Gladstone Ports Corporation

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Port of Bundaberg Maintenance Dredging Environmental Monitoring

Brief description

The monitoring and management during dredging activities at the Port of Bundaberg is essential to ensure that potential environmental impacts of this activity are controlled through the identification of sensitive environmental receptors, understanding environmental risks and employing measures and safeguards to mitigate potential issues.

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Document Accountability	
Role	**Position**
Owner	Manager Port of Bundaberg
Custodian	Acting Manager Port Operations & Performance/Environment Superintendent

If you require any further information, please contact the Custodian.

The current version of this Procedure is available on GPC's Intranet.

Contents

Terms and definitions

Term	Definition
Owner	Under the GPC governance structure, the Owner is accountable for approval and has the authorised discretion to implement or significantly change the system
Custodian	Under the GPC governance structure, the Custodian is accountable for monitoring the application of the system and advising the owner of the monitoring outcomes, and is also accountable for proposing system design or redesign and facilitation of conformance
Environmental Harm/Nuisance	Unreasonable interference or likely interference with an environmental value caused by: • Noise, dust, odour or light; • An unhealthy, offensive or unsightly condition because of contamination; or another way prescribed by Regulation.
Monitoring	• Observe and check the progress or quality of (something) over a period of time; keep under systematic review • Maintain regular surveillance over listen to and report on
Sensitive Receptor	A fixed location of significance with the potential for impact.
Water Quality	A quantitative measure of the physical, chemical and biological characteristics of water, relative to the requirements of a stated environmental value.
Exceedance	When a contaminant has been released to the receiving environment at a level beyond what is allowed or stipulated by a set limit.

Acronyms

Acronym	Spelling
DES	Department of Environment and Science
EA	Environmental Authority
EC	Electrical conductivity
ECS	Environmental Compliance Specialist
EM	Environmental monitoring
EMP	Environmental management plan
EMS	Environmental Monitoring Specialist
EMS	Environmental Management System
EVs	Environmental values
EWMA	Exponentially Weighted Moving Average
GPC	Gladstone Ports Corporation Limited
GW	Groundwater

Acronym	Spelling
LTMMP	Long Term Management and Monitoring Plan for Maintenance Dredging and Disposal
MP	Monitoring procedure
MRA	Material reclamation area
NADG	National Assessment Guidelines for Dredging
PoB	Port of Bundaberg
PSD	Particle size distribution
NATA	National Association of Testing Authorities
SAP	Sediment analysis plan
SWL	Standing water level
TSS	Total suspended solids
WQ	Water quality

1 Introduction

1.1 Purpose

The Port of Bundaberg (PoB) Monitoring Procedure (MP) has been developed to:

- Describe the Gladstone Ports Corporation Limited (GPC) systems for monitoring and managing potential environmental risks and impacts associated to maintenance dredging (MD) activities at the PoB;
- Describe the measures and safeguards to be implemented around and during MD; and
- Address compliance requirements of the Sea Dumping Permit (#817969) and Environmental Authority (EA) EPPR00671913 (#1330286).

1.2 Scope

This MP covers all aspects of the environmental monitoring (EM) undertaken around the PoB annual MD for the period of 25 March 2021 to 3 April 2021 by GPC. This monitoring, herein referred to as ''activity based monitoring'' includes several aspects which are implemented at different locations and frequency (Section 2.3).

The present MP implements, supports and should be read in conjunction with:

- The Port of Bundaberg Environmental Management Plan (EMP) for Maintenance Dredging Activities (#971879) and;
- The Port of Bundaberg Long Term Management and Monitoring Plan for Maintenance Dredging and Disposal (LTMMP) (#964479).

The latter describes GPC long-term, from 2012 to 2022, environmental management measures and monitoring for MD and dredge spoil sea placement at the PoB. As this is the overarching framework around the PoB MD, this MP will also introduce and describe some of its aspects and associated long-term monitoring schedule. The activity based monitoring undertaken around MD is used to prevent and manage any direct environmental harm. Monitoring elements part of the long term schedule are

instead commitments made by GPC in order to assess any long term impacts of MD activities, dredging and disposal on the receiving environment and sensitive receptors.

