

# CAIRNS SHIPPING DEVELOPMENT PROJECT

## Revised Draft Environmental Impact Statement

### Chapter B10: Noise and Vibration





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## B10.1 Introduction

### B10.1.1 Overview

This chapter presents the outcomes of a detailed assessment of potential noise and vibration impacts which could result from the Cairns Shipping Development Project undertaken as part of the CSDP Revised Draft EIS (Ports North 2014a).

It identifies the existing noise characteristics of the study areas, identifies locations of sensitive receptors and conservatively estimates the noise and vibration emissions which could result from project activities using a range of quantitative methods. It considers both construction and operation phases, including cruise ship docking and at dock operations. Consideration of potential noise and vibration impacts of dredging previously undertaken in the Draft EIS has been reviewed and included where relevant and updated on the basis of revised project elements (refer **Appendix AU**).

In the absence of detailed plant and equipment specifications and noise emission rates and types at this stage of the project planning process, some assumptions are conservative. The chapter provides a range of mitigation measures to ensure impacts are appropriately managed and mitigated.

The assessment of potential noise and vibration impacts uses a risk based methodology, developing mitigation measures that can be incorporated into the design and future management of the project and assesses the residual impacts following mitigation.

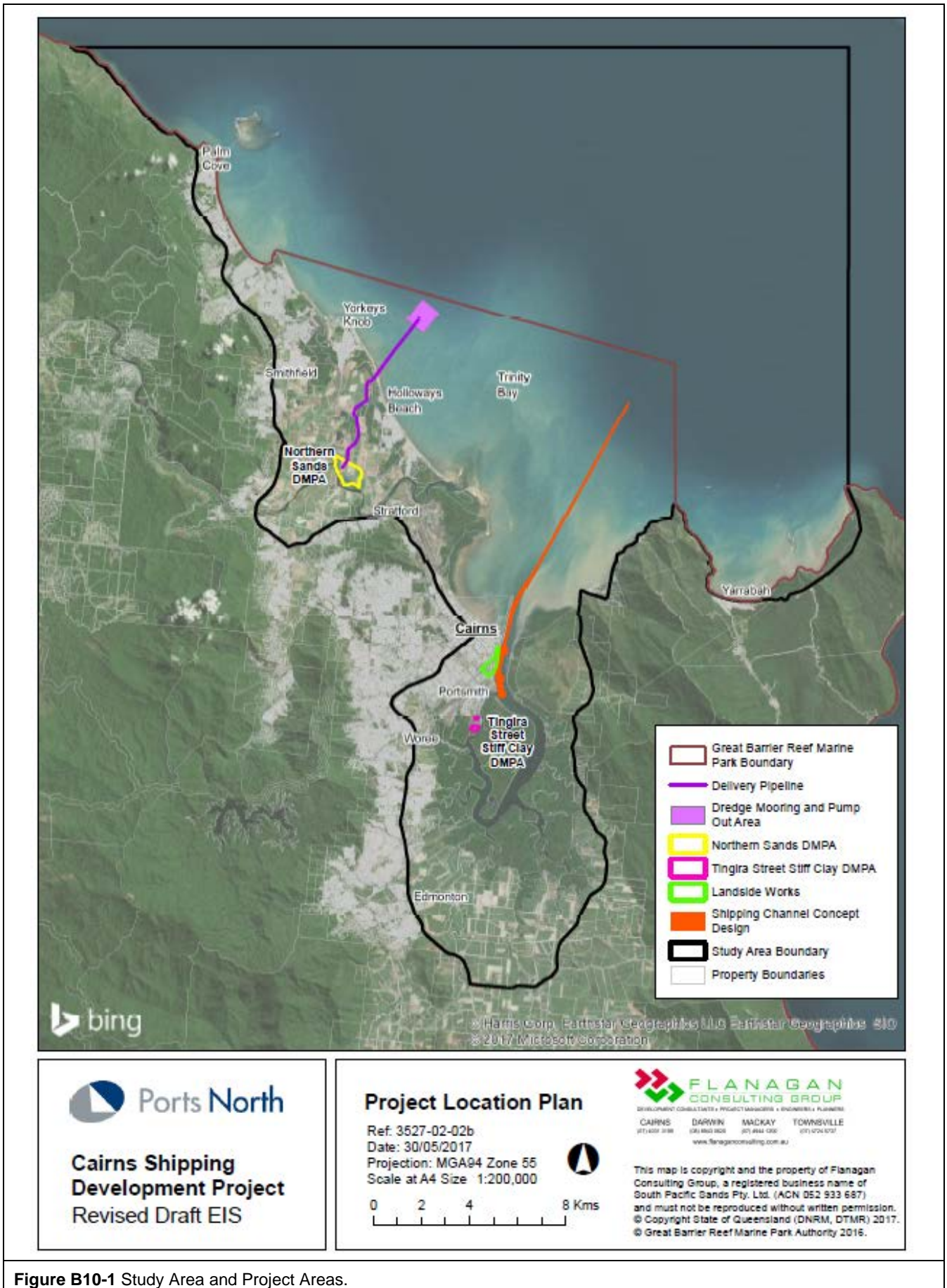
### B10.1.2 The Study Area and Project Areas

The 'study area' for the EIS varies depending on the issue at hand while the 'project area' is the immediate footprint of the proposed works. In the consideration of noise impacts as defined above, the 'local scale' is appropriate. The local scale (**Figure B10-1**) is defined as follows:

- The township of Cairns.
- The marine environment including the Trinity Inlet, Trinity Bay and surrounding waters including:
  - all waters of Trinity Bay
  - the tidal waters of Trinity Inlet, including landward areas to the boundary of the Fish Habitat Area
  - Double Island
  - the coastline and nearshore waters of Cairns' Northern Beaches
  - Mission Bay
  - the coastline extending to Cape Grafton.

Project Areas are also shown on **Figure B10-1** and encompass:

- Channel Project Area including the shipping channel and the route to the dredge mooring and pump out point at the seaward end of the pipeline to the Northern Sands DMPA.
- Landside Works Project Area for wharf upgrades and berthing of cruise ships.
- Northern Sands DMPA Project Area (includes the DMPA, delivery pipeline, tailwater ponds, and tailwater outlet works).
- Tingira Street Stiff Clay DMPA Project Area.



**Figure B10-1** Study Area and Project Areas.



### B10.1.3 Overview of the CSD Project

The following is a brief discussion of the CSD Project as it relates to assessment of noise. A more detailed description is provided in **Chapter A3** (Project Description). Management is proposed via two plans documented elsewhere in this Revised Draft EIS:

- **Chapter C1** (Construction Environmental Management Plan). This covers the works necessary to prepare the DMPAs for receiving the soft clays (Northern Sands DMPA) and stiff clays (Tingira Street DMPA) and then remove all temporary works and make good.
- **Chapter C2** (Dredge Management Plan). This covers the construction and operation of the actual placement activities including the delivery and tailwater pipelines.

#### B10.1.3.a Dredging and Delivery Pipeline

Dredge material is to be transported to shore based Dredge Material Placement Areas (DMPAs) at the Northern Sands sand extraction operation on the Barron Delta. The soft clays are to be dredged via a 5600 m<sup>3</sup> capacity Trailer Suction Hopper Dredge (TSHD) discharging to a temporary floating pump out facility between approximately 2.6 and 3.6 km NE of Yorkeys Knob.

Dredge material will be pumped to the DMPA from the TSHD via a pump out facility and a submerged steel pipeline, which will make landfall near the Richters Creek mouth, thence to the Northern Sands DMPA via cane farm headlands and Captain Cook Highway culverts (refer Figure B10-1).

Due to the 8 km pipeline distance from pump out facility to the Northern Sands DMPA, up to three pipeline booster pumps will be required, depending on TSHD pumping capacity.

#### B10.1.3.b Landside Works Project Area

An additional IFO storage tank, with a capacity of approximately 10 000 m<sup>3</sup> may be required within the existing fuel farm to store monthly deliveries from fuel ships via the existing fuel wharf 10.

New water, firefighting and sewerage services are required for wharves 1 to 5. These will include replacement / extension of existing water mains and installation of a sewage pump station, underground storage tank and odour control system.

Work for the wharf upgrade includes installation of new berthing structures, demolition and reconstruction of wharf 6, including driving of piles accessed with wharf and barge mounted equipment.

#### B10.1.3.c Northern Sands Project Area

The Northern Sands DMPA contains an operating sand mine and a 25 ha water-filled void (known locally as Lake Narelle) that is to be enlarged and used for the placement of soft clays pumped to the site. The current void contains fresh water from groundwater seepage and rainfall.

Site preparation at the DMPA will involve bunding and enlargement of the existing void to the north as part of future 'business as usual' quarry expansion plans, forming a total bunded placement area of 29.6 ha. The DMPA operations will be separated from ongoing sand extraction and construction and demolition waste disposal by a lined rock wall.

Dredged material will be delivered into the lake as a slurry through the dredged material delivery pipeline in pulses as the TSHD completes approximately six circuits per 24 hours over the dredging program. As the prepared void fills with the dredge material slurry, solids will settle and commence consolidation on the floor of the void leaving turbid supernatant waters (tailwater). These will gradually clarify on the Northern Sands DMPA and in the dedicated tailwater ponds prior to discharge via a discharge pipeline to the Barron River, once they have met the adopted water quality discharge standards.

All placement and tailwater management operations are as described in **Chapter C2** (Dredge Management Plan).

### **B10.1.3.d Tingira Street Project Area**

Dredge material comprising the stiff clay portion, is to be dredged by a backhoe dredge and barged to an existing area of port land upon which a DMPA is to be established. The site preparation at the Tingira Street DMPA will be minor and will involve clearing and grubbing to remove the existing grass and regrowth vegetation and then the formation of bunds (estimated to be < 0.5 m high) around the perimeter of the placement areas using insitu clay materials. Erosion and sedimentation control works in accordance with FNQROC requirements will be installed as soon as possible in the site preparation process.

The dredged material will be progressively placed within the bunded area using heavy haulage vehicles and other plant. Environmental management of establishment and disestablishment works will be as described in **Chapter C1** (Construction Environmental Management Plan).

### **B10.1.4 End Use of DMPAs and Pipeline**

End uses of the DMPAs are described below because an appreciation of these is critical to the assessment of impacts.

#### **B10.1.4.a Northern Sands DMPA**

The soft clay placement campaign will fill all or most of the void over a period of some three months after which it will settle over one wet season. Once this filling is complete, the DMPA will revert to the control of the owner who will then determine subsequent uses. No assumptions can be made about this use although current approvals imply that at some time the void is to be completely filled.

