BUNBURY PORT DEVELOPMENT
LONG TERM MONITORING AND MANAGEMENT PLAN
## DOCUMENT CONTROL

<table>
<thead>
<tr>
<th>Version Number</th>
<th>Description</th>
<th>Reviewed by</th>
<th>Approved by</th>
<th>Revision Date</th>
<th>Issue Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>New Document</td>
<td>Environmental Officer</td>
<td>Health Safety &amp; Environmental Manager</td>
<td>20/12/2012</td>
<td>20/12/2012</td>
</tr>
<tr>
<td>01</td>
<td>Document Reviewed</td>
<td>Environmental Officer</td>
<td>Health Safety &amp; Environmental Manager</td>
<td>09/11/2017</td>
<td>09/11/2017</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

## DOCUMENT CONTROL
- Document Owner: Environmental Officer
- Revision No: 01
- Revision Date: 09/11/2017

## LIST OF FIGURES
- Page 4

## LIST OF TABLES
- Page 5

## GLOSSARY
- Page 6

1. **INTRODUCTION AND BACKGROUND** .............................................. 7
   1.1. Purpose and context of this document ........................................ 7
   1.2. Regulatory framework ............................................................... 7
   1.2.1. Commonwealth .................................................................. 7
   1.2.2. State of Western Australia .................................................. 7
   1.3. Long Term Monitoring and Management Plan (LTMMP) ............... 7
   1.4. Responsibilities ...................................................................... 8
   1.5. Structure of the LTMMP ......................................................... 8
   1.6. SP-Bun Organisation Structure ................................................. 8

2. **THE PORT OF BUNBURY** ............................................................... 8
   2.1. Port Facilities .......................................................................... 8

3. **DREDGING AND SEA DUMPING REQUIREMENTS** ..................... 12
   3.1. Maintenance dredging .............................................................. 12
   3.1.1. History .................................................................................. 12
   3.1.2. Future maintenance dredging requirements ......................... 12
   3.1.3. Dredging methods ............................................................... 12
   3.1.4. Disposal of dredged material .............................................. 12
   3.2. Capital dredging .................................................................... 12
   3.2.1. History .................................................................................. 12
   3.2.2. Future capital dredging requirements .................................. 12
   3.2.3. Dredging methods ............................................................... 12
   3.2.4. Disposal of dredged material .............................................. 13

4. **EXISTING ENVIRONMENT AND POTENTIAL IMPACTS** ........... 13
   4.1. Existing environment .............................................................. 13
   4.1.1. Port and adjacent area benthic habitat .................................. 13
   4.1.2. Spoil ground ....................................................................... 13
   4.1.3. Bathymetry ........................................................................ 14
   4.1.4. Tides and currents .............................................................. 14
   4.1.5. Climate ............................................................................... 15
   4.1.6. Seabed sediments ............................................................... 17
   4.1.7. Water column ................................................................. 17
   4.2. Protected Areas and Matters of National Environmental Significance ........................................... 17
   4.2.1. Protected Areas (Marine Parks) ........................................... 17
4.2.2. Matters of National Environmental Significance ............................................ 17
4.2.3. Marine Threatened Species .............................................................................. 18
4.2.4. Marine migratory species.................................................................................. 19
4.2.5. Commercial, recreational and indigenous users of the area.......................... 21
4.3. Potential impacts .......................................................................................... 21
5. MANAGEMENT MEASURES AND CONTINGENCIES ................................. 23
5.1. Summary of Management measures .................................................................. 23
5.2. Review of Key Performance Indicators .............................................................. 30
5.3. Contingencies ............................................................................................... 30
6. SAMPLING AND ANALYSIS PLAN ................................................................. 30
7. WATER, SEDIMENT AND BIOTA MONITORING PROGRAMME .................. 30
  7.1. Aims and outline .......................................................................................... 30
  7.2. Methods ....................................................................................................... 31
  7.2.1. Sediment sampling ................................................................................... 31
  7.2.2. Seawater sampling ................................................................................... 31
  7.2.3. Biota sampling .......................................................................................... 31
  7.2.4. Particle Size Distribution by Laser Diffraction .......................................... 31
  7.2.5. Analyses .................................................................................................. 31
  7.3. Frequency .................................................................................................... 32
  7.4. Sampling locations ........................................................................................ 32
  7.5. Reporting and review .................................................................................... 32
  8. INVASIVE MARINE SPECIES SURVEILLANCE .......................................... 35
  8.1. Sampling Frequency ..................................................................................... 35
  8.2. Survey Locations .......................................................................................... 35
  8.3. Monitoring Sampling Methods ...................................................................... 37
  9. AUDITING, REPORTING AND CONTINUOUS IMPROVEMENT ................. 37
  10. REFERENCES ............................................................................................... 38
APPENDIX A .............................................................................................................. 39
APPENDIX B .............................................................................................................. 40
APPENDIX C ............................................................................................................. 41
LIST OF FIGURES

- Figure 1 Aerial photo of Bunbury Port 9
- Figure 2 Bunbury Port structure 10
- Figure 3 Spoil grounds used for sea dumping 14
- Figure 4 Bunbury annual 9 am and 3 pm wind climate 16
- Figure 5 Spatial distribution of sampling sites 34
- Figure 6 Inner Harbour sampling sites 34
- Figure 7 Outer Harbour survey location and survey methods used at each site 36
- Figure 8 Inner Harbour survey location and survey methods used at each site 36
- Figure 9 Spoil Ground survey location and survey methods used at each site 36
LIST OF TABLES

- Table 1 Berth Information 11
- Table 2 Bunbury climate 15
- Table 3 Marine threatened species within 10 km of the Port of Bunbury 18
- Table 4 Marine migratory species within 10 km of the Port of Bunbury 19
- Table 5 Management Measures 23
- Table 6 Sample containers, preservation, storage and transportation 31
- Table 7 Sampling Schedule 32
- Table 8 Sampling site coordinates 33
GLOSSARY

Clean Material  Material from locations distant from appreciable pollution sources (i.e. in pristine locations) as well as material composed largely (>95%) of gravel, sand or rock, but only where this material is found in areas of high current or wave energy, where the seabed consists of shifting gravel and sandbars.

Contaminant  A substance, inorganic or organic, present in the sediment at or near levels that could be toxic to some organisms.

Contaminated  Spoil is defined as contaminated if it contains contaminants of concern. Dredge sites will be classified as one of the following contamination levels: ‘probably contaminated’, ‘suspect’, or ‘probably clean’. Material is ‘probably contaminated’ if current data indicates the presence of contaminants of concern. Material is ‘suspect’ if the site is close to probably contaminated material or there is a new source of contamination since the previous testing. Material is ‘probably clean’ if current data indicates the absence of contaminants of concern or it is appreciably distant from potential pollution sources.

