Procedure

Port of Gladstone Marina Maintenance Dredging Environmental Monitoring

Endorsed: DES:
Endorsed GPC: OB 19 March 2020

Brief description

The monitoring and management of maintenance dredging activities at the Port of Gladstone Marina is essential to ensure that the potential environmental impacts of this activity are controlled by understanding environmental risks and employing measures and safeguards to prevent and mitigate environmental issues.

Document information

Current version	1
First released	04 December 2019
Last updated	19 March 2020
Effective by	01 April 2020
Review frequency	5 yearly
Review before	01 April 2025
Audience	Port Infrastructure Asset Team, Environment Team, GPC qualified auditors, external auditors, administering authorities, contractors

Document accountability

Role	Position
Owner	Port Infrastructure Asset Manager
Custodian	Port Infrastructure Asset Manager / Environment Superintendent

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Terms, Definitions and Abbreviations

The following key terms and definitions apply to this Procedure:

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
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.
ASS	Acid Sulphate Soils
DES	Department of Environment and Sciences
DO	Dissolved oxygen
EA	Environmental Authority
EM	Environmental monitoring
EMP	Environmental Management Plan
GPC	Gladstone Ports Corporation Limited
IL	Inverted level
MD	Maintenance dredging
MP	Monitoring procedure
NATA	National Association of Testing Authorities
NTU	Nephelometric Turbidity Units
QASSTM	Queensland Acid Sulfate Soil Technical Manual
PoG	Port of Gladstone
SAP	Sediment Analysis Plan
RGT	RG Tanna
TSS	Total suspended solids
WQ	Water quality

Figures

Figure 1: The Gladstone Marina.

Figure 2: Gladstone Marina MD footprint, RGT reclamation (red dashed line) area and tailwater flow path (blue arrows).

Figure 3: Adaptive management flowchart to be implemented during Gladstone Marina tailwater discharge.

Tables

Table 1: Approved tailwater discharge locations for the RGT dredge cell to be utilised for the Gladstone Marina MD.

Table 2: Compliance WQ monitoring parameters and related limits for tailwater discharge at the RGT reclamation area.

1 Introduction

1.1 Procedure purpose

This Monitoring Procedure (MP) has been developed to:

- Describe the Gladstone Ports Corporation Limited (GPC) and contractors performing the works systems for monitoring and managing potential environmental risks and impacts associated with maintenance dredging (MD) activities of the Port of Gladstone (PoG) Marina (Figure 1) herein referred to as ''Gladstone Marina";
- Describe the measures and safeguards to be implemented during MD at the Gladstone Marina; and
- Address compliance requirements.

1.2 Procedure scope

The present MP covers all aspects of the environmental monitoring (EM) undertaken during the Gladstone Marina MD for the period of April 2020 to August 2020 by GPC and engaged contractors.

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

- The Gladstone Marina MD Environmental Management Plan (EMP) (#1139693);
- The PoG Long Term Maintenance Dredging Management Plan (LMDMP) (#1385321); and
- The dredging contractor EMP.

As part of this MP and associated EMP, all reasonable and practicable measures will be taken to minimise the likelihood of environmental harm being caused.

1.3 Procedure objectives

This MP aims to maintain compliance with the relevant permits and approvals detailed in the EMP by implementing the required and appropriate EM program. Adaptive management actions based on monitoring results are in place to ensure no environmental harm occurs to the receiving environment and/or sensitive receptors.

This procedure addresses:

- Environmental values and risks; and
- Incorporation of a risk based framework in the monitoring programs.

The performance of this MP will be measured through auditing (EMP Section 4.11). 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.