#### **B10.1.4.b Delivery Pipeline**

After the completion of the soft clay placement campaign, the inlet pipeline (landward and marine sections) and booster stations will be disassembled and removed. The disturbed area will be restored and the small amount of natural vegetation cleared for its construction will be rehabilitated using appropriate native species as described in **Chapter C2** (Dredge Management Plan). A specific Restoration Plan will be prepared by the contractor during the detailed planning and approvals phase and implemented for this purpose.

#### **B10.1.4.c Tailwater Discharge Pipeline(s)**

Similarly, the tailwater discharge pipelines will be disassembled and removed and the disturbed area restored and rehabilitated as described in **Chapter C2** (Dredge Management Plan).

#### **B10.1.4.d Tailwater Ponds**

When no longer required, the tailwater ponds will be back filled and the disturbed area restored such that the area can be re-used for existing use such as growing sugar cane. No rehabilitation will be necessary.

#### **B10.1.4.e Tingira Street Project Area**

The Tingira Street DMPA is currently cleared (although some marine plants have recolonised much of the area not covered by anthropogenic grasslands) and in its past, has been filled to above Highest Astronomical Tide. The placed stiff clay will be used to fill and preload the site to accelerate settlement. As a separate project, Ports North intends to import additional fill and construct industrial hardstands and other infrastructure. This project has been under consideration for many years and most of the necessary approvals have already been obtained.



## B10.2 Methodology

### B10.2.1 Detailed Technical Assessments

Several detailed technical assessments were undertaken in support of both the concept design of the project (documented in **Chapter A2** (Project Background)) and this chapter. These are listed in **Table B10-1** below. The final column shows where these reports are located in this Revised Draft EIS.

**TABLE B10-1 DETAILED TECHNICAL ASSESSMENTS**

STUDY	DETAILS	APPENDIX NO
ASK (2016) Baseline Noise Constraints Assessment	Existing situation and assessment of noise constraints and opportunities	<b>Appendix R</b>
ASK (2017) CSDP Tingira Street DMPA- Noise Impact Assessment	Assessment of potential noise impacts of stiff clay unloading and placement at Tingira Street DMPA	<b>Appendix AT</b>
ASK (2017) Noise Impact Assessment	Assessment of noise impacts for the construction and operation of Northern Sands DMPA, pipeline, pump out facility and construction of wharf and services upgrades and cruise ship operations	<b>Appendix AU</b>

In addition, noise issues relating to dredging have not been reassessed and the findings from the Draft EIS (Ports North 2014a, 2014b) are presented in this chapter where appropriate (noting that the CSD Project now involves less than a quarter of the volume proposed in the Draft EIS). Underwater noise is assessed in **Chapter B7** (Marine Ecology).

These new studies and the Draft EIS are referred to where appropriate (note that the relevant baseline information in **Appendix R** has been subsumed into **Appendix AU**). While all relevant findings have been incorporated into this chapter, readers are referred to the original reports for further details if required. Together these technical studies involved:

- literature reviews to gather relevant information from previous studies
- desktop identifications and in field verification of sensitive receptors
- establishment of acoustic criteria (i.e. applicable standards and requirements)
- selection of a modelling methodology
- baseline noise monitoring at locations representative of sensitive receptors
- preliminary identification of construction and operation works and noise emissions
- modelling of potential noise impacts.

### B10.2.2 Acoustic Criteria (Noise Standards)

A critical aspect of the methodology for noise and vibration is relevant emission standards. These differ for construction and operational noise.

The Terms of Reference (ToR) for the Project refers to the following documents:

- Environmental Protection (Noise) Policy 2008 (EPP (Noise))
- Noise Measurement Manual (Department of Heritage and Environmental Protection 2013)
- Guideline: Planning for Noise Control (Department of Heritage and Environmental Protection 2009).

The (EPP (Noise)) contains Acoustic Quality Objectives which can be used as noise limits for assessment of operational noise emissions from the wharf. The Acoustic Quality Objectives are discussed in detail in Section 3.3.1 of **Appendix AU**.

The Planning for Noise Control Guideline (PNCG) also includes methods for determining noise limits for assessment. These noise limits are considered applicable for the assessment of operational noise. The PNCG noise limits were applied in Section D.7.6.1.1 of Appendix D.7 of the Draft EIS (Ports North 2014b) for the previous assessment of wharf operation noise.

Noise monitoring undertaken for the CSD Project was undertaken in accordance with the EHP Noise Measurement Manual.

The acceptability of predicted noise in terms of these acoustic criteria is discussed in **Section B10.4.2**.

### **B10.2.3 Modelling Methodology**

#### **B10.2.3.a Overview**

The SoundPLAN environmental noise modelling program was used for assessment of noise impacts from construction work associated with the development.

The construction contractors for CSD Project have not been selected at the time of this assessment, and therefore the assessment has been undertaken on the basis of an assumed construction methodology utilising appropriate plant and equipment. It is expected that the assumed methodology considered in this assessment is representative of the methodology that will be adopted and that it is therefore appropriate for impact purposes.

Assumptions included in the assessment which may be refined by the contractor include the following aspects:

- selection of fixed and mobile equipment
- location of plant (including booster pumps).

The sound power levels (L<sub>w</sub>) applied in this assessment have been chosen based on available information regarding the anticipated type and specifications (brand, model, size, etc.) for mobile and fixed plant. The sound power levels applied in the assessment for this plant have been obtained from the study team's extensive noise source database, which includes data obtained from noise measurements as well as from a review of published literature.

It should be noted that at this stage, the plant items detailed in this study are indicative of the plant required to complete the construction of the CSD Project. The accuracy of the SoundPLAN noise model may be affected should plant be modified, moved (substantially) or replaced. Any major changes to plant can be updated in the SoundPLAN noise model as and when required.

The successful contractor, in preparing noise control measures for their Environmental Management Plan (Construction) will need to confirm noise levels of the actual equipment to be used.

#### **B10.2.3.b Assumptions and Technical Limitations**

There are several assumptions and technical limitations associated with the modelling and these are briefly described below:

- As with most proposed developments, and as indicated in the Draft EIS, the impact assessment process is based on defining representative scenarios reflecting typical conditions likely to be experienced during construction and operation of the project. The nature of the CSD Project is that the main operational noise source, the cruise ships, are 'external' to the project in that Ports North has no direct control or specific prior knowledge of the noise emission characteristics of individual ships. The assessment is therefore based on 'typical' noise impacts for different categories of cruise ship.
- Similarly, prediction of noise impacts from any construction project involves unknown source characteristics in that the particular construction equipment to be used on site will not be confirmed until detailed planning for the construction process is undertaken.

Therefore, the representative acoustic scenarios for the assessment were determined based on measurements and assumptions of representative plant and vessels and a comparative review of source levels used for previous EIS assessments. In the case of construction noise and vibration predictions, the adopted methodology based on the Department of Environment and Climate Change (NSW) Interim Construction Noise Guideline (ICNG) (DECC 2009). The ICNG is a 'screening criterion' approach – i.e. the assessment identifies which construction activities have higher risks of resulting in noise or vibration impacts and therefore which activities require noise mitigation measures or management strategies to be incorporated into planning the activity.

During the detailed planning of the construction sequence, these activities should be planned and managed to minimise noise impacts, e.g. by including mitigation measures as discussed in **Section B10.5** and implemented in **Chapter C1** (Construction Environmental Management Plan) and **Chapter C2** (Dredge Management Plan).

The prediction of acoustic impacts based on representative sources, means that there is the possibility that the actual source construction or operational noise levels may be higher (or lower) than predicted in this assessment (e.g. an individual 'loud ship' or a particularly noisy construction activity). There is no direct control over the former possibility, although standards are improving in response to noise issues across the industry.

In the latter situation, additional mitigation measures or management strategies will be implemented as documented in a Noise Management Plan to be included within the Contractor's EMP (Construction) to be prepared for the CSD Project. Actual residual impacts will, however, be determined by the acoustic impacts after appropriate mitigation is applied.

#### **B10.2.3.c Noise Model Settings and Inputs**

There are many technical assumptions inherent in the assumed construction methodology and plant, as well as in the modelling itself. These are discussed in detail in **Appendix AU** and **Appendix AT**. As noted above, these assumptions are appropriate for impact assessment but can be expected to vary in practice.

## B10.3 Existing Situation

### B10.3.1 Sensitive Receptors

It is standard practice in assessments of noise and vibration to consider 'sensitive receptors'.

Sensitive receptors are defined under the EPP (Noise) as 'an area or place where noise is measured'. These are usually associated with what is defined under the State Planning Policy (2014) as a 'sensitive land use'. These are caretakers' accommodation, child care centre, community care centre, community residence, detention facility, dual occupancy, dwelling house, dwelling unit, educational establishment, health care services, hospital, hotel, multiple dwelling, non-resident workforce accommodation, relocatable home park, residential care facility, resort complex, retirement facility, rooming accommodation, rural workers accommodation, short-term accommodation or tourist park.

Boat berths where permanent pylons are provided for mooring are considered sensitive locations under the definition of relocatable home park.

A summary of the nearest sensitive receptors for each of the three project areas (Landside Works Project Area, Northern Sands Project Area, and Tingira Street Project Area) is included in **Table B10-2** below. These sensitive receptors have been located by inspection of aerial photographs and maps and are shown on **Figure B10-2** to **Figure B10-5** below.