Contaminants of Concern  COC are those contaminants which exceed the background concentrations and the Screening Level and for which the bioavailability, bioaccumulation or toxicity assessments indicate that significant effects from the contaminants are likely. For COCs, definite action is required.

Contaminants of Potential Concern  COPC are those contaminants that exceed the background concentrations and the Screening Level (or elevated concentrations of contaminants for which guidelines do not exist). For COPCs, no immediate action may be required.

Currency of Data  Existing chemical or toxicity data for the sediments of the area to be dredged will have a maximum currency of five years, where there is no reason to believe that the contamination status has changed significantly, after which new data would need to be gathered. New data will be required where contamination of the site is likely to have increased or new pollution sources are present (such as a new industry or accidental spills). Information and data older than 5 years may be useful in some parts of an assessment to demonstrate trends over time.

Pristine Site  A location which is distant from, and unaffected by, anthropogenic contaminants.

Uncontaminated  Material is defined as uncontaminated for the purposes of sea disposal if it comes from a pristine environment, or it, after assessment, it contains no COCs.
1. INTRODUCTION AND BACKGROUND

1.1. Purpose and context of this document

This document describes the Long Term Monitoring and Management Plan (LTMMP) for continued maintenance dredging and potential capital dredging programmes associated with future harbour expansion projects, for the period 2012 to 2022.

This LTMMP for dredging and disposal supports the application to the Department of the Environment and Energy (DotEE) for a long-term Sea Dumping Permit for maintenance dredging under the Environment Protection (Sea Dumping) Act 1981 (Sea Dumping Act) for the same period.

This document is to be subject to review (every 5 years after 2022) and continual improvement over the life of this plan and the corresponding Sea Dumping Permit.

1.2. Regulatory framework

1.2.1. Commonwealth

In Australia, ocean disposal of dredged material both within and outside State and Territory waters is regulated by the Department of the Environment and Energy (DotEE) under the Environment Protection (Sea Dumping) Act 1981 and the National Assessment Guidelines for Dredging (NAGD) (CA 2009) and its subsequent versions. The development of these documents has been guided by the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (London Convention), and the more recent 1996 Protocol to the London Convention, to which Australia is a signatory. These agreements aim to prevent pollution of the sea from the dumping of wastes or other matter, including dredged material.

Management of the potential impacts of ocean disposal of dredged material includes a requirement for physical and chemical analysis of sediment to be dredged to identify whether the material is suitable for ocean disposal or requires special management. Choice of the disposal site must also be guided by physical, chemical and biological parameters, so that the potential impacts of sea disposal can be identified, minimised and monitored as appropriate.

1.2.2. State of Western Australia

Capital dredging programmes in Western Australia are subject to a formal environmental approval process involving the submission of documentation and public reviews. This process generally involves the Commonwealth Government when the Environmental Protection and Biodiversity Conservation Act (EPBC) process is triggered.

In addition, the Environmental Protection Authority of Western Australia (EPA) has released the Environmental Assessment Guideline for Marine Dredging Proposals (EAG7) (EPA 2011) which provides guidance for the State approval process. The guidelines are principally intended for capital dredging projects but may also apply to maintenance dredging projects. Specifically, this guideline sets out an approach by which predictive uncertainty can be taken into account by reflecting a target that the proponent aims to achieve using best practice approaches to dredging and its management. It also recommends proponents identify an outcome that they are confident of achieving using best practice even if things do not go well.

This framework also guides the development of efficient and cost-effective monitoring and management programmes that are linked to the predictions and that aim to keep impacts as low as practicable and ensure the environmental protection outcomes are achieved.

1.3. Long Term Monitoring and Management Plan (LTMMP)

It is the intention of this LTMMP to guide the management and monitoring of maintenance and possible capital dredging and ocean disposal activities over a period of ten years (approximately three maintenance dredging cycles). A dredging cycle may incorporate multiple dredging campaigns depending upon the availability of dredges and the size and complexity of the programme and the extent to which harbour areas are subject to sediment and sand accumulation due to seasonal variations.
1.4. Responsibilities

The Southern Ports - Bunbury (SP-Bun) is responsible for implementing the LTMMP. Where required, consultants will be engaged to undertake the data collection and monitoring programmes outlined in the LTMMP and to provide advice and interpretation of monitoring data.

1.5. Structure of the LTMMP

The LTMMP contains the following information:

A description of the Port of Bunbury and its surrounding environment

The history of maintenance and capital dredging and a description of dredging and disposal requirements for the life of the permit – see appendix B

A description of the spoil ground and rationale for its location

A dredge material management strategy

A sampling and analysis plan (SAP) for the characterisation of the material to be dredged prior to each dredging campaign – see appendix C

An outline of proposed management and monitoring of dredging and ocean disposal over the life of the plan

1.6. SP-Bun Organisation Structure

The person responsible for all aspects of this LTMMP including management measures associated with dredging and disposal is the Chief Executive Officer (CEO) through the Harbour Master who has day to day management responsibility for the planning, implementation and monitoring of dredging operations. Both aforementioned PoB Officers have accountabilities set out in State Legislation in the Port Authorities Act 1999. Technical and administrative support and advice is provided by the Health, Safety and Environment Manager who reports to the HSES General Manager.

2. THE PORT OF BUNBURY

2.1. Port Facilities

The Port of Bunbury is located in Koombana Bay on the south-western coast of Western Australia and is operated by the Southern Ports – Bunbury (SP-Bun). Sandy beaches extend to the north and south of the Port, with the Leschenault Estuary immediately north of the Port and a remnant of the estuary to the south with both these water bodies connected to Koombana Bay via man-made channels. These features are shown in the aerial photograph below (Figure 1).

The Port is divided into two primary commercial areas: the older Outer Harbour and the man-made Inner Harbour constructed in the 1970s. The Port has seven berths totalling 1,485 m in length capable of handling ships with an overall draft of up to 11.6 m in the Inner Harbour (Figure 2). Detailed information on the berths is provided in Table 1.