1.3 Objectives

This MP aims to maintain compliance with relevant EA and commitments by implementing the required EM program for MD activities at the PoB. Adaptive management actions based on activity based monitoring results are in place to ensure no environmental harm occurs to the receiving environment and sensitive receptors from MD related plumes. The present document addresses:

- Environmental values and risks;
- Incorporation of a risk based framework in the monitoring programs;
- Monitoring of the effects of dredging activities and inform adaptive management. This can be subdivided into three (3) aspects:
    1. Ambient monitoring;
    2. Impact detection; and
    3. Real time adaptive management.
- Implementation of relevant components of the Long Term Monitoring Schedule;

This MP will be reviewed annually and/or prior to each MD campaign, including emergency MD. Moreover, the performance of this document will be measured through post dredging audit (EMP Section 3.11). Permit non compliances or other environmental incidents during MD operations will be used as a measurement of this procedure effectiveness and will also trigger review of its contents.

2 Port of Bundaberg Monitoring Procedure

2.1 Roles and responsibilities

GPC staff and contractors are responsible for the environmental performance of their activities and for complying with the general environmental duty as set out in Section 319 (1) of the *Environmental Protection Act 1994* which states:

'A person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to minimise the harm'.

Roles and responsibilities in relation to this monitoring procedure are outlined in Section 3.7 of the EMP.

2.2 Environmental monitoring framework

GPC's Risk Management Framework provides the processes to ensure the Environmental Management System (EMS) suitably identifies, analyses and evaluates, manages and monitors all aspects under the control or influence of GPC. The PoB MD risk assessment is documented in GPC's Aspects and Impacts Register (#764185). Monitoring based risk controls are documented and communicated in this MP and are derived from the LTMMP which sets the long term monitoring programs for and around MD activities.

To establish the activity based (Section 2.3) and long term monitoring program (Section 2.4), GPC applies a risk assessment framework and considers the following aspects and impacts:

- Identification of sensitive receptors and environmental values including water quality (WQ), flora and fauna, and Matters of State and National Environmental Significance;

- Predicted impacts of MD on identified sensitive receptors and environmental values;
- State-wide MD considerations to optimise operational efficiency and minimise environmental impacts;
- Ambient and observational information for environmental evaluation purposes; and
- Activity based environmental monitoring and adaptive management to prevent and mitigate predicted impacts.

An Environmental Monitoring Schedule (#314935) has been established to ensure the key elements of GPC's monitoring around MD are being identified and implemented. Monitoring outcomes informs GPC's adaptive management of MD and the continual improvement processes described in the LTMMP.

2.3 Activity based monitoring overview

At the PoB, MD is regulated through the EA EPPR00571913. The latter is divided into two (2) sections regulating dredging with sea disposal (Section 1) and land disposal (Section 2). The third Section of the EA regulates sand screening activities. The separate sections trigger different types of monitoring which are described in this document:

- Sea disposal: ambient WQ; and
- Land disposal: ambient water, tailwater and groundwater (GW) WQ.

All monitoring programs are designed to protect sensitive receptors around the PoB, with the closest being the conservation park at Barubbra Island (Figure 1). Moreover, the programs have been devised based upon verification sampling works undertaken by GPC in previous campaigns as well as numerous studies and modelling undertaken for the PoG MD which has generated significant knowledge around MD generated plumes, their extent and longevity.

Data generated from monitoring is analysed by GPC and adaptive management decisions and/or mitigation measures proactively taken in case of necessity. All monitoring related to the PoB MD is undertaken by suitably qualified personnel following relevant standards and guidelines such as the DES Monitoring and Sampling Manual 2018. Where applicable, samples are analysed by a National Association of Testing Authorities (NATA) accredited laboratory holding the accreditation for the analyses required. All instruments are calibrated and maintained as per the manufacturer recommendations.