**TABLE B10-2 SENSITIVE RECEPTORS**

ID	NAME / ADDRESS	REAL PROPERTY DESCRIPTION	EASTING	NORTHING
<b>Landside Works Project Area</b>				
A	Park Regis City Quays Hotel, 6-8 Lake Street, Cairns City	N/A	369960	8128319
B	Piermonde Apartments, 2-4 Lake Street, Cairns City	N/A	369988	8128264
C	Jack & Newell Apartments, 27 - 29 Wharf Street, Cairns City	N/A	369999	8128312
D	Madison on Abbott Apartments, 3 Abbott Street, Cairns City	N/A	370001	8128362
E	Pullman Reef Hotel Casino, 35/41 Wharf Street, Cairns City	N/A	370038	8128438
F	Hilton Hotel, 34 Esplanade, Cairns City	N/A	370105	8128559
G	Cairns Harbour Lights Apartments, 1 Marlin Parade, Cairns City	N/A	370127	8128685
H	Shangri-La Hotel, Pier Point Road, Cairns City	N/A	370106	8128915
I	Boats used as residences, east side of Trinity Inlet	N/A	370443	8127598
I	Boats used as residences, east side of Trinity Inlet	N/A	370554	8128060
I	Boats used as residences, east side of Trinity Inlet	N/A	370656	8128624
<b>Northern Sands Project Area (delivery pipeline) + offshore pump out facility and booster</b>				
J	Holloways Beach Environmental Education Centre, 46 Poinsettia Street, Holloways Beach	122/NR840892	365190	8138963
K	2-4 Deauville Close, Yorkeys Knob	0/BUP105844	364417	8140742
K2	Clinton Street, Yorkeys Knob (Yorkeys Knob Primary School)	178/NR6811	363987	8140490
K3	Yorkeys Knob Road, Yorkeys Knob (near Antonetta Close)	4/RP749342	363646	8139820
L	30 Acacia Street, Holloways Beach	328/H9082	365130	8138811
M	Morabito Road (off Yorkeys Knob Road), Yorkeys Knob	2/RP800898	363937	8138570
N	72 Baronía Crescent, Holloways Beach	40/RP742748	364972	8138264
O	108 Baronía Crescent, Holloways Beach	22/RP742750	364958	8137890

ID	NAME / ADDRESS	REAL PROPERTY DESCRIPTION	EASTING	NORTHING
P	101-103 Wistaria Street, Holloways Beach	1/RP731885	365220	8137538
Q	78 Wistaria Street, Holloways Beach	21/RP741077	365265	8137228
R	613 Holloways Beach Access Road	5/RP857577	364512	8136716
S	Dwelling under construction, Holloways Beach Access Road	22/SP211748	364587	8136488
<b>Northern Sands DMPA</b>				
T	637 Captain Cook Highway	4/RP800591	363235	8136373
U	637 Captain Cook Highway	4/RP800591	363162	8136228
V	Holloways Beach Access Road	1/RP804218	364663	8135785
W	Holloways Beach Access Road	1/RP804218	364566	8135742
X	Holloways Beach Access Road	1/RP804218	364561	8135676
Y	417-419 Captain Cook Highway	4/RP748713	364662	8135074
<b>Tingira Street DMPA</b>				
T1	Refer <b>Figure B10-5</b>	27/SP218291	145.770985°	-16.952701°
T2	Refer <b>Figure B10-5</b>	27/SP218291	145.772212°	-16.952683°
T3	Refer <b>Figure B10-5</b>	27/SP218291	145.770205°	-16.949232°
T4	Refer <b>Figure B10-5</b>	27/SP218291	145.772328°	-16.951392°

Source: Appendix AU (Table 4.1) and Appendix AT (Table 5.1).

### B10.3.1.a Landside Works Project Area and Northern Sands Project Area

All of the receptors listed in **Table B10-2** are existing residential dwellings (houses or units) with the exception of Receptor J which is an educational centre, Receptor S which is a residential dwelling currently under construction, and Receptor I which are boat moorings.

Boat berths (Receptor I) where permanent pylons are provided for mooring are considered sensitive locations under the definition of relocatable home park. It is understood that Ports North control the lease of these mooring pylons, and that during construction activity (including dredging), that Ports North may limit the use of boat moorings to prevent the potential for noise impacts to these receptors. Therefore the receptors have been identified in this assessment for completeness, but have not been considered in the noise assessment as they may not be present during construction activity. The operation of the wharf, with respect to impacts onto the boat moorings, is not considered to require assessment based on the nature of these moorings.

It is noted that while not all sensitive receptors near the project areas are identified in **Table B10-2**, those adopted are considered to be representative of the potentially worst affected receptors.

### **B10.3.1.b Tingira Street Project Area**

The only sensitive receptor near the Tingira Street DMPA is the Great Barrier Reef International Marine College, which is located at the northern end of the property that includes the DMPA as shown on **Figure B10-5**. The facility includes:

- Full Mission Bridge Simulator (Kongsberg Polaris)
- Tug-optimised bridge
- Desktop simulators
- Multi-purpose Emergency Response Training Simulator (MERTS)
- Engineering workshops
- Immersion pool
- Training vessel.

Other buildings between the two placement areas and in close proximity to the northern placement area are occupied by Australian Maritime Safety Authority (AMSA), Maritime Safety Queensland, Queensland Police Service (Water Police) and Queensland Parks and Wildlife Service. Whilst these activities are not defined as sensitive, they are in close proximity so it is appropriate to mitigate any potential nuisance using good practice noise control measures.

### **B10.3.2 Baseline Noise**

#### **B10.3.2.a Details**

##### **Landside Works Project Area and Northern Sands Project Area**

For the Landside Works Project Area and Northern Sands Project Area, the presence of sensitive receptors was considered in the selection of noise monitoring locations utilised for the assessment of noise emissions and impacts. See **Figure B10-2** to **Figure B10-4** for the location of monitoring points. Data on the existing noise environment at these project areas is an amalgam of that collected from the following campaigns:

- the Draft EIS (August 2013) – relevant for the Landside Works Project Area only
- for the Aquis Resort at The Great Barrier Reef EIS (August 2013) – this is relevant as the delivery pipeline corridor passes through the Aquis site
- for the Revised Draft EIS (August 2016 and May 2017) – additional representative sites in all project areas.

For the 2016 and 2017 work, noise measurements were taken to determine the existing noise environment at and around areas that could be affected by the project activities. The measurements consisted of long-term noise logging at three sites over a period of approximately one week, and short-term attended noise measurements. Attended noise measurements were conducted at the three logging sites and at additional monitoring sites.

The long-term noise logging measurement results assist in understanding the variation in the ambient noise environment noise level by time of day and at different locations. The attended measurements provide additional information on the sources contributing to the noise levels technical staff were present during the measurement period. The short period of the attended measurements allows additional measurement positions to be considered.





**Figure B10-2** Landside Works Project Area key sensitive receptors and noise monitoring locations.

Source: Appendix AU (Figure 5.3).





**Figure B10-3** Northern Sands DMPA key sensitive receptors and noise monitoring locations.

**Source:** Appendix AU (Figure 5.1).



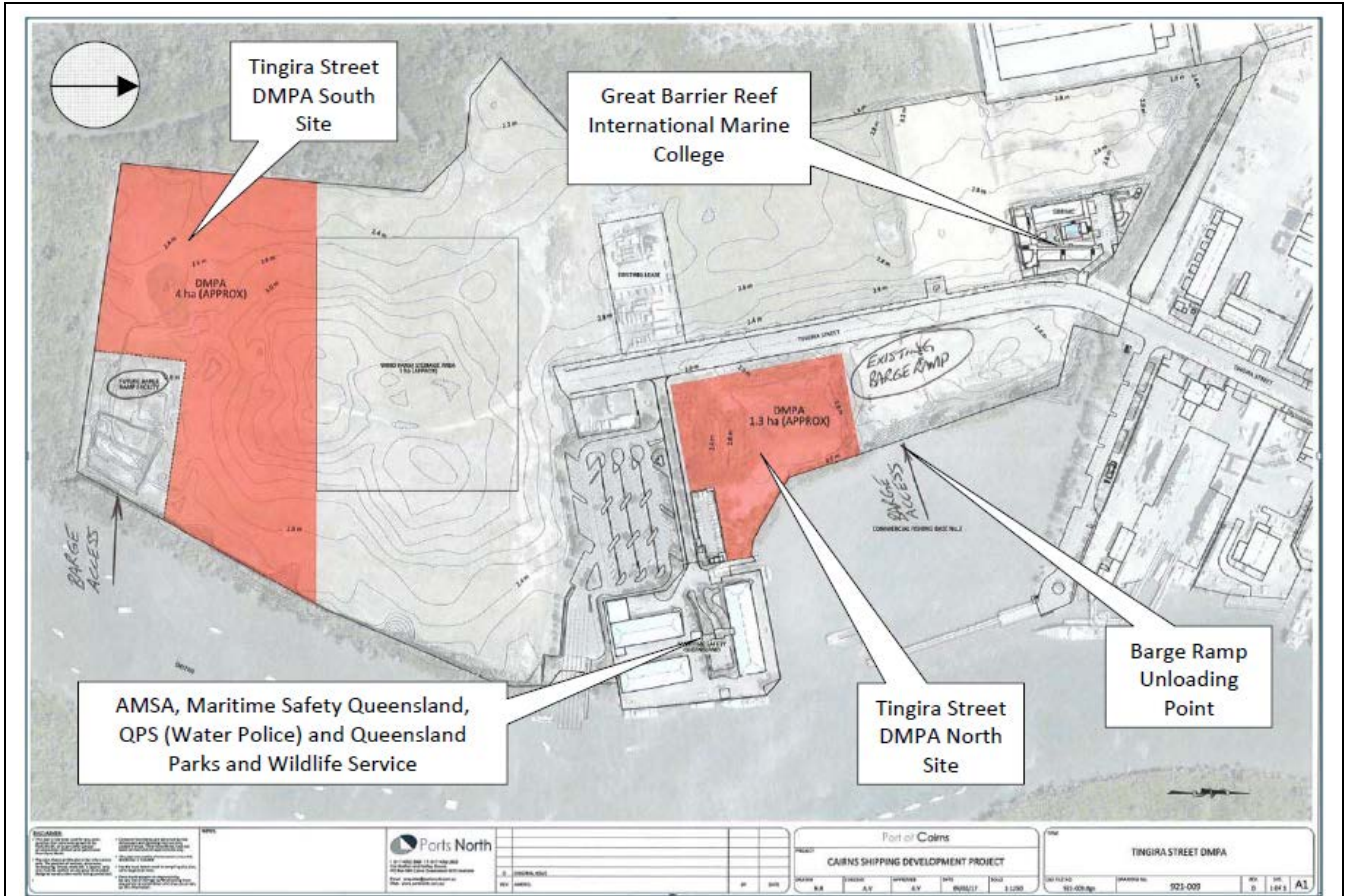
**Figure B10-4** Northern Sands Project Area (delivery pipeline) key sensitive receptors and noise monitoring locations.  
**Source:** Appendix AU (Figure 5.2).

### Tingira Street Project Area

For the Tingira Street Project Area, noise monitoring was undertaken to determine the existing noise environment at and around areas that could be affected by project activities. The monitoring consisted of short-term attended noise measurements.

The locations used for noise monitoring are shown on **Figure B10-5** and described in **Table B10-2**. These were selected based on the presence of sensitive or non-sensitive receptors and consideration of likely actions and potential impacts resulting from stiff clay placement component of the CSD Project.





**Figure B10-5** Tingira Street Project Area and nearest buildings.

Source: Appendix AT (Figure 2.2).

