This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 253257-00

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Contents

1 Introduction 1
   1.1 Background 2
   1.2 Project Location 2
   1.4 Purpose, Scope and Objectives 5
   1.5 DMP Change Control 6
   1.6 Legislation 6
   1.7 Environmental Management Framework 7

2 Environmental Management Strategies 9
   2.1 General Requirements 9
   2.2 Specific Management Elements 12
   2.3 Marine Water Quality and Marine Ecology 13
   2.4 Marine Megafauna 18
   2.5 Seagrass Management 18
   2.6 Marine Pests and Ballast Water 20
   2.7 Waste Management 23
   2.8 Noise Quality 24

Tables

Table 1: General Requirements Environmental Management
Table 2 DMP Structure
Table 3: Monitoring Sites
Table 4 Marine Water Quality and Ecology DMP
Table 5 Marine Megafauna DMP
Table 6: Seagrass Monitoring
Table 7 Marine Pests and Ballast Water DMP
Table 8 Waste Management DMP
Table 9 Acoustic Quality DMP

Figures

Figure 1 OHCW Project Location
Figure 2 Gulf St Vincent DMPA
Figure 3: Flinders Ports Environmental Management Framework
Figure 4 Proposed water quality monitoring locations
Appendices

Appendix A
Sediment Sampling Results

Appendix B
Development Consent Notification
1 Introduction

Flinders Ports Pty Ltd (Flinders Ports) has identified the need for an upgrade of the existing infrastructure at Port Adelaide as a priority project for Flinders Ports. A detailed Development Application (DA) Report was submitted in July 2017 in accordance with the Development Act 1993, as a Section 49 application given this project is defined as public infrastructure. Sponsorship for this application was received from the Minister for Transport and Infrastructure prior to lodgement in May 2017.

Flinders Ports have identified the optimal upgrade to meet this growing demand is to widen the existing channel to suit the Post Panamax class vessels. It currently caters to vessels with a maximum width of 36.0m, (up to 42.2m with operational restrictions which includes speed and tidal restrictions), and are planning to increase the overall width to accommodate vessels up to a maximum width of 49.0m without the need to implement operational restrictions and hence ensuring maximum efficiency.

Flinders Ports DA 010/V048/17 received approval on 28th May 2018. The DA conditions applicable to this DMP are attached to this DMP at Appendix B.

In accordance with the Environment Protection Act 1993, Flinders Ports has prepared this Dredge Management Plan (DMP) to comply with the requirements of the Dredge Licence that will be issued by the Environmental Protection Authority (EPA).

It is intended that this DMP will guide the development of a Dredge Contractor’s Construction Environmental Management Plan (CEMP) upon granting of required regulatory approvals and appointment of a Dredge Contractor. Flinders Ports is committed to achieving a high standard of environmental performance during construction and mitigating any identified environmental risks.

This DMP is based on the following project description of works (refer to separate attachments (Attachment A) for the Outer Harbor Channel Widening (OHCW) Project Drawings and Specifications detailing the scope of works for the Dredge Contractor):

- Widening the existing 130m channel to 170m, to a depth of 14.2m Lowest Astronomical Tide (LAT), with 1:2 batters
- Widening the existing swing basin to 560m in diameter, to a depth of 14.2m LAT
- Placing the material off-shore in a 7km by 5km area of seabed approximately 30km from Port Adelaide, and
- Relocation of up to 16 navigational aids (via a separate contract and not involving dredging – this will not be considered any further as part of the DMP)

It is anticipated that dredging activity will occur over a period of approximately 4-6 months (nominally 180 dredge days maximum as modelled).
This DMP is based upon a dredge methodology that will involve a combination of a small-medium Trailing Suction Hopper Dredger (TSHD) of 3,000m³ hopper capacity and a medium size Cutter Suction Dredger (CSD) supported by 2,000m³ hopper capacity Split Hull Barges (SHB). The TSHD will be used to dredge the sandy/soft material. The CSD will be used for breaking up the sea bed material and discharging directly into SHB’s for transport to the Dredge Material Placement Area (DMPA) (no side-casting methodology). This methodology may be subject to change upon appointment of the Dredge Contractor, however significant changes are unlikely. If this occurs, an amendment to any approvals granted will be sought.

1.1 Background

The Port of Adelaide is the primary port in South Australia, located approximately 14km west of the Adelaide CBD. Operated by Flinders Ports the Port handles a diverse array of inbound and outbound cargoes, contributing significantly to the State’s economic activity. A significant amount of this trade is containerised, and Outer Harbor is the location for the Flinders Adelaide Container Terminal, which forms a critical freight hub for South Australia and the import and export of goods. It also includes the Port Adelaide Passenger Terminal which is growing in visitations to Adelaide and hence adding to the economic stimulus provided through the operations and infrastructure at Port Adelaide.

The Port is a tidal port, utilising a deepened shipping channel that extends approximately 7km into Gulf St Vincent to manage the safe and efficient movements of visiting shipping. Prior investment by Flinders Ports deepened the existing channel in 2005 from an existing depth of 12.2m Lowest Astronomical Tide (LAT) to the current depth of 14.2m LAT. This deepening project was driven by the emergence globally of larger, deeper draught vessels (known as Panamax class vessels).

1.2 Project Location

Figure 1 below provides an overview of the proposed OHCW Project location showing the channel and swing basin within the Port and Figure 2 shows the location within Gulf St Vincent for the proposed Dredge Material Placement Area (DMPA).
Figure 1 OHCW Project Location
Figure 2 Gulf St Vincent DMPA
1.4 Purpose, Scope and Objectives

The purpose of the DMP is to identify the preferred means of managing environmental issues associated with dredging for the OHCW Project. This DMP covers all aspects of the Project, based on the following elements:

- Dredging
- Vessel movements
- Dredged material placement
- Vessel management (e.g. bunkering, ballast water exchange)
- Biosecurity

The objectives of this DMP are:

- To describe relevant legal and other requirements and how compliance with these is to be achieved
- To describe Flinders Ports’ environmental requirements, procedures and processes for the project
- To identify and outline environmental management roles and responsibilities
- To promote environmental best practice
- To describe performance objectives for the construction phase of the project that the Dredge Contractor must meet
- To detail incident procedures, monitoring and reporting requirements for the construction component of the project
- To minimise, monitor and manage water quality impacts attributable to dredging and placement operations
- To identify and adopt best practice management for the following:
  - Handling and storage of all waste materials on the dredge vessel
  - Handling and management of fuel and wastewater transfer operations
  - Reducing the risk of translocation of organisms in ballast water or on the hull of the dredge vessel
  - Minimise the spread of POMS virus beyond the existing exclusion zone
  - Minimising nuisance noise from the dredging on surrounding facilities, users and visitors
  - Minimising air emissions produced during dredging operations and thereby minimising potential effects on the airshed
- To minimise the risk of an environmental incident occurring with the dredging operations such as a megafauna strike, oil spill, vessel collision or similar
• To ensure cultural heritage items are not impacted during dredging.

1.5 DMP Change Control

The Dredge Contractor is required to comply with these objectives and general controls outlined in this DMP as part of their contractual obligations. This DMP incorporates all approval conditions and other statutory requirements of related permits are incorporated into this document to ensure consistency between the DMP and approval conditions.

The DMP is to be maintained at all times to reflect existing approval conditions and statutory requirements, with any proposed changes or amendments to be updated by the Dredge Contractor and submitted for approval prior to implementation.

1.6 Legislation

The DMP has been developed in accordance with and considering legislative requirements set out in Acts and Regulations at Commonwealth and State level that are listed below.

1.6.1 International and Commonwealth Legislation

• International Convention for the Prevention of Pollution from Ships (MARPOL)
• Environment Protection and Biodiversity Conservation Act 1999
• Environment Protection (Sea Dumping) Act 1981
• Biosecurity Act 2015
• Protection of Sea (prevention of pollution from ships) Act 1983
• Australian Maritime Safety Authority Act 1990

1.6.2 State Legislation

• Environment Protection Policy (Water Quality) 2015
• Environment Protection Act 1993
• Fisheries Management Act 2007 (Fisheries Act)
• Native Vegetation Act 1991
• Adelaide Dolphin Sanctuary Act 2005
• National Resources Management Act 2004 (NRM Act)

This DMP has been prepared to support the dredge licence application; the Dredge Contractor is required to document their methodology for complying with both legislation and all conditions of approval granted for the project.