2.3.1 Sea disposal monitoring: ambient WQ

At the PoB, an impact to WQ by means of increased turbidity is deemed as one of the biggest risks to the local receiving environment and sensitive receptors. Turbidity is in fact a measurement of water clarity and is influenced by suspended matter (organic and inorganic) and dissolved organic matter. Turbidity is an expression of the optical property of light to be scattered and absorbed with a greater amount of matter within the water column leading to a higher amount of light scattering and thus higher turbidity. Dredging activities have the capacity to increase turbidity levels potentially resulting in environmental harm. Therefore turbidity is an important parameter to measure during dredging operations.

Monitoring of ambient WQ during MD with sea disposal placement is undertaken starting at least two (2) weeks prior MD operations commencement, it will continue throughout dredging operations and it will conclude no earlier than two (2) weeks post dredging operations completion. The monitoring is conducted at Pylon #12 (-24.755083, 152.407367) by a multiparameter sonde collecting the full suite of physical-chemical parameters at 10 minutes intervals (Figure 1). The sonde is connected to a telemetry system allowing raw data to be consulted in real-time. Turbidity readings as an Exponentially Weighted Moving Average (EWMA) will be screened and assessed against trigger values (Section 2.3.3).

The EWMA is a smoothing technique developed by statistical experts that takes into consideration background levels so that readings increase and decrease gradually avoiding false readings and alarms (both on and off). Therefore when values exceed triggers or go below triggers they will not be expected to invert their trends suddenly. The 6 Hour EWMA is calculated by using a 60:40 weighting system, where the current EWMA (Zi) is computed by adding 60% of the mean turbidity readings during the preceding (just recorded) 6 hours (X i) to 40% of the preceding 6 hour EWMA value (Zi-1). Mathematically, 6-hourly values of the EWMA statistic are computed using the following equation:

$$Zi = 0.6\ Xi + 0.4Zi\text{-}1$$

Where i is the mean of the data for the ith period (in this case, the current 6-hour period).

In the event that the deployed sonde fails or data generated is questionable/unreliable, WQ data from the telemetered buoy deployed at the mouth of the Burnett River (-24.755452, 152.407077) will be utilised. As a further backup in case both telemetry systems are not operating correctly, daily monitoring for turbidity using a hand held calibrated instrument shall occur in proximity of Pylon #12 instead. In this scenario, the repair to the telemetry equipment will be undertaken as soon as practicable with minimum turnaround time. Turbidity as EWMA, only in the instance telemetry data from Pylon #12 is used, is screened against turbidity triggers developed for the PoB from long term data sets with adaptive management actions in place in case the triggers are reached (Section 2.3.3).