### B10.3.2.b Findings

The detailed data and a discussion of results are included in **Appendix AU** and **Appendix AT**. The following is a summary of broad findings.

#### Landside Works Project Area

- The Wharf Street area is typical of an urban noise environment, with ambient noise levels generally characterised by man-made noise sources such as traffic noise from local roads and mechanical plant noise from surrounding buildings.
- The existing noise environment at Locations E1 and E2 is heavily influenced by traffic on Wharf Street and mechanical plant associated with the Jack & Newell Apartments and the Pullman Hotel. In the absence of traffic noise, mechanical plant noise is the dominant noise source. The items of plant that were observed to be the source of the noise were exhaust air fans.
- Noise monitoring at the Wharf Street area did not capture noise events from operation of the port, and therefore does not provide an indication of the noise environment with the inclusion of this existing noise source.
- Noise monitoring at Monitoring Location G1 and G2 (Piermonde Apartments, Receptor B) indicates that the apartments at higher levels are also affected by mechanical plant noise.

### **Northern Sands Project Area**

- The dominant noise source at Monitoring Location B1 (near Northern Sands DMPA) is road traffic noise on the Captain Cook Highway. The noise environment is also influenced by insects. Monitoring did not detect any noise from the sand mining operation.
- The noise environment at Monitoring Location C1 (Holloways Beach Access Road) is influenced by insect and bird noise. Aircraft noise associated with jet aircraft landing at the Cairns Airport is also a dominant noise source with semi-regular events.
- It is noted that aircraft noise will change with runway heading changes due to wind directions and approach methods.
- The noise environment at Locations D1 to D4 (Holloways Beach) is representative of a quiet residential area. Insect noise influences the noise environment.

Monitoring undertaken for the Aquis project (Aquis 2013) reveals that seasonal harvesting adds to the noise environment on cane farms.

### **Tingira Street Project Area**

- Noise sources included very distance industrial noise coming from the main port area, birdsong, vehicles on Tingira Street, small boats, forklifts, cranes, and other plant operating on nearby properties.

## B10.4 Assessment of Potential Impacts

### B10.4.1 Impact Assessment Methodology

#### B10.4.1.a Risk-based Assessment

The following impact assessment has been undertaken for each of the matters described in the previous chapter. It uses the risk-based process adopted for the Revised Draft EIS as outlined in **Chapter A1** (Introduction) and includes an assessment of the following:

- the magnitude of impacts (consequence) (**Table B10-3**)
- the duration of impact (from **Chapter A1** (Introduction))
- the likelihood of impact (from **Chapter A1** (Introduction))
- risk level (from **Chapter A1** (Introduction)).

These are considered together to determine the final level of impact risk, which is described in **Table B10-7**.

#### B10.4.1.b Impact Significance / Consequence Criteria

Impact consequence criteria are different for each matter under discussion. **Table B10-3** shows the criteria used for this chapter.

**TABLE B10-3 IMPACT CONSEQUENCE CRITERIA**

IMPACT CONSEQUENCE	DESCRIPTION OF SIGNIFICANCE
Very High	<p>The management of the impact is critical to decision-making, including the selected methodology for delivering the Project and the development of management measures.</p> <p>Noise emissions will:</p> <ul style="list-style-type: none"> <li>• significantly exceeds noise limits at receptors occur over a medium or long-term duration</li> <li>• moderately exceed noise limits for permanent duration</li> <li>• occur during noise sensitive periods (night) or outside standard construction hours (6:30 am - 6:30 pm, Monday to Saturday).</li> </ul>
High	<p>Addressing the impact is very important to decision-making, including the selected methodology for delivering the Project and the development of management measures.</p> <p>Noise emissions will:</p> <ul style="list-style-type: none"> <li>• significantly exceeds noise limits for a temporary to short term activity, or, moderately exceed the noise limits for a medium to long-term duration activity, or, result in a minor exceedance of noise limits for a permanent activity</li> <li>• occur during noise sensitive periods (night) or outside standard construction hours (6:30 am - 6:30 pm, Monday to Saturday)</li> <li>• not be consistent with the existing noise environment.</li> </ul>
Moderate	<p>The effects of the impact are important to decision-making including the selected methodology for delivering the Project and the development of management measures.</p> <p>Noise emissions will:</p> <ul style="list-style-type: none"> <li>• significantly exceeds the derived noise limit for a temporary to short term activity, or, result in minor or moderate exceedance of noise limits for a medium to long-term duration activity, or, result in a minor exceedance of noise limits for a permanent activity</li> <li>• occur during standard construction hours (6:30am - 6:30pm, Monday to Saturday), or, be consistent with the existing noise environment.</li> </ul>

(Continued over)



IMPACT CONSEQUENCE	DESCRIPTION OF SIGNIFICANCE
Minor	<p>Impacts are recognisable/detectable but acceptable and are unlikely to influence decision making.</p> <p>Noise emissions will:</p> <ul style="list-style-type: none"> <li>significantly exceeds the derived construction noise limit, but not the 'highly affected noise limit, for a temporary activity.</li> <li>result in a minor exceedance of the derived noise limits for any activity duration for activities which occur during standard construction hours (6:30 am - 6:30 pm, Monday to Saturday) only.</li> <li>comply with noise limits at all receptors, but occur outside of standard construction hours or during noise sensitive periods (i.e. night) and therefore may impact people more sensitive to noise.</li> </ul>
Negligible	<p>Negligible impacts are anticipated.</p> <p>Noise emissions will:</p> <ul style="list-style-type: none"> <li>be compliant at all receptors</li> <li>will not occur outside of standard construction hours (6:30am - 6:30pm, Monday to Saturday in the vicinity of sensitive receptors.</li> </ul>
Beneficial	Amenity of the area in respect to noise is improved

#### B10.4.1.c Duration of Impacts

Table B10-4 shows the general approach to classifying the duration of identified impacts.

**TABLE B10-4 CLASSIFICATIONS OF THE DURATION OF IDENTIFIED IMPACTS**

CLASSIFICATION	DURATION	APPLICABLE PROJECT NOISE SOURCES
Temporary	1 - 2 Weeks	Sandbar cutting, pipeline construction and decommissioning
Short Term	Up to 1 Month	Pipe fabrication
Medium Term	Up to 3 Months (~12 Weeks)	TSHD and backhoe dredging IFO facility construction, booster pump operation, tailwater pump operation DMPA construction and operation
Long Term	Up to 12 Months	Wharf upgrade construction
Permanent	In excess of 12 Months	Wharf operation

#### B10.4.1.d Likelihood of Impact

Likelihood of impact is described in Table B10-5 below.

**TABLE B10-5 LIKELIHOOD OF IMPACT**

LIKELIHOOD OF IMPACT	RISK PROBABILITY CATEGORIES
Highly Unlikely	Highly unlikely to occur but theoretically possible
Unlikely	May occur during construction of the project but probability well below 50%; unlikely, but not negligible
Possible	Less likely than not but still appreciable; probability of about 50%
Likely	Likely to occur during construction or during a 12 month timeframe; probability greater than 50%
Almost Certain	Very likely to occur as a result of the proposed project construction and/or operations; could occur multiple times during relevant impacting period

### B10.4.1.e Risk Matrix

Risk is described as the product of likelihood and consequence as shown in **Table B10-6** below.

**TABLE B10-6 RISK MATRIX**

LIKELIHOOD	CONSEQUENCE				
	NEGLIGIBLE	MINOR	MODERATE	HIGH	VERY HIGH
Highly Unlikely/ Rare	Negligible	Negligible	Low	Medium	High
Unlikely	Negligible	Low	Low	Medium	High
Possible	Negligible	Low	Medium	Medium	High
Likely	Negligible	Medium	Medium	High	Extreme
Almost Certain	Low	Medium	High	Extreme	Extreme

### B10.4.1.f Risk Rating

The rating of risk as assessed above is as shown in **Table B10-7** below for the topics covered by this chapter.

**TABLE B10-7 RISK RATING LEGEND**

RISK RATING	DESCRIPTION
Extreme Risk	An issue requiring change in project scope to reduce risk.
High Risk	An issue requiring further detailed investigation and planning to manage and reduce risk.
Medium Risk	An issue requiring project scope specific controls and procedures to manage.
Low Risk	Manageable by standard mitigation and similar operating procedures.
Negligible Risk	No additional management required.
Beneficial	A beneficial impact.

### B10.4.1.g Risk Assessment

The detailed risk assessment is included in **Section B10.4.4** and revised in **Section B10.6**, taking in to account the results of mitigation (**Section B10.6**).

## B10.4.2 Detailed Assessment – Noise

### B10.4.2.a Detailed Findings

Detailed findings are included in Section 7 of **Appendix AU**, Section 7 of **Appendix AT**, and in Chapter B10 of the Draft EIS. The following summaries are based on the tables of results in those documents and the subsequent discussions. Note that the assessment of dredging and activities in the Landside Works Project Area relies largely on that documented in the Draft EIS, updated as appropriate.

### B10.4.2.b Underwater Noise

The Draft EIS includes details of underwater noise emissions and this was used to inform the assessment of ecological impacts on marine fauna in **Chapter B7** (Marine Ecology). Key findings are:

- Dredging noise is predicted to have negligible impacts on sensitive marine fauna with localised behavioural changes (avoidance) within approximately 100 – 200 m of the dredge. Hearing damage would only be expected if animals remain in the immediate vicinity (approximately 10 m of the dredge) for prolonged periods, which is considered extremely unlikely to ever occur. **Chapter B7** (Marine Ecology) describes the general impacts that could occur from interactions between marine fauna and anthropogenic underwater noise and concludes that this involves a low residual risk (mitigation is recommended in **Chapter C2** (Dredge Management Plan)).

- For the wharf upgrade works, underwater noise will result from multiple sources, of which the most chronic will be repeated pulsed inputs from driving the 84 racking steel piles during construction. Noise will also be generated directly from general wharf construction work, as well as through the operation of construction vessels. It is envisaged that the piles will be driven from a barge, by a piling rig with crane and hammer.
- The Draft EIS stated that piling activities during the wharf upgrade works are predicted to result in localised fish mortality within the immediate vicinity (~one-three metres) of the piling rig and behavioural changes (avoidance) expected at distances within one km of the piling rig. However, the use of ‘soft-start’ piling techniques is expected to mitigate this impact. Recommended mitigation measures are provided in **Chapter C1** (Construction Environmental Management Plan).
- Piling noise is expected to potentially result in hearing damage to marine mammals in the immediate vicinity of the piling rig (up to ~10 m). Although behavioural changes (avoidance) are expected, these are predicted to be limited to within up to ~500 m of the piling rig. Overall, any piling related noise effects to marine megafauna are considered to be temporary (for the duration of construction works) and minimal in the context of the existing noise regime of the area.

