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Marine environmental monitoring plan

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Amrun Port and River Facility Maintenance Dredging - Marine Environmental Monitoring Plan

RTA Weipa Pty Ltd

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Template 2.8.1

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1. Introduction

1.1 Background to marine monitoring plan

Amrun Port is part of the larger Amrun Project (formerly South of Embley) developed and operated by RTA Weipa Pty Ltd (RTAW). The Port is located in the Gulf of Carpentaria on the north-west coast of the Cape York Peninsula, approximately 40 km south of Weipa. Amrun port consists of a 3.3 ha berth pocket adjacent to the wharf and an 11.2 ha main shipping channel for vessels travelling to and from the berth. These facilities are located in the open coast region at the southern end of Albatross Bay, between Boyd Point and Pera Head.

Additional to Amrun Port, RTAW also operate two terminals in the Embley and Hey River estuary located to the north of Amrun and nearby to the township of Weipa. These two facilities are the Hey River Terminal and Humbug Terminal. These two facilities are the Hey River Terminal and Humbug Terminal. Dredging of these facilities will be occasion al and will generally involve small volumes. Measures in this plan should be applied where deemed necessary to monitor and minimise environmental risks.

Amrun Port only recently began operation (2018) to enable shipment of bauxite from RTAW's nearby mining operation. The first stage in the construction process was a capital dredging campaign from the 26 March to 9 April 2016 which removed 202,416 m_3 of marine sediments and deposited them at the new Amrun Port dredge material placement area (DMPA). Since the completion of capital dredging, maintenance dredging has been undertaken at the Port in 2018 and 2019; removing approximately 40,000 m_3 of sediment each year.

The environmental values surrounding Amrun Port have been extensively examined over a number of studies for previous project approval processes and monitoring plans. This includes several studies undertaken for the Port of Weipa; also located within Albatross Bay and operated by NQBP. Both RTAW and NQBP also undertake non-project related monitoring that provides an ongoing understanding of the long-term baseline environmental conditions. This monitoring currently focuses on turtles, dolphins, sediments, water quality, seagrass and invasive marine pests.

1.2 Purpose

This document supports the Amrun Port Long-term Maintenance Dredging Management Plan (2020-2030) (LMDMP) and provides details on the marine monitoring requirements established under that Plan.

The marine monitoring outlined in this document is aimed at ensuring that best practice environmental management is applied to the design and execution of maintenance dredging at the Amrun Port over the 10-year timeframe.

The specific aims of this monitoring plan are to:

- Assess the long-term baseline environmental health of the Port and nearby sensitive receptors and allow for corresponding management of operations.
- Detect any impacts from maintenance dredging, both immediately after dredging campaigns and over time.
- Respond to real time environmental conditions during maintenance dredging to prevent environmental harm during dredging campaigns.
- Collect data that will be used to drive continual improvement.

1.3 Scope

The scope of this monitoring plan consists of a two-tiered program:

1. Ambient monitoring – ongoing to assess long-term baseline environmental health
2. Adaptive monitoring – real time monitoring during each maintenance dredging campaign to prevent incidents of environmental harm.

Key parameters will be monitored across the tiers of the plan, with data from each tier being consistent and able to be integrated. This will ensure that the aims of the plan can be met holistically. Key parameters for monitoring are listed in **Table 1**. The suitability of each parameter for monitoring is discussed in **Section 4**.

Table 1: Key parameters to be monitored

Parameter	Ambient	Adaptive
Marine water quality		✓
Sediment quality	✓	
Invasive marine pests	✓	
Marine megafauna	✓	✓

1.4 Relationship to other documents

This monitoring plan has key links to the *Amrun Port Long-term Maintenance Dredging Management Plan (2021 – 2031)*. The LMDMP sets out the process by which the results of the monitoring will be reviewed, analysed and reported. This monitoring plan has been developed in line with the findings of the *Amrun Port Maintenance Dredging – Environmental Risk Assessment* (ELA, 2020) to ensure monitoring is focused on the key environmental values.

1.5 Continuous improvement

This marine monitoring plan provides the mechanism for driving continuous improvement using the data gained from each of the discrete monitoring programs for each parameter. As such the plan will be periodically reviewed to update (maintain, increase or decrease) monitoring effort and focus, based on the new and historical findings from the monitoring data.