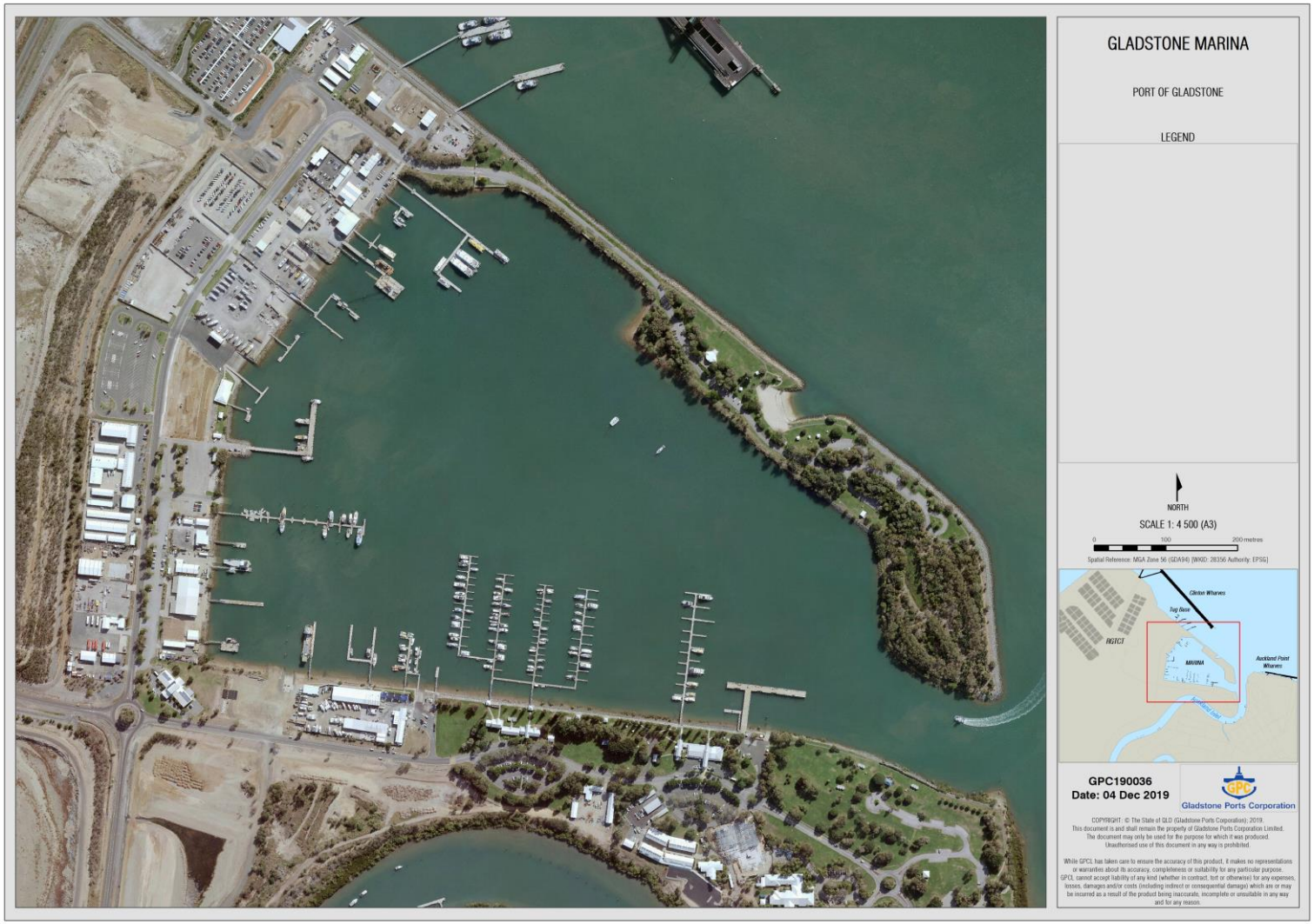

Figure 1: The Gladstone Marina.

2 Procedure

1.4 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 detailed in Section 4.6 of the EMP. Persons undertaking monitoring or sampling as outlined by this procedure must be suitably qualified.

1.5 Environmental Monitoring Framework

GPC's Risk Management Framework details the processes to follow to ensure the Environmental Management System (EMS) suitably manages all aspects under the control or influence of GPC. Maintenance dredging of the Gladstone Marina is a component of the port wide (navigable channels and swing basins) PoG MD and therefore is under the same Environmental Authority (EA) (EPPR00570813) and LMDMP framework.

