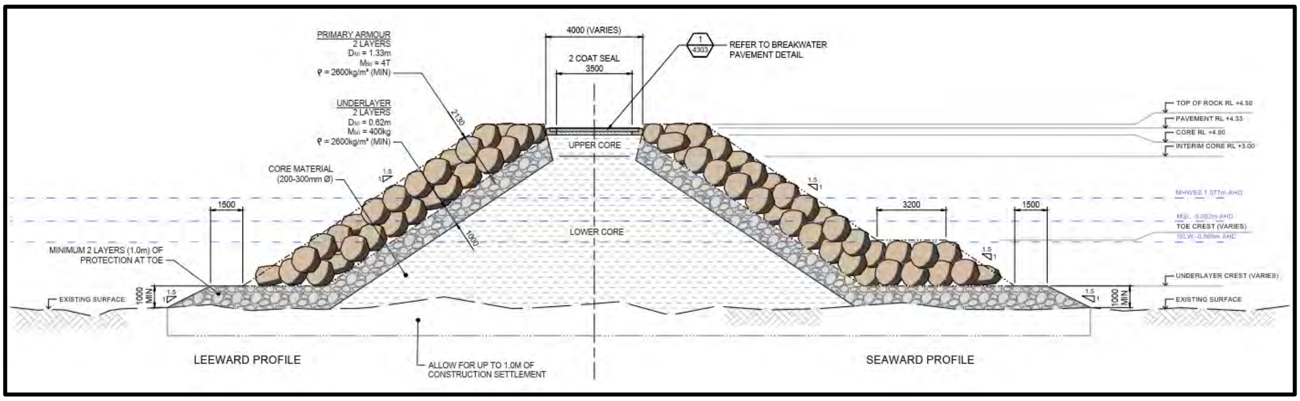


Guide to bored pile tool selection (Reproduced from Soilmec document 'Rock Drilling Tools' www.soilmec.com)

10 BREAK WALL EXTENSION WORKS

Concept plans have been provided for the break wall extension works, (Drawing No Ref PA2509-RHD-GE-0001). A cross section of the new break wall was extracted from the drawings and is presented below. Based on the drawing the following geometry for the break wall has been adopted:

- Minimum Crest Width (Upper Core): 4.0m
- Minimum Crest Width: 9.0m
- Primary Armour Batter Angle: 1.5H to 1V
- Break Wall Crest Level: 4.3mAHD



10.1 Foundation Recommendations

The break wall extension works will be founded on the loose to medium dense marine sand. For the rockfill embankment founded on the marine sand an Allowable Bearing Pressure (ABP) of 250kPa may be adopted. For the assessment of settlements a Youngs Modulus value of 30MPa should be adopted.

10.2 Stability Analysis

Design parameters adopted in the assessment of stability are shown in Table 7. The parameters have been selected based on the results of laboratory testing and experience with similar materials.

Table 7: Summary of Soil Strength Parameters for Break Wall Analysis

Geotechnical Unit	Bulk Density (kN/m^3)	Effective Stress Parameters	
		Ø' (Degrees)	**c' (kPa)**
Embankment Rockfill	20	43	0
Marine Sand: Fine to Medium Grained, Medium Dense	18	32	0
Residual Clay: High Plasticity, Very Stiff to Hard	19	26	5
Extremely to Moderately Weathered Argillite	22	30	10

10.3 ADOPTED MINIMUM FACTOR OF SAFETY FOR REMEDIAL DESIGNS

For the stability analysis the adopted minimum FoS are:

- Minimum FoS of 1.5 for long term
- Minimum FoS of 1.3 for short term

The design has considered the following loads:

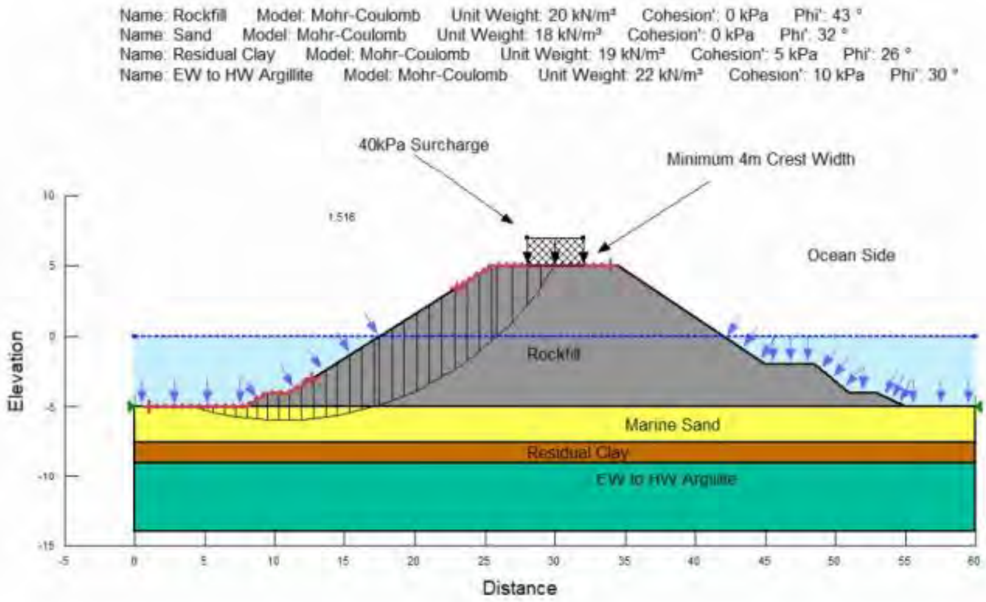
a) Short Term - This load combination considers the permanent effect from soil loading and 40kPa live traffic load. This load case is considered for the short term conditions.
b) Long Term - This load combination considers the permanent effect from soil loading. This load case is considered for the long term conditions.

10.4 Design Assumptions and Considerations

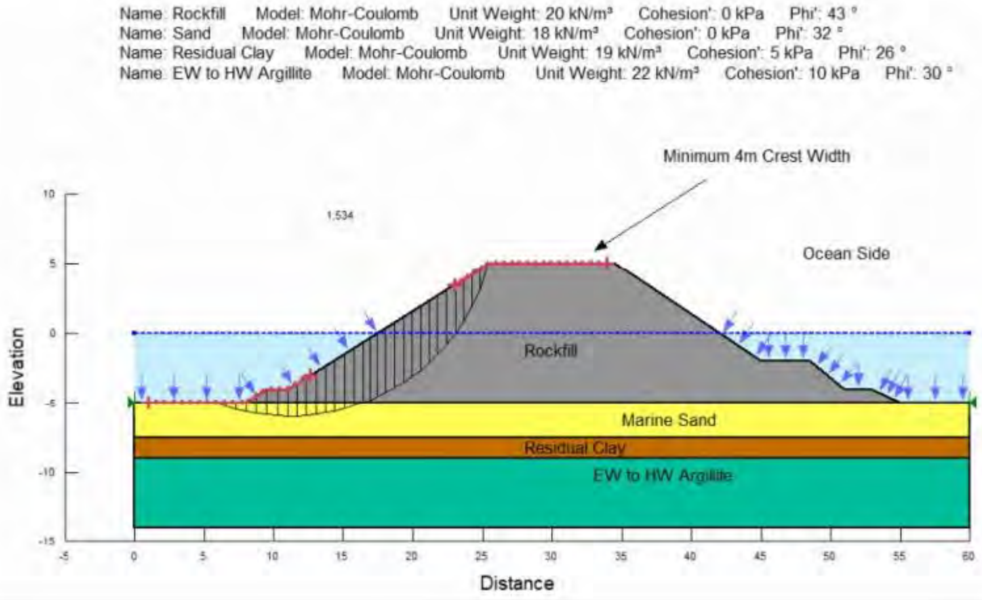
The stability check for the break wall extensions has been undertaken using the commercially available software Slope/W. Furthermore, the global stability of the slope has been evaluated taking into consideration a circular failure mode which is considered to represent a realistic slip failure. The results are presented in Table 4. The outputs are presented below. The modelling indicates that the proposed designs meet the minimum factors of safety required.

Table 8: Summary of Stability Analysis for Permanent Works

Stability Case	Required FoS	Achieved FoS
Short Term – Break Wall With Traffic Loading	1.3	1.52
Long Term – Break Wall With Traffic Loading	1.5	1.53



Model 1: Results of Short Term Stability Analysis



Model 2: Results of Long Term Stability Analysis

11 DREDGING WORKS

The dredging works are to involve removal of the sand to RL-2.5mAHD. Based on the boreholes drilled within the boat ramp basin and the footprint of the break wall extension the marine sand extends below the levels designed for dredging. Therefore, it is anticipated that the dredging depths should be achievable during construction.

Samples of the bottom sediments that will require dredging as part of the works and for future channel deepening works were collected during the overwater drilling operations. The samples were collected using a combination of methods including long reach excavator bucket (Samples S1 to S5) sampling from within the boat ramp and from the SPT sampler at the borehole locations (Samples BH1 to BH7). The purpose of the sampling and subsequent laboratory analysis was to provide a preliminary assessment of the presence and extend of acid sulfate soils and soil contamination. The preliminary assessment would then inform the need for further sampling and analysis and management requirements as part of the boat ramp upgrade works.

11.1 Acid Sulfate Soils

Acid Sulfate Soils (ASS) produce sulphuric acid when exposed to oxygen due to the presence of iron sulphides in the form of pyrite within the soil matrix. These soils form when iron-rich sediments are deposited in saltwater or brackish water environments. Prior to oxidation, these pyritic soils are referred to as Potential ASS. ASS that have produced acid as a result of oxidation are referred to as Actual ASS. They typically occur in natural, low-lying coastal depositional environments below approximately 5m AHD. In the field ASS are generally identified as saline sediments such as alluvial or estuarine soils or bottom sediments in creeks and estuaries.

Eighteen samples were located submitted for acid sulfate soil analysis. Nine samples were screened for the presence of actual or potential ASS using methods 23Af and 22Bf of the ASSMAC Acid Sulfate Soils Manual. The results of the screening tests are summarised below:

- The samples revealed pH_F values of 6.42 to 9.36 in distilled water. In this test, pH <4 is an indicator of Actual ASS;
- The samples revealed pH_{FOX} values of 5.49 to 7.85 in hydrogen peroxide. Values of less than 3 are an indicator of Potential ASS; and
- The samples showed a pH change between the two tests of between 0.56 and 2.59, with 6 of the nine samples showing a pH drop of greater than 1. A significant drop in pH between the two tests can be an indicator of Potential ASS.

To further assess for the presence of potential ASS, eleven samples were submitted for Chromium Reducible Sulphur analysis. The test results are summarised below.

Table 9: Summary of ASS CRS Test Results

Sample Location	Sample Depth (m)	Texture	Titratable Actual Acidity, TAA (mol H^+/t)	Chromium Reducible Sulfur, S_{cr} (%)	Acid Neutralising Capacity (mol H^+/t)	Net Acidity (mol H^+/t)
S1	0 - 0.5*	Coarse	<2	164	3080	164
S2	0 - 0.5*	Coarse	<2	<10	1450	<10
S3	0 - 0.5*	Coarse	<2	<10	3430	<10
10S4	0 - 0.5*	Coarse	<2	10	4590	10
S5	0 - 0.5*	Coarse	<2	<10	2890	<10
BH1	0 – 0.45	Coarse	<2	23	6510	23
BH1	1.0 – 1.45	Coarse	<2	27	8770	27
BH2	0.0 – 0.45	Coarse	<2	14	4210	14
BH2	1 – 1.45	Coarse	<2	60	7350	60
BH6	5.1 – 5.5	Coarse	0	4	1370	4
BH7	3.3 – 3.75	Coarse	0	0	1318	0

Note: Adopted action criteria of 18 mol H+/t and 0.03% Scr is applicable for coarse grained soils. Values in bold exceed the adopted action criteria.

* Sampled with long reach excavator bucket

The laboratory test results indicate the following:

- No existing actual titratable acidity and therefore the sediment samples are not Actual ASS.
- Four of the sediment samples contain chromium reducible sulfur contents in excess of 18 mol H+/t (>0.03%), indicating the presence of Potential ASS.
- All samples contain a natural buffering capacity which neutralises the potential sulphuric acidity and results in net acidity values well below the adopted action criteria.

Conclusions Regarding Acid Sulfate Soils

The sediments at the site are therefore considered to be Potential ASS, however, the sediments contain sufficient calcium carbonate to neutralise the potential sulfidic acidity. It is also noted that pyrite is generally concentrated within the sediment fines. The fines are likely to be disturbed during the excavation works and end up in suspension and be transported back to the water body thus preventing any opportunity to oxidise. While the testing has shown that there is sufficient neutralising capacity within the sediments Chip Tray Incubation testing should be undertaken to ensure the effectiveness of the sediments self-neutralising capacity. It is noted that this testing must be undertaken on large sample sizes and takes several months to complete.

In strict accordance with the ASSMAC Acid Sulfate Soils Manual (1998) an Acid Sulfate Soil Management Plan is required for the proposed works as the oxidisable sulfur content exceeded the relevant Action Criteria for coarse grained soils.

11.2 SEDIMENT CONTAMINATION ASSESSMENT

Soil sampling and analysis was undertaken on select samples to provide a preliminary assessment of the potential presence of contamination within the materials that area likely to be dredged. The purpose of the testing was not to provide a site contamination assessment but to provide some indication of potential contamination that may impact the proposed works.

It is noted that Council have been dredging the sediments for some years to maintain safe passage within the boat ramp area and to our knowledge no contamination has been identified (Though no testing may have been undertaken).

The assessment was undertaken following a review of the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009) and the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM 2013) and involved the following process:

- Sampling and analysis of sediment samples collected from within the boat ramp and outer harbour areas as shown on the Appended Figures. A total of nine samples were analysed.
- Analyses of samples for the suite of contaminants detailed Table 10.
- Evaluate the test results against the screening levels outlined in Table 10.
- Conclusions and recommendations regarding contamination.

Table 10: Analytes and Adopted Screening Levels

Analyte	Adopted Screening Levels
Copper	65 mg/kg
Lead	50 mg/kg
Zinc	200 mg/kg
Cadmium	1.5 mg/kg
Chromium (VI)	80 mg/kg
Arsenic	20 mg/kg
Nickel	21 mg/kg
Mercury	0.15 mg/kg
Total PCB	23 mg/kg
Organochlorine Pesticides (OC)	0.32 mg/kg
PAH	10,000 mg/kg
TPH	550 mg/kg
Organotin Compounds	9 µg Sn/kg

A summary of the results is presented below:

- Heavy metal concentrations were either below their Practical Quantitation Limit (PQL), or below the NAGD screening level.
- Total PCBs were below their PQL and therefore below the NAGD screening level.

- Pesticides were below their PQL and therefore below the NAGD screening level.
- PAH compounds were below their PQL and therefore below the NAGD screening level.
- TPH compounds were below their PQL and therefore below the NAGD screening level.
- One sample (BH1 1 – 1.45) significantly exceeds the NAGD screening level for Tributyltin of 9 µg Sn/kg with a level of 1220 µg Sn/kg. All other samples are below their PQL. And therefore, below the NAGD screening level.

Conclusions Regarding Contamination

The laboratory analysis indicates that level of contamination is typically below Practical Quantitation Limit (PQL), or below the NAGD screening levels apart from one sample that has elevated levels of Tributyltin (TBT). The contaminated sample was collected from BH1 at a depth of 1.0 to 1.45m. The proposed works are unlikely to disturb material in this area and therefore the TBT contaminated material is unlikely to be impacted.

TBT is a compound found in antifouling paint used on boat hulls. TBT enters the marine environment via several process including the leaching from boat hulls and hull cleaning and maintenance. TBT can degrade rapidly in an aerobic environment but can last decades within anerobic environments.

Marine sediments within the greater harbour area are highly mobile and the contamination could have originated from the harbour precinct to the north. The former Coffs Harbour Slipway is known to have been contaminated with extensive remediation works completed some years ago. Details of these works are unknown, but this may be the source of the TBT contamination.

Further assessment of sediments to be dredged should be undertaken to assess the extent of the contamination and treatment / disposal requirements.

12 LIMITATIONS

This report comprises the results of an investigation carried out for a specific purpose and client as defined in the document. The report should not be used by other parties or for purposes or projects other than those assumed and stated within the report, as it may not contain adequate or appropriate information for applications other than those assumed or advised at the time of its preparation. The contents of the report are for the sole use of the client and no responsibility or liability will be accepted to any third party. The report should not be reproduced either in part or in full, without the express permission of Regional Geotechnical Solutions Pty Ltd.

Geotechnical site investigation is based on data collection, judgment, experience, and opinion. By its nature, it is less exact than other engineering disciplines. The findings presented in this report and used as the basis for the recommendations presented herein were obtained using normal, industry accepted geotechnical design practises and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points.

The recommended depth and properties of any soil, rock, groundwater, or other material referred to in this report is an engineering estimate based on the information available at the time of its writing. The estimate is influenced and limited by the fieldwork method and testing carried out in the site investigation, and other relevant information as has been made available. In cases where information has been provided to Regional Geotechnical Solutions for the purposes of preparing this report it has been assumed that the information is accurate and appropriate for such use. No responsibility is accepted by Regional Geotechnical Solutions for inaccuracies within any data supplied by others.

If site conditions encountered during construction vary significantly from those discussed in this report, Regional Geotechnical Solutions Pty Ltd should be contacted for further advice.

This report alone should not be used by contractors as the basis for preparation of tender documents or project estimates. Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

If you have any questions regarding this report or require any additional consultations, please contact the undersigned.

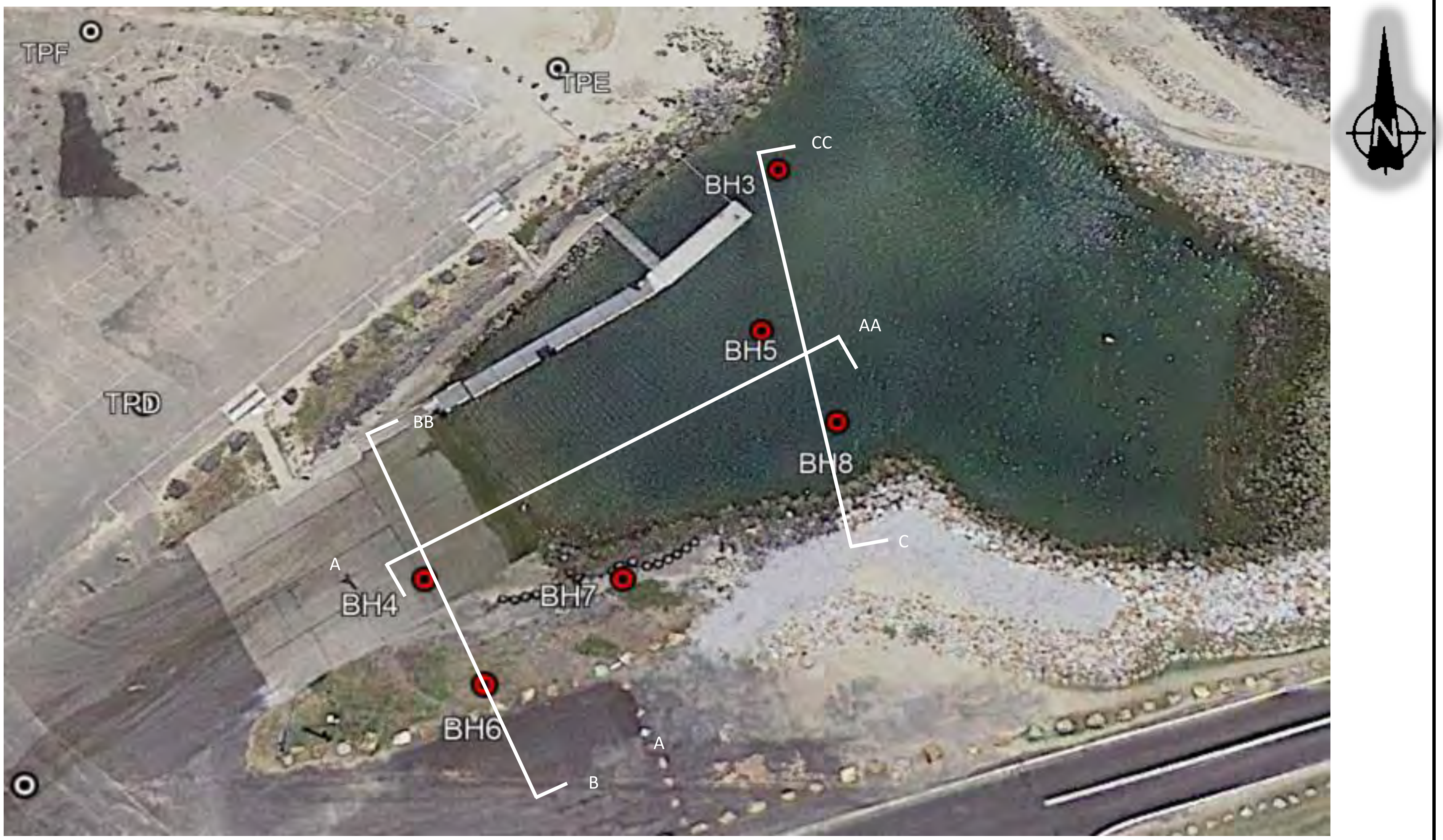
For and on behalf of Regional Geotechnical Solutions Pty Ltd

Prepared by	Reviewed by
Matt Rowbotham	Adam Holzhauser
Associate Engineering Geologist	Associate Geotechnical Engineer

Figures

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	21.8.20
Title:	Site Plan Showing Proposed Works	Drawing No.	Figure 1



REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	21.8.20
Title:	Borehole Investigation Plan - Jetty Boat Ramp	Drawing No.	Figure 2

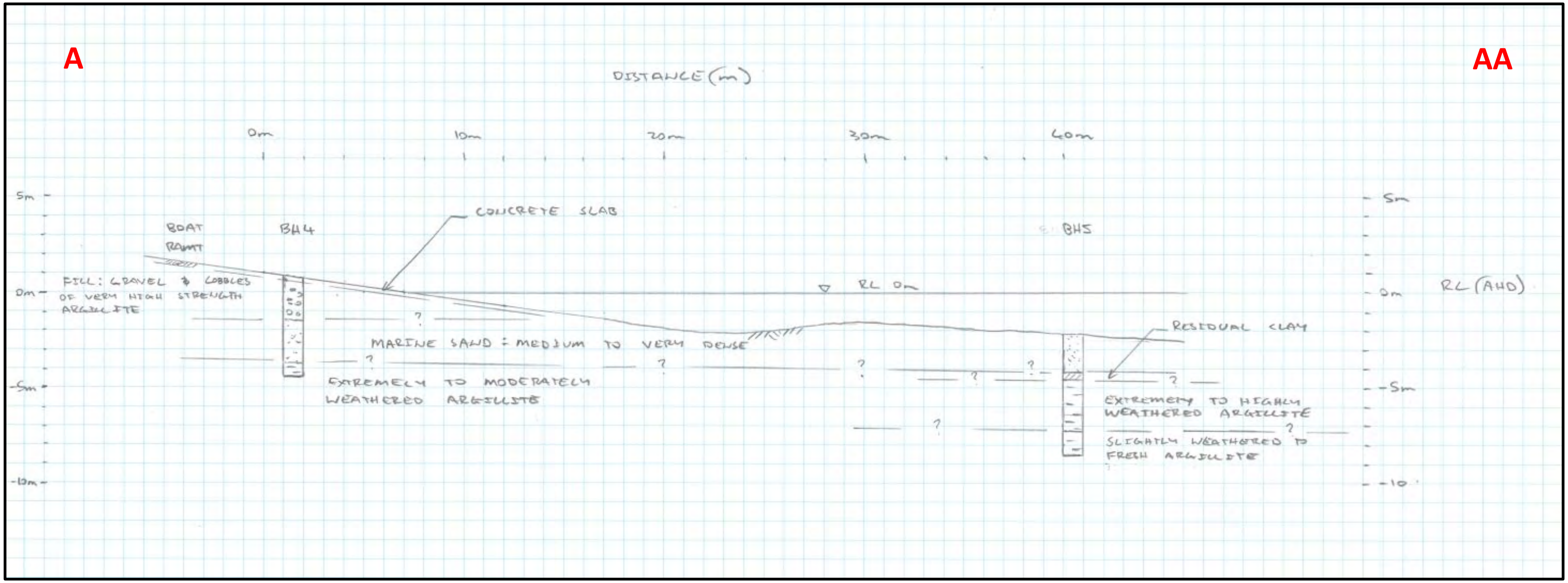
REGIONAL GEOTECHNICAL SOLUTIONS	Client:	Transport for NSW	Job No.	RGS32282.1
	Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
			Date:	21.8.20
	Title:	Borehole Investigation Plan - Boat Ramp Breakwall	Drawing No.	Figure 3

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	21.8.20
Title:	Test Pit Plan	Drawing No.	Figure 4

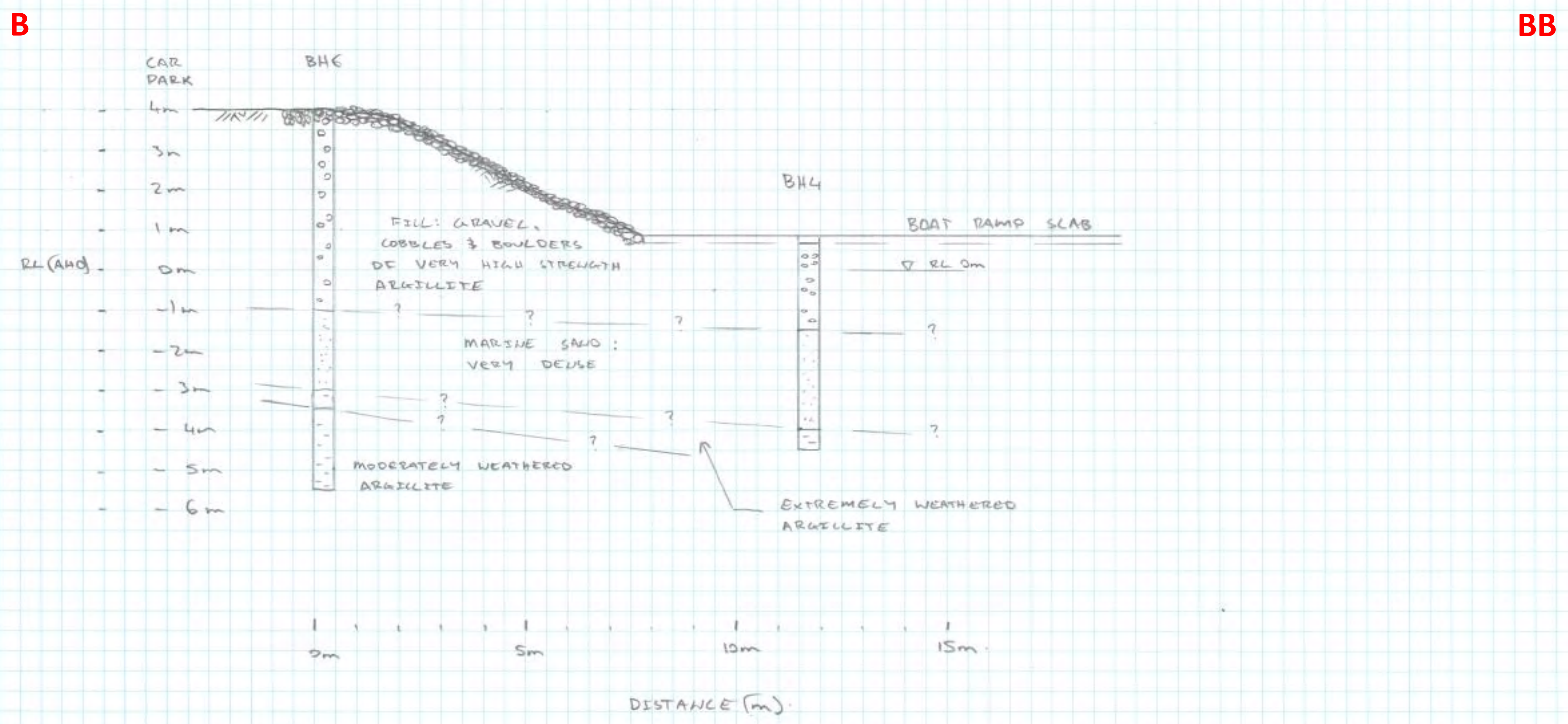
REGIONAL
GEOTECHNICAL
SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	21.8.20
Title:	Sediment Sampling Plan	Drawing No.	Figure 5



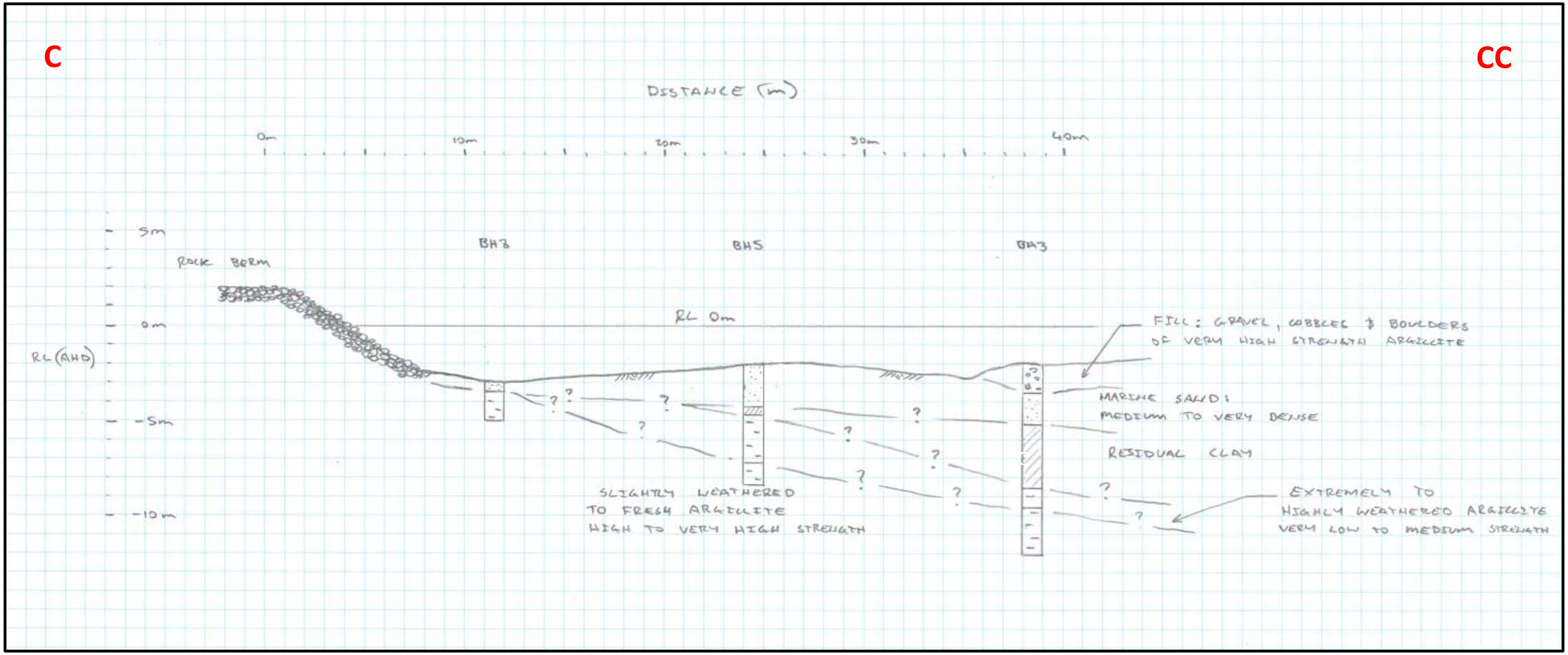
REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	21.8.20
Title:	Interpretive Geotechnical Section A-AA	Drawing No.	Figure 6



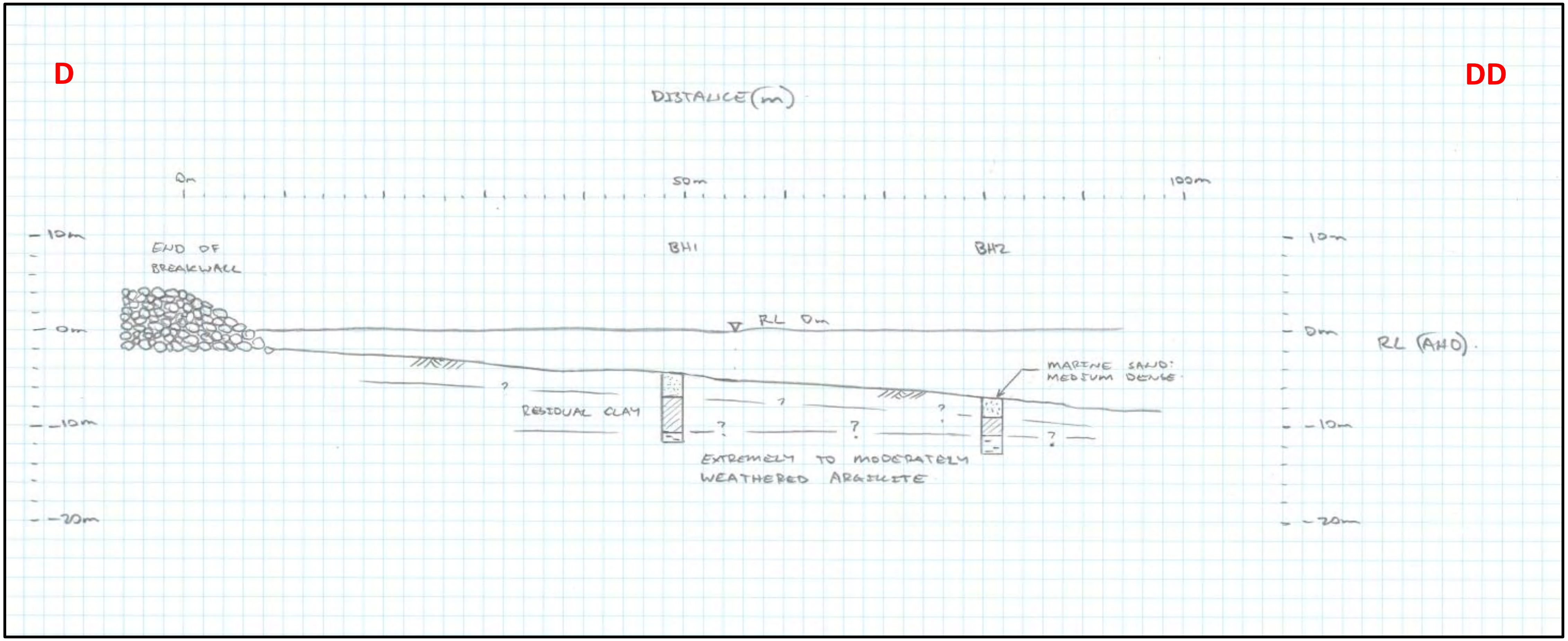
REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	21.8.20
Title:	Interpretive Geotechnical Section B-BB	Drawing No.	Figure 7



REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	21.8.20
Title:	Interpretive Geotechnical Section C-CC	Drawing No.	Figure 8



REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	21.8.20
Title:	Interpretive Geotechnical Section D-DD	Drawing No.	Figure 9

Appendix A

Results of Field Investigations

ENGINEERING LOG - TEST PIT

CLIENT:	Transport for NSW	**TEST PIT NO:**	**TP1**
PROJECT NAME:	Proposed Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 1
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	MR
		DATE:	1/9/20

EQUIPMENT TYPE:	8T Excavator	**EASTING:**	513604 m	**SURFACE RL:**	
TEST PIT LENGTH:	**WIDTH:**	**NORTHING:**	6646772 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered				▬		**ASPHALT CONCRETE:** Black	D				FILL
					▨		0.15m **FILL:** EXISTING PAVEMENT MATERIAL, Sandy GRAVEL, dark grey, fine to medium grained, some silt	D	D			
					▨	CL	0.40m **FILL:** Gravelly CLAY, medium to high plasticity, grey and dark grey	M < W_P	VSt	HP	200	
				0.5	▨	SP	0.50m **FILL:** SAND, fine to medium grained, pale yellow	M	MD			
				1.0 1.5			0.70m Hole Terminated at 0.70 m On stormwater pipe					

LEGEND:

Water

- ▼ Water Level (Date and time shown)
- ▶— Water Inflow
- —◀ Water Outflow

Strata Changes

- — — — Gradational or transitional strata
- ——— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - TEST PIT

CLIENT:	Transport for NSW	**TEST PIT NO:**	**TP2**
PROJECT NAME:	Proposed Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 1
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	MR
		DATE:	1/9/20

EQUIPMENT TYPE:	8T Excavator			**EASTING:**	513628 m	**SURFACE RL:**	
TEST PIT LENGTH:		**WIDTH:**		**NORTHING:**	6646786 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered	B 0.75m		0.5 1.0	▨	SM	**FILL:** Silty SAND, fine to medium grained, brown, some high strength metasiltstone gravel up to 40mm throughout 1.00m	M	MD - D			FILL
				1.5			Hole Terminated at 1.00 m					

LEGEND:

Water

- Water Level (Date and time shown)
- ▶— Water Inflow
- —◀ Water Outflow

Strata Changes

- — — Gradational or transitional strata
- —— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: **TP3**

CLIENT:	Transport for NSW	**PAGE:**	1 of 1
PROJECT NAME:	Proposed Coffs Harbour Boat Ramp Upgrade	**JOB NO:**	RGS32282.1
SITE LOCATION:	Coffs Harbour	**LOGGED BY:**	MR
TEST LOCATION:	Refer to Figure 1	**DATE:**	1/9/20

EQUIPMENT TYPE:	8T Excavator			**EASTING:**	513643 m	**SURFACE RL:**	
TEST PIT LENGTH:		**WIDTH:**		**NORTHING:**	6646711 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered	B 0.60m			▨	CL	**FILL:** Silty CLAY, medium plasticity, red/brown, some fine to medium grained gravel comprising high strength metasiltstone	M < W_P	H	HP	600	FILL
				0.5 0.60m	▨	GW	**FILL:** Clayey GRAVEL, brown and dark grey, fine to coarse grained, high strength metasiltstone to 100mm in size	M	D			
				1.0 1.00m			Hole Terminated at 1.00 m					
				1.5								

LEGEND:

Water

- Water Level (Date and time shown)
- ▶— Water Inflow
- —◀ Water Outflow

Strata Changes

- — — Gradational or transitional strata
- —— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

RG LIB 1.04.4.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS32282.1 TP LOGS.GPJ <<DrawingFile>> 02/10/2020 14:05 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

CLIENT:	Transport for NSW	**TEST PIT NO:**	**TP4**
PROJECT NAME:	Proposed Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 1
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	MR
		DATE:	1/9/20

EQUIPMENT TYPE:	8T Excavator	**EASTING:**	513660 m	**SURFACE RL:**	
TEST PIT LENGTH:	**WIDTH:**	**NORTHING:**	6646736 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered	B 0.75m		0.5 1.0	▨		0.02m **SPRAY SEAL:** Black **EXISTING PAVEMENT MATERIAL:** Sandy GRAVEL, brown and dark grey, gravel comprises high strength metasiltstone to 70mm in size, some silt and clay fines 1.00m	M	VD			FILL
				1.5			Hole Terminated at 1.00 m					

LEGEND:

Water

▼	Water Level (Date and time shown)
►—	Water Inflow
—◄	Water Outflow

Strata Changes

— — —	Gradational or transitional strata
———	Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

CLIENT:	Transport for NSW	**TEST PIT NO:**	**TP5**
PROJECT NAME:	Proposed Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 1
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	MR
		DATE:	1/9/20

EQUIPMENT TYPE:	8T Excavator	**EASTING:**	513632 m	**SURFACE RL:**	
TEST PIT LENGTH:	**WIDTH:**	**NORTHING:**	6646752 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered						0.03m **SPARY SEAL:** Black					FILL
		B 0.75m		0.5 1.0		GP	**FILL:** GRAVEL & COBBLES, fine to coarse grained, comprising high strength metasiltstone up to 150mm in size, some silt and sand	D	VD			
				1.5			1.00m Hole Terminated at 1.00 m					

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- — — Gradational or transitional strata
- —— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP6
CLIENT: Transport for NSW
PAGE: 1 of 1
PROJECT NAME: Proposed Coffs Harbour Boat Ramp Upgrade
JOB NO: RGS32282.1
SITE LOCATION: Coffs Harbour
LOGGED BY: MR
TEST LOCATION: Refer to Figure 1
DATE: 1/9/20

EQUIPMENT TYPE: 8T Excavator
EASTING: 513616 m
SURFACE RL:
TEST PIT LENGTH:
WIDTH:
NORTHING: 6646622 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered						**EXISTING PAVEMENT MATERIAL:** Sandy GRAVEL, grey, fine to coarse grained, gravel comprising high strength metasiltstone to 70mm in size 0.25m	D	VD			FILL
				0.5		SP	**FILL:** SAND, fine to medium grained, grey and pale yellow/brown 0.60m	M	D			
						CH	**FILL:** CLAY, high plasticity, pale grey and yellow/brown mottle 0.80m	M > W_P		HP	250	
				1.0		ML	**FILL:** Sandy SILT, low plasticity, dark grey, some fine grained gravel 1.00m	M		HP	200	
				1.5			Hole Terminated at 1.00 m					

LEGEND:

Water

▼	Water Level (Date and time shown)
▶—	Water Inflow
—◀	Water Outflow

Strata Changes

— — —	Gradational or transitional strata
———	Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - TEST PIT

CLIENT:	Transport for NSW	**TEST PIT NO:**	**TP7**
PROJECT NAME:	Proposed Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 1
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	MR
		DATE:	1/9/20

EQUIPMENT TYPE:	8T Excavator	**EASTING:**	513648 m	**SURFACE RL:**	
TEST PIT LENGTH:	**WIDTH:**	**NORTHING:**	6646643 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered	B 0.55m		0.5	▨	SW	**FILL:** Silty SAND, fine to coarse grained, brown, some high strength metasiltstone gravel to 40mm in size 0.55m	M	MD - D			FILL
				1.0	▨	CL	**FILL:** Silty CLAY, medium plasticity, red/brown and grey mottle 1.00m	M ~ W_P		HP	100	
				1.5			Hole Terminated at 1.00 m					

LEGEND:

Water

▼ Water Level

(Date and time shown)

▶— Water Inflow

—◀ Water Outflow

Strata Changes

— — Gradational or transitional strata

—— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

CLIENT:	Transport for NSW	**TEST PIT NO:**	**TPA**
PROJECT NAME:	Proposed Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 1
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	MR
		DATE:	1/9/20

EQUIPMENT TYPE:	8T Excavator			**EASTING:**	513631 m	**SURFACE RL:**	
TEST PIT LENGTH:		**WIDTH:**		**NORTHING:**	6646735 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered			0.5 1.0	▨	SM	**FILL:** Silty SAND, fine to medium grained, grey, trace of gravel 20mm in size 1.00m	M	D - MD			FILL
				1.5			Hole Terminated at 1.00 m					

LEGEND:

Water

▼	Water Level (Date and time shown)
▶—	Water Inflow
—◀	Water Outflow

Strata Changes

— — —	Gradational or transitional strata
———	Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TPB
CLIENT: Transport for NSW
PAGE: 1 of 1
PROJECT NAME: Proposed Coffs Harbour Boat Ramp Upgrade
JOB NO: RGS32282.1
SITE LOCATION: Coffs Harbour
LOGGED BY: MR
TEST LOCATION: Refer to Figure 1
DATE: 1/9/20

EQUIPMENT TYPE: 8T Excavator
EASTING: 513622 m
SURFACE RL:
TEST PIT LENGTH:
WIDTH:
NORTHING: 6646685 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered	B 0.60m		0.5	▨	CL	**FILL:** Silty CLAY, medium plasticity	M > W_P		HP	500	FILL
				0.60m	▨	GP	**FILL:** Sandy GRAVEL, brown/dark grey, some silt, Gravel and Cobbles of high strength metasiltstone to 100mm in size	M	D - MD			
				1.0 1.00m			Hole Terminated at 1.00 m					
				1.5								

LEGEND:

Water

- Water Level (Date and time shown)
- ▶ Water Inflow
- ◀ Water Outflow

Strata Changes

- — — Gradational or transitional strata
- —— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

CLIENT: Transport for NSW
PROJECT NAME: Proposed Coffs Harbour Boat Ramp Upgrade
SITE LOCATION: Coffs Harbour
TEST LOCATION: Refer to Figure 1

TEST PIT NO: **TPC**
PAGE: 1 of 1
JOB NO: RGS32282.1
LOGGED BY: MR
DATE: 1/9/20

EQUIPMENT TYPE: 8T Excavator
TEST PIT LENGTH:
WIDTH:
EASTING: 513695 m
NORTHING: 6646698 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered			0.03m			**SPRAY SEAL:** Black					FILL
				0.5 1.0		GP	**FILL:** GRAVEL& COBBLES, fine to coarse grained, comprising high strength metasiltstone up to 100mm in size, some silt and sand	D	VD			Bridging rock
				1.00m 1.5			Hole Terminated at 1.00 m					

LEGEND:

Water

▼	Water Level (Date and time shown)
▶—	Water Inflow
—◀	Water Outflow

Strata Changes

— — —	Gradational or transitional strata
———	Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - TEST PIT

CLIENT:	Transport for NSW	**TEST PIT NO:**	**TPD**
PROJECT NAME:	Proposed Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 1
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	MR
		DATE:	1/9/20

EQUIPMENT TYPE:	8T Excavator			**EASTING:**	513700 m	**SURFACE RL:**	
TEST PIT LENGTH:		**WIDTH:**		**NORTHING:**	6646735 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered						0.03m **SPRAY SEAL:** Black					FILL (Bridging rock)
				0.5 1.0		GP	**FILL:** GRAVEL & COBBLES, fine to coarse grained, comprising high strength metasiltstone up to 200mm, some silt and sand	D	VD			
							1.00m					
				1.5			Hole Terminated at 1.00 m					

