3.
Project Description

3.1 General

Northport proposes to expand its existing facilities to increase freight storage and handling capacity to support the future freight needs of the upper North Island.

The proposal includes:

- Reclamation within the Coastal Marine Area (CMA) and earthworks to the immediate east of the existing reclamation to expand Northport's footprint by approximately 13.8 hectares. This comprises 11.7ha of reclamation within the CMA and 2ha of earthworks outside the CMA (on the WDC esplanade reserve).
- Capital and associated maintenance dredging to enlarge and deepen the existing swing basin, and to enable construction of the extended wharf and tug berthing facility.
- Construction of additional beach/roosting habitat.
- A 250m long wharf (excluding the consented but not yet constructed 270m long Berth 4) constructed on the northern (seaward) face of the proposed reclamation.
- Sheet piling and rock revetment structures on the eastern edge of the proposed reclamation.
- Treatment of operational stormwater via the existing pond-based stormwater system and/or proprietary devices.
- Port-related activities on the proposed expansion and wharves.
- Lighting to facilitate night-time operations.
- Construction of a new tug berthing facility.
- Replacement of the existing floating pontoon, public access, and public facilities.

The construction of the reclamation, wharf and associated structures is expected to include some or all the following activities:

- Capital dredging, using a trailer suction hopper dredger (TSHD) and/or cutter suction dredger (CSD), to remove an anticipated volume of approximately 1.72 million m^3 of dredge spoil.
- Reclamation, using the dredge spoil, and discharge of decant water.
- Construction dredging, using a backhoe dredger (BHD), to create the desired underwater profile and allow for construction of the batter slope.
- Excavation, placement of material and compaction.
- Construction work to construct seawalls and abutments (work above and below MHWS).
- Staging of construction equipment, including piling to create work platforms and install pile gates.

- Pile-driving, using methods including vibro and top-driven impact hammers. This will involve cranes (shore based and/or mounted on jack-up barges), excavators and power packs (generators and hydraulic pumps).
- Placement of formwork, tying reinforcing steel and laying of ducts and pipework.
- Pouring of concrete for the port deck and discharge of concrete curing water.
- Construction of pavement surfaces.
- Installation of wharf furniture (bollards, fenders etc).
- Installation of services and other infrastructure on the expansion area.

The final design will be confirmed during the detailed design phase. Further detailed information can be found below.

3.2 Port activities

3.2.1 Container terminal

Northport proposes to increase its freight storage and handling capacity to support the future freight needs of the upper North Island.

The terminal design is modular with the port being progressively developed into a high-density container terminal. The initial design is based on the use of reach stackers for container handling, eventually transitioning to a high-density design based on the use of Rubber Tyre Gantry cranes (RTGs) (see **Figure 2** below).

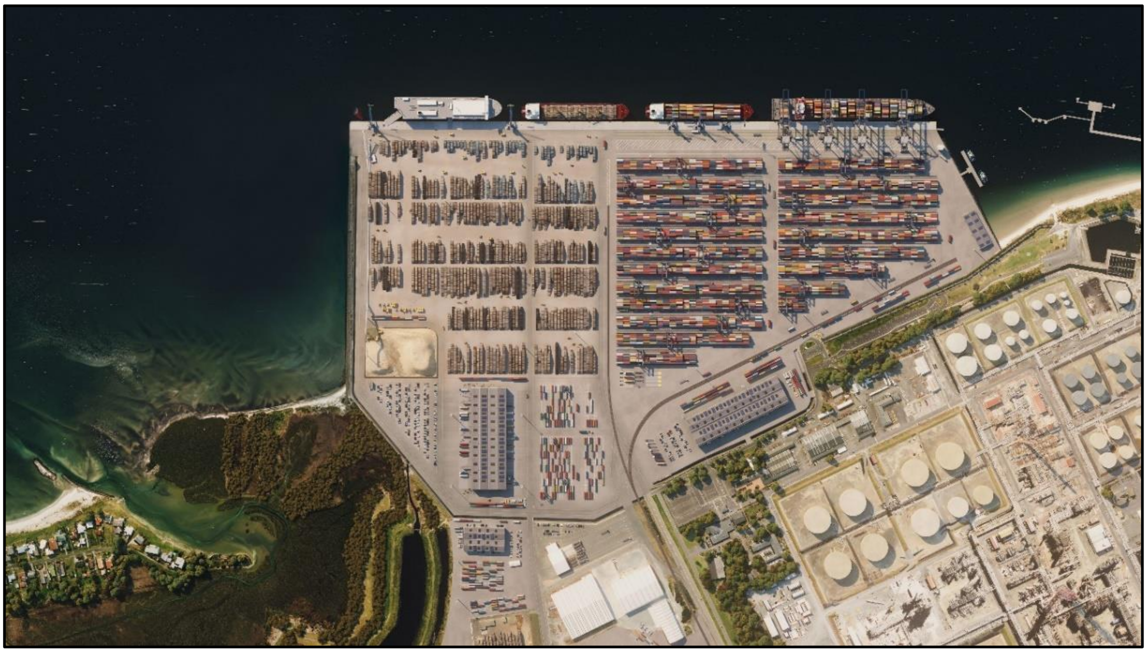

Figure 2: *High-density port design (long-term)*

3.2.2 Other facilities

The following associated/ancillary facilities are anticipated on the port, and the resource consent applications have been framed to also facilitate these:

- Harbour control facilities.
- Coastguard facilities.
- Biosecurity facilities.
- Boarder control/customs facilities.
- Quarantine facilities.
- Tug and pilot facilities.
- Offices, workshops, and other facilities to support the above.

3.2.3 Cranes

As the number of containers handled by Northport increases, crane handling equipment is also expected to change. Cranes expected to be used in the container terminal are detailed below.

Mobile harbour cranes

Northport currently operates two mobile harbour cranes for loading and unloading containers. They have a maximum height of 68m when fully extended (see **Figure 3** below).