1.6 Plan review

This marine monitoring plan will be reviewed and updated after each maintenance dredging campaign, as required.

2. Environmental setting

The area adjacent to Amrun Port has been highly modified in recent years. Prior to 2016 the area was predominantly a 'greenfield' site, with only exploration related activity having taken place, after which development of the Amrun Project began. This included the construction of Port facilities (a jetty, wharf, stockpile and ship loaders) and the creation of a berth pocket and departure channel via capital dredging. New wharf facilities were constructed at the Hey River Terminal to support the mine along with an upgrade of facilities at Humbug Terminal. The Amrun Project also includes the development of the new bauxite mine and related infrastructure including:

- roads
- processing facilities
- barge, ferry and tug facilities
- a freshwater dam
- temporary construction facilities and accommodation
- an infrastructure corridor (power lines, water supply and access track).

Full details of the Amrun Project development is available in RTA (2011) .

The greater Weipa region supports agricultural (cattle grazing), fishing, shipping, industrial, commercial, recreational and tourism uses. Weipa has also undergone significant urban development, supporting approximately 4,000 residents, including indigenous people; some of which are Traditional Owners of the land.

The region also supports areas of international, national and state environmental significance with the Gulf of Carpentaria providing important habitat to a variety of terrestrial and marine species.

The environmental values of the Port and surrounds are summarised in the Environmental Risk Assessment (ELA, 2020) and are further described in detail in GHD (2019). Key environmental values of the marine environment in the region of the Port include:

- A patchy reef system dominated by hard coral species adapted to environments of higher turbidity and temperature.
- Coastal seagrass meadows, which are limited and seasonally variable.
- The most extensive mangrove system in the Gulf of Carpentaria which provides important feeding habitat and fish nursery habitat.
- Locally important populations of a number of threatened and migratory marine species, including marine turtles, dugong, saltwater crocodile, cetaceans and sawfish.
- Internationally important migratory shorebird roosting and feeding sites.

3. Previous monitoring

3.1 Sediment characteristics and quality

Sediment sampling has occurred across the Amrun Port as part of the current Sea Dumping Permit (SDP) and to support the application for capital and maintenance dredging under relevant environmental legislation for the Amrun Project. Sediments at Amrun Port are predominately comprised of silt and clay, with lower levels of sand and gravel (RTA 2017).

Sediment quality has also been assessed at the Amrun Port to ensure suitability for ocean placement under the approach outlined in the National Assessment Guidelines for Dredging (NAGD, DEWHA 2009). These previous assessments have shown that the sediment in the Port has been suitable for ocean placement. The 2017 survey found no concentrations of contaminants (including TBT, metals, hydrocarbons, BTEXN and PAHs) to be above screening level and therefore the sediment has been deemed to be currently suitable for ocean placement (RTA 2017). Full details are provided in **Appendix A**.

3.2 Water quality

Water quality monitoring has previously been undertaken at Amrun Port to support applications for capital and maintenance dredging and comply with existing monitoring requirements. In 2018 NQBP established the Port of Weipa Ambient Marine Water Quality Monitoring Program to identify potential impacts of operations at Amrun Port and the Port of Weipa on water quality, and to characterise the natural variability in key water quality parameters within the adjacent sensitive habitats.

The first survey was conducted in 2018 at one monitoring site (WQ3), located approximately 3 km to the south south-west of Amrun Port (Waltham *et al.* 2018). The site was chosen to spatially align with the location of key sensitive receptor habitats (predominantly coral reefs) and the predicted dredge plume (PCS 2019a & 2019b)

Overall, the results of the study show that:

- The water column is well mixed, with the exception of a turbid bottom layer caused by sediment resuspension, with water turbidity and suspended solids driven predominately by wave energy.
- Particulate nitrogen (PN), particulate phosphorus (PP) and chlorophyll-α concentrations levels were elevated above the relevant guidelines (ANZG 2018) - this is potentially a result of seasonal variations in rainfall.
- Herbicides and pesticides were detected in very low concentrations.
- A total of 45 phytoplankton species and 18 zooplankton species were recorded, and community composition is thought to be seasonally influenced.
- Rainfall can also influence water quality within the Port as a result of catchment flow into the rivers and estuaries in the Weipa region.
- There is a strong correlation between suspended sediment concentration (SSC) and the wave conditions in Albatross Bay.
- Photosynthetically active radiation (PAR) was variable at the monitoring site and was primarily driven by tidal cycles.
- Cyclones can cause significant increase in SSC and turbidity (Waltham *et al.* 2018).