LEGEND:

Water

- Water Level (Date and time shown)
- ▶— Water Inflow
- —◀ Water Outflow

Strata Changes

- — — Gradational or transitional strata
- —— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

CLIENT:	Transport for NSW	**TEST PIT NO:**	**TPE**
PROJECT NAME:	Proposed Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 1
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	MR
		DATE:	1/9/20

EQUIPMENT TYPE:	8T Excavator			**EASTING:**	513738 m	**SURFACE RL:**	
TEST PIT LENGTH:		**WIDTH:**		**NORTHING:**	6646775 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered			0.5 1.0	▨	GP	**FILL:** GRAVEL & COBBLES, fine to coarse grained, comprising high strength metasiltstone up to 130mm in size, some silt and sand 1.00m	D	VD			FILL (Bridging rock)
				1.5			Hole Terminated at 1.00 m					

LEGEND:

Water

▼	Water Level (Date and time shown)
▶—	Water Inflow
—◀	Water Outflow

Strata Changes

— — —	Gradational or transitional strata
———	Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - TEST PIT

CLIENT: Transport for NSW
PROJECT NAME: Proposed Coffs Harbour Boat Ramp Upgrade
SITE LOCATION: Coffs Harbour
TEST LOCATION: Refer to Figure 1

TEST PIT NO: TPF
PAGE: 1 of 1
JOB NO: RGS32282.1
LOGGED BY: MR
DATE: 1/9/20

EQUIPMENT TYPE: 8T Excavator
TEST PIT LENGTH:
WIDTH:
EASTING: 513638 m
NORTHING: 6646780 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
300mm Auger	Not Encountered			0.5 1.0	▨	GP	0.02m **SPRAY SEAL:** Black **FILL:** GRAVEL & COBBLES, fine to coarse grained, comprising high strength metasiltstone up to 150mm in size, some silt and sand 1.00m	D	VD			FILL Bridging rock
				1.5			Hole Terminated at 1.00 m					

LEGEND:

Water
Water Level (Date and time shown)
Water Inflow
Water Outflow

Strata Changes
— — Gradational or transitional strata
—— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

REGIONAL
GEOTECHNICAL
SOLUTIONS

ENGINEERING LOG - BOREHOLE

CLIENT:	Transport for NSW	**BOREHOLE NO:**	**BH1**
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 1
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1 UTM56J	**LOGGED BY:**	JB
		DATE:	22/10/20

DRILL TYPE:	Tracked Rig			**EASTING:**	513750 m	**SURFACE RL:**	-5.0 m
BOREHOLE DIAMETER:	100 mm	**INCLINATION:**	90°	**NORTHING:**	6646865 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
WB	Not Encountered	SPT 5,9,7 N=16 0.45m 1.00m SPT 3,2,3 N=5 1.45m	-6.0 -7.0	1.0 2.0	⁘	SP	**SAND:** Fine to medium grained, dark grey and brown, trace clay fines 2.50m	W	MD			MARINE
		2.50m SPT 3,4,6 N=10 2.95m 5.50m SPT 5,13,17 N=30 5.95m	-8.0 -9.0 -10.0 -11.0	3.0 4.0 5.0 6.0	▨	CH	**Silty CLAY:** High plasticity, grey 6.50m	M > W_P	VSt - H			RESIDUAL
			-12.0	7.0	☰		**EXTREMELY WEATHERED ARGILLITE:** Silty CLAY, high plasticity, grey and brown 7.00m					EXTREMELY WEATHERED ARGILLITE
					☰		**ARGILLITE:** Low to medium strength, highly to moderately weathered, grey and brown 7.50m					HIGHLY TO MODERATELY WEATHERED ARGILLITE
							Hole Terminated at 7.50 m Refusal on High Strength Argillite					

LEGEND:

Water

▼	Water Level (Date and time shown)
▶—	Water Inflow
—◀	Water Outflow

Strata Changes

— — —	Gradational or transitional strata
———	Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density			
	V	Very Loose	Density Index <15%
	L	Loose	Density Index 15 - 35%
	MD	Medium Dense	Density Index 35 - 65%
	D	Dense	Density Index 65 - 85%
	VD	Very Dense	Density Index 85 - 100%

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

CLIENT:	Transport for NSW	**BOREHOLE NO:**	**BH2**
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 1
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1 UTM56J	**LOGGED BY:**	JB
		DATE:	22/10/20

DRILL TYPE: Tracked Rig **EASTING:** 513732 m **SURFACE RL:** -6.0 m
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** 6646895 m **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
WB	Not Encountered	SPT 7,5,3 N=8 0.45m 1.00m SPT 3,2,1 N=3 1.45m 2.50m	-7.0 -8.0	1.0 2.0	⁘	SP	**SAND:** Fine to medium grained, dark grey and brown, with clay fines	W	MD			MARINE
		SPT 2,8,11 N=19 2.95m 4.00m	-9.0 -10.0	3.0 4.0	▨	CH	2.50m **Silty CLAY:** High plasticity, grey mottled brown	M > W_P	VSt - H	HP	220	RESIDUAL
		SPT 3,6,8 N=14 4.45m 5.00m	-11.0	5.0	☰		4.00m **EXTREMELY WEATHERED ARGILLITE:** Silty CLAY, high plasticity, grey and brown			HP	300	EXTREMELY WEATHERED ARGILLITE
		SPT 25/120mm N=R 5.12m			☰		5.00m **ARGILLITE:** Low strength, highly to moderately weathered, grey and brown 5.70m Becoming slightly weathered, high strength, blue-grey					HIGHLY TO MODERATELY WEATHERED ARGILLITE
			-12.0 -13.0	6.0 7.0			Hole Terminated at 5.70 m					

LEGEND:

Water

- Water Level (Date and time shown)
- ▶ Water Inflow
- ◀ Water Outflow

Strata Changes

- — — Gradational or transitional strata
- —— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

CLIENT:	Transport for NSW	**BOREHOLE NO:**	**BH3**
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 3
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1 UTM56J	**LOGGED BY:**	JB
		DATE:	14/10/20

DRILL TYPE: Tracked Rig **EASTING:** 513761 m **SURFACE RL:** -2.0 m

BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** 6646762 m **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
WB	Not Encountered					SP	**FILL:** SAND, Fine to medium grained, dark grey, becoming brown	W				FILL
				0.40m		GP	**FILL:** COBBLES & BOULDERS, dark grey, up to 1100mm in size, comprising very high strength argillite					
			-3.0	1.0								
				1.50m		SP	**SAND:** Fine to medium grained, brown		VD			MARINE
		2.00m SPT 9,10,13 N=23 2.45m	-4.0	2.0								
			-5.0	3.0								
				3.20m		CH	**Silty CLAY:** High plasticity, pale grey	M > W_P	VSt			RESIDUAL
		3.50m SPT 3,4,5 N=9 3.95m	-6.0	4.0						HP	180	
		5.00m SPT 2,3,5 N=8 5.45m	-7.0	5.0			Becoming mottled red-brown, trace iron indurated zones			HP	260	
			-8.0	6.0								
		6.50m SPT 19,15/80mm N=>50 6.95m		6.50m			**EXTREMELY WEATHERED ARGILLITE:** Gravelly CLAY, medium plasticity, grey and orange-brown, fine to coarse grained gravel					EXTREMELY WEATHERED ARGILLITE
			-9.0	7.0								
				7.60m			**HIGHLY TO MODERATELY WEATHERED ARGILLITE:** Brown and dark grey, estimated medium strength					HIGHLY TO MODERATELY WEATHERED ARGILLITE
				7.90m								

LEGEND:

Water

Water Level (Date and time shown)

▶— Water Inflow

—◀ Water Outflow

Strata Changes

— — Gradational or transitional strata

—— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: BH3
CLIENT: Transport for NSW
PAGE: Page 2 of 3
PROJECT NAME: Coffs Harbour Boat Ramp Upgrade
JOB NO: RGS32282.1
SITE LOCATION: Coffs Harbour
LOGGED BY: JB
TEST LOCATION: Refer to Figure 1 UTM56J
DATE: 14/10/20

DRILL TYPE: Tracked Rig
EASTING: 513761 m
SURFACE RL: -2.0 m
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
NORTHING: 6646762 m
DATUM: AHD

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
		-3.0	1.0								
		-4.0	2.0								
		-5.0	3.0								
		-6.0	4.0								
		-7.0	5.0								
		-8.0	6.0								
		-9.0	7.0								
					START CORING AT 7.90m						

LEGEND:

Method

WB	Wash Bore
RR	Rock Roller
CB	Claw or Blad Bit
NMLC	NMLC Core
NQ,HQ,PQ	Wireline Coring

Bedding

Laminated	<20mm
Thinnly Bedded	20-200mm
Medium Bedded	200-600mm
Thickly Bedded	600-2000mm
Very Thickly Bedded	2000mm
Massive	No Visible Bedding

Degree of Fracturing

Fragmented	<20mm
Highly Fractured	20mm to 40mm
Fractured	40mm to 200mm
Slightly Fractured	200mm to 1000mm

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
CS	Crushed Seam

Roughness		**Coating**		**Planarity**	
VR	Very Rough	CN	Clean	PL	Planar
RO	Rough	SN	Stained	CU	Curved
SO	Smooth	VN	Veneer(<1mm)	ST	Stepped
SL	Slickensided	CO	Coating(1-5mm)	IR	Irregular

ENGINEERING LOG - CORED BOREHOLE

CLIENT:	Transport for NSW	**BOREHOLE NO:**	**BH3**
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**PAGE:**	Page 3 of 3
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1 UTM56J	**LOGGED BY:**	JB
		DATE:	14/10/20

DRILL TYPE:	Tracked Rig	**EASTING:**	513761 m	**SURFACE RL:**	-2.0 m
BOREHOLE DIAMETER:	100 mm **INCLINATION:** 90°	**NORTHING:**	6646762 m	**DATUM:**	AHD

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
NMLC		-11.0 -12.0	9.0 10.0		**ARGILLITE:** Highly fractured, some defects rehealed *(continued)*	FR	H - VH				JT 20° IR RO CN JT 20° IR RO sand and gravel infill JT 20° IR RO CN JT 20° IR RO CN JT 20° IR RO CN JT 90° IR RO CN JT 45° PL RO CN JT 70° PL RO CN JT 20° PL RO CN JT 45° PL RO FeSt JT 30° PL RO FeSt JT 15° PL RO FeSt JT 80° PL RO CN
		-13.0 -14.0 -15.0 -16.0 -17.0	11.0 12.0 13.0 14.0 15.0		Hole Terminated at 10.12 m						

LEGEND:

Method

WB	Wash Bore
RR	Rock Roller
CB	Claw or Blad Bit
NMLC	NMLC Core
NQ,HQ,PQ	Wireline Coring

Bedding

Laminated	<20mm
Thinnly Bedded	20-200mm
Medium Bedded	200-600mm
Thickly Bedded	600-2000mm
Very Thickly Bedded	2000mm
Massive	No Visible Bedding

Degree of Fracturing

Fragmented	<20mm
Highly Fractured	20mm to 40mm
Fractured	40mm to 200mm
Slightly Fractured	200mm to 1000mm

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength		**$I_{s(50)}$**
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
CS	Crushed Seam

Roughness		**Coating**		**Planarity**	
VR	Very Rough	CN	Clean	PL	Planar
RO	Rough	SN	Stained	CU	Curved
SO	Smooth	VN	Veneer(<1mm)	ST	Stepped
SL	Slickensided	CO	Coating(1-5mm)	IR	Irregular

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	2.10.20
Title:	BH3 Core Photo 7.9 to 10.12m	Core Photo	BH3

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

CLIENT:	Transport for NSW	**BOREHOLE NO:**	**BH4**
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 1
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1 UTM56J	**LOGGED BY:**	MR
		DATE:	3/9/20

DRILL TYPE:	MD200	**EASTING:**	513728 m	**SURFACE RL:**	0.8 m
BOREHOLE DIAMETER:	100 mm **INCLINATION:** 90°	**NORTHING:**	6646717 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
Diatube				0.20m			**CONCRETE:** Grey, with steel reinforcement					CONCRETE SLAB
				0.70m		GP	**FILL:** GRAVEL & COBBLES, dark grey, comprising high strength argillite to 200mm in size, some sand and silt	M	VD			FILL (Bridging rock)
WB-RR	▶		0.0 -1.0	1.0 2.0 2.45m		GP	**FILL:** GRAVEL & COBBLES, dark grey, comprising high strength argillite to 200mm in size, some sand and silt, with fine to medium grained sand matrix	W				
		2.45m SPT 12,32,35 N=67 2.90m 3.60m SPT 24,35,38 N=73 4.05m	-2.0 -3.0 -4.0	3.0 4.0 4.80m		SP	**SAND:** Fine to medium grained, brown	W	VD			MARINE SAND
		5.00m SPT 24,32 N=>50 5.30m		5.0 5.30m			**EXTREMELY TO MODERATELY WEATHERED ARGILLITE:** Grey and dark grey, some clay seams throughout					EXTREMELY WEATHERED ARGILLITE
			-5.0 -6.0 -7.0	6.0 7.0			Hole Terminated at 5.30 m					

LEGEND:

Water

⯆	Water Level (Date and time shown)
▶	Water Inflow
◀	Water Outflow

Strata Changes

— —	Gradational or transitional strata
——	Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

CLIENT:	Transport for NSW	**BOREHOLE NO:**	**BH5**
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 2
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1 UTM56J	**LOGGED BY:**	JB
		DATE:	13/10/20

DRILL TYPE:	Tracked Rig			**EASTING:**	513759 m	**SURFACE RL:**	-2.0 m
BOREHOLE DIAMETER:	100 mm	**INCLINATION:**	90°	**NORTHING:**	6646743 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
WB	Not Encountered					SP	**SAND:** Fine to medium grained, dark grey, trace clay fines	W	VL			MARINE
						SP	0.50m **SAND:** Fine to medium grained, grey-brown		MD			
		1.00m SPT 2,2,4 N=6 1.45m	-3.0	1.0								
			-4.0	2.0								
		2.40m SPT 6,11,19 N=30 2.85m				CH	2.20m **Silty CLAY:** High plasticity, pale grey	M > W_P	H			RESIDUAL
			-5.0	3.0			2.60m **EXTREMELY WEATHERED ARGILLITE:** Silty CLAY, medium plasticity, grey and brown, with fine to coarse grained gravel		Fb			EXTREMELY WEATHERED ARGILLITE
		4.00m SPT 10,24/1300mm N=>50	-6.0	4.0			4.35m					
							Continued as Cored Drill Hole					
			-7.0	5.0								
			-8.0	6.0								
			-9.0	7.0								

LEGEND:

Water

▼	Water Level (Date and time shown)
▶	Water Inflow
◀	Water Outflow

Strata Changes

— —	Gradational or transitional strata
——	Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - CORED BOREHOLE

CLIENT:	Transport for NSW	**BOREHOLE NO:**	**BH5**
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**PAGE:**	Page 2 of 2
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1 UTM56J	**LOGGED BY:**	JB
		DATE:	13/10/20

DRILL TYPE: Tracked Rig
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90°
EASTING: 513759 m **SURFACE RL:** -2.0 m
NORTHING: 6646743 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
		-3.0	1.0								
		-4.0	2.0								
		-5.0	3.0								
		-6.0	4.0								
					START CORING AT 4.35m						
NMLC					**ARGILLITE:** Dark grey and brown, highly fractured at 5-10mm spacing, partially healed and iron induration	HW	VL - L				HIGHLY TO EXTREMELY FRACTURED Extremely weathered seam
		-7.0	5.0								
					ARGILLITE: Dark grey, pale green/pale grey, highly to extremely fractured at 5-10mm spacing, some defects, partially healed	SW - FR	M - H				
		-8.0	6.0								
					Hole Terminated at 6.36 m						
		-9.0	7.0								

LEGEND:

Method

WB	Wash Bore
RR	Rock Roller
CB	Claw or Blad Bit
NMLC	NMLC Core
NQ,HQ,PQ	Wireline Coring

Bedding

Laminated	<20mm
Thinnly Bedded	20-200mm
Medium Bedded	200-600mm
Thickly Bedded	600-2000mm
Very Thickly Bedded	2000mm
Massive	No Visible Bedding

Degree of Fracturing

Fragmented	<20mm
Highly Fractured	20mm to 40mm
Fractured	40mm to 200mm
Slightly Fractured	200mm to 1000mm

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
CS	Crushed Seam

Roughness		**Coating**		**Planarity**	
VR	Very Rough	CN	Clean	PL	Planar
RO	Rough	SN	Stained	CU	Curved
SO	Smooth	VN	Veneer(<1mm)	ST	Stepped
SL	Slickensided	CO	Coating(1-5mm)	IR	Irregular

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	2.10.20
Title:	BH5 Core Photo 4.35 to 6.36m	Core Photo	BH5

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

CLIENT:	Transport for NSW	**BOREHOLE NO:**	**BH6**
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 3
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1 UTM56J	**LOGGED BY:**	JB
		DATE:	8/9/20

DRILL TYPE:	Tracked Rig	**EASTING:**	513734 m	**SURFACE RL:**	4.1 m
BOREHOLE DIAMETER:	100 mm	**NORTHING:**	6646707 m	**DATUM:**	AHD
INCLINATION:	90°				

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/T			4.0			GP	**FILL:** GRAVEL & COBBLES, dark grey and brown, fine to coarse grained gravel, cobbles up to 150mm in size, trace boulders, fill comprises very high strength argillite	M				FILL (Bridging rock)
			3.0	1.0								
WB			2.0	2.0								
	▽		1.0	3.0				W				
			0.0	4.0								
		5.10m SPT 18,24,29 N=53 5.55m	-1.0	5.0		SP	5.00m **SAND:** Fine to medium grained, brown		VD			MARINE
		6.50m SPT 30/60mm N=>50 7.00m	-2.0	6.0								
		6.95m SPT 40 N=>50	-3.0	7.0			7.00m **ARGILLITE:** Very low to low strength, highly weathered, grey and brown 7.30m					EXTREMELY WEATHERED ARGILLITE
							Continued as Cored Drill Hole					

LEGEND:

Water

▼ Water Level (Date and time shown)

▶ Water Inflow

◀ Water Outflow

Strata Changes

– – Gradational or transitional strata

—— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

CLIENT:	Transport for NSW	**BOREHOLE NO:**	**BH6**
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**PAGE:**	Page 2 of 3
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1 UTM56J	**LOGGED BY:**	JB
		DATE:	8/9/20

DRILL TYPE: Tracked Rig
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90°
EASTING: 513734 m **NORTHING:** 6646707 m
SURFACE RL: 4.1 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
		4.0									
		3.0	1.0								
		2.0	2.0								
		1.0	3.0								
		0.0	4.0								
		-1.0	5.0								
		-2.0	6.0								
		-3.0	7.0		START CORING AT 7.30m						
NMLC					**ARGILLITE:** Green, grey mottled brown, with extremely weathered layers, highly fractured	MW	L - M				

LEGEND:

Method	
WB	Wash Bore
RR	Rock Roller
CB	Claw or Blad Bit
NMLC	NMLC Core
NQ,HQ,PQ	Wireline Coring

Bedding	
Laminated	<20mm
Thinnly Bedded	20-200mm
Medium Bedded	200-600mm
Thickly Bedded	600-2000mm
Very Thickly Bedded	2000mm
Massive	No Visible Bedding

Degree of Fracturing	
Fragmented	<20mm
Highly Fractured	20mm to 40mm
Fractured	40mm to 200mm
Slightly Fractured	200mm to 1000mm

Weathering	
EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type	
JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
CS	Crushed Seam

Roughness	
VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating	
CN	Clean
SN	Stained
VN	Veneer(<1mm)
CO	Coating(1-5mm)

Planarity	
PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

ENGINEERING LOG - CORED BOREHOLE

CLIENT:	Transport for NSW	**BOREHOLE NO:**	**BH6**
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**PAGE:**	Page 3 of 3
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1 UTM56J	**LOGGED BY:**	JB
		DATE:	8/9/20

DRILL TYPE:	Tracked Rig	**EASTING:**	513734 m	**SURFACE RL:**	4.1 m
BOREHOLE DIAMETER:	100 mm	**INCLINATION:**	90°	**NORTHING:**	6646707 m
DATUM:	AHD				

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
NMLC		-4.0			**ARGILLITE:** Green, grey mottled brown, with extremely weathered layers, highly fractured, with some healed joints	MW	H				
		-5.0	9.0								
					Hole Terminated at 9.45 m						
		-6.0	10.0								
		-7.0	11.0								
		-8.0	12.0								
		-9.0	13.0								
		-10.0	14.0								
		-11.0	15.0								

LEGEND:

Method

WB	Wash Bore
RR	Rock Roller
CB	Claw or Blad Bit
NMLC	NMLC Core
NQ,HQ,PQ	Wireline Coring

Bedding

Laminated	<20mm
Thinnly Bedded	20-200mm
Medium Bedded	200-600mm
Thickly Bedded	600-2000mm
Very Thickly Bedded	2000mm
Massive	No Visible Bedding

Degree of Fracturing

Fragmented	<20mm
Highly Fractured	20mm to 40mm
Fractured	40mm to 200mm
Slightly Fractured	200mm to 1000mm

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
CS	Crushed Seam

Roughness		**Coating**		**Planarity**	
VR	Very Rough	CN	Clean	PL	Planar
RO	Rough	SN	Stained	CU	Curved
SO	Smooth	VN	Veneer(<1mm)	ST	Stepped
SL	Slickensided	CO	Coating(1-5mm)	IR	Irregular

BH6 7.3m to 9.45m

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	2.10.20
Title:	BH6 Core Photo 7.3 to 9.45m	Core Photo	BH6

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

CLIENT:	Transport for NSW	**BOREHOLE NO:**	**BH7**
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 2
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1 UTM56J	**LOGGED BY:**	JB
		DATE:	9/9/20

DRILL TYPE: Tracked Rig **EASTING:** 513746 m **SURFACE RL:** 1.4 m
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** 6646717 m **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/T	Not Encountered	2.00m	1.0 0.0	1.0 2.0	▩	GP	**FILL:** GRAVEL & COBBLES, dark grey and brown, fine to coarse grained gravel, with argillite boulders	M				FILL (Bridging rock)
		SPT 3,12,15 N=27 2.45m 3.30m SPT 13,25,15/70mm N=>50 3.67m 4.50m SPT 10,27 N=>50 4.95m	-1.0 -2.0 -3.0	3.0 4.0 5.0	⁙	SP	2.00m **SAND:** Fine to medium grained, brown	W	VD			MARINE
			-4.0		☰		5.00m **EXTREMELY WEATHERED ARGILLITE:** Grey and brown, fine to medium grained					EXTREMELY WEATHERED ARGILLITE
			-5.0 -6.0	6.0 7.0			5.77m Continued as Cored Drill Hole					

LEGEND:

Water

- ▼ Water Level (Date and time shown)
- ►— Water Inflow
- —◄ Water Outflow

Strata Changes

- — — — Gradational or transitional strata
- ——— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: BH7

CLIENT:	Transport for NSW	**PAGE:**	Page 2 of 2
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**JOB NO:**	RGS32282.1
SITE LOCATION:	Coffs Harbour	**LOGGED BY:**	JB
TEST LOCATION:	Refer to Figure 1 UTM56J	**DATE:**	9/9/20

DRILL TYPE: Tracked Rig
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90°
EASTING: 513746 m **NORTHING:** 6646717 m
SURFACE RL: 1.4 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
		1.0									
			1.0								
		0.0									
			2.0								
		-1.0									
			3.0								
		-2.0									
			4.0								
		-3.0									
			5.0								
		-4.0			START CORING AT 5.77m						
NMLC			6.0		**ARGILLITE:** Dark grey with healed joints	FR	H - VH				
		-5.0			Hole Terminated at 6.30 m						
			7.0								
		-6.0									

LEGEND:

Method

WB	Wash Bore
RR	Rock Roller
CB	Claw or Blad Bit
NMLC	NMLC Core
NQ,HQ,PQ	Wireline Coring

Bedding

Laminated	<20mm
Thinnly Bedded	20-200mm
Medium Bedded	200-600mm
Thickly Bedded	600-2000mm
Very Thickly Bedded	2000mm
Massive	No Visible Bedding

Degree of Fracturing

Fragmented	<20mm
Highly Fractured	20mm to 40mm
Fractured	40mm to 200mm
Slightly Fractured	200mm to 1000mm

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength		**$I_{s(50)}$**
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer(<1mm)
CO	Coating(1-5mm)

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

BH7 5.77m to 6.3m

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	2.10.20
Title:	BH7 Core Photo 5.77 to 6.3m	Core Photo	BH7

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

CLIENT:	Transport for NSW	**BOREHOLE NO:**	**BH8**
PROJECT NAME:	Coffs Harbour Boat Ramp Upgrade	**PAGE:**	1 of 2
SITE LOCATION:	Coffs Harbour	**JOB NO:**	RGS32282.1
TEST LOCATION:	Refer to Figure 1 UTM56J	**LOGGED BY:**	JB
		DATE:	13/10/20

DRILL TYPE:	Tracked Rig			**EASTING:**	513766 m	**SURFACE RL:**	-3.0 m
BOREHOLE DIAMETER:	100 mm	**INCLINATION:**	90°	**NORTHING:**	6646733 m	**DATUM:**	AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
WB	Not Encountered					SP	**SAND:** Fine to medium grained, dark grey, trace clay fines	W	VD			MARINE
							0.40m **SLIGHTLY WEATHERED ARGILLITE:** Dark grey					SLIGHTLY WEATHERED ARGILLITE
			-4.0	1.0			1.00m Continued as Cored Drill Hole					
			-5.0	2.0								
			-6.0	3.0								
			-7.0	4.0								
			-8.0	5.0								
			-9.0	6.0								
			-10.0	7.0								

LEGEND:

Water

- Water Level (Date and time shown)
- ▶— Water Inflow
- —◀ Water Outflow

Strata Changes

- — — Gradational or transitional strata
- —— Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		**UCS (kPa)**
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: BH8
CLIENT: Transport for NSW
PAGE: Page 2 of 2
PROJECT NAME: Coffs Harbour Boat Ramp Upgrade
JOB NO: RGS32282.1
SITE LOCATION: Coffs Harbour
LOGGED BY: JB
TEST LOCATION: Refer to Figure 1 UTM56J
DATE: 13/10/20

DRILL TYPE: Tracked Rig
EASTING: 513766 m
SURFACE RL: -3.0 m
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
NORTHING: 6646733 m
DATUM: AHD

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
		-4.0	1.0		START CORING AT 1.00m						
NMLC					**ARGILLITE:** Dark grey, some rehealed joints	SW - FR	H - VH				JT 60° PL RO CN JT 0° IR RO CN JT 30° IR RO CN JT 60° PL RO FeSt
		-5.0	2.0		Hole Terminated at 1.86 m						
		-6.0	3.0								
		-7.0	4.0								
		-8.0	5.0								
		-9.0	6.0								
		-10.0	7.0								

LEGEND:

Method

WB	Wash Bore
RR	Rock Roller
CB	Claw or Blad Bit
NMLC	NMLC Core
NQ,HQ,PQ	Wireline Coring

Bedding

Laminated	<20mm
Thinnly Bedded	20-200mm
Medium Bedded	200-600mm
Thickly Bedded	600-2000mm
Very Thickly Bedded	2000mm
Massive	No Visible Bedding

Degree of Fracturing

Fragmented	<20mm
Highly Fractured	20mm to 40mm
Fractured	40mm to 200mm
Slightly Fractured	200mm to 1000mm

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
CS	Crushed Seam

Roughness		**Coating**		**Planarity**	
VR	Very Rough	CN	Clean	PL	Planar
RO	Rough	SN	Stained	CU	Curved
SO	Smooth	VN	Veneer(<1mm)	ST	Stepped
SL	Slickensided	CO	Coating(1-5mm)	IR	Irregular

BH8 1.0m to 1.86m

RGS32282.1 BH8 START AT 1.0m

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Transport for NSW	Job No.	RGS32282.1
Project:	Coffs Harbour Boat Ramp Upgrade and Precinct Development	Drawn By:	MR
		Date:	2.10.20
Title:	BH8 Core Photo 1.0 to 1.86m	Core Photo	BH8

Appendix B

Results of Laboratory Testing

Material Test Report

AC TESTING SERVICES
SOILS | AGGREGATES | CONCRETE
P 0438 857 377 E info@actestingservices.com.au ABN 41 634 083 793
Nambucca Heads Laboratory 2/1 Monro St, Nambucca Heads NSW 2448
Armidale Laboratory Shop 11/215 Mann St, Armidale NSW 2350

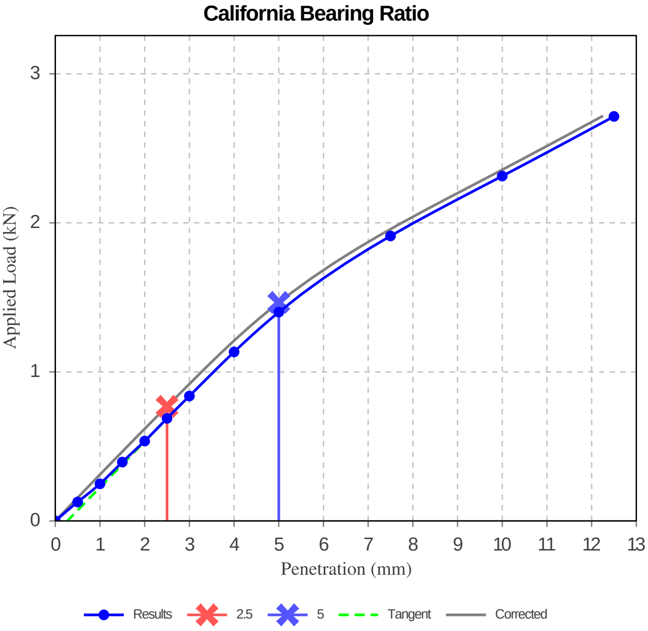
A C Testing Services
2/1 Monro St Nambucca Heads NSW 2448
Phone: 0438 857 377
Email: adam@actestingservices.com.au

Report Number: **RGS-276-1**
Issue Number: 2 - *This version supersedes all previous issues*
Date Issued: 29/09/2020
Client: Regional Geotechnical Solutions
14/25-27 Hurley Drive, Coffs Harbour NSW 2450
Contact: Matt Rowbotham
Project Number: RGS-276
Project Name: Coffs Boat Harbour Boat Ramp Upgrade
Project Location: Coffs Harbour
Client Reference: RGS32282.1
Work Request: 1867
Sample Number: ACTS20-1867A
Date Sampled: 04/09/2020
Dates Tested: 10/09/2020 - 14/09/2020
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: RGS32282.1 - Coffs Boat Harbour Boat Ramp Upgrade
Site Selection: Selected by Client
Sample Location: **TP3, Depth: 0-0.6m**

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Adam Crawford
Lab Manager
NATA Accredited Laboratory Number: 19604

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**7**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual/Tactile		
Maximum Dry Density (t/m^3)	1.76		
Optimum Moisture Content (%)	16.5		
Laboratory Density Ratio (%)	101.0		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.76		
Field Moisture Content (%)	14.5		
Moisture Content at Placement (%)	16.3		
Moisture Content Top 30mm (%)	20.2		
Moisture Content Rest of Sample (%)	18.1		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	48		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	1.7		



This document shall not be reproduced except in full without approval of the laboratory.
Results relate only to the items tested/sampled.

Material Test Report

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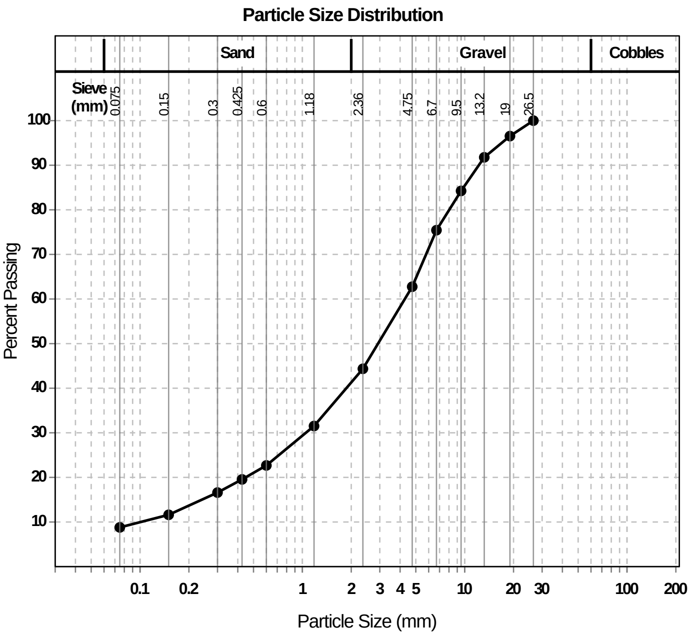
Approved Signatory: Adam Crawford
Lab Manager
NATA Accredited Laboratory Number: 19604

Report Number: **RGS-276-1**
Issue Number: 2 - *This version supersedes all previous issues*
Date Issued: 29/09/2020
Client: Regional Geotechnical Solutions
14/25-27 Hurley Drive, Coffs Harbour NSW 2450
Contact: Matt Rowbotham
Project Number: RGS-276
Project Name: Coffs Boat Harbour Boat Ramp Upgrade
Project Location: Coffs Harbour
Client Reference: RGS32282.1
Work Request: 1867
Sample Number: ACTS20-1867B
Date Sampled: 04/09/2020
Dates Tested: 10/09/2020 - 26/09/2020
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: RGS32282.1 - Coffs Boat Harbour Boat Ramp Upgrade
Site Selection: Selected by Client
Sample Location: **TP1, Depth: 0.15-0.4m**

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
26.5 mm	**100**		
19 mm	**97**		
13.2 mm	**92**		
9.5 mm	**84**		
6.7 mm	**75**		
4.75 mm	**63**		
2.36 mm	**44**		
1.18 mm	**32**		
0.6 mm	**23**		
0.425 mm	**20**		
0.3 mm	**17**		
0.15 mm	**12**		
0.075 mm	**9**		

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	25		
Plastic Limit (%)	18		
Plasticity Index (%)	**7**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	2.5		
Cracking Crumbling Curling	None		



Material Test Report

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Phone: 0438 857 377
Email: adam@actestingservices.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Adam Crawford
Lab Manager
NATA Accredited Laboratory Number: 19604

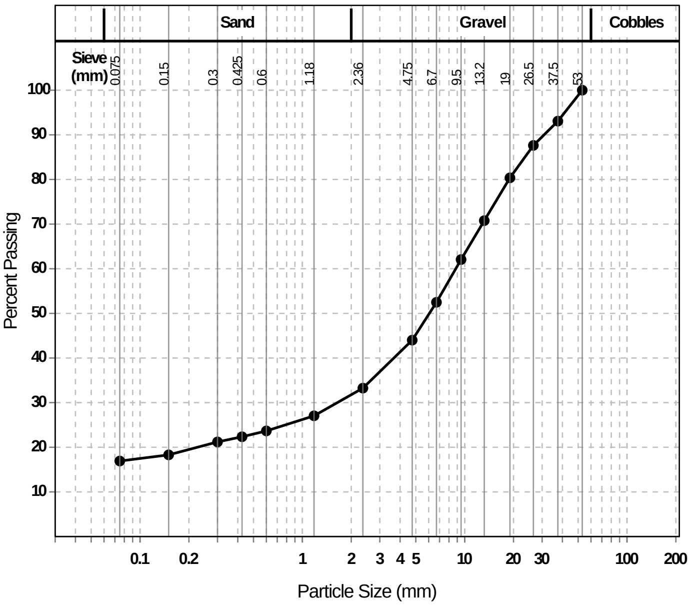
Report Number: **RGS-276-1**
Issue Number: 2 - *This version supersedes all previous issues*
Date Issued: 29/09/2020
Client: Regional Geotechnical Solutions
14/25-27 Hurley Drive, Coffs Harbour NSW 2450
Contact: Matt Rowbotham
Project Number: RGS-276
Project Name: Coffs Boat Harbour Boat Ramp Upgrade
Project Location: Coffs Harbour
Client Reference: RGS32282.1
Work Request: 1867
Sample Number: ACTS20-1867C
Date Sampled: 04/09/2020
Dates Tested: 10/09/2020 - 26/09/2020
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: RGS32282.1 - Coffs Boat Harbour Boat Ramp Upgrade
Site Selection: Selected by Client
Sample Location: **TP4, Depth: 0.02-0.75m**

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
53 mm	**100**		
37.5 mm	**93**		
26.5 mm	**88**		
19 mm	**80**		
13.2 mm	**71**		
9.5 mm	**62**		
6.7 mm	**52**		
4.75 mm	**44**		
2.36 mm	**33**		
1.18 mm	**27**		
0.6 mm	**24**		
0.425 mm	**22**		
0.3 mm	**21**		
0.15 mm	**18**		
0.075 mm	**17**		

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	28		
Plastic Limit (%)	19		
Plasticity Index (%)	**9**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	3.0		
Cracking Crumbling Curling	None		

Particle Size Distribution



Material Test Report

Report Number: **RGS-276-1**
Issue Number: 2 - *This version supersedes all previous issues*
Date Issued: 29/09/2020
Client: Regional Geotechnical Solutions
14/25-27 Hurley Drive, Coffs Harbour NSW 2450
Contact: Matt Rowbotham
Project Number: RGS-276
Project Name: Coffs Boat Harbour Boat Ramp Upgrade
Project Location: Coffs Harbour
Client Reference: RGS32282.1
Work Request: 1867
Sample Number: ACTS20-1867D
Date Sampled: 04/09/2020
Dates Tested: 10/09/2020 - 14/09/2020
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: RGS32282.1 - Coffs Boat Harbour Boat Ramp Upgrade
Site Selection: Selected by Client
Sample Location: **TPB, Depth: 0-0.6m**

AC TESTING SERVICES
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Armidale Laboratory Shop 11/215 Mann St, Armidale NSW 2350

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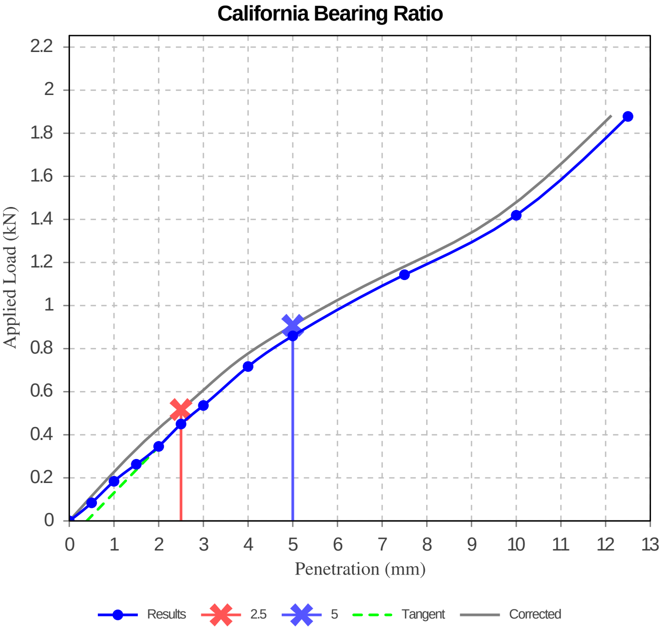
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Adam Crawford
Lab Manager
NATA Accredited Laboratory Number: 19604

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**4.5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual/Tactile		
Maximum Dry Density (t/m^3)	1.69		
Optimum Moisture Content (%)	20.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	101.5		
Dry Density after Soaking (t/m^3)	1.68		
Field Moisture Content (%)	20.3		
Moisture Content at Placement (%)	20.4		
Moisture Content Top 30mm (%)	23.4		
Moisture Content Rest of Sample (%)	21.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	48		
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

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Report Number: **RGS-276-1**
Issue Number: 2 - *This version supersedes all previous issues*
Date Issued: 29/09/2020
Client: Regional Geotechnical Solutions
14/25-27 Hurley Drive, Coffs Harbour NSW 2450
Contact: Matt Rowbotham
Project Number: RGS-276
Project Name: Coffs Boat Harbour Boat Ramp Upgrade
Project Location: Coffs Harbour
Client Reference: RGS32282.1
Work Request: 1867
Sample Number: ACTS20-1867E
Date Sampled: 04/09/2020
Dates Tested: 10/09/2020 - 26/09/2020
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: RGS32282.1 - Coffs Boat Harbour Boat Ramp Upgrade
Site Selection: Selected by Client
Sample Location: **TP6, Depth: 0-0.25m**

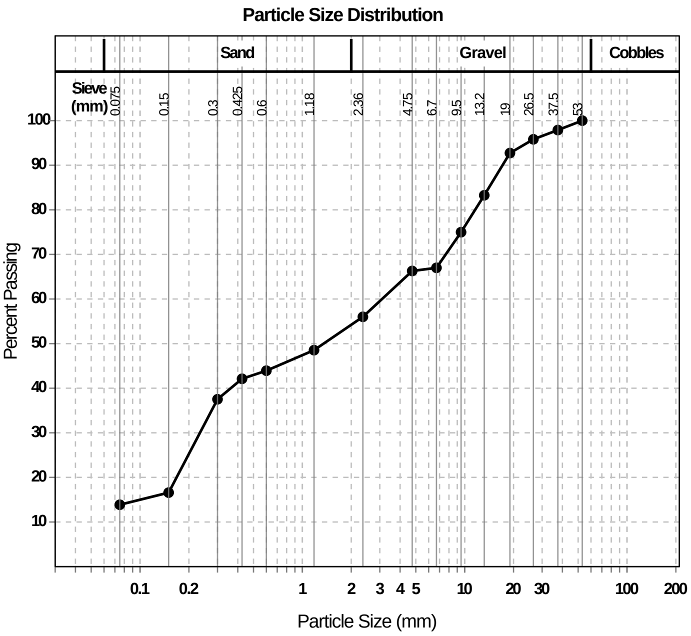
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Adam Crawford
Lab Manager
NATA Accredited Laboratory Number: 19604

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
53 mm	**100**		
37.5 mm	**98**		
26.5 mm	**96**		
19 mm	**93**		
13.2 mm	**83**		
9.5 mm	**75**		
6.7 mm	**67**		
4.75 mm	**66**		
2.36 mm	**56**		
1.18 mm	**49**		
0.6 mm	**44**		
0.425 mm	**42**		
0.3 mm	**38**		
0.15 mm	**17**		
0.075 mm	**14**		

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	Not Obtainable		
Plastic Limit (%)	Not Obtainable		
Plasticity Index (%)	**Non Plastic**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	0.0		
Cracking Crumbling Curling	None		



Material Test Report

AC TESTING SERVICES
SOILS | AGGREGATES | CONCRETE

P 0438 857 377 E info@actestingservices.com.au ABN 41 634 083 793
Nambucca Heads Laboratory 2/1 Monro St, Nambucca Heads NSW 2448
Armidale Laboratory Shop 11/215 Mann St, Armidale NSW 2350

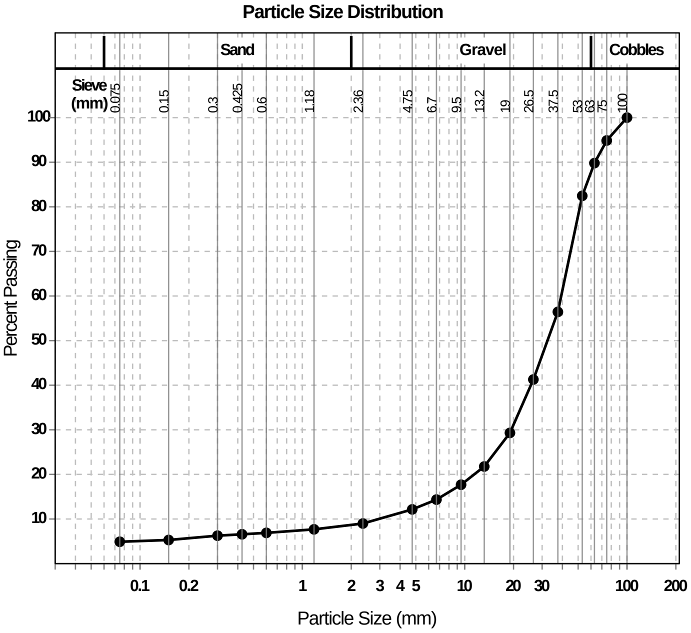
A C Testing Services
2/1 Monro St Nambucca Heads NSW 2448
Phone: 0438 857 377
Email: adam@actestingservices.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Adam Crawford
Lab Manager
NATA Accredited Laboratory Number: 19604

Report Number: **RGS-276-1**
Issue Number: 2 - *This version supersedes all previous issues*
Date Issued: 29/09/2020
Client: Regional Geotechnical Solutions
14/25-27 Hurley Drive, Coffs Harbour NSW 2450
Contact: Matt Rowbotham
Project Number: RGS-276
Project Name: Coffs Boat Harbour Boat Ramp Upgrade
Project Location: Coffs Harbour
Client Reference: RGS32282.1
Work Request: 1867
Sample Number: ACTS20-1867F
Date Sampled: 04/09/2020
Dates Tested: 10/09/2020 - 29/09/2020
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: RGS32282.1 - Coffs Boat Harbour Boat Ramp Upgrade
Site Selection: Selected by Client
Sample Location: **TP5, Depth: 0.02-0.75m**

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
100 mm	**100**		
75 mm	**95**		
63 mm	**90**		
53 mm	**82**		
37.5 mm	**56**		
26.5 mm	**41**		
19 mm	**29**		
13.2 mm	**22**		
9.5 mm	**18**		
6.7 mm	**14**		
4.75 mm	**12**		
2.36 mm	**9**		
1.18 mm	**8**		
0.6 mm	**7**		
0.425 mm	**7**		
0.3 mm	**6**		
0.15 mm	**5**		
0.075 mm	**5**		