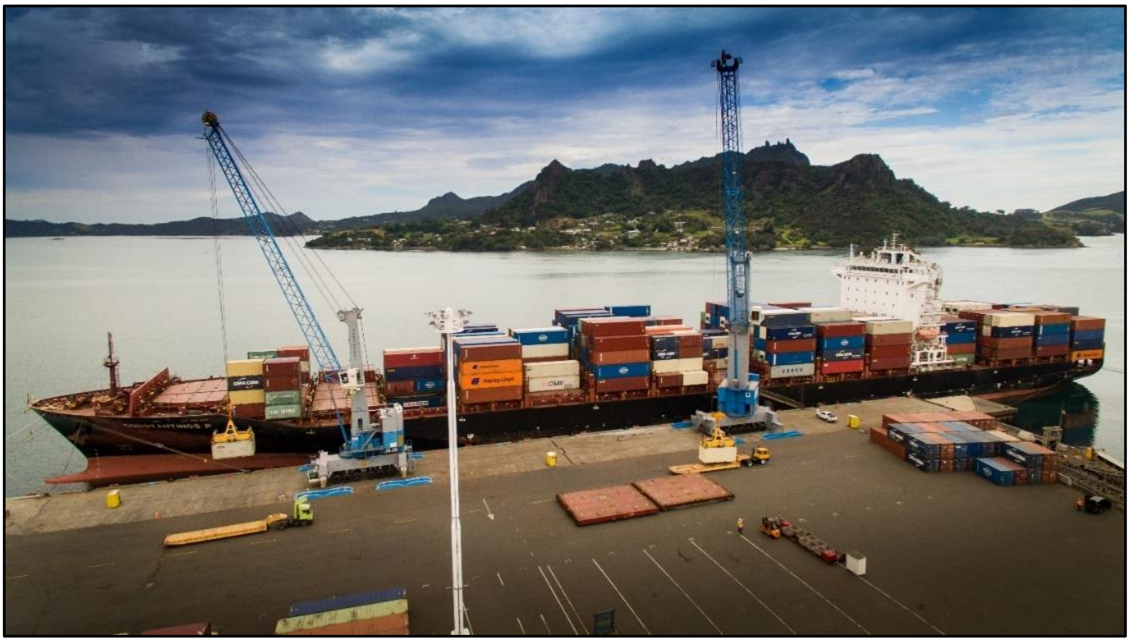

Figure 3: *Mobile harbour cranes at Northport*

Ship to shore gantry cranes

As the number of containers handled by Northport increases, ship to shore gantry cranes (similar to those at Ports of Auckland) will be required (see **Figure 4** below). These cranes have a height of approximately 83m when they are being used, and approximately 117m when dormant (i.e. the main boom is raised).

Figure 4: *Ship to shore gantry cranes at Ports of Auckland*

3.2.4 Road transport

In the absence of a rail link to the port, all import and export cargo will continue to be transported to and from Northport via SH15 which links directly with SH1.

3.2.5 Rail transport

There is currently no rail link to Northport. However, Kiwirail has designated a spur line from Northport to the main trunk line. While there are currently no firm plans to construct the line, the existence of the designation means that Northport remains hopeful that a rail link will be available to service Northport in the future. The proposal has therefore been designed to facilitate the transport of cargo by rail, as well as road.

3.2.6 Lighting

Northport is a 24-hour operation and lighting on the port is essential. The details of the lighting layout will depend on the final layout of the storage areas and the type of equipment used to handle the cargo. It is anticipated that the new lighting system will use LED technology and lighting poles with a height of approximately 36m. LED technology has been selected because it allows for better control of light spill as well as the use of variable brightness for operational and non-operational times.

3.2.7 Proposed conditions relating to port structures

Proposed conditions relating to port operations are summarised as follows:

- **Maximum building height** (excluding public utilities, light towers, silos, aerials, cranes, cargo handling equipment, containers, and tanks): 20m above deck level.
- **Maximum height for public utilities, light towers, silos, aerials, and tanks** (excluding cranes and containers): 60m above deck level.
- **Maximum height for containers**: 30m.
- **Maximum operational height[15] for cranes**: 85m above ground level.
- **Storage/stockpile height:** 20m above deck level.

These conditions are aligned with the permitted activity rules for the Port Zone (currently applicable to the existing Berths 1-3).

3.3 Marine structures

3.3.1 General

To support the reclamation and provide berthage for ships, several marine structures are proposed. The exact dimensions and structural form of these structures will be determined during the detailed design stage, but they will be contained within the envelope shown on the WSP design drawings in **Appendix 3**. The general nature and location of the structures are known and are broadly described below.

3.3.2 Revetment and seawalls

The eastern edge of the reclamation (which meets the natural shoreline) will, for the most part, be a rock revetment, of similar look and construction to the existing eastern edge of the port. The revetment will be covered in armouring which protects the reclamation from erosion and will most likely comprise of large rocks. To provide additional strength, piles may be driven behind the revetment to create a retaining structure. In some instances, most likely on the north portion of the eastern face, the edge of the reclamation may need to be formed with a vertical seawall, either of steel (sheet pile) or concrete construction.

3.3.3 Wharf structures

A 250m wharf extension (in addition to the consented but not constructed Berth 4 wharf) will be constructed on the northern face of the proposed reclamation. The wharf will be designed to secure and work cargo vessels, primarily container vessels.

[15] There is no maximum height for cranes that are not in operation.

The structural form of the wharf will be confirmed during detailed design, but is likely to be:

- A grid of driven piles (steel or concrete) with a cast in-situ reinforced concrete deck (similar to Northport Berths 1 and 2). This could include a sheet-piled (or concrete) seawall atop a rock revetment to form the slope down to the seabed under the wharf.
- A diaphragm wall (two parallel walls, tied together with the space between backfilled) as used for Northport Berth 3 (**Figure 5**).

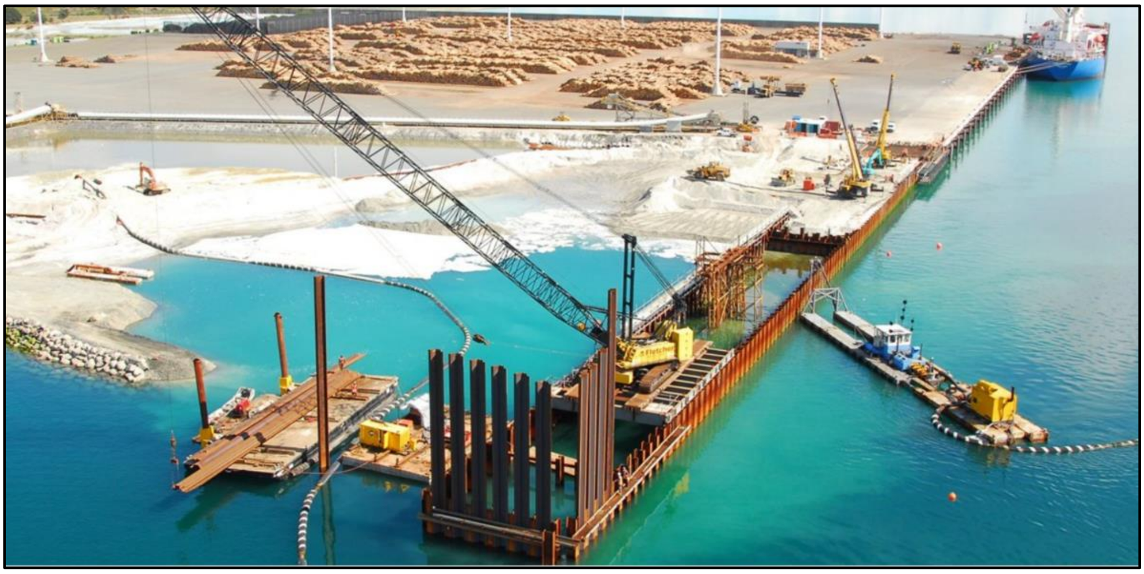

Figure 5: *Berth 3 under construction showing the two parallel steel walls prior to backfilling*