Further details of the history of the Port of Bunbury are contained in the document titled “Compilation and Review of Existing Information” (SKM 2010) which is a live document periodically updated as required.
Figure 1 Aerial photo of Bunbury Port

Taken August 2010
Figure 2 Bunbury Port structure
## Table 1 Berth Information

<table>
<thead>
<tr>
<th>Berth</th>
<th>Location</th>
<th>Construction</th>
<th>Dimensions</th>
<th>Imports</th>
<th>Exports</th>
</tr>
</thead>
</table>
| 1 and 2 | Outer Harbour Land backed berth with rubber fendering Concrete piles (3 deep) | Length 368 m  
Depth 8 – 9 m | Methanol (CH$_3$CH$_2$OH) | Mineral sands (TiO$_2$, FeTiO$_3$, FeTiO$_3$.TiO$_2$ & ZrO$_2$)  
Iron Concentrate  
Scrap metal  
Break bulk cargo |                                                                 |
| 3     | Inner Harbour  | Dolphin berth with metal faced rubber fendering Steel piles in clusters | Length 381 m  
Depth 11.6 m | Caustic soda (NaOH) | Woodchips  
Grain |
| 4     | Inner Harbour  | Dolphin berth with rubber or laminated metal fendering Vertical steel piles (4 deep) | Length 123 m  
Depth 11.6 m | Petroleum coke (C)  
Fertiliser (N:P:K plus trace metals Cd, Pb and Hg)  
Break bulk cargo  
Coal | Scrap metal  
Pine logs  
Iron Concentrate  
Mineral Sands |
| 5     | Inner Harbour  | Land backed berth with rubber fendering Vertical steel piles (4 deep) | Length 240 m  
Depth 11.6 m | Caustic soda (NaOH) | Alumina (Al$_2$O$_3$) |
| 6     | Inner Harbour  | Dolphin berth with rubber or laminated metal fendering Vertical steel piles in clusters | Length 123 m  
Depth 11.6 m | Caustic soda (NaOH) | Alumina (Al$_2$O$_3$) |
| 8     | Inner Harbour  | Land backed berth with rubber fendering Steel casings (4 deep) | Length 250 m  
Depth 11.6 m | Mineral sands (TiO$_2$, FeTiO$_3$, FeTiO$_3$.TiO$_2$ & ZrO$_2$)  
Silica sand (SiO$_2$)  
Spodumene (LiAlSi$_2$ O$_6$)  
Woodchips  
Copper sulphide concentrate  
Refined waste oil  
Bauxite | |
3. **DREDGING AND SEA DUMPING REQUIREMENTS**

3.1. **Maintenance dredging**

3.1.1. **History**

Further details of the historical dredging and disposal programmes of the Port of Bunbury are contained in appendix B of this document.

3.1.2. **Future maintenance dredging requirements**

Historically, the volume of material requiring dredging, principally from the Outer Harbour and Approach Channel, has been in the order of 200,000–300,000 m³ per year but undertaken triennially. The most recent maintenance dredging programme took place during April 2017 with approximately 91,000 m³ of material being disposed to the existing offshore Spoil Ground to maintain the Port’s declared depths.

The increased sand inundation of the Port’s Outer Harbour and shipping channel appears to be as a result of increased coastal processes transporting sand around Point McKenna due to the sand traps created by groynes being full and thus being bypassed. At present there appears to be no solution to this other than to regularly remove the sand by dredging and transporting it to the spoil ground.

Recent hydrographic surveys have demonstrated that the inundation of the Outer Harbour and Approach Channel is continuing and, as a result, the annual volume of material requiring dredging has significantly increased. It is estimated that the Port may require the removal of up to 700,000 m³ from the Outer Harbour and Approach Channel annually to maintain declared depths and ensure shipping safety. This is more than double the historical requirement.

3.1.3. **Dredging methods**

Maintenance dredging of the fine to coarse sanding sediments of the Inner and Outer Harbours and the Shipping Channel is best achieved using a trailer suction hopper dredge (TSHD). The method has been employed on all maintenance dredging programmes in the past and will be used for all future programmes. In addition, a “sweep bar” will be used to remove any high spots left after dredging. In recent times, the shipping channel has been cleared of accumulated wrack prior to dredging using a net trawling method.

3.1.4. **Disposal of dredged material**

Spoil would continue to be disposed to the existing spoil ground until such time as there is insufficient capacity. Based on the present rate of disposal predictions indicate that the spoil ground has at least two decades of capacity for maintenance dredging.

3.2. **Capital dredging**

3.2.1. **History**

Further details of the historical dredging and disposal programmes of the Port of Bunbury are contained in appendix 2 of this document.

3.2.2. **Future capital dredging requirements**

At this stage capital dredging for a future proposed development of the Inner Harbour area is considered within the Strategic Public Environmental Review (SPER) document.

3.2.3. **Dredging methods**

If and when capital dredging is progressed it may necessitate the removal of portions of the underlying basalt layer by rock fracturing techniques. This is considered within the Strategic Public Environmental Review (SPER) document.
3.2.4. Disposal of dredged material

Disposal of the basalt material removed from the Inner Harbour would be assessed at the time of seeking environmental approval from the Western Australian EPA and would consider, but would not be limited to, the following or a combination of the following:

Sea disposal to the existing spoil ground;
Sea disposal to a new spoil ground;
Sea disposal as part of artificial reef creation;
Reuse as structural material for the Inner Harbour or other Port infrastructure; and
Recycling by crushing on land for sale.

Note that a separate approval under the Sea Dumping Act may be required if the dredge material is to be used for the creation of an artificial reef.

4. EXISTING ENVIRONMENT AND POTENTIAL IMPACTS

4.1. Existing environment

4.1.1. Port and adjacent area benthic habitat

The seabed in the region of the Port of Bunbury was surveyed and mapped in detail for benthic habitat during 2011 in association with a proposed Inner Harbour berth development. In addition, a significant amount of seabed survey work has been undertaken over the past two decades associated with spoil ground site selection, monitoring programmes and dredging investigations. The benthic habitat in the region is discussed further in the SPER Technical Investigations Benthic Habitat – GHD, December 2014 and Bunbury Port Berth 14 Expansion and Coal Storage and Loading facility Technical Report 5: Benthic Habitats near Bunbury, Western Australia – Wave Solutions October 2012.

4.1.2. Spoil ground

The existing spoil ground has been in use since at least 1976. The spoil ground was originally 1,000 m long north to south and 400 m wide east to west and was located, in part, inshore of the present spoil ground location (see red dotted rectangle in (Figure 3). The bounding coordinates for the existing spoil ground are:

- NW corner: 33° 15.70’ South 115° 39.25’ East
- NE corner: 33° 15.70’ South 115° 39.65’ East
- SE corner: 33° 16.80’ South 115° 39.65’ East
- SW corner: 33° 16.80’ South 115° 39.25’ East

Datum is GDA94
Figure 3 Spoil grounds used for sea dumping

Note: Historical spoil grounds to the south of the existing spoil ground are referred to as the southern spoil grounds. The chart is presently being amended to remove these spoil grounds as they are no longer used.

The red dashed area represents an earlier historical disposal area.