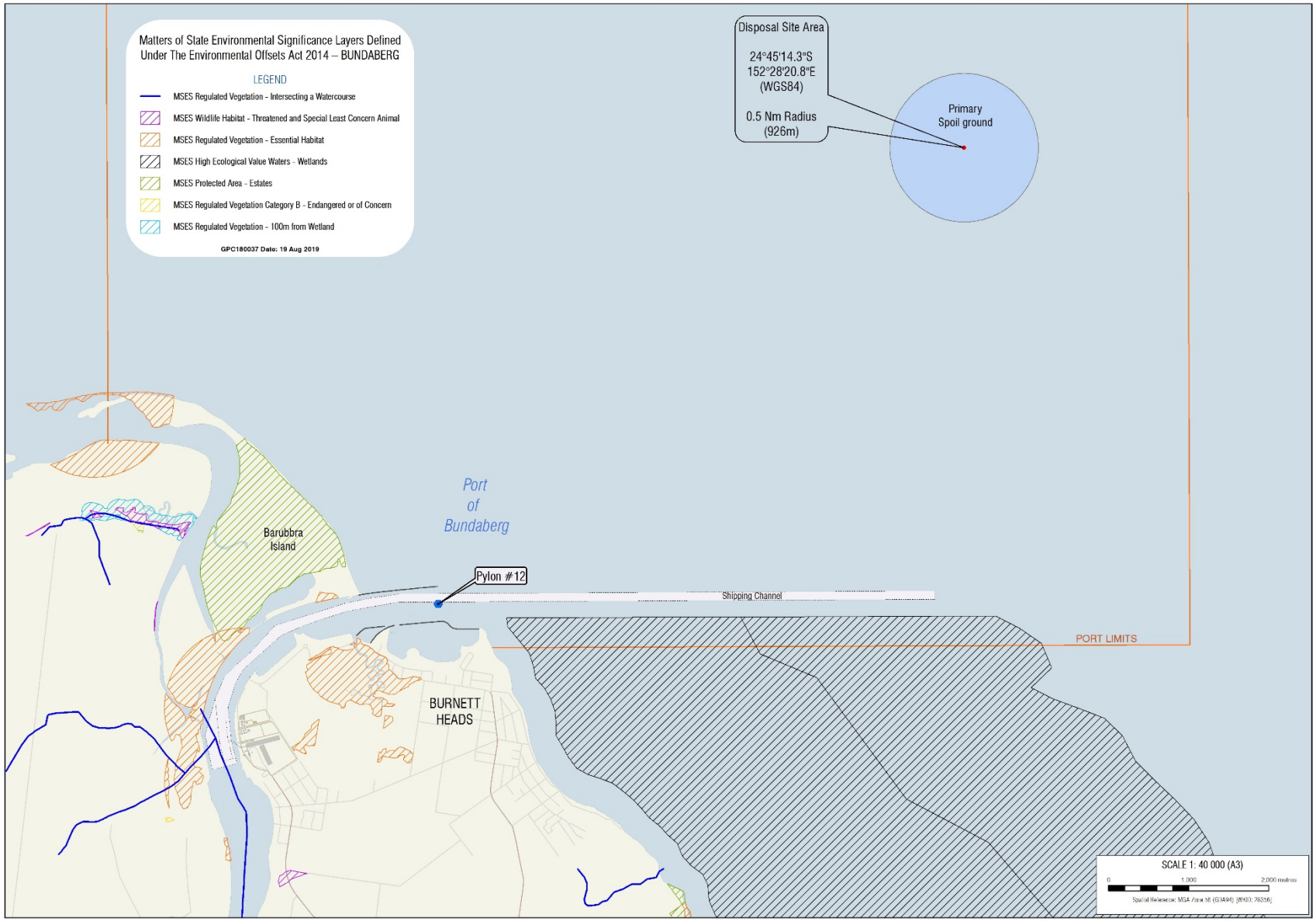

Figure 1: *Matters of State Environmental Significance around the PoB.*

2.3.2 Land disposal monitoring

Land disposal monitoring covers different components such as ambient (similarly to sea disposal monitoring), tailwater and GW WQ. As well as impact through dredging, this monitoring is also tailored to highlight any potential issue caused by placement of dredge material on land with related tailwater discharge.

GPC undertakes dredging with land disposal only when it is not practicable to undertake sea disposal. The latter is therefore the most utilised method of disposal of dredged sediments at the PoB. In the instance dredging with land disposal is undertaken, all spoils are placed within the approved material reclamation area (MRA) (Figure 2).

2.3.2.1 Ambient WQ

As per during MD with sea disposal, ambient WQ monitoring for MD with land disposal is undertaken starting at least two (2) weeks prior MD operations commencement, continuing throughout dredging operations and concluding no earlier than two (2) weeks post dredging operations completion.

As sampling locations are not fixed and not always suitable for telemetry systems such as the one described in Section 2.3.1, monitoring is undertaken daily with grab samples/ hand measurements (Table 1); observations such as tidal state are also recorded. Monitoring locations are based upon proposed dredging footprint, however they are approximately 100 m upstream and 200 m downstream of any proposed dredging work.

Turbidity data are screened against triggers developed for the PoB from long term data sets with adaptive management actions in place in case the triggers are reached (Section 2.3.3).

Table 1: *Ambient WQ monitoring regime to be implemented during dredge with land disposal at the PoB. Note: No limits are specified within the EA.*

Approximate monitoring locations	Parameters	Limits	Units	Frequency
100 m upstream	Turbidity	Triggers (Section 2.3.3)	NTU	Daily
200 m downstream	pH	-	-	
	Visibility (Secchi disc)	-	m	

2.3.2.2 Tailwater WQ

As mentioned in Section 2.3.2, when dredging with land disposal is undertaken all dredge spoil is pumped ashore to the MRA. The spoil, which is pumped with different amounts of water depending on the type of sediment being dredged, can enter the MRA via different points. As a consequence, a different flow path and discharge point is utilised to allow the longest flow path and thus settlement time possible ensuring sediments in suspension settle out before water is released into Wallace Creek via the approved discharge points. Here monitoring must be undertaken to assess WQ and prevent discharge of non-compliant water and thus the risk of causing any harm to receiving environment (Table 2).