Thus, the Gladstone Marina as well as the PoG MD risk assessment is documented in GPC's Aspects and Impacts Register (#764185). Monitoring based risk controls and actions are documented and detailed in this MP and are derived from the LMDMP which set the long term monitoring programs for MD activities. These programs cover a wide range of monitoring with related hypotheses such as dredging plumes, seagrass and reef and are undertaken at set intervals ensuring MD at the PoG does not have any long term impacts on receiving environment and sensitive receptors. The implementation and effectiveness of the MP is monitored through processes such as risk reviews, audits, inspections, incident and complaint investigations and reporting.

Monitoring outputs inform GPC's adaptive management of MD and the continual improvement processes described in the LMDMP. To define and establish adequate monitoring of MD activities, GPC applies a risk assessment framework and considers the following aspects and impacts:

- Identification of sensitive receptors and environmental values through hydrodynamic modelling and impact assessment (LMDMP Section 3). These include water quality (WQ), flora and fauna, and Matters of State and National Environmental Significance;
- Predicted impacts, through the abovementioned modelling and impact assessment, of maintenance dredging on identified sensitive receptors and environmental values; and
- State-wide maintenance dredging considerations to optimise operational efficiency and minimise environmental impacts;

1.6 Monitoring Rationale

The Gladstone Marina MD dredging is undertaken separately to the annual port-wide MD due to the size and bathymetry of the dredging footprint. Dredging is in fact undertaken by a small cutter suction dredge, which is able to access and manoeuvre in the constrained space and shallow depths of the Gladstone Marina, with dredged sediments pumped into the RG Tanna (RGT) reclamation area. In fact, due to practicalities and constraints related to using a small dredger, the land disposal solution is the only viable and practicable one.

As a result of the small nature of the operation and of the processes highlighted in Section 1.5, the EM associated to the Gladstone Marina MD is solely composed by tailwater discharge monitoring. This is

anticipated to start approximately (1) week post dredging activities commencement and to cease approximately six (6) weeks post dredging operations completion.

The most recent Sediment Analysis Plan (SAP) (#1427539), undertaken in 2017, showed that sediment in the dredging footprint of the Gladstone Marina are suitable for unconfined sea disposal as well as land placement. Moreover the sediments were also sampled and analysed for Acid Sulphate Soils (ASS) and screened against the Queensland Acid Sulfate Soil Technical Manual (QASSTM) with no samples exceeding the action criteria.

All sampling will be undertaken in accordance with relevant guidelines and standards such as the Department of Environment and Science (DES) Monitoring and Sampling Manual 2018.

1.7 Tailwater Discharge

Dredged material will be beneficially reused within the RGT reclamation area which is fit for purpose to receive dredge spoils and it is one of the reclamation areas that can be used for this intent and listed within the abovementioned EA. The resulting tailwaters will be discharged into Port Curtis via Ken's Drain (Figure 2) through the two (2) approved discharge locations (Table 1).

Dredge spoils will be pumped into cell 1 with resulting tailwaters flowing through cell 2 and 3 to cell 4, giving the associated sediment load the longest decant time possible. Tailwaters will be discharged into Ken's Drain via discharge point 1 in cell 4. At the end of dredging operations, in order to fully drain the reclamation area discharge point 2 might be used as positioned at a lower inverted level (IL). Both discharging locations will be fitted with telemetry to ensure release waters are compliant with EA conditions. Tailwater discharge and associated monitoring (Section 1.8) will be managed by the dredging contractor. The latter will

Table 1: Approved tailwater discharge locations for the RGT dredge cell to be utilised for the Gladstone Marina MD.