3.3 Coral

Coral monitoring was undertaken by RTAW as part of the initial capital dredging program to determine any potential impacts to coral communities around the Port. Coral cover, health (bleaching and mucous) and sediment deposition were monitored at six locations pre and post dredging (one and two months post capital dredging) in 2016 (Advisian 2016).

The results of this monitoring survey found:

- A variety of hard coral genera are present in the area, with the most common species being those typically found in environments of high turbidity and temperature (Porites and Favia).
- Coral cover is patchy with up to 6.3% of available substrate covered by hard coral.
- Some species were observed undergoing more flattened growth, with less branching, indicating an adaption to low light conditions.
- Coral bleaching (hard and soft coral) was observed at all survey sites and appeared to be a result of the sustained increase in sea temperatures between February and April of 2016.
- No difference in hard coral cover, coral health or sediment deposition was observed between pre and post dredging surveys (Advisian 2016).

3.4 Invasive Marine Pests

RTA has previously monitored invasive marine pasts (IMPs) prior to capital dredging in 2015 and since 2016 as part of an IMP monitoring program. The objective of this program is to prevent the establishment of IMPs in Amrun Port and to provide early detection of new incursions. IMP presence is monitored using settlement plates in four locations:

- 150 m north of the Amrun Port jetty
- 150 m south of the Amrun Port jetty
- in Boyd Bay northeast of Boyd Point
- northwest of Pera Head

Overall, the results of previous monitoring have found that (Biofouling Solutions 2016 & 2017):

- No IMPs were detected in the Port of Amrun during baseline surveys.
- In May 2017, the Asian Green Mussel (*Perna viridis*) an invasive marine pest declared under the Queensland *Biosecurity Act 2014*, was identified on a monitoring program settlement plate (150 m south of Amrun Port jetty).
- Further investigations and surveillance have been undertaken since the discovery of Asian Green Muscle to determine the extent of incursion, with no additional specimens identified.
- The origin of the IMP is unknown and was not considered to originate from project related vessels given the strict protocols in place to screen at risk vessels.
- Biosecurity Queensland continues to work with RTAW and NQBP on the monitoring program.

3.5 Marine megafauna

RTA has been monitoring inshore dolphin populations in the Amrun region since 2014 as part of the Inshore Dolphin Offset Strategy (RTA 2014). RTAW were required to develop and implement this strategy as part of the Amrun Project Commonwealth EPBC Approval (EPBC 2010/5642). Although this strategy is not explicitly a monitoring program, it effectively provides baseline monitoring information for inshore dolphin populations and other megafauna in the Amrun region. The strategy states that survey findings (from annual surveys conducted under the strategy) will be used to inform management plans for the operational phase of the Amrun Project, including maintenance dredging at Amrun Port (RTA 2014).

Over the four annual surveys, the key findings relevant to monitoring are (Blue Planet Marine 2019):

- A variety of dolphin species are recorded each year with the Australian Humpback dolphin (*Sousa sahulensis*), Inshore bottlenose dolphin (*Tursiops* spp.) and Australian snubfin dolphin (*Orcaella heinsohni*) commonly occurring.
- Other marine fauna frequently observed during the surveys include:
    - Saltwater crocodiles
    - Dugongs
    - Sharks

  - Rays
  - Sea snakes
  - Turtles
- The lowest numbers of dolphin species and other marine fauna occurred in 2016 which could be due to a number of factors including seasonal variations in environmental conditions.
- Data on environmental parameters including water temperature, salinity, turbidity and pH is also collected as part of the surveys and the potential impacts of these parameters on marine fauna can be investigated.