Works may not commence until all necessary approvals are in place.
1.7 Environmental Management Framework

Figure 3 shows the overall environmental management framework, which will be adopted as part of the contractual arrangements for the OHCW Project.
1.7.1 Roles and Responsibilities

The principal entities and their roles and responsibilities under the DMP are as follows:

**Flinders Ports**

Flinders Ports is the proponent and overall project administrator of the OHCW Project. As part of the contract specifications prepared for the appointed Dredge Contractor, all copies of approval commitments, conditions and requirements will be provided to the Dredge Contractor, who will be responsible for day-to-day compliance with these. Flinders Ports will also work with a Dredge Contractor, once appointed, to prepare an updated DMP to reflect the Dredge Contractor’s confirmed plant and equipment and CEMP.

To oversee dredging, Flinders Ports will appoint a Principal’s Site Representative to oversee the works and to contract manage the Dredge Contract. Monitoring and auditing of the Dredge Contractor will be undertaken by a suitably qualified person appointed by Flinders Ports on a regular basis. A suitably qualified auditor is defined as:

- A person with environmental management or planning qualifications (or deemed equivalent); and
- A person with a minimum 5 years’ experience in both auditing and the environmental management of dredging projects; or
- A person with auditing training and/or certified qualifications in EMS14001.

**Dredge Contractor**

The Dredge Contractor is responsible for preparation of more detailed plans of operation for the dredging, implementation of their environmental management systems, compliance with all conditions of approval, all relevant legislation, monitoring and reporting of their activities as detailed and required at all times.

**Training**

All site personnel involved in project construction will be provided with general environmental awareness training and any site-specific measures as contained in this DMP by the Dredge Contractor’s Environment Manager.

The training is to include, but not be limited to:

- Requirements of this DMP (and/or the Contractor’s CEMP) and any conditions of approvals
- Emergency response management in the event of an environmental incident
- Site-specific environmental controls to be applied
- Incident reporting procedures.

### 1.7.2 Contamination Testing

Testing of sediments to be dredged for contamination has been undertaken in accordance with state and commonwealth guidelines. No exceedances of contamination triggers were encountered, indicating that the material is suitable for placement at sea (Refer to Appendix A for contamination testing results. The suitability of testing undertaken has been reviewed, and meets state and commonwealth guidelines for placement at sea).

## 2 Environmental Management Strategies

The following sections outline environmental management measures for potential environmental impacts as a result of dredging activities. These strategies are to be continually reviewed and updated to reflect best practice, changes to construction processes and any conditions of approval issued by authorities. Each strategy outlines specific objectives, performance indicators and monitoring requirements that can measure the effectiveness of environmental performance during construction. An adaptive management approach has been outlined that allows actions to be reviewed and revised through corrective actions where objectives are not being met.

### 2.1 General Requirements

This section is supplemented by specific management elements detailed in Section 2.2.

<table>
<thead>
<tr>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>To ensure dredging and disposal operations and associated activities for the OHCW Project comply with relevant environmental duties and obligations as set out in legislation and with permit requirements.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance criteria</th>
<th>n/a</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Management action</th>
<th>Responsibility</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a General Method Statement outlining the intended scope of works and methodology to be employed as part of the works. At a minimum, the method statement should include the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Description of the general scope of works</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Reference to international dredging standards and company standards (e.g. quality, occupational, health and safety and environmental management systems), and how they apply to the current project and any other project-specific document</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Responsibilities of the dredge contractor and key staff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- A clear map of the areas where dredging activities will take place consistent with regulatory approvals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dredge Contractor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior to commencement of dredging</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Objective**

To ensure dredging and disposal operations and associated activities for the OHCW Project comply with relevant environmental duties and obligations as set out in legislation and with permit requirements.

**Performance criteria**

n/a

<table>
<thead>
<tr>
<th>Management action</th>
<th>Responsibility</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a <em>Detailed Dredge Management Plan</em> that updates this framework DMP based on requirements of regulatory agencies. This should address the following:</td>
<td>Flinders Ports and Dredge Contractor</td>
<td>Prior to commencement of dredging</td>
</tr>
<tr>
<td>• General description of the dredging process and the specifics of the plant to be used in the dredging process including the proposed methodology, dredging control, dredging patterns, vessel navigation routes to be used and vessel operations while at the disposal site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Specific method statements in accordance with the requirements of Section 2.2 of this DMP.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Environmental commitments, including a commitment by senior management of the dredge contractor to achieve specified and relevant environmental goals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Identification of environmental issues and potential impacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Control measures for routine operations to minimise the likelihood of environmental harm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Contingency plans and emergency procedures for non-routine situations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Organisational structure and responsibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Effective communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Staff training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Record keeping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Periodic review of environmental performance and continual improvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Specific elements in Section 2.2 of this DMP.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Objective

To ensure dredging and disposal operations and associated activities for the OHCW Project comply with relevant environmental duties and obligations as set out in legislation and with permit requirements.

| Performance criteria | n/a |

| Management action                                                                 | Responsibility                      | Timing                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ensure that all measures, plant and equipment necessary to undertake the dredging are operated and maintained in a proper and efficient condition. This includes appropriate servicing and maintenance of engines and emission control devices such that emissions comply with relevant guidelines and standards. | Dredge Contractor                   | At all times during dredging campaign    |
| Develop a complaints response procedure that covers environmental complaints                                                                                                                      | Dredge Contractor                   | Prior to commencement of dredging        |
| Record all complaints received by the dredge contractor or Flinders Ports related to environmental issues such as noise, air or water quality, including investigations undertaken, conclusions formed and actions taken. For complaints received by Dredge Contractor, provide notification about the complaint and any associated response to Flinders Ports in a timely fashion. | Dredge Contractor and/or Flinders Ports (as relevant) | At all times during dredging campaign |
| Take all reasonable and practicable measures to prevent and/or minimise the likelihood of environmental harm being caused by the Project                                                                 | Dredge Contractor                   | At all times during dredging campaign    |
| If environmental harm is caused or is likely to have been caused notify South Australia Environmental Protection Authority immediately                                                                 | Dredge Contractor and/or Flinders Ports (as relevant) | At all times during dredging campaign |
| Keep records of all monitoring results required by Flinders Ports or as part of permit requirements, in accordance with specific elements in Section 2.2.                                                                 | Dredge Contractor                   | At all times during and after dredging campaign |
| Keep records on the volume and size distribution of material removed from the dredge footprint area, summarised in a monthly report.                                                                 | Dredge Contractor                   | At all times during and after dredging campaign |
| Provide monthly report of dredging volumes and environmental compliance to Flinders Ports.                                                                                                             | Dredge Contractor                   | Within 5 working days after the end of each month during dredging campaign |

**Monitoring**

Monthly environmental audits will be undertaken by Flinders Port or their representative of the dredging operations during the campaign to ensure documentation and performance against the general requirements are being met.

**Reporting**

Report of environmental compliance to be prepared by dredging contractor each month and provided to Flinders Ports (see above). Additional reporting requirements are outlined in the specific elements of Section 2.2.

**Corrective action**

Corrective action will be required in the context of findings of the audits or in the context of any issues raised by regulatory bodies. Corrective actions may also be required because of complaints from the community in accordance with the complaint response process outlined above.

Table 1: General Requirements Environmental Management
2.2 Specific Management Elements

This section of the DMP identifies specific environmental management strategies associated with different elements of the project. The requirements in this section are intended to apply in addition to the General Requirements outlined in Section 2.1.

2.2.1 Structure

The following are the key elements that make up this DMP:

- Marine water and benthic ecology
- Marine megafauna
- Cultural heritage
- Navigation and maritime safety
- Marine pests and ballast water
- Bunkering and spills
- Waste management
- Amenity and emissions.