Some, or all the following activities would be needed for each option:

- Construction dredging to create the desired underwater profile and allow for construction of the batter slope.
- Excavation, placement of material and compaction.
- Construction work to construct seawalls and abutments (work above and below MLWS).
- Staging of construction equipment, including piling to create work platforms and install pile gates.
- Driving of piles, using a variety of methods including vibro and top driven impact hammers. This involves cranes (shore based and/or mounted on jack-up barges), excavators and power packs (generators and hydraulic pumps).
- Placement of formwork, tying reinforcing steel and laying of ducts and pipework.
- Pouring of concrete for the port deck and discharge of concrete curing water.
- Installation of wharf furniture (bollards, fenders etc).

The final wharf design will be confirmed at the detailed design stage.

3.3.4 New tug berthing facility

A new tug berthing facility providing berthage for tugs, work boats, and pilot vessels is proposed to replace the existing tug wharf at the eastern end of Northport. The tugs are commercially operated by NTL and are an essential requirement for safe navigation and berthing by vessels visiting both Northport and the CINZL fuel import terminal.

The berthing facility will be located generally as shown on **Figure 6** below. The final tug facility design will be confirmed at the detailed design stage.

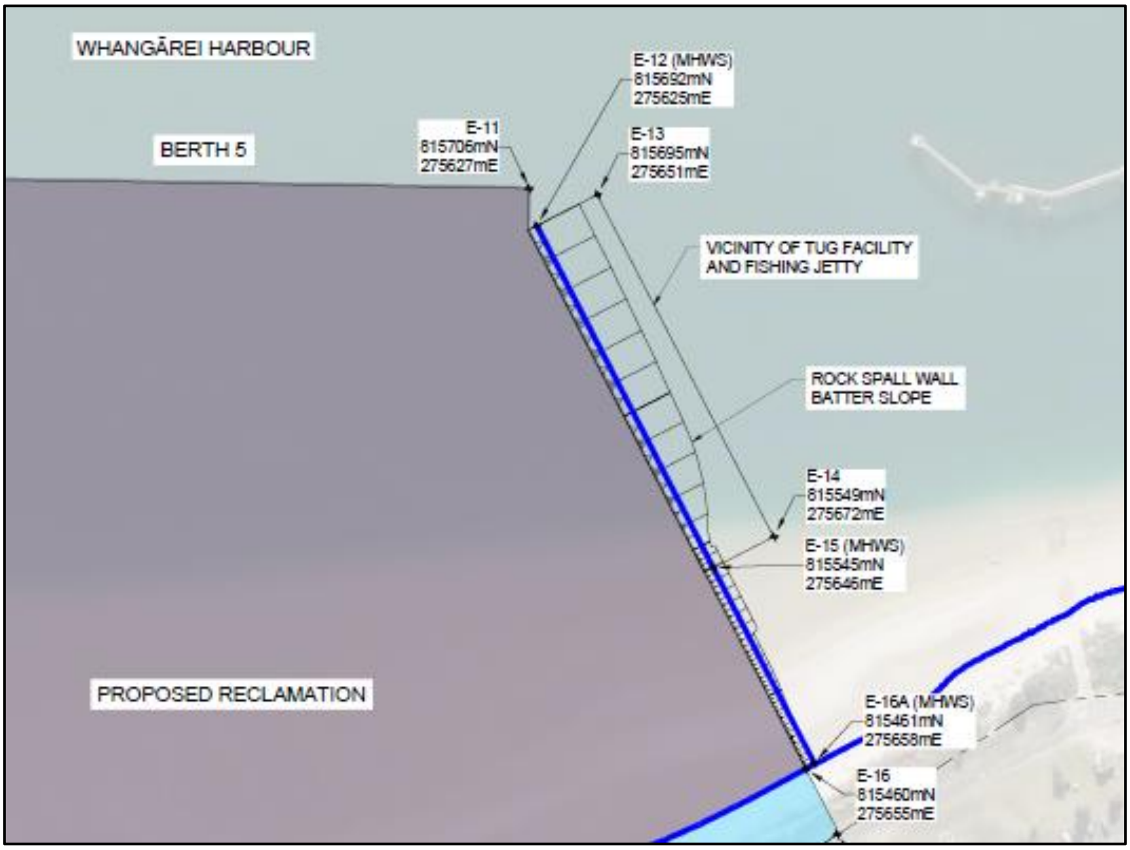

Figure 6: *Location of proposed tug berthing facility*

3.3.5 New fishing and water taxi pontoon

A new public fishing pontoon will be established on the eastern side of the expanded port, near to and/or in conjunction with the tug berthing facility. Access to the pontoon will be incorporated with access to the public reserve/park proposed at the eastern end of the port (see **Figure 16** in Section 3.9 of this report). The pontoon may also be used by water taxis associated with the Te Araroa trail.

3.4 Port noise

3.4.1 General

The proposal is to manage the noise associated with the existing and expanded port with a noise management framework developed in general accordance with New Zealand Standard 6809:1999 Acoustics – Port noise management and land use planning.

Key features of the proposed noise conditions are as follows:

- Specified limits for port noise applicable in residential zones and at the notional boundary of any residential unit in other zones.
- A requirement for the port to offer noise mitigation when monitored or predicted noise reaches a specified level at the façade of a residential unit.
- The introduction of a Port Noise Management Plan designed to minimise port noise through best practice and ongoing community liaison. The proposed noise conditions (including limits) relate to noise generated in 'Port Operations Area A' as shown on **Figure 7** below, and on Berth 4 (consented) and 5 (proposed).[16]