Particle Size Distribution

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	28		
Plastic Limit (%)	18		
Plasticity Index (%)	**10**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	3.5		
Cracking Crumbling Curling	None		

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order : **ES2031176**
Client : **REGIONAL GEOTECHNICAL SOLUTION**
Contact : MR ADAM HOLZHAUSER
Address : Unit 14 25-27 Hurley Drive
COFFS HARBOUR NSW, AUSTRALIA 2450
Telephone : +61 02 6553 5641
Project : RGS32282.1 Boat Ramp Upgrade
Order number : ----
C-O-C number : ----
Sampler : ----
Site : ----
Quote number : EN/222
No. of samples received : 5
No. of samples analysed : 5

Page : 1 of 7
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61-2-8784 8555
Date Samples Received : 04-Sep-2020 10:30
Date Analysis Commenced : 09-Sep-2020
Issue Date : 16-Sep-2020 16:27

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Diana Mesa	Senior Organic Chemist	Brisbane Inorganics, Stafford, QLD
Diana Mesa	Senior Organic Chemist	Brisbane Organics, Stafford, QLD
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP068: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP068: Where reported, Total OCP is the sum of the reported concentrations of all Organochlorine Pesticides at or above LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- EP090-Organotin: The LOR of TBT has been raised for sample 'S1' due to matrix interference.
- ASS: EA033 (CRS Suite): Laboratory determinations of ANC needs to be corroborated by effectiveness of the measured ANC in relation to incubation ANC. Unless corroborated, the results of ANC testing should be discounted when determining Net Acidity for comparison with action criteria, or for the determination of the acidity hazard and required liming amounts.
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**S1**	**S2**	**S3**	**S4**	**S5**
			Client sampling date / time	02-Sep-2020 00:00	02-Sep-2020 00:00	02-Sep-2020 00:00	02-Sep-2020 00:00	02-Sep-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2031176-001**	**ES2031176-002**	**ES2031176-003**	**ES2031176-004**	**ES2031176-005**
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**9.4**	**9.7**	**9.8**	**9.8**	**9.8**
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.263**	**0.015**	**0.016**	**0.016**	**0.015**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**164**	<10	<10	**10**	<10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**15.4**	**7.28**	**17.2**	**23.0**	**14.5**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**3080**	**1450**	**3430**	**4590**	**2890**
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**4.94**	**2.33**	**5.49**	**7.35**	**4.64**
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	**0.26**	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**164**	<10	<10	**10**	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t	**12**	<1	<1	<1	<1
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**27.9**	**21.6**	**22.7**	**24.0**	**21.4**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	**10**	**10**	**15**	**15**	**15**
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**8**	**4**	**5**	**5**	**5**
Copper	7440-50-8	5	mg/kg	**6**	<5	<5	<5	<5
Lead	7439-92-1	5	mg/kg	<5	<5	<5	<5	<5
Nickel	7440-02-0	2	mg/kg	**2**	<2	<2	<2	<2
Zinc	7440-66-6	5	mg/kg	**39**	**7**	**9**	**7**	**8**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**S1**	**S2**	**S3**	**S4**	**S5**
			Client sampling date / time	02-Sep-2020 00:00	02-Sep-2020 00:00	02-Sep-2020 00:00	02-Sep-2020 00:00	02-Sep-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2031176-001**	**ES2031176-002**	**ES2031176-003**	**ES2031176-004**	**ES2031176-005**
				Result	Result	Result	Result	Result
EP066: Polychlorinated Biphenyls (PCB) - Continued								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ **Total Chlordane (sum)**	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ **Endosulfan (sum)**	115-29-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S1	S2	S3	S4	S5
			Client sampling date / time	02-Sep-2020 00:00	02-Sep-2020 00:00	02-Sep-2020 00:00	02-Sep-2020 00:00	02-Sep-2020 00:00
Compound	CAS Number	LOR	Unit	ES2031176-001	ES2031176-002	ES2031176-003	ES2031176-004	ES2031176-005
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

			Client sample ID	**S1**	**S2**	**S3**	**S4**	**S5**
			Client sampling date / time	02-Sep-2020 00:00	02-Sep-2020 00:00	02-Sep-2020 00:00	02-Sep-2020 00:00	02-Sep-2020 00:00
Compound	CAS Number	LOR	Unit	**ES2031176-001**	**ES2031176-002**	**ES2031176-003**	**ES2031176-004**	**ES2031176-005**
				Result	Result	Result	Result	Result
EP080: BTEXN - Continued								
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ **Sum of BTEX**	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ **Total Xylenes**	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.9	<0.5	<0.5	<0.5	<0.5
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**107**	**105**	**79.7**	**114**	**127**
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	**66.7**	**62.8**	**71.3**	**70.4**	**76.1**
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	**62.9**	**59.9**	**74.8**	**72.4**	**67.3**
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**94.0**	**83.7**	**83.6**	**92.5**	**92.6**
2-Chlorophenol-D4	93951-73-6	0.5	%	**95.3**	**87.9**	**87.8**	**95.4**	**91.1**
2.4.6-Tribromophenol	118-79-6	0.5	%	**81.8**	**58.0**	**56.8**	**57.6**	**48.8**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**104**	**97.2**	**98.0**	**104**	**100**
Anthracene-d10	1719-06-8	0.5	%	**111**	**102**	**102**	**111**	**106**
4-Terphenyl-d14	1718-51-0	0.5	%	**94.0**	**87.7**	**87.6**	**95.5**	**92.8**
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	**73.8**	**88.1**	**81.8**	**85.7**	**86.8**
Toluene-D8	2037-26-5	0.2	%	**85.6**	**91.7**	**86.8**	**88.3**	**93.0**
4-Bromofluorobenzene	460-00-4	0.2	%	**89.1**	**94.6**	**91.1**	**90.2**	**92.1**
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	**91.4**	**108**	**107**	**116**	**90.4**

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	*CAS Number*	***Recovery Limits (%)***	
		Low	***High***
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order : **ES2037636**
Client : **REGIONAL GEOTECHNICAL SOLUTION**
Contact : JOEL BABBAGE
Address : Unit 14 25-27 Hurley Drive
COFFS HARBOUR NSW, AUSTRALIA 2450

Telephone : ----
Project : RGS32282.1 Boat Ramp Upgrade
Order number : ----
C-O-C number : ----
Sampler : ----
Site : Coffs Harbour
Quote number : EN/222
No. of samples received : 4
No. of samples analysed : 4

Page : 1 of 7
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone : +61-2-8784 8555
Date Samples Received : 27-Oct-2020 10:50
Date Analysis Commenced : 30-Oct-2020
Issue Date : 05-Nov-2020 16:52

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Diana Mesa	Senior Organic Chemist	Brisbane Organics, Stafford, QLD
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General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP068: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP068: Where reported, Total OCP is the sum of the reported concentrations of all Organochlorine Pesticides at or above LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EP071: Results of sample BH2 1-1.45 have been confirmed by re-extraction and re-analysis
- EG005: Poor precision was obtained for Chromium on sample ES2037644-13. Results have been confirmed by re-extraction and re-analysis.
- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- EP090 Organotins: Sample 'BH1 1-1.45' required dilution due to the presence of high level contaminants. LOR values have been adjusted accordingly and surrogate values are not determined.
- EP090 Organotins: Poor matrix spike recovery for MBT due to matrix interference.
- ASS: EA033 (CRS Suite): Laboratory determinations of ANC needs to be corroborated by effectiveness of the measured ANC in relation to incubation ANC. Unless corroborated, the results of ANC testing should be discounted when determining Net Acidity for comparison with action criteria, or for the determination of the acidity hazard and required liming amounts.
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**BH1 0-0.45**	**BH1 1-1.45**	**BH2 0-0.45**	**BH2 1-1.45**	**----**
			Client sampling date / time	[22-Oct-2020]	[22-Oct-2020]	[22-Oct-2020]	[22-Oct-2020]	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2037636-001**	**ES2037636-002**	**ES2037636-003**	**ES2037636-004**	**--------**
				Result	Result	Result	Result	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**9.7**	**9.6**	**9.6**	**9.6**	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.036**	**0.043**	**0.022**	**0.096**	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**23**	**27**	**14**	**60**	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**32.6**	**43.9**	**21.0**	**36.8**	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**6510**	**8770**	**4210**	**7350**	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**10.4**	**14.0**	**6.74**	**11.8**	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	----
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	----
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	----
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	**0.04**	**0.04**	**0.02**	**0.10**	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**23**	**27**	**14**	**60**	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	**2**	**2**	**1**	**4**	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**26.4**	**29.8**	**21.2**	**30.1**	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	**8**	**8**	**9**	**6**	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	----
Chromium	7440-47-3	2	mg/kg	**6**	**5**	**6**	**5**	----
Copper	7440-50-8	5	mg/kg	<5	**17**	<5	<5	----
Lead	7439-92-1	5	mg/kg	<5	<5	<5	<5	----
Nickel	7440-02-0	2	mg/kg	**2**	<2	**2**	**2**	----
Zinc	7440-66-6	5	mg/kg	**10**	**83**	**8**	**11**	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	----
EP066: Polychlorinated Biphenyls (PCB)								

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Client sample ID	**BH1 0-0.45**	**BH1 1-1.45**	**BH2 0-0.45**	**BH2 1-1.45**	**----**
			Client sampling date / time	[22-Oct-2020]	[22-Oct-2020]	[22-Oct-2020]	[22-Oct-2020]	----
Compound	CAS Number	LOR	Unit	**ES2037636-001**	**ES2037636-002**	**ES2037636-003**	**ES2037636-004**	--------
				Result	Result	Result	Result	----
EP066: Polychlorinated Biphenyls (PCB) - Continued								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
^ **Total Chlordane (sum)**	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
^ **Endosulfan (sum)**	115-29-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/5 0-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**BH1 0-0.45**	**BH1 1-1.45**	**BH2 0-0.45**	**BH2 1-1.45**	**----**
			Client sampling date / time	[22-Oct-2020]	[22-Oct-2020]	[22-Oct-2020]	[22-Oct-2020]	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2037636-001**	**ES2037636-002**	**ES2037636-003**	**ES2037636-004**	**--------**
				Result	Result	Result	Result	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ **Benzo(a)pyrene TEQ (half LOR)**	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	**0.6**	----
^ **Benzo(a)pyrene TEQ (LOR)**	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	**1.2**	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	----
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	----
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
^ **C10 - C36 Fraction (sum)**	----	50	mg/kg	<50	<50	<50	<50	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	----
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	**60**	----
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	----
^ **>C10 - C40 Fraction (sum)**	----	50	mg/kg	<50	<50	<50	**60**	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	50	mg/kg	<50	<50	<50	**60**	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

			Client sample ID	**BH1 0-0.45**	**BH1 1-1.45**	**BH2 0-0.45**	**BH2 1-1.45**	**----**
			Client sampling date / time	[22-Oct-2020]	[22-Oct-2020]	[22-Oct-2020]	[22-Oct-2020]	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2037636-001**	**ES2037636-002**	**ES2037636-003**	**ES2037636-004**	**--------**
				Result	Result	Result	Result	----
EP080: BTEXN - Continued								
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
^ **Sum of BTEX**	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
^ **Total Xylenes**	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	----
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	----
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	**4**	<1	<1	----
Dibutyltin	1002-53-5	1	µgSn/kg	<1	**27**	<1	<1	----
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	**1220**	<0.5	<0.5	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**85.9**	**75.4**	**80.7**	**75.8**	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	**98.2**	**85.7**	**98.7**	**100**	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	**81.2**	**71.4**	**85.9**	**68.5**	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**99.4**	**91.3**	**92.9**	**95.6**	----
2-Chlorophenol-D4	93951-73-6	0.5	%	**100**	**92.6**	**93.3**	**97.5**	----
2.4.6-Tribromophenol	118-79-6	0.5	%	**76.0**	**68.2**	**70.8**	**70.5**	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**115**	**106**	**107**	**110**	----
Anthracene-d10	1719-06-8	0.5	%	**114**	**106**	**107**	**109**	----
4-Terphenyl-d14	1718-51-0	0.5	%	**105**	**96.3**	**99.2**	**101**	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	**101**	**102**	**110**	**104**	----
Toluene-D8	2037-26-5	0.2	%	**102**	**98.1**	**106**	**101**	----
4-Bromofluorobenzene	460-00-4	0.2	%	**122**	**119**	**125**	**119**	----
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	**76.2**	**Not Determined**	**70.0**	**64.9**	----

Surrogate Control Limits

Sub-Matrix: **SOIL**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130

RESULTS OF ACID SULFATE SOIL ANALYSIS

2 samples supplied by Regional Geotechnical Solutions Pty Ltd on 1st October, 2020. Lab Job No.J9004

Analysis requested by Joel Babbage. Your Job: RGS32282.1

14/25-27 Hurley Drive COFFS HARBOUR NSW 2450

															Non-treated soil		Non-treated soil	
Sample Identification	EAL Lab Code	Texture	Moisture Content		pH_F and pH_{FOX}				Potential Sulfidic Acidity (Chromium Reducible Sulfur - CRS)			Actual Acidity (Titratable Actual Acidity - TAA)	Retained Acidity		Acid Neutralising Capacity (ANC_{BT})		Net Acidity	Lime Calculation
			(% moisture of total wet weight)	(g moisture / g of oven dry soil)	pH_F	pH_{FOX}	pH change	Reaction	(% S_{cr})	(mol H^+/t)	pH_{KCl}	(mol H^+/t)	(%S_{NAS})	(mol H^+/t)	(% $CaCO_3$)	(mol H^+/t)	(mol H^+/t)	(kg $CaCO_3$/t DW)
Method Info.		**	**		(In-house method S21)				(In-house method S20)		(In-house method 16b)		**		(In-house method S14)		**	**
BH6 5.1-5.5	J9004/1	Coarse	17.1	0.21	9.36	6.77	-2.59	Low	0.006	4	9.98	0	..	..	6.86	1370	4	0
BH7 3.3-3.75	J9004/2	Coarse	18.2	0.22	8.94	7.85	-1.10	Extreme	<0.005	0	9.87	0	..	..	6.60	1318	0	0

NOTES:

1. All analysis is reported on a dry weight (DW) basis, unless wet weight (WW) is specified.
2. Samples are dried and ground immediately upon arrival (unless supplied dried and ground).
3. Analytical procedures are sourced from Sullivan L, Ward N, Toppler N and Lancaster G. 2018. National acid sulfate soils guidance: national acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. CC BY 4.0.
4. The Acid Base Accounting Equation, where Acid Neutralising Capacity has not been corroborated by other data, is **Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity** (Eq. 3.2; Sullivan et al. 2018 - full reference above).
5. The Acid Base Accounting Equation for post-limed soil materials is **Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - (post treatment Acid Neutralising Capacity - initial Acid Neutralising Capacity)** (Eq. 3.3; Sullivan et al. 2018 - full reference above).

   While the Acid Neutralising Capacity of a soil material may not be included in the Net Acidity calculation (Note 4), it must be measured to give an Initial Acid Neutralising Capacity if verification testing is planned post-liming.

   The Inital Acid Neutralising Capacity must be provided by the client to enable EAL to produce Verification Net Acidity and Liming calculations for post-limed soil materials.
6. The Acid Base Accounting Equation, where Acid Neutralising Capacity has been corroborated by other data, is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - Acid Neutralising Capacity (Eq. 3.1; Sullivan et al. 2018 - full reference above).
7. The lime calculation includes a Safety Factor of 1.5 as a safety margin for acid neutralisation (Sullivan et al. 2018). This is only applied to positive values. An increased Safety Factor may be required in some cases.
8. Retained Acidity is required when the pH_{KCl} < 4.5 or where jarosite has been visually observed.
9. A negative Net Acidity result indicates an excess acid neutralising capacity.
10. If insufficient mixing occurs during intial sampling, or during post-liming, or both: the Potential Sulfidic Acidity may be greater in the post-limed sample than in the intial sample; the post-liming Acid Neutralising Capacity may be lower in the post-limed sample than in the intial sample.
11. **An acid sulfate soil management plan is triggered by Net Acidity results greater than the texture dependent criterion: coarse texture ≥ 0.03% S or 18 mol H^+/t; medium texture ≥ 0.06% S or 36 mol H^+/t; fine texture ≥ 0.1% S or 62 mol H^+/t)** (Table 1.1; Sullivan et al. 2018 - full reference above)
12. For projects that disturb > 1000 t of soil material, the coarse trigger of ≥ 0.03% S or ≥ 18 mol H^+/t must be applied in accordance with Sullivan et al. (2018) (full reference above).
13. Acid sulfate soil texture triggers can be related to NCST (2009) textures: coarse and peats = sands to loamy sands; medium = clayey sand to light clays; fine = light medium to heavy clays (Sullivan et al. 2018 - full reference above).
14. Bulk density is required to convert liming rates to soil volume based results. Field bulk density rings can be submitted to EAL for bulk density determination.
15. A negative Net Acidity result indicates an excess acid neutralising capacity.
16. '..' is reported where a test is either not requested or not required. Where pH_{KCl} is < 4.5 or > 6.5, zero is reported for S_{NAS} and ANC in Net Acidity calculations, respectively.
17. Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
18. ** NATA accreditation does not cover the performance of this service.
19. Analysis conducted between sample arrival date and reporting date.
20. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal or on request).
21. Results relate to the samples tested.
22. This report was issued on 07/10/2020.

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ACCREDITATION
Accreditation No. 14960
Accredited for compliance
with ISO/IEC 17025 - Testing

checked: ....
Graham Lancaster
Laboratory Manager

RESULTS OF ACID SULFATE SOIL ANALYSIS

7 samples supplied by Regional Geotechnical Solutions Pty Ltd on 16th October, 2020. Lab Job No.J9515
Analysis requested by Joel Babbage. Your Job: RGS32282.1

14/25-27 Hurley Drive COFFS HARBOUR NSW 2450

Sample Identification	EAL Lab Code	Texture	Moisture Content		pH_F and pH_{FOX}			
			(% moisture of total wet weight)	(g moisture / g of oven dry soil)	pH_F	pH_{FOX}	pH change	Reaction
Method Info.		**	**		*(In-house method S21)*			
BH3 2-2.45	*J9515/1*	Coarse	19.5	0.24	8.63	6.84	-1.79	Low
BH3 3.5-3.95	*J9515/2*	Fine	32.4	0.48	7.94	6.30	-1.64	Medium
BH3 5-5.45	*J9515/3*	Fine	32.3	0.48	7.40	6.63	-0.77	Medium
BH3 6.5-6.95	*J9515/4*	Fine	20.2	0.25	6.42	5.49	-0.93	Medium
BH5 1-1.45	*J9515/5*	Coarse	22.4	0.29	8.98	6.66	-2.32	Low
BH5 2.4-2.85	*J9515/6*	Fine	23.1	0.30	8.43	6.65	-1.78	Medium
BH5 4-4.3	*J9515/7*	Fine	20.0	0.25	6.96	6.40	-0.56	Extreme

NOTES:

1. All analysis is reported on a dry weight (DW) basis, unless wet weight (WW) is specified.
2. Samples are dried and ground immediately upon arrival (unless supplied dried and ground).
3. Analytical procedures are sourced from Sullivan L, Ward N, Toppler N and Lancaster G. 2018. National acid sulfate soils guidance: national acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. CC BY 4.0.
4. The Acid Base Accounting Equation, where Acid Neutralising Capacity has not been corroborated by other data, is **Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity** (Eq. 3.2; Sullivan et al. 2018 - full reference above).
5. The Acid Base Accounting Equation for post-limed soil materials is **Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - (post treatment Acid Neutralising Capacity - initial Acid Neutralising Capacity)** (Eq. 3.3; Sullivan et al. 2018 - full reference above).

   While the Acid Neutralising Capacity of a soil material may not be included in the Net Acidity calculation (Note 4), it must be measured to give an Initial Acid Neutralising Capacity if verification testing is planned post-liming.

   The Inital Acid Neutralising Capacity must be provided by the client to enable EAL to produce Verification Net Acidity and Liming calculations for post-limed soil materials.
6. The Acid Base Accounting Equation, where Acid Neutralising Capacity has been corroborated by other data, is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - Acid Neutralising Capacity (Eq. 3.1; Sullivan et al. 2018 - full reference above).
7. The lime calculation includes a Safety Factor of 1.5 as a safety margin for acid neutralisation (Sullivan et al. 2018). This is only applied to positive values. An increased Safety Factor may be required in some cases.
8. Retained Acidity is required when the pH_{KCl} < 4.5 or where jarosite has been visually observed.
9. A negative Net Acidity result indicates an excess acid neutralising capacity.
10. If insufficient mixing occurs during intial sampling, or during post-liming, or both: the Potential Sulfidic Acidity may be greater in the post-limed sample than in the intial sample; the post-liming Acid Neutralising Capacity may be lower in the post-limed sample than in the intial sample.
11. **An acid sulfate soil management plan is triggered by Net Acidity results greater than the texture dependent criterion: coarse texture ≥ 0.03% S or 18 mol H^+/t; medium texture ≥ 0.06% S or 36 mol H^+/t; fine texture ≥ 0.1% S or 62 mol H^+/t)** (Table 1.1; Sullivan et al. 2018 - full reference above)
12. For projects that disturb > 1000 t of soil material, the coarse trigger of ≥ 0.03% S or ≥ 18 mol H^+/t must be applied in accordance with Sullivan et al. (2018) (full reference above).
13. Acid sulfate soil texture triggers can be related to NCST (2009) textures: coarse and peats = sands to loamy sands; medium = clayey sand to light clays; fine = light medium to heavy clays (Sullivan et al. 2018 - full reference above).
14. Bulk density is required to convert liming rates to soil volume based results. Field bulk density rings can be submitted to EAL for bulk density determination.
15. A negative Net Acidity result indicates an excess acid neutralising capacity.
16. '..' is reported where a test is either not requested or not required. Where pH_{KCl} is < 4.5 or > 6.5, zero is reported for S_{NAS} and ANC in Net Acidity calculations, respectively.
17. Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
18. ** NATA accreditation does not cover the performance of this service.
19. Analysis conducted between sample arrival date and reporting date.
20. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal or on request).
21. Results relate to the samples tested.
22. This report was issued on 19/10/2020.

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checked: ....
Graham Lancaster
Laboratory Manager

Appendix C

Pavement Design Sheets

FLEXIBLE PAVEMENT THICKNESS DESIGN

CLIENT: TfNSW
Job No.: RGS32282.1
PROJECT: Coffs Jetty Boat Ramp and Precinct Upgrade
LOCATION: Coffs Jetty Boat Ramp
Date: 9.11.20

REGIONAL GEOTECHNICAL SOLUTIONS

ROAD NAME:	**Jordan Esplanade Realignment**	**Refer to drawing:**	
Chainage Interval (m):	Not Provided	**Road classification ref:**	N/A
Road Classification:	N/A	**Design Traffic:**	$1.0\text{x } 10^6$ ESA

Subgrade Conditions

Expected subgrade:	Sand and Clay		
Adopted Subgrade CBR value:	4.5	Required subgrade compaction:	100% Standard Compaction
Potential construction or performance issues:	Potential localised soft spots requiring excavation and replacement with approved granular fill. Proof roll and inspection required after excavation to identify areas requiring use of bridging or subgrade replacement		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Wearing course thickness (mm):	30	ACr to Council requirements.	
Base thickness (mm):	120	DGB20 or equivalent	98% Modified Compaction
Sub-base thickness (mm):	270	DGS40 or equivalent	97% Modified Compaction
Select thickness (mm):	0	Existing pavement gravel CBR>15, PI<15	100% Standard Compaction
Total thickness (mm):	420	New Pavement Design	

Definitions:

Design traffic loading:	The anticipated number of equivalent standard axles (ESA), as defined by AUSTROADS, in the design lane during the design life of the pavement.
Modified Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.2.1-2003 or equivalent.
Standard Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.1.1-2003 or equivalent.
Density Index:	Minimum required Density Index AS1289 5.6.1-1998, defined as the ratio of field dry density determined by AS1289 5.3.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent

Note: Pavement designs assume appropriate drainage is installed and maintained. Refer to Regional Geotechnical Solutions Report No. RGS32282.1-AB for recommendations regarding pavement construction and drainage.

FLEXIBLE PAVEMENT THICKNESS DESIGN

CLIENT: TfNSW
PROJECT: Coffs Jetty Boat Ramp and Precinct Upgrade
LOCATION: Coffs Jetty Boat Ramp
Job No.: RGS32282.1
Date: 9.11.20

ROAD NAME:	**Boat Ramp Car Park**	**Refer to drawing:**	
Chainage Interval (m):	Not Provided	**Road classification ref:**	N/A
Road Classification:	N/A	**Design Traffic:**	1.0x 10^6 ESA

Subgrade Conditions

Expected subgrade:	Sand and Clay		
Adopted Subgrade CBR value:	5.0	Required subgrade compaction:	100% Standard Compaction
Potential construction or performance issues:	Potential localised soft spots requiring excavation and replacement with approved granular fill. Proof roll and inspection required after excavation to identify areas requiring use of bridging or subgrade replacement		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Wearing course thickness (mm):	30	ACr to Council requirements.	
Base thickness (mm):	170	DGB20 or equivalent	98% Modified Compaction
Sub-base thickness (mm):	0	DGS40 or equivalent	97% Modified Compaction
Select thickness (mm):	100	Existing pavement gravel CBR>15, PI<15	100% Standard Compaction
Total thickness (mm):	300	Overlay Design (Assumes minimum pavement thickness of 300mm)	

Definitions:

Design traffic loading:	The anticipated number of equivalent standard axles (ESA), as defined by AUSTROADS, in the design lane during the design life of the pavement.
Modified Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.2.1-2003 or equivalent.
Standard Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.1.1-2003 or equivalent.
Density Index:	Minimum required Density Index AS1289 5.6.1-1998, defined as the ratio of field dry density determined by AS1289 5.3.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent

Note: Pavement designs assume appropriate drainage is installed and maintained. Refer to Regional Geotechnical Solutions Report No. RGS32282.1-AB for recommendations regarding pavement construction and drainage.

FLEXIBLE PAVEMENT THICKNESS DESIGN

CLIENT: TfNSW

PROJECT: Coffs Jetty Boat Ramp and Precinct Upgrade

LOCATION: Coffs Jetty Boat Ramp

Job No.: RGS32282.1

Date: 9.11.20

REGIONAL GEOTECHNICAL SOLUTIONS

ROAD NAME:	**Gallows Beach Car Park**	**Refer to drawing:**	
Chainage Interval (m):	Not Provided	**Road classification ref:**	N/A
Road Classification:	N/A	**Design Traffic:**	1.0x 10^6 ESA

Subgrade Conditions

Expected subgrade:	Sand and Clay		
Adopted Subgrade CBR value:	5.0	Required subgrade compaction:	100% Standard Compaction
Potential construction or performance issues:	Potential localised soft spots requiring excavation and replacement with approved granular fill. Proof roll and inspection required after excavation to identify areas requiring use of bridging or subgrade replacement		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Wearing course thickness (mm):	30	ACr to Council requirements.	
Base thickness (mm):	150	DGB20 or equivalent	98% Modified Compaction
Sub-base thickness (mm):	0	DGS40 or equivalent	97% Modified Compaction
Select thickness (mm):	220	Existing pavement gravel CBR>15, PI<15	100% Standard Compaction
Total thickness (mm):	400	Overlay Design	

Definitions:

Design traffic loading:	The anticipated number of equivalent standard axles (ESA), as defined by AUSTROADS, in the design lane during the design life of the pavement.
Modified Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.2.1-2003 or equivalent.
Standard Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.1.1-2003 or equivalent.
Density Index:	Minimum required Density Index AS1289 5.6.1-1998, defined as the ratio of field dry density determined by AS1289 5.3.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent

Note: Pavement designs assume appropriate drainage is installed and maintained. Refer to Regional Geotechnical Solutions Report No. RGS32282.1-AB for recommendations regarding pavement construction and drainage.

FLEXIBLE PAVEMENT THICKNESS DESIGN

CLIENT: TfNSW
Job No.: RGS32282.1
PROJECT: Coffs Jetty Boat Ramp and Precinct Upgrade
LOCATION: Coffs Jetty Boat Ramp
Date: 9.11.20

REGIONAL GEOTECHNICAL SOLUTIONS

ROAD NAME:	**Gallows Beach Car Park and Access Roads**	**Refer to drawing:**	
Chainage Interval (m):	Not Provided	**Road classification ref:**	N/A
Road Classification:	N/A	**Design Traffic:**	1.0x 10^6 ESA

Subgrade Conditions

Expected subgrade:	Sand and Clay		
Adopted Subgrade CBR value:	5.0	Required subgrade compaction:	100% Standard Compaction
Potential construction or performance issues:	Potential localised soft spots requiring excavation and replacement with approved granular fill. Proof roll and inspection required after excavation to identify areas requiring use of bridging or subgrade replacement		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Wearing course thickness (mm):	30	ACr to Council requirements.	
Base thickness (mm):	120	DGB20 or equivalent	98% Modified Compaction
Sub-base thickness (mm):	250	DGS40 or equivalent	97% Modified Compaction
Select thickness (mm):	0	Existing pavement gravel CBR>15, PI<15	100% Standard Compaction
Total thickness (mm):	400	New Pavement Design	

Definitions:

Design traffic loading:	The anticipated number of equivalent standard axles (ESA), as defined by AUSTROADS, in the design lane during the design life of the pavement.
Modified Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.2.1-2003 or equivalent.
Standard Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.1.1-2003 or equivalent.
Density Index:	Minimum required Density Index AS1289 5.6.1-1998, defined as the ratio of field dry density determined by AS1289 5.3.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent

Note: Pavement designs assume appropriate drainage is installed and maintained. Refer to Regional Geotechnical Solutions Report No. RGS32282.1-AB for recommendations regarding pavement construction and drainage.

Appendix I

Sediment Transport Modelling Report

COFFS HARBOUR BOAT RAMP REDEVELOPMENT

SEDIMENT TRANSPORT MODELLING

DRAFT Report MHL2784
November 2020

Prepared for:

Transport for NSW
Maritime Infrastructure Delivery Office

Cover Photograph: Photo to be added for final report

Coffs Harbour Boat Ramp Redevelopment

Sediment Transport Modelling

DRAFT Report MHL2784
November 2020

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DRAFT V2

Report classification

☐	Public	Report existence and contents publicly available.
☒	Release by consent only	Report existence is known but contents are available only with consent by MHL's client and the MHL Director.
☐	Private	Report existence and content are strictly confidential.

Report No. MHL2784

First published as draft in October 2020

Manly Hydraulics Laboratory is Safety, Environment & Quality System Certified to AS/NZS 4801, ISO 14001 and ISO 9001

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Foreword

NSW government's professional specialist advisor, Manly Hydraulics Laboratory (MHL), was commissioned by Transport for NSW Maritime Infrastructure Delivery Office (MIDO) to undertake numerical modelling using DHI's MIKE21 coupled wave, current and sediment transport software to assess the potential impact on sediment transport dynamics by the proposed extension to the Coffs Harbour Regional Boat Ramp entrance breakwater. The modelling aimed to investigate the impact of proposed breakwater extension options (40 m, 60 m and 75 m extension) on sedimentation within the boat ramp basin entrance and beach alignment of south Jetty Beach. Potential impact on small reef environments approximately 175–200 m north of the existing boat ramp basin entrance was also investigated.

The report was prepared by Mark Kulmar and Ben Blumberg. The numerical modelling for the investigation was undertaken by Ben Blumberg.

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Executive summary

Since the Coffs Harbour boat ramp and basin was constructed in the mid-1970s there has been a history of reports by mariners of difficulties launching and retrieving boats and navigating vessels in the entrance channel to the boat ramp. Following construction, the boat ramp basin regularly suffered from water level surges, and operational difficulties were also experienced in the vicinity of the boat ramp during times that north-easterly swell entered the harbour.

Following a series of investigations into wave dynamics and long period oscillations (seiching) the boat ramp basin was extended in 2015 to its present-day configuration. The extension of the basin has reduced seiche action in the boat ramp basin, but ongoing deposition of sediment in the entrance to the basin has resulted in unsafe navigation conditions for vessels entering and leaving the boat ramp basin. Periodic removal of sediment from the boat ramp basin entrance channel is required to improve navigational safety and to maintain the serviceability of the boat ramp.

As part of the proposed redevelopment of the Coffs Harbour Regional Boat Ramp precinct, in 2020 physical model testing was undertaken by MHL to assess the change in wave conditions due to an extension to the boat ramp basin entrance breakwater and to check such an extension to the breakwater would not have an adverse impact on seiche action at the boat ramp. An extension to the breakwater will improve navigational safety by moving the entrance to the boat ramp basin further offshore from the rocky shoreline to the west of the boat ramp entrance channel that has been the scene of numerous vessel groundings in recent years. The physical modelling determined that any extension to the breakwater will not have any significant effect on seiche action in the boat ramp basin and, therefore, an extension to the breakwater to improve navigation was recommended.

Previous investigations on sediment movement in Coffs Harbour have identified a sediment transport pathway along the southern shoreline that passes the entrance to the boat ramp basin. This sediment transport results in formation of a shoal at the entrance to the boat ramp basin and migration of sediment into the basin entrance channel. Therefore, sediment management to inhibit the formation of a shoal at the entrance to the boat ramp basin will also be required in conjunction with any extension of the boat ramp entrance breakwater.

This study undertook sediment transport modelling to examine the effects of a proposed extension to the boat ramp basin breakwater on shoal formation and channel sedimentation near the boat ramp basin, and impacts on the southern end. DHI's industry-recognised MIKE21 software packages was utilised to model wave, currents and sediment transport interdependently, using wind data and NSW Government's NSW Nearshore Wave Forecast Tool outputs. The modelling consisted of three stages: Stage 1 included calibration of the wave and current model against real-world harbour measurements; Stage 2 involved identification and preliminary transport modelling of several representative (median) wind and wave conditions, the condition that best replicated annual transport rates along the south-eastern harbour shoreline of 4,000–6,000 m^3 was adopted for the option analysis; Stage 3 included the analysis of the existing configuration and the three breakwater extension options considered (40 m, 60 m and 75 m extensions). The following forcing conditions were utilised for Stage 3 modelling based on the findings of Stage 2: significant wave height of 1 m, peak wave period of 10 s, mean wave direction of 100 degrees, directional spreading index of 10, wind speed of 16 m/s, wind direction of 230 degrees.

The model indicated that extension of the breakwater would shift the shoal created at the breakwater head further offshore, however, it was inconclusive on whether the size of the shoal would be impacted. It is likely that the relocation of the shoal offshore would reduce transportation of sediments into the boat ramp basin, which may be driven by harbour seiche and, to a lesser extent, diffraction around the breakwater head. The shift in the shoal formation location would likely reduce hazardous entrance conditions. It is possible that sediments would accumulate over a longer period to form a large shoal in the lee of the breakwater; this effect was beyond the limitations of the modelling conducted in this study.

The model indicates small changes to the net sediment transport at the three environmentally sensitive reefs north of the boat ramp basin. For the existing boat ramp basin breakwater configuration, the modelling indicated negative net sediment transport (scour) at all three reefs. These negative accretion rates reduced at Reefs 2 and 3 for the three breakwater extension option, which could be attributed to some sediment transport being redirected towards the reef area by the extensions, however, the net accretion in these areas remained negative. At Reef 1 there was, in general, an increase in the net negative transport, attributable to increased wave and current conditions due to the extensions. These changes can likely be considered minor relative to the existing conditions, however, the effect of these changes on the reef environments is beyond the scope of this study.

The modelling indicates that extension of the boat ramp basin breakwater would create a lee, reducing onshore transport of sediment westwards of the boat ramp basin. The reduction of onshore transport to Jetty Beach at a southernmost 80 m length was estimated to be 45% for Option 3 (approximately 7,000 m^3), 30% for Option 2 (approximately 4,500 m^3) and a 5% increase of accretion for Option 1 (approximately 900 m^3). This modelling does suggest that some recession to south Jetty Beach may occur if the boat ramp basin breakwater was extended according to Option 2 (50 m extension) or Option 3 (75 m extension). This sand deficit for the southernmost 80 m of Jetty Beach (modelled as approximately 7,000 m^3 for the Option 3 extension and 4,500 m^3 for the Option 2 extension) is due to reduced onshore transport and thus would be accompanied by an equivalent accretion in the nearshore shoal.

Due to the limitations and assumptions of the modelling undertaken in this study, the findings and volumes provided should be interpreted as estimates. MHL recommends that a hydrographic and beach survey be undertaken along and offshore to south Jetty Beach to document existing conditions prior to any extension to the boat ramp basin breakwater.

Contents

TABLES

FIGURES

1 Introduction

1.1 Background

The Coffs Harbour boat ramp is located in a small basin on the southern side of the harbour **(Figure 1.1)**. Since the original boat ramp and basin was constructed in the mid-1970s there is a history of reports by mariners of difficulties launching and retrieving boats and navigating vessels in the entrance channel to the boat ramp. Following construction, the boat ramp basin regularly suffered from water level surges, and operational difficulties were also experienced in the vicinity of the boat ramp during times that north-easterly swell entered the harbour.

Previous studies recognised that long period oscillations (or seiching) of the harbour can drive water level oscillations within both the inner harbour (on the north side of the main harbour) and the boat ramp basin. The phenomenon of seiching in Coffs Harbour and the boat ramp basin is discussed in MHL (2019). In addition to the surging experienced in the vicinity of the boat ramp, sediment migrates into the boat ramp basin creating further navigation or operational problems. As a result, periodic removal of sediment from the boat ramp basin and navigation channel region is required to maintain the serviceability of the boat ramp.

Following numerical and physical modelling studies the original boat ramp basin was extended in 2015 and reports and observations from mariners using the boat ramp indicate that seiche action has decreased since the basin extension was completed. However, on occasions, use of the boat ramp remains problematic, most notably by vessels entering the ramp basin during times of low tide levels combined with wave action.

In December 2018, the Coffs Harbour Regional Boat Ramp Precinct Enhancement Committee issued a report presenting proposed enhancements to the Coffs Harbour boat ramp facilities: *Final Report Enhancements for the Coffs Harbour Regional Boat Ramp Precinct*. The committee's vision is to develop the boat ramp precinct into a world class facility to meet the high demand for present-day and future use of the boat ramp by local and visiting mariners. Following regular boating safety incidents, in particular over the 2018 Easter holiday period, where over a dozen boats were washed onto rocks at the entrance to the boat ramp basin, safety and congestion issues have been identified by the committee to be addressed as a priority. Coffs Harbour City Council (CHCC) endorsed the committee's vision of a world class boat ramp facility and supported its proposal to deliver a report on the enhancements required to meet this vision. The report proposed ten areas for enhancement which included both the land and marine environments:

1) enhanced boat ramp entrance (75 m breakwater extension)
2) widened bay and ramp area
3) six boat environmental washdown facility
4) more parking for cars, boats and trailers
5) toilet and shower/change room facility
6) increased capacity for boat rigging and derigging
7) security camera, lighting and signage

8) enhanced environmental fish cleaning facility
9) recreational seating, tables and barbeques
10) redesign of the walking path.

The main safety enhancements recommended include a 75 m extension to the boat ramp basin entrance breakwater, an extended ramp basin and widening of the boat ramp with additional pontoons.

It is understood that funding of $10 million is available from the NSW Government for the redevelopment project and to progress this work. In 2019 Transport for NSW Maritime Infrastructure Delivery Office (MIDO) commissioned Manly Hydraulics Laboratory (MHL) to undertake to undertake 3D physical model testing to assess the performance of the proposed extension to the boat ramp entrance breakwater to improve navigation safety of vessels using the boat ramp, and to verify that any changes to the boat ramp basin and the construction of the breakwater extension will not have an adverse impact on wave and seiche action in the basin. The results of the physical model testing is documented in MHL (2020).

In parallel with the physical modelling investigations MIDO also engaged Royal HaskoningDHV to develop options for the redevelopment of the boat ramp precinct that included areas for enhancement identified in CHRBRPEC (2018). Details of the development options for the Coffs Harbour regional boat ramp precinct are documented in Royal HaskoningDHV (2020).

As noted in MHL (2020), it is recognised that in addition to extension of the boat ramp entrance breakwater, sediment management will also be vital to improve the navigational safety for vessels using the boat ramp. Coffs Harbour has been experiencing ongoing long-term sediment accretion since the harbour construction was practically completed in 1946, following the construction of the southern breakwater (causeway between South Coffs Island and the mainland), eastern and northern breakwaters (**Figure 1.1**).

A number of previous investigations have identified that the harbour is infilling as a result of the net northward littoral drift of sediment along this part of the NSW coastline. Furthermore, as the north sediment transport mechanism is interrupted by the harbour, a sediment deficit is present to the north of Muttonbird Island, resulting in the long-term recession of Park Beach. Periodic dredging of the harbour has been undertaken since the late 1980s to maintain navigability and vessel safety within Coffs Harbour, although the overall process of harbour infilling has not been prevented and Park Beach has experienced episodic erosion hazards in between harbour dredging campaigns (MHL 2015).

Previous studies have identified a sediment transport pathway, primarily driven by ocean swell waves propagating into the harbour, that runs along the southern shoreline of Coffs Harbour from the eastern breakwater that passes (and migrates into) the entrance of the boat ramp basin and then on to Jetty Beach. Any extension to the boat ramp entrance breakwater will intercept this sediment transport pathway, and therefore potentially have an impact on sediment movement in the vicinity of the boat ramp basin and also on Jetty Beach. To assess the impact of an extension to the boat ramp entrance breakwater on local sediment dynamics, MIDO engaged MHL to undertake numerical sediment transport modelling as the next stage of the investigations for the redevelopment of the Coffs Harbour regional boat ramp facilities. The modelling undertook to identify impacts of three proposed breakwater extension options (40 m, 60 m and 75 m) on sedimentation (shoaling) around the entrance to the boat ramp basin, and on south Jetty Beach.

1.2 Scope of work

The scope of work for the study includes:

- definition of the Coffs Harbour regional offshore wave climate and nearshore wave climate near the entrance to Coffs Harbour
- a summary sediment transport behaviour at Coffs Harbour and Jetty Beach based on previous investigations and beach cross-section data available from the Office of Environment and Heritage's NSW Beach Profile Database
- collection and particle size analysis of sediment samples in the vicinity of the Coffs Harbour boat ramp and along the length of Jetty Beach
- numerical modelling sediment transport within Coffs Harbour using DHI's MIKE21 coupled wave and current software to assess the effect of breakwater extension options on shoal formation at the breakwater head and within the boat ramp basin entrance channel, as well as any effect on small reef environments north of the breakwater, and impact of the extension options on south Jetty Beach.

1.3 Sediment transport modelling methodology

The Coffs Harbour sediment transport study was completed in three stages. Model calibration and forcing condition selection was undertaken in Stages 1 and 2, while option testing for the selected forcing conditions was undertaken in Stage 3. Further description of each stage is given below:

- **Stage 1**: Stage 1 of the study involved calibrating the MIKE21 SW wave and HD current modules using wave measurements taken inside the harbour in November 2011. Nearshore Wave Forecast Tool historical outputs at the harbour entrance and local wind measurements, for the same time period, were used to force the coupled model during the calibration stage.
- **Stage 2**: Stage 2 incorporated preliminary sediment modelling for several representative forcing conditions (median seasonal offshore wave and wind conditions) for the existing boat ramp basin breakwater configuration. Representative conditions which generated transport rates along the south-east shore most consistent with historical estimates (4000–6000 m^3 annually) were selected for option analysis in Stage 3. Further calibration of the MIKE21 sediment transport module was completed in Stage 2.
- **Stage 3**: The existing and three proposed breakwater extension options were analysed in Stage 3 of the study, utilising forcing conditions identified in Stage 2. The impacts of the options on sedimentation in the vicinity of the boat ramp basin entrance and breakwater head, three small environmentally sensitive areas north of the breakwater, and south Jetty Beach, were investigated.

1.4 Sediment transport modelling software, assumptions and limitations

Modelling was undertaken in this investigating using DHI's industry-recognised MIKE21 software package. The MIKE21 package provides for coupled wave, current and sediment transport modelling, where instantaneous interaction of each component is resolved for each timestep. Wave modelling was completed using MIKE21's spectral wave (SW) module, a phase-averaged approach which models wave transmission by calculating the parameterised wave spectrum throughout the domain for each timestep. MIKE21's hydrodynamic (HD) module was used to model currents, which determines current dispersion by solving conservation of mass and momentum equations, and considering the radiation stresses produced by the wave field. Sediment transport was calculated using MIKE21's sediment transport (SD) module.

Key assumptions of the modelling methodology, and limitations of the modelling software, are discussed below:

- Tidal currents were deemed to be an insignificant factor on sediment transport responses around the boat ramp basin. Therefore, tidal variation was excluded from the model to reduce computation time and model convergence problems.
- Wave conditions at the model boundary (approximately 400 m offshore of the entrance to Coffs Harbour) were determined using outputs from the NSW Nearshore Wave Forecast Tool. The directional spreading index (the parameter relating the distribution of wave energy across directional spectrum) was assumed to be 10, a typical value for a primarily swell-driven wave climate.
- Although MIKE21's spectral wave module can include diffraction effects, phase-resolving models such as SW are not generally considered less accurate (biased to underestimation) for modelling diffraction than phase-resolving models such as Boussinesq wave modelling. Therefore, diffraction of waves around the head of the boat ramp breakwater, and subsequently the transport of sediment into the breakwater lee, may be underestimated. Furthermore, inclusion of diffraction in a coupled (simultaneously resolved) wave and current model caused the model not to converge. Therefore, waves and currents were modelled separately. Waves were modelled initially with diffraction effects included, and subsequently currents were modelled using radiation stresses from the resolved wave field. The effects of wind was included in both wave and current modelling. The sediment transport results of modelling wave and currents separately, with diffraction included, was compared to that of a fully coupled wave and current model without diffraction. The results were similar throughout the model, with increased diffraction occurring in the first approach. As such, this approach (modelling waves and currents separately, and then modelling sediment transport using the output wave and current fields) was adopted.
- Given this modelling approach, the evolution of the seabed level (due to sediment transport) did not feedback into recalculation of the wave and current field. The breakwater extension option analysis utilised the transport and accretion rates relating to the existing bathymetry, rather than analysing long-term shoal and shoreline morphology.