The structure used for each of these DMP elements is as follows in Table 2.

<table>
<thead>
<tr>
<th>Objective</th>
<th>A description of the environmental values associated with the element to be protected, enhanced and/or managed, and associated management commitment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance criteria</td>
<td>Outlines measurable criteria/outcomes for each element that, when achieved, represent compliance with the objective for the element.</td>
</tr>
<tr>
<td>Management action</td>
<td>Outlines the strategies, tasks or action program that would be implemented to achieve the performance criteria. For each management action, there is details on responsibility (i.e. person responsible for undertaking the action) and timing (i.e. when the action should occur in the context of the Project).</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Describes the monitoring requirements to measure achievement of performance criteria based on implementation of management actions. This includes auditing actions intended to check compliance with requirements of the element.</td>
</tr>
<tr>
<td>Reporting</td>
<td>Defines the format, timing and responsibility of reporting requirements associated with the element.</td>
</tr>
<tr>
<td>Corrective action</td>
<td>Lists actions to be implemented where monitoring or auditing indicates performance criteria are not being met to minimise environmental harm and/or achieve performance criteria.</td>
</tr>
</tbody>
</table>

Table 2 DMP Structure
2.3  Marine Water Quality and Marine Ecology

This section outlines the management actions necessary to mitigate impacts to marine water quality and benthic ecology. Water quality impacts are concerned mostly with generation of a dredge plume and the resuspension of sediments during the dredging and placement operations. These impacts to marine water quality also impact on benthic ecology, i.e. seagrass meadows. Impacts related to wastewater and spills are discussed in Section 2.7 below.

A range of mitigation measures will be committed to and required to be undertaken by Flinders Ports and its future Dredge Contractor from the outset of the project. Use of a selection of mitigation measures from a range of possible options will be informed by the experience of the contractor, operational requirements, legislative requirements and direction from Flinders Ports.

An Environmental Monitoring Program will be prepared and submitted to the EPA prior to the commencement of dredging to demonstrate and validate the modelled zones of impact presented in the DA documentation.

2.3.1  Water Quality Testing

Water quality testing will be undertaken by the Principal’s Environmental Representative, with the key objective to measure water quality (turbidity and benthic PAR) at key sensitive receptor sites (seagrass communities) within the predicted zone of influence from dredge plumes from dredging.

Monitoring will involve a period of baseline data collection prior to dredging to assess baseline conditions and to finalise dredging limits. Baseline data collected will include: turbidity, electric conductivity, pH, Dissolved Oxygen and water temperature. Monitoring will continue for the duration of the dredge campaign.

2.3.2  Monitoring Locations

Water quality monitoring is proposed to be undertaken at three (3) sites to collect water quality data as follows:

- Two ‘dredge plume monitoring’ sites – one site located to the north of the channel (D1) and one site to the south of the channel (D2). These sites would be located near to seagrass meadows and within the predicted zone of influence as indicated by dredge plume modelling.
- One ‘background’ site - located approximately 12 km from the channel dredging area, and representing background conditions.
- The proposed monitoring sites are included in Table 3, and shown in Figure 4. All three sites are located in a water depth of approximately -6 m LAT.

Additionally, visual sediment plumes extending from the dredge channel and dredge material placement area will be monitored using Sentinel-2 (10 m resolution) satellite imagery captured in the Gulf St. Vincent (~ 5,000 km²) up to three times prior to dredging (baseline phase) and up to twice per week for the first 1-2 months of dredging, depending on cloud cover. If Sentinel-2 satellite data is not available, Landsat 7 and 8 data (30m resolution) can be used. The satellite
image data will be processed to remove any atmospheric interference and surface water glare, with final outputs comprising aerial images showing spatial extent of turbid dredge plumes (if present). The purpose of this is to provide a qualitative assessment of sediment plume extent only.

<table>
<thead>
<tr>
<th>Site</th>
<th>Description</th>
<th>Approximate Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Dredge plume monitoring site 1</td>
<td>-34.7774 138.4590</td>
</tr>
<tr>
<td>D2</td>
<td>Dredge plume monitoring site 2</td>
<td>-34.7997 138.4750</td>
</tr>
<tr>
<td>B1</td>
<td>Background site</td>
<td>-34.9012 138.4800</td>
</tr>
</tbody>
</table>

Table 3: Monitoring Sites

Figure 4  Proposed water quality monitoring locations

2.3.3 Parameters to be Monitored

The following parameters will be continuously measured (i.e. data logged every 10 minutes) during baseline and dredging phases:
- **Turbidity** - as measured by optical scatter via a nephelometer giving readings in Nephelometric Turbidity Units (NTU). Turbidity provides a proxy for suspended sediments within the water column.

- **Photosynthetically Active Radiation (PAR)** – benthic PAR measured on the seafloor to represent that part of the light spectrum that is available to benthic photosynthetic organisms (e.g. seagrass) to utilise. Terrestrial PAR will also be measured to provide an indication of light attenuation through the water column, making allowance for cloudy conditions.

- **Dissolved oxygen, pH, salinity and temperature** – water quality instruments at each site will also be fitted with sensors to measure these additional parameters. These measurements will not be directly used for compliance purposes, but will be used to aid interpretation of other dredge monitoring activities (seagrass surveys, etc).

To supplement the continuously logged data, and to give independent measures of turbidity, water samples will be collected at the three monitoring sites during servicing trips and analysed for the following parameters:

- Total suspended solids
- Turbidity
- Chlorophyll-a

Water samples will be analysed at a NATA accredited laboratory, with results provided in the dredge monitoring report at the completion of dredging.

### 2.3.4 Monitoring Equipment

At each monitoring site, a water quality logger will be fitted with sensors designed for long-term deployments in the marine environment. These loggers will record turbidity, and be deployed using purpose-built monitoring buoys anchored to the seabed to maintain position. With the loggers installed in each monitoring buoy, the sensors will be located at a depth of approximately 1 m below the water surface. This allows telemetry and real-time access to data, and has the advantage that measurements would be available in real-time via the telemetered data feed and a web-based portal, which allows for continuous monitoring of data capture and quality.

As the monitoring buoys will be located in relatively shallow water depths (approximately -6 m LAT), it is expected that the water column will be fairly well mixed. As such, it is expected that surface turbidity readings will be representative of turbidity throughout the water column. This will be confirmed during water quality depth profiling (turbidity readings collected through the water column) during equipment servicing.

Benthic PAR sensors will be deployed at each monitoring site on a bottom-mounted frame. These sensors will measure light levels reaching seagrass beds, and will be attached to the surface monitoring buoy (with telemetry) using a cable, allowing the data to be downloaded remotely.

At one benthic PAR monitoring site (site D1 or D2), an additional PAR sensor will be mounted approximately 1 m vertically above the lower PAR sensor. Data
from these two PAR sensors will be used to calculate light attenuation in the water column.

One terrestrial PAR sensor will also be deployed in a secure location (e.g. at the Port) to collect surface PAR data. This sensor will be fixed to a structure (e.g. roof or post) in an unobstructed area in full sunlight, which can be accessed on a routine basis for data downloading and servicing.

Water quality loggers will provide continuous logging of data, with anti-fouling guards and sensor wiping apparatus to prevent interference to sensors from marine growth. Instruments will be programmed to log data once every ten minutes and report any exceedance of targets immediately to the Dredge Contractor for actioning.

Telemetry and other appropriate water quality monitoring equipment will also be installed to ensure dredging can be reactive within a timely manner and flag exceedances in real time. This data will be available to both the Dredge Contractor and the Principal’s Site Representative, with alerts via mobile text message or email of any exceedance under the RMP.

The 10 minute logged monitoring data will be downloaded and stored in a database. Monitoring data downloaded via telemetry (turbidity data) will be fed live onto a secure website for real-time viewing by key project personnel, including the Dredge Contractor, Principal’s Site Representative and Flinders Ports staff. This will allow the project team to immediately detect and where necessary respond to any water quality issues.