Discharge location no.	DMS coordinates	DD coordinates	Description
1	23°49'58.2"S 151°14'06.0"E	-23.832833, 151.235000	Cell 4 discharge point into Ken's Drain through two (2) steel pipes. A weir box is installed at the discharge point weir box
2	23°49'54.6"S 151°14'04.2"E	-23.831833, 151.234500	Cell 3 discharge point into Ken's Drain through reinforced PVC pipe. The IL of the discharge point is lower than discharge point 1 allowing full drainage of the reclamation area

1.8 Tailwater Discharge Monitoring

Tailwater WQ will have to meet a range of specifications (Table 2) in order to be released from the abovementioned discharge locations into the receiving environment. At the tailwater compliance discharge location(s) a water quality (WQ) telemetry (real-time) station equipped with dual multiparameter sonde will be installed, commissioned and maintained to collect readings at 15 minutes intervals. The full suite of physico-chemical parameters will be collected as well as grab samples to be analysed for various nutrients and metals (Table 2). Note that whilst the full suite of physico-chemical parameters will be collected, turbidity, pH and dissolved oxygen (DO) readings will be screened against compliance purposes. The remaining parameters will be utilised in the data analysis. Note that no specific limit is associated to turbidity, however it will be closely

monitored to infer total suspended solids (TSS) levels and avoid release of non-compliant tailwater. The dredging contractor will have a validation process in place that will be applied to all telemetry data.

Whilst this aspect of the monitoring will be undertaken by the dredging contractor, GPC will be kept up to date with the data and analyses results through weekly reports. The dredging contractor will notify GPC immediately of any elevation, exceedances or issues so that GPC can meet notifications times imposed by the EA (24 hrs) (See EMP Section 4.13). In case of exceedance the contractor will also follow up with a full investigation report including data, plots and analysis of the likely exceedance causes and adaptive measures put in place. The investigation report will be submitted to GPC for review within five (5) business days.

GPC will also provide support, whenever required and appropriate, to the dredging contractor so that every precaution is taken to manage and discharge tailwater appropriately avoiding any potential environmental harm. The dredging contractor will provide GPC a weekly report with summary tables and plots of any exceedance, elevation, lab results or incident. Moreover at the end of dredging, the dredging contractor will provide all telemetry data, lab results, incident statistics, metadata and any other relevant information to GPC in electronic format (Excel) and GPC approved format to allow GPC to meet its compliance obligation as stated in the EA of a comprehensive compliance report.