- A minimum depth of –2 m AHD was applied to the modelling domain (i.e. ‘shallow’ areas were set to –2 m) to reduce computation time and model convergence problems. This approach was taken due to the inability of spectral wave models to accurately simulate wave breaking, runup behaviour and current generation in shallow water. Furthermore, depths below –2 m only occurred adjacent to Jetty Beach and assuming a depth cut-off in these areas was assessed to not impact sediment transport regimes investigated in this study.
- The spectral wave module assumes land boundaries to be fully absorbent. This may cause the model to underpredict sediment transport along the southern shoreline, and breakwater face, to the east of the boat ramp basin breakwater.
- The phase-averaging nature of SW (spectral wave) modelling does not incorporate seiching (resonance-induced long waves) which has been shown to occur within Coffs Harbour. Seiching may be a significant factor in transporting sediment from the shoal at the breakwater head to within the boat ramp basin.

Image: Google Earth 2012

COFFS HARBOUR
LOCATION MAP

Manly
Hydraulics
Laboratory

Report MHL2784

Figure

1.1

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2 Coffs Harbour sediment dynamics

2.1 Previous studies

Coffs Harbour has been experiencing ongoing long-term sediment accretion since the harbour construction was practically completed in 1946, following the construction of the southern breakwater (causeway between South Coffs Island and the mainland), eastern and northern breakwaters (**Figure 1.1**). A number of previous investigations have identified that the harbour is infilling as a result of the net northward littoral drift of sediment along this part of the NSW coastline. Furthermore, as the north sediment transport mechanism is interrupted by the harbour, a sediment deficit is present to the north of Muttonbird Island, resulting in the long-term recession of Park Beach. Periodic dredging of the harbour has been undertaken since the late 1980s to maintain navigability and vessel safety within Coffs Harbour, although the overall process of harbour infilling has not been prevented, and Park Beach has experienced episodic erosion hazards in between harbour dredging campaigns (MHL 2015).

In 2015 MHL was commissioned by the Department of Primary Industries – Lands to undertake a study on sand management options for Coffs Harbour. This work was published in Report MHL2371, *Coffs Harbour Sand Management Study Stage 1* (MHL 2015). As part of this study a comprehensive literature and data review was undertaken to collate all available information on sediment transport within Coffs Harbour and environs. The following publications were reviewed:

- *A Coastal Process Investigation, Coffs Harbour, NSW*, Lord and van Kerkvoort, 5th Australian Conference on Coastal and Ocean Engineering, 1981
- *Coffs Harbour Boat Harbour Siltation Investigation*, Australian Water and Coastal Studies, Report AWACS 95/18, 1995
- *Coffs Harbour Port – Shoal Management Planning Program*, Coffs Harbour Working Party, 2002
- *Specialist Coastal Engineering Advice for Harbourside Project – Coffs Harbour*, University of NSW, Water Research Laboratory, Technical Report 2005/21, 2005
- *Feasibility Study of the Extraction of Marine Sand from the Outer Harbour at Coffs Harbour*, NSW Public Works, 2010
- *Coffs Harbour Sediment Transport Modelling and Investigation*, McAvoy, Water Technology, Griffith University, 2011
- *Coffs Harbour Coastal Processes and Hazards Definition Study,* BMT WBM, 2011
- *Coffs Harbour Boat Ramp Seiche Assessment*, Water Technology/Geolink, 2012
- *Coffs Harbour Coastal Zone Management Plan*, BMT WBM, 2013.

Based on the information drawn from the above studies, MHL (2015) documented a conceptual coastal processes model for the Coffs Harbour region. **Figure 2.1** presents the estimated sediment budget of Coffs Harbour and environs including, where available, some of the uncertainties associated with the sediment transport rate quantities.

The long-term average rates of sediment transport in geographical order from south to north as summarised by MHL (2015) are:

- up to 75,000 m^3/year northward littoral drift along Boambee Beach
- approximately 20,000 m^3/year contributing to the accretion of North Boambee Beach and approximately 30,000 m^3/year accreting offshore to the south of South Coffs Island
- 30,000 m^3/year transported along the outside of the Coffs eastern breakwater (from the 30,000 m^3/year being deposited offshore of South Coffs Island)
- 20,000–25,000 m^3/year entering the main harbour (within a range of 5,000–130,000 m^3/year)
- 5,000–10,000 m^3/year accreting to the south of the bedrock reef of Muttonbird Island
- 10,000–20,000 m^3/year bypassing Macauleys Headland resulting in a long-term sediment deficit of 10,000–20,000 m^3/year on Park Beach.

The sediment transport path of primary interest to this investigation is along the southern breakwater (causeway) that passes (and migrates into) the entrance to the boat ramp basin and on to the southern end of Jetty Beach (**Figure 2.2)**. AWACS (1995) estimated the sediment transport rate along the eastern and southern breakwaters to be 5,700 m^3/year. This transport rate was based on:

- dredging records for the boat ramp basin region obtained from Coffs Harbour City Council (500 m^3/year)
- the rates of accretion of Jetty Beach as determined by photogrammetric analysis by the Public Works Department (1,800 m^3/year)
- the rates of accretion in the near offshore region of Jetty Beach identified through isopach analysis (3,400 m^3/year).

Coffs Harbour City Council dredge records in the vicinity of the boat ramp basin between 2009 and 2019 indicate average infilling of approximately 3,300 m^3/year, rather than 500 m^3/year as considered in the AWACS (1995) report. This increased annual dredge volume could be due to a wider dredge regime resulting in reduced offshore accretion (third dot point above).

The sediment transport rate of 5,700 m^3/year agreed favourably with numerical modelling undertaken by AWACS (1995) using the UNIBEST sediment transport model which estimated a transport rate of 6,000 m^3/year.

It is considered that this transport rate has not significantly changed over the past 20 years and is currently estimated to be 4,000–6,000 m^3/year as shown in **Figure 2.2**.

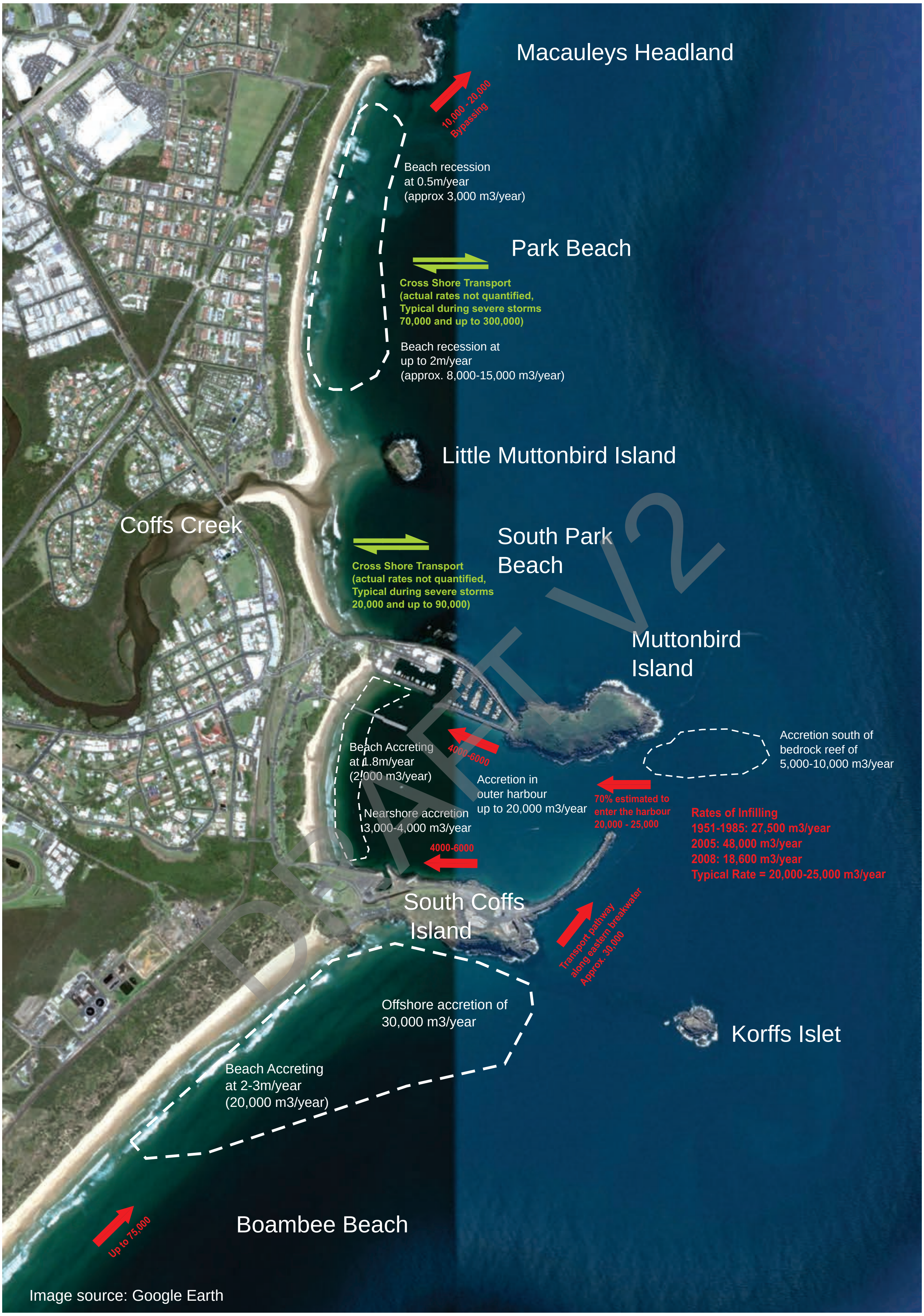
2.2 Jetty Beach

The previous studies on sediment transport in and around Coffs Harbour outlined in **Section 2.1** estimate the current rate of subaerial accretion of Jetty Beach is around 1.1 m/year. This accretion is the result of approximately 2,000 m^3/year of sand accumulating on the subaerial beach and in excess of 3,000 m^3/year of sand being deposited immediately offshore of the beach (MHL 2015). Based on the previous studies outlined in **Section 2.1**, the current understanding of the sediment transport budget within Coffs Harbour and Jetty Beach is provided in **Figure 2.2**.

The dynamics and long-term accretion of Jetty Beach since 1942 can be observed using the Office of Environment and Heritage NSW Beach Profile Database (OEH 2020). The database utilises extensive aerial imagery data acquired by the NSW Government and comprises over 10,000 survey transects along the NSW 990 km sandy beach coastline, dating back to the 1930s at some locations. Through the use of stereo-photogrammetric techniques the aerial photography has been processed into profiles along the NSW coast. Representative transects along the beaches are typically at a spacing of 20 to 200 m with transect location kept constant across survey dates. Point density along the transects varies but is typically from 10 to 20 points per profile (Harrison et al. 2017).

The location of eight selected profiles from the NSW Beach Profile Database along the length of Jetty Beach are shown on **Figure 2.3** and the beach profiles presented in **Figure 2.4** and **Figure 2.5**. The seaward progression of Jetty Beach, particularly since the 1973 and 1977 profiles, is clearly evident in all beach profiles.

Any extension of the boat ramp entrance breakwater will interrupt the existing sediment transport pathway along the Coffs Harbour southern shoreline. In addition, the wave climate in the lee of a longer breakwater and the southern end of Jetty Beach will be modified, potentially resulting in change of the rate of sand deposition on the beach and a realignment of the southern section of Jetty Beach. The sediment transport modelling undertaken for this study aims to assess such changes to the sediment dynamics and any potential impact on Jetty Beach.



Source: MHL (2015)

GROSS TRANSPORT (m3/yr)

LONG-TERM AVERAGE NET TRANSPORT (m3/yr)

NSW GOVERNMENT

COFFS HARBOUR LOCAL SEDIMENT BUDGET

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Figure

2.1

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Source: Google Earth 2020

COFFS HARBOUR
SEDIMENT TRANSPORT PATHS AND BUDGET

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Report MHL2784

Figure
2.2

DRAWING 2784-02-02.cdr

Source: Google Earth 2020

NSW GOVERNMENT

NSW BEACH PROFILE DATABASE
SELECTED JETTY BEACH PROFILE

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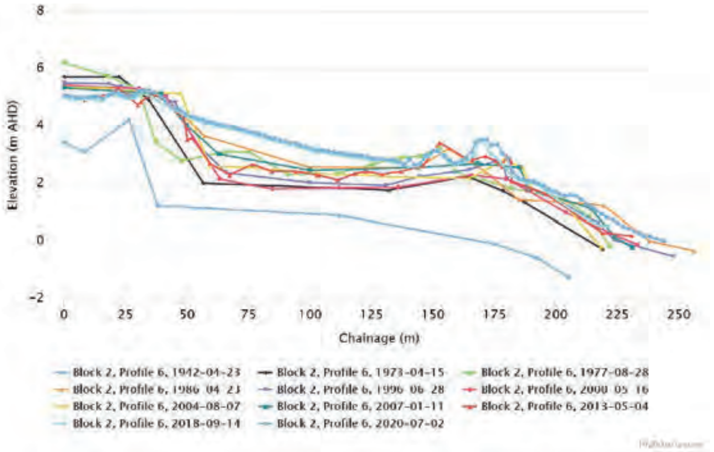
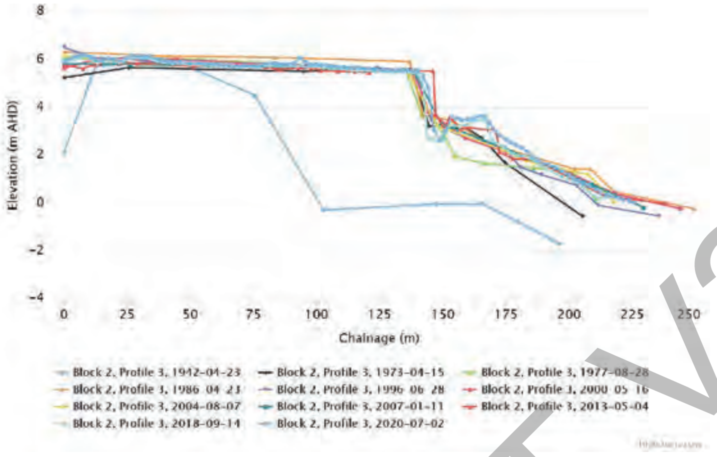
Figure

2.3

DRAWING 2784-02-03.cdr

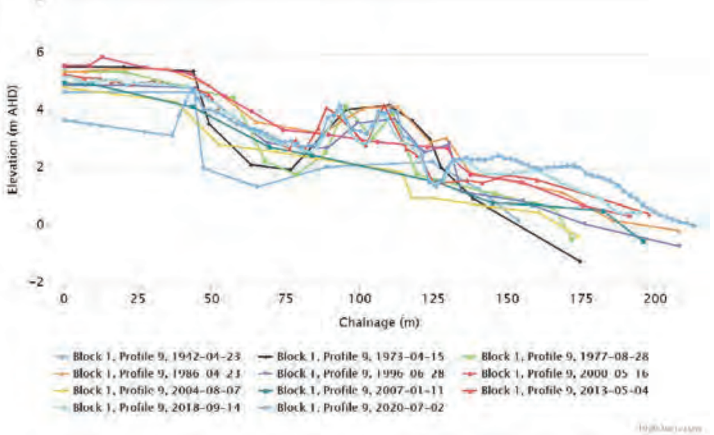


Block 2 Profile 6



Block 2 Profile 3

Block 2 Profile 1



Block 1 Profile 9

Source: NSW Beach Profile Database (2020) www/nswbpd.wrl.unsw.edu.au

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JETTY BEACH 1942–2020
NORTHERN BEACH CROSS-SECTIONS

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Figure
2.4

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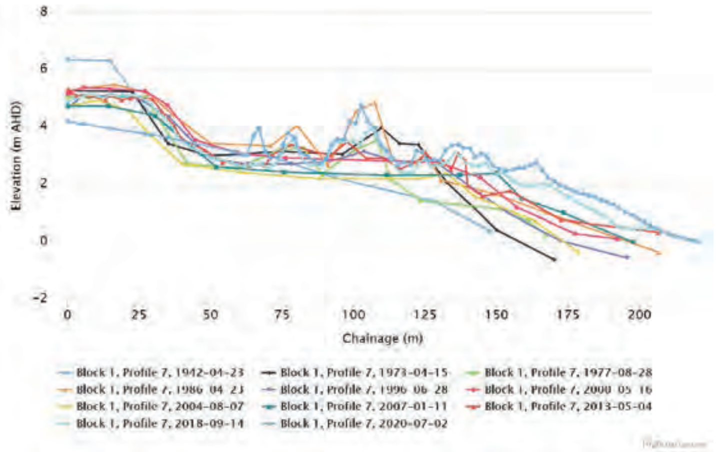
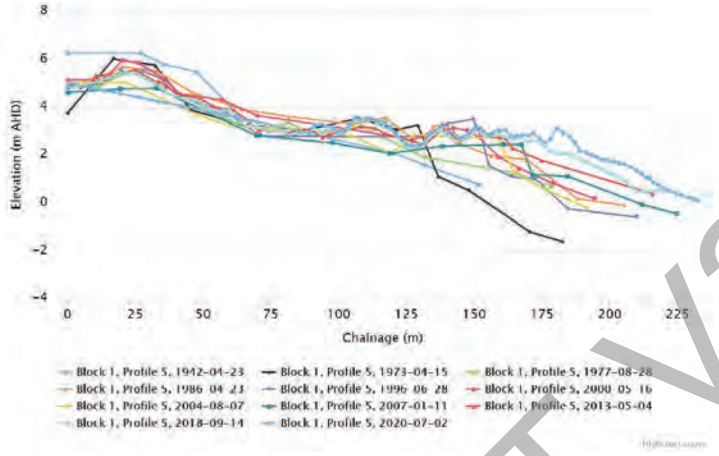
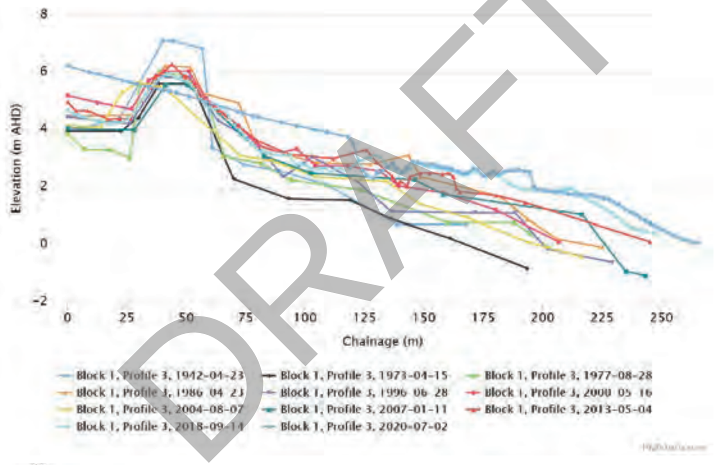
Block 1 Profile 7



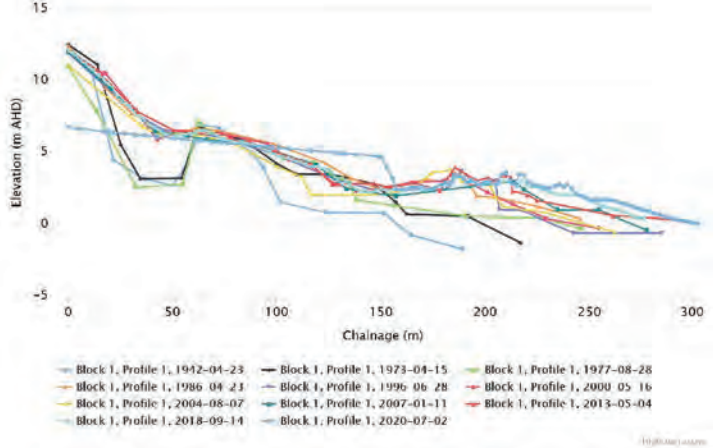
Block 1 Profile 5



Block 1 Profile 3



Block 1 Profile 1



Source: NSW Beach Profile Database (2020) www/nswbpd.wrl.unsw.edu.au

JETTY BEACH 1942–2020
SOUTHERN BEACH CROSS-SECTIONS

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Report MHL2784
Figure
2.5

DRAWING 2784-02-05.cdr

3 Offshore and nearshore wave climates

3.1 Offshore wave climate

3.1.1 Coffs Harbour Waverider buoy

The Coffs Harbour offshore wave climate has been monitored since May 1976 by a Waverider buoy moored in a water depth of 72 m about 12 km east-south-east off the entrance to Coffs Harbour. The Waverider buoy is operated by MHL for the Department of Planning, Industry and Environment Climate Change and Sustainability Division. In February 2012, the Waverider buoy was upgraded to a Directional Waverider buoy to provide information on the directional wave climate at Coffs Harbour. To date over 280,000 hourly data records have been recorded at the Waverider buoy station.

The Coffs Harbour regional offshore wave climate is summarised in **Section 3.1.2**.

3.1.2 Average offshore wave conditions

Wave height: The significant wave height (Hsig) exceedance probability since the Coffs Harbour Waverider buoy was commissioned in May 1976 is presented in **Figure 3.1**. The annual average Hsig is 1.57 m with an average monthly minimum wave height of 1.44 m occurring in December, and an average monthly maximum wave height of 1.71 m occurring in June. This seasonality in average wave height is not so apparent for the recorded maximum Hsig statistics, with the lowest maximum Hsig of 5.40 m being recorded in September and the highest Hsig of 7.37 m being recorded in June. The breakdown of monthly statistics in **Figure 3.1 (b)** also shows that severe storm events in which the Hsig exceeds 6 m can occur during most months of the year.

Wave period: **Figure 3.2** presents the occurrence probability for the peak spectral wave period (TP1) for the Coffs Harbour Waverider station. The wave period occurrence ranges from 3 to 19 seconds but typically is between 8 and 12 seconds, with an average period of 9.65 seconds. Like wave height, some seasonality is also displayed in the wave period distribution with an average TP1 during the winter months being around 10.3 seconds and during summer being about 9.1 seconds.

The percentage joint occurrence of wave height (Hsig) and wave period (TP1) is presented in **Figure 3.3 (a)**. The most frequent joint occurrence is for wave height and wave period is for waves from 1–1.5 m with a wave period from 8–10 seconds occurring approximately 13% of the time.

Wave direction: Wave direction data is available since February 2012 when a Directional Waverider buoy replaced the original non-directional buoy at Coffs Harbour. The percentage joint occurrence of wave height (Hsig) and principal wave direction (wave direction at TP1) is presented in **Figure 3.3 (b)**. The most frequent wave directions are typically from the south-east to south-south-east quadrant, with waves recorded over 46% of the time from these directions. This result is best illustrated by the wave height and wave direction rose plot in **Figure 3.4**.

The seasonal wave height and wave direction rose plots are presented in **Figure 3.5**. The seasonal rose plots clearly show the difference in wave direction distribution between the seasons, particularly between winter and summer. In winter, larger waves from the south-east to south-south-east sector dominate, while during the summer months the waves are typically lower and approach mainly from the east to east-south-east sector.

3.2 Nearshore wave climate

3.2.1 NSW Nearshore Wave Forecast Tool

The NSW Government's NSW Nearshore Wave Forecast Tool was used to investigate the wave climate at the entrance to Coffs Harbour, and to identify representative forcing conditions for the model. The tool provides transformed wave data based on offshore wave conditions from the NSW Waverider buoy network and NOAA WAVEWATCH III model at 10 m and 30 m contour locations along the NSW coast. **Figure 3.6** shows a screenshot of the tool's webpage, indicating the output location from which nearshore conditions (outside of the harbour entrance) were adopted.

3.2.2 Average nearshore wave conditions

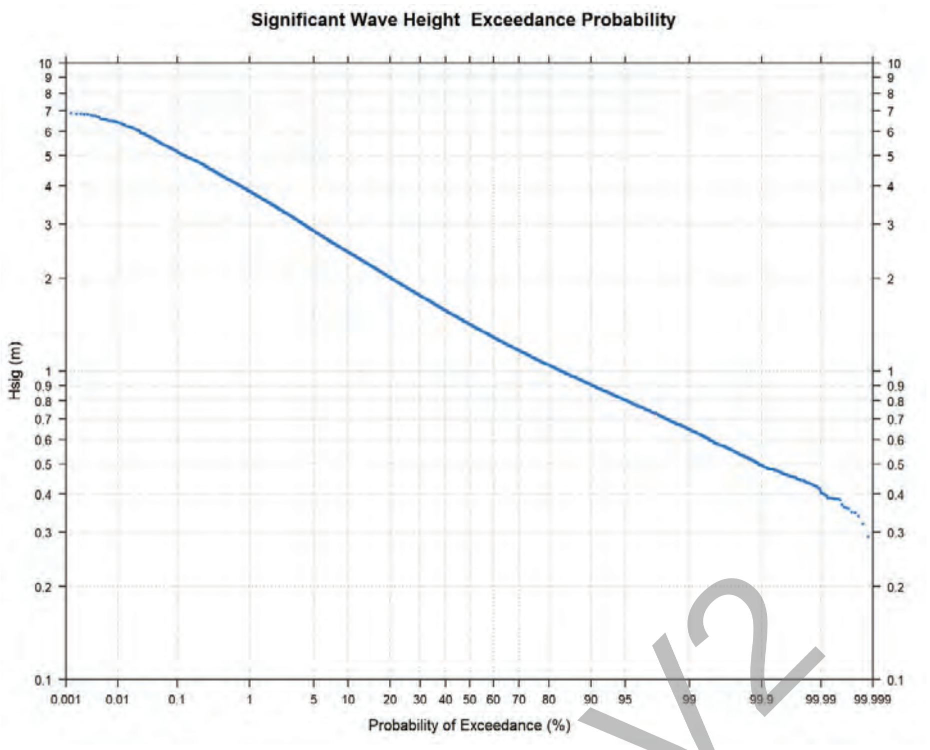
Figure 3.7 (a) presents the annual directional wave rose for five years (2013–2018) of historical data extracted from the NWFT at the harbour entrance. **Figure 3.7 (b)** provides the joint frequency distribution of significant wave height, peak wave period and mean wave direction for the outputs. **Figure 3.8** presents the summer and winter joint frequency distribution analysis for the location. Each joint distribution plot indicates the representative forcing conditions selected in Stage 2 of the sediment transport modelling (see **Section 5.5**).

Wave height: From the five years of historical NWFT outputs analysed, the median significant wave height during summer months was 1.13 m, while the median for winter months was 1.16 m. The 95th percentile significant wave height was 2.18 m for summer months and 2.39 m for winter months. These observations are consistent with the larger offshore wave heights observed in winter months being dissipated by depth-limited wave breaking.

Wave period: The median peak wave period during summer months was 9.2 s, while the median for winter months was 10 s. More longer period events (13–18 seconds) were observed in winter months as expected, with increased storm events occurring in winter. Furthermore, milder waves conditions were observed in summer months with a period of 5–7 seconds emanating from an east to east-north-east direction (**Figure 3.8 (a)**).

Wave direction: Refraction of offshore waves towards coastline normalcy (i.e. tendency towards an eastly direction) is observed in the nearshore directional wave rose. In winter months waves tended to be from the south-easterly direction, consistent with the south-easterly to south-south-easterly offshore direction during those months. Summer months emanated from an east to east-south-easterly direction consistent the observed prevalent offshore directions. Furthermore, summer months exhibited increased spread in their directional distribution, with more mild conditions emanating from the east-north-east.

Nominated Start/Finish: 26-May-1976 to 31-December-2019
Record Length: 43.60 years No. of Records: 280,575
Data Capture: 86.00 %



a) Significant wave height exceedance probability

Percentage Exceedance for Hsig (m)

	Monthly Exceedance Probability												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Hsig (m)													
0.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	**100.000**
0.50	99.95	99.99	99.98	99.91	99.79	99.85	99.83	99.80	99.98	99.97	99.75	99.89	**99.893**
1.00	81.74	85.45	89.06	87.20	84.51	84.75	83.32	78.67	82.16	83.09	82.58	80.35	**83.567**
1.50	40.62	47.20	53.28	50.33	51.91	52.55	48.53	41.05	40.18	38.49	38.82	34.85	**44.739**
2.00	17.53	22.29	23.44	24.40	25.74	28.29	23.94	19.45	16.73	16.61	16.14	13.60	**20.619**
2.50	6.83	9.62	10.22	10.80	11.15	13.26	11.46	8.53	7.41	6.69	7.15	5.01	**8.987**
3.00	2.37	4.28	4.88	4.99	4.64	6.56	5.04	4.08	2.90	2.72	3.13	2.16	**3.963**
3.50	1.07	1.93	2.17	2.19	2.34	3.52	1.94	1.90	1.20	1.08	1.28	0.90	**1.783**
4.00	0.45	0.94	0.87	0.85	1.39	1.78	0.61	0.76	0.36	0.41	0.48	0.38	**0.766**
4.50	0.17	0.39	0.36	0.29	0.75	0.87	0.21	0.36	0.10	0.11	0.21	0.13	**0.327**
5.00	0.11	0.16	0.09	0.08	0.37	0.40	0.09	0.16	0.02	0.02	0.07	0.03	**0.131**
5.50	0.05	0.10	0.04	0.01	0.11	0.21	0.05	0.08	0.00	0.00	0.01	0.01	**0.055**
6.00	0.03	0.05	0.01	0.00	0.03	0.11	0.03	0.04	0.00	0.00	0.00	0.00	**0.025**
6.50	0.01	0.01	0.00	0.00	0.00	0.06	0.01	0.00	0.00	0.00	0.00	0.00	**0.008**
7.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	**0.001**
7.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.000**
Monthly Statistics													
Minimum	0.46	0.47	0.29	0.26	0.34	0.38	0.40	0.44	0.38	0.44	0.36	0.29	**0.26**
Average	1.50	1.61	1.68	1.66	1.67	1.71	1.63	1.53	1.50	1.50	1.50	1.44	**1.57**
Maximum	6.95	6.87	6.21	6.22	6.51	7.37	6.84	6.61	5.40	5.69	6.03	5.80	**7.37**
Number of Data Points Used for Statistical Analysis													
No. Points	22,794	21,160	22,567	22,003	23,810	22,528	24,047	24,998	25,354	25,160	22,948	23,206	**280,575**
Percent Capture Based on Nominated Start/Finish													
% Capture	82.78	85.31	83.62	80.90	86.26	83.82	86.94	90.40	93.21	87.95	85.77	84.62	**86.00**

b) Monthly significant wave height exceedance probability

NSW GOVERNMENT

COFFS HARBOUR WAVERIDER BUOY
SIGNIFICANT WAVE HEIGHT EXCEEDANCE

Manly Hydraulics Laboratory

Report MHL2784
Figure
3.1

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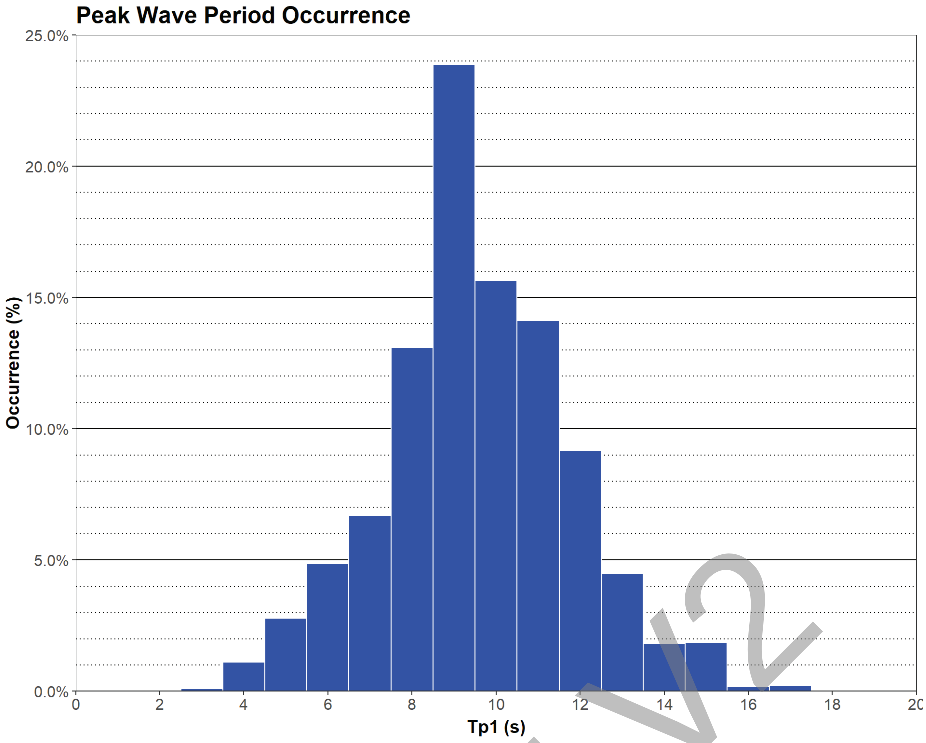
Nominated Start/Finish: 26-May-1976 to 31-December-2019
Record Length: 43.60 years   No. of Records: 280,575
Data Capture: 86.00 %



a) Peak wave period occurrence histogram

Percentage Occurrence for Peak Wave Period

	Monthly Occurrence Probability												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Tp1 (s)													
2.00- 3.99	0.47	0.31	0.18	0.20	0.12	0.24	0.30	0.43	0.60	0.75	0.62	0.53	**0.402**
4.00- 5.99	7.67	3.98	2.88	2.63	1.63	2.20	2.61	5.20	7.66	10.95	9.52	9.76	**5.624**
6.00- 7.99	20.68	14.57	14.06	12.87	10.42	11.31	9.54	10.63	15.59	18.87	21.05	23.49	**15.241**
8.00- 9.99	38.87	41.33	40.74	37.92	32.57	31.09	30.28	27.94	30.41	29.87	33.18	33.62	**33.793**
10.00- 11.99	23.81	26.89	25.62	29.76	33.12	31.70	30.02	31.20	26.62	25.39	23.06	23.28	**27.560**
12.00- 13.99	7.35	11.59	14.25	14.75	18.79	20.31	23.15	20.50	16.23	12.38	11.60	8.78	**15.062**
14.00- 15.99	0.84	1.20	2.02	1.47	2.62	2.62	3.31	3.40	2.57	1.42	0.80	0.47	**1.920**
16.00- 17.99	0.30	0.13	0.23	0.38	0.68	0.51	0.74	0.68	0.32	0.36	0.17	0.05	**0.384**
18.00- 19.99	0.00	0.00	0.02	0.02	0.05	0.03	0.04	0.01	0.00	0.01	0.00	0.00	**0.015**
	Monthly Statistics												
Minimum	2.60	2.80	3.00	3.00	3.01	2.50	2.30	2.70	2.90	2.90	2.60	2.90	**2.30**
Average	9.01	9.52	9.72	9.83	10.24	10.21	10.37	10.17	9.62	9.16	9.07	8.88	**9.65**
Maximum	17.44	17.14	19.70	19.70	19.79	19.79	19.79	19.79	17.44	19.79	17.44	17.14	**19.79**
	Number of Data Points Used for Statistical Analysis												
No. Points	22,794	21,160	22,567	22,003	23,810	22,528	24,047	24,998	25,354	25,160	22,948	23,206	**280,575**
	Percent Capture Based on Nominated Start/Finish												
% Capture	82.78	85.31	83.62	80.90	86.26	83.82	86.94	90.40	93.21	87.95	85.77	84.62	**86.00**

b) Monthly peak wave period occurrence probability

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COFFS HARBOUR WAVERIDER BUOY
PEAK WAVE PERIOD OCCURRENCE

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Report MHL2784
Figure
3.2

DRAWING 2784-03-02.cdr

Nominated Start/Finish: 26-May-1976 to 31-December-2019
Record Length: 43.60 years   No. of Records: 280,575
Data Capture: 86.00 %

Percentage Joint Occurrence for Significant Wave Height and Peak Wave Period

	Tp1 (s)									
	2.00 to 3.99	**4.00 to 5.99**	**6.00 to 7.99**	**8.00 to 9.99**	**10.00 to 11.99**	**12.00 to 13.99**	**14.00 to 15.99**	**16.00 to 17.99**	**18.00 to 19.99**	**Total**
Hsig (m)										
0.00 to 0.49	0.00	0.00	0.01	0.02	0.04	0.03	0.01	0.00	0.00	**0.11**
0.50 to 0.99	0.24	1.10	2.95	5.32	3.60	2.60	0.42	0.09	0.00	**16.32**
1.00 to 1.49	0.15	3.38	6.67	13.54	9.30	4.91	0.71	0.15	0.01	**38.82**
1.50 to 1.99	0.00	1.05	3.80	8.50	7.08	3.27	0.36	0.06	0.00	**24.12**
2.00 to 2.49	0.00	0.09	1.43	3.99	4.02	1.86	0.20	0.04	0.00	**11.63**
2.50 to 2.99	0.00	0.00	0.33	1.67	1.88	1.02	0.10	0.02	0.00	**5.02**
3.00 to 3.49	0.00	0.00	0.05	0.55	0.89	0.64	0.04	0.01	0.00	**2.18**
3.50 to 3.99	0.00	0.00	0.00	0.16	0.44	0.38	0.03	0.00	0.00	**1.01**
4.00 to 4.49	0.00	0.00	0.00	0.04	0.17	0.20	0.02	0.00	0.00	**0.43**
4.50 to 4.99	0.00	0.00	0.00	0.01	0.07	0.10	0.02	0.00	0.00	**0.20**
5.00 to 5.49	0.00	0.00	0.00	0.00	0.03	0.04	0.01	0.00	0.00	**0.08**
5.50 to 5.99	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	**0.03**
6.00 to 6.49	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	**0.02**
6.50 to 6.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
7.00 to 7.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	Total Percentage									
Total %	0.39	5.62	15.24	33.80	27.54	15.08	1.92	0.37	0.01	**100.00**

a) Percentage joint occurrence for significant wave height and peak wave period

Percentage Joint Occurrence for Wave Direction and Significant Wave Height

		Hsig (m)														
		0.00 to 0.49	**0.50 to 0.99**	**1.00 to 1.49**	**1.50 to 1.99**	**2.00 to 2.49**	**2.50 to 2.99**	**3.00 to 3.49**	**3.50 to 3.99**	**4.00 to 4.49**	**4.50 to 4.99**	**5.00 to 5.49**	**5.50 to 5.99**	**6.00 to 6.49**	**6.50 to 6.99**	**Total**
Principal Wave Direction (°TN)																
N	*(348.75 - 11.24)*	0.00	0.10	0.12	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.25**
NNE	*(11.25 - 33.74)*	0.00	0.34	1.31	0.47	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**2.21**
NE	*(33.75 - 56.24)*	0.00	0.97	2.98	1.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**5.11**
ENE	*(56.25 - 78.74)*	0.01	1.60	3.04	0.83	0.14	0.06	0.03	0.03	0.01	0.02	0.01	0.02	0.01	0.01	**5.81**
E	*(78.75 -101.24)*	0.01	3.23	6.75	2.64	0.75	0.24	0.12	0.05	0.04	0.02	0.01	0.00	0.00	0.00	**13.87**
ESE	*(101.25 -123.74)*	0.04	3.39	6.83	3.02	0.93	0.29	0.14	0.06	0.02	0.01	0.01	0.00	0.00	0.00	**14.74**
SE	*(123.75 -146.24)*	0.02	3.35	8.62	4.59	1.98	0.58	0.30	0.13	0.04	0.01	0.01	0.00	0.00	0.00	**19.64**
SSE	*(146.25 -168.74)*	0.02	2.94	8.50	7.29	4.89	2.00	0.84	0.41	0.25	0.07	0.02	0.01	0.01	0.01	**27.24**
S	*(168.75 -191.24)*	0.00	0.50	2.16	2.88	2.07	1.12	0.53	0.17	0.08	0.02	0.02	0.01	0.00	0.00	**9.57**
SSW	*(191.25 -213.74)*	0.00	0.09	0.41	0.39	0.21	0.06	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	**1.22**
SW	*(213.75 -236.24)*	0.00	0.05	0.11	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.17**
WSW	*(236.25 -258.74)*	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.06**
W	*(258.75 -281.24)*	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**
WNW	*(281.25 -303.74)*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**
NW	*(303.75 -326.24)*	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**
NNW	*(326.25 -348.74)*	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.03**
		Total Percentage														
Total %		0.10	16.66	40.88	23.16	11.22	4.35	1.99	0.87	0.44	0.15	0.08	0.04	0.02	0.02	**100.00**

b) Percentage joint occurrence for wave direction and significant wave height

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COFFS HARBOUR WAVERIDER BUOY
JOINT WAVE HEIGHT, PERIOD AND DIRECTION
OCCURRENCE

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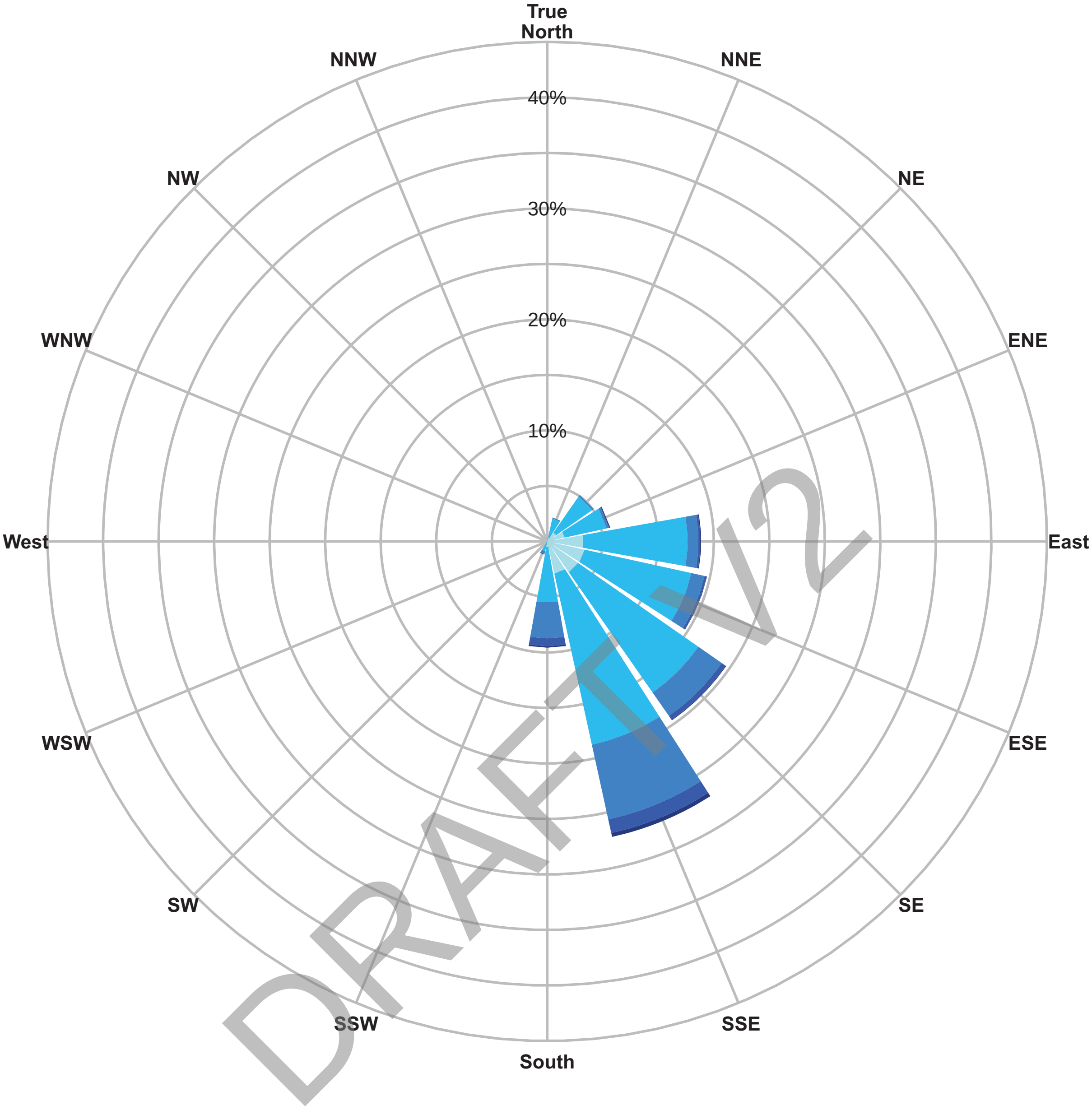
Figure
3.3

DRAWING 2784-03-03.cdr



Significant Wave Height vs. Direction Rose

Site: Coffs Harbour

Start: 14 December 2012

Finish: 30 December 2019

Record Length (yrs): 7.04

N° of Hourly Records: 56,470

Significant Wave Height (m)