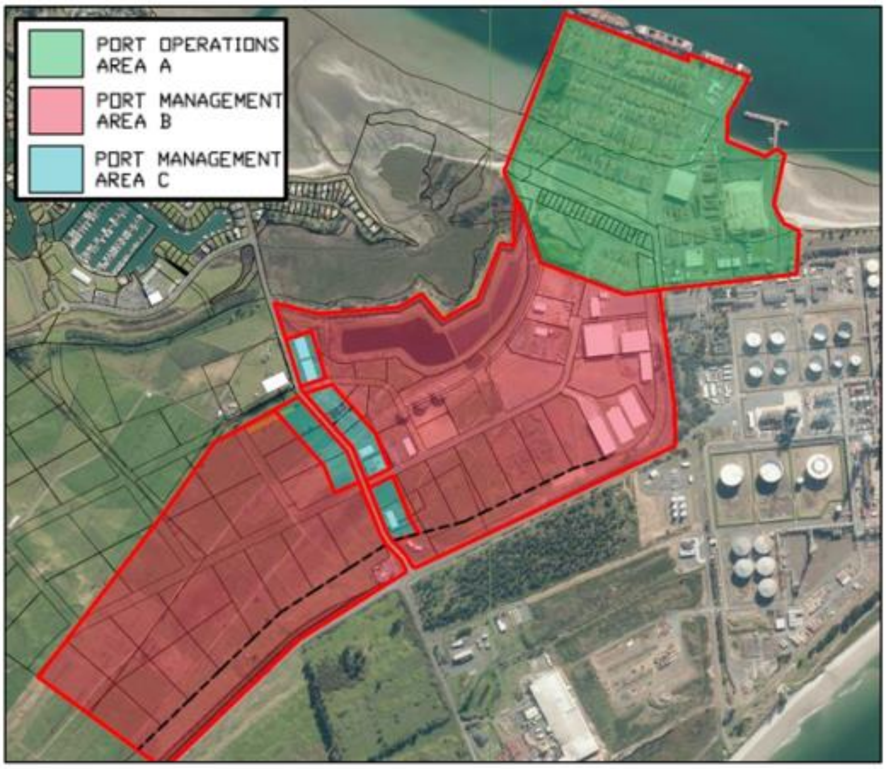

Figure 7: *Port Operations Area A (<u>Source</u>: Whangarei District Plan)*

[16] It is intended that Port Operations Area A will eventually be extended to include the expanded port via a future plan change.

3.4.2 Proposed noise limits

The proposed noise limits for noise generated in ‘Port Operations Area A’ and on Berth 4 (consented) and Berth 5 (proposed) applicable at any point on land in the General Residential and Rural Village Residential Zones are as follows:

Day-night (Long Term)

58 dB $L_{dn\ (5\text{-}day)}$
61 dB $L_{dn\ (1\text{-}day)}$

Night-time (Short term)

53 dB $L_{Aeq\ (9\ hrs)}$
58 dB $L_{Aeq\ (15\ min)}$
75 dB L_{AFmax}

3.4.3 Port Noise Management Plan

As recommended in NZS6809:1999, a Port Noise Management Plan (PNMP) is proposed to ensure that noise emissions from the port are minimised, consistent with practicality, safety, and the efficient operation, use and development of the port.

A draft PNMP is included with the MDL report in **Appendix 4**.

The objectives of the PNMP are to:

- Ensure the port complies with the relevant noise performance standards.
- Provide a framework for the measurement, monitoring, assessment, and management of noise.
- Identify and adopt the Best Practicable Option (BPO) for the management of noise effects.
- Require engagement with the community and timely management of complaints.

The PNMP will include a port noise contour map, to be updated annually. The purpose of the map is to identify properties that are likely to be affected by actual or modelled (predicted) port noise.

The PNMP will apply at all times. It is a ‘living document’ that is expanded and updated as appropriate. It will be reviewed annually in consultation with the community, including the current port noise contour map.

3.4.4 Port assisted mitigation

A condition of consent is proposed whereby, following the annual review of the noise contours in the PNMP, Northport will offer to mitigate any dwellings exposed to port noise levels above 55 dB $L_{dn\ (5\text{-}day)}$. This threshold aligns with Port Noise Standard C1.4 where it states: “*mitigation measures may be necessary when the day-night average sound level in a resident community exceeds 55 dBA L_{dn}*”.

Because dwellings would need windows to be closed at night to achieve 40 dB $L_{dn\ (5\text{-}day)}$ inside, Northport will offer to fund mechanical ventilation and cooling of habitable rooms. The proposed mitigation must achieve a spatial average indoor design sound level of 40 dB $L_{dn\ (5\text{-}day)}$ in all habitable spaces. This is 5 decibels more stringent than the Port Noise Standard requirement for existing ports of 45 dB $L_{dn\ (5\text{-}day)}$. This will enable occupants to close the windows during peak periods, or at any time at their discretion, therefore maintaining a suitable indoor noise environment. The offer has no timeframe attached to it, meaning it can be taken up at any time.

The annual review process will ensure that mitigation for existing dwellings occurs proximate to when the noise effects materialise. This incentivises Northport to constrain their noise footprint through other means (e.g. investment in quieter equipment or timing of loud activities during the day).

There are 16 dwellings in Reotahi and none in Marsden Bay that are predicted to potentially require noise mitigation by 2035. The predicted noise levels for the most exposed facade range from 55 – 58 dB $L_{dn\ (5\text{-}day)}$.

3.4.5 Timing

The proposed noise conditions will apply to all port operations on the existing[17] and expanded port but will not have effect until port operations commence on either Berth 4 or Berth 5. The existing noise limits in the NAV chapter of the District Plan will continue to apply to Berths 1-3 in the interim.

3.5 Reclamation

3.5.1 Areal extent

The areal extent of the reclamation is shown with associated coordinates on the plan in **Figure 8**.[18]

[17] 'Port Operations Area A' as defined in the Whangarei District Plan.
[18] See also WSP plans in **Appendix 3.**