Source: AUS0115 Approaches to Bunbury.

4.1.3. Bathymetry

The Port is located within Koombana Bay which is a relatively shallow embayment (5–10 m) and protected by McKenna Point (see Figure 3). The Shipping Channel, which runs through Koombana Bay to the Inner Harbour, has a maintained depth of at least 12.2 m. The Outer and Inner Harbours have maintained depths of 9.1 m and 12.2 m respectively. To the north of the Port the Spoil Ground lies offshore and is surrounded by a flat featureless seabed with water depths of 10–14 m. Further west the water depth gradually increases to 19–20 m.

4.1.4. Tides and currents

The tidal regime of the Bunbury region is diurnal meaning that there is one high and one low tide each 24 hour period. The highest astronomical tide (HAT) is 1.2 m and the lowest astronomical tide (LAT) is 0.4 m thus the tidal range is 0.8 m and mean sea level (MSL) is...
0.6 m. The SP-Bun has tide gauges on the outer most channel marker Beacon 3 and at Beacon 10 in Koombana Bay.

The tides in the region are small and have negligible effect on the prevailing currents. The main current is predominantly to the north and results from the inshore Capes Current which dominates the Leeuwin Current. This current varies seasonally, having a southward movement in autumn and winter and a general northward tendency during the summer months (Rochford, 1969; Cresswell et al., 1989).

### 4.1.5. Climate

The Bunbury region has a Mediterranean climate meaning that it is characterised by warm to hot, dry summers and mild to cool, wet winters. The average monthly temperature and precipitation ranges are provided in Table 2 below.

<table>
<thead>
<tr>
<th>Month</th>
<th>Year</th>
<th>Average High (°C)</th>
<th>Average Low (°C)</th>
<th>Precipitation (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>29.6</td>
<td>15.2</td>
<td>13.0</td>
<td>147.5</td>
</tr>
<tr>
<td>Feb</td>
<td>30.0</td>
<td>15.8</td>
<td>6.4</td>
<td>148.4</td>
</tr>
<tr>
<td>Mar</td>
<td>27.7</td>
<td>14.2</td>
<td>15.0</td>
<td>4117.7</td>
</tr>
<tr>
<td>Apr</td>
<td>24.1</td>
<td>11.6</td>
<td>36.0</td>
<td>79.0</td>
</tr>
<tr>
<td>May</td>
<td>21.1</td>
<td>9.4</td>
<td>91.6</td>
<td>24.7</td>
</tr>
<tr>
<td>Jun</td>
<td>18.4</td>
<td>7.9</td>
<td>147.5</td>
<td>15.2</td>
</tr>
<tr>
<td>Jul</td>
<td>17.2</td>
<td>7.1</td>
<td>148.4</td>
<td>730.2</td>
</tr>
<tr>
<td>Aug</td>
<td>17.5</td>
<td>8.4</td>
<td>4117.7</td>
<td></td>
</tr>
<tr>
<td>Sep</td>
<td>18.3</td>
<td>9.1</td>
<td>79.0</td>
<td></td>
</tr>
<tr>
<td>Oct</td>
<td>20.8</td>
<td>12.1</td>
<td>24.7</td>
<td></td>
</tr>
<tr>
<td>Nov</td>
<td>24.3</td>
<td>13.3</td>
<td>15.2</td>
<td></td>
</tr>
<tr>
<td>Dec</td>
<td>27.2</td>
<td>11.0</td>
<td>730.2</td>
<td></td>
</tr>
</tbody>
</table>


The summer wind climate is characteristically south easterly to easterly winds in the morning and sea breezes (south westers) in the afternoon as depicted in the annual wind roses provided in Figure 4. The main driving force for wave action in all seasons is wind; however, there are periodic swell waves which are generated much further to the south-west and impact on the region due to the absence of offshore bathymetric conditions which would attenuate such wave activity. Wind and wave activity is measured on the outer most shipping channel marker Beacon 3 and at Beacon 10 in Koombana Bay.
Figure 4 Bunbury annual 9 am and 3 pm wind climate

4.1.6. Seabed sediments
Sediments in the region of the Port vary considerably depending upon depth of water and exposure to hydrodynamic conditions. Within the Inner Harbour the area has been dredged to the level of the underlying basalt bedrock and there are only thin layers of silt (<10 cm) which are derived from material carried in by wave activity along the Shipping Channel. Koombana Bay has shallow sandy surficial sediments (<1 m) low in organic content. The Shipping Channel and Outer Harbour berth areas often accumulate considerable quantities of drift algae and seagrass wrack which decomposes and adds organic content and fine silt to the sediments. The Spoil Ground is located in an area of considerable hydrodynamic activity which results in sediment erosion. Seabed sediments in this area are transported shoreward and northwards and contribute to beach renourishment.

4.1.7. Water column
The water column in and adjacent to the Port is well mixed as a result of wind and wave action thus there is negligible potential for stratification. However, as a result of these hydrodynamic conditions, the water is often turbid and it is only in very calm conditions that the water column clears resulting in vertical visibility approaching 10 m.

4.2. Protected Areas and Matters of National Environmental Significance

4.2.1. Protected Areas (Marine Parks)
There are no protected areas or marine parks within 50 km of the Port. The closest marine park to the north is the Shoalwater Marine Park over 100 km to the north of the Port of Bunbury. The closest marine park to the south is the Geographe Commonwealth Marine Reserve declared in November 2012 under transitional arrangements until management plans come into effect in July 2014. The Walpole and Normalup Inlets Marine Park is more than 200 km from Bunbury. The proposed Ngari Capes Marine Park is approximately 60 km south of Bunbury although it has not been approved and the Western Australian government presently has a hold on any new marine parks.

4.2.2. Matters of National Environmental Significance
The eight matters of national environmental significance protected under the EPBC Act are listed below along with the significance based on the Commonwealth of Australia Protected Matters Search Tool within 10 km of the Port of Bunbury:

- World heritage properties: None
- National heritage places: None
- Wetlands of international importance (listed under the Ramsar Convention): None
- Listed threatened species and ecological communities: 39 species
- Migratory species protected under international agreements: 29 species
- Commonwealth marine areas: Relevant
- The Great Barrier Reef Marine Park: None
- Nuclear actions (including uranium mines): None
4.2.3. Marine Threatened Species

Of the 39 threatened species listed for the area, 23 are marine species and of them only six are known to occur or are likely to occur in the area. These species are provided in Table 3 below.