Marine megafauna has also been monitored as part of the adaptive monitoring for previous dredging activities at the Port to avoid direct impacts to megafauna from dredging activities (**Section 0**).

4. Monitoring framework

4.1 Framework

The monitoring detailed in this plan is an important component of the overarching Dredge Management Strategy as described in the LMDMP. RTAW will oversee the implementation of the monitoring plan, with each component being undertaken by appropriately qualified personnel.

Overall, the monitoring plan is made up of a combination of regular baseline monitoring (long-term monitoring) and individual dredging event related monitoring (real time adaptive monitoring). The environmental monitoring plan aims to:

- Assess the long-term baseline environmental health of the Port and nearby sensitive receptors and allow for corresponding management of operations.
- Respond to real time environmental conditions during maintenance dredging to prevent environmental harm during dredging campaigns.
- Collect data that will be used to drive continual improvement.

These aims will be met through the implementation of a two-tiered approach to monitoring**.** The two-tiers will include baseline and adaptive monitoring. Results from each tier of the monitoring program will be used to inform the relevant stages of the dredging management framework. Details of each tier of the program is provided in **Sections 5 – 6.**

It should be noted that other maintenance dredging monitoring programs (including that for the Port of Weipa) often include an impact monitoring phase. This phase is designed to detect any impacts from maintenance dredging, both immediately after dredging and subsequently over time as impacts can be delayed. However, given the small volumes of dredging at Amrun Port, coupled with the very low risk of environmental impacts, a dedicated impact monitoring program was not considered necessary at Amrun. Should the baseline or ambient monitoring reveal unexpected adverse results, this Plan will be updated to include an additional impact monitoring phase.

4.2 Parameters

The parameters listed in **Section 1.3** will be monitored as part of this monitoring plan. A rationale for each is provided below.

4.2.1 Water quality

Based on water quality monitoring results during the capital dredge campaign, short duration of the maintenance dredge campaign (likely less than 3 days) and the known variability in natural turbidity levels in the region, impacts to water quality are unlikely. Accordingly ambient monitoring is not deemed necessary, monitoring during dredging activities will be undertaken to confirm low levels of risk.

4.2.2 Invasive marine pests

Invasive marine pests (IMP) have the capacity to enter into ports in ballast water, internal seawater systems and on the hulls of vessels (ships and yachts) or other vectors such as flotsam and jetsam. The operation of the dredge vessel is a small contributing factor to the overall risk of IMPs given an IMP risk assessment forms part overall dredge vessel management prior to mobilising to Port. Monitoring will be undertaken as part of the baseline program.

4.2.3 Sediment quality

Monitoring of sediment characteristics at the Port will be undertaken to ensure dredged material is suitable for ocean placement as per the requirements of the NAGD. This guideline provides data currency for 5 years, and monitoring will therefore be undertaken as part of the baseline program.

4.2.4 Marine megafauna

Inshore dolphin populations will be monitored as part of the baseline monitoring program, as per the Inshore Dolphin Offset Strategy (RTA 2015; refer to this Strategy for full details). Marine megafauna will be monitored during the adaptive monitoring, whilst the dredge is operating. The primary aim of this monitoring is to prevent interactions between the vessel and key marine fauna such as cetaceans, dugongs, turtles, crocodiles and sawfish.

5. Ambient monitoring

The following section describes the ambient monitoring that will continue to be undertaken at Amrun Port. The aim of this monitoring is to provide a long-term baseline environmental health assessment of the Port and nearby sensitive receptors. The ambient monitoring focuses on water quality, sediment quality and invasive marine pests.

5.1 Sediment testing

In order to be placed at sea, dredged sediments must be considered suitable for ocean placement as per criteria established under the *Environment Protection (Sea Dumping) Act 1981*. At the time of writing this Plan, the criteria are set out in the *National Assessment Guidelines for Dredging* (NAGD, DEWHA 2009).

Monitoring of sediment characteristics at the Port (and when necessary at the River Facilities) will be undertaken to ensure dredged material is suitable for ocean disposal as per the requirements of the NAGD.