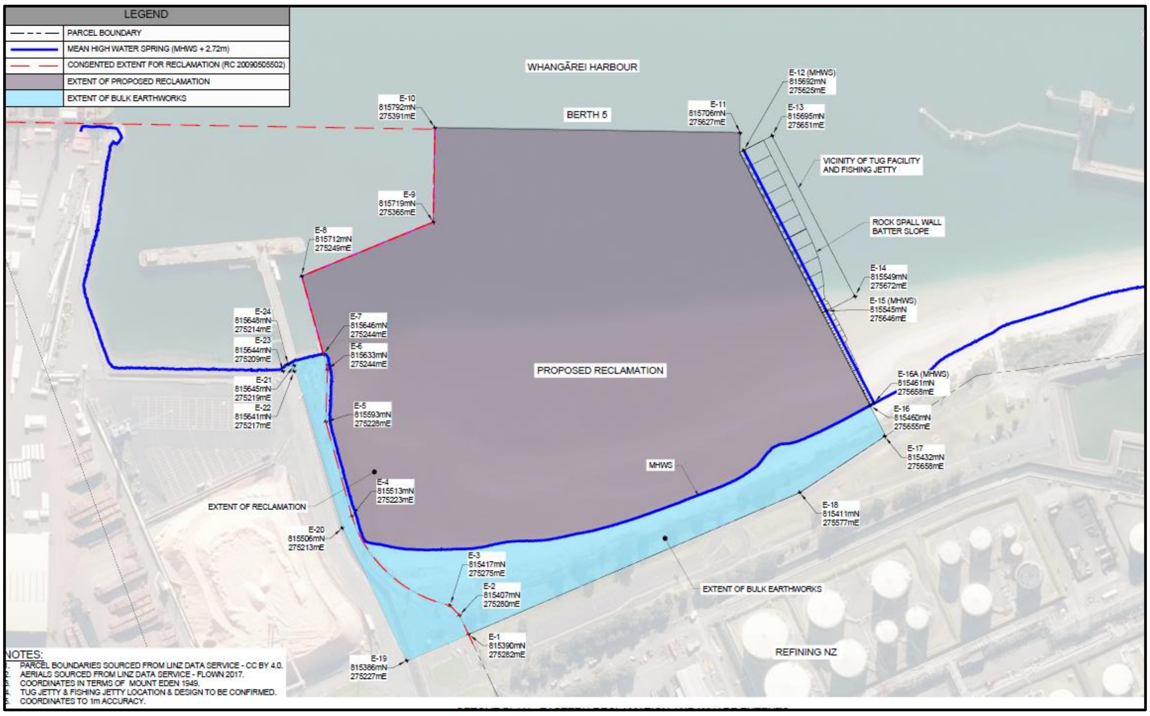

Figure 8: *Proposed extent of reclamation*

The proposed reclamation will have an area of approximately 11.7ha (see **Figure 9** below).[19]

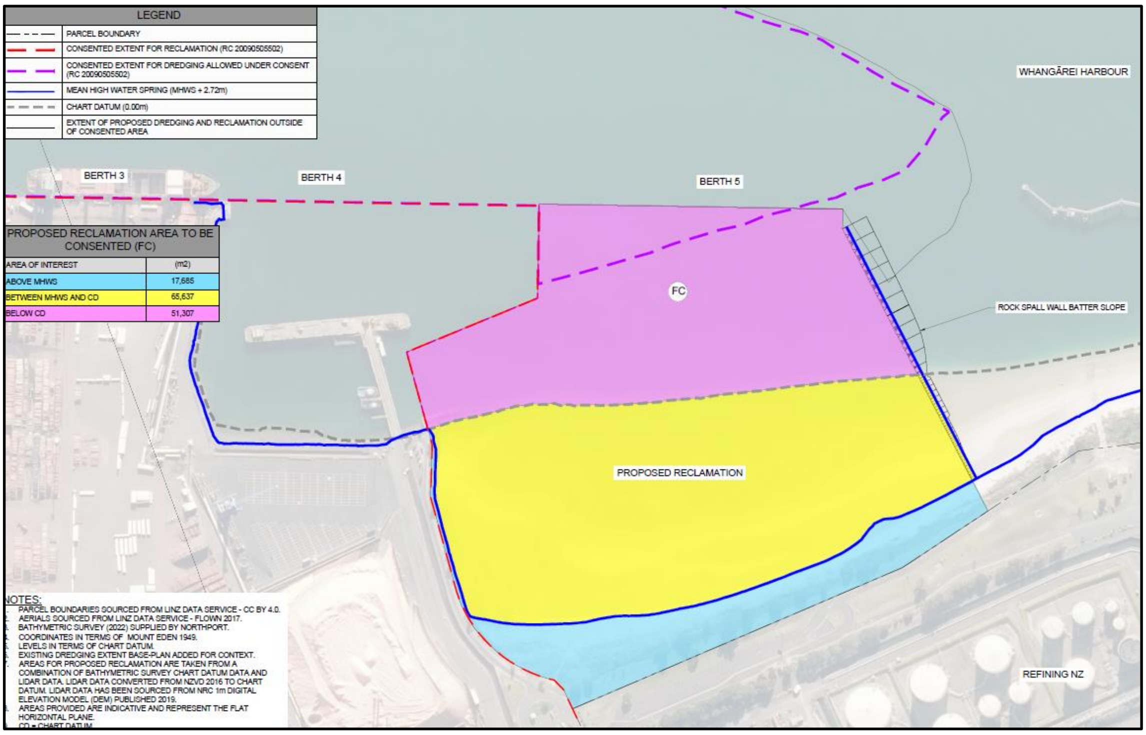

Figure 9: *Proposed reclamation area (pink/yellow areas)*

[19] The overall expanded port area will be 13.7ha, 2ha of which is above MHWS.

3.5.2 Hard protection structures

A wharf will be constructed on the northern edge of the proposed reclamation (a linear extension of the existing Northport wharf). This edge will be retained using either sheet piling or a rip-rap rock revetment wall.

A rip-rap protected batter slope will be constructed along the eastern edge (similar to the eastern batter of the existing port). Some portions of the eastern edge could also be a sheet pile wall.

3.5.3 Deck height

The design height of the land will generally match the existing Northport deck level, being a minimum of 5.0m above chart datum.

3.5.4 Construction material

The land will be built using dredge spoil (sands and silts) and imported material (sand, rock, and gravel).

3.5.5 Construction methodology

It is anticipated that the reclamation will be built using techniques used by Northport for previous reclamations. Broadly, sand and silts won from dredging will be used to reclaim land, with some imported material used where needed.

It is most likely that a bund will be built around the perimeter of the reclamation, and the dredge spoil pumped or deposited into this enclosed area. It is anticipated that the bund will be predominantly rock and crushed aggregate, but some sections may need to be constructed of sheet piles. In some instances, a bund may not be used, with the sediment controlled by way of silt curtains (as was used for parts of the Berth 3 reclamation construction).

Once the rock bunded area is complete (or alternative measures such as silt curtains are installed), dredge spoil (as a slurry) will be placed within the bunded area. The slurry will be pumped from the dredger through a series of pipes and booster pumps, and ultimately discharged into the reclamation area where the solids will quickly settle out. A series of internal paddocks may be needed to settle out the finer-grained materials before discharging the water.

Marine plant will likely install a combi-pile or sheet pile wall across the northern face of the reclamation.

Piling associated with the wharf construction will be undertaken from marine plant with the piles predominantly being driven with a vibro hammer, although an impact hammer may be needed to complete the driving. Support vessels (barges etc) will be used to supply the piles.

Hardfill (crushed rock/gravel) will then be placed on the reclamation to create a suitable sub-base for future paving.