## 2.3.5 Monitoring Timing

The duration of water quality monitoring will be as follows:

- **Baseline monitoring** - expected to commence in late June 2018 and continue until dredging commences around April 2018. This may be supplemented by other data collected by the EPA.
- **Dredge monitoring** - undertaken for the duration of dredging, which is expected to be for a period of approximately 4-6 months.

| Objective | To minimise impacts to water quality and marine ecological sensitive receptors, including seagrass and benthic habitats of the Port River and Gulf St Vincent. |
| Performance criteria | Setting trigger values for receiving environments for surface water, derived from baseline data collection completed prior to dredging activity. |
| Potential Impacts | • Impacts to water quality from capital dredging  
• Impacts to seagrass habitat within areas identified as being in the zone of high-medium impact. |

<table>
<thead>
<tr>
<th>Management action</th>
<th>Responsibility</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>A dredging methodology must be utilised that meets or exceeds the base case methodology which involves no ‘side-casting’.</td>
<td>Dredge Contractor</td>
<td>At all times during dredging campaign</td>
</tr>
<tr>
<td>The dredge will operate at all times within the design dredge footprint, guided by an accurate electronic positioning system to track movements at all times</td>
<td>Dredge Contractor</td>
<td>At all times during dredging campaign</td>
</tr>
</tbody>
</table>
Hopper compartments are maintained water tight during all dredge activities

Dredge Contractor At all times during dredging campaign

The dredge is fitted with a ‘green’ valve to minimise the extent of turbidity plumes generated by the dredge operation.

Dredge Contractor At all times during dredging campaign

Background water quality monitoring will be performed prior to the commencement of works to set relevant performance triggers

Flinders Ports Prior to dredging campaign

Refuelling is to be undertaken in accordance with Flinders Ports environmental procedures, with appropriate spill controls and containment measures in place.

Dredge Contractor At all times during dredging campaign.

Monitoring
A Monitoring Program will be implemented with appropriate water quality exceedance triggers, monitoring locations at sensitive receptors and corrective actions for dredging (refer to Section 2.3.1 to 2.3.5). Any exceedance of trigger values recorded by monitoring equipment will be immediately notified to the dredge contractor via email/SMS for action.

Reporting
A baseline monitoring report will be prepared upon completion of baseline monitoring. This report will include a summary of the baseline data, along with calculated water quality trigger values.

The following reports are to be prepared during the dredging by the Principal’s appointed Environmental Representative:

- Monthly compliance reports, including details of exceedances and corrective actions.
- At the completion of dredging, a dredge monitoring report will be prepared. This report will include:
  - Summary of monitoring program
  - Raw monitoring data (QA checked)
  - QA/QC procedures
  - Summary of data
  - Details of trigger value exceedances and corrective actions taken (to be informed by the Dredging Contractors monthly and exception reports)

Corrective action
Dredge Contractor may choose from a range of corrective measures should they not meet water quality performance targets set. These may include:

- Reducing overflow durations
- Modifying the timing or location of dredging when experiencing adverse conditions (i.e. weather conditions or tides), particularly when in proximity to sensitive receptors
- Scheduling maintenance activities in adverse conditions
- Cease works until water quality is reduced to acceptable levels.
- Dredging only on certain tidal currents in order to reduce the likelihood of dredge plume in sensitive areas.
- Minimise generation of plumes from the Cutter Suction Dredger (CSD) by control of the cutter suction head (i.e. change of direction and/or speed).

Table 4 Marine Water Quality and Ecology DMP
2.4 Marine Megafauna

This section outlines requirements that are to be met associated with the management of potential interactions between dredge equipment (and supporting vessels) and marine megafauna.

| Objective | To reduce the risk of disturbance or injury to marine megafauna (cetaceans, dolphins, sharks) resulting from dredging and disposal activities. |
| Performance criteria | • No incidents of vessel-related disturbance or mortality to marine megafauna, including entrainment. |

<table>
<thead>
<tr>
<th>Management action</th>
<th>Responsibility</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>All employees to receive training in marine megafauna awareness from a suitably qualified person.</td>
<td>Dredge Contractor</td>
<td>Prior to start of dredge campaign</td>
</tr>
</tbody>
</table>

- A marine mammal observer must maintain a watch for whales during piling vessel transit. If a whale(s) is sighted:
  a) Vessel speed and direction must be adjusted to avoid impact with whales (within safety constraints of the vessel)
  b) The vessel must not intentionally approach within 100m of a whale
  c) Within 300m of a whale, a max. speed of 8 knots must be applied |

- All sightings of cetaceans to be reported to Flinders Ports immediately. |

- Light levels from the dredging works to be limited to those lights that are necessary for the safe operation of the vessel. |

| Monitoring | Monitoring based on visual observations undertaken always during transit and operation |
| Reporting | All sightings of cetaceans (other than dolphins) to be recorded, indicating the sighting of each individual animal and actions taken. Any instance of animal injury or mortality to be reported to PSR and detailed in an incident report. |

| Corrective action | In the event of an environmental incident, regulatory agencies are to be informed. Actions to be undertaken in accordance with advice from regulatory agencies, including capture of injured animals if necessary. Environmental incident to be investigated and, if necessary, management actions in this element are to be updated. |

Table 5 Marine Megafauna DMP

2.5 Seagrass Management

This section outlines monitoring requirements to minimise and measure impacts to seagrass from increased turbidity from dredging. A best-practice dredging methodology has been chosen for works that minimises disturbance to seagrass as much as possible. Nevertheless, it is expected that there will be some temporary loss of seagrass immediately following the dredge campaign, and a monitoring campaign will be put in place prior to, during and following works, using a ‘before and after control impact’ (BACI) design, to measure seagrass health metrics.

This will be detailed in the Environmental Monitoring Program provided to the EPA for review prior to the commencement of dredging.
A separate Native Vegetation Clearance application and Significant Environmental Benefits (SEB) agreement is to be determined with the Native Vegetation Council (NVC) - all seagrass monitoring is to be coordinated in accordance with this agreement and any NVC requirements, which may alter some of the management actions below which will be updated (if required) prior to commencement of works to align agreed management plans.

### Objective
To minimise long term impacts to seagrass from dredging activity

### Potential Impacts
A reduction in seagrass mass following dredging activity.

### Management Action | Responsibility | Timing
---|---|---
An Environmental Monitoring Program is to be prepared and approved by the EPA prior to the commencement of dredging. | Flinders Ports | Prior to the commencement of dredging
Conduct a baseline survey of seagrass extent immediately prior to dredging – this should be undertaken in accordance with the survey methodology agreed in the EMP. | Flinders Ports | Immediately prior to the commencement of dredging
Turbidity and PAR levels are to be monitored throughout dredging (Refer to Section 2.3) and corrective measures taken if trigger limits are exceeded. Seagrass transects are to be monitored (at a minimum) at water quality monitoring sites (D1, D2 and B1) | Flinders Ports & Dredge Contractor | At all times during dredging
Seagrass surveys are to be undertaken immediately post and 3-5 years following dredging to measure seagrass spatial coverage (or as agreed in the Environmental Monitoring Program). | Flinders Ports | Immediately post, and 3-5 years after dredging has been completed.