Table 2: *Discharge and monitoring points at the PoB MRA to be implemented during dredge with land disposal tailwater discharge.*

Monitoring and discharge points	Parameters	Release limit	Units	Monitoring frequency
M2 when discharge point W1 is utilised	Total suspended solids (TSS)	100	mg/L	Weekly
M3 when discharge point W2 is utilised	Turbidity	No visible plume	NTU	Twice a week
	pH	6.5-9.0	-	

2.3.2.3 Groundwater WQ

In case of dredging with land disposal, GW monitoring results are used to identify any fluctuations in standing water level (SWL) and WQ that may occur due to the disposal to land of dredge spoil. The aim of this monitoring is to prevent any potential impact to GW and the estuarine wetlands, mainly dominated by mangroves, in the vicinity of the MRA.

For this purpose, five (5) GW bores are monitored for SWL, electrical conductivity (EC) and pH at two (2) month intervals irrespective of dredging occurrence (Table 3). After collection result are reviewed internally by GPC environmental monitoring specialist (EMS), processed and appropriately recorded within GPC systems. Results from monitoring undertaken when no dredging with land disposal is taking place are used as baseline.

Results from monitoring conducted during and one (1) month after dredging with land disposal operations are instead screened against baseline results to assess potential impact on the GW and local environment. If the results deviate more than 10% from the baseline data range, the Department of Environment and Science (DES) is notified as soon as practicable including advice on the potential cause of the change and corrective measures to be implemented to avoid impact to sensitive receptors. Moreover, all results from GW monitoring are collated into an annual report and submitted to DES.

Table 3: *Groundwater monitoring around the PoB MRA.*

Bore	Parameters monitored	Monitoring interval
P3	SWL (m) EC (µs/cm) pH	Bi-monthly
P19		
P20		
P21		
B3		