Figure 10 (below) shows land being built using an enclosed paddock method, with two main paddocks in use. The un-bunded method using enclosing silt fences is shown in **Figure 11.**

Figure 10: *Sand being discharged using the perimeter bund method (with several internal paddocks) during original reclamation works at Northport*

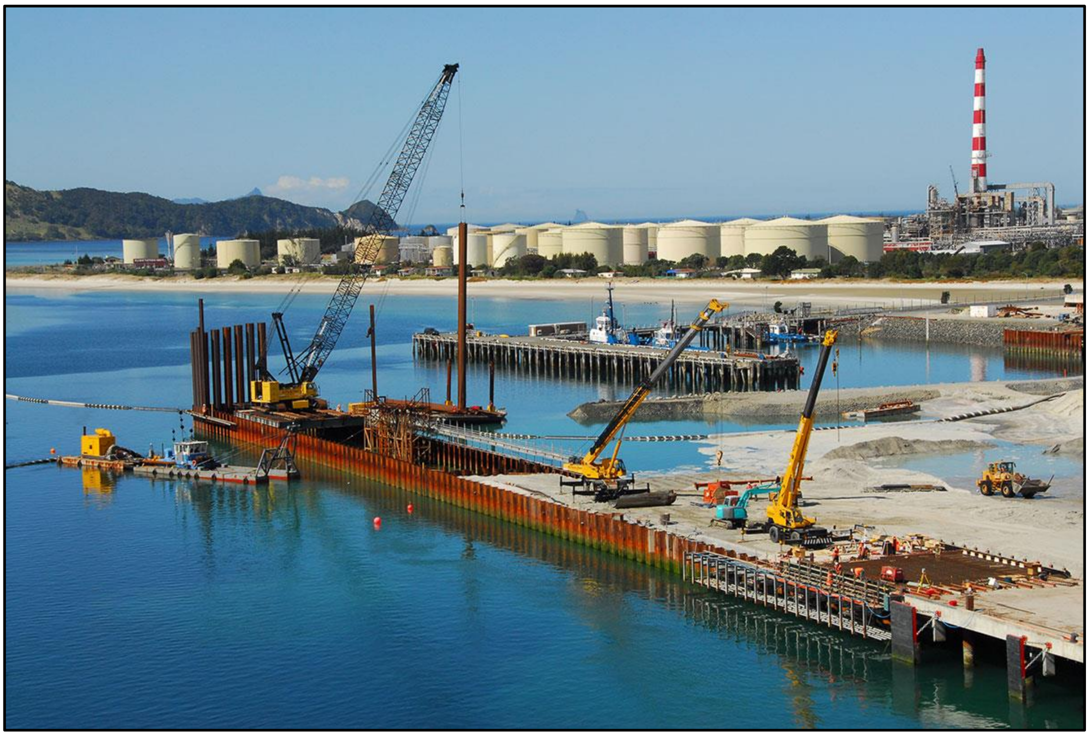

Figure 11: *Pumping sand to an open area (right side midground) during previous reclamation works at Northport*

3.6 Dredging

3.6.1 General

Capital dredging is proposed to increase the area and depth of the existing swing basin and to create a linear berth depth alongside the new wharf structures. The existing swing basin will be deepened to -14.5m CD at the western end, transitioning to -16.0m CD at the eastern end.

Further dredging is required at the eastern end of the reclamation to provide sufficient water depth for the tug berthing facility.

The anticipated volume of capital dredging is 1.72 million m^3 (including dredging to shape the reclamation batter slopes and to key in the batter slopes to the seabed).

East-west batter slopes (in line with current) are to be 1:15, while north-south batter slopes (across currents) are to be 1:10.

The proposed capital dredging area is shown in **Figure 12** below and on the WSP design drawings in **Appendix 3**.

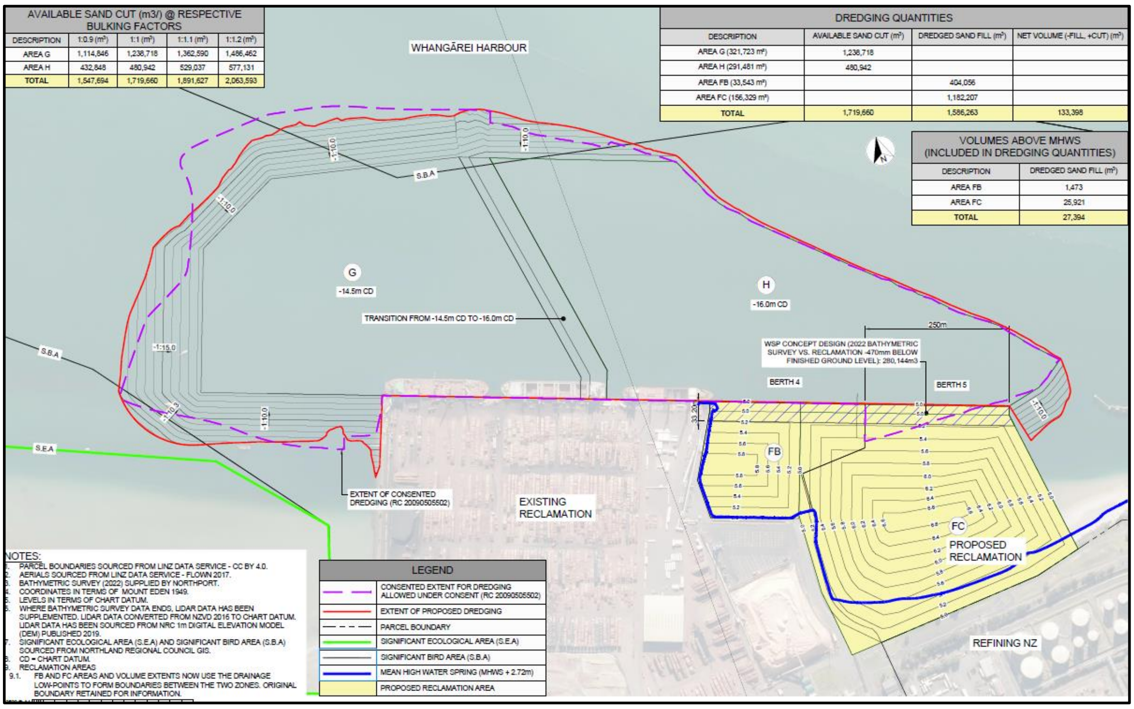

Figure 12: *Proposed capital dredging area*

3.6.2 Dredging methodology

Three types of dredging methods may be used. Specifically, there are two options to dredge the bulk volume in the swing basin, and another to dredge any silty material close to wharves and for construction-related dredging.

The various dredging methods are described below. These same methods have also been modelled by Met Ocean in order to determine potential dredge plumes.