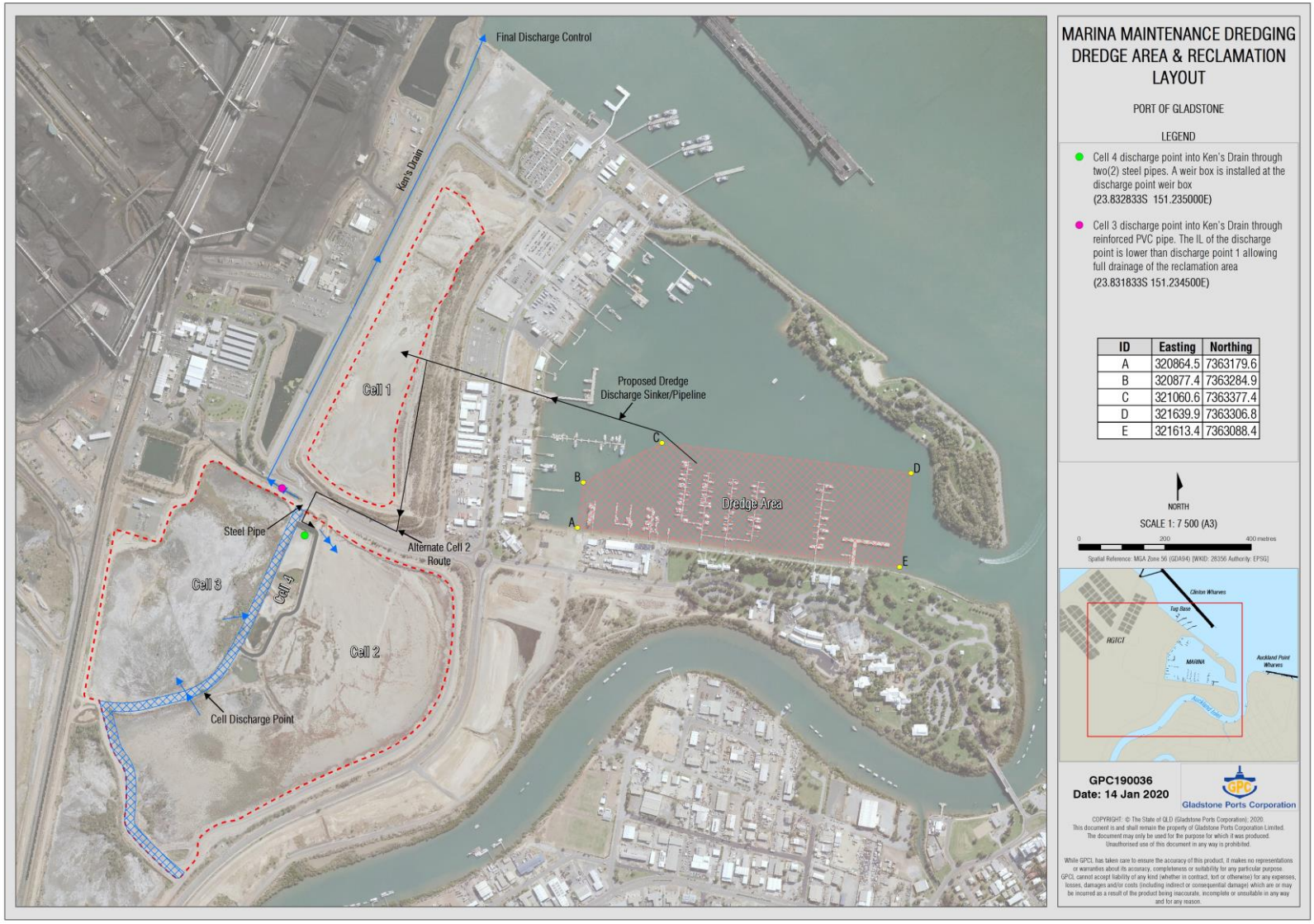

Figure 2: Gladstone Marina MD footprint, RGT reclamation (red dashed line) area and tailwater flow path (blue arrows).

Table 2: Compliance WQ monitoring parameters and related limits for tailwater discharge at the RGT reclamation area.

Parameter	Minimum	Maximum	Monitoring Frequency
TSS	-	100 mg/L (Senescent)	Weekly
	-	60 mg/L (Growing)	Weekly
Turbidity	-	-	Continuously
DO	2.0 mg/L	-	Continuously
pH	6.5	9.0	Continuously
Ammonia	-	1 mg/L	Weekly
Aluminium	-	165 mg/L[3]	-
Cadmium (Filtered)	-	2.1 mg/L[3]	Weekly[2]
Chromium (Filtered)	-	13.2 mg/L[3]	Weekly[2]
Copper (Filtered)	-	3.9 mg/L[3]	Weekly[2]
Lead (Filtered)	-	13.2 mg/L[3]	Weekly[2]
Mercury (Filtered)	-	0.3 mg/L[3]	Weekly[2]
Nickel (Filtered)	-	21.0 mg/L[3]	Weekly[2]
Silver (Filtered)	-	4.2 mg/L[3]	Weekly[2]
Zinc (Filtered)	-	45 mg/L[3]	Weekly[2]
Tributylin (TBT)	-	-	Weekly[2]

Table notes:
''Senescent'' season is from 1 January to 30 June inclusive, the rest of the year ''Growing'' season.
[2] Whenever pH levels are outside the range reported in Table 2, monitoring of the above metals must be carried out daily.
[3] These limits are trigger values only and only when three consecutive results exceeds the limits all results must be reported to the administering authority and immediately cease discharging.