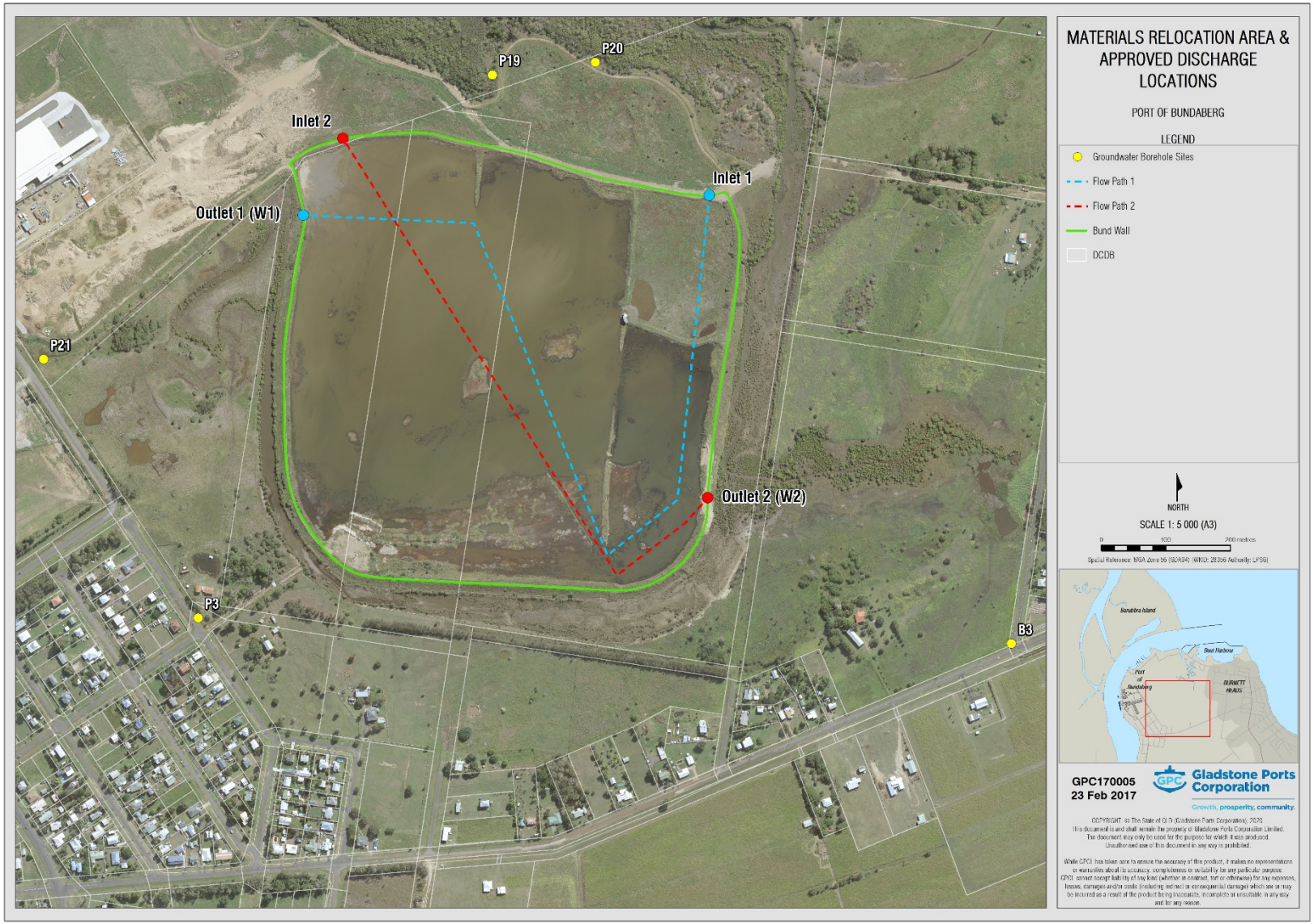

Figure 2: *The PoB MRA with marked approved discharge locations as well as flow paths and monitoring GW bores.*

2.3.3 Ambient WQ turbidity triggers

Water quality objectives (WQOs) are numeric measures to protect environmental values (EVs) such as aquatic ecosystems. No specific WQOs for the Burnett River have been developed, however the Queensland Water Quality Guidelines 2009 suggest a turbidity value of 8 NTU for mid-estuarine environments in the Central Coast Queensland Region, from the Burnett River Basin to the Black River.

This figure is not specific for the Burnett River and thus not representative of its environmental conditions. Moreover WQOs are usually developed using baseflow condition data and therefore may not reflect the natural variability of highly changeable environments such as estuaries where the PoB is located. Therefore for the purpose of this MP, specific turbidity triggers based long term continuous data collected from Pylon #12 were established.

As described in Section 2.3.1 and 2.3.2.1, turbidity values obtained from ambient WQ monitoring are screened against the abovementioned triggers which are percentiles of data ranges:

- 80th percentile (%tile): 13 NTU, internal alert when values exceed trigger > 36 hrs; and
- 95th %tile: 25 NTU, adaptive management actions when values exceed trigger > 24 hrs.

Note that only in the instance turbidity data are obtained through a multiparameter sonde and telemetry station, turbidity will be screened against triggers as EWMA.

2.3.4.1 Ambient WQ adaptive management

The triggers detailed in Section 2.3.3 will be utilised to manage WQ, in particular turbidity, during MD operations. An adaptive management turbidity trigger flowchart has been developed for this purpose (Figure 3) detailing steps that will be undertaken in case of turbidity levels exceeding the abovementioned triggers. The flowchart and actions are designed to and will prevent or reduce and manage any turbidity impacts to PoB sensitive receptors.

While turbidity values (in the instance grab sampling is undertaken) or turbidity EWMA (in in the instance real-time monitoring is undertaken) remain below the internal trigger (Alert Level 1) no investigation into the cause of turbidity changes (if any) is conducted.