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Common Name</th>
<th>Status</th>
<th>Presence in area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishes:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carcharias taurus</td>
<td>Grey Nurse Shark</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Carcharodon carcharias</td>
<td>Great White Shark</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Rhincodon typus</td>
<td>Whale Shark</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Reptiles:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caretta caretta</td>
<td>Loggerhead Turtle</td>
<td>Endangered foraging, feeding or related behaviour</td>
<td>Known to occur</td>
</tr>
<tr>
<td>Chelonia mydas</td>
<td>Green Turtle</td>
<td>Vulnerable species or species habitat</td>
<td>Likely to occur</td>
</tr>
<tr>
<td>Dermochelys coriacea</td>
<td>Leatherback Turtle</td>
<td>Endangered species or species habitat</td>
<td>Likely to occur</td>
</tr>
<tr>
<td>Birds:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anous tenuirostris melanops</td>
<td>Australian Lesser Noddy</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Diomedea exulans amsterdamensis</td>
<td>Amsterdam Albatross</td>
<td>Endangered species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Diomedea exulans exulans</td>
<td>Tristan Albatross</td>
<td>Endangered foraging, feeding or related behaviour</td>
<td>May occur</td>
</tr>
<tr>
<td>Diomedea exulans gibsoni</td>
<td>Gibson's Albatross</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Diomedea exulans (sensu lato)</td>
<td>Wandering Albatross</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Macronectes giganteus</td>
<td>Southern Giant-Petrel</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Halobaena caerulea</td>
<td>Blue Petrel</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
</tbody>
</table>
### Marine Migratory Species

Of the 29 migratory species listed for the area, 23 are marine species only five are known to occur or are likely to occur in the area. These species are provided in **Table 4** below.

#### Table 4 Marine migratory species within 10 km of the Port of Bunbury

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Common Name</th>
<th>Status</th>
<th>Presence in area</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Macronectes halli</em></td>
<td>Northern Giant-Petrel</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td><em>Pterodroma mollis</em></td>
<td>Soft-plumaged Petrel</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td><em>Sternula nereis nereis</em></td>
<td>Fairy Tern (Australian)</td>
<td>Vulnerable species or species habitat</td>
<td>Likely to occur</td>
</tr>
<tr>
<td><em>Thalassarche carteri</em></td>
<td>Indian Yellow-nosed Albatross</td>
<td>Vulnerable foraging, feeding or related behaviour</td>
<td>May occur</td>
</tr>
<tr>
<td><em>Thalassarche cauta cauta</em></td>
<td>Shy Albatross</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td><em>Thalassarche melanophris</em></td>
<td>Black-browed Albatross</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td><em>Balaenoptera musculus</em></td>
<td>Blue Whale</td>
<td>Endangered species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td><em>Eubalaena australis</em></td>
<td>Southern Right Whale</td>
<td>Endangered species or species habitat</td>
<td>Known to occur</td>
</tr>
<tr>
<td><em>Megaptera novaeangliae</em></td>
<td>Humpback Whale</td>
<td>Vulnerable congregation or aggregation</td>
<td>Known to occur</td>
</tr>
<tr>
<td><em>Neophoca cinerea</em></td>
<td>Australian Sea-lion</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Species Name</td>
<td>Common Name</td>
<td>Status</td>
<td>Presence in area</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------------------------</td>
<td>---------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td><em>Haliaeetus leucogaster</em></td>
<td>White-bellied Sea-Eagle</td>
<td>Species or species habitat</td>
<td>Likely to occur</td>
</tr>
<tr>
<td><strong>Reptiles:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caretta caretta</td>
<td>Loggerhead Turtle</td>
<td>Endangered foraging, feeding or related behaviour</td>
<td>Known to occur</td>
</tr>
<tr>
<td>Chelonia mydas</td>
<td>Green Turtle</td>
<td>Vulnerable species or species habitat</td>
<td>Likely to occur</td>
</tr>
<tr>
<td>Dermochelys coriacea</td>
<td>Leatherback Turtle</td>
<td>Endangered Species or species habitat</td>
<td>Likely to occur</td>
</tr>
<tr>
<td><strong>Birds:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diomedea amsterdamensis</td>
<td>Amsterdam Albatross</td>
<td>Endangered species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Diomedea dabbenena</td>
<td>Tristan Albatross</td>
<td>Endangered foraging, feeding or related behaviour</td>
<td>May occur</td>
</tr>
<tr>
<td>Diomedea exulans (sensu lato)</td>
<td>Wandering Albatross</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Diomedea gibsoni</td>
<td>Gibson's Albatross</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Macronectes giganteus</td>
<td>Southern Giant-Petrel</td>
<td>Endangered species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Macronectes halli</td>
<td>Northern Giant-Petrel</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Thalassarche carteri</td>
<td>Indian Yellow-nosed Albatross</td>
<td>Vulnerable foraging, feeding or related behaviour</td>
<td>May occur</td>
</tr>
<tr>
<td>Thalassarche cauta (sensu stricto)</td>
<td>Shy Albatross</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Thalassarche chlororhynchos</td>
<td>Yellow-nosed Albatross</td>
<td>Vulnerable foraging, feeding or related behaviour</td>
<td>May occur</td>
</tr>
<tr>
<td>Thalassarche melanophris</td>
<td>Black-browed Albatross</td>
<td>Vulnerable species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td>Species Name</td>
<td>Common Name</td>
<td>Status</td>
<td>Presence in area</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------</td>
<td>---------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td><strong>Mammals:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Balaenoptera edeni</em></td>
<td>Bryde’s Whale</td>
<td>Species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td><em>Balaenoptera musculus</em></td>
<td>Blue Whale</td>
<td>Endangered species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td><em>Caperea marginata</em></td>
<td>Pygmy Right Whale</td>
<td>Species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td><em>Eubalaena australis</em></td>
<td>Southern Right Whale</td>
<td>Endangered species or species habitat</td>
<td>Known to occur</td>
</tr>
<tr>
<td><em>Lagenorhynchus obscurus</em></td>
<td>Dusky Dolphin</td>
<td>Species or species habitat</td>
<td>May occur</td>
</tr>
<tr>
<td><em>Megaptera novaeangliae</em></td>
<td>Humpback Whale</td>
<td>Vulnerable congregation or aggregation</td>
<td>Known to occur</td>
</tr>
<tr>
<td><em>Orcinus orca</em></td>
<td>Killer Whale, Orca</td>
<td>Species or species habitat</td>
<td>May occur</td>
</tr>
</tbody>
</table>

4.2.5. Commercial, recreational and indigenous users of the area

There is no commercial or recreational fishing permitted within the Inner and Outer Harbours due to safety constraints with shipping operations in such enclosed spaces. Recreational diving takes place in the region but this is many kilometres from the Port and Spoil Ground. The closest recreational dive site to the Port is the scuttled vessel Lena approximately nine km south-west of McKenna Point.