### Performance Criteria
Minimise exceedance of water quality criteria during dredging.

### Monitoring & Reporting
As agreed in the approved Environmental Monitoring Program.

Table 6: Seagrass Monitoring
2.6 Marine Pests and Ballast Water

This section outlines requirements that are to be met by the dredge contractor associated with ballast water management before leaving the port of origin, during transit between areas of operation, during operations, and following completion of dredging activities prior to departing Port Adelaide.

| Objective | To ensure risk of translocation of organisms in ballast water or on the hull of a dredge vessel is minimised. To minimise the potential for the spread of POMS virus beyond the Port river Estuary. |
| Potential Impacts | Introduction of high risk ballast water or harmful marine organisms/pests into Adelaide Port. Spread of POMS Virus beyond the Port River Estuary. |
| Management Action | Responsibility | Timing |
| In accordance with the *National Bio-fouling Management Guidance for Non-Trading Vessels* (Australian Government 2008), prior to leaving the dredge vessel’s port of origin: | Dredge Contractor | Prior to leaving the vessel’s port of origin |
| Assess the biofouling risk of the vessel prior to departing for Australia and take remedial action as necessary | | |
| Undertake regular inspections of areas most prone to biofouling (e.g. damaged paint, propellers, bow and stern thrusters, sea chests and cooling pipes) | | |
| Implement a regular schedule for maintenance and dry docking to apply antifouling coatings | | |
| Regularly ensure marine growth prevention systems are operating efficiently and effectively | | |
| Inspect support vessels, ship hull, hopper and dredge gear (especially dredge- head) to ensure that no material which may transport organisms (sediments, organic material, or waters) is retained. This should be undertaken in accordance with PIRSA’s Guidelines for Good Vessel Cleaning Practices. | | |
| Implement measures to reduce the spread of POMS outside the Port River Estuary, once measures are approved by PIRSA Biosecurity SA and SARDI Aquatic Sciences. | | |
### Objective

To ensure risk of translocation of organisms in ballast water or on the hull of a dredge vessel is minimised. To minimise the potential for the spread of POMS virus beyond the Port river Estuary.

### Potential Impacts

- Introduction of high risk ballast water or harmful marine organisms/pests into Adelaide Port.
- Spread of POMS Virus beyond the Port River Estuary.

### Management Action

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dredge Contractor</td>
<td>At all times during machinery transit</td>
</tr>
<tr>
<td>Flinders Ports and Dredge Contractor</td>
<td>Prior to and during dredging activities</td>
</tr>
</tbody>
</table>

In accordance with the International Maritime Organisation (IMO) Ballast Water Convention 2004, during transit between the Port of Origin and Port Adelaide:

- Any ballast tanks holding seawaters to be exchanged with a minimum of 150% of design volume with seawaters at a location as distant from the coastline or other shallow (<100 m) areas as possible but not less than five nautical miles from the coast.
- Any waters held in the hopper during transit to be treated as for other ballast water.

During operations at Port Adelaide:

- On arrival at the Port Adelaide, the dredge is to operate in accordance with DAWR and Australian Quarantine regulations.
- Hull inspections to be carried out and plant certified as free of marine pests to DAWR standards.

*Caulerpa taxifolia* must be managed to ensure that fragments are not spread to the nearshore environment. A pre-works check by video transect or diving to identify the presence and extent of *C. taxifolia* is to be undertaken. Should it be detected within the area to be dredged, further consultation with Biosecurity SA will be undertaken to determine the best treatment method.

### Performance Criteria

- No high-risk ballast water brought into Port limits.
- Ensure ballast water discharge and marine pest inspections occur in accordance with Port Operating Procedures.
- No harmful marine organisms are translocated on the under-keel hull, dredge-head or within the hopper of the dredge.
### Objective

To ensure risk of translocation of organisms in ballast water or on the hull of a dredge vessel is minimised. To minimise the potential for the spread of POMS virus beyond the Port river Estuary.

### Potential Impacts

Introduction of high risk ballast water or harmful marine organisms/pests into Adelaide Port. Spread of POMS Virus beyond the Port River Estuary.

### Management Action

<table>
<thead>
<tr>
<th>Monitoring &amp; Reporting</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Responsibility</th>
</tr>
</thead>
</table>

Hopper water discharge and replacement records are to be kept in the Ship’s log and made available upon request. A record will be kept of volumes, location and time of all ballasting and de-ballasting operations. No spread of *C. taxifolia* beyond the port boundary.

### Table 7 Marine Pests and Ballast Water DMP
2.7 Waste Management

This section outlines requirements to manage wastes generated from or incidental to the dredging operations. It is separated into three categories: (i) Solid waste and garbage, (ii) Sewage, and (iii) Hazardous waste.

<table>
<thead>
<tr>
<th>Objective</th>
<th>To ensure that general refuse produced on-board the dredge vessel is collected, retained and transferred to an appropriate facility without unintentional material loss.</th>
</tr>
</thead>
</table>
| Performance criteria | • No loss of solid waste material overboard during collection or transfer.  
• No discharge other than at berth. |
| Potential Impact | Discharge of solid waste to the environment |
| Management action | Responsibility | Timing |
| Vessel fitted with appropriately sized waste disposal bins. | Principal’s Site Representative | Prior to commencement of dredging campaign |
| Vessel bins to be secured and fitted with secure lids to prevent material being blown overboard during storage or handling. | Dredge Contractor | At all times during vessel transit |
| Where practicable, ensure all material compacted to further prevent unintentional loss. | Dredge Contractor | At all times during dredging campaign |
| Ensure the bins are collected and emptied while at berth at appropriate intervals (e.g. emptied at 75% capacity or below). | Dredge Contractor | At all times during dredging and placement activities |
| All procedures to minimise spills or leakage during storage to be undertaken and spill response equipment to be provided on board for minor material spills. | Dredge Contractor | At all times during dredging campaign |
| Black and grey water is to be disposed to an appropriate sewage treatment facility where possible. | Dredge Contractor | At all times during dredging campaign |
| No waste material is to be discharged to the St Vincent Gulf | Dredge Contractor | At all times during dredging campaign |
| Monitoring | Monitoring based on visual observations |
| Reporting | Dredge contractor to report any significant loss of waste material to Flinders Ports immediately. |
| Corrective action | If practicable, take measures to retrieve material that is lost.  
Review procedures causing material loss and take immediate action to rectify. |

Table 8 Waste Management DMP
### 2.8 Noise Quality

#### Objective
- To protect the acoustic amenity and minimise nuisance noise on surrounding sensitive receivers.
- To respond effectively to any noise quality issues that arises during construction.

#### Performance criteria
- There are no complaints lodged from the public or port users about noise associated with dredge operations.
- Minimal noise impacts experienced by marine fauna.

#### Potential Impact
- Acoustic nuisance to other port users, the public or sensitive marine fauna from dredging.

#### Management action | Responsibility | Timing
---|---|---
All dredging undertaken in the vicinity of the Outer Harbor port entrance/ passenger terminal is to be conducted during daytime hours and favourable weather conditions with respect to human noise sensitive receivers (i.e. receivers upwind of dredging works) only | Dredge Contractor | At all times
Ensure that engines and equipment on board the dredge are properly maintained in good working order. | Dredge Contractor | At all times
Maintain and operate all equipment on board the dredge in a safe and efficient manner. | Dredge Contractor | At all times
Carry out non-essential maintenance during daylight hours. | Dredge Contractor | At all times
Planned maintenance, refuelling, and similar activities occur outside of sensitive night time noise periods | Dredge Contractor | At all times
Dredging activities are to be avoided at night in proximity to identified residential receptors | Dredge Contractor | At all times
The contractor staff are aware of noise requirements within relevant permits and/or approvals. | Dredge Contractor | At all times

#### Monitoring
Investigation will be required in response to any noise complaints received during the dredging operation, and corrective actions taken within 24 hrs if related to a fault or poor weather conditions (i.e. machinery fixed, additional noise controls or avoiding dredging in adverse wind conditions). No additional noise monitoring is proposed, as dredging within the vicinity of sensitive receivers is for a short period and restricted to daylight hours only.

#### Reporting
The results of any noise investigations and corrective actions are to be provided to Flinders Ports within 2 days following receipt of a complaint.

#### Corrective action
In the event that a noise complaint is received, an investigation is to be undertaken and corrective measures applied where feasible including fixing faulty machinery that is causing nuisance noise, repositioning noise-producing plant and avoiding dredging in unfavourable wind conditions.

Table 9 Acoustic Quality DMP
Appendix A

Sediment Sampling Results
Technical Memorandum

From: Daniel Moran, Darren Richardson
To: Lisa McKinnon
Date: 16 January 2018
CC:

Subject: Summary of Results

Background

An assessment of the physio-chemical properties of the Port Adelaide Outer Harbour Channel was undertaken to determine the suitability of proposed dredged sediments for ocean placement. A summary of the sampling methodology and survey findings are provided below.