■ 4 – 7
■ 3 – 4
■ 2 – 3
■ 1 – 2
■ 0 – 1

COFFS HARBOUR WAVERIDER BUOY
SIGNIFICANT WAVE HEIGHT vs. WAVE DIRECTION ROSE

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Manly Hydraulics Laboratory

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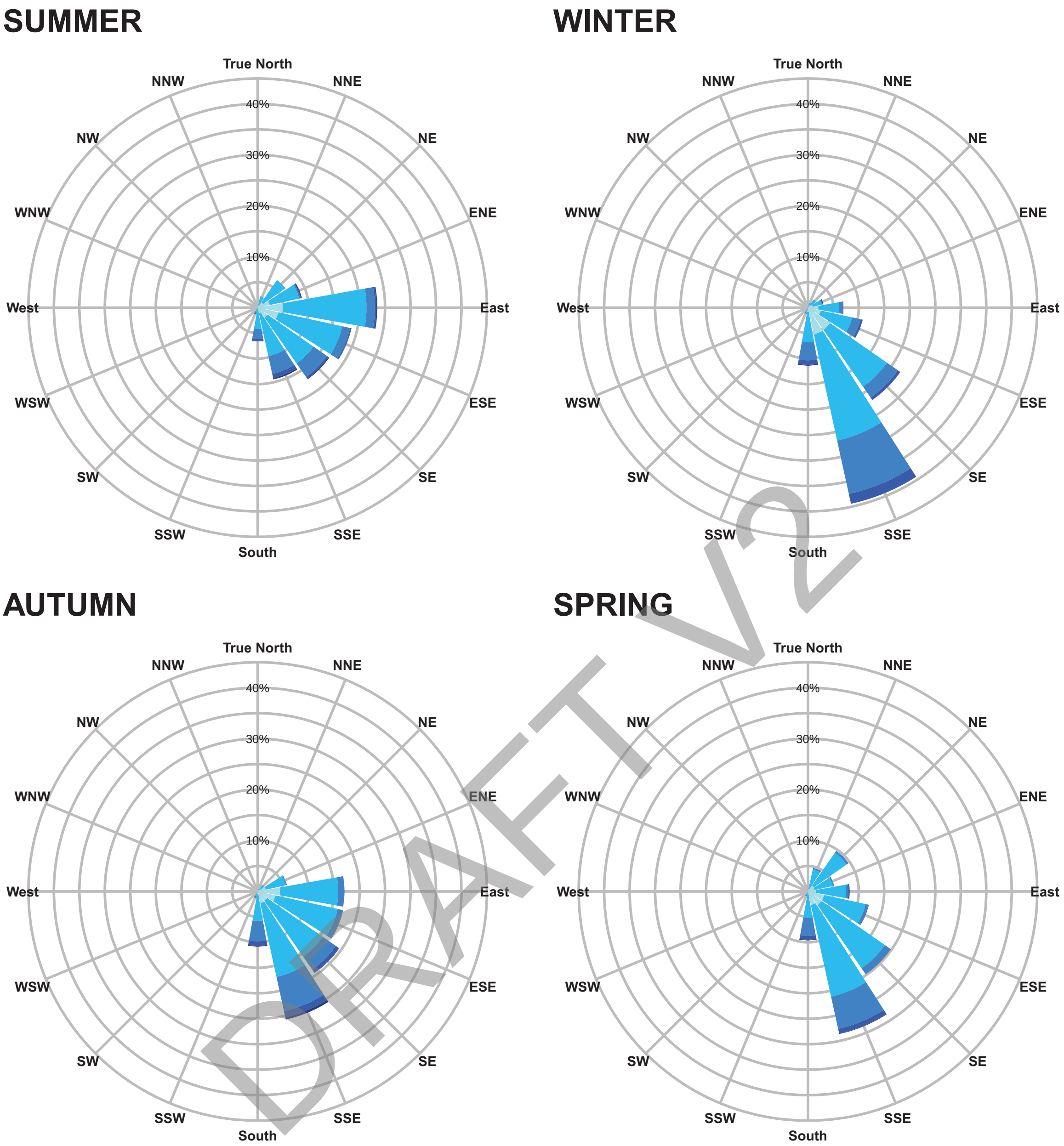
Figure
3.4

DRAWING 2784-03-04.cdr



Significant Wave Height vs. Direction Rose

Site: Coffs Harbour
Start: 14 December 2012
Finish: 30 December 2019
Record Length (yrs): 7.04
N° of Hourly Records: 56,470

Significant Wave Height (m)	
■	4 – 7
■	3 – 4
■	2 – 3
■	1 – 2
■	0 – 1

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COFFS HARBOUR WAVERIDER BUOY
SEASONAL SIGNIFICANT WAVE HEIGHT
vs. WAVE DIRECTION ROSE

Manly Hydraulics Laboratory

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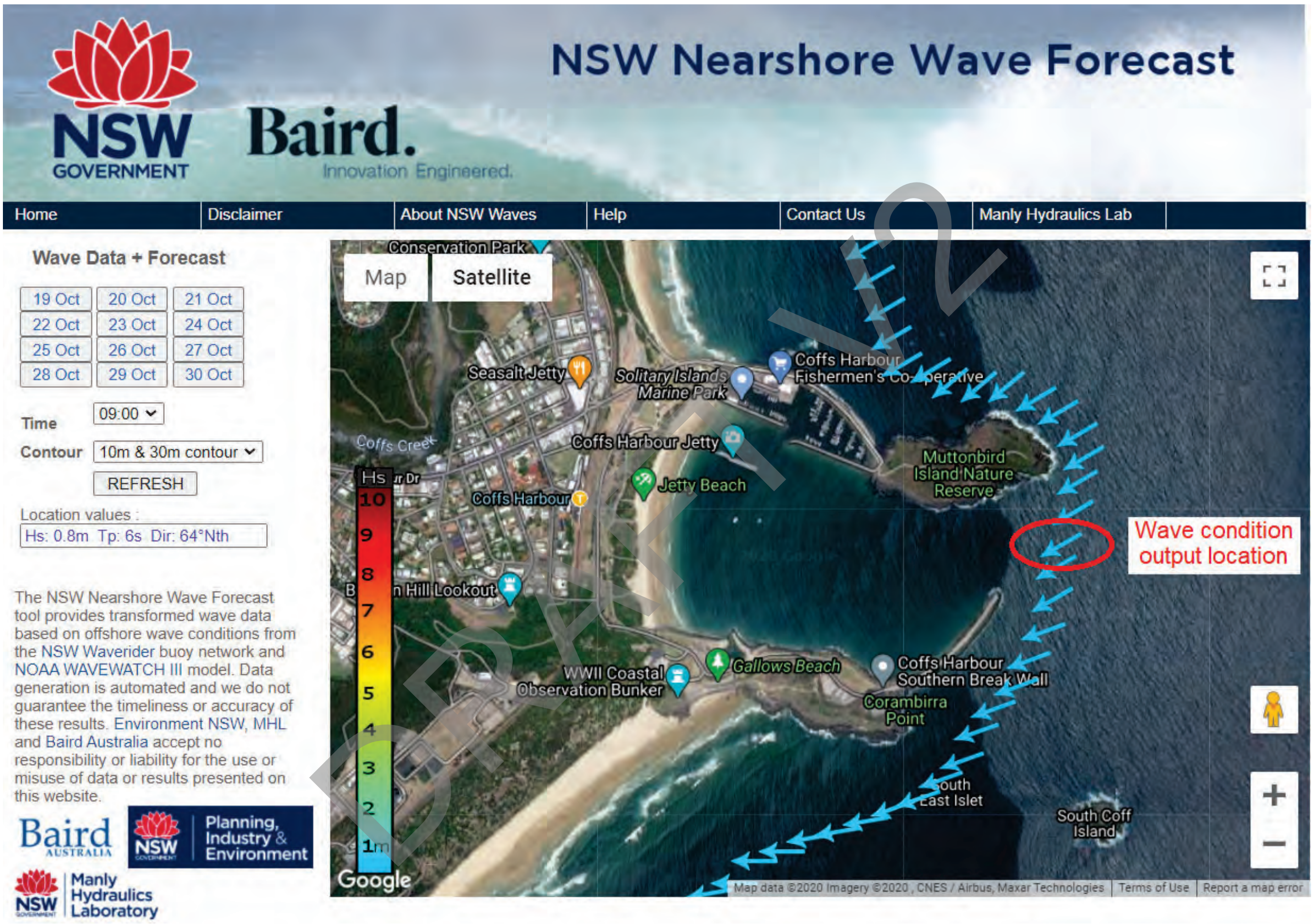
Figure
3.5

DRAWING 2784-03-05.cdr



Wave Data + Forecast

Time: 09:00

Contour: 10m & 30m contour

Location values :
Hs: 0.8m Tp: 6s Dir: 64°Nth

The NSW Nearshore Wave Forecast tool provides transformed wave data based on offshore wave conditions from the NSW Waverider buoy network and NOAA WAVEWATCH III model. Data generation is automated and we do not guarantee the timeliness or accuracy of these results. Environment NSW, MHL and Baird Australia accept no responsibility or liability for the use or misuse of data or results presented on this website.

Wave condition output location

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NSW NEARSHORE WAVE FORECAST
SCREENSHOT AND OUTPUT LOCATION

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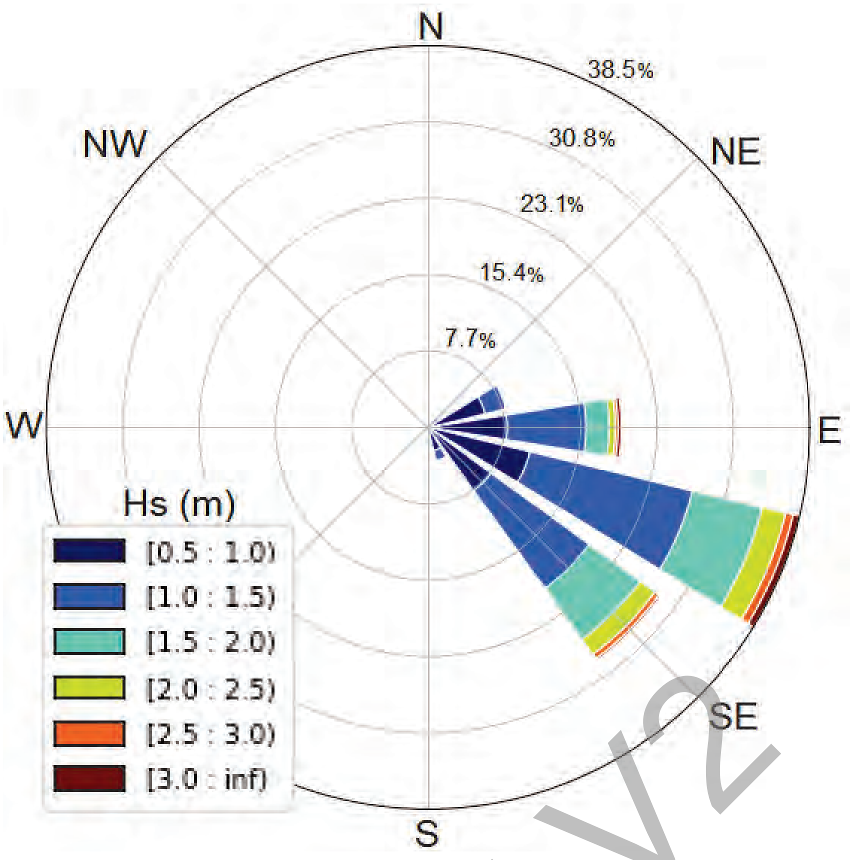
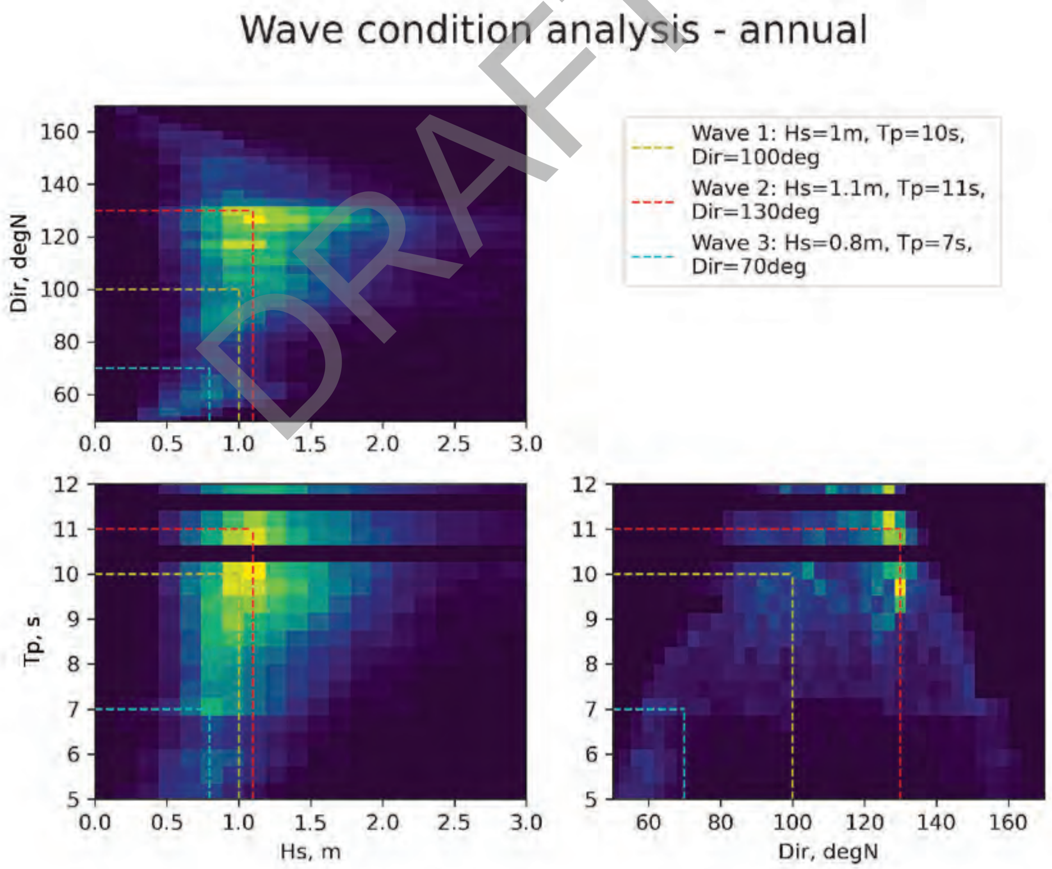
Figure
3.6

DRAWING 2784-03-06.cdr





NSW GOVERNMENT

ANNUAL NEARSHORE WAVE CLIMATE ANALYSIS

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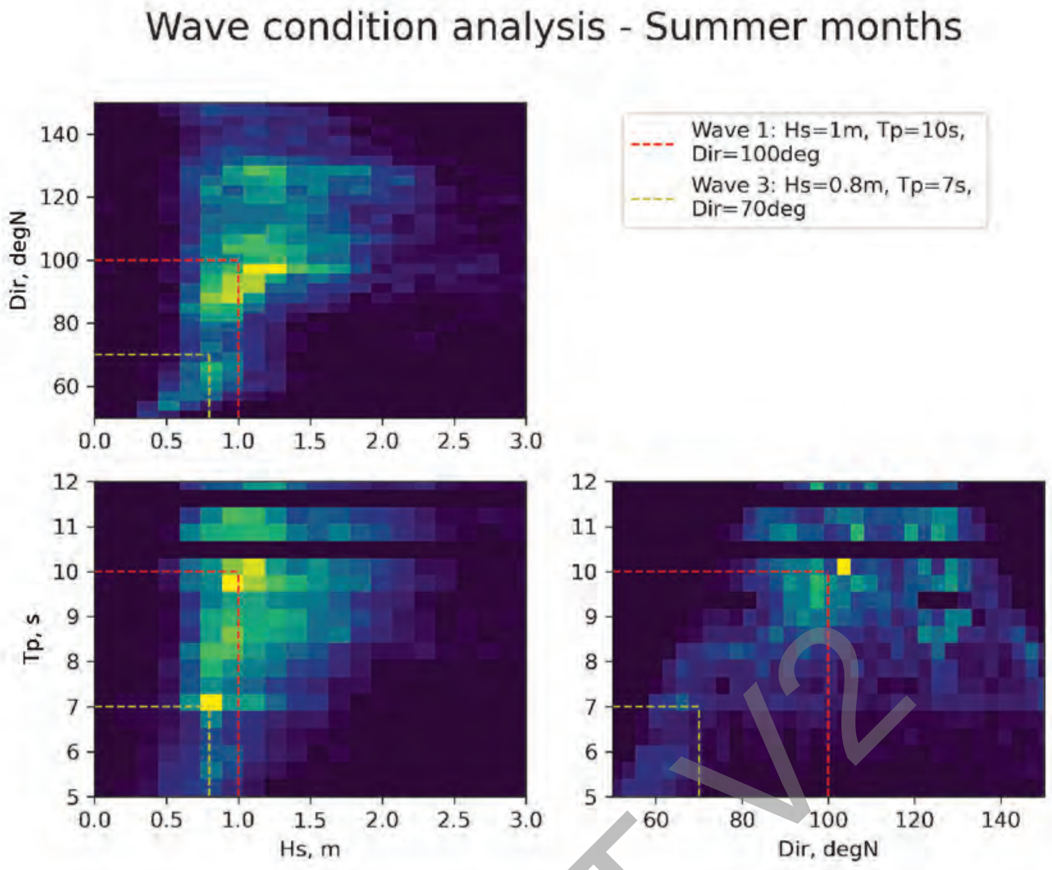
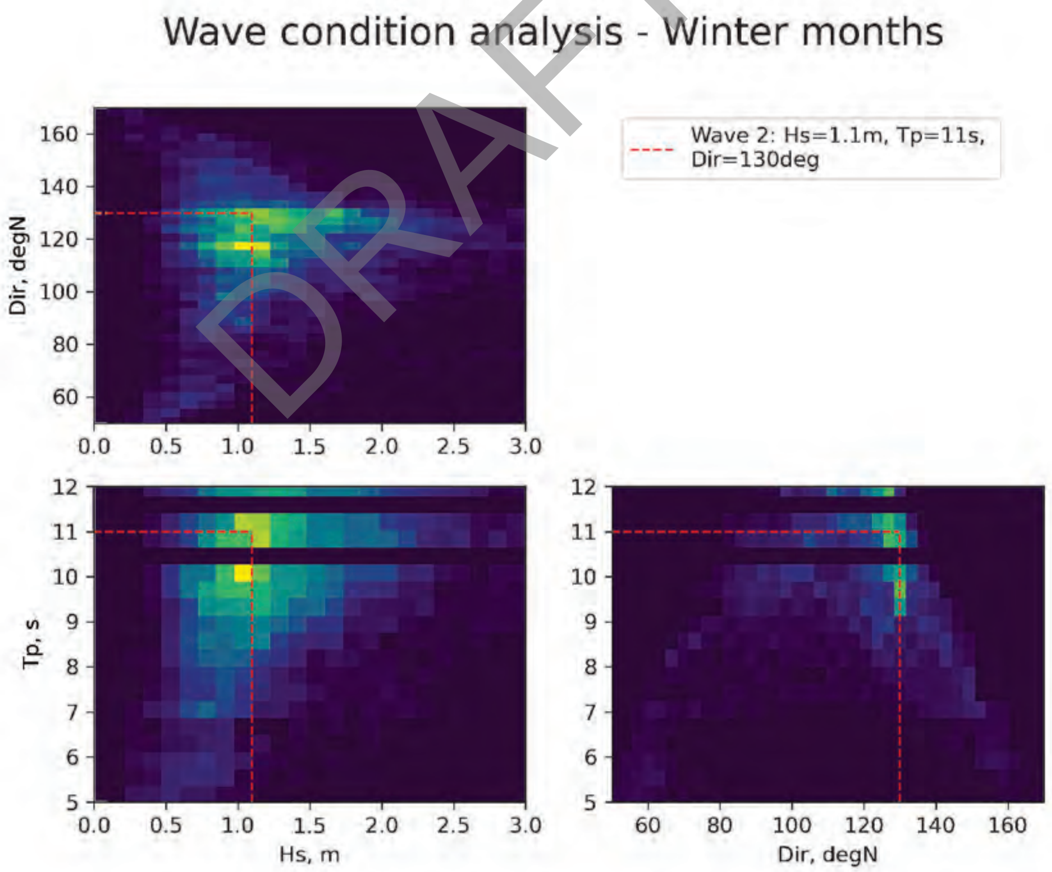
Report MHL2784

Figure

3.7

DRAWING 2784-03-07.cdr





NSW GOVERNMENT

SEASONAL NEARSHORE WAVE CLIMATE ANALYSIS

Manly Hydraulics Laboratory

Report MHL2784

Figure

3.8

DRAWING 2784-03-08.cdr

4 Sediment sampling and analysis

4.1 Coffs Harbour sediment sample locations

Sediment samples were collected from locations in Coffs Harbour to determine the grain size and basic sediment characteristics and to inform the sediment transport modelling component of the study. The sediment samples were collected by MHL personnel during two field visits on 20 August 2020 and 10 September 2020. Seventeen samples were collected with the location of each sample shown in **Figure 4.1**. The sediment samples were collected from several locations along Jetty Beach from both the middle of the beach berm and in the swash zone. Samples were also collected from shallow water off the Coffs Harbour southern shoreline and in the boat ramp basin and entrance channel. The spatial distribution of the sampling locations was selected to assess if there is any significant differences to the sand characteristics along Jetty Beach and if the beach sand differs from the sand being transported from the eastern breakwater along the southern shore of Coffs Harbour.

4.2 Particle size analysis

The Public Works Advisory Geotechnical Centre undertook analysis of the 17 samples to determine the particle size distribution for each sample. The laboratory is NATA-accredited for compliance with ISO/IEC 17025 and the test method applied was the *DPWS GM 9: Determination of the Particle Size Distribution of a Soil* which employs sieving of the samples to determine the particle size distribution based on the percentage of the sample material passing or retained by a number of different sized sieves. Effective and median grain sizes are required to describe a soil or sediment sample as a measure to comparatively describe grains that are not completely spherical or cubic (as is common in nature). Both the effective (D_{10}; where 10% of grains are smaller than the indicated diameter) and median (D_{50}; where 50% of grains are smaller than the indicated diameter) grain sizes are given where the effective grain size is commonly used to determine a soil's permeability and median grain size is used to estimate the sediment's settling (or fall) velocity. Particle size distribution results for each sample analysed are provided in **Appendix A** and are summarised in **Table 4.1**.

Table 4.1 Coffs Harbour sediment sample particle size analysis results

Sample number [1]	Sample location	Effective grain size D_{10} (mm)	Median grain size D_{50} (mm)	Uniformity coefficient D_{60} / D_{10}	Curvature coefficient $\frac{(D_{30})^2}{(D_{60} \times D_{10})}$
1	Jetty Beach south end beach berm	0.150	0.212	1.5	0.9
2	Jetty Beach south end swash zone	0.150	0.205	1.4	0.9
3	Jetty Beach 2nd south access berm	0.150	0.200	1.4	0.9
4	Jetty Beach 2nd south access swash	0.150	0.226	1.6	0.9
5	Jetty Beach 3rd south access berm	0.150	0.193	1.3	0.9

Sample number [1]	Sample location	Effective grain size D_{10} (mm)	Median grain size D_{50} (mm)	Uniformity coefficient D_{60} / D_{10}	Curvature coefficient $\frac{(D_{30})^2}{(D_{60} \times D_{10})}$
6	Jetty Beach 3rd south access swash	0.150	0.210	1.5	0.9
7	Coffs Harbour east south shore	0.100	0.178	1.8	1.2
8	Harbour east boat ramp breakwater	0.100	0.181	1.8	1.2
9	Centre of boat ramp basin	0.100	0.182	1.8	1.2
10	Boat ramp basin entrance channel	0.110	0.181	1.6	1.1
11	Jetty Beach south end offshore	0.110	0.181	1.6	1.1
12	Jetty Beach north end beach berm	0.100	0.170	1.6	1.2
13	Jetty Beach north end swash zone	0.100	0.175	1.6	1.1
14	Coffs Harbour Jetty beach berm	0.120	0.170	1.5	1.1
15	Coffs Harbour Jetty swash zone	0.100	0.175	1.7	1.2
16	Jetty Beach middle beach berm	0.150	0.192	1.2	0.9
17	Jetty Beach middle swash zone	0.150	0.275	1.8	0.9

[1] See **Figure 5.1** for sample location

In general, the particle distribution analysis showed little variation between the samples, with the effective grain size (D_{10}) ranging from 0.10 mm to 0.15 mm with a median grain size (D_{50}) between 0.170 mm and 0.275 mm. The particle size distribution curves for each sample included in **Appendix A** classify all samples as fine-medium sand and display a grading indicative of an active or mobile deposit within the sampled surface layer. The Uniformity Coefficient (C_u) and Curvature Coefficient (C_c) for the sediment samples in **Table 4.1** are used for engineering purposes to classify sands and gravels as poorly or well graded. All the Coffs Harbour sediment samples can be classified as poorly graded sand. Further details of the classification of sediment is documented in AS1726:2017.

A visual inspection of the samples using a magnifying lens indicated a high degree of similarity between the samples, with typically sub-angular particles and medium sphericity. The sand appears to be primarily quartz with an estimated shell content of 5 to 10% indicating a marine origin. There is also a small percentage of very fine dark grains present in most of the samples but it was not possible to identify the type of material through the visual examination. Photographs of selected samples from Jetty Beach berm, the swash zone, the boat ramp basin and the southern Coffs Harbour sediment transport pathway are shown in **Figure 4.2**. Using the particle size distribution curves included in **Appendix A**, a median grain size (D_{50}) of 0.2 mm and a grading coefficient of D_{85}/D_{15} of 2 was adopted for sediment transport modelling using MIKE21's ST software.

Source: Google Earth 2020

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COFFS HARBOUR
SAND SAMPLE LOCATIONS

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Figure
4.1

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Sample 12 - Jetty Beach north end berm


Sample 5 - Jetty Beach 3rd south access berm


Sample 2- Jetty Beach south end swash


Sample 11 - Jetty Beach south end offshore


Sample 9 - Centre boat ramp basin


Sample 7 - Coffs Harbour east south shore

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COFFS HARBOUR
SEDIMENT SAMPLE PHOTOGRAPHS

Manly Hydraulics Laboratory

Report MHL2784
Figure
4.2

DRAWING 2784-04-02.cdr

5 Sediment transport modelling

5.1 Previous studies

As noted in **Section 2.1** MHL (2015) included a comprehensive literature and data review to collate all available information on sediment transport in the Coffs Harbour region. Several previous studies have included numerical wave modelling within Coffs Harbour (Water Technology/Geolink 2012, 2014 and McAvoy (2011)), but only AWACS (1995) includes numerical sediment transport modelling within Coffs Harbour. As part of an investigation on siltation in the Coffs Harbour boat ramp basin AWACS (1995) carried out numerical modelling along the southern shoreline sediment transport pathway shown in **Figure 2.2** using the Delft Hydraulics UNIBEST sediment transport model.

Based on dredging records, photogrammetric analysis and accretion rates along Jetty Beach AWACS (1995) estimated the sediment transport rate along the Coffs Harbour southern shoreline to be 5,700 m^3/year. This result agreed favourably with the rate of 6,000 m^3/year obtained using the UNIBEST model.

5.2 Modelling package

Modelling was undertaken in this investigating using DHI's industry-recognised MIKE21 software package. Wave modelling was completed using MIKE21's spectral wave (SW) module, a phase-averaged approach which models wave transmission by calculating the parameterised wave spectrum throughout the domain for each timestep. MIKE21's hydrodynamic (HD) module was used to model currents, which determines current dispersion by solving conservation of mass and momentum equations and considers radiation stresses produced by the wave field. Sediment transport was calculated using MIKE21's sediment transport (SD) module. A discussion of modelling assumptions and limitations is provided in **Section 1.4**.

5.3 Model source data

5.3.1 Nearshore wave boundary

Historical wave data was extracted from the NSW Nearshore Wave Forecast Tool (NWFT) at the entrance to Coffs Harbour. This data was utilised to inform the ocean boundary wave forcing for the SW modelling. Historical data for November 2011 was used for model calibration (Stage 1) while a 5-year period of historical data (2013–2018) was used to construct a wave climate from which representative wave conditions were selected for preliminary modelling (Stage 2, see also **Section 3.2**). **Figure 3.6** shows the extraction location of NWFT wave data.

5.3.2 Harbour wave measurements

During November 2011 Water Technology (2012) installed a wave probe approximately 100 m offshore of the boat ramp basin, collecting timeseries data as part of a study for Coffs Harbour City Council. This data has been used with permission from Water Technology to calibrate the SW and HD models, as described in **Section 5.4**. The location of the wave probe is indicated in **Figure 5.2**.

5.3.3 Wind

Wind forcing is utilised in both the wave (SW) and current (HD) modelling. Hourly data recorded at Coffs Harbour airport was obtained from the Bureau of Meteorology. In Stage 1, real-time data from November 2011 is utilised in model calibration. Stages 2 and 3 utilise representative wind conditions selected by an analysis of five years of hourly data spanning 2011 to 2015. **Figure 5.1** presents the seasonal joint distribution of wind speed and direction. The figure also indicates the representative wind conditions selected in Stage 2, which is discussed in **Section 5.5**.

5.3.4 Model domain and bathymetry

The modelling domain (mesh) utilised in this study includes the full extent of Coffs Harbour, extending 400 m offshore from the harbour entrance. The mesh consists of high resolution in the study focus area with a maximum element size of 75m^2, a coarser mesh in peripheral areas including the offshore wave boundary and northern marina, with a maximum element size of 3000 m^2, and a transitional area with a maximum element area of 750 m^2. The transitional area ensures mesh transition is below threshold length ratio between adjacent mesh elements of 4.

The bathymetric data utilised in this study were a June 2019 survey covering the harbour south of Coffs Harbour Jetty, and an April 2013 survey covering the full extent of Coffs Harbour including the northern marina. These data sets were complemented by approximations of the MSL line along Jetty Beach from satellite imagery, and offshore depth data available from 2009 Geographic Australia sounding data. In modelling of wave, current and sediment transport a –2 m depth cut-off was applied due to the spectral wave model being unable to accurately model wave breaking and runup behaviour in shallow water. This limitation does not have a significant impact on sediment transport in the vicinity of the breakwater and boat ramp basin, and the impact of options on south Jetty Beach can be inferred from transport behaviour offshore of the beach at depths greater than 2 m. The model mesh, with bathymetry values, is presented in **Figure 5.2**.

5.3.5 Sediment grain size and grading

The sediment grain size and grading coefficient utilised in the ST module were informed by sand sampling undertaken in this study (see **Section 4**). The median grain size (D_{50}) was found to be 0.2 mm, and a grading coefficient of D_{85}/D_{15} of 2 was adopted based on sample grading curves provided in **Appendix A**.

5.3.6 Environmentally sensitive reef areas

Stage 3 included investigating the impact of each breakwater extension option on three environmentally sensitive reefs approximately 175–200 m north of the existing boat ramp basin entrance. The locations of these reefs are indicated in **Figure 5.2**.

5.4 Stage 1 methodology and results

Stage 1 included calibration of the wave and current models using real-world data available from 21 to 29 November 2011. The model was forced by hourly wind data (**Section 5.3.3**) and hourly wave parameter outputs from the Nearshore Wave Forecast Tool (**Section 5.3.1**), and was calibrated against hourly real-world wave parameters recorded within the harbour (**Section 5.3.2**). **Figure 5.3** compares probe measurements against model outputs from the location of the harbour probe, indicating the SW module successfully replicates wave conditions within the harbour.

The SW (spectral wave) module incorporated a quasi-stationary, directionally decoupled formulation, with a wave breaking gamma coefficient of 2 and bottom friction of 0.006 m. Diffraction was included with a smoothing factor of 0.2 applied with one smoothing step. Waves were forced from the north, east and southern offshore boundary (east of the harbour entrance), while the north-south running boundaries adjacent to the harbour entrance were considered to be closed (fully absorbent land boundaries). Further calibration of the HD module was conducted in Stage 2. Following calibration the HD module incorporated a quasi-stationary formulation, no model flood and drying (tidal inundation), a constant eddy formulation coefficient of 1 m^2/s, a spatially constant bed resistance Manning number of 32 m$^{1/3}$/s, and assumed zero normal current velocity at the offshore boundaries.

5.5 Stage 2 methodology and results

Stage 2 involved the selection and preliminary modelling of representative entrance wave and wind conditions. Representative conditions were selected by analysing the seasonal joint distribution of waves by Hs (significant wave height), Tp (peak wave period) and direction, as shown in **Figures 3.7** and **3.8.** Wave conditions were selected from an analysis of hourly data from 2013–2018 historical NWFT outputs (see **Section 5.3.1**).

From an analysis of summer wave conditions, a wave with Hs=1 m, Tp=10 s, direction=100 deg was selected as a median, representative condition. In addition, a representative of mild east-north-easterly conditions was selected with Hs=0.8 m, Tp=7 s, direction=70 ˚Q. The summer wave analysis and representative conditions are presented in **Figure 3.8a**. One representative condition was identified for winter wave conditions, with Hs=1.1 m, Tp=11 s, direction=130 ˚Q, as shown in **Figure 3.8b**.

In addition, two representative wind conditions were identified based on seasonal joint distribution analysis of wind speed and direction (**Figure 5.1**). A wind with speed of 16 m/s and direction of 230 ˚Q is seen to be prevalent year-round, a second, more severe wind condition occurring in summer and spring months was selected with speed of 30 m/s and direction of 30 ˚N. During Stage 2 modelling this wind condition was modelled with the larger summer wave only as a sensitivity test. In Stage 2 each of the sediment transport response to each of these conditions was modelled for the existing breakwater configuration. **Table 5.1** presents the representative wave and wind conditions tested in Stage 2.

Table 5.1 Representative wave and wind conditions

Wave conditions		**Wind condition**	
Wave 1	Hs=1m, Tp=10s, Dir=100 ˚Q	Wind 1	Speed=16m/s, Dir=230 ˚Q
Wave 2	Hs=1.1m, Tp=11s, Dir=130 ˚Q	Wind 2	Speed=30m/s, Dir=30°N (tested with Wave 1 only)
Wave 3	Hs=0.8m, Tp=7s, Dir=70 ˚Q		

Sediment transportation along the south-eastern harbour shore for the existing breakwater case was used to identify the forcing conditions which best replicated annual transport estimates in the literature of 4,000–6,000 m^3. These identified wind and wave forcing conditions were adopted in Stage 3 in the option analysis. **Figure 5.4** presents the calculated sediment transport rate in the study focus area for each of the conditions tested, for the existing breakwater configuration. In addition, the total annualised transport across four transects along the south-eastern harbour shore was plotted for each set of conditions as shown in **Figure 5.5**. The locations of the transects are shown in **Figure 5.4**.

As seen in **Figure 5.5**, the model utilising Wave 1 and Wind 1 best replicated expected annual transport along the south-eastern harbour shoreline. On this basis, these conditions were adopted for Stage 3 breakwater option modelling. Furthermore, the inclusion of the strong north-easterly wind (Wind 2) generated a strong longshore current southward along Jetty Beach, forming a jet eastward along the southern harbour shoreline. This extreme result is due to assessing transport caused by a severe, prolonged onshore wind and is not noted to be a significant feature of the real-world sediment dynamics in Coffs Harbour.

5.6 Stage 3 methodology and results

Stage 3 involved modelling the sediment transport regimes for the existing configuration and three boat ramp basin breakwater extension options (40 m, 60 m and 75 m). The representative wind and wave forcing conditions identified in Stage 2 as best reproducing estimates of transport rate along the south-eastern shoreline, were adopted for Stage 3 modelling. These conditions included wave conditions of Hs=1 m, Tp=10 s and wave direction of 100 °N, and wind with speed of 16 m/s and a direction of 230 °N. As discussed in **Section 1.4** the sediment transport and accretion rates were resolved based on the existing bathymetry, rather than including dynamic evolution of the bathymetry due to the effects of morphology. As such, the transport regimes presented represent the equilibrium states based on the existing bathymetry, forcing conditions and resultant wave and current fields. The following results figures are provided, the breakwater extensions are represented within the modelling and in the result images as zero-width lines:

- **Figure 5.6** presents the sediment transport rate in the study focus area for the four configurations: existing configuration, Option 1 (40 m extension), Option 2 (60 m extension), Option 3 (75 m extension).
- **Figure 5.7** presents the daily accretion rate (bed level change rate based on static existing bathymetry and conditions) for the study focus area for the four configurations.
- **Figure 5.8** presents the daily accretion rate for the four configurations in the vicinity of the breakwater and boat ramp basin entrance.
- **Figure 5.9** presents the daily accretion rate in the vicinity of Jetty Beach for the three breakwater extension options relative to the existing configuration (i.e. rate with extension minus rate for existing configuration).
- **Figure 5.10** presents the daily accretion rate in the vicinity of the three environmentally sensitive reef areas north of the boat ramp basin relative to the existing configuration (i.e. rate with extension minus rate for existing configuration).

5.6.1 Discussion – impacts on boat ramp basin shoal formation and entrance channel sedimentation

The model indicated a reduction of the shoal formation around the breakwater head. The annualised load (daily accretion multiplied by element area multiplied by 365) around the head was –4500 m^3 for the existing breakwater configuration, 450 m^3 for Option 1, 86 m^3 for Option 2, and 45 m^3 for Option 3. The large negative load for the existing configuration is likely caused by net onshore transport occurring near the shoreline, as evident in **Figure 5.7**. Discounting this effect, the extension of the breakwater appears to reduce the quantity of sediment being deposited into the shoal. However, the SW model weakness in modelling wave breaking and subsequent longshore current may reduce transport along the breakwater's eastern face, resulting in accretion along the breakwater face (which is not observed in practice). Therefore, the decreased shoal formation rates of the extended breakwater cases may be a result of increased deposition opportunity along the breakwater. MHL suggests that it is likely that the rate of sediment transport around the breakwater head would be independent of the breakwater length, as evidenced by the lack of sedimentation occurring east of the boat ramp basin breakwater.

Figure 5.7 indicates that extension of the boat ramp breakwater would cause the sedimentation leeward of the breakwater head to be deposited further from shore. This may reduce sedimentation within the boat ramp basin entrance channel, as there would be increased opportunity for dissipation of the shoal away from the channel entrance. Seiche long waves which have been demonstrated to be present within the harbour may be primary mechanism of transporting sediment from the shoal accumulating at the breakwater head into the boat ramp basin entrance. The shoal being at a greater distance from the boat ramp basin entrance may reduce the magnitude of currents transporting sediments into the basin. Furthermore, shoal formation related to any of the extension options considered would occur further from the shoreline, and therefore reduce hazardous entrance conditions at the boat ramp basin entrance. It is possible that sediments would accumulate in the lee of the breakwater over time to form a larger shoal, eventually increasing navigation and channel sedimentation issues. Modelling this effect was beyond the limitations of the modelling due to weak simulation of diffraction and seiche waves in the wave model (seiche waves cannot be incorporated into MIKE21's SW module).

5.6.2 Discussion – impacts on environmentally sensitive reef areas

Changes to accretion rates in the vicinity of three environmentally sensitive reefs are shown in **Figure 5.10** and **Table 5.2.** The sediment transport model indicates negative accretion (scour) occurs around the three environmentally sensitive reefs for all configurations tested. The existing configuration modelling shows between 32 and 84 cm of scour occurring at these locations annually, which is likely attributable to onshore transport of sediments by incident waves and currents.

At Reefs 2 and 3, each breakwater extension option results in a net increase in accretion, which may be due to the extensions directing some transported sediment towards the reefs. This is increase is most pronounced at Reef 3 for the 60 m extension, and most pronounced at Reef 2 for the 75 m extension. Any increase in net accretion at Reefs 2 and 3 reduces scour and does not result in positive accretion in the model.

At Reef 1 the scour rates modelled increase from the existing condition for the 40 m and 60 m breakwater extension. This could be due to these options causing an increase in wave and currents in the area resulting in increased onshore transport. The model shows a decrease in scour at Reef 1 for the 75 m extension option, which could be attributed to some sediment transport being directed towards the area by the breakwater extension.

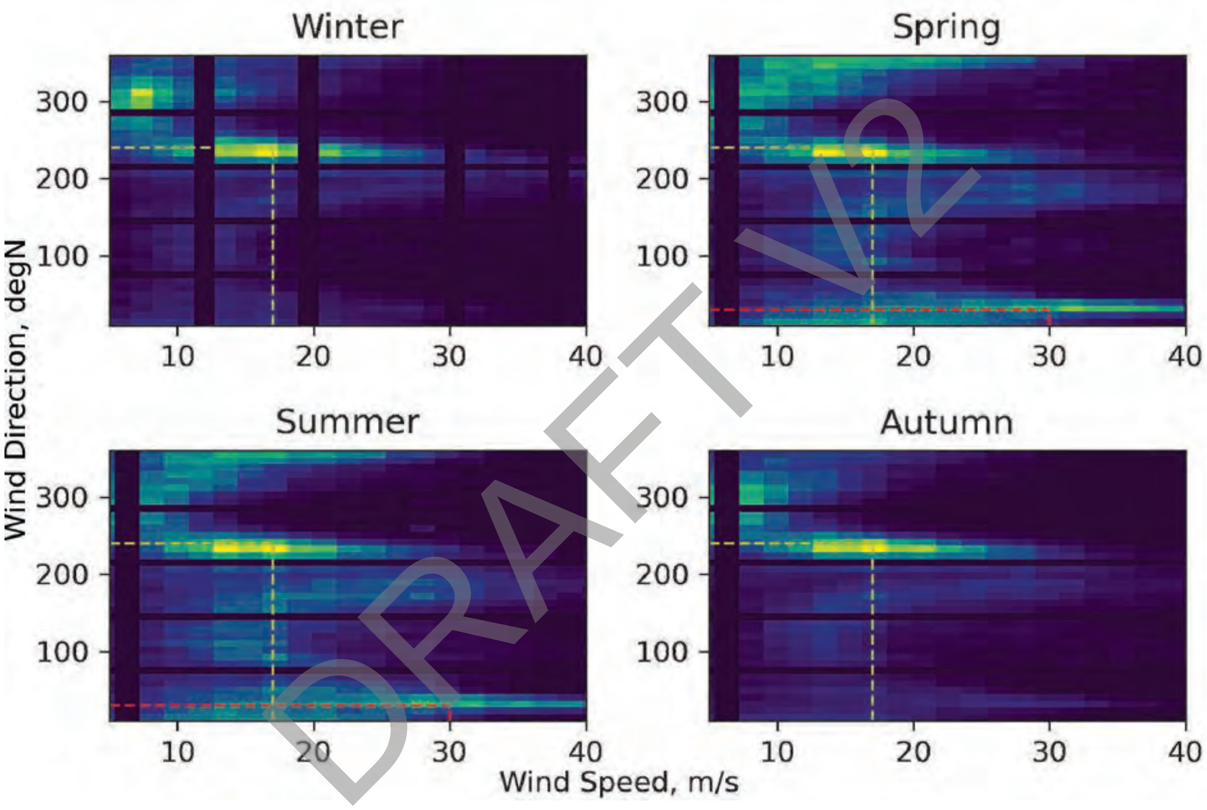
In summary the model suggests there is small negative net sediment transport (scour) occurring in the environmentally sensitive areas under the existing conditions, and that the breakwater options modelled result in small changes to these conditions, generally reducing the net negative transport at Reefs 2 and 3 and increasing the net negative transport at Reef 1. These changes can likely be considered minor relative to the existing conditions, however, the effect of these changes on the reef environments is beyond the scope of this study.

Table 5.2 Changes in annual scour at environmentally sensitive reef areas (cm/yr)

Breakwater configuration	Reef 1	Reef 2	Reef 3
Existing configuration	84	54	32
Option 1 – 40 m extension	97	41	20
Option 2 – 60 m extension	127	40	6
Option 3 – 75 m extension	71	29	21

5.6.3 Discussion – impacts on south Jetty Beach

The key impact of extending the boat ramp basin breakwater affecting south Jetty Beach is the creation of a lee which reduces onshore transport of sediment. This effect is evident in **Figure 5.9** which presents accretion rates relative to the existing configuration. The figure indicates how the lee for Option 1 extends along the southern shoreline only, whereas the lee for Options 2 and 3 extends approximately 80 m along Jetty Beach from the south end. The annual reduction of onshore transport in this 80 m length, relative to the existing case, is estimated to be approximately 7,000 m^3 (45%) for Option 3, 4,500 m^3 (30%) for Option 2 and a 900 m^3 (5%) increase of accretion for Option 1. This increase for Option 1 is likely to be due to more sand accumulating offshore of the beach due to the effects of the breakwater extension. Similarly, the Option 2 and 3 breakwater extensions cause a small increase in accretion to the north of the beach length impacted by the breakwater lee (a length of approximately 80 m from the south end of Jetty Beach). It should be noted that these changes would be due to a reduction (or at the north end of the segment, a slight increase) in transport from the offshore shoal due to reduced wave and current conditions.