A relationship between TSS and turbidity exists; this is highly changeable depending on a several factors such as salinity, dry and wet weather conditions as well as between sites. This relationship can be used to infer TSS levels from turbidity readings. Thus, as well as the abovementioned monitoring which is embedded in the EA, in the initial two weeks of tailwater discharge three (3) grab samples will be collected by the dredging contractor daily and analysed for Turbidity (NTU (Nephelometric Turbidity Units)) and TSS. This will allow to develop a calibration dataset to establish an *ad-hoc* TSS-NTU relationship thus inferring TSS levels from NTU readings collected via telemetry. In this way the likelihood of exceeding TSS limits and potentially causing environmental harm would be greatly reduced as grab samples for TSS and other contaminants will be undertaken once a week as per EA with results not available for several days due to laboratory turnaround times. The weekly samples will be used to validate the established TSS-NTU relationship.

All monitoring will be undertaken by suitably qualified personnel and following relevant and appropriate guidelines. Samples will be analysed by a National Association of Testing Authorities (NATA) accredited laboratory holding the accreditation for the analyses required.

1.8.1.1 Adaptive Management

Adaptive management steps have been developed to ensure appropriate procedures and actions are undertaken when WQ parameters, telemetry and grabs, at the tailwater discharge locations exceed the thresholds of listed in Table 2 (Figure 3).

The trigger 1 – Alert (internal) will be used as a proactive step to avoid to implement adaptive measures and prevent any exceedance. When the step is reached, the dredging contractor will undertake an internal investigation to determine the likely cause(s) of the increase readings and emplace a range of measure to rectify any issue. Note that turbidity triggers have been estimated upon local knowledge and will be modified if deemed appropriate following sample collection and establishment of the *ad-hoc* TSS-NTU relationship.

Contaminant thresholds are set as step triggers, therefore an exceedance and the Trigger 2 - External is reached when laboratory results are above thresholds for three (3) consecutive weeks. Moreover, an exceedance in physico-chemical parameters is considered when parameters exceed the respective thresholds, as detailed in (Table 2), for more than 24 consecutive hrs. In this instance tailwater discharge will also cease. An investigation will be undertaken by the dredging contractor to determine the likely cause(s) of the increase readings and rectify the issue through adaptive management and mitigation measures (Figure 3). When physico-chemical values return within limits for at least 24 consecutive hrs tailwater discharge will resume.

In case of exceedance, and thus when the Trigger 2 – External is reached, in physico-chemical parameters and/or WQ from grab samples refer to Section 4.13 of the Marina MD EMP.

1.9 Dredger Data

All GPS coordinates recorded by the dredger must be to three decimal places. Key data collected by the dredger during the activity and reported to DES include:

- Areas and volumes being dredged;
- Any incidents in line with the requirements of the Environmental Authority (EA)

Additional data to maintain compliance with approvals includes:

- Weekly plotting sheet or certified ship extract: and
- Vessel Log including responsible vessel person (Master).

All data must be made available by the dredging contractor to GPC upon request and in GPC approved format.

1.10 Data Management

Data shall be managed in accordance with the Environmental and Resource Use Data Management Procedure (#1101368). This procedure outlines GPC processes for recording and managing environmental and resource use data. The purpose of this Procedure is to document the processes used by GPC to:

- Collect, store and report on environmental and resource use data;
- Report trends and exceedances to internal and external parties for compliance and due diligence purposes or to help identify efficiency opportunities;
- Ensure processes are in place to monitor the quality and accuracy of data; and
- Describe how GPC meets the requirements of AS/NZS ISO 14001:2015.