5.1.1 Parameters

The specific parameters to be tested are determined in accordance with the NAGD and can differ depending on the area of the Port under consideration and its history of testing and sediment contamination. In accordance with the NAGD, no contaminants of concern (COCs) are present in Amrun Port, but a number of contaminants of potential concern (COPCs) are identified. Based on the COPCs, the following sediment characteristics will be tested:

- metals (aluminium, antimony, arsenic, cadmium, copper, iron, lead, mercury, nickel and zinc)
- PAHs (Suite of 21 analytes)
- organotins (Monobutyltin, Dibutyltin, Tributyltin)
- total organic carbon (TOC) and moisture content
- particle size descriptions (PSD)
- total petroleum hydrocarbons (TPH) total recoverable hydrocarbons (TRH)
- benzene, toluene, ethylbenzene, xylene (BTEX).

5.1.2 Protocol

Sampling will be undertaken in accordance with the requirements of the NAGD and as per an approved Sampling and Analysis Plan (SAP). Key steps in the sampling and analysis of sediments include:

- Sediment samples are collected with a Van-veen grab (0.05 m_3) deployed from the sampling vessel.
- Appropriate QA/QC protocols will be employed including taking blank and replicate samples.
- Sample will be logged on the sampling vessel before being homogenized and stored for transport as per the NAGD.
- Analysis will be undertaken at a NATA accredited laboratory.
- Sediment sampling results will be compared with criteria in the NAGD to determine suitability for ocean disposal.

If required, elutriate and bioavailability testing and toxicity and bioaccumulation testing will be carried out. However, the need for these levels of testing is considered unlikely based on historical results.

5.1.3 Timing and frequency

Sediment sampling will be undertaken the Port to ensure that data is current to within 5 years. Sediment testing at the river facilities will be undertaken in advanced of any planned dredging.

5.1.4 Sites

Based on previous sampling, the site is not expected to differ significantly between the channel and berth pocket; therefore, the Amrun Port area is treated as one site. The minimum number of sampling locations required in the NAGD for the 2017 surveys was 17. An additional four locations at the DMPA were also sampled. The location of future sampling sites will be determined prior to each sampling occasion in accordance with the NAGD and an approved SAP. The river facilities will be treated separately and sampled on a needs basis depending on sedimentation rates.

5.2 Invasive marine pests

Invasive marine pests (IMP) have the capacity to enter into ports in ballast water, internal seawater systems and on the hulls of vessels (ships and yachts). Monitoring of IMPs will be conducted to prevent the establishment of IMPs in Amrun Port and to provide early detection of new incursions.

5.2.1 Parameters

The IMP monitoring program targets the following seven species:

- American slipper limpet (*Crepidula fornicate*)
- Asian green mussel (*Perna viridis*)
- Black-striped mussel (*Mytilopsis sallei*)
- Green macroalga (Codium fragile spp. Fragile)
- Ivory Barnacle (Amphibalanus eburneus)
- Pacific oyster (*Crassostrea gigas*)
- Tubeworm (Hydroides dianthus).

The species of most concern are the Asian Green Mussel and Black-striped mussel.

5.2.2 Protocol

An IMP monitoring program for Amrun Port was established by RTA in 2016 in accordance with the management plans approved under the Amrun Project EPBC Act Approval (EPBC2010/5642). Key steps of the IMP monitoring program are as follows (RTA 2018):

- Two stainless steel open frame cubes (containing four 250 x 250 mm settlement plates) are moored via and anchor and chain attached to a surface buoy at two depths (two and five metres)
- The chain runs through the centre of the cube and is held in place by centre rings at the top and bottom of each cube to prevent dislodgement of the plates
- Each cube also has two 10 cm long splat ropes attached
- For analysis, the cubes are removed from the water and photographed while still attached to the chain
- The plates and splat ropes are then disconnected and individually photographed
- Suspected marine pests are removed, photographed and sent for identification
- Plates and splat ropes are replaced after each assessment and returned to mooring sites.

5.2.3 Timing and frequency

Settlement plates will be checked quarterly.

5.2.4 Sites

Settlement plate locations are selected on a risk-based approach, with deployment at sites of the highest risk (i.e. locations likely to experience primary infestation). Settlement plates are currently deployed at the following four locations:

- 150m north of the Amrun Port jetty
- 150m south of the Amrun Port jetty

- In Boyd Bay northeast of Boyd Point
- Northwest of Pera Head.