Swing basin dredging

The swing basin dredging could be undertaken using one of the following two dredge types:

Trailer Suction Hopper Dredger (TSHD)

A self-propelled vessel which drags a suction head (or heads) on the sea floor as it travels forward. These suction heads fluidise the sediments and pump them into the vessel's hopper. The solids settle in the hopper and the cleaner water can be discharged (known as overflowing) to allow more room in the hopper for sediment.

Once the hopper is full, the dredger can either steam to an offshore disposal ground where it disposes of the load via bottom dump doors (not what is proposed here), or it can be piped to shore for use in land reclamation. It does this by connecting to a pipe, re-fluidising the sediment, and pumping it to where it is needed onshore.

Once the hopper is emptied, the process is repeated until the desired dredge extent and depth is achieved. A TSHD is shown in **Figure 13** below.

Figure 13: Trailer suction hopper dredger (TSHD) 'Albatros' in the Whangarei Harbour

Cutter Suction Dredger (CSD)

A CSD uses a rotating cutter head to dislodge sediment from the seafloor and fluidise it. Dredge pumps suck up the fluidised sediment and pump it to the shore via a pipe network. This pipe network may have one or more booster pumps to transport the slurry to its final location. The current Northport swing basin was dredged by a CSD, with sediment pumped to shore and used in the reclamation.

CSD do not move while dredging. Rather, they swing side to side, dredging in an arc. Once the arc is complete, they pick up their anchoring system (a series of spuds or anchors) and move forward to begin dredging a new arc. Some CSD are self-propelled, but many rely on tugs or other workboats for propulsion and positioning. An example of a CSD, the Kotuku (which dredged the current swing basin) is shown in **Figure 14.**

Figure 14: *Small Cutter suction dredger with attached pipework*

Construction dredging

For construction dredging (i.e. shaping of batter slopes, deepening close to existing berths, and for smaller volumes) a smaller, more accurate dredging kit is needed. In these areas, a Backhoe Dredger (BHD) will most likely be used. A BHD may also be used if very silty material is encountered.

A BHD is typically a barge with a long reach mechanical excavator (see **Figure 15**). For this project, a barge with a crane and clamshell is also being considered (as they have similar work rates and plumes). A BHD can either be self-propelled or use attendant vessels for manoeuvring. Similar to a CSD, BHD often use one or more spuds to hold position and undertake limited movement to alter dredge position. A BHD typically places the excavated sediment into hopper barges. For this project, the barges would transport the material to shore for on-land management.

Figure 15: *Backhoe dredger loading a hopper barge*

3.7 Management plans

A range of management plans are proposed to manage the construction effects of the proposed expansion. The primary management plan for the construction phase of the project is the Construction and Environmental Management Plan (CEMP). The CEMP will include a Marine Mammal Management Plan (MMMP), and additional chapters in respect to avifauna, biosecurity, turbidity during dredging, and general dredging effects management. Draft CEMP and MMMPs are attached in **Appendix 5.** In addition, as noted earlier, a draft PNMP is included with the MDL report in **Appendix 4**.

The final management plans will be prepared in accordance with conditions of consent.

3.8 Stormwater discharges

The canal and pond-based collection and treatment system described in Section 4.16.2 of this report is capable of managing stormwater from the expanded port. The additional dead storage area required for the additional port area can be achieved in the extended perimeter canal.

Proprietary devices may also be utilised depending on the final design of the expanded port.

A new resource consent is sought for the stormwater treatment system covering the existing and expanded port. The existing consent[20] will be surrendered when the expanded port becomes operational. The water quality standards required by the conditions of consent in the existing consent will be retained.

[20] Consent reference CON20090505532.

3.9 Public access and recreation

A public park/reserve area is proposed at the eastern end of the expanded port, generally as depicted on the plan in **Figure 16** below. The concept is shown in further detail in **Appendix 6.**

Figure 16: *Proposed public park/reserve area and associated access concept*

The proposed reclamation will be keyed into the adjoining WDC esplanade reserve at the desired deck height. Vehicle access to the park/reserve area will then be constructed between the expanded port area and the CINZL boundary.

Key components of the proposed park are as follows:

- A relocated carpark and toilets to allow easy access to the beach.
- A new pontoon for fishing, swimming, and socialising, and to operate as a potential terminal for the Te Araroa Trail water taxi.
- Beach and water access points suited to socialising and swimming, developed to attract such users to the western end of the beach away from one of the preferred fishing areas near the CINZL wharf, and to reduce disturbance of roosting birds along the beach.
- Walking access from the park to the proposed fishing pontoon along the eastern edge of the revetment.

Consultation with the WDC Parks Division is ongoing, and Northport remains open to alternative scenarios to improve public access and recreation facilities in the vicinity of the port and in the surrounding area.

3.10 Earthworks

Earthworks will be required to construct the part of the port deck above Mean High Water Springs (MHWS), and to construct the proposed walkway and park area detailed in Section 3.9 of this report. The proposed earthworks area is 20,767m² (approx.) and the volume is 31,630m³ (approx.).[21] The extent of earthworks is shown on **Figure 17** below.

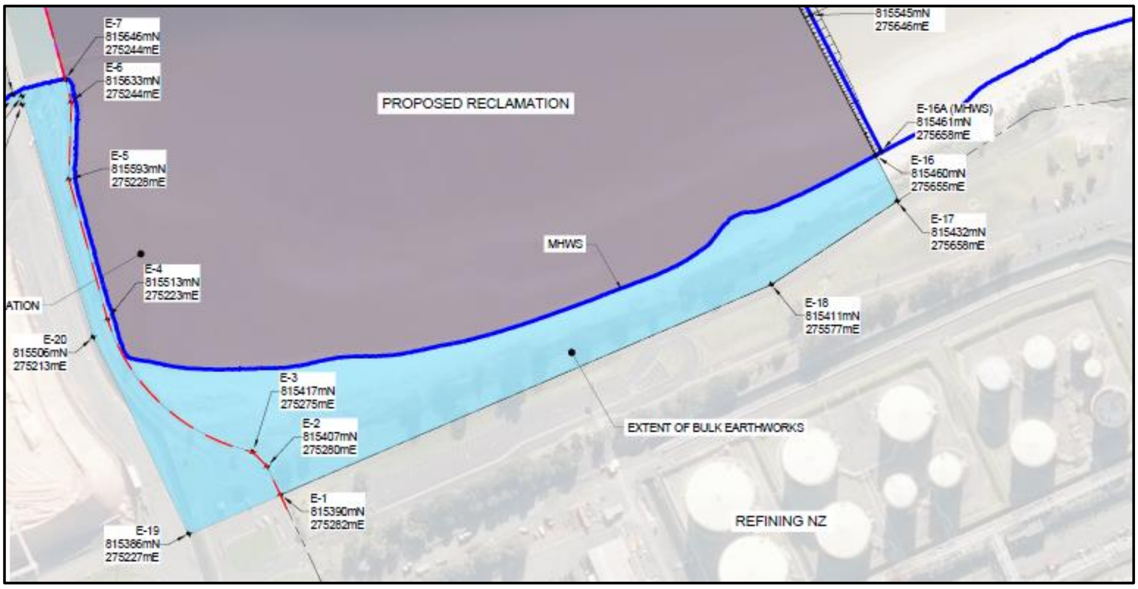

Figure 17: *Proposed extent of earthworks (above MHWS)*

A sediment control plan will be provided for certification as part of the CEMP. Dust suppression measures will also be employed in accordance with the recommendations in the PDP air quality report.