There are a number of private vessels which moor at the Casuarina Boat Harbour at the western side of Koombana Bay. A small number of these vessels are commercial fishing vessels which operate well outside the Port limits. The Dolphin Discovery Centre operates out of premises located on the southern shoreline of Koombana Bay and takes tourists into Koombana Bay to see the local dolphins. While there are no specific fishing rights for local indigenous or other groups within the Port areas, limited recreational fishing and crabbing does take place within port waters away from Berth areas. These activities are rarely compromised by port operations including shipping movements.

The Bunbury Sailing Club conducts events within Port waters but these events are not impacted by dredging operations.

4.3. Potential impacts

The potential impacts of dredging and spoil disposal to sea are as follows:

**Water Quality:** Turbidity monitoring during two previous disposal programmes has shown that minor effects outside the Port areas where dredging took place and at the Spoil Ground when compared to reference locations. Any changes were of a short-term nature and water quality returned to pre-disturbance conditions within days. The dredge spoil has no bioavailable contaminants and as such does not pose a threat to the area. Nutrients in the spoil are in an organic form that will be released upon decomposition, similar to that which occurs in the area through natural decomposition of seagrass and algal wrack. Oxygen depletion, if any, would be localised and short-term.
**Sediment Quality:** Previous monitoring has shown that the footprint of impact from disposal is contained within the Spoil Ground boundary. Monitoring has also demonstrated that contaminant levels on the Spoil Ground are within the ANZECC/ARMCANZ guidelines applied to Spoil Grounds.

**Flora and Fauna:** The impact of smothering is generally accepted for Spoil Grounds and monitoring of infauna has documented some recovery after dumping events; however, impacts outside the spoil ground were not significant. The substrate has changed little over time due to the dispersive nature of the Spoil Ground. There are no seagrass meadows within the area of impact. Dolphins which inhabit the Port area appear to be unaffected by Port operations and are not harmed in any way. The same is true for migrating whale populations.

**Invasive Marine Species Translocation:** The potential for translocation of marine pest species is low. The species present in the Port of Bunbury have not been found to successfully colonise the spoil ground and are unlikely to do so. The potential for increased predation and/or loss of habitat is negligible in the area. The disposal of spoil does not affect predation because it provides no change to habitat complexity and thus does not alter the community structure for prey or predators. There is no sensitive habitat in the region of the Spoil Ground and, as such, there will be no loss of available habitat. The habitat offered by the Spoil Ground itself will not be significantly altered from its present character. Invasive Marine Species surveys are conducted biennially within the Port, adjacent areas of Koombana Bay and at the Spoil Ground.

**Other Users of the Area:** The social value of the Port area and areas immediately surrounding it are important to the residents of the Bunbury area as it has been for many decades. Southern Ports - Bunbury understands this and works well with the local community to ensure that there is a good flow of information regarding port activities and in particular when dredging is to occur. There has been no history of adverse public reaction to dredging as it is well accepted by the community as part of ensuring the continued viability of the Port. There is no scuba diving value in the vicinity of the Port or spoil ground due to the absence of seabed features.
5. MANAGEMENT MEASURES AND CONTINGENCIES

This section of the LTMMP outlines the management measures contingencies to be employed to manage where practicable to do so the quality and quantity of the dredged material generated at the Port of Bunbury. This is a key aspect of managing the potential impacts of dredging and dredged material disposal and focuses on the following aspects:

Targeted of dredging campaigns
Minimisation of dredging requirements in new development areas of the Port
Reuse or recycling of dredged material
Improvement of sediment quality
Minimisation of impacts adjacent to the disposal ground