Methods

Sampling was conducted by Golder Associates on the 15th, 22nd, and 23rd November 2017 at 47 sites (Figure 1) within Zones A and B of the channel (see Sediment Analysis Plan (SAP) prepared by BMT in November 2017) and at a reference location offshore. Additionally, contamination testing of the port swing basin was undertaken in 2016 by Golder Associates, which did not identify any material that exceeded relevant standards (Refer to Attachment A for further detail).

Samples were collected from the surface horizon (0.0-0.5m) at all sites and from a deep horizon (0.5-1.0m below the substrate) at three sites. Additional samples were also collected for elutriate testing and quality assurance purposes. Samples retained and analysed from each site are summarised in Table 1. Parameters which were analysed included:

- PSD (Particle Size Distribution)
- pH, TOC (Total Organic Carbon)
- Metals including Aluminium, Antimony, Arsenic, Cadmium, Chromium, Copper, Cobalt, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Vanadium and Zinc
- TRH (Total Recoverable Hydrocarbons) and BTEX (Benzene, Toluene, Xylenes)
- Nutrients including Total Kjeldahl Nitrogen (as N), Total Phosphorus (as P) and Ammonium (as N)
- Tributyltin
- Elutriate Testing – screen for TBT and metals only
Results were compared to screening levels in the National Assessment Guidelines for Dredging (NAGD) as updated in the ANZECC/ARMCANZ sediment quality guidelines (Simpson et al. 2013). Where a parameter exceeded screening level in an individual sample, the 95% upper confidence level (UCL) was calculated for the dredge zone and compared to screening level. All statistical procedures were undertaken in accordance with NAGD using the software package ProUCL V5.1 (US EPA 2015).

Table 1 Summary of sampling regime

<table>
<thead>
<tr>
<th>Site</th>
<th>Zone</th>
<th>Primary Analysis</th>
<th>Phase III Analysis</th>
<th>QAQC</th>
</tr>
</thead>
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<td>Surface: 0.0-0.5m</td>
<td>Deep: 0.5-1.0m</td>
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</tr>
</tbody>
</table>
Figure 1 Sediment Sampling Locations
**Results**

**Phase II Testing**

Concentrations of chemicals measured in sediment samples were compared to screening levels in NAGD (Commonwealth of Australia 2009) and updated ANZECC sediment guideline values (Simpson *et al.* 2013), and results are summarised in Table 2. This represents Phase II testing in accordance with the NAGD assessment framework.

Phase II testing demonstrated that sediments were uncontaminated in all dredge zones and therefore suitable for ocean disposal in accordance with NAGD. In this regard, the 95% upper confidence level (95% UCL) of the mean was below relevant screening levels/guideline values for all parameters in all zones.

A single exceedance of the NAGD screening level was recorded; the metalloid antimony at site SB29 (0.5-1.0m horizon) in Zone B (nearshore channel). This parameter was also only recorded in a single sample, therefore representing an outlier. Since the 95% UCL (0.52 mg/kg) was well below the screening level of 2 mg/L, this parameter is not of concern from a dredging and disposal perspective in accordance NAGD.

Otherwise, no individual samples exceeded screening levels or updated sediment quality guideline values for other parameters.

Many parameters do not have screening levels. Some of these parameters were found to be greater in dredge sediments than offshore background sites, reflecting longitudinal gradients in fine sediment inputs and sediment types with distance offshore. In particular, ammonia had higher concentrations in dredge sediments than offshore background sites. Ammonia is a naturally occurring form of nitrogen that occurs in organically enriched sediments, as occurs in nearshore areas. Detailed investigations have been carried out at other locations to investigate the behaviour of ammonia enriched dredged sediments during ocean disposal (BMT WBM 2008a,b; Jones and Lee 1981; Lohrer and Wetz 2003; Cornwell and Owens 2011). Studies indicate that water quality effects are localised, short lived and within the range and natural variability, due to rapid oxidation, biological uptake and dispersion by currents. On this basis, ammonia is not considered to represent a contaminant of potential concern in the context of the project.

**Phase III Elutriate Testing**

Phase III testing represents the next step in the NAGD assessment framework, and is only required if Phase II testing detects potential contamination. Phase II testing did not identify a contaminant of potential concern in dredge material, but Phase III elutriate testing was conservatively undertaken to assess potential bioavailability of metals/metalloids and TBT in the water column. All parameters had concentrations less than ANZECC/ARMCANZ (2000) trigger values for slightly-moderately disturbed systems. On this basis, metals/metalloids and TBT are not considered to represent a water quality risk during dredging and disposal.

**Conclusion**

Phase II and Phase III testing demonstrated that dredged sediments had concentrations below relevant guideline levels and are therefore considered suitable for ocean disposal in accordance with NAGD.
Table 2 Sediment results summary

<table>
<thead>
<tr>
<th>Results Sheet</th>
<th>Samples/horizons</th>
<th>Parameters</th>
<th>c.f. guideline levels</th>
<th>QA/QC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALS - EB1724514</td>
<td>Samples S47, S46, S45, S44, S43, S42, S37, S38 and 0-0.5 (no sample attribute) (all surface 0-0.5 m) and S46 Deep (0.5-1.0 m). Note – only one subsurface sample collected rather than 20% of locations specified in the SAP</td>
<td>pH, metals, PSD, nutrients, TRH, TPH, BTEX, TBT, TOC</td>
<td>All parameters &lt; NAGD screening levels, therefore considered suitable for ocean disposal in accordance with NAGD</td>
<td>S47 - Sample heterogeneity resulted in poor duplicate results (metals); possible lab contamination of sample (hydrocarbons), LOR raised but still &lt;&lt; SL</td>
</tr>
<tr>
<td>Eurofins - 573724-S</td>
<td>DUP2 0-0.5</td>
<td>Metals, TRH, TPH, BTEX, TBT, pH not analysed</td>
<td>All parameters &lt; NAGD screening levels</td>
<td>S46 - Sample heterogeneity resulted in poor spike recovery for sample</td>
</tr>
<tr>
<td>ALS - EB1725136</td>
<td>SB41 EL, SB40 EL, SB23 EL, SB28EL, SB30 EL, SB33 EL, SB34 EL, SB35 EL, SB09 EL, SB11 EL, “Elutriate”</td>
<td>Elutriates – metals, TBT</td>
<td>All &lt; ANZECC 95% spp. protection</td>
<td>LOR raised for xylene but not an issue as &lt; guideline</td>
</tr>
<tr>
<td></td>
<td>SB41, SB39, SB39 DUP3, SB40, SB22, SB22 DUP5, SB23, SB24, SB25, SB26, SB26 Deep, SB27, SB27 DUP7, SB28, SB29, SB29 Deep, SB30, SB31, SB32, SB33, SB34, SB35, SB01, SB01 DUP9, SB02, SB03, SB04, SB05, SB06, SB07, SB08, SB09, SB10, SB11, SB12, SB13, SB14, SB15, SB16, SB17, SB18, SB19, SB20, SB21</td>
<td>pH, metals, PSD, nutrients, TRH, TPH, BTEX, TBT, TOC</td>
<td>All parameters &lt; NAGD screening levels except antimony in one sample (SB29 Deep). 95% UCL &lt; screening level and therefore considered clean and suitable for ocean disposal.</td>
<td></td>
</tr>
<tr>
<td>Results Sheet</td>
<td>Samples/horizons</td>
<td>Parameters</td>
<td>c.f. guideline levels</td>
<td>QA/QC</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>------------------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>----------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Eurofins – 574886-S</td>
<td>SB39 DUP4, SB22 DUP6, SB27 DUP8, SB01 DUP10</td>
<td>Metals, TRH, TPH, BTEX TBT, pH not analysed</td>
<td>All parameters &lt; NAGD screening levels</td>
<td>All within lab Acceptance Limits</td>
</tr>
</tbody>
</table>

Table 3  Summary Statistics and 95% UCLs for Antimony in Zone B

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>PQL</th>
<th>Screening Level (SL)</th>
<th>% detects</th>
<th>% &gt; SL</th>
<th>mean</th>
<th>geomean</th>
<th>SD</th>
<th>Distribution</th>
<th>95% UCL</th>
<th>80th %ile</th>
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<tbody>
<tr>
<td>Antimony</td>
<td>mg/kg</td>
<td>0.5</td>
<td>2</td>
<td>4.76</td>
<td>4.76</td>
<td>0.35</td>
<td>0.28</td>
<td>0.46</td>
<td>no discernible distribution</td>
<td>0.52</td>
<td>0.25</td>
</tr>
</tbody>
</table>
References


Cornwell JC, Owens MS (2011) Quantifying sediment nitrogen releases associated with estuarine dredging. Aquatic Geochemistry 17, 499-517.