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SEASONAL WIND ANALYSIS

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Figure

5.1

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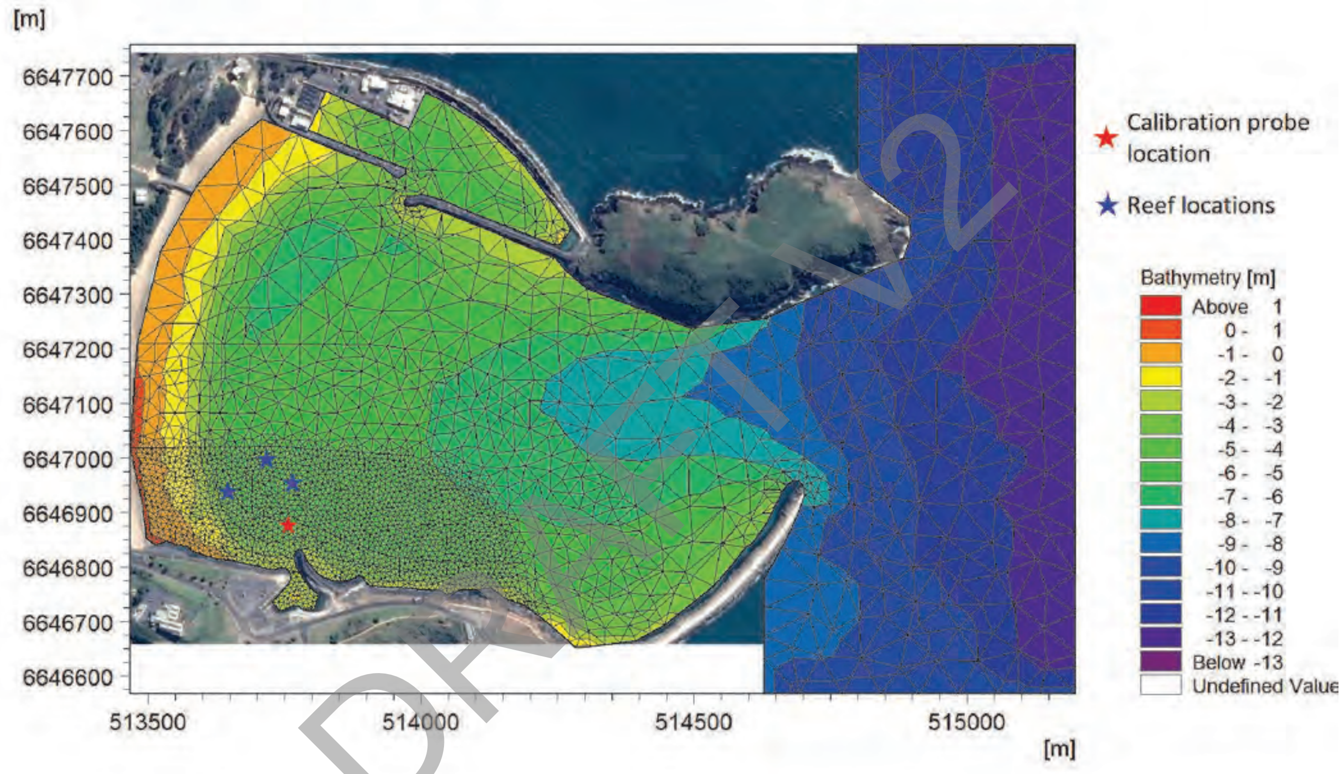

MODEL MESH AND BATHYMETRY VALUES

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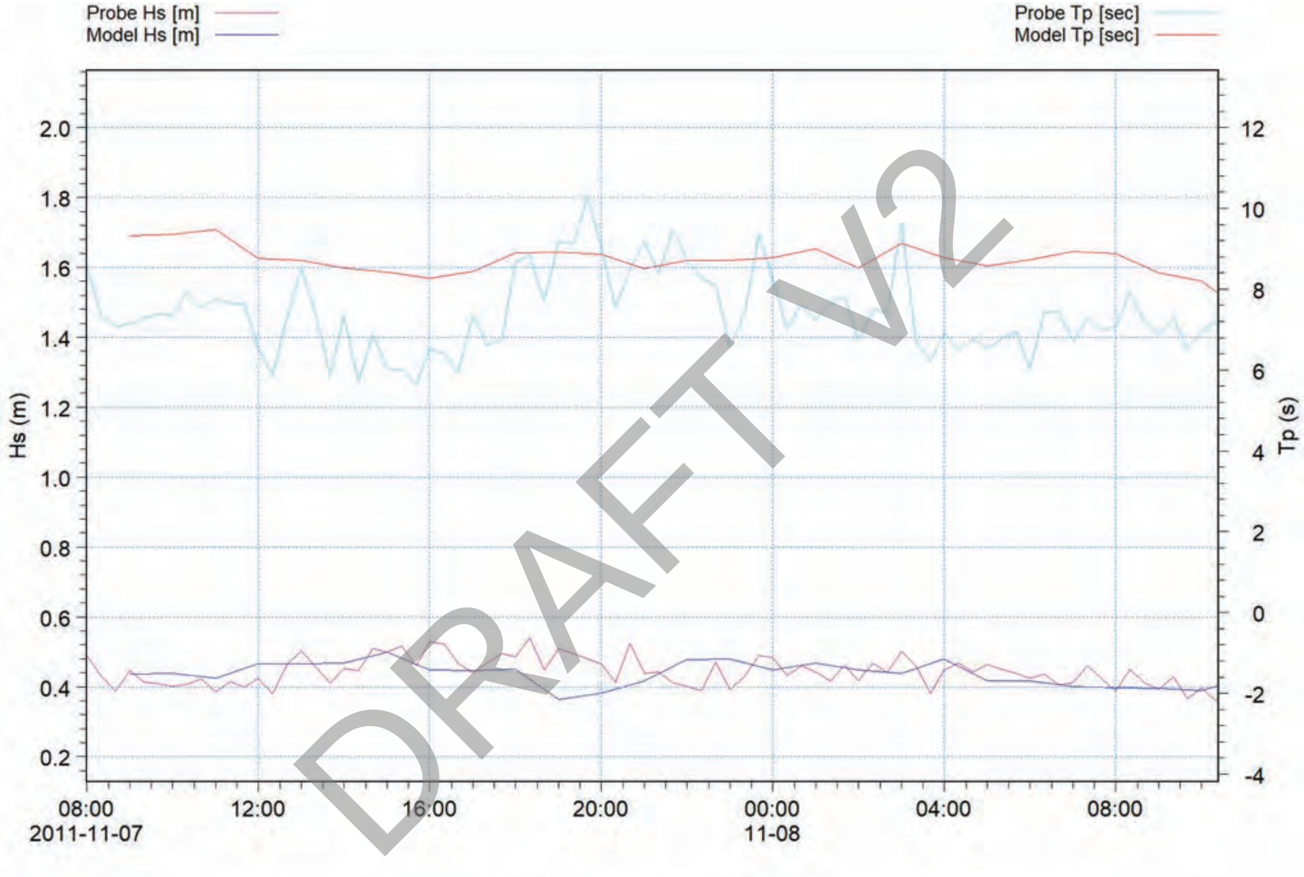
Figure

5.2

DRAWING 2784-05-02.cdr



STAGE 1: CALIBRATION RESULTS

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Figure

5.3

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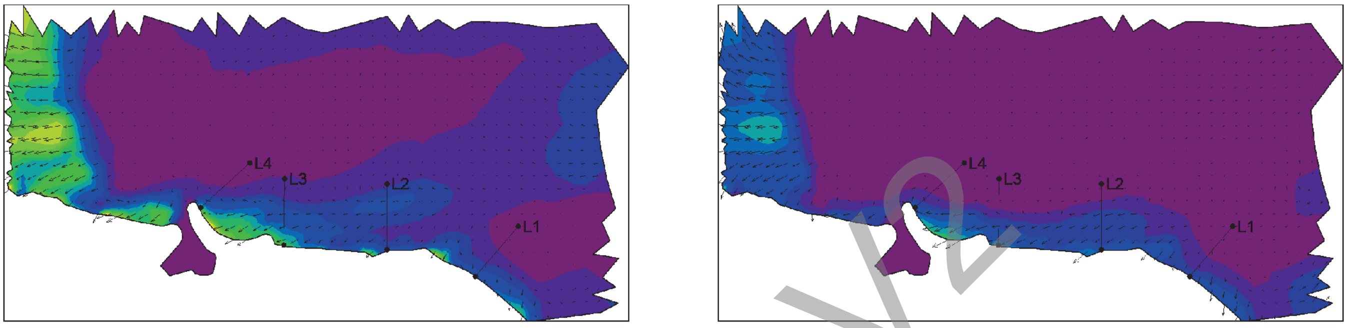
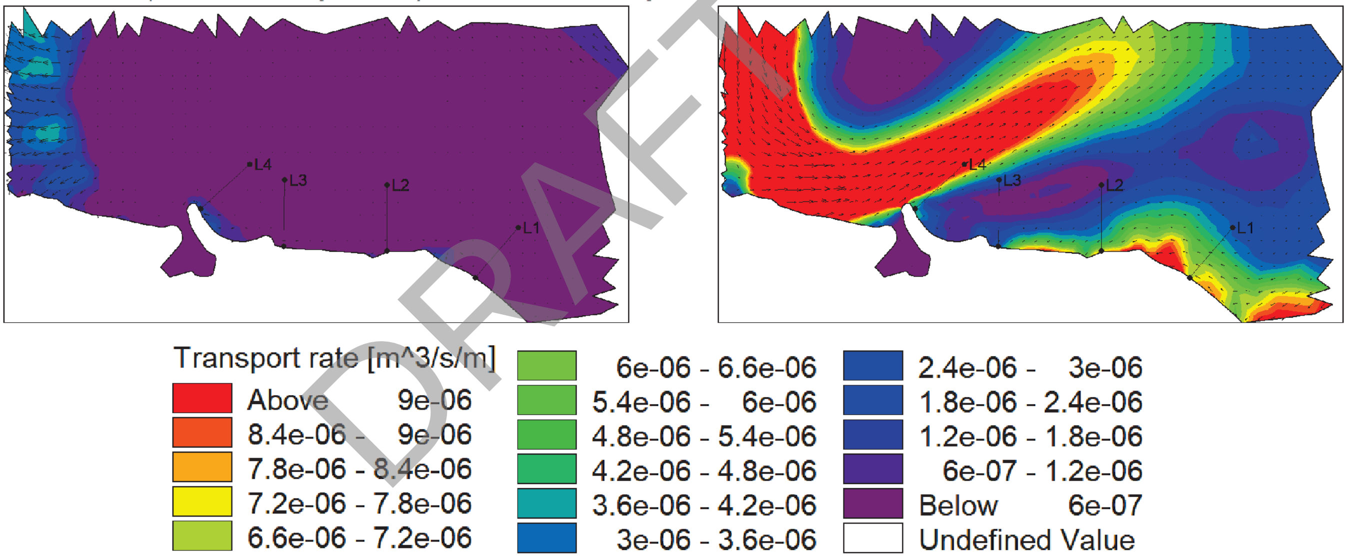
Wave 1 Wind 1 Existing Configuration

Wave 3 Wind 1 Existing Configuration



Wave 2 Wind 1 Existing Configuration

Wave 1 Wind 3 Existing Configuration



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STAGE 2: PRELIMINARY MODELLING RESULTS

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Figure

5.4

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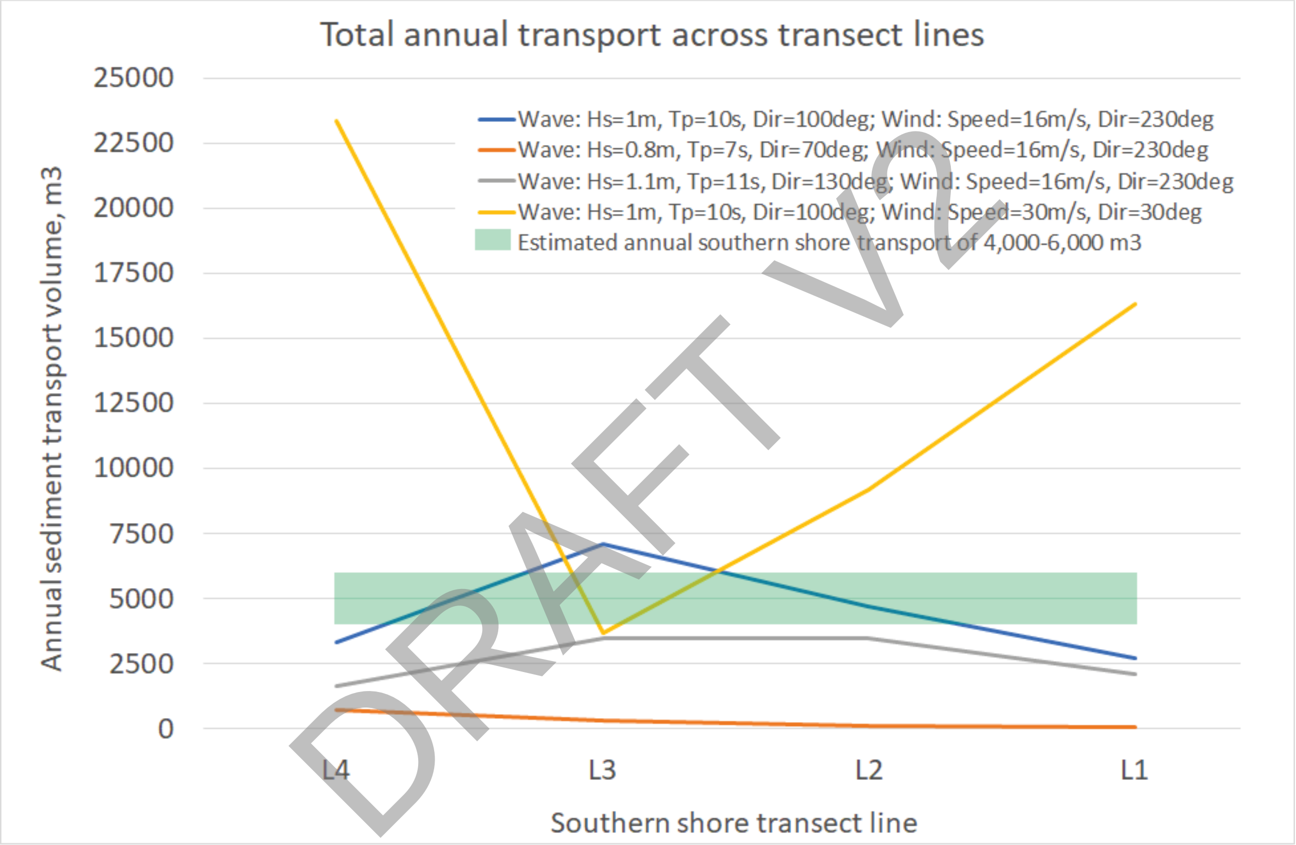

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STAGE 2: ANNUALISED SOUTH-EASTERN HARBOUR SHORE TRANSPORT LOADS

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Figure

5.5

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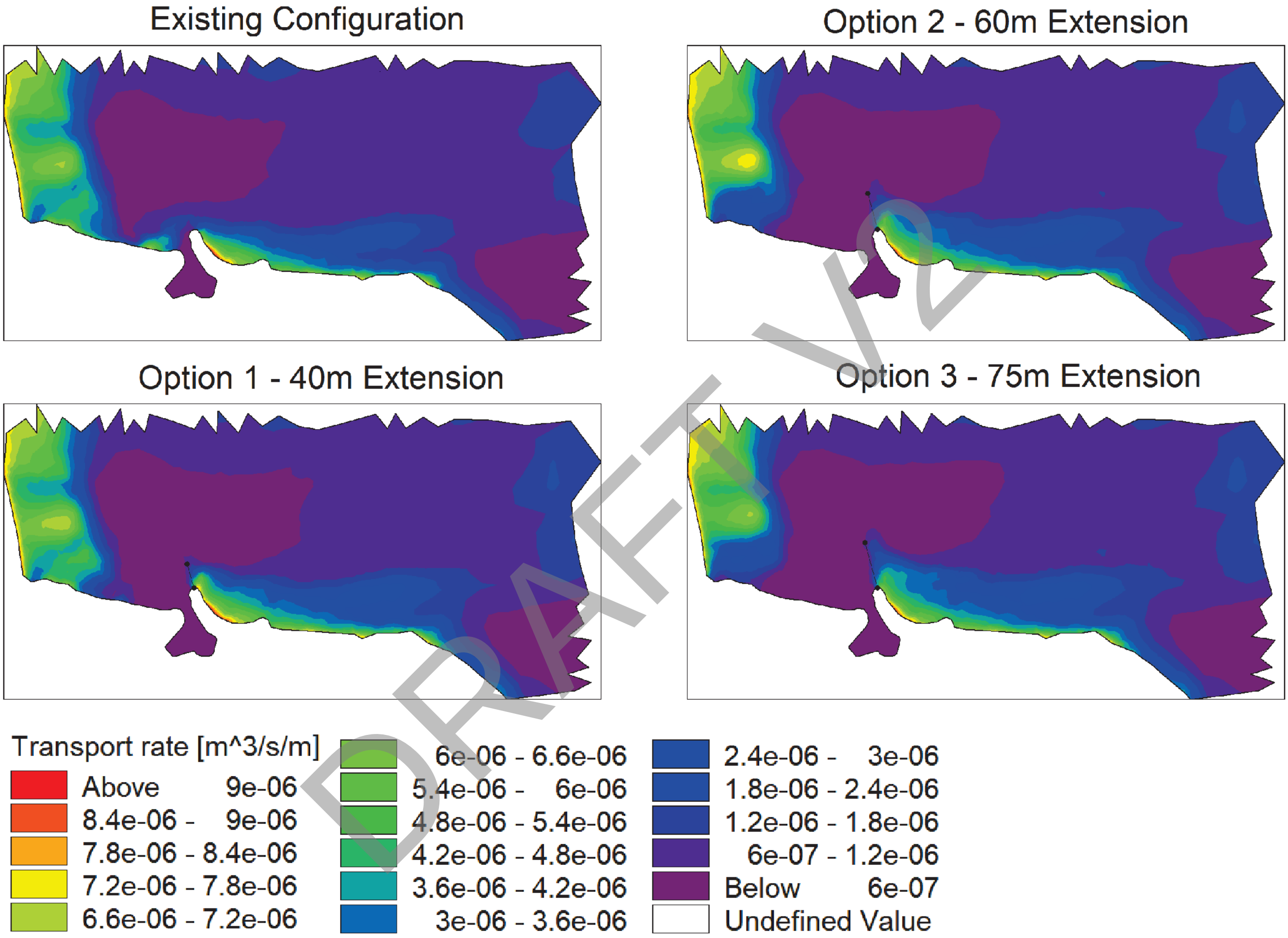

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STAGE 3: TRANSPORT RATE RESULTS

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Figure
5.6

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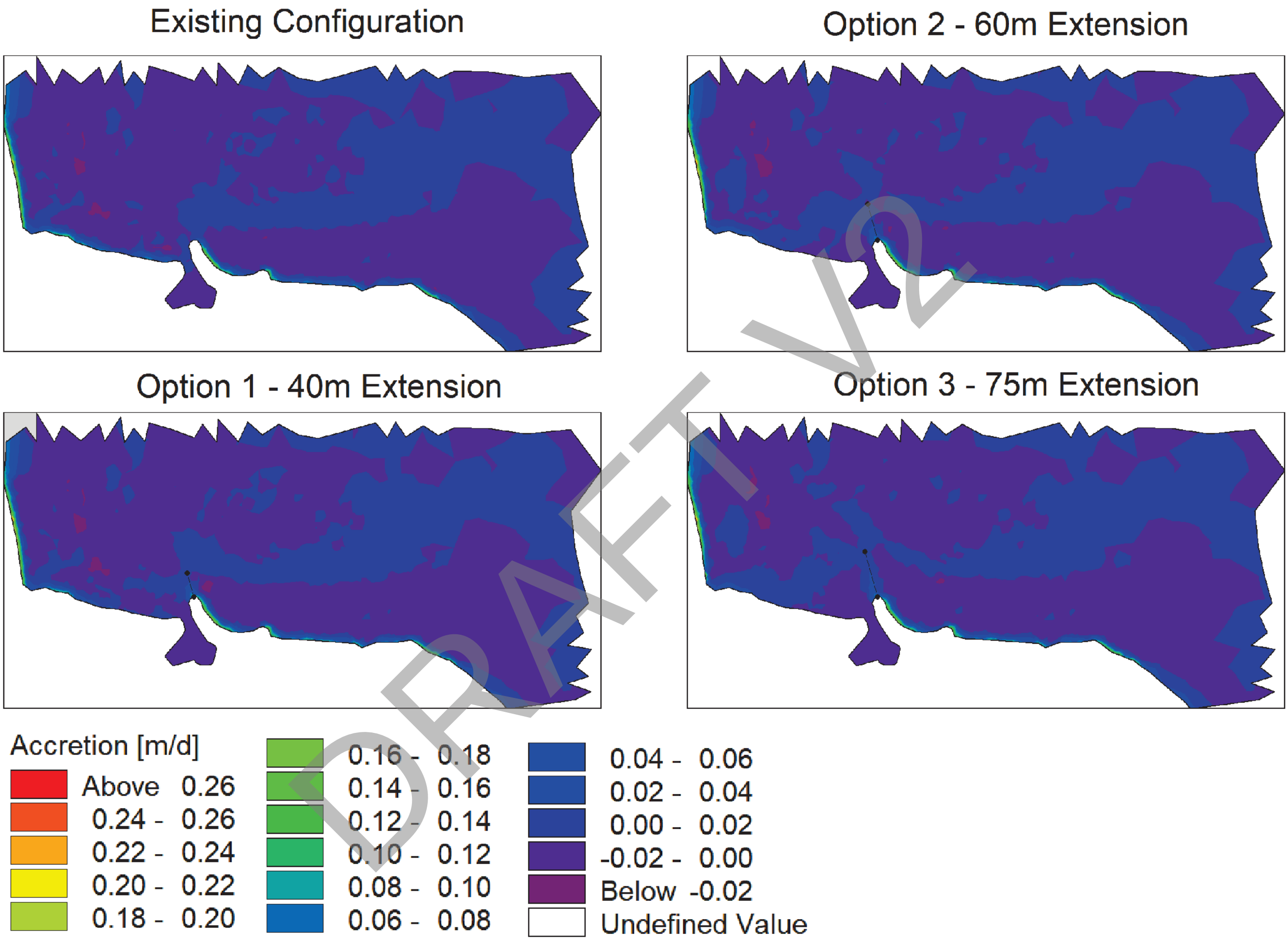

Existing Configuration

Option 2 - 60m Extension

Option 1 - 40m Extension

Option 3 - 75m Extension

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STAGE 3: DAILY ACCRETION RATE RESULTS

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Figure

5.7

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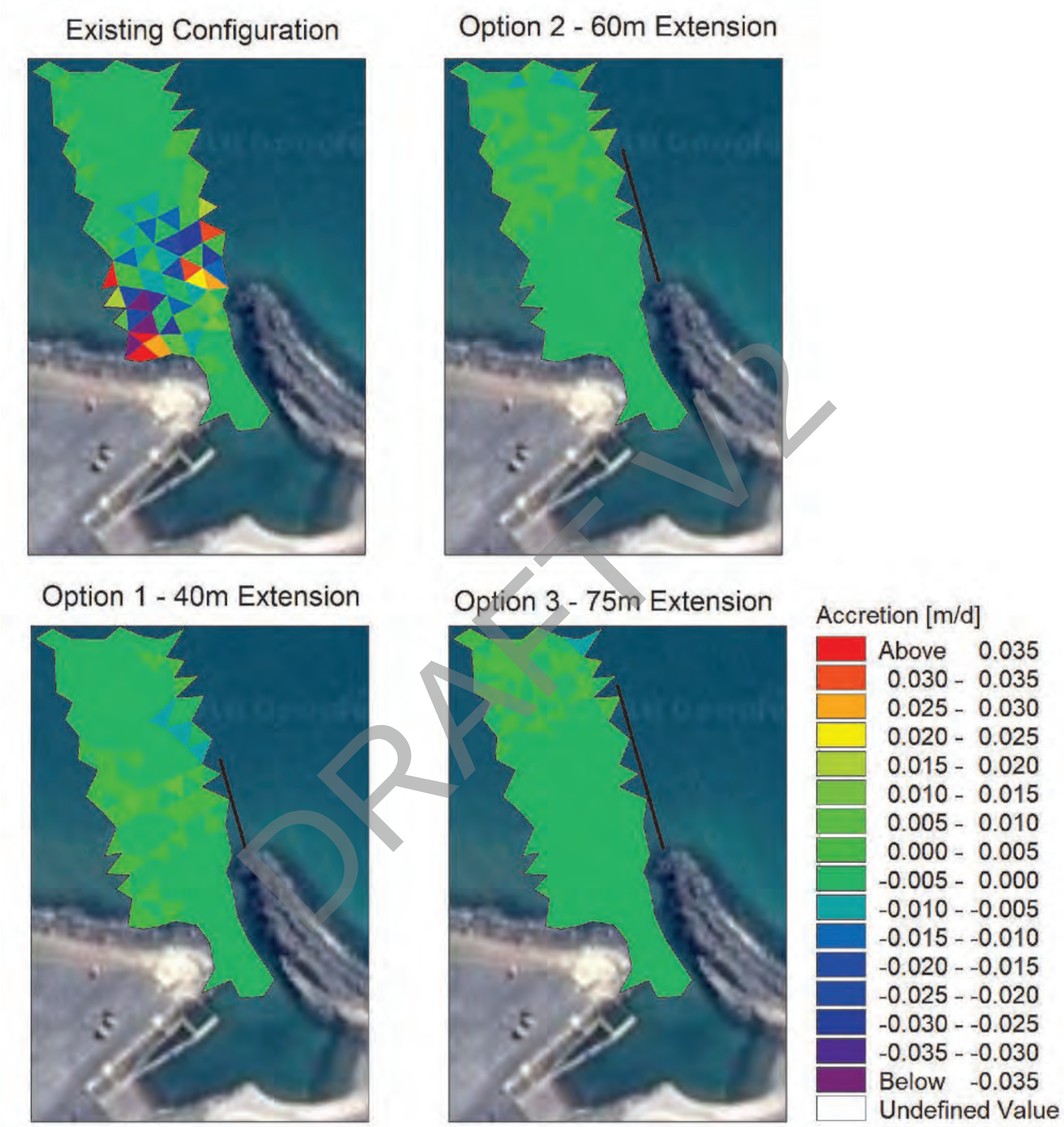

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STAGE 3: DAILY ACCRETION NEAR BOAT RAMP BASIN

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Figure

5.8

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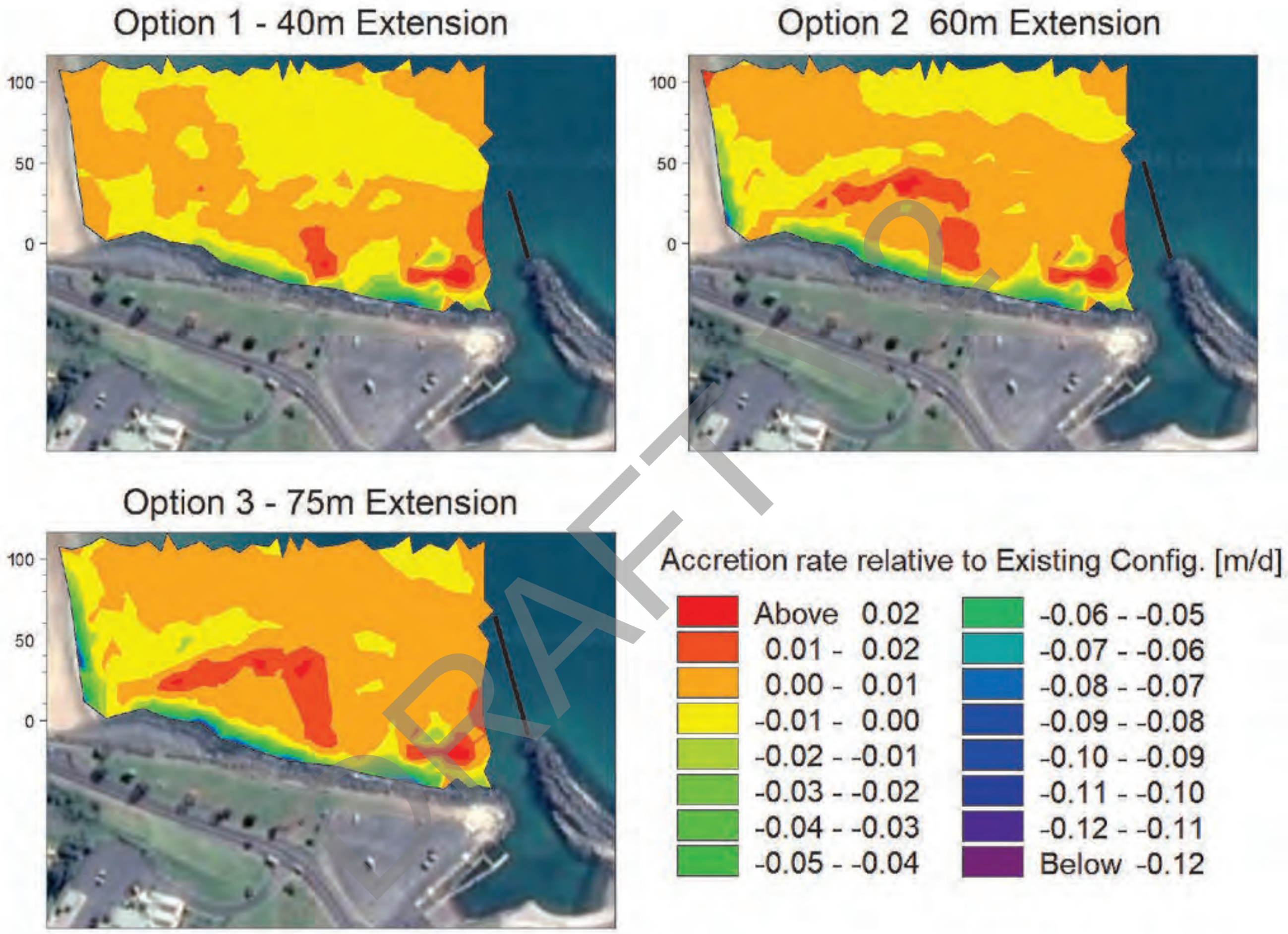

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STAGE 3: DAILY ACCRETION RATE NEAR
SOUTH JETTY BEACH RELATIVE TO
EXISTING CONFIGURATION

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Figure
5.9

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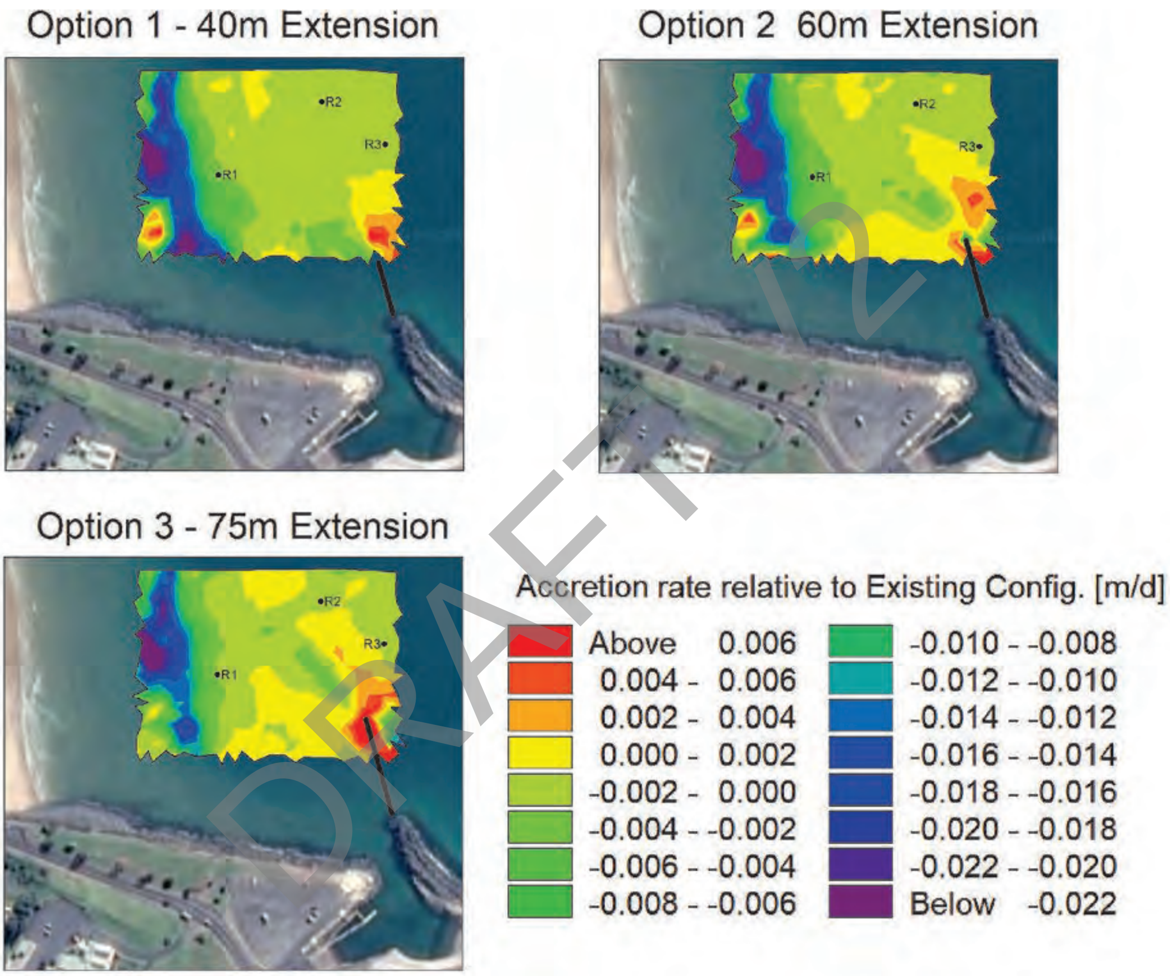

STAGE 3: DAILY ACCRETION RATE NEAR
ENVIRONMENTALLY SENSITIVE REEFS
RELATIVE TO EXISTING CONFIGURATION

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Figure

5.10

DRAWING 2784-05-10.cdr

6 Conclusion

This investigation utilised nearshore wave historical data outputs from the NSW Government's Nearshore Wave Forecast Tool, historical wind data, sand analysis results, harbour wave measurements, and a review of previous studies and modelling to calibrate a wave, current and sediment transport model to allow the impact of proposed extensions to the Coffs Harbour boat ramp breakwater to be analysed. The study investigated the effects of three extension options (40 m, 60 m and 75 m) on shoal formation and channel sedimentation in and around the boat ramp basin, and on south Jetty Beach. The model indicated lower sedimentation rates in the breakwater head shoal for longer breakwater extensions, however this result may be produced by model limitations, and it is likely that the rate of sediment transport around the breakwater head would be independent of the breakwater length, as evidenced by the lack of sedimentation occurring east of the boat ramp basin breakwater. The effect of the extension to move the shoal created at the breakwater head further offshore may reduce the sediment transported to the boat ramp basin entrance, as the currents acting on the shoal would be less likely to transport sediments directly into the basin. Furthermore, the shift in the shoal location associated with the extension options would reduce hazardous entrance conditions and the boat ramp basin entrance, as indicated in the channel accretion results. It is possible that sediments would accumulate over time in the lee of the breakwater, causing channel sedimentation and entrance navigation issues, an effect which may not have been observed due to weaknesses in the modelling of diffraction and harbour resonance waves.

The model indicates small negative net sediment transport (scour) occurs in the vicinity of the three environmentally sensitive reefs under the existing boat ramp basin breakwater configuration. These negative accretion rates are likely attributable to beachward transport of sediment, increasing closer to shore. The three extension options modelled resulted in a decrease in the negative transport at Reefs 2 and 3, attributable to some sediment transport being redirected towards the reef area by the extension, however, the net accretion in these areas remained negative. At Reef 1 there was, in general, an increase in the net negative transport, attributable to increased wave and current conditions due to the extensions. These changes can likely be considered minor relative to the existing conditions, however, the effect of these changes on the reef environments is beyond the scope of this study.

The modelling indicates that extension of the boat ramp basin breakwater would create a lee, reducing onshore transport of sediment westwards of the boat ramp basin. The modelling indicates that Option 1 (40 m extension) creates a lee reducing transport to the southern shoreline only, whereas the lee for Options 2 and 3 extends approximately 80 m along Jetty Beach from the south end. The reduction of onshore transport in this 80 m length, relative to the existing case, is estimated to be 45% for Option 3 (approximately 7,000 m^3), 30% for Option 2 (approximately 4,500 m^3) and a 5% increase of accretion for Option 1 (approximately 900 m^3). This increase for Option 1 is likely to be due to more sand accumulating offshore of the beach due to the effects of the breakwater extension. This modelling result does suggest that some recession to south Jetty Beach may occur if the boat ramp basin breakwater were extended according to Option 2 (60 m extension) or Option 3 (75 m extension), due to reduced transport from the near offshore.

Due to modelling limitations and assumptions, the measurements should be considered as estimates to indicate the relative impacts of each breakwater extension. As such, MHL recommends that a hydrographic and beach survey be undertaken along and offshore to south Jetty Beach to document existing conditions prior to any extension to the boat ramp basin breakwater.

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Appendix A Coffs Harbour sediment samples particle size distribution

Geotechnical Centre

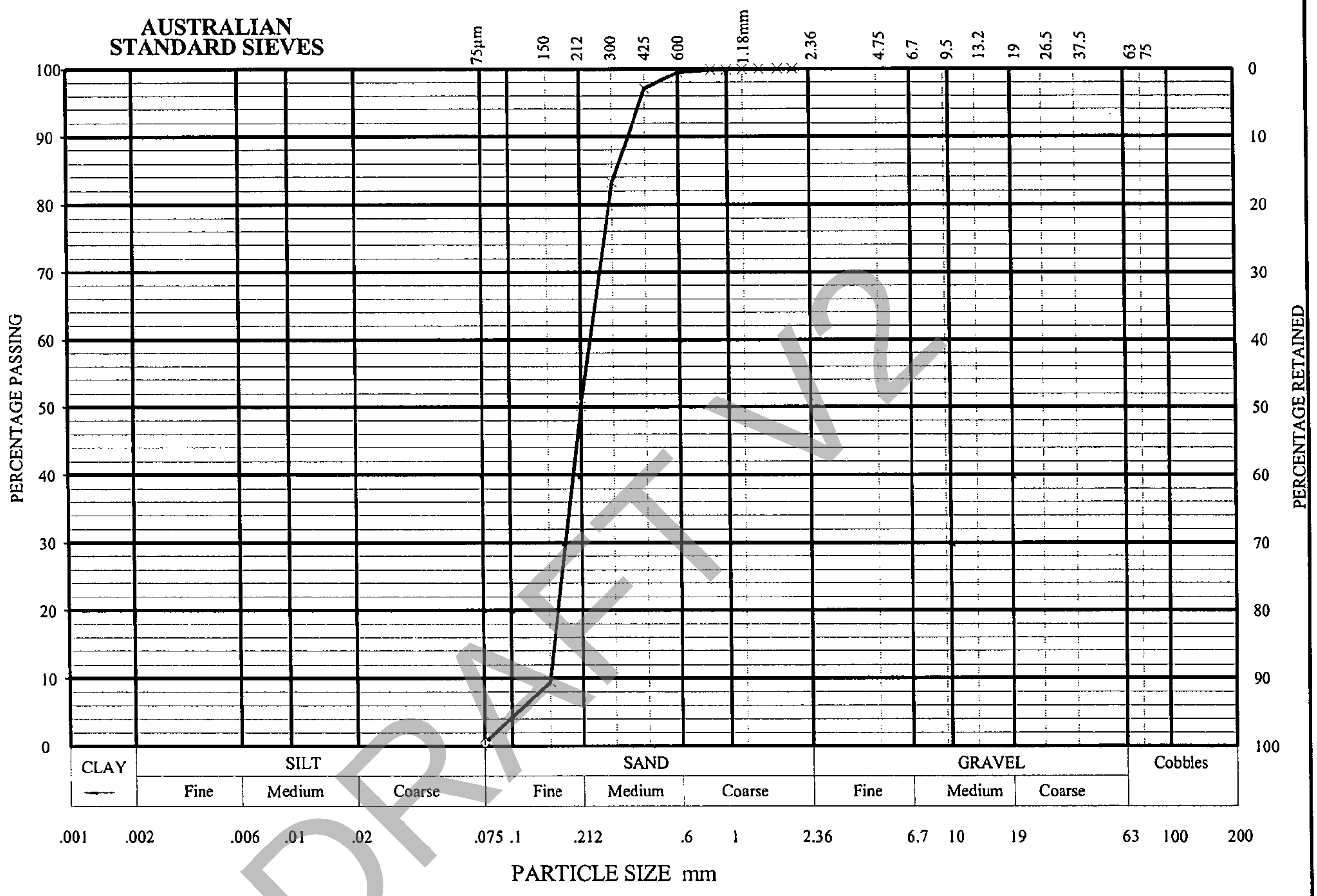
110B King Street, Manly Vale NSW 2093
Telephone 02 9949 0253
NATA Accreditation Number: 13380

NSW GOVERNMENT Public Works Advisory

CLIENT: Manly Hydraulics Laboratory
REPORT No: 20013/1075/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY
SAMPLE No: 1075
LOCATION: Jetty Beach - south end berm
HOLE No: 1
DEPTH (m): 0.00



PARTICLE SIZE DISTRIBUTION R1119 (ISSUE 5, 2018)

SIZE DISTRIBUTION	
COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	99 %
MATERIAL FINER THAN 75um	1 %

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
2.000	100.0	0.600	99.4
1.700	100.0	0.425	97.1
1.400	100.0	0.300	83.3
1.180	99.9	0.212	50.1
1.000	99.9	0.150	9.5
0.850	99.8	0.075	0.6

EFFECTIVE SIZE D10: 0.150 mm
UNIFORMITY COEFFICIENT D60/D10(Cu): 1.5
CURVATURE COEFFICIENT $D30^2$ /(D60 x D10) (Cc): 0.9

Notes on Test: Tested as received
Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

NATA Accredited for compliance with ISO/IEC 17025 - Testing

Sampled Date: 20/08/2020 Tested By: MA Date Tested: 28/09/2020

APPROVED SIGNATORY

Mark Ashover 12/10/2020

Geotechnical Centre
110B King Street, Manly Vale NSW 2093
Telephone 02 9949 0253
NATA Accreditation Number: 13380

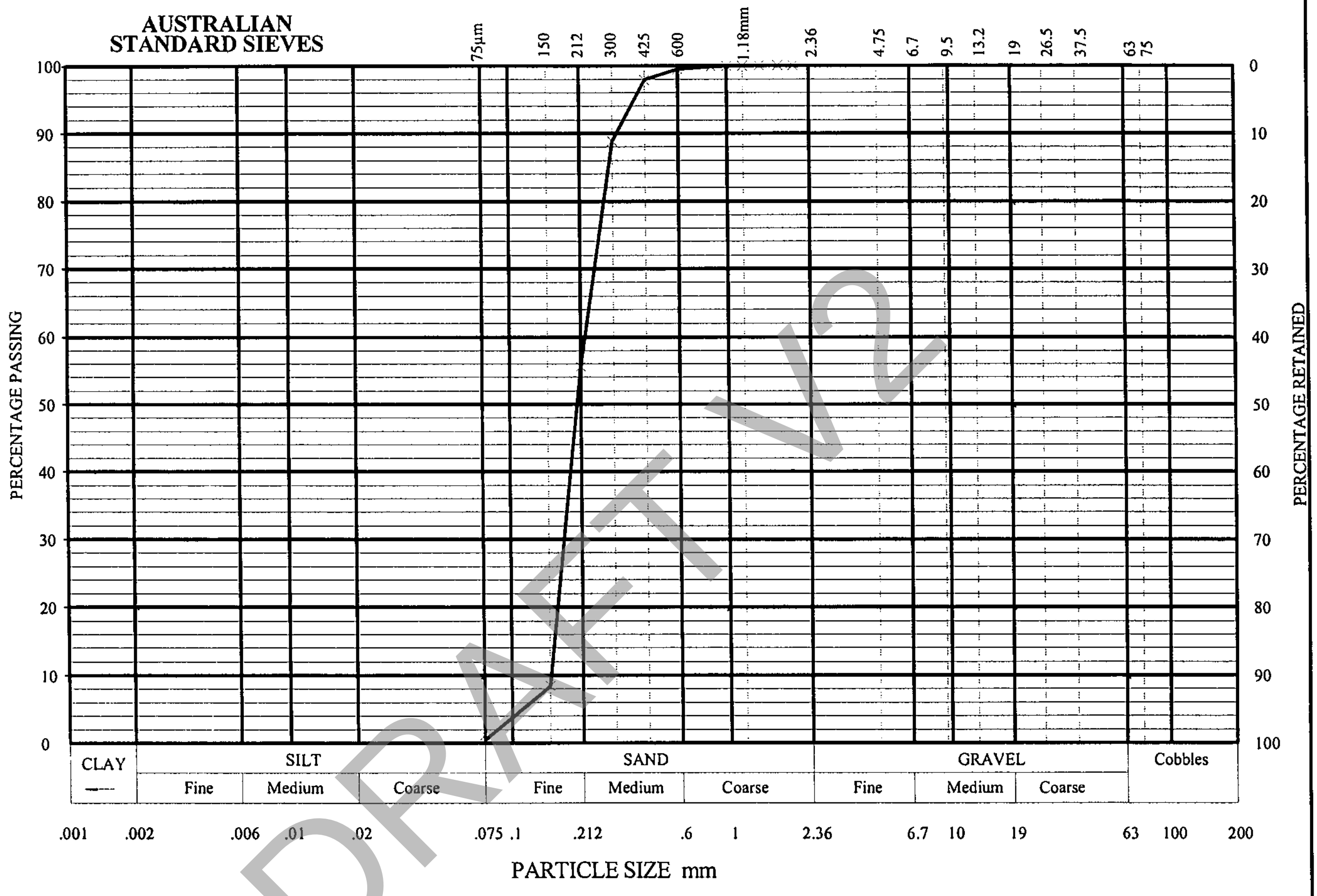
NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory | REPORT No: 20013/1076/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY | SAMPLE No: 1076

LOCATION: Jetty Beach - south end swash | HOLE No: 2 | DEPTH (m): 0.00



SIZE DISTRIBUTION	
COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	99 %
MATERIAL FINER THAN 75um	1 %

EFFECTIVE SIZE D10:	0.150 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.4
CURVATURE COEFFICIENT D30² /(D60 x D10) (Cc):	0.9

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
2.000	100.0	0.600	99.4
1.700	100.0	0.425	97.9
1.400	100.0	0.300	88.9
1.180	99.9	0.212	55.6
1.000	99.9	0.150	8.4
0.850	99.8	0.075	0.5