The Alert Level 1 is in fact reached when turbidity EWMA values are above 80th %tile for a 36 hour (or two (2) consecutive days in case of grab sampling is being undertaken) period triggering Response 1. Here GPC EMS increases scrutiny on data and commence an internal investigation to determine the causes of the elevation.

If the GPC EMS deems the elevation in turbidity (as EWMA) to be predominantly due to dredging activities, GPC stakeholders such GPC environmental compliance specialist (ECS), PoB Manager, Daywork Supervisor and the dredging contractor are consulted. This consultation deliberates what management measures are to be implemented to rectify dredging related impacts on turbidity (Adaptive Management 1).

If, instead, the abovementioned investigation shows that likely causes of elevation of turbidity or turbidity EWMA are driven by environmental conditions no actions are taken, WQ monitoring continues and the status goes back to general monitoring.

Alert level 2 is reached when turbidity or turbidity EWMA values are above 95th %tile for a 24 hour (or one (1) day in case of grab sampling is being undertaken) triggering Response 2. As per Response 1 an investigation is undertaken by the EMS (or continued) and only if deemed the elevation in turbidity is predominantly due to dredging, Adaptive Management 2 is triggered where the abovementioned stakeholders will review and modify adaptive management actions on dredging operations. For any reporting detail consult the relevant section of the EMP.