#### **B10.4.2.c Channel Project Area**

As part of the dredging process, soft clay dredge material captured by the TSHD will be transferred to the dredge material pipeline via an off-shore pump out facility. Noise emissions from the TSHD pump out process are considered in the assessment of construction noise impacts for the Channel project Area.

- The Draft EIS assessment of airborne noise from dredging concludes:
  - TSHD dredging is predicted to have negligible impacts during standard construction hours. Outside standard construction hours, TSHD dredging is predicted to have a minor noise impact on moored residential receptors located on Trinity Inlet. If the program of TSHD dredging results in the dredge staying in the vicinity of a receptor for greater than one month, noise impacts outside standard construction hours would increase to moderate.
  - Backhoe dredging is predicted to result in minor noise impacts to all receptors (including those at Wharf Street and Trinity Inlet) during standard construction hours. Should dredging be undertaken in the vicinity of CityPort outside standard construction hours, it is predicted that there would be high noise impacts to receptors at Wharf Street and Trinity Inlet.
- The predicted cumulative noise levels from TSHD pump out and booster pump operation comply with the night-time noise level targets under neutral conditions, but exceed the night-time noise level targets at Receptors J, K, L, N and O under adverse conditions. The highest predicted noise exceedance under adverse conditions is up to 4 dBA at Receptor J.
- It is noted that the predicted noise level from the TSHD pump out by itself is compliant, however the influence of the booster stations resulting in an overall noise level which exceeds the night-time noise level targets.
- Overall, the level of the predicted exceedances is considered moderate. It is expected that further mitigation of the booster pump stations to achieve compliance would be possible.
- A detailed assessment of noise emissions from the booster pumps and TSHD pump out process will be required when pump selections and the number of stations and their locations, is confirmed. Further discussion of the requirements for this further assessment is provided in **Section B10.5**.

#### **B10.4.2.d Landside Works Project Area**

The following is a summary of the modelling documented in **Appendix AU**. This refers extensively to previous work undertaken for the Draft EIS, updated as appropriate.

##### **Construction**

- It is expected that the IFO pipeline construction will comply with the construction noise level targets at sensitive receptors near the wharf if construction is limited to standard construction hours as is proposed.

- As for any construction project where piling is to occur near sensitive receptors, it is expected that noise from piling has the potential to impact sensitive receptors, and therefore it is recommended that piling is only undertaken during standard construction hours.
- If piling is required to be undertaken outside of standard construction hours, it is recommended that it is not undertaken between the hours of 10:00 pm to 7:00 am (night-time), as it is expected that piling during this period may result in sleep disturbance.

### Operation

- The Draft EIS noted that operational noise exceeded Acoustic Criteria but that these were considered acceptable on the basis that noise levels are generally not increasing and there have been no complaints to Ports North regarding the existing noise levels. A further review of the noise levels indicates that noise level exceedances are nil or relatively small when compared to alternative criteria determined on the basis of achieving internal noise levels with doors/windows closed. Therefore, it could be considered that on the basis of these alternative criteria, and the outcome that noise levels will not be increasing, that the impacts are acceptable.

### B10.4.2.e Northern Sands Project Area

The following is a summary of the modelling documented in **Appendix AU** (sensitive receptors are identified on **Figure B10-6**).

#### Northern Sands DMPA

- The preparation of the DMPA (construction of earth bunding) will be undertaken by the quarry as part of 'business as usual' operations. Construction will be daytime only and use equipment such as dozers and excavators which are typically used in a quarry or on farms in the area – but for extended periods during bund construction. This activity is not within the scope of the CSD Project and therefore does not require assessment.
- It is likely that noise emissions from the tailwater pump will be compliant at sensitive receptors, and minimal mitigation will be required. However, if an additional tailwater pond is required, and the pump is required to be located towards the northern boundary of the DMPA, more detailed consideration of noise mitigation will be required. It is recommended that an assessment of tailwater pump noise is undertaken when the exact location of the pump is known, and when the pump model has been selected.

#### Pipeline

- The main noise generating activities are associated with the construction and operation of the delivery pipeline.
- Noise from the pipe fabrication area is predicted to be compliant with the noise level targets at all receptors.
- Noise from the sandbar cutting is predicted to slightly exceed (up to 4 dBA) the construction noise level targets during adverse conditions.
- Noise from the dozer and excavator crew is predicted to exceed the noise limits at numerous receptors during both neutral and adverse conditions. The highest exceedance is up to 13 dBA at Receptor M, which is the closest receptor to the pipeline route. The predicted noise level at Receptor M is well below the highly affected noise level of 75 dBA  $L_{eq}(15 \text{ minute})$  – see discussion below **Figure B10-6**.
- The cumulative noise levels also exceed the noise criteria at numerous receptors during both neutral and adverse conditions. The predicted cumulative noise levels are dominated by noise from the dozer and excavator crew, with noise from the fabrication area having only a minor influence on the overall noise level at some receptors.

## Boosters

- Boosters will only operate periodically (i.e. the soft clay will be delivered in pulses corresponding to the TSHD operations).
- Predicted noise levels comply with the night-time noise level targets under neutral conditions, but exceed the night-time noise level targets at Receptors J, L and O under adverse conditions. The predicted noise exceedance under adverse conditions is up to 3 dBA at Receptors J and L, and up to 1 dB at Receptor O.
- Overall the level of these exceedances is considered minor, and it is expected that further mitigation (i.e. bunding or quieter plant selection) will result in compliance with the noise level targets.
- A detailed assessment of noise emissions from the booster pumps will be required when pump selections, the number of stations required is confirmed, and potential locations for the stations is confirmed. Further discussion of the requirements for this further assessment is provided in **Section B10.5**.

It is noted that the highest predicted noise level from pipeline construction activity is 55 dBA  $L_{eq}$ (15 minutes) at Receptor M, which is the closest receptor to the pipeline route. This noise level is well below the highly-affected noise level of 75 dBA  $L_{eq}$ (15 minute) as prescribed by the ICNG (see **Appendix AU** Table 3.2).

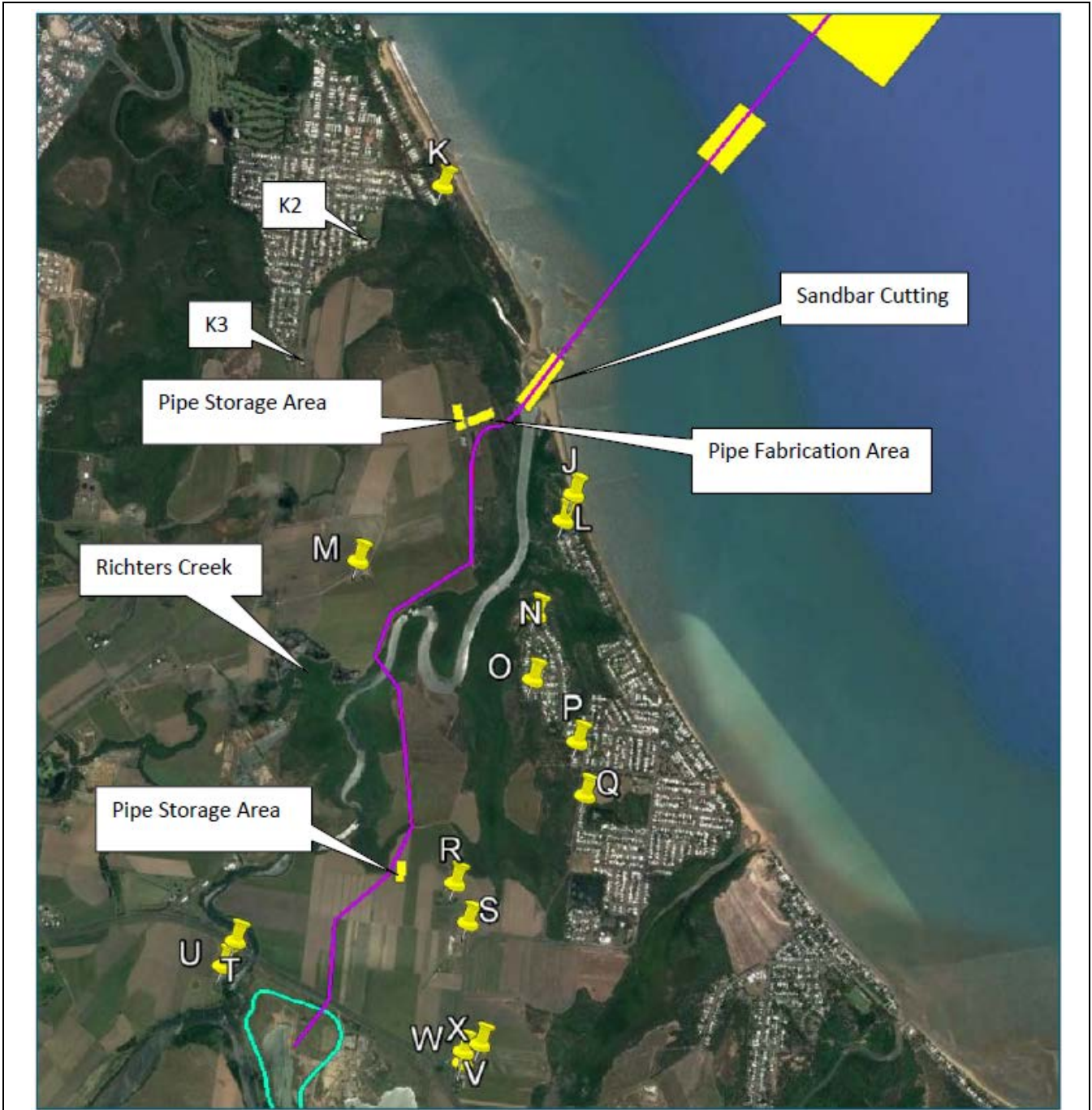
Based on the anticipated construction time and decommissioning time required (up to 6 weeks), and the current proposed length of the pipeline (approximately 4.5 kilometres onshore), the anticipated pipeline construction rate is approximately 200 metres per day. Therefore it is considered unlikely that receptors will be subject to the predicted noise levels (see **Appendix AU** Table 7.3) for more than a few days.

As the anticipated duration required for sandbar cutting is up to one week, receptors will only be exposed to noise associated with this activity for a short period of time.

It is also noted that as the pipeline will be built during cane harvesting season, it is possible that noise from the pipeline construction may not be discernible from cane harvesting operations at some locations.