### Attachment A – Swing Basin Sediment Sampling (Golder Associates 2016)

#### Sample ID  
**Easting (m)**  |  **Northing (m)**
---|---
Swing Basin samples
1  | 0269815  | 6149907
2  | 0269890  | 6150007
9  | 0269918  | 6150041
11 | 0269727  | 6149788
18 | 270018   | 6150056
21 | 0269833  | 6149913
22 | 0269907  | 6149983
38 | 0270018  | 6150036
49 | 0270034  | 6149884
53 | 0269941  | 6149921

#### Table A.1 Sampling Locations

<table>
<thead>
<tr>
<th>Site ID</th>
<th>Sample Depth (m)</th>
<th>Metals, pH, Tributyltin</th>
<th>TPH/BTEX N/PAH</th>
<th>Cations/anions</th>
<th>Total Organic Carbon</th>
<th>VIC EPA Screen</th>
<th>Potential Acid Sulfate Soils (SCR)</th>
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<tbody>
<tr>
<td>SB01</td>
<td>0 – 0.5</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.9</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SB02</td>
<td>0 – 0.5</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.9</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SB02/Dup1/Dup 2</td>
<td>0.5 – 0.9</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>SB09</td>
<td>0 – 0.5</td>
<td>✓</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.9</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SB11</td>
<td>0 – 0.5</td>
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<td></td>
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<tr>
<td></td>
<td>0.5 – 0.75</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>SB18</td>
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<td>✓</td>
<td>✓</td>
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<td></td>
<td>0.5 – 0.75</td>
<td>✓</td>
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<tr>
<td>SB21</td>
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</tr>
<tr>
<td></td>
<td>0.5 – 0.9</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SB22</td>
<td>0 – 0.5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.8</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>SB38</td>
<td>0 – 0.5</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.9</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>SB49</td>
<td>0 – 0.15m</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SB53</td>
<td>0 – 0.5</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.65</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rinsate1</td>
<td>-</td>
<td>✓</td>
<td>✓ (not PAH)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rinsate2</td>
<td>-</td>
<td>✓</td>
<td>✓ (not PAH)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Abbreviations

- VIC: Virginia Inland Waterways
- EPA: Environmental Protection Agency
- SCR: Scree
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- VIC: Virginia Inland Waterways
- EPA: Environmental Protection Agency
- SCR: Scree
<table>
<thead>
<tr>
<th>Site ID</th>
<th>Sample Depth (m)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB01</td>
<td>0 – 0.5</td>
<td>Silty SAND, dark grey, fine to medium grain sand, trace roots</td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.9</td>
<td></td>
</tr>
<tr>
<td>SB02/Dup1/Dup2</td>
<td>0 – 0.5</td>
<td>Silty SAND, dark grey, fine to medium grain sand, trace roots</td>
</tr>
<tr>
<td>SB02</td>
<td>0.5 – 0.9</td>
<td></td>
</tr>
<tr>
<td>SB09</td>
<td>0 – 0.5</td>
<td>Silty SAND, dark grey to black, fine to medium grain sand, trace roots and shell fragments</td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.8</td>
<td>Silty SAND, dark grey, trace roots</td>
</tr>
<tr>
<td>SB11</td>
<td>0 – 0.5</td>
<td>Silty SAND, dark grey, fine to medium grain sand</td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.75</td>
<td>Gravelly SAND, fine to coarse grain sand, fine to medium gravel, dark grey to brown</td>
</tr>
<tr>
<td>SB18</td>
<td>0 – 0.5</td>
<td>Silty SAND, dark grey, fine to medium grain sand, trace vegetation</td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.75</td>
<td></td>
</tr>
<tr>
<td>SB21</td>
<td>0 – 0.5</td>
<td>Silty SAND, dark grey, fine to medium grain sand, trace roots</td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.9</td>
<td></td>
</tr>
<tr>
<td>SB22</td>
<td>0 – 0.5</td>
<td>Silty SAND, dark grey, fine to medium grain sand</td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.8</td>
<td></td>
</tr>
<tr>
<td>SB38</td>
<td>0 – 0.5</td>
<td>Silty SAND, dark grey, fine to medium grain sand</td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.9</td>
<td></td>
</tr>
<tr>
<td>SB49</td>
<td>0 – 0.15m</td>
<td>Gravelly sandy CLAY, M-HP, yellowish brown, fine to coarse sand, fine to coarse gravel</td>
</tr>
<tr>
<td>SB53</td>
<td>0 – 0.5</td>
<td>Silty SAND dark grey to yellow, fine to coarse grain sand</td>
</tr>
<tr>
<td></td>
<td>0.5 – 0.65</td>
<td></td>
</tr>
</tbody>
</table>

Table A.3  Sediment Descriptions
Concentrations were below the LOR so a value of half the LOR has been assigned.

Figure A.1 Arsenic and Copper Results
*Concentrations were below the LOR so a value of half the LOR has been assigned

Figure A.2 Lead and Mercury Results
Concentrations were below the LOR so a value of half the LOR has been assigned.

*Concentrations were below the LOR so a value of half the LOR has been assigned

Figure A.3 Nickel and Zinc Results
1.1 Tributyltin

Tributyltin (TBT) was historically used as an antifouling agent in paint applied to hulls of ships and is a common contaminant for sediments in port areas. It has a high toxicity, especially to filter feeders. It becomes unstable when oxidised (to become tin) and hence when the sediment is placed on land and dries. Its use has been prohibited since September 2008 (Department of Environment 2013).

Total organic carbon was analysed to enable normalisation of TBT results. Total organic carbon ranged from 1.1 to 1.4 % in the Swing Basin. Normalisation was calculated by dividing TBT by TOC concentrations.

The normalised concentrations of TBT in the Swing Basin samples are presented below.

![Tributyltin graph](image)

1.2 Other organics

A selection of samples were also analysed for additional organic chemicals which included the following in selected samples:

- Halogenated Benzenes
- Monocyclic aromatic hydrocarbons (MAHs)
- Polycyclic aromatic hydrocarbons (PAHs)
- Total Petroleum Hydrocarbons (TPHs)
- Phenolics
- Polychlorinated biphenyls (PCBs)
- Herbicides and Pesticides, and
- Volatile Organic Compounds (VOCs).

Sample concentrations from the Swing Basin were below the LOR. The laboratory limits of reporting were also below the NAGD screening levels, ANZECC guidelines and WDF criteria, therefore the results show that for the organic chemicals listed above, were acceptable.

2.0 CLOSURE

Testing by Golder demonstrates that there were no reported levels of contamination that exceeded the ANZECC guidelines.
3.0 Reference


Environmental Protection Authority (2013). Standards for the production and use of Waste Derived Fill. South Australia.


Appendix B

Development Consent Notification
South Australia – Sections 49 and 49A Development Act 1993

CROWN DEVELOPMENT AND PUBLIC INFRASTRUCTURE
AND
ELECTRICITY INFRASTRUCTURE DEVELOPMENT
DECISION NOTIFICATION FORM

Contact Officer: Reece Svetec / Lee Webb
Telephone: 8343 2950
KNET Reference: 12287203

Development Number: 010/V048/17

FOR DEVELOPMENT APPLICATION

DATED: 7 July 2017
REGISTERED ON: 12 July 2017

TO: Flinders Ports Pty Ltd.
296 St Vincent Street
PORT ADELAIDE SA 5015
EMAIL: Kolokas.lee@flindersports.com.au

LOCATION OF PROPOSED DEVELOPMENT:
Out of Council Land, Outer Harbor Channel, Gulf St Vincent

NATURE OF PROPOSED DEVELOPMENT: Dredging of the existing Outer Harbor channel and swing basin to widen the channel by approximately 40m (from 130m to 170m) for a distance of approximately 7km. The removal of 1.55 million m$^3$ of material to be placed off-shore at a designated placement area (7km x 5km) within the Gulf St Vincent.