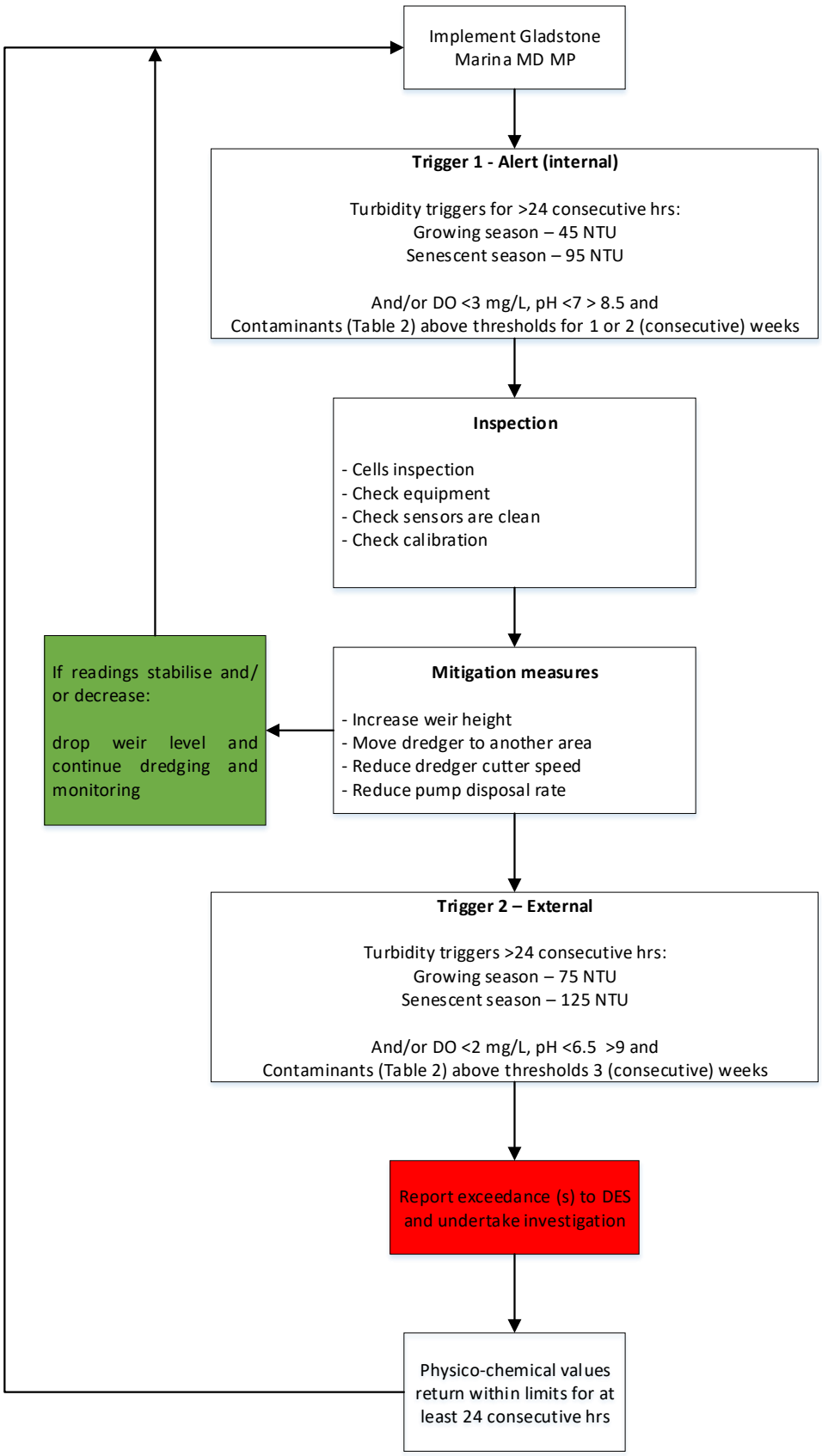

Figure 3: Adaptive management flowchart to be implemented during Gladstone Marina tailwater discharge. Note this flowchart will be updated by the dredging contractor and GPC once the TSS-Turbidity relationship will be developed (Section 1.8).

1.11 Validation

Environmental data validation in line with LMDMP is achieved by the following processes:

1.11.1 Quality Control / Quality Accreditation

Quality control of laboratory analysis is controlled through the use of laboratories that hold current NATA accreditation, where possible.