Overall, it is expected that noise emissions from pipeline construction and decommissioning will not significantly impact sensitive receptors. Mitigation methods and management strategies to reduce noise impacts onto sensitive receptors are discussed in **Section B10.5**.





**Figure B10-6** Location of pipe storage and laydown, fabrication areas and sensitive receivers.

Source: Appendix AU (Figure 7.1).



### **B10.4.2.f Tingira Street Project Area**

Noise predictions were made for the assumed placement methodology and construction fleet at the identified sensitive receptors. These are detailed in **Appendix AT**. The key conclusions are as follows.

The proposed hopper barge landing point (refer **Figure B10-5**) is estimated at approximately 160 metres from the college and offices. Other distances are taken from the middle of the respective DMPA areas, or from the middle of haulage routes for the trucks. The calculated noise levels are as follows:

- Northern Tingira Street DMPA to Offices: 68 dBA  $L_{eq}(15min)$
- Northern Tingira Street DMPA to College: 62 dBA  $L_{eq}(15min)$
- Southern Tingira Street DMPA to Offices: 64 dBA  $L_{eq}(15min)$
- Southern Tingira Street DMPA to College: 60 dBA.  $L_{eq}(15min)$ .

The ICNG noise affected levels are 65 dBA  $L_{eq}(15minute)$  for the college and 70 dBA  $L_{eq}(15minute)$  for the offices. The predicted noise levels listed above for typical construction scenarios are therefore compliant with a 2 to 3 dBA margin.

Based on the anticipated construction time of up to 5 weeks and the compliance with the ICNG levels, it is considered that noise levels will not significantly impact the college and offices.

Although construction activities will also occur in the evening and night periods, there are no sensitive receptors in the vicinity to be exposed to the noise in these periods, and therefore no special assessment has been made of night-time noise.

No specific mitigation measures are proposed but general mitigation methods to reduce noise impacts on receptors are discussed in **Section B10.5.1.b**.

### **B10.4.3 Detailed Assessment – Vibration**

#### **B10.4.3.a Landside Works Project Area**

The Draft EIS assessment of vibration is still relevant to the CSD Project and relevant material has been extracted from Chapter B10 of the Draft EIS (Ports North 2014b).

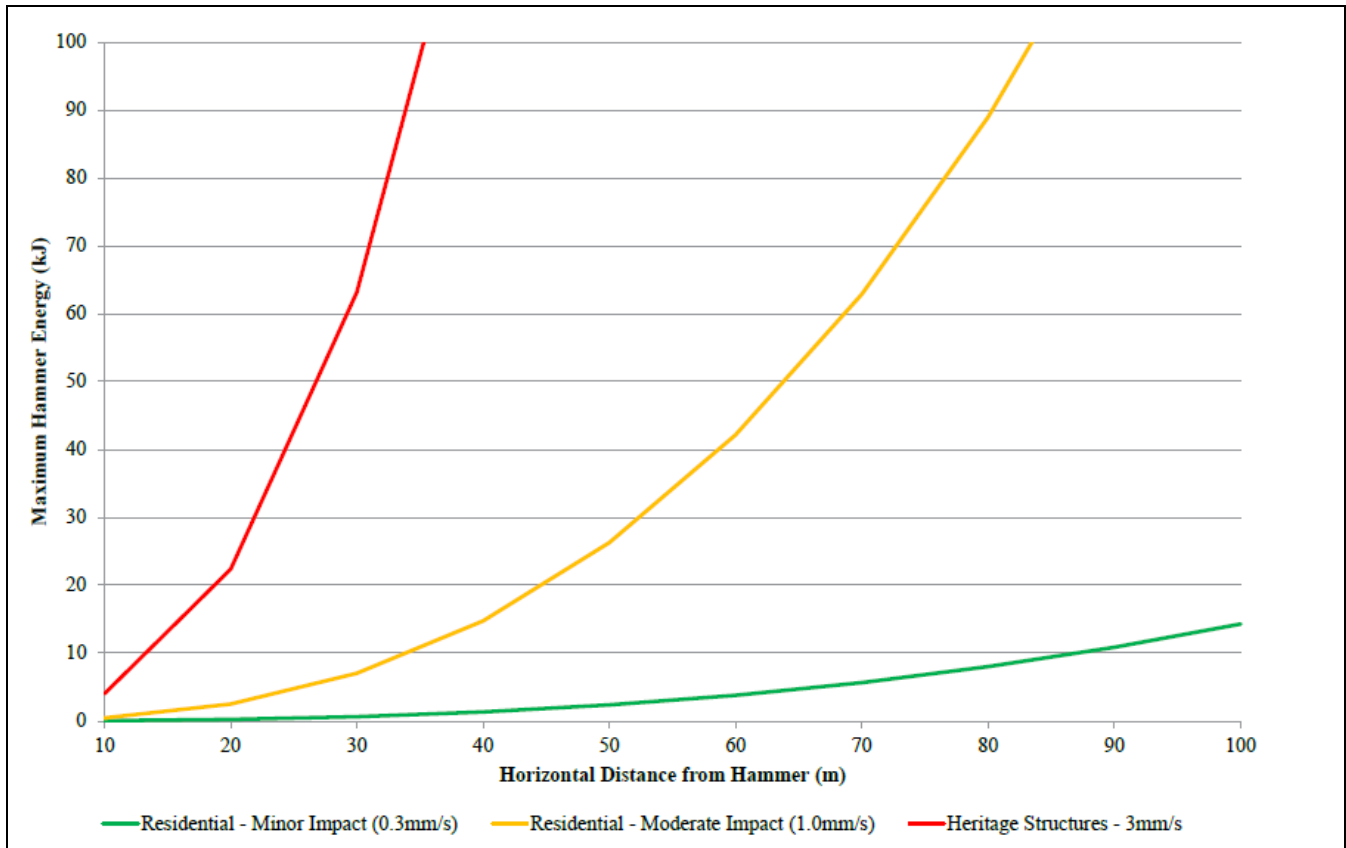
Vibration levels from vibration-inducing equipment were predicted at the nearest sensitive receptors for human comfort vibration effects from construction activities which are the apartments/hotels on Wharf Street. The closest receptor for building damage is the heritage wharf at Port of Cairns. The highest vibration inducing activities during construction will be:

- Impact piling
- Dredging (TSHD and backhoe)
- Directional drilling from IFO pipeline installation (if required).

#### **Vibration from Piling**

Vibration levels from piling are dependent on the hammer energy, which in turn is related to the hammer mass and drop height. These factors will be determined as part of the detailed planning of construction activities. Accordingly, the Draft EIS assessment was based on providing calculated stand-off distances (i.e. horizontal buffer zone between the piling rig and sensitive receptors) for piling as a function of the drop energy in order to comply with the project vibration goals. These stand-off distances will be used in planning piling operations to ensure that vibration goals are not exceeded.

A graph of nominal hammer energies relative to distance is provided for vibration criteria relevant to this study (see **Figure B10-7**).



**Figure B10-7** Maximum nominal hammer energy (kJ) to comply with project vibration targets for piling as a function of distance from receiver.

**Source:** Ports North (2014a) (Figure B10.5.1.2a).

For typical hammer energies predicted vibration impacts on the Wharf Street residential receptors are likely to be in the range  $0.3 < PPV < 1.0$  for the duration of piling ( $>1$  month). This corresponds to a minor impact.

To prevent impacts to the heritage wharf, the piling rig hammer energy will be controlled, with the hammer energy being reduced as the piling rig approaches the wharf. This will be achieved by limiting the drop height relative to the hammer mass so that piling has a negligible impact. From the experience of past installation of piles during capital works such as the CCLT wharf refurbishment in 2010 and installation of piles for maintenance of the actual heritage structure, vibration impacts are predicted to be negligible.

### Terrestrial Vibration from Dredging

Vibration impacts from dredging are not commonly assessed because of the source-receiver distances encountered in typical EIS projects. The Port of Cairns is unusual in that port operations occur in close proximity to residential land usage and hence it is relevant to consider vibration levels from dredging activities.

There is little or no specific information of groundborne vibration levels from dredging in the literature (likely because in a typical assessment there are no vibration-sensitive receivers in the vicinity). In the absence of specific vibration information from dredging in the literature, dredging impacts have been modelled using the TRL construction vibration methodology data for tunnelling operations. Data from tunnelling indicates that the ground conditions are the main factor determining vibration levels from an excavation type activity.

For soft soils (clay and sand+clay), which are the closest available data to the seabed conditions for dredging, tunnelling vibration levels are expected to be below  $0.1 \text{ mm/s}$  for all distances. Note that this is likely a conservative approach since a fluid seabed is likely even softer than the data assumed in this assessment.

This is well below vibration impact criteria for all receptor types and therefore represents a negligible impact.

## Summary of Findings

The Draft EIS assessment of vibration associated with piling at the Landside Works Project Area was based on soft cohesive soil as being representative of the channel bed. The predicted peak particle velocity (PPV) levels were calculated for nominal typical hammer energies to the heritage wharf (30 m) and nearest potentially affected residential receptors (100 m) and concluded that vibration impacts on residential receptors will be in the range  $0.3 < PPV < 1.0$  for all nominal hammer energies. Human comfort vibration impacts may be expected for vibration levels above approximately 0.3 mm/s PPV.

Levels in the above range correspond to a 'minor' impact (Ports North (2014a) Chapter B10 Table B10.3e).

Vibration levels from dredging are well below impact criteria for all receptor types and therefore represents a negligible impact.

### B10.4.3.b Other Project Areas

Vibration from other construction activities (Northern Sands DMPA, pipeline corridor, and Tingira St DMPA) and operational activities (cruise ships at wharf) is considered to be minor or insignificant.

## B10.4.4 Risk Assessment

### B10.4.4.a Assessment

**Table B10-8** sets out the results of the risk assessment for noise and vibration issues based on the previous analysis. This assumes that only standard mitigation (i.e. statutory) is applied.