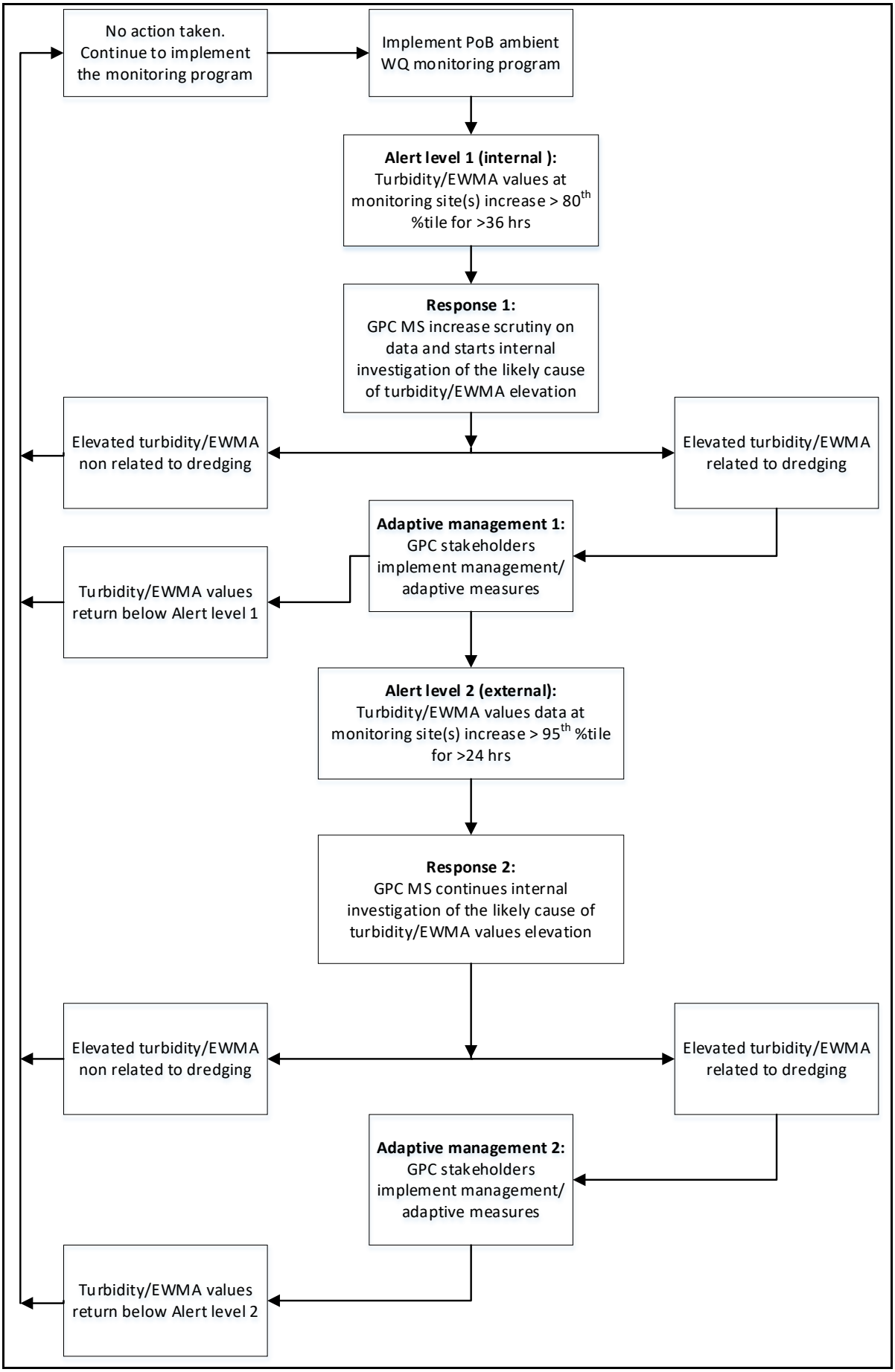

Figure 3: *PoB adaptive management flowchart for ambient WQ monitoring (turbidity).*

2.4 Long term monitoring program overview

As mentioned in Section 1.2 and 2.2, an LTMMP is in place for the PoB describing long-term management and monitoring arrangements for MD and sea disposal. GPC have committed to various monitoring activities which are embedded in this framework (Figure 4).

Figure 4: *PoB MD and sea disposal LTMMP (2012-2022) monitoring program from 2015 to 2020. X indicates the years when studies will take place.*

Monitoring study	2015	2016	2017	2018	2019	2020
Spoil ground benthic habitats study: benthic fauna, particle size distribution (PSD) and seagrass	x					x
Sediment analysis plan (SAP)					x	

2.4.1 Sediment analysis plan

As per National Assessment Guidelines for dredging (NADG) 2009, a SAP is undertaken every five (5) years to characterise sediment to be dredged during the upcoming dredging campaigns. This allows to identify contaminants of concerns present within the sediment and thus make appropriate decisions on dredge spoils disposal.

2.4.2 Spoil ground benthic habitats

This study aims to investigate potential long term impacts of sea dumping activities on benthic habitats. Specifically, benthic fauna and seagrass monitoring is undertaken as these have been identified in the approved LTMMP as the primary receptor habitats of sea dumping activities at the PoB spoil ground.

3 Procedure review

This procedure, its operation and implementation will be reviewed annually or as a result of findings of internal and external audits or a change in legislation in order to preserve currency, relevance and accuracy. Revisions, unless of very minor extent, are filed as new versions in GPC's document management system and communicated to all relevant internal stakeholders.

4 More information

This Procedure will be available to all GPC Representatives, Contractors and Consultants.

This document is uncontrolled when printed. The current version of this Procedure is located on Neptune.

If you require any further information, please contact the Custodian, listed under Document Accountability on the cover page.

5 Appendices

5.1 Appendix 1 – Related documents

Gladstone Ports Corporation documents

The following documents relate to this Procedure:

Type	Document number and title
Tier 1: Policy	#366016 Environment Policy
Tier 2: Standard/Strategy	#809151 Environmental Management Standard #829152 Risk Management Standard
Tier 3: Specification/ Procedure/Plan	#146256 Environmental Management System Manual #971879The Port of Bundaberg EMP for Maintenance Dredging Activities #964479The Port of Bundaberg LTMMP for Maintenance Dredging Activities

5.2 Appendix 2 – Revision history

Revision date	Revision description	Author	Endorsed by	Approved by
06/03/2019	Annual review	Freddie Pastorelli, Environment Specialist	Jason Pascoe, Port of Bundaberg Manager	
23/08/2019	Procedure review including alignment with conditions register and EMP. Minor Amendment to Groundwater section	Terese Tobin, Environment Specialist		
27/03/2020	Finalise for 2020 MD campaign	Freddie Pastorelli, Environment Monitoring Specialist		
16/06/2021	Document review. Streamlined document and aligned with PoG MP. Updated template	Freddie Pastorelli, Environment Monitoring Specialist		