GPC conducts audits on external providers that undertake environmental monitoring on a periodic basis to:

- Assess the level of conformance of the external providers with the requirements of AS/NZS ISO 14001:2015, relevant Australian standards for sampling and standard test methods;
- Assess the contractor's level of conformance with GPC contract requirements, which includes qualifications, technical experience and previous direct experience with the scope of works requirements; and
- Provide GPC with feedback regarding the operation and compliance of monitoring and reporting activities undertaken by external parties.

1.11.2 Peer review of reports

All reports are peer reviewed to ensure report:

- Aligns with scope of works and delivers required objectives; and
- Contains no technical or referencing errors and is to the required standard.

1.12 Access to Reports and Data

GPC publishes the current approved version of the LMDMP and Environmental Monitoring Procedure on the GPC website for public access.

GPC also provides a WQ and adaptive management report, for details refer to Section 4.15 of the Marina MD EMP.

From January 2019 all monitoring reports related to the PoG LMDMP is published on GPC's website.

1.13 Monitoring and review

This procedure will be reviewed prior to each dredging campaign as required/appropriate or as a result of:

- Findings of internal and external inspections and/or audits;
- Changes in legislation or approvals;
- Incident and/or complaint investigations; and
- The review of monitoring results.

The review process is necessary to ensure currency, relevance and accuracy. Revisions are kept as a new version in GPC's document management system eDOCs and must be communicated to all relevant GPC staff.

For protocols on document management and review for this procedure refer to Section 3.17 of the EMP.

2 More information

This MP will be available to all personnel, vendors and contractors as well as administering authorities.

This document is uncontrolled when printed. The current version of this Procedure is located on Gladstone Ports Corporation's Intranet.

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

3 Document version control

Version	Date	Author	Change description (administrative or material)
1	04/12/2019	F. Pastorelli	Document development

4 Appendices

4.1 Appendix 1 – Related documents

4.1.1 Legislation and regulation

Key relevant legislation and regulation, as amended from time to time, includes but is not limited to:

Type	What
Federal Acts	*Environment Protection and Biodiversity Conservation Act 1999* *Water Act 2000* *ANZECC Water Quality Guidelines* *Environment Protection (Sea Dumping) Act 1981*
State Acts	*Environmental Protection Act 1994* *Environmental Protection Regulation 1998* *Environmental Protection (Water) Policy 2009*
Other	AS/NZS 14001:2015 Environmental Management Systems

4.1.2 Gladstone Ports Corporation documents

The following documents relate to this Procedure:

Type	Document number and title
Policy	Environment Policy (#366016)
Standard	Environmental Standard (#809151)
Specification/Procedure	Environmental Management System Plan (#146256) Port of Gladstone Long Term Maintenance Dredging Management Plan – V6 (#1385321) PoG Marina MD Environmental Management Plan (EMP) (#1139693)

4.2 Appendix 2 – Dredging contractor deliverables

The dredging contractor will supply GPC a range of information as detailed in this MP and summarised below:

Deliverable	Timeframe	Details
TSS/NTU relationship	Within 5 business days of data collection completion	All data and lab results in in electronic format (Excel) and GPC approved format
Notification	Immediately after becoming aware	Notification following elevations, exceedances and incidents.
Exceedance report	Within 5 business days of the exceedance date	Validated data, metadata, plots and analysis of the likely exceedance causes and adaptive measures put in place.

Weekly report	Weekly – Submitted every Wednesday for the previous week	Report including summary tables and plots of exceedances, elevations, lab results and incidents. Report to include also dredging logs such as volumes.
All data for GPC comprehensive compliance report	Within 15 business days of completion of all monitoring conducted by the dredging contractor	All relevant dates, telemetry validated data, lab results, incident statistics, metadata, calibration data and any other relevant information in electronic format (Excel) and GPC approved format to allow GPC to meet its compliance obligation as stated in the EA of a comprehensive compliance report