**TABLE B10-8 RISK ASSESSMENT**

PROJECT AREA	CONSTRUCTION ACTIVITY / NOISE SOURCE	INITIAL ASSESSMENT WITH STANDARD MITIGATION MEASURES		
		CONSEQUENCE	LIKELIHOOD	RISK RATING
<b>Construction</b>				
TSHD Dredging Noise (a)	TSHD dredging (Draft EIS) – daylight hours	Negligible	Almost Certain	Low
TSHD Dredging Noise (b)	TSHD dredging (Draft EIS) – night-time hours	Moderate	Almost Certain	Medium
TSHD Dredging Vibration	TSHD dredging (Draft EIS)	Negligible	Almost Certain	Low
Backhoe Dredging (a)	Backhoe dredging (Draft EIS) – daylight hours	Minor	Almost Certain	Medium
Backhoe Dredging (b)	Backhoe dredging (Draft EIS) – night-time hours	High	Almost Certain	Extreme
TSHD Dredging	TSHD Pump out	Moderate	Likely	Medium
Wharf Construction	IFO Construction	Minor	Likely	Low
	Piling (noise)	Moderate	Likely	Medium
	Piling (vibration) – Draft EIS	Minor	Almost Certain	Medium
Pipeline Commissioning and Decommissioning	Sandbar Cutting	Minor	Possible	Low
	Pipe Fabrication	Negligible	Possible	Negligible
	Pipeline Construction and Decommissioning	Minor	Possible	Low
Pipeline Operation	Booster Pump Stations	Moderate	Almost Certain	High

PROJECT AREA	CONSTRUCTION ACTIVITY / NOISE SOURCE	INITIAL ASSESSMENT WITH STANDARD MITIGATION MEASURES		
Northern Sands DMPA	Tailwater Pumps	Minor	Almost Certain	Medium
Tingira Street DMPA	Various	Negligible	Possible	Negligible
<b>Operation</b>				
Wharf Operation	Cruise Ships	Minor	Possible	Medium

#### **B10.4.4.b Discussion**

This assessment shows that all risks are Medium or less, with the exception of the following.

##### **Backhoe dredging (Draft EIS) – night-time hours**

Modelling shows that backhoe dredging in the vicinity of the wharf street sensitive receptors could involve excessive noise (Extreme risk) if undertaken at night (Backhoe Dredging (b)). The alternative (Backhoe Dredging (a)) involves a lesser (Medium) risk. Backhoe dredging only during daylight hours is an obvious mitigation strategy. In addition, it should be noted that the backhoe dredge will only be in the vicinity of the sensitive receptors for a small proportion of the campaign (as indicated by the dredge logs) and such activity will occur intermittently within each working day while barge transfers occur.

##### **Pipeline Operation (Booster Pump Stations)**

As noted in **Section B10.4.2.e**, boosters will only operate periodically (i.e. the soft clay will be delivered in pulses corresponding to the TSHD operations). In addition, the predicted noise levels comply with the night-time noise level targets under neutral conditions, but exceed the night-time noise level at some receptors under adverse conditions. Overall, the level of these exceedances is considered minor, and it is expected that further mitigation (i.e. bunding or quieter plant selection) will result in compliance with the noise level targets. This is discussed in **Section B10.5.1.a**.

## B10.5 Recommended Mitigation Measures

### B10.5.1 Construction Noise

Specific mitigation measures and management Strategies for each of the assessed construction activities have been identified and are listed in **Table B10-9**.

#### B10.5.1.a Specific Measures

**TABLE B10-9 RECOMMENDED CONSTRUCTION NOISE MITIGATION MEASURES AND MANAGEMENT STRATEGIES**

CONSTRUCTION ACTIVITY	RECOMMENDED MITIGATION
TSHD dredging	<ul style="list-style-type: none"> <li>Avoid TSHD dredging in the vicinity of CityPort during night-time hours.</li> </ul>
Backhoe dredging	<ul style="list-style-type: none"> <li>Avoid backhoe dredging in the vicinity of CityPort during night-time hours.</li> </ul>
Construction Activity Near Boat Moorings	<ul style="list-style-type: none"> <li>Ports North should consult with users of boat moorings near construction areas within the channel and near the wharf to prevent the potential for noise impacts to these receptors. Users will have the choice to stay or leave during temporary construction activity.</li> </ul>
Pipe Fabrication	<ul style="list-style-type: none"> <li>No additional mitigation measures are required based on the outcomes of the assessment.</li> <li>Temporary noise barriers or earth bunding around the fabrication area could reduce noise impacts in the event of a noise complaint.</li> </ul>
Sandbar Cutting	<ul style="list-style-type: none"> <li>Based on the anticipated duration of this activity (up to one week), the recommended mitigation measure is communication with stakeholders to inform them of the dates and times when sandbar cutting will be undertaken, and that noise from this work may be audible during these periods.</li> </ul>
Pipeline Construction and Decommissioning	<ul style="list-style-type: none"> <li>Selection of lower noise plant (excavator and dozers) which is suitable for performing the construction and decommissioning work.</li> <li>Communication with stakeholders should be undertaken prior to and during pipeline construction and decommissioning work. A pipeline construction and decommissioning plan should be developed by the appointed contractor, determining where noise generating activity will occur along the length of the pipeline route, when this work will occur and the likely duration of the work. This information should then be made available to stakeholders and residents to inform them of the potential for noise from construction activity. Special attention should be provided to sensitive receptors located closer to the pipeline route, (i.e. sensitive receivers represented by Receptors J, L, M, N, O and R).</li> <li>If the selected contractors pipeline construction and decommissioning method varies from the method assumed in this assessment report, or the alignment of the pipeline alters significantly with respect to proximity to sensitive receptors, a revised assessment of noise emissions from pipeline construction and decommissioning may be required to assess potential noise impacts and determine required mitigation measures.</li> </ul>
Booster Pump Stations	<ul style="list-style-type: none"> <li>A detailed noise assessment of the booster pump stations will be required once the location and number of pump stations has been defined by the contractor, and the actual pump stations have been selected. The assessment should determine if compliance with the construction noise limits will be achieved with the selected booster pumps as standard, or whether additional mitigation measures are required to achieve compliance.</li> <li>Mitigation measures which could be considered in a detailed noise assessment of the booster pump stations may include: <ul style="list-style-type: none"> <li>Enclosing the engine with an acoustically robust enclosure including internal acoustic absorption.</li> <li>Fitting industrial mufflers.</li> <li>Enclosing the pump.</li> <li>Altering the location of pump stations.</li> <li>Selection of alternative (quieter) or over-specified equipment (allowing lower operating speeds for the same throughput) plant.</li> </ul> </li> </ul>

CONSTRUCTION ACTIVITY	RECOMMENDED MITIGATION
Tailwater Pumps	<ul style="list-style-type: none"> <li>• A detailed assessment of noise emissions from the selected pumps should be undertaken to determine if compliance with the construction noise limits will be achieved with the selected pump/s as standard, or whether additional mitigation measures are required to achieve compliance.</li> <li>• Mitigation measures which could be considered in a detailed assessment of noise emissions from the tailwater pumps may include:               <ul style="list-style-type: none"> <li>- Enclosing the pump with an acoustically robust enclosure including internal acoustic absorption.</li> <li>- Installation of temporary noise barriers or earth bunding.</li> <li>- Locating the pump further away from receptors.</li> <li>- Using smaller pumps in series.</li> <li>- Selection of alternative (quieter) or over-specified equipment (allowing lower operating speeds for the same throughput) plant.</li> </ul> </li> </ul>
TSHD Pump out	<ul style="list-style-type: none"> <li>• A detailed assessment of noise emissions from the TSHD pump out process should be undertaken when the TSHD has been selected, and when the booster pump stations and locations have been confirmed.</li> <li>• During pump out the TSHD should be located as far off-shore as practically possible to minimise noise levels at on-shore receptors, subject to the results of the detailed noise assessment.</li> </ul>
IFO Pipeline Construction	<ul style="list-style-type: none"> <li>• With the exception of limiting IFO pipeline construction work to standard hours, no additional mitigation measures for this activity.</li> </ul>
Piling	<ul style="list-style-type: none"> <li>• Piling activities should be limited to the typical construction hours (6:30 am to 6:30 pm, Monday to Saturday) unless approval is obtained from DEHP/local authority based on “sufficient grounds” to justify construction outside these hours.</li> <li>• If piling is to occur outside of typical construction hours, advance notice (preferably at least one weeks’ notice) should be provided to stakeholders who may potentially be affected.</li> <li>• Piling between the hours of 10:00 pm to 7:00 am (night-time) should be avoided as much as practically possible.</li> <li>• A resilient pad (dolly) should be used where feasible between the pile and hammer head in order to reduce airborne noise impacts, as recommended by BS5228.</li> <li>• Vibration impacts should be controlled by limiting the hammer energy used to undertake piling based on the distance to the nearest sensitive receptors and structures. This will be achieved by setting the relevant drop height relative to the mass of the piling rig hammer.</li> <li>• Vibration monitoring should be undertaken during piling to confirm/calibrate the vibration predictions.</li> <li>• Contractor to review existing dilapidation survey(s) for the heritage wharf during planning of / prior to commencement of construction and adjust construction program accordingly.</li> </ul>
Tingira Street DMPA	<ul style="list-style-type: none"> <li>• No special measures required (see <b>General Measures</b> below).</li> </ul>

### B10.5.1.b General Measures

In addition to the above measures for specific activities, all general activities relating to the construction works in all project areas should be carried out in accordance with best practice measures to reduce the potential for noise impacts, including the following:

- Modern and well-maintained equipment should be used to undertake the works.
- Noisy or vibration generating plant, equipment and activities should be substituted with lower impact options where possible.
- Arrange work flow to minimise the use of reversing alarms on vehicles and plant. Use equipment with broadband (squashed duck) alarms where possible.
- Locate noisy plant, site vehicle entrances and off-site truck parking areas away from sensitive receptors where possible.



- Plant known to emit noise strongly in one direction should, where possible, be orientated so that the noise is directed away from the closest noise-sensitive areas.
- Where machines are fitted with mufflers, these should be kept in good condition and replaced if degradation has led to noticeably increased noise emissions.
- There should be continuous training of operators, labourers, subcontractors and supervisors through induction training and ongoing meetings on the need to minimise noise impacts on surrounding local residents.
- Where machines are fitted with engine covers, these should be kept closed when the machine is in use.
- The drivers of machinery should be provided with appropriate communication equipment, to ensure that signalling by other means (e.g. horns) is kept to a minimum.
- When workers arrive prior to 6:30 am, care should be taken to ensure unloading of tools and equipment and preparation work does not generate significant noise.
- Construction work should be limited as much as possible to between the hours of 6:30 am to 6:30 pm Monday to Saturday.
- Noise sensitive receptors should be informed of any out-of-hours construction works in advance (preferably at least one weeks' notice, except for emergency works) of works occurring.
- Provide advanced notice, where possible, to stakeholders when loud construction or demolition activity is proposed to be undertaken.
- Open communication should occur with stakeholders located in the vicinity of construction areas who could potentially be impacted by activities resulting in noise and vibration emissions. A construction engagement program should be developed and implemented to create a dialogue with stakeholders during the construction phase.
- A designated communication channel, i.e. email and phone number, should be established, to facilitate communication with stakeholders. This communication method should be actively managed to ensure complaints and issues can be addressed as soon as practically possible.