3.11 Creation of high-tide roosting habitat

3.11.1 Purpose

Additional roosting habitat for variable oystercatcher (VOC) and NZ Dotterel is proposed to be created in the inter-tidal area to the west of the existing port (see **Figure 18** below. This habitat will be created prior to the construction of the proposed reclamation so that it is available for use ahead of the loss of habitat associated with the reclamation.

[21] This volume excludes imported hardfill for pavement. The total volume including pavement material is 27,040m³ approx.).

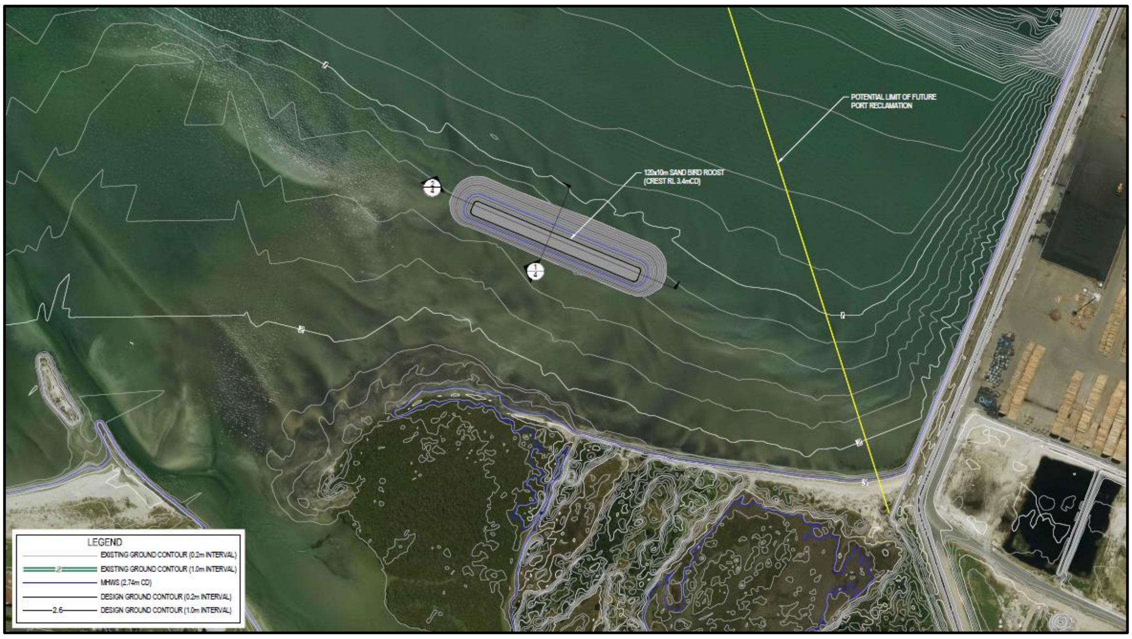

Figure 18: *Proposed high tide roost location*

Historically there was a sand/shell bank at the proposed roosting site, but this has been impacted over time due to changes in coastal processes.

3.11.2 Design constraints

Requisite requirements for the roost area are:

- Be independent from the existing shoreline during high tide to provide a safe area.
- Be largely, or completely, formed from sand.
- Provide a reasonable area above mean high water springs.
- Be situated away from ecologically significant areas.
- Avoiding potential future developments, such as the shipyard area.

3.11.3 Roost design

The preferred nature-based approach for forming the roost is to use fine to medium sand to augment the existing sandy flood spit feature extending along its length, recognising that this will adapt and adjust to the coastal processes over time. This approach uses sediments similar to those present on the intertidal area.

The cross section of the roost has been informed by the slopes and elevation of the existing shoreline. The existing beach face on the spit is around 8(H):1(V) with a back slope of around 4(H):1(V) and the crest of the beach is around 3.1m CD. The design has been based on these slopes extending to a crest level of 3.4m or around 0.6m above MHWS. This elevation would be sufficient to retain a dry area apart from during significant events and onshore winds, where overtopping could occur resulting in the landward migration of the roost and possibly lowering of the reef form.

To provide a smaller construction profile the roost will be constructed with steeper slopes (say 4(H):1(V)), with the expectation that the seaward slope will adjust overtime to a flatter slope.

3.11.4 Roost performance

The proposed bird roost is situated in a relatively sheltered environment, with low tidal currents (typically less than 0.2 m/s) and generally low wave heights (typically lower than 0.2 m) with higher waves only likely to occur during higher stages of the tide and during periods of strong north-westerly winds.

The roost will create a more sheltered environment between the roost and the existing barrier spit. Tonkin and Taylor (T+T) consider that this sheltering is likely to result in a reduction of the landward retreat of the existing barrier beach at this location and is also likely to enable the existing mangrove to extend further seaward in the lee of the roost.

T+T predict that the proposed roost will gradually lower due to wave overtopping moving sediment landward. The deflation and lowering are expected to result in a local raising of the seabed level between the roost and the landward spit feature and potentially merging with this spit.

The period that the bird roost will remain largely above MHWS is difficult to predict. However, the evidence from aerial imagery suggests that the remnant spit feature has remained at this location since prior to the original port construction (greater than 15 years). T+T anticipate that the proposed roost could remain effective for decades, although it is likely that some sediment loss will occur. If overwash occurs, moving sand to the landward side of the spit, this could retain a crest area above MHWS, but with a progressive landward location. However, it is also possible that if the roost deflates there could remain a high point, but below MHWS.

This means that top-ups of the roost may be required to maintain a sufficient high tide area. Therefore, there will need to be monitoring and a top-up plan established as part of the management of this roost. Conditions of consent will be proposed for this purpose. T+T recommend a top up volume of 10% of the capital be allowed for (i.e., 740m^3) every five years, although the actual volume will be dependent on the performance of the roost.

3.11.5 Construction methodology

The roost will be constructed with sand transported to the area at high tides with shallow draft barges which will be unloaded and shaped with hydraulic excavators.

The roost is likely to require at least 40 barge loads and take 1-3 months to complete.