From: MINISTER FOR PLANNING

I hereby APPROVE the above-mentioned application under the Development Act 1993.

You may therefore proceed in accordance with your plans, as submitted, subject to conditions as shown on the attached sheet.

Building works may commence only when a Certificate of Compliance with Building Rules has been received from a Private Certifier, subject to any conditions imposed by the Minister for Planning (or his delegate) and the Certifier.

Stephan Knoll
MINISTER FOR PLANNING
Date of Decision: 28 MAY 2018

Pages: 4
PLANNING CONDITIONS

1. That except where minor amendments may be required by other relevant Acts, or by conditions imposed by this application, the development shall be established in strict accordance with the details and following plans submitted in Development Application No 010/V048/17.
   - Outer Harbor Channel Widening Project DA Report – Addendum #1 prepared, by ARUP, Job no. 2532257-00, dated 13 September 2017.
   - Project Location, prepared by ARUP & BMT WBM, Revision A.
   - Dredge Material Placement Area location plan, prepared by ARUP & BMT WBM, Revision A.

2. The dredging methodology to be used must implement the 'no side casting of the Cutter Suction Dredger (CSD)' option presented in the Flinders Ports Pty Ltd Outer Harbor Channel Widening DA Report – Addendum #2 as prepared by ARUP Pty Ltd on 6 November 2017 or similar method that can achieve an equivalent (or better) environmental outcome.

3. Prior to the commencement of dredging works, an Environmental Monitoring Program (EMP) must be prepared (in consultation with the Coast Protection Board) to the reasonable satisfaction of the EPA. The EMP must be designed to demonstrate and validate the zones of seagrass Impact predicted in the hydrodynamic modelling documented in the Technical Memorandum prepared by BMT WBM on 23 October 2017 and incorporate, as a minimum, the monitoring of seagrass conditions using a 'before after control impact' (BACI) design measuring appropriate seagrass health metrics at an appropriate spatial and temporal frequency. The EMP must then be implemented.

4. Prior to the commencement of dredging works, a Dredge Management Plan (DMP) must be prepared and submitted to the reasonable satisfaction of the EPA which is designed to provide real time adaptive management of dredge plumes (incorporating 'alarm' and 'hold' triggers and management actions if triggers are exceeded) and incorporates, as a minimum, details about the following:
   a. The use of continuous (10 minute interval or similar) turbidity and light logging (using calibrated remote and telemetered instruments with self-cleaning capability).
   b. Water sampling (at an appropriate spatial and temporal frequency) to monitor total suspended solids (TSS) and chlorophyll to enable comprehensive seasonal calibration of relationships between other parameters.
   c. The use of probes or similar to monitor dissolved oxygen, pH, salinity, temperature (at an appropriate spatial and temporal frequency);
   d. Real-time access to telemetered stations so that raw data can be obtained in an appropriate electronic format.
   e. Monitors to confirm dumping activities are occurring within the designated area in real time.
   f. Implementation of additional mitigation measures for any dredging works undertaken between December to February.
   g. Appropriate management of Caulerpa taxifolia within the Outer Harbor shipping channel to ensure that dredging near the Outer Harbor breakwater and swing basin (where Caulerpa taxifolia infestations are known to occur) would not spread fragments of Caulerpa taxifolia throughout the nearshore marine environment.
   h. Measures to minimise the risk factors associated with the spread of Pacific Oyster Mortality Syndrome (POMS) outside the Port River Estuary. This component of the Plan shall be developed to the reasonable satisfaction of PIRSA Biosecurity SA and SARDI Aquatic Sciences.
5. Dredging works conducted in the vicinity of the Outer Harbor port entrance/passenger terminal must be undertaken during the day-time and at times of favourable weather conditions with respect to human noise sensitive receivers (i.e. receivers upwind of dredging works).

6. Piling works within 1600 metres of noise sensitive receivers must only occur between 7am to 7pm Monday to Saturday.

7. Piling works must not be undertaken on a Sunday.

8. Any piling works must be undertaken in accordance with the Department of Planning, Transport and Infrastructure Underwater Piling Guidelines (2012)

OBLIGATIONS PURSUANT TO THE DEVELOPMENT ACT 1993 AND DEVELOPMENT REGULATIONS 2008

i. Pursuant to Section 49(14) of the Development Act 1993 before any building work is undertaken, the building work is to be certified by a private certifier, or by some person determined by the Minister for the purposes of this provision, as complying with the provisions of the Building Rules (or the Building Rules as modified according to criteria prescribed by the Regulations).

ii. The development must be substantially commenced within two (2) years of the date of this Notification, unless this period has been extended by the Minister for Planning.

iii. You are also advised that any act or work authorised or required by this Notification must be completed within four (4) years of the date of the Notification unless this period is extended by Minister for Planning.

iv. You will require a fresh consent before commencing or continuing the development if you are unable to satisfy these requirements.

ADVISORY NOTES


b. At completion of the project all certified documents should be retained by the responsible agency for the life of the asset.

c. For additional information relating to certification of government building projects, contact Infrastructure Delivery, Department of Planning, Transport and Infrastructure (telephone 8343 2511) Level 1, 77 Grenfell Street, Adelaide, 5000.

d. Prior to the time period specified above, any request for an extension of time must be lodged with the Development Assessment Branch, Department of Planning, Transport and Infrastructure, GPO Box 1815 Adelaide SA 5001.

e. The applicant is reminded of its general environmental duty, as required by Section 25 of the Environment Protection Act 1993, to take all reasonable and practicable measures to ensure that the activities on the whole site, including during construction, do not pollute the environment in a way which causes or may cause environmental harm.

f. An environmental authorisation in the form of a licence is required for the operation of this development. The applicant is required to contact the Environment Protection Authority before acting on this approval to ascertain licensing requirements. Information on applying for a licence (including licence application forms) can be accessed here: http://www.epa.sa.gov.au/business_and_industry/applying_for_a_licence
g. EPA Information sheets, guidelines documents, codes of practice, technical bulletins etc. can be accessed on the following website: http://www.epa.sa.gov.au

h. The applicant is advised of the following requirements of the Historic Shipwrecks Act 1981, if works with the potential to impact on historic shipwreck remains are to proceed, a permit under the Historic Shipwrecks Act 1981 will be required. Permit conditions may include a detailed recording of shipwreck remains, establishing procedures to prevent damage to the identified shipwreck remains, archaeological recovery/relocation of shipwreck remains to a location outside of the development footprint, and/or monitoring of works to determine if undetected remains have been encountered during the works.

i. Seagrass is protected by the Native Vegetation Act 1991 and permission must be received from the Native Vegetation Council before any clearance can occur. In this instance, it’s likely that the clearance would be considered under the Native Vegetation Regulations in relation to the provision of Infrastructure. However, in order to approve clearance, it must be demonstrated that clearance has been minimised as much as practically possible and that there will be a Significant Environmental Benefit (SEB). In particular, the Native Vegetation Council will consider all the clearance that is reasonably likely to occur as a result of the development. This includes both direct clearance, such as the removal of vegetated sand through dredging and indirect impacts such as shading of seagrasses through the turbidity from the dredging. All of these impacts must be assessed and considered as part of an application to the Native Vegetation Council as well as the actions taken to avoid and minimise impacts. Such actions could include, but not limited to, dredging at an appropriate time when it will limit turbidity or the turbidity will have less impact on the seagrass, using equipment that will limit turbidity or undertaking other actions that will limit the effect of the turbidity.