5.1. Summary of Management measures

- Table 5 Management Measures

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Aims</th>
<th>Management Measures</th>
<th>Key Performance Indicators</th>
</tr>
</thead>
</table>
| Targeted dredging campaigns – SP-Bun will attempt to better target its dredging campaigns at the Port of Bunbury by focussing on those areas of the Port subjected to the most frequent inundation | - To undertake dredging effectively at the Port of Bunbury.  
- To concentrate on the sand trap areas to increase their capture capacity an attempt to reduce future dredging requirement from the outset | - Investigation of the coastal processes that are leading to the increased deposition of sand in the Outer Harbour and recommendation for mitigation strategies.  
- Dredge closer into silt pockets and sediment traps where possible to increase the capture capacity of these traps.  
- Minimise overflow dredging where ever practicable to do so.  
- Ensure best practice dredging methods to improve | - The % volume of sand as opposed to water carted to the spoil ground per sea dumping cycle.  
- Cost of dredging per annum (as an average) (including dredge, hydrographic soundings etc).  
- Length of time that declared drafts are maintained. |
<table>
<thead>
<tr>
<th>Aspects</th>
<th>Aims</th>
<th>Management Measures</th>
<th>Key Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimisation of dredging requirements in new development areas of the Port – SP-Bun will attempt to minimise dredging requirements at the Port of Bunbury.</td>
<td>To minimise the amount of maintenance dredging required at the Port.</td>
<td>Ensure best practice dredging methods to improve efficiency of dredging and reduce future large scale dredging requirements.</td>
<td>Amount of material dredged per annum (as an average).</td>
</tr>
<tr>
<td></td>
<td>To consider maintenance dredging requirements in all port planning and development in an attempt to reduce future dredging requirement from the outset.</td>
<td>Undertake research where necessary to gain an improved understanding of siltation rates and sediment movements at the Port of Bunbury.</td>
<td>Cost of dredging per annum (as an average) (including dredge, hydrographic soundings etc).</td>
</tr>
<tr>
<td></td>
<td>Wrack removal from the Shipping Channel annually to slow sand entrapment and build up.</td>
<td>Investigation of the coastal processes that are leading to the increased deposition of sand in the Outer Harbour and recommendation for mitigation strategies.</td>
<td>Length of time that declared drafts are maintained.</td>
</tr>
<tr>
<td></td>
<td>Utilise silt pockets and sediment traps where possible to prevent siltation in operationally important areas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspects</td>
<td>Aims</td>
<td>Management Measures</td>
<td>Key Performance Indicators</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
<td>---------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Reuse or recycling of dredged material - Where economically feasible and when the dredge material has such physical and chemical characteristics that it is fit to be used for other purposes, SP-Bun will attempt to reuse dredged material to reduce the volumes disposed in the disposal ground. This will have the added benefit of reducing the requirement to import fill and extending the life of the existing spoil ground. However, reuse of clean sand will need to be balanced against the need to ensure that not too much sand is removed from the coastal process such that it results in regression of the shoreline on the Leschenault Peninsula.</td>
<td>To reuse dredged material onshore if suitable and where economically feasible. To reduce volumes of dredged material disposed at the disposal ground where economically feasible.</td>
<td>Improved understanding of siltation rates and sediment movements at the Port of Bunbury. Incorporate long term dredging requirements into all development proposal assessments.</td>
<td>Percentage of dredged material that can be reused in each dredging campaign. Life of the disposal ground.</td>
</tr>
<tr>
<td>Assess composition of dredged material prior to dredging to determine whether it can economically and sustainably be utilised onshore for reclamation or other purposes. Where material can be disposed of onshore, include requirements for capability for onshore and offshore disposal in dredging tenders. If material is to be disposed of onshore, management of return waters is to be undertaken to reduce turbidity and contaminant concentrations.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspects</td>
<td>Aims</td>
<td>Management Measures</td>
<td>Key Performance Indicators</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
<td>----------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Improvement of sediment quality – SP-Bun will seek to implement measures to improve the quality of the sediment to be dredged. This will reduce the risk of sediment being assessed as unsuitable for unconfined ocean disposal.</td>
<td>To reduce the level of contamination within the sediments to be dredged. To reduce the potential for new contamination within the sediments to be dredged. To minimise the risk of sediment being assessed as unsuitable for unconfined ocean disposal.</td>
<td>Implement the SP-Bun Environmental Management System (Appendix A) which contains a number of controls that will contribute to reducing the introduction of contaminants into sediments. Ensure implementation of appropriate dust controls on conveyors and ship loaders. Ensure implementation of storm and wash down water controls on wharves to minimise contaminated runoff into the marine environment. Prevent hosing of excess product from ship decks into surrounding waters. Ensure emergency response procedures are in place for incidents during ship loading and unloading so that spillage of product is minimised. Do not allow sediments to build up over long periods in areas that are known to be at risk of contamination. Ongoing training of SP-Bun staff and Port users in oil and</td>
<td>Contaminant levels in sediment compared to previous sampling programmes. Contaminant levels in sediment compared with reference sites. Suitability of sediments for unconfined ocean disposal.</td>
</tr>
<tr>
<td>Aspects</td>
<td>Aims</td>
<td>Management Measures</td>
<td>Key Performance Indicators</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Minimisation of impacts on the spoil ground – SP-Bun will minimise the impacts of dredged material disposal on the spoil ground.</td>
<td>To minimise the impacts of dredged material disposal on water quality, sediment quality and the marine communities on and adjacent to the spoil ground.</td>
<td>chemical spill response and clean-up procedures.</td>
<td>Sediments disposed in disposal ground are assessed as suitable for ocean disposal under the requirements of the (NAGD) and its subsequent versions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HAZID / Risk analysis of existing and proposed products exported or imported through the Port to ensure that adequate risk management strategies and controls are in place to prevent environmental impacts.</td>
<td>Turbid plumes do not impact on any future identified sensitive marine environments.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dredged material will be evenly disposed throughout the disposal ground to achieve the minimum possible depth.</td>
<td>Contaminants such as TBT placed and buried on the spoil ground stay within the boundaries of the spoil ground.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Undertake bathymetric surveys pre and post dredging to determine depth and location of dredged material deposition.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimise the volume of dredged material disposed at the disposal ground (see Section 5.1.1).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Undertake sampling and analysis of the material to be dredged prior to disposal and assess suitability for disposal in accordance with the National Assessment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspects</td>
<td>Aims</td>
<td>Management Measures</td>
<td>Key Performance Indicators</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Improvement to understanding of dredging and disposal impacts – SP-Bun | To implement a long term monitoring programme to fill the current gaps in knowledge regarding the pathways (sediment, water and biota) of Port related contaminants | Guidelines for Dredging (NAGD) and its subsequent versions.  
|                                                                        |                                                                      | ▪ Utilise best practice dredging technology including reducing overflow for the reduction of turbid plumes.  
|                                                                        |                                                                      | ▪ Ensure that turbid plumes do not impact on any future identified sensitive marine environments.  
|                                                                        |                                                                      | ▪ Central burial of contaminated material such as TBT beneath clean material with approval.  
|                                                                        |                                                                      | ▪ Undertake baseline surveys to fill information gaps regarding marine communities.  
|                                                                        |                                                                      | ▪ Undertake sediment, water quality and biota monitoring on a regular basis.  
|                                                                        |                                                                      | ▪ Undertake hydrodynamic modelling to quantify sediment deposition and remobilisation, the capacity and stability of the disposal ground and the migration of turbid plumes.  
|                                                                        |                                                                      | ▪ Improved level of information regarding the extent, composition and condition of the marine environment within and adjacent to the Port.  
<p>|                                                                        |                                                                      | ▪ Quantification of sediment dynamics in the region, including the ability to model the movement of turbid plumes during dredging and disposal.  |</p>
<table>
<thead>
<tr>
<th>Aspects</th>
<th>Aims</th>
<th>Management Measures</th>
<th>Key Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management of contaminated material – SP-Bun will manage identified</td>
<td>Identify and remove contaminated material from the Port in a manner that</td>
<td>Undertake sediment sampling and analysis in accordance with the Sampling and Analysis</td>
<td>Removal of contaminated material from the Port.</td>
</tr>
<tr>
<td>contaminated material from the Port and dispose it in a manner that</td>
<td>does not result in environmental harm.</td>
<td>Plan (see Section 6) prior to each round of maintenance dredging.</td>
<td>Containment or treatment of contaminated material to prevent environmental harm.</td>
</tr>
<tr>
<td>does not result in environmental harm.</td>
<td></td>
<td>- Remove material that is identified as unsuitable for unconfined ocean disposal and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>dispose either in a confined ocean disposal area or on land with the appropriate water</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>quality controls in place</td>
<td></td>
</tr>
</tbody>
</table>
5.2. Review of Key Performance Indicators

The SP-Bun has developed and implemented an Environmental Management System (EMS) to meet ISO 14001 requirements. The EMS contains the SP-Bunbury Environmental Policy which commits the Port to continual improvement and the prevention of pollution and putting in place a framework for setting and reviewing environmental objectives and key performance indicators including those that will form part of the LTMMP. The Environmental Policy is available for viewing on the Southern Ports website (www.southernports.com.au). The EMS requires periodic review of the system by SP-Bun senior management including a review of the discrete programmes and plans that comprise the Environmental Management Programme Hierarchy.

The LTMMP will be reviewed periodically and consultants will also be engaged as required to ensure sufficient technical expertise and experience is available to ensure the objectives of the LTMMP are being met and that opportunities for improvement are identified.