The existing Amrun Port settlement plate arrangement will be reviewed with Biosecurity Queensland to assess placement on the Amrun Port export facility itself. IMS monitoring relevant to the River Facilities is undertaken by NQBP as part of the Port of Weipa.

6. Adaptive monitoring and management

The following section describes the adaptive monitoring that will be undertaken at Amrun Port. This monitoring will be implemented for each maintenance dredging campaign. The monitoring is focused on real time collection and analysis of data to detect impending environmental harm and undertake corrective action where necessary. This is a key step in impact avoidance and management.

Monitoring of dredge plume behaviour, weather conditions and megafauna will be undertaken, as detailed in the monitoring protocol tables below. The nature of the response will be scaled according to the monitoring results. Adaptive management actions are provided in the adaptive management tables below.

6.1 Monitoring and management actions

6.1.1 Dredge plume monitoring

Dredge plume monitoring will be undertaken during large dredging campaigns (i.e. 60,000 m_3). Daily visual analysis of images (from MODIS) will be used to compare actual plume location with predicted plume location (from the hydrodynamic model). Should the actual plume location deviate substantially from that predicted by the hydrodynamic model, the need for impact monitoring (post-dredging at any sensitive receptors) will be evaluated.

For smaller volumes (e.g. 40,000 m_3) including when dredging occurs at the river facilities, the plume is not expected to cause any environmental impacts and will dissipate quickly.

6.1.2 Weather condition monitoring

Adaptive monitoring of weather conditions during dredging campaigns will be undertaken according to the protocol provided in **Table 2**.

Table 2: Adaptive weather conditions monitoring protocol

Protocol	Details
Parameters	Tides Wind strength and direction Weather warnings
Method	Forecast reports from Bureau of Meteorology (BoM)
Timing and frequency	12-hourly weather checks If warnings have been issued, review as each new update issued by BoM
Sites	Port of Amrun (Weipa Aero BoM weather station)
Data analysis	Data to be reviewed by captain of the TSHD Brisbane (or other dredge vessel/s) to inform dredge operations

6.1.3 Megafauna monitoring

Adaptive monitoring of marine megafauna during dredging campaigns will be undertaken according to the protocol provided in **Table 3**.

Table 3: Adaptive marine megafauna monitoring protocol

Protocol	Details
Parameters	Presence of marine megafauna in monitoring zone: • Megafauna includes whales, cetacean, dugong and turtles • Monitoring zone is within 300 m of dredging activity
Method	Observations using binoculars from bridge of dredger by crew
Timing and frequency	Throughout dredging campaign Observations to commence prior to any activities commencing and will continue until all activities cease
Sites	Where dredge is operating
Data analysis	Record observations in Masters' log and manage according to procedure outlined in the LMDMP

7. Data analysis and reporting

7.1 Adaptive monitoring

Data analysis for the dredge plume monitoring will occur daily for large dredging volumes, with an overview of imagery collated at the cessation of dredging. Daily reports on weather conditions and marine megafauna monitoring will be recorded by the dredge contractor.

A summary report will be completed within six months of the completion of each dredge campaign, detailing adaptive monitoring results, permit condition compliance and dredging execution parameters (volumes, post dredge bathymetry, operational timing and shut downs). This report will be provided to regulators and BPDTAG members.

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Appendix A Sediment sampling results summary

Location	Particle size	Organotins	Metals	TPH &TRH	BTEX	PAHs
Port (berth pocket and channel	Silt (58%), clay (28%), sand (13%) and gravel (1%)	Below reporting limit of screening levels	Nickel elevated – determined to be below screening level following elutriate and dilute acid extraction (DAE). All other metals below screening levels	Below screening levels	Below screening levels	Below screening levels
DMPA	Sand (41%), clay (27%), silt (25%) and gravel (6%)	Below reporting limit of screening levels	Nickel elevated – determined to be below screening level following elutriate and dilute acid extraction (DAE). All other metals below screening levels	Below screening levels	Below screening levels	Below screening levels

Source: RTA 2017

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