A Construction Noise and Vibration Management Plan should be developed for the Project, including these mitigation strategies.

### **B10.5.2 Operational Noise**

There is no significant change to the operational noise (i.e. following completion of the CSD Project) assessment compared with the Draft EIS. The following recommendations are reproduced below.

The main contributing noise source to operational noise impacts is from a cruise ship itself, either on arrival to the Port of Cairns or while docked at the CCLT.

It is relevant to note that Port of Cairns has been operating for decades with vessel movements potentially occurring 24-hours per day in the immediate vicinity of the Cairns CBD. As such, although the project will introduce a greater number of overnight port visits, the project will not result in the introduction of a completely new noise source. It is also relevant that Ports North have received few, if any, noise complaints regarding noise emission from existing operation at the CCLT (with the exception of complaints against specific 'loud ships', particularly visiting Navy vessels).

There is little opportunity to reduce noise emissions from individual ships accessing the CCLT; however progressively as newer, quieter ships are introduced into service noise levels may reduce in future. Available noise data generally supports this trend: e.g. despite its larger size, measured docked noise levels from the *Carnival Spirit* were lower than measured docked noise levels from *Rhapsody of the Seas*.

Existing 'worst case' noise exposures, represented by the *Rhapsody of the Seas* cruise ship, which is the largest ship that has regularly visited Port of Cairns in recent years, are predicted to result in minor exceedances of the noise criteria during the night time period, with noise levels from docked ships, loading/unloading activities and ship arrival/departure predicted to exceed the noise criteria. Although loading/unloading and ship arrival/departure are unlikely to occur at night for a typical ship visit, the noise from the ship itself is predicted to exceed the noise criteria at night.

Future noise impacts associated with the project can be divided into two categories:

- Medium-sized cruise ships (e.g. *Pacific Dawn*, *Sun Princess*), which will likely represent the majority (~60 percent or greater) of future cruise ship visits following the project, and are predicted to be quieter than *Rhapsody of the Seas* and to meet noise criteria for all activities except ships arriving/departing at night (which is unlikely to occur in practice)
- Large-sized cruise ships (e.g. *Radiance of the Seas*), which are predicted to have very similar noise impacts to the existing noise impacts from *Rhapsody of the Seas*.

The lack of historical noise complaints to Ports North regarding cruise ship noise at Port of Cairns suggests that future large cruise ships with similar noise emission characteristics to *Rhapsody of the Seas* are unlikely to cause significant additional noise impacts.

The 'typical' future scenario, with Medium-sized cruise ships, is unlikely to result in significant noise impacts on residences.

Noise impacts from ship arrival/departure at Trinity Inlet receptors are not expected to be significant. This is because ship arrivals will only occur once per assessment time period (i.e. a single noise event), will generally not occur during the night time period, and because the cruise ship activity is consistent with current port uses.

In the event that noise impacts occur, updates to future Port Operations and CCLT procedures to ensure ship operators are aware of the need to reduce noise impacts on surrounding residences and such measures may include:

- where possible, avoiding running the ship's primary propulsion engines at night (between 2200-0600)
- where possible, avoiding conducting loading/unloading activities or refuelling at night
- where possible, avoiding the use of the ship's external PA system at night.

Where operational circumstances require ships to conduct noise-generating activities at night, future Port Operations procedures may require ship operators to provide Ports North with advance warning (e.g. 24 hours' notice) so that Ports North may, at its discretion, implement additional management measures (e.g. notifying surrounding residents). Such procedures may be required in future, and could include mechanisms for notifying residents of ship visits (e.g. link to appropriate section of Ports North website), as well as details of complaints handling procedures to deal with any future noise complaints associated with operation of the CCLT, and provisions for dealing with individual noisy ships.

In addition to the above, Council (or Ports North for areas of Strategic Port Land) could consider imposing minimum acoustic construction requirements for new buildings in the vicinity of the wharf to minimise the potential for future noise complaints. This could be provided in the form of a Wharf Overlay Code or similar.

## B10.6 Residual Impacts and Assessment Summary Conclusion

### B10.6.1 Assessment

**Table B10-10** summarises in standard risk matrix format, the likelihood and consequences of noise and vibration impacts associated with the CSD Project. The unmitigated risk is as assessed in **Table B10-8**.

### B10.6.2 Conclusions

The following conclusions can be drawn for the above assessment.

#### B10.6.2.a Channel Project Area

- TSHD dredging is predicted to have Low residual risk at all receptors if conducted during standard construction hours. Outside standard construction hours, it is predicted to have a Minor risk of noise impacts on moored residential receptors located on Trinity Inlet. If the program of TSHD dredging results in the dredge staying in the vicinity of a receptor for greater than one month, noise risk outside standard construction hours would increase to High. Management is required to ensure that this does not occur.
- Backhoe dredging is predicted to result in a Low residual risk to all receptors (including those at Wharf Street and Trinity Inlet) during standard construction hours. Should dredging be undertaken in the vicinity of CityPort outside standard construction hours, it is predicted that there would be Extreme risk to receptors at Wharf Street and Trinity Inlet. Management is required to ensure that this does not occur.
- Dredging and piling noise is predicted to have Low residual risk on sensitive marine fauna. Mitigation is recommended in **Chapter C1** (Construction Environmental Management Plan) and **Chapter C2** (Dredge Management Plan).
- Noise emissions from the TSHD pump-out in combination with the marine booster pump may result in moderate exceedances, however, it is expected that noise emissions can be mitigated to achieve compliance. A detailed assessment of noise emissions from the TSHD pump out and marine booster will be required when equipment is selected.

#### B10.6.2.b Landside Works Project Area

- Noise and vibration emissions from wharf construction activities will be acceptable if occurring during standard construction hours (residual risk is assessed as Low).
- Noise emissions from wharf operations may result in minor exceedances of night-time acoustic objectives within nearby units, with windows and doors closed. However, the exceedance is considered acceptable on the basis that noise levels are not increasing in magnitude, only frequency of occurrence, and there are no historical complaints from existing noise levels (residual risk is assessed as Low).

#### B10.6.2.c Northern Sands Project Area

- Noise emissions from pipeline construction and decommissioning will not significantly impact sensitive receptors.
- Noise emissions from booster pump stations may result in minor noise exceedances but it is expected that further mitigation (i.e. bunding or quieter plant selection) will result in compliance with the noise limits. A detailed assessment of noise emissions from the booster pumps will be required when pump selections, the number of stations required is confirmed, and potential locations for the stations is confirmed.
- Noise emissions from the tailwater pump may require minor mitigation or more detailed analysis, depending on the proposed location. It is recommended that an assessment of tailwater pump noise is undertaken when the exact location of the pump is known, and when the pump model has been selected. With appropriate noise mitigation the noise levels should be compliant (residual risk is assessed as Low).

#### B10.6.2.d Tingira Street Project Area

- Noise emissions from the Tingira Street DMPA will not significantly impact sensitive receptors.
- A Construction Noise and Vibration Management Plan should be developed. The management plan should include the standard mitigation measures nominated in **Section B10.5.1**.

**TABLE B10-10 RESIDUAL RISK ASSESSMENT**

PROJECT AREA	CONSTRUCTION ACTIVITY / NOISE SOURCE	INITIAL ASSESSMENT WITH STANDARD MITIGATION MEASURES			RESIDUAL ASSESSMENT WITH ADDITIONAL MITIGATION IN PLACE		
		CONSEQUENCE	LIKELIHOOD	RISK RATING	CONSEQUENCE	LIKELIHOOD	RISK RATING
<b>Construction</b>							
TSHD Dredging Noise (a)	TSHD dredging (Draft EIS) – daylight hours	Negligible	Almost Certain	Low	Negligible	Almost Certain	Low
TSHD Dredging Noise (b)	TSHD dredging (Draft EIS) – night-time hours	Moderate	Almost Certain	Medium	Negligible <sup>1</sup>	Almost Certain	Low
TSHD Dredging Vibration	TSHD dredging (Draft EIS)	Negligible	Almost Certain	Low	Negligible	Almost Certain	Low
Backhoe Dredging (a)	Backhoe dredging (Draft EIS) – daylight hours	Minor	Almost Certain	Medium	Negligible	Almost Certain	Low
Backhoe Dredging (b)	Backhoe dredging (Draft EIS) – night-time hours	High	Almost Certain	Extreme	Negligible <sup>1</sup>	Almost Certain	Low
TSHD Dredging	TSHD Pump out	Moderate	Likely	Medium	Minor	Possible	Low
Wharf Construction	IFO Construction	Minor	Likely	Low	Minor	Likely	Low
	Piling (noise)	Moderate	Likely	Medium	Minor <sup>2</sup>	Likely	Low
	Piling (vibration) – Draft EIS	Minor	Almost Certain	Medium	Minor	Possible	Low
Pipeline Commissioning and Decommissioning	Sandbar Cutting	Minor	Possible	Low	Minor	Possible	Low
	Pipe Fabrication	Negligible	Possible	Negligible	Negligible	Possible	Negligible
	Pipeline Construction and Decommissioning	Minor	Possible	Low	Minor	Possible	Low
Pipeline Operation	Booster Pump Stations	Moderate	Almost Certain	High	Minor	Possible	Low
Northern Sands DMPA	Tailwater Pumps	Minor	Almost Certain	Medium	Minor	Possible	Low
Tingira Street DMPA	Various	Negligible	Possible	Negligible	Negligible	Possible	Negligible

(Continued over)

PROJECT AREA	CONSTRUCTION ACTIVITY / NOISE SOURCE	INITIAL ASSESSMENT WITH STANDARD MITIGATION MEASURES			RESIDUAL ASSESSMENT WITH ADDITIONAL MITIGATION IN PLACE		
<b>Operation</b>							
Wharf Operation	Cruise Ships	Minor	Likely	Low	Minor	Likely	Low <sup>3</sup>

Note: 1 Negligible consequence if TSHD and backhoe dredging is limited to standard construction hours when in the vicinity of sensitive receptors.

2 Minor consequence if piling is limited to standard construction hours.

3 Low risk rating attributed to understanding of lack of historical noise complaints, and recommendation for imposing minimum acoustic construction requirements in the vicinity of the wharf for new buildings to minimise the chance of future noise complaints.



## B10.7 References

AEC Group. 2016. Cairns Shipping Development Project, Demand Study Update , Report 18279BNE Final Draft v02 for Ports North, November 2016.

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