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

NATA Accredited for compliance with ISO/IEC 17025 - Testing

Sampled Date: 20/08/2020 Tested By: MA Date Tested: 28/09/2020

APPROVED SIGNATORY M. Ashover
Mark Ashover 12/10/2020

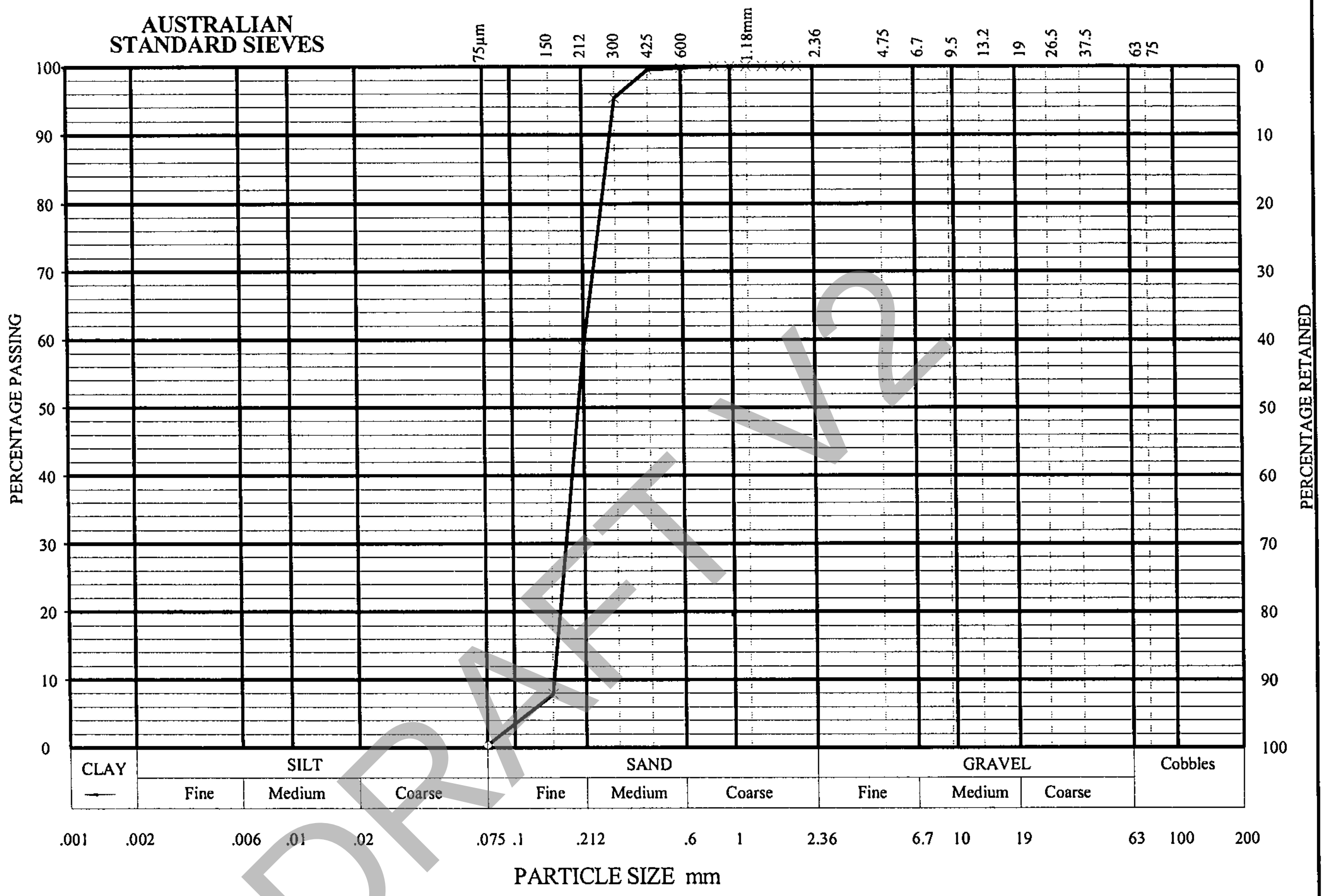
Geotechnical Centre
110B King Street, Manly Vale NSW 2093
Telephone 02 9949 0253
NATA Accreditation Number: 13380

NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory
REPORT No: 20013/1077/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY
SAMPLE No: 1077
LOCATION: Jetty Beach - 2nd south access berm
HOLE No: 3
DEPTH (m): 0.00



SIZE DISTRIBUTION

COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %
EFFECTIVE SIZE D10:	0.150 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.4
CURVATURE COEFFICIENT $D30^2$ /(D60 x D10) (Cc):	0.9

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
1.400	100.0	0.300	95.4
1.180	100.0	0.212	58.9
1.000	100.0	0.150	7.9
0.850	100.0	0.075	0.4
0.600	99.7		
0.425	99.5		

Notes on Test: Tested as received
Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

NATA **Accredited for compliance with ISO/IEC 17025 - Testing**

Sampled Date: 20/08/2020 Tested By: MA Date Tested: 28/09/2020

APPROVED SIGNATORY

Mark Ashover 12/10/2020

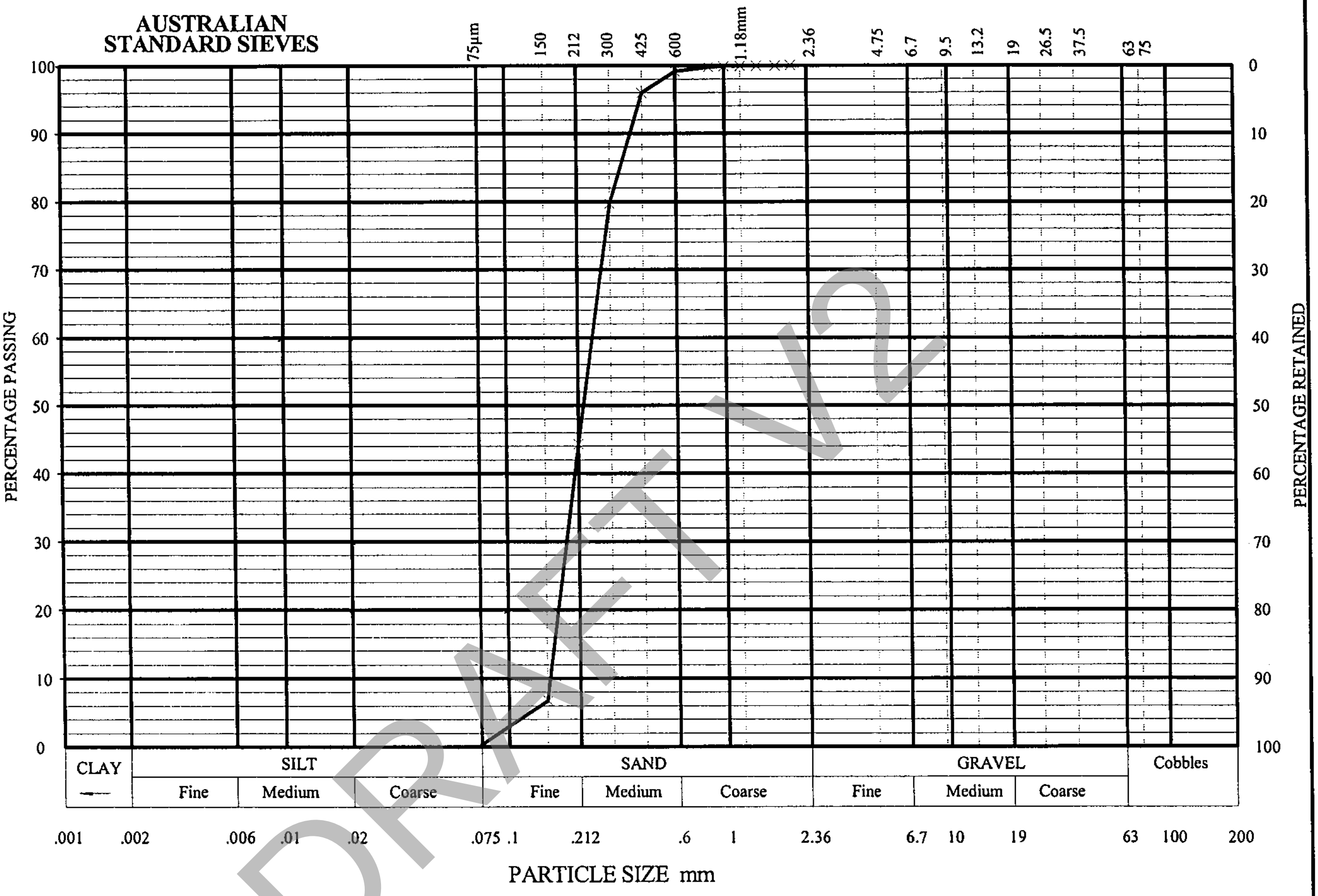
Geotechnical Centre
110B King Street, Manly Vale NSW 2093
Telephone 02 9949 0253
NATA Accreditation Number: 13380

NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory	REPORT No: 20013/1078/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY		SAMPLE No: 1078
LOCATION: Jetty Beach - 2nd south access swash	HOLE No: 4	DEPTH (m): 0.00



SIZE DISTRIBUTION	
COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %
EFFECTIVE SIZE D10:	0.150 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.6
CURVATURE COEFFICIENT $D30^2$ /(D60 x D10) (Cc):	0.9

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
2.000	100.0	0.600	99.1
1.700	100.0	0.425	96.0
1.400	99.9	0.300	79.7
1.180	99.9	0.212	44.3
1.000	99.9	0.150	6.8
0.850	99.8	0.075	0.4

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

Sampled Date: 20/08/2020 Tested By: MA Date Tested: 28/09/2020

NATA Accredited for compliance with ISO/IEC 17025 - Testing

APPROVED SIGNATORY M. Ashover
Mark Ashover 12/10/2020

Geotechnical Centre
110B King Street, Manly Vale NSW 2093
Telephone 02 9949 0253
NATA Accreditation Number: 13380

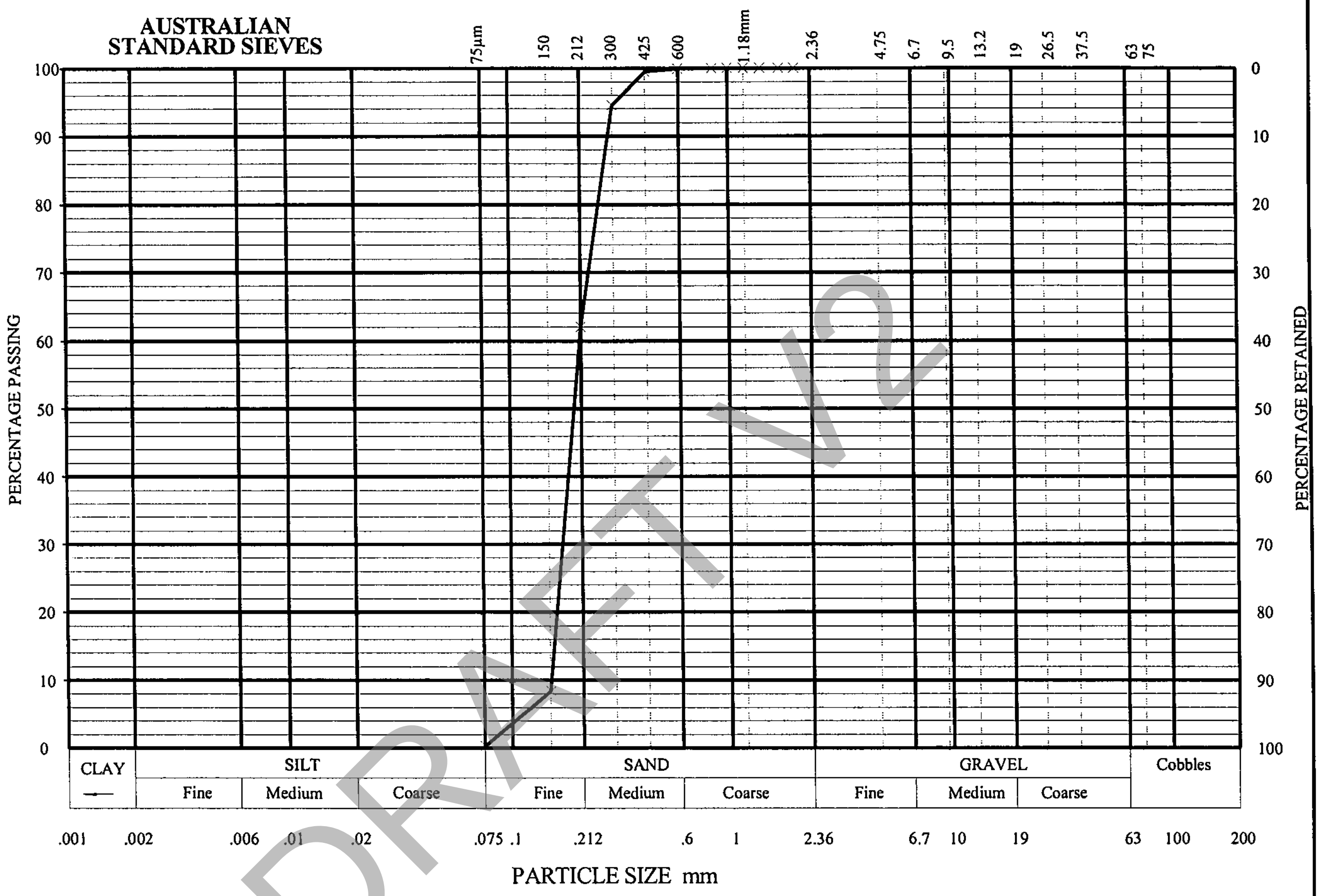
NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory | REPORT No: 20013/1079/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY | SAMPLE No: 1079

LOCATION: Jetty Beach - 3rd south access berm | HOLE No: 5 | DEPTH (m): 0.00



SIZE DISTRIBUTION

COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %

EFFECTIVE SIZE D10:	0.150 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.3
CURVATURE COEFFICIENT $D30^2$ /(D60 x D10) (Cc):	0.9

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
1.180	100.0	0.212	62.1
1.000	100.0	0.150	8.4
0.850	100.0	0.075	0.4
0.600	99.9		
0.425	99.5		
0.300	94.6		

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

PARTICLE SIZE DISTRIBUTION R1119 (ISSUE 5, 2018)

NATA Accredited for compliance with ISO/IEC 17025 - Testing

Sampled Date: 20/08/2020 Tested By: MA Date Tested: 29/09/2020

APPROVED SIGNATORY M. Ashover

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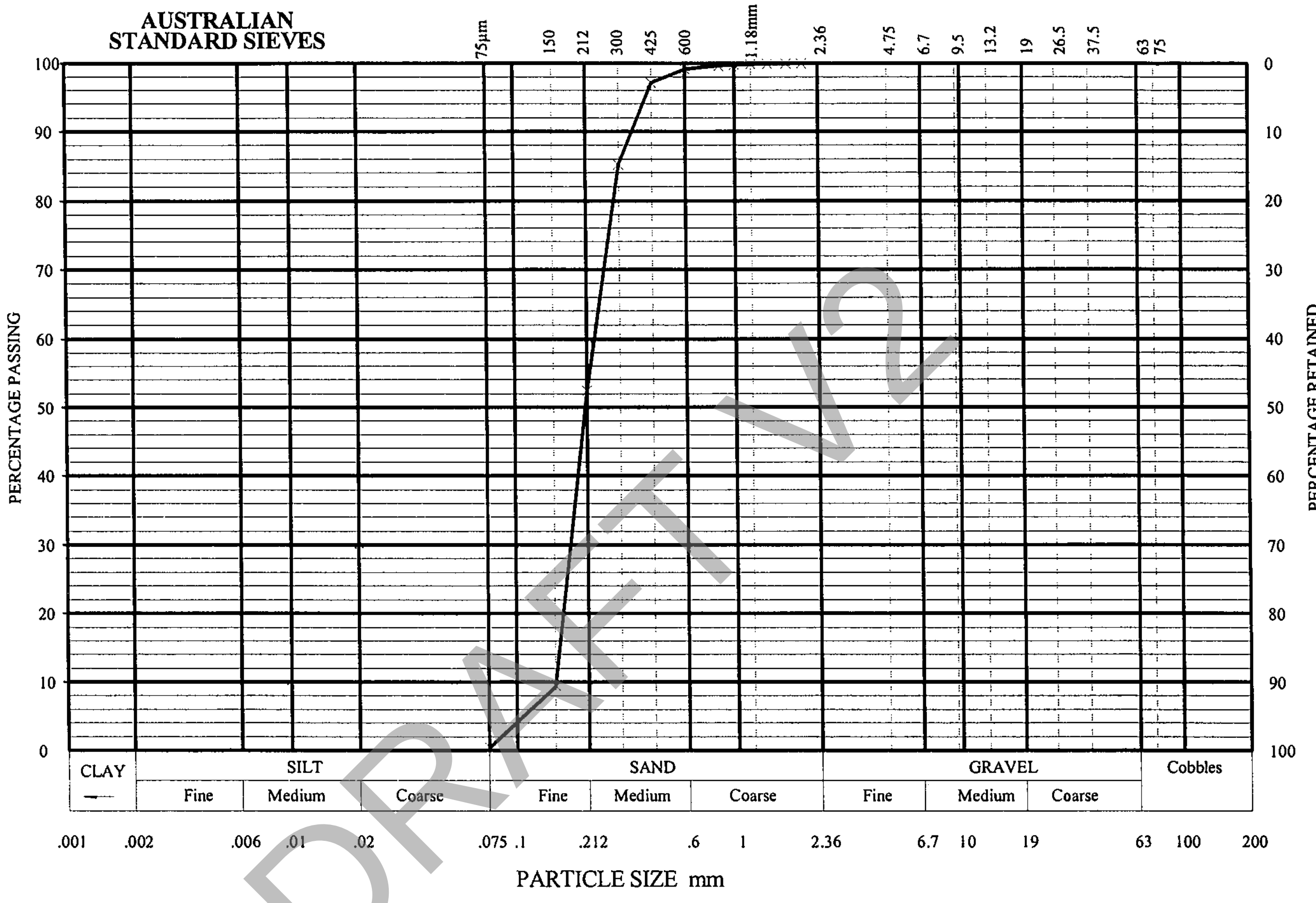
NATA Accreditation Number: 13380

NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory
REPORT No: 20013/1080/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY
SAMPLE No: 1080
LOCATION: Jetty Beach - 3rd south access swash
HOLE No: 6
DEPTH (m): 0.00



SIZE DISTRIBUTION	
COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %
EFFECTIVE SIZE D10:	0.150 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.5
CURVATURE COEFFICIENT D30² /(D60 x D10) (Cc):	0.9

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
		0.850	99.6
2.000	99.9	0.600	99.1
1.700	99.9	0.425	97.1
1.400	99.9	0.300	85.2
1.180	99.8	0.212	52.4
1.000	99.7	0.150	9.3
		0.075	0.4

Notes on Test: Tested as received
Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

NATA Accredited for compliance with ISO/IEC 17025 - Testing

Sampled Date: 20/08/2020 Tested By: MA Date Tested: 29/09/2020

APPROVED SIGNATORY M. Ashover
Mark Ashover 12/10/2020

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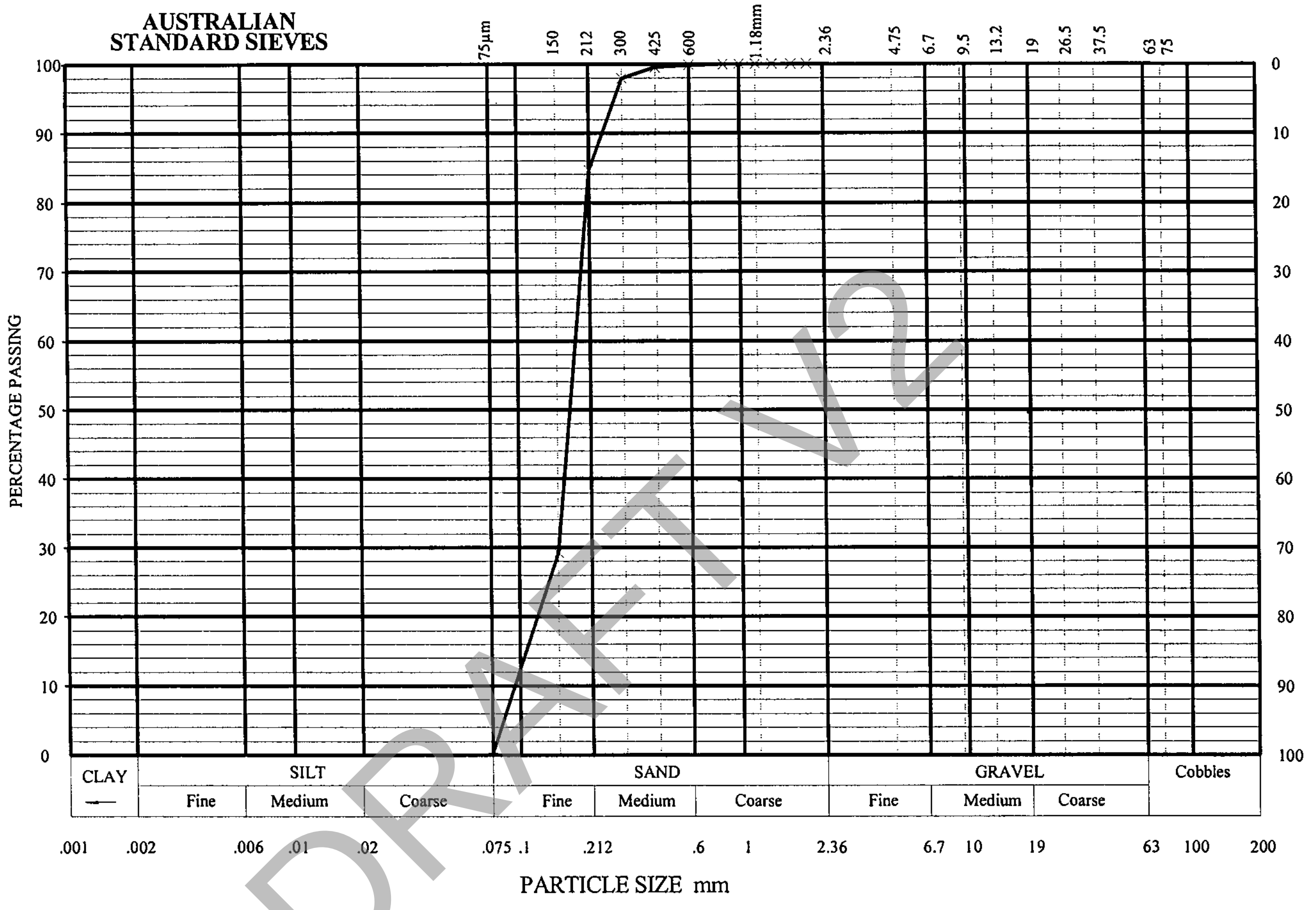
NATA Accreditation Number: 13380

NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory	REPORT No: 20014/1081/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY	SAMPLE No: 1081	
LOCATION: Coffs Harbour east south shore	HOLE No: 7	DEPTH (m): 0.00



SIZE DISTRIBUTION

COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %
EFFECTIVE SIZE D10:	0.100 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.8
CURVATURE COEFFICIENT $D30^2/(D60 \times D10)$ (Cc):	1.2

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
2.000	100.0	0.600	99.8
1.700	100.0	0.425	99.5
1.400	100.0	0.300	97.9
1.180	100.0	0.212	84.6
1.000	100.0	0.150	29.2
0.850	99.9	0.075	0.3

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

NATA Accredited for compliance with ISO/IEC 17025 - Testing

Sampled Date: 10/09/2020 Tested By: MA Date Tested: 29/09/2020

APPROVED SIGNATORY M. Ash

Mark Ashover 12/10/2020

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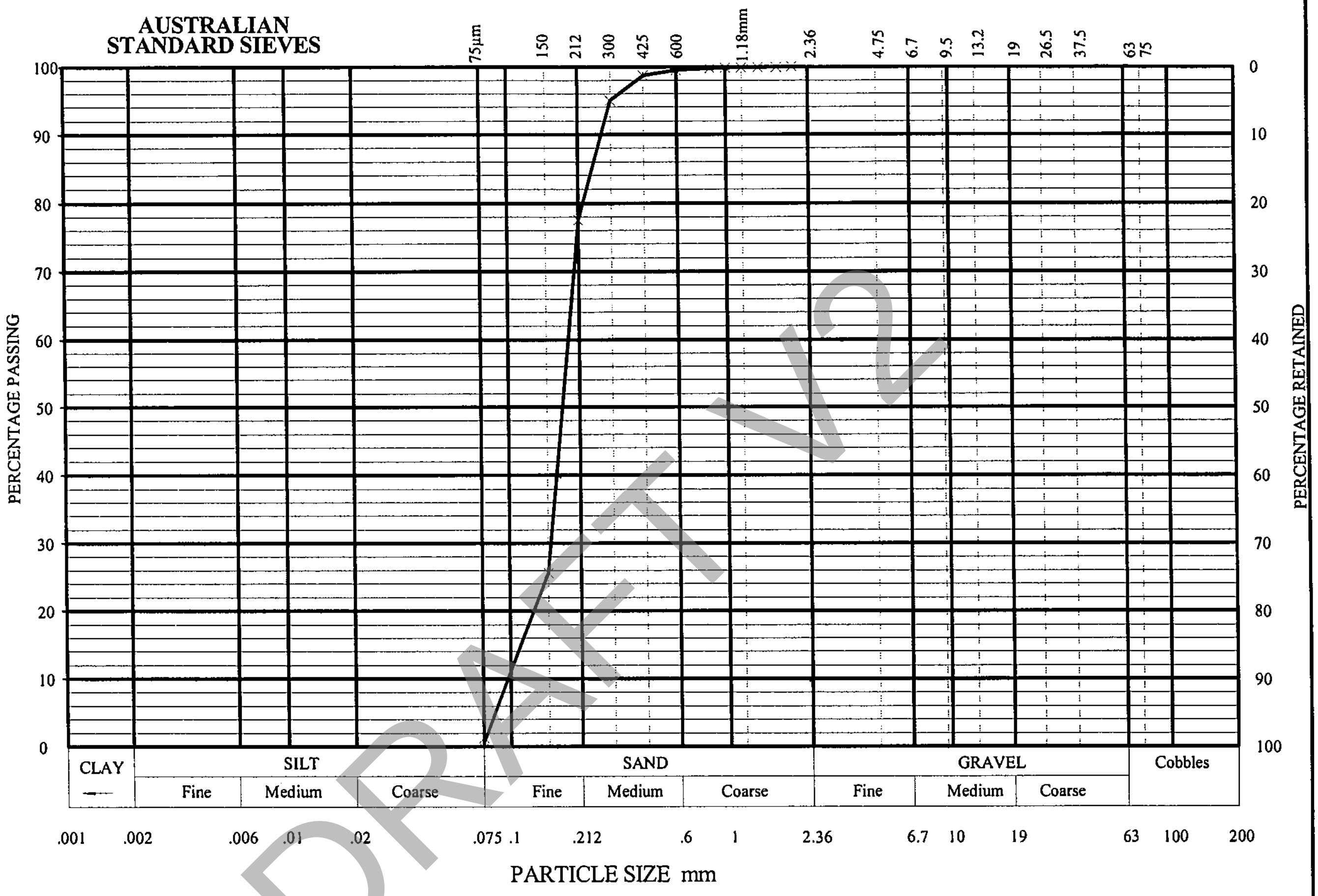
NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory	REPORT No: 20014/1082/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY		SAMPLE No: 1082
LOCATION: Coffs Harbour east boat ramp breakwater	HOLE No: 8	DEPTH (m): 0.00



SIZE DISTRIBUTION

COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	99 %
MATERIAL FINER THAN 75um	1 %
EFFECTIVE SIZE D10:	0.100 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.8
CURVATURE COEFFICIENT $D30^2$ /(D60 x D10) (Cc):	1.2

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
2.000	100.0	0.600	99.5
1.700	99.9	0.425	98.7
1.400	99.9	0.300	95.0
1.180	99.9	0.212	77.5
1.000	99.8	0.150	25.6
0.850	99.7	0.075	0.5

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

Sampled Date: 10/09/2020 Tested By: MA Date Tested: 29/09/2020

NATA Accredited for compliance with ISO/IEC 17025 - Testing

APPROVED SIGNATORY

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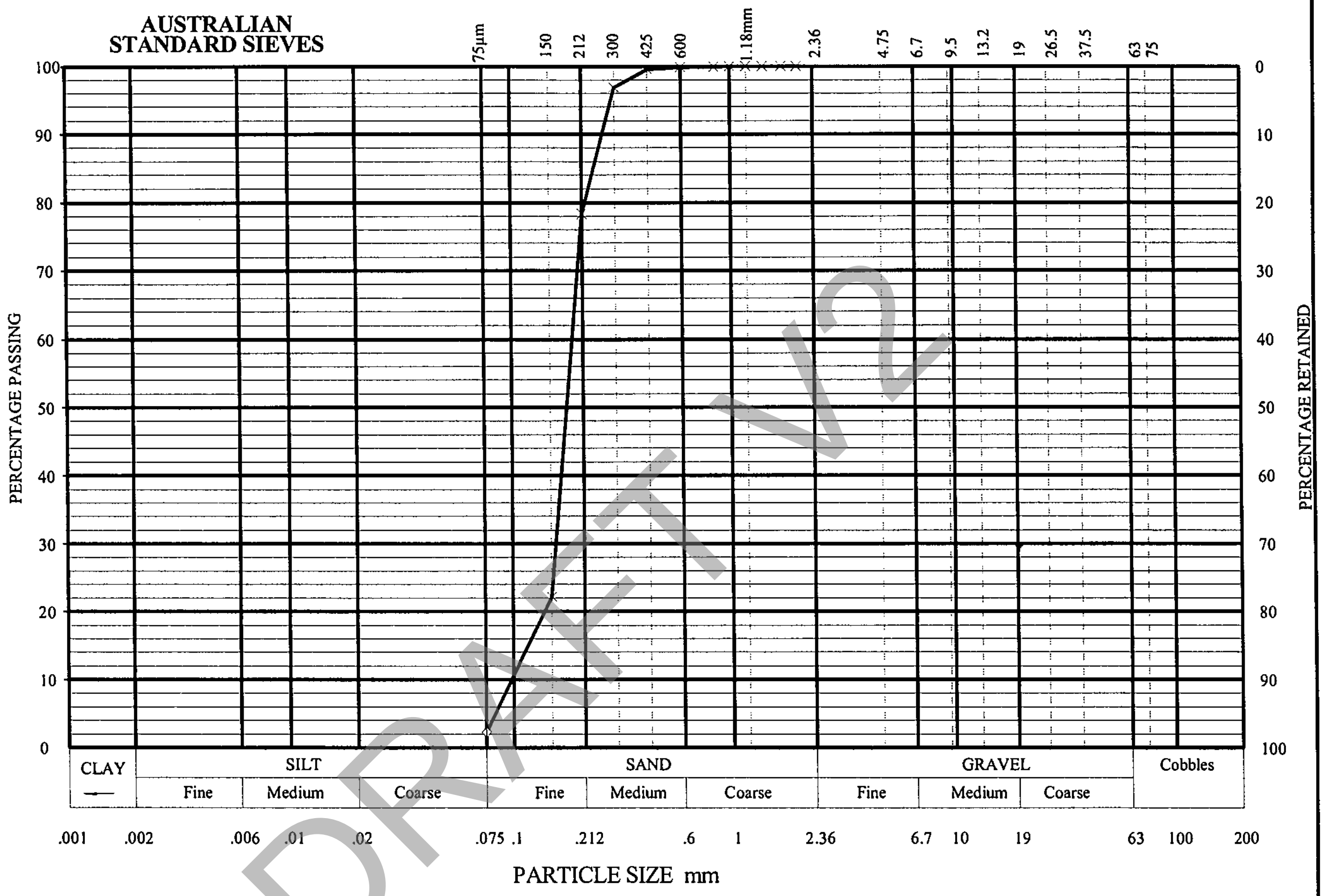
CLIENT: Manly Hydraulics Laboratory	REPORT No: 20014/1083/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY	SAMPLE No: 1083

LOCATION: Coffs Harbour centre boat ramp basin	HOLE No: 9	DEPTH (m): 0.00



SIZE DISTRIBUTION	
COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	98 %
MATERIAL FINER THAN 75um	2 %
EFFECTIVE SIZE D10:	0.100 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.8
CURVATURE COEFFICIENT $D30^2$ /(D60 x D10) (Cc):	1.2

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
1.400	100.0	0.300	96.9
1.180	100.0	0.212	78.3
1.000	100.0	0.150	22.2
0.850	99.9	0.075	2.3
0.600	99.8		
0.425	99.6		

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

NATA Accredited for compliance with ISO/IEC 17025 - Testing

Sampled Date: 10/09/2020 Tested By: MA Date Tested: 29/09/2020

APPROVED SIGNATORY M. Ashover

Mark Ashover 12/10/2020

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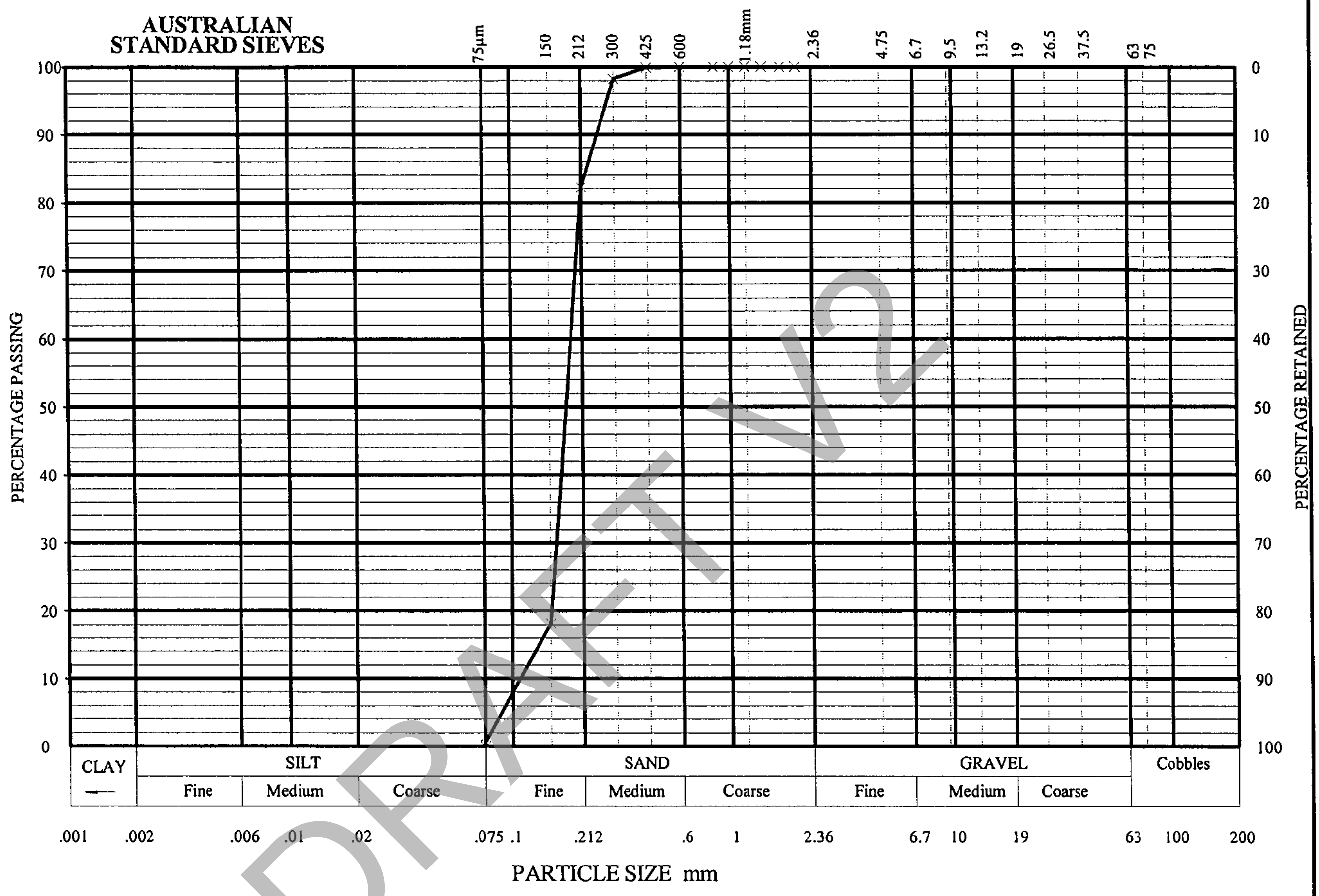
CLIENT: Manly Hydraulics Laboratory	REPORT No: 20014/1084/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY		SAMPLE No: 1084
LOCATION: Coffs Harbour boat ramp entrance channel	HOLE No: 10	DEPTH (m): 0.00



SIZE DISTRIBUTION

COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	99 %
MATERIAL FINER THAN 75um	1 %

EFFECTIVE SIZE D10:	0.110 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.6
CURVATURE COEFFICIENT D30² /(D60 x D10) (Cc):	1.1

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
1.180	100.0	0.212	82.2
1.000	100.0	0.150	18.2
0.850	100.0	0.075	0.7
0.600	100.0		
0.425	99.9		
0.300	98.2		

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

Sampled Date: 10/09/2020 Tested By: MA Date Tested: 02/10/2020

NATA Accredited for compliance with ISO/IEC 17025 - Testing

APPROVED SIGNATORY M. Ashover
Mark Ashover 12/10/2020

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NATA Accreditation Number: 13380

NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory

REPORT No: 20014/1085/R1119

PARTICLE SIZE DISTRIBUTION

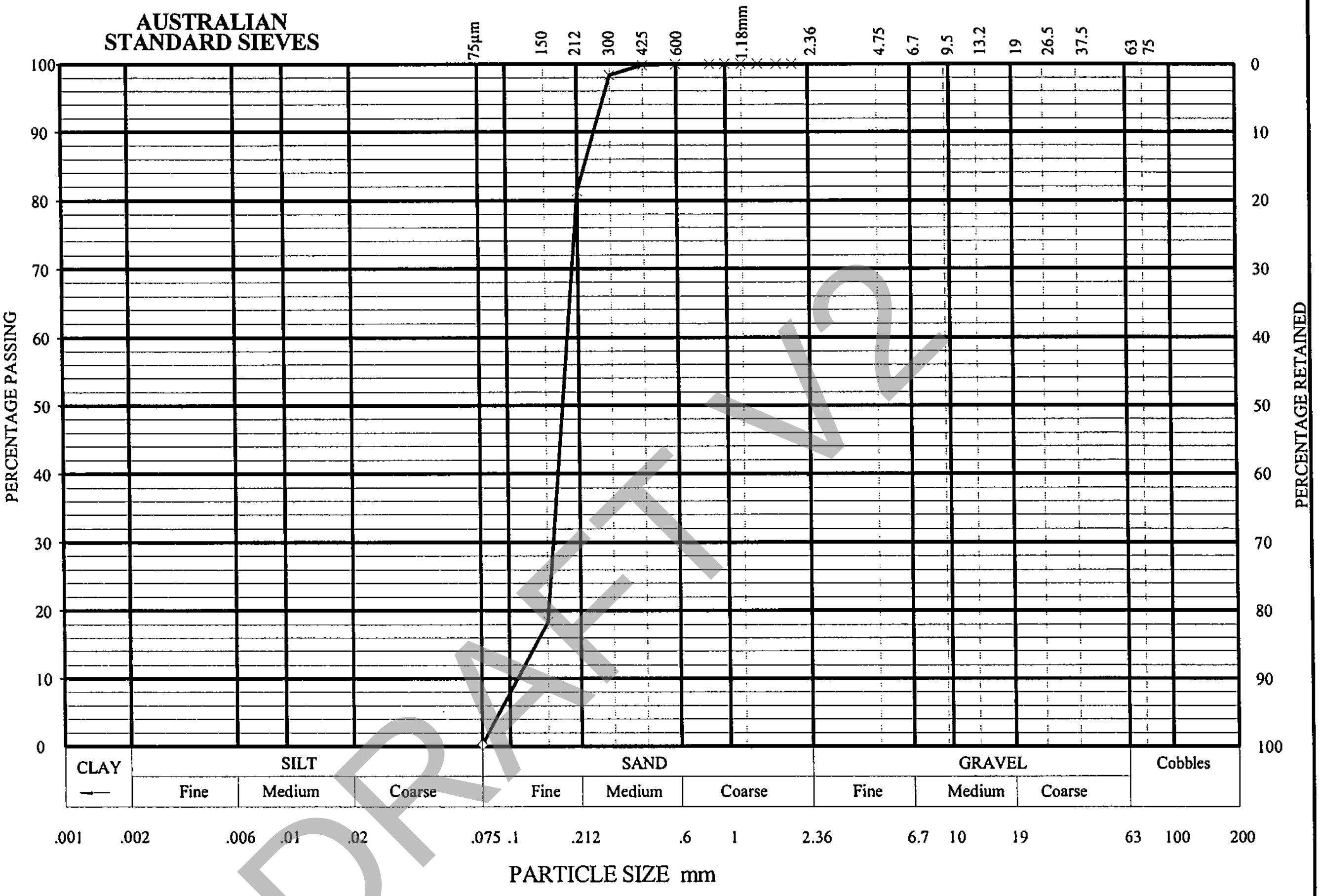
PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY

SAMPLE No: 1085

LOCATION: Jetty Beach - south end offshore

HOLE No: 11

DEPTH (m): 0.00



SIZE DISTRIBUTION	
COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %
EFFECTIVE SIZE D10:	0.110 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.6
CURVATURE COEFFICIENT D30² /(D60 x D10) (Cc):	1.1

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
1.180	100.0	0.212	81.4
1.000	100.0	0.150	18.4
0.850	100.0	0.075	0.3
0.600	99.9		
0.425	99.8		
0.300	98.3		

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

Sampled Date: 10/09/2020 Tested By: MA Date Tested: 02/10/2020

NATA Accredited for compliance with ISO/IEC 17025 - Testing

APPROVED SIGNATORY M. Ash

Mark Ashover 12/10/2020

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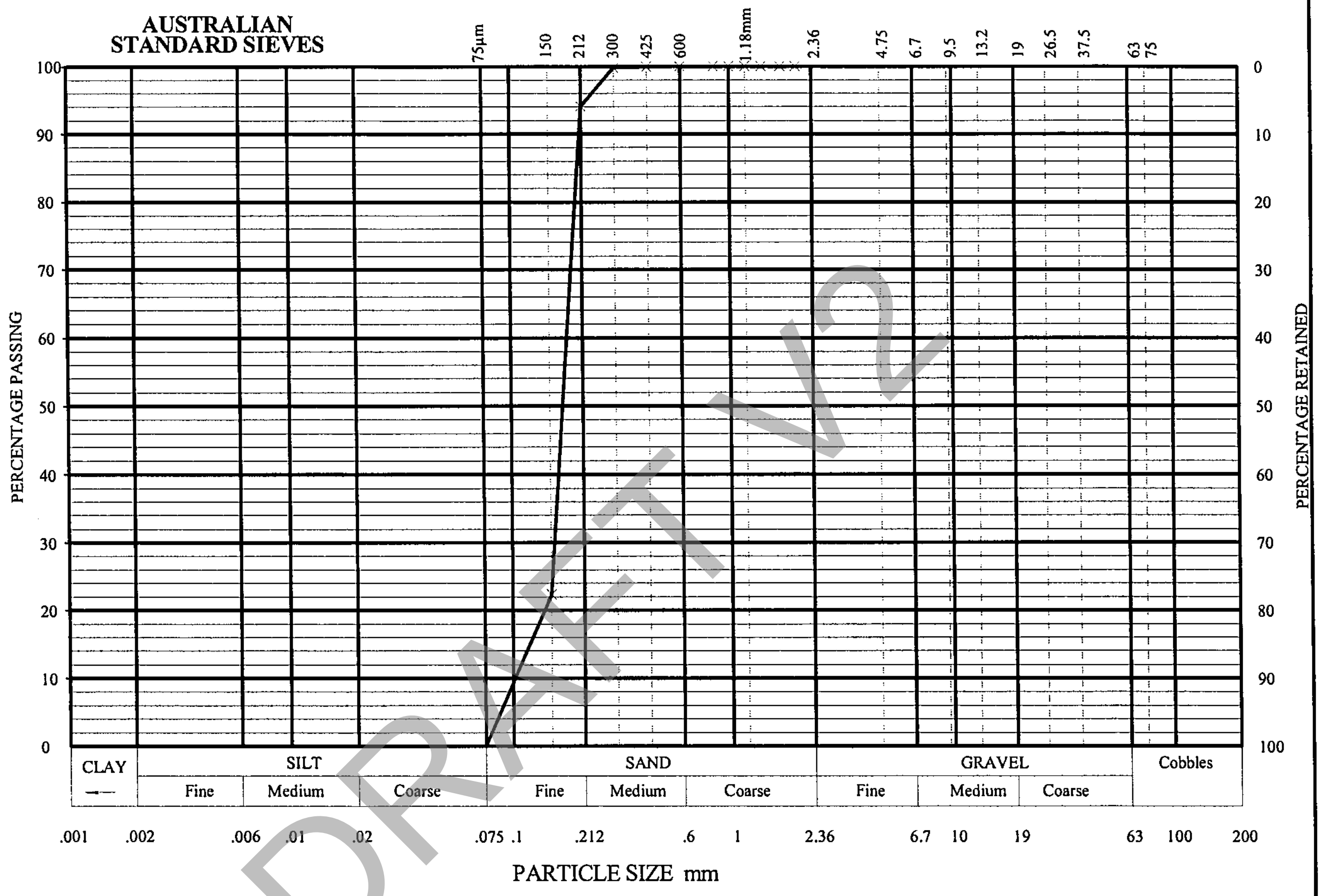
NATA Accreditation Number: 13380

NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory	REPORT No: 20014/1086/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY		SAMPLE No: 1086
LOCATION: Jetty Beach - north end berm	HOLE No: 12	DEPTH (m): 0.00



SIZE DISTRIBUTION	
COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %
EFFECTIVE SIZE D10:	0.100 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.6
CURVATURE COEFFICIENT D30² /(D60 x D10) (Cc):	1.2

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
1.700	100.0	0.425	99.9
1.400	100.0	0.300	99.8
1.180	100.0	0.212	94.1
1.000	100.0	0.150	22.3
0.850	100.0	0.075	0.1
0.600	100.0		

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

NATA Accredited for compliance with ISO/IEC 17025 - Testing

Sampled Date: 10/09/2020 Tested By: MA Date Tested: 02/10/2020

APPROVED SIGNATORY M- Ashover

Mark Ashover 12/10/2020

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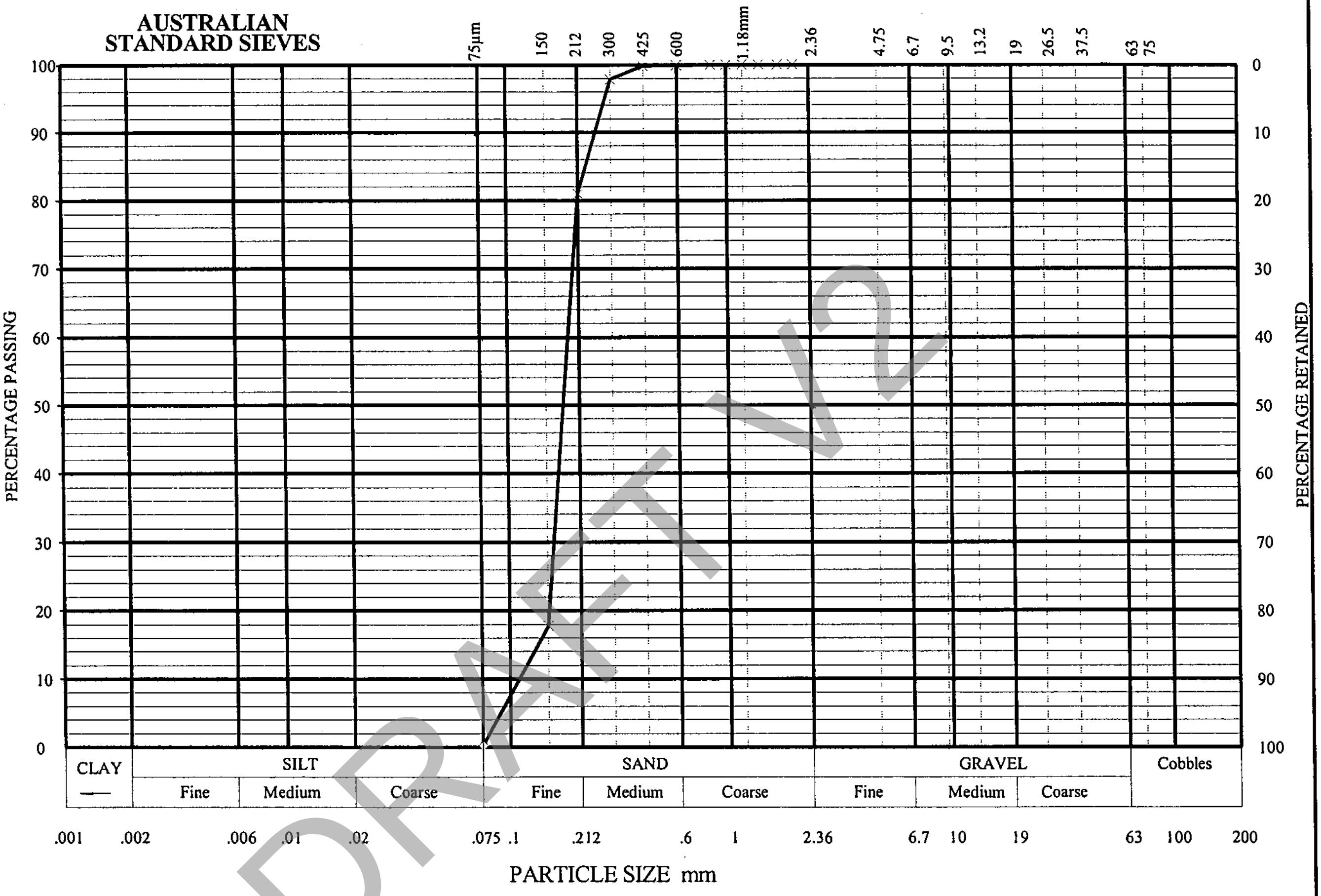
NATA Accreditation Number: 13380

NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory	REPORT No: 20014/1087/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY		SAMPLE No: 1087
LOCATION: Jetty Beach - north end swash	HOLE No: 13	DEPTH (m): 0.00



SIZE DISTRIBUTION

COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %

EFFECTIVE SIZE D10:	0.110 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.6
CURVATURE COEFFICIENT $D30^2/(D60 \times D10)$ (Cc):	1.1

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
1.700	100.0	0.425	99.8
1.400	100.0	0.300	97.8
1.180	100.0	0.212	80.9
1.000	100.0	0.150	17.8
0.850	100.0	0.075	0.3
0.600	99.9		

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

Sampled Date: 10/09/2020 Tested By: MA Date Tested: 02/10/2020

NATA Accredited for compliance with ISO/IEC 17025 - Testing

APPROVED SIGNATORY M. Ashover

Mark Ashover 12/10/2020

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CLIENT: Manly Hydraulics Laboratory

REPORT No: 20014/1088/R1119

PARTICLE SIZE DISTRIBUTION

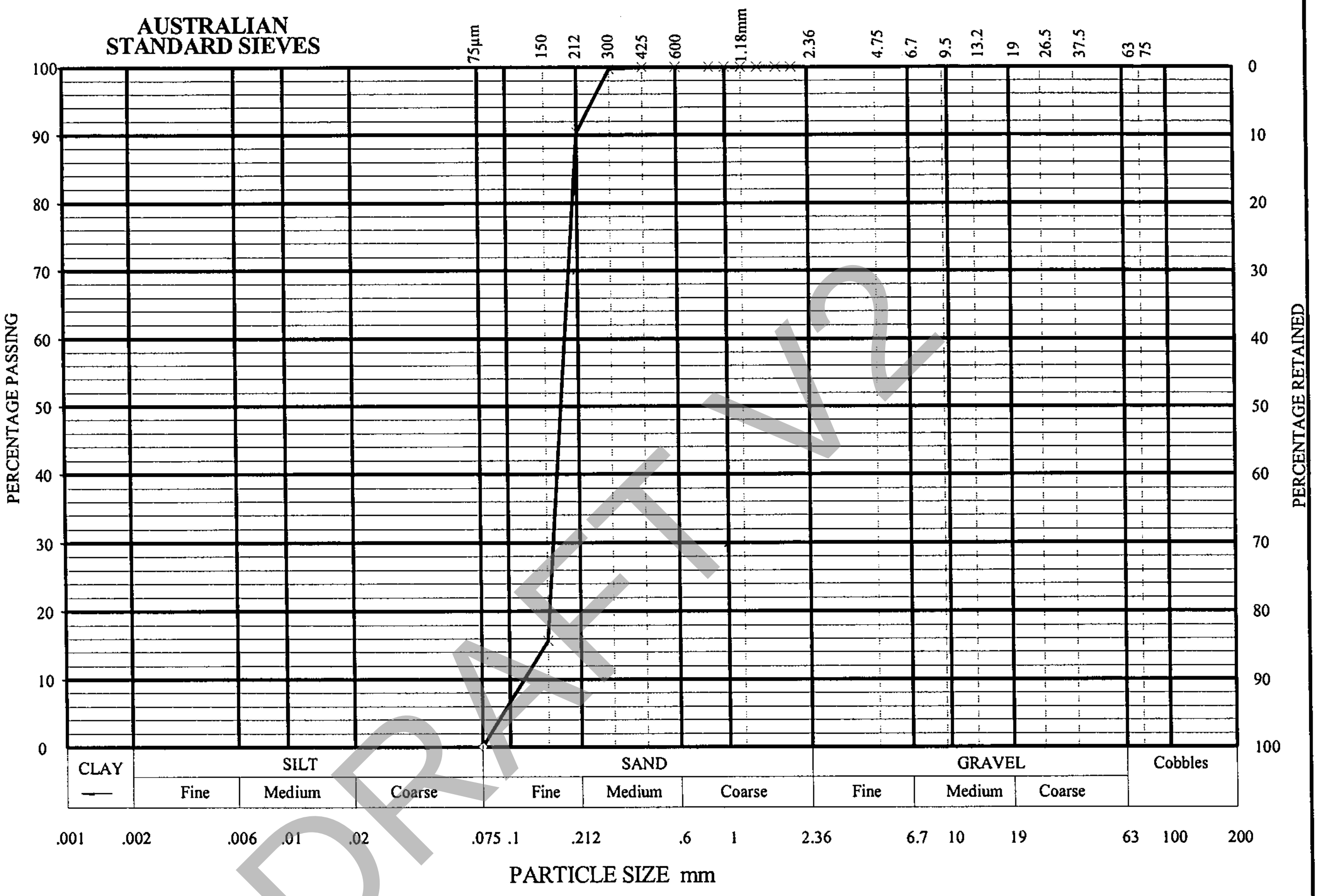
PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY

SAMPLE No: 1088

LOCATION: Coffs Harbour Jetty berm

HOLE No: 14

DEPTH (m): 0.00



PARTICLE SIZE DISTRIBUTION R1119 (ISSUE 5, 2018)

SIZE DISTRIBUTION

COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %
EFFECTIVE SIZE D10:	0.120 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.5
CURVATURE COEFFICIENT $D30^2$ /(D60 x D10) (Cc):	1.1

SIZE (mm)	% PASSING
0.600	100.0
0.425	100.0
0.300	99.7
0.212	90.4
0.150	15.7
0.075	0.1

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

NATA Accredited for compliance with ISO/IEC 17025 - Testing

Sampled Date: 10/09/2020 Tested By: MA Date Tested: 02/10/2020

APPROVED SIGNATORY

Mark Ashover 12/10/2020

Geotechnical Centre

110B King Street, Manly Vale NSW 2093
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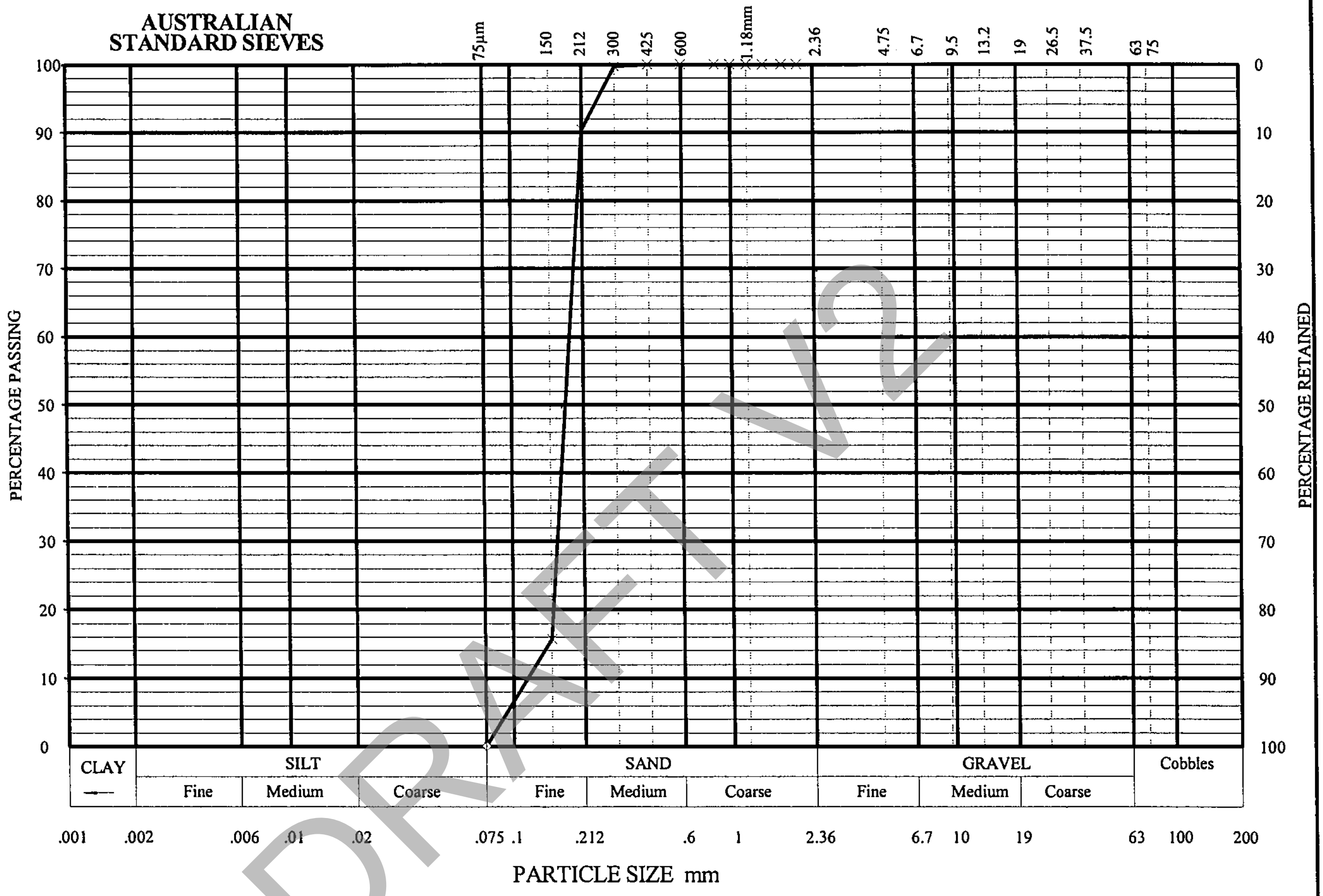
NATA Accreditation Number: 13380

NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory	REPORT No: 20014/1088/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY		SAMPLE No: 1088
LOCATION: Coffs Harbour Jetty berm	HOLE No: 14	DEPTH (m): 0.00



SIZE DISTRIBUTION	
COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %
EFFECTIVE SIZE D10:	0.120 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.5
CURVATURE COEFFICIENT D30² /(D60 x D10) (Cc):	1.1

SIZE (mm)	% PASSING
0.600	100.0
0.425	100.0
0.300	99.7
0.212	90.4
0.150	15.7
0.075	0.1

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

NATA Accredited for compliance with ISO/IEC 17025 - Testing

Sampled Date: 10/09/2020 Tested By: MA Date Tested: 02/10/2020

APPROVED SIGNATORY

Mark Ashover 12/10/2020

Geotechnical Centre
110B King Street, Manly Vale NSW 2093
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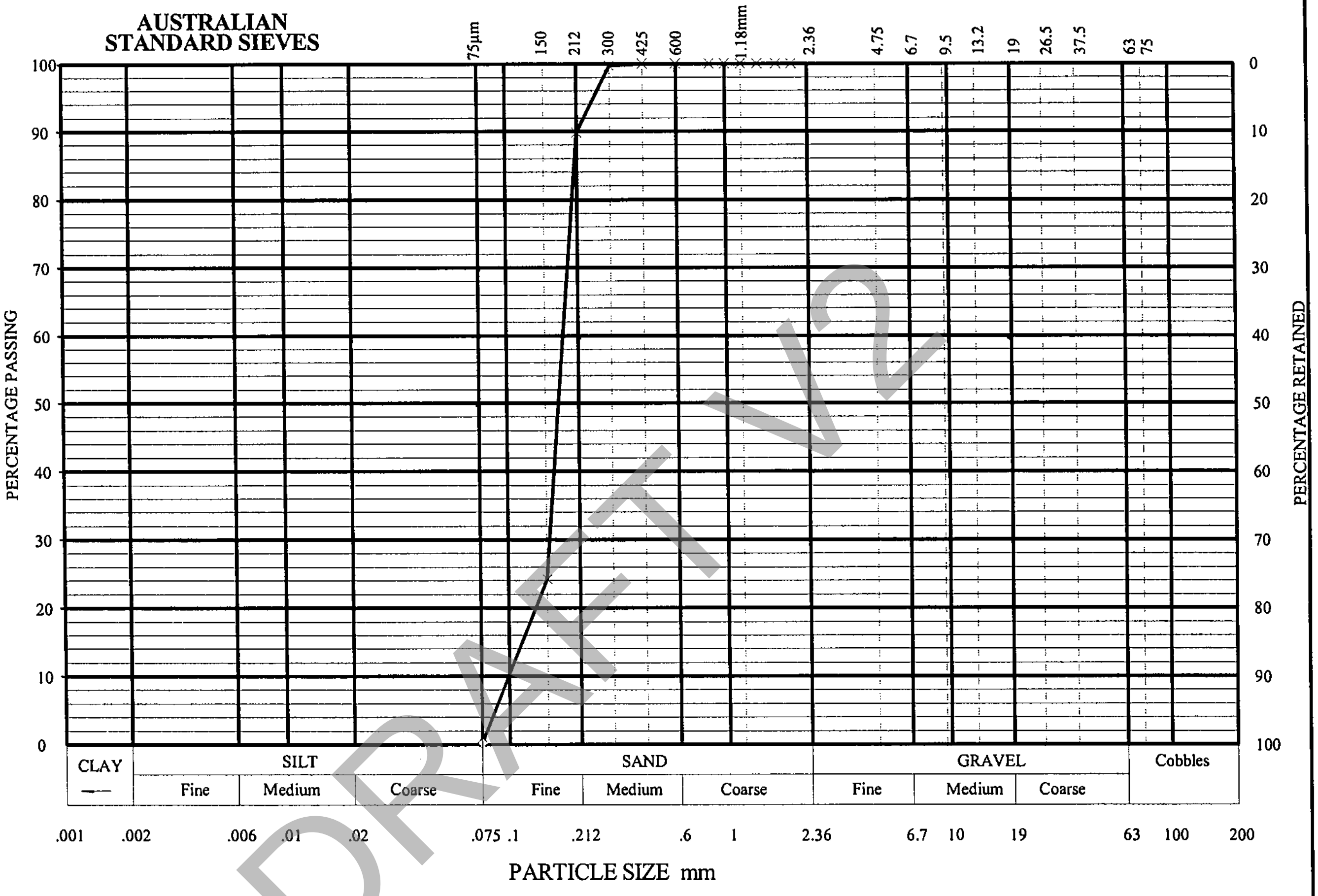
NATA Accreditation Number: 13380

NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory
REPORT No: 20014/1089/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY
SAMPLE No: 1089
LOCATION: Coffs Harbour Jetty swash
HOLE No: 15
DEPTH (m): 0.00



SIZE DISTRIBUTION

COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %

EFFECTIVE SIZE D10:	0.100 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.7
CURVATURE COEFFICIENT D30² /(D60 x D10) (Cc):	1.2

SIZE (mm)	% PASSING
0.600	100.0
0.425	100.0
0.300	99.7
0.212	89.9
0.150	24.2
0.075	0.2

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

NATA Accredited for compliance with ISO/IEC 17025 - Testing

Sampled Date: 10/09/2020 Tested By: MA Date Tested: 02/10/2020

APPROVED SIGNATORY

Mark Ashover 12/10/2020

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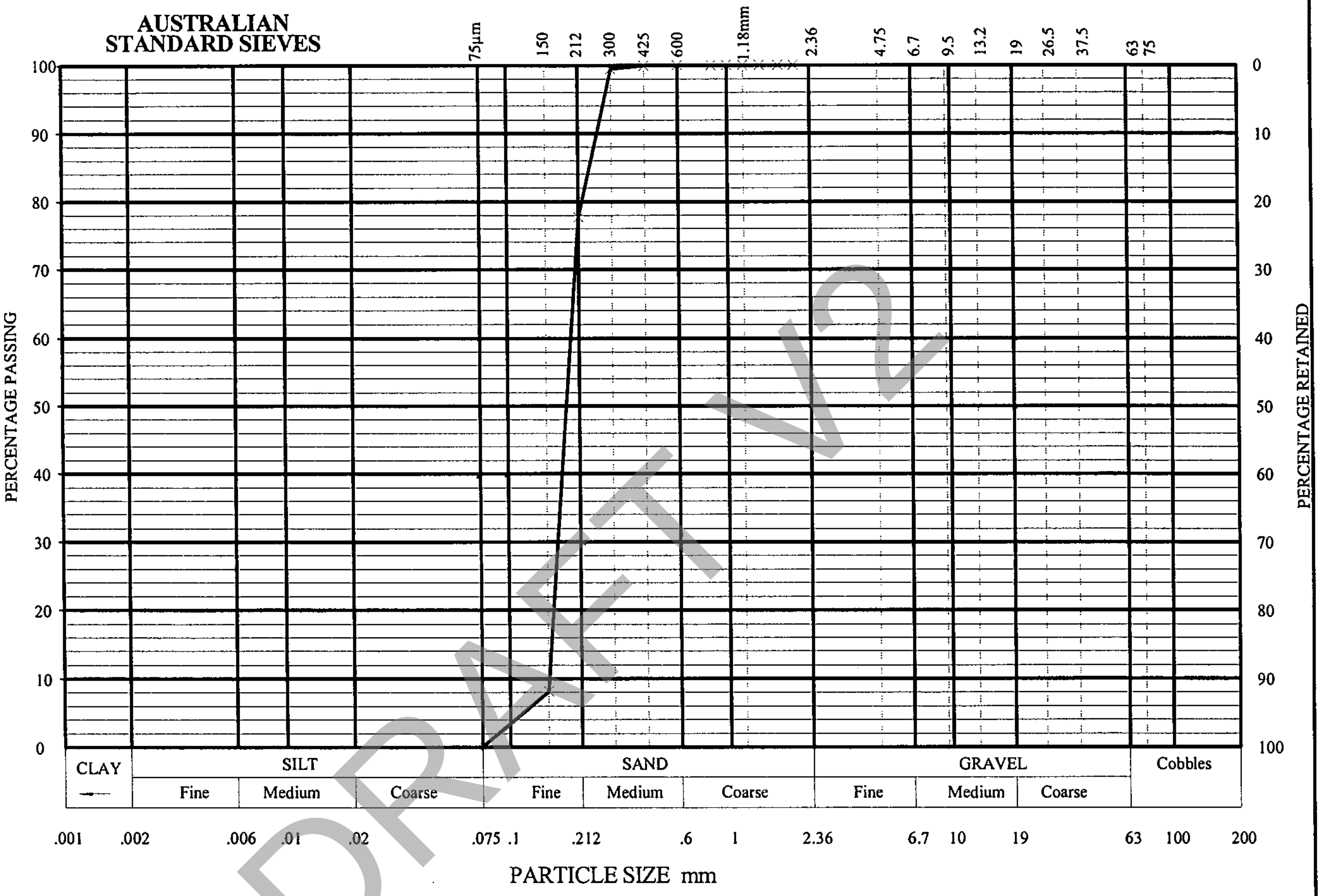
NSW GOVERNMENT | Public Works Advisory

CLIENT: Manly Hydraulics Laboratory
REPORT No: 20014/1090/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY
SAMPLE No: 1090
LOCATION: Jetty Beach - middle berm
HOLE No: 16
DEPTH (m): 0.00



SIZE DISTRIBUTION	
COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %
EFFECTIVE SIZE D10:	0.150 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.2
CURVATURE COEFFICIENT D30² /(D60 x D10) (Cc):	0.9

SIZE (mm)	% PASSING	SIZE (mm)	% PASSING
0.850	100.0	0.075	0.1
0.600	100.0		
0.425	99.9		
0.300	99.4		
0.212	77.7		
0.150	8.2		

Notes on Test: Tested as received
Loss in pre-treatment: 0 %

Test Methods:
DPWS GM 9: Determination of the Particle Size Distribution of a Soil

NATA Accredited for compliance with ISO/IEC 17025 - Testing

Sampled Date: 10/09/2020 Tested By: MA Date Tested: 02/10/2020

APPROVED SIGNATORY

Mark Ashover 12/10/2020

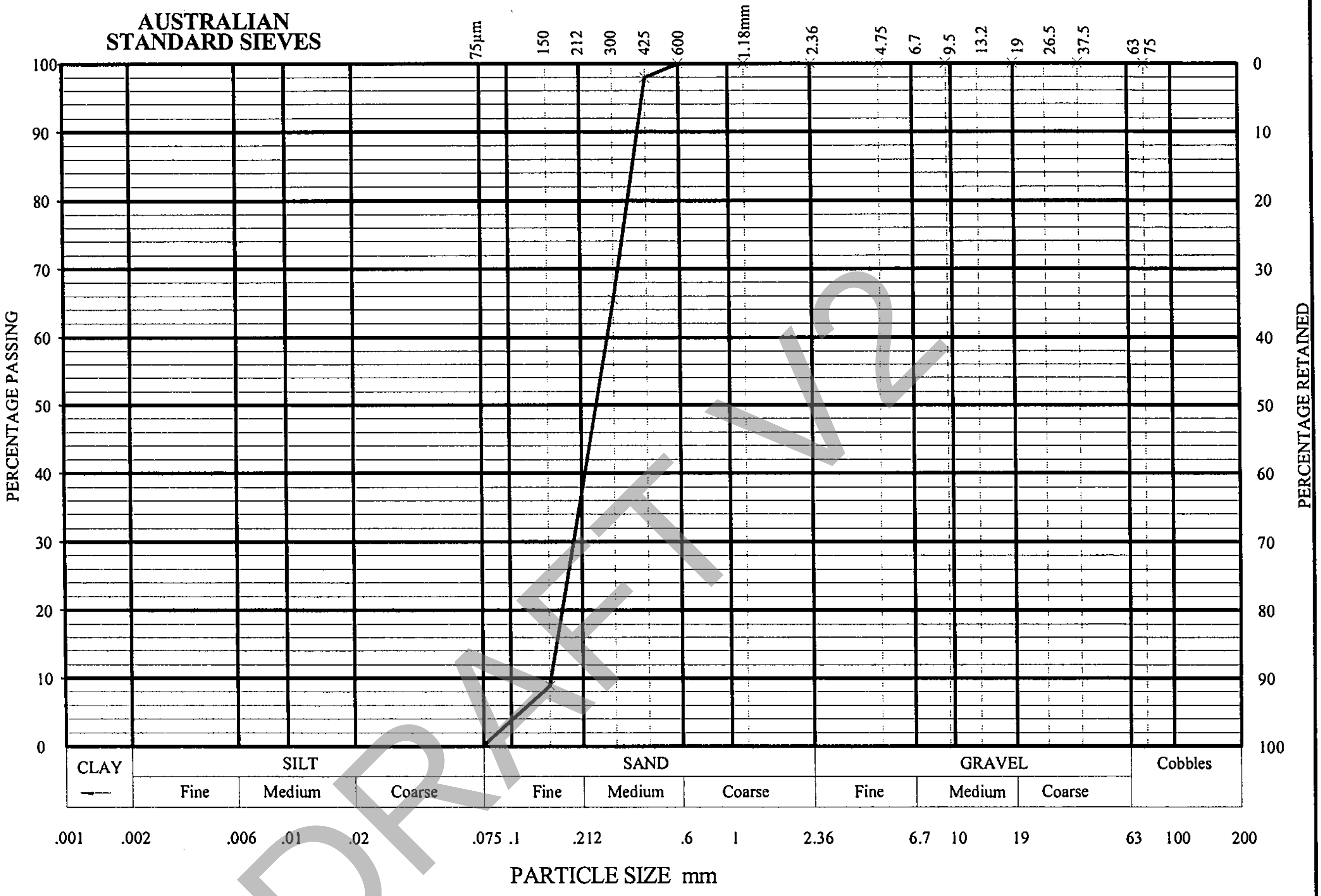
Geotechnical Centre
110B King Street, Manly Vale NSW 2093
Telephone 02 9949 0253
NATA Accreditation Number: 13380

NSW GOVERNMENT
Public Works Advisory

CLIENT: Manly Hydraulics Laboratory
REPORT No: 20014/1091/R1119

PARTICLE SIZE DISTRIBUTION

PROJECT: COFFS HARBOUR SEDIMENT TRANSPORT STUDY
SAMPLE No: 1091
LOCATION: Jetty Beach - middle swash
HOLE No: 17
DEPTH (m): 0.00



SIZE DISTRIBUTION	
COBBLES	0 %
GRAVEL	0 %
SAND RETAINED 75um	100 %
MATERIAL FINER THAN 75um	0 %
EFFECTIVE SIZE D10:	0.150 mm
UNIFORMITY COEFFICIENT D60/D10(Cu):	1.8
CURVATURE COEFFICIENT $D30^2$ /(D60 x D10) (Cc):	0.9

SIZE (mm)	% PASSING
1.180	100.0
0.600	100.0
0.425	97.9
0.300	65.5
0.150	8.9
0.075	0.2

Notes on Test: Tested as received

Loss in pre-treatment: 0 %

Test Methods:
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APPROVED SIGNATORY M. Ash

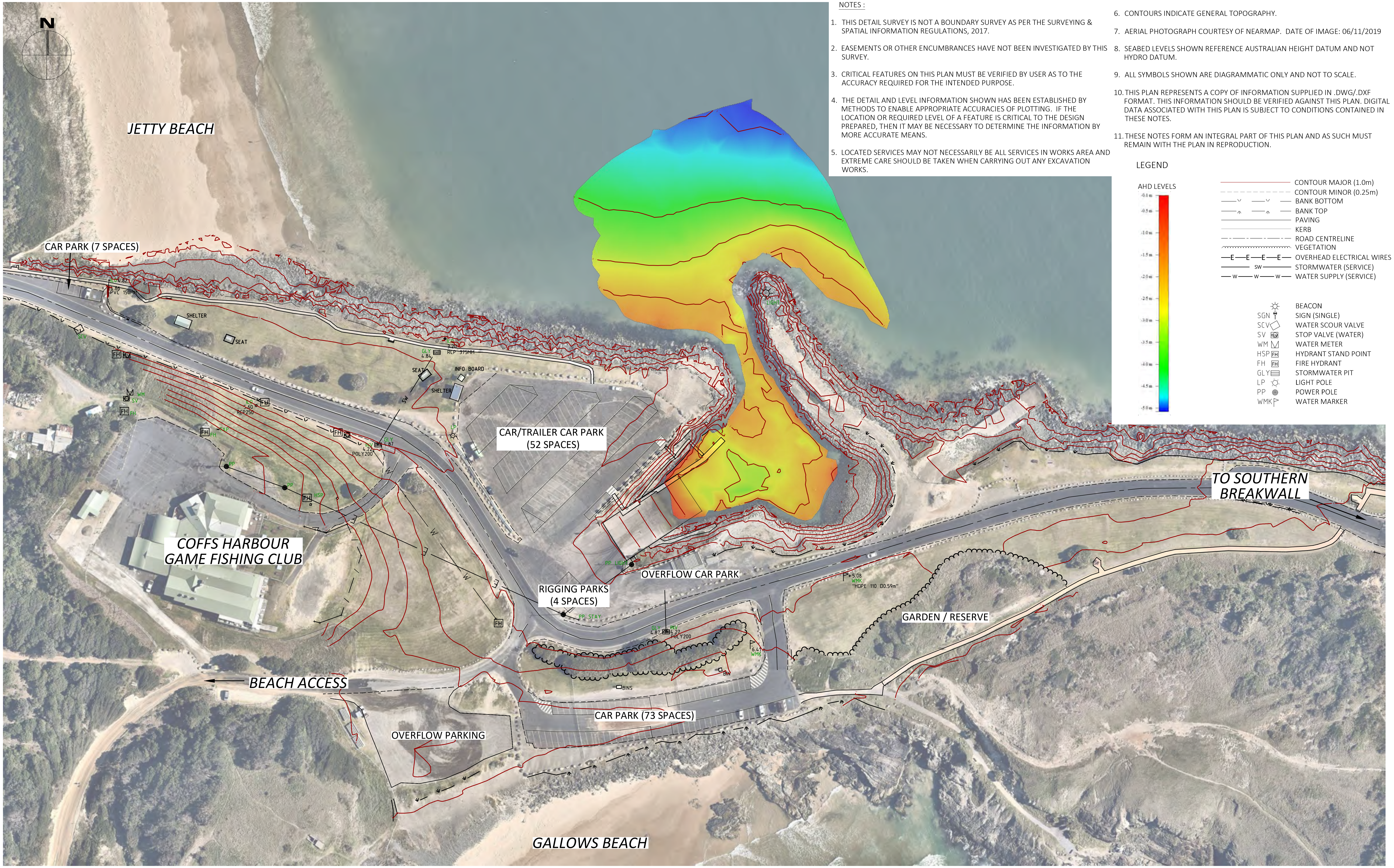
Mark Ashover 12/10/2020

PARTICLE SIZE DISTRIBUTION R1119 (ISSUE 5. 2018)

110B King Street
Manly Vale NSW 2093

Appendix J

Bathymetry Survey of Proposed Basin Dredging



NOTES :

1. THIS DETAIL SURVEY IS NOT A BOUNDARY SURVEY AS PER THE SURVEYING & SPATIAL INFORMATION REGULATIONS, 2017.
2. EASEMENTS OR OTHER ENCUMBRANCES HAVE NOT BEEN INVESTIGATED BY THIS SURVEY.
3. CRITICAL FEATURES ON THIS PLAN MUST BE VERIFIED BY USER AS TO THE ACCURACY REQUIRED FOR THE INTENDED PURPOSE.
4. THE DETAIL AND LEVEL INFORMATION SHOWN HAS BEEN ESTABLISHED BY METHODS TO ENABLE APPROPRIATE ACCURACIES OF PLOTTING. IF THE LOCATION OR REQUIRED LEVEL OF A FEATURE IS CRITICAL TO THE DESIGN PREPARED, THEN IT MAY BE NECESSARY TO DETERMINE THE INFORMATION BY MORE ACCURATE MEANS.
5. LOCATED SERVICES MAY NOT NECESSARILY BE ALL SERVICES IN WORKS AREA AND EXTREME CARE SHOULD BE TAKEN WHEN CARRYING OUT ANY EXCAVATION WORKS.
6. CONTOURS INDICATE GENERAL TOPOGRAPHY.
7. AERIAL PHOTOGRAPH COURTESY OF NEARMAP. DATE OF IMAGE: 06/11/2019
8. SEABED LEVELS SHOWN REFERENCE AUSTRALIAN HEIGHT DATUM AND NOT HYDRO DATUM.
9. ALL SYMBOLS SHOWN ARE DIAGRAMMATIC ONLY AND NOT TO SCALE.
10. THIS PLAN REPRESENTS A COPY OF INFORMATION SUPPLIED IN .DWG/.DXF FORMAT. THIS INFORMATION SHOULD BE VERIFIED AGAINST THIS PLAN. DIGITAL DATA ASSOCIATED WITH THIS PLAN IS SUBJECT TO CONDITIONS CONTAINED IN THESE NOTES.
11. THESE NOTES FORM AN INTEGRAL PART OF THIS PLAN AND AS SUCH MUST REMAIN WITH THE PLAN IN REPRODUCTION.

LEGEND

AHD LEVELS
-0.1 m
-0.5 m
-1.0 m
-1.5 m
-2.0 m
-2.5 m
-3.0 m
-3.5 m
-4.0 m
-4.5 m
-5.0 m

CONTOUR MAJOR (1.0m)
CONTOUR MINOR (0.25m)
BANK BOTTOM
BANK TOP
PAVING
KERB
ROAD CENTRELINE
VEGETATION
—E—E—E—E— OVERHEAD ELECTRICAL WIRES
—SW— STORMWATER (SERVICE)
—W—W—W— WATER SUPPLY (SERVICE)

☼	BEACON
SGN	SIGN (SINGLE)
SCV	WATER SCOUR VALVE
SV	STOP VALVE (WATER)
WM	WATER METER
HSP FH	HYDRANT STAND POINT
FH FH	FIRE HYDRANT
GLY	STORMWATER PIT
LP	LIGHT POLE
PP ◎	POWER POLE
WMK	WATER MARKER

NORTH COAST SURVEYS

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REV	DATE	DESCRIPTION
0	30/03/20	ORIGINAL ISSUE

SCALE 1:1500

15 0 15 30 45 60 75

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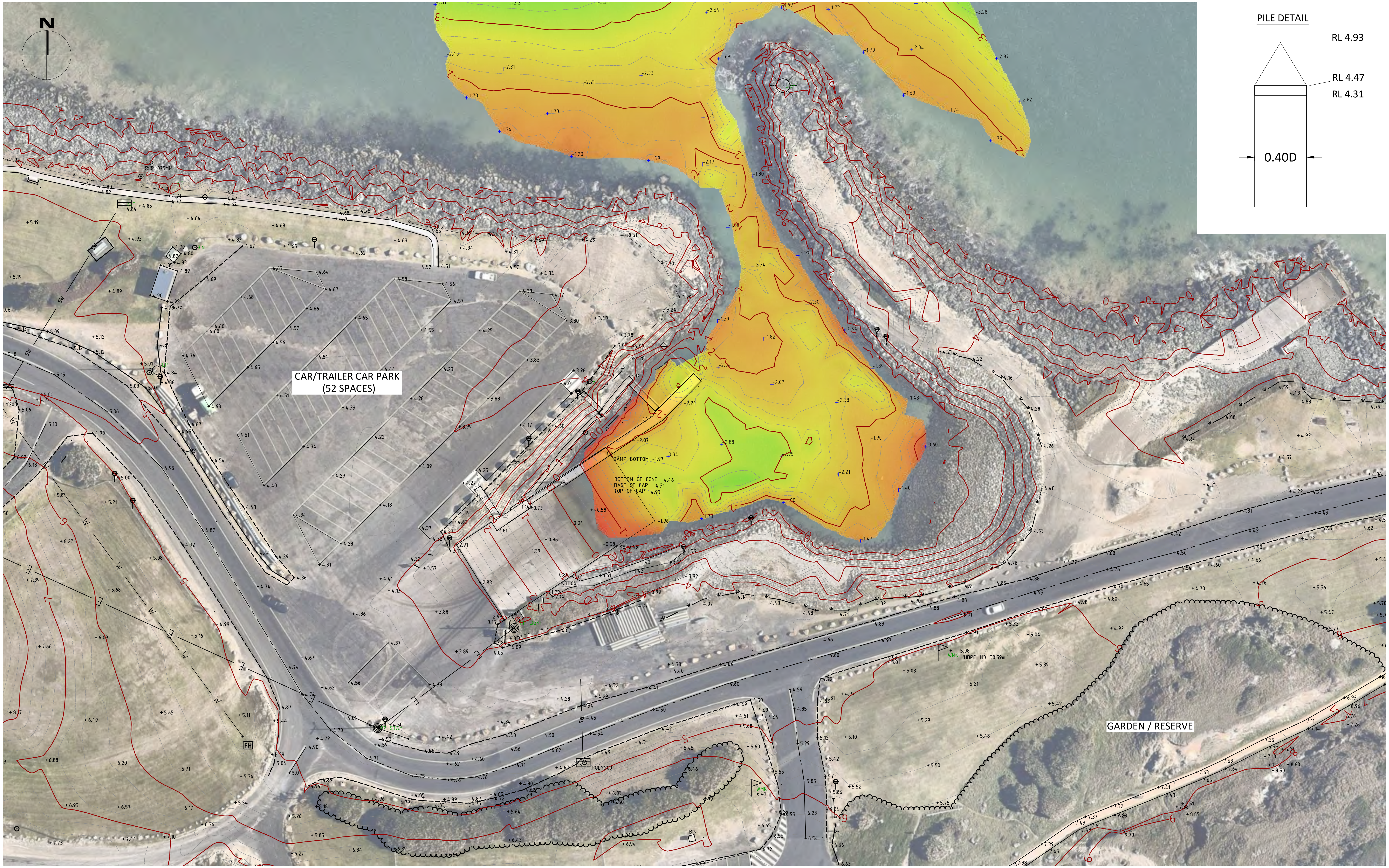
JOB No.	20039
SURVEYED BY	JS
CHECKED BY	DC
DATE OF SURVEY	20/03/2020
Vz DATUM	AHD71
ORIGIN	PM82044
Hz DATUM	MGA56 (1994)
ORIGINAL SHEET SIZE A3	

TITLE: PLAN SHOWING CONTOURS & DETAIL - OVERVIEW

SITE: COFFS HARBOUR BOAT RAMP
COFFS HARBOUR NSW 2450

CLIENT: RHDHV

DWG No: 20039A BOAT RAMP.DWG SHEET 1 OF 3 REV 0



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REV	DATE	DESCRIPTION
0	30/03/20	ORIGINAL ISSUE

SCALE 1:750

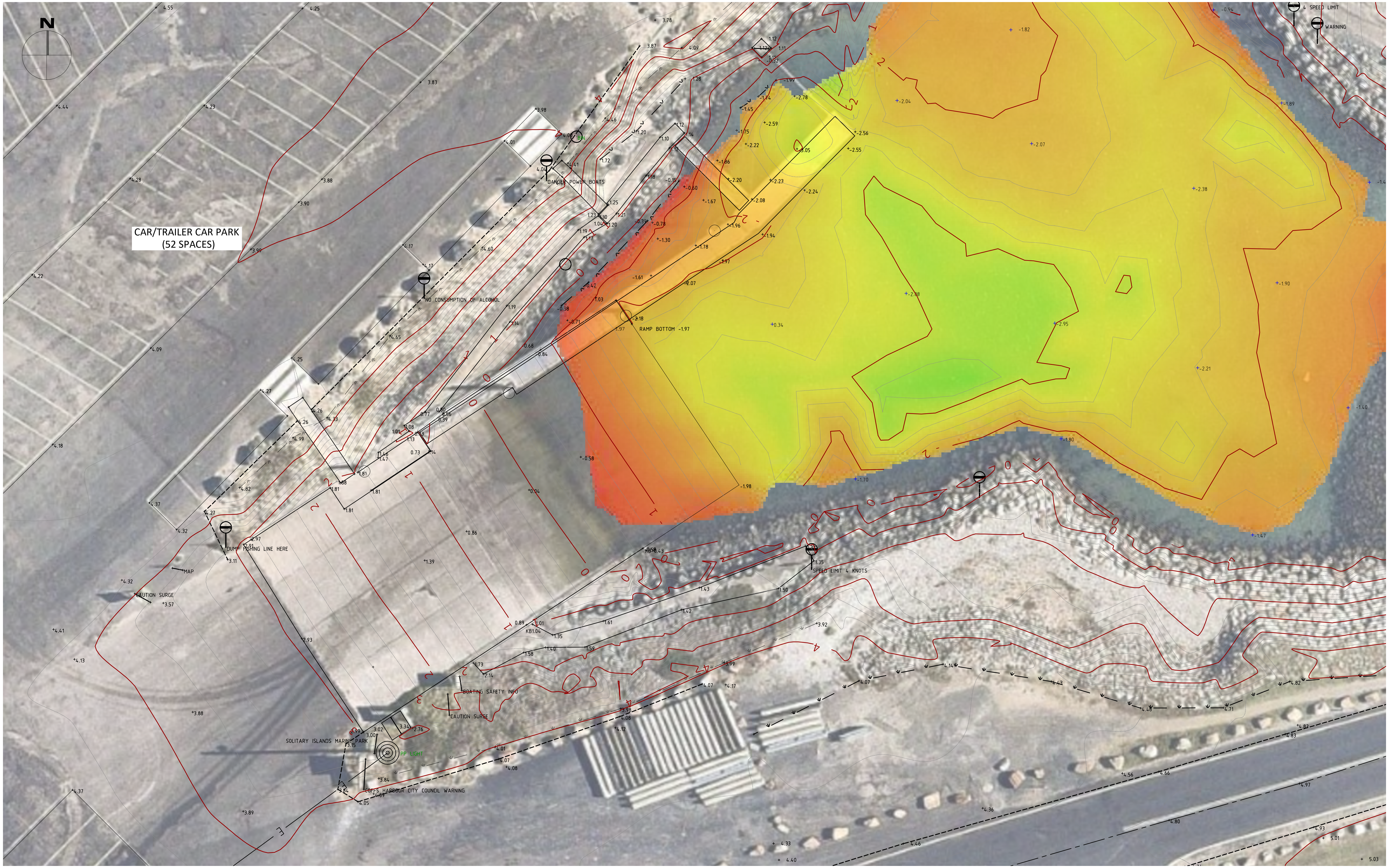
7.5 0 7.5 15 22.5 30 37.5

JOB No.	20039
SURVEYED BY	JS
CHECKED BY	DC
DATE OF SURVEY	20/03/2020
Vz DATUM	AHD71
ORIGIN	PM
Hz DATUM	MGA56 (1994)

ORIGINAL SHEET SIZE A3

TITLE: PLAN SHOWING CONTOURS & DETAIL - SHEET 2
SITE: COFFS HARBOUR BOAT RAMP
COFFS HARBOUR NSW 2450
CLIENT: RHDHV

DWG No: 20039A BOAT RAMP.DWG SHEET 1 OF 3 REV 0



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REV	DATE	DESCRIPTION
0	30/03/20	ORIGINAL ISSUE

SCALE 1:300

3 0 3 6 9 12 15

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JOB No.	20039
SURVEYED BY	JS
CHECKED BY	DC
DATE OF SURVEY	20/03/2020
Vz DATUM	AHD71
ORIGIN	PM
Hz DATUM	MGA56 (1994)
ORIGINAL SHEET SIZE A3	

TITLE: PLAN SHOWING CONTOURS & DETAIL - SHEET 3
SITE: COFFS HARBOUR BOAT RAMP
COFFS HARBOUR NSW 2450
CLIENT: RHDHV
DWG No: 20039A BOAT RAMP.DWG SHEET 1 OF 3 REV 0