5.3. Contingencies

Dredging at the Port has taken place on a regular basis for several decades and to date no impacts to the planning or implementation of sampling or monitoring has taken place that required any contingencies. The weather and sea-state in Bunbury does not adversely affect field programmes due to the relatively protected nature of the majority of the Port environment. In addition, the SP-Bun is at this time the only proponent for dredging and disposal at the Port and as such does not require contingencies for cumulative impacts by other users.

The activities of the commercial users of the Port are continually being assessed and the routine monitoring programme implemented by SP-Bun is aimed at detecting changes to seawater, sediment and biota quality. Changes that could impact on the ability to dredge or sea dump, would be immediately addressed and the necessary action taken to rectify the situation on a case by case basis.

6. SAMPLING AND ANALYSIS PLAN

The development of Sampling Analysis Plan (SAP) has been based upon the National Assessment Guidelines for Dredging (NAGD) (CA 2009). The full details of the sampling programme are outlined in Appendix C of this document.

Characterisation of the potential contaminants in material to be removed from the proposed dredge area will be made by comparing analytical results of sediments with the screening sediment contaminant levels detailed in the NAGD (CA 2009).

7. WATER, SEDIMENT AND BIOTA MONITORING PROGRAMME

7.1. Aims and outline

Numerous sediment surveys have detected metal/metalloid and organic (TBT, PAH and TPH) contaminant concentrations near the screening level and arsenic above screening level. In addition, with the expansion of the Port users to include export of copper sulphide concentrate the aims of this monitoring programme are to document:

Changes in contaminant concentrations over time.

Differentiation of natural versus anthropogenic changes in contaminant concentrations.

The spatial extent of any anthropogenic changes to contaminant concentrations.

Changes in TBT (normalised to 1% TOC) concentrations over time.
7.2. Methods

7.2.1. Sediment sampling

Single sediment samples will be collected at each of 17 sites within the Port (Inner Harbour including two sites in the Casting Basin, Outer Harbour, Area B and Shipping Channel) and at threeReference sites outside of the Port. At each site, sediment cores will be collected by a van Veen grab with the top 2cm sub sampled from the undisturbed sediment. The sampling sites will be spatially arranged as shown in Figure 5 and Figure 15.

7.2.2. Seawater sampling

Surface (within 0.5 m of the water surface) and bottom (0.5 m above the seabed) seawater samples were collected at 14 sites using a submersible pump, which was comprised of five sites in the Inner Harbour including the Casting Basin, Outer Harbour, Area B and the Shipping Channel as well as at three reference sites outside of the Port.

7.2.3. Biota sampling

Biota sampling will involve the collection of molluscs due to the fact that they bioaccumulate metals from the environment through filtration of seawater and also pick up particulate material such as sediment that is suspended by discharges and sediment resuspension by ships. The preferred biomonitoring organisms for metals are molluscs such as the blue mussel (*Mytilus edulis*). The usual reference site for mussel sampling (Beacon 3) was not initially suitable for collecting mussels when it was replaced in 2011 as it has minimal growth on it. The next closest available site, with enough mussel growth was Channel Marker 6 (1.5 km SSE of Beacon 3), Replicate samples (two) of mussels will be harvested from this site. If the numbers are limited, deployment of mussels obtained from mussel farms may be required. If deployment is required, mussels in cages will be deployed at two locations at each of three berths (Berth 5, 6 and 8).

7.2.4. Particle Size Distribution by Laser Diffraction

Particle Size Distribution (PSD) will be carried out by the Marine and Freshwater Research Laboratory (NATA 10603) using a Malvern Mastersizer 3000 Laser Diffraction instrument for size fractions up to 500 μm and with wet sieving techniques for larger size fractions. Grain size classification is grouped according to Mudroch et al. 1997.

7.2.5. Analyses

Samples will be analysed for the parameters as indicated in Table 6.

<table>
<thead>
<tr>
<th>Matrix</th>
<th>Parameter</th>
<th>Sites Inner Harbour</th>
<th>Outer Harbour</th>
<th>Area B</th>
<th>Approach Channel</th>
<th>Reference</th>
<th>Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sediment</td>
<td>Metals/Metalloids</td>
<td>3 3 3 3 3 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOC</td>
<td>3 3 3 3 3 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TBT</td>
<td>3 3 3 3 3 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seawater</td>
<td>Metals/Metalloids</td>
<td>3 3 3 3 3 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biota</td>
<td>Metals/Metalloids</td>
<td>5 4 2 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Metals and metalloids are comprised of the following parameters: Aluminium (Al), Antimony (Sb), Arsenic (As), Barium (Ba), Beryllium (Be), Bismuth (Bi), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Lead (Pb), Lithium (Li), Manganese (Mn), Mercury (Hg), Molybdenum (Mo), Nickel (Ni), Selenium (Se), Silver (Ag), Strontium (Sr), Vanadium (V) and Zinc (Zn).
7.3. Frequency

Baseline surveys were implemented in May 2008 and September 2009 followed by a three month survey in February 2010 and a six month survey in May 2010. Subsequent surveys have been undertaken with the latest being in November 2012. Current frequencies of sampling are as follows:

Annual monitoring events commenced in November 2012 for a three year period; and then Biennial monitoring with a reassessment of the programme after 5 years.

Therefore future sampling will be done on the following schedule:

- Table 7 Sampling Schedule

<table>
<thead>
<tr>
<th>Programme</th>
<th>Dates</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine monitoring December 2012</td>
<td>December 18–19, 2012</td>
<td>MAFRL 2013</td>
</tr>
<tr>
<td>Routine monitoring December 2013</td>
<td>December 11–12, 2013</td>
<td></td>
</tr>
<tr>
<td>Routine monitoring January 2015 (Monitoring originally scheduled for December 2014 but held over due to Berth 8 unavailability at the time)</td>
<td>January 15–16, 2015</td>
<td>Current survey</td>
</tr>
<tr>
<td>Routine monitoring December 2016</td>
<td>To Be Arranged (TBA)</td>
<td></td>
</tr>
<tr>
<td>Re-assessment of the programme December 2017</td>
<td>TBA</td>
<td></td>
</tr>
<tr>
<td>Routine monitoring December 2018</td>
<td>TBA</td>
<td></td>
</tr>
<tr>
<td>Routine monitoring December 2020</td>
<td>TBA</td>
<td></td>
</tr>
<tr>
<td>Routine monitoring December 2022</td>
<td>TBA</td>
<td></td>
</tr>
</tbody>
</table>

Changes resulting from any reassessment will be documented and reflected in the next monitoring event.

Monitoring would preferably be undertaken at the same time of year to reduce the influence of seasonality (if any) and provide the best comparison with the baseline data.

7.4. Sampling locations

The sampling location coordinates are provided in Table 8 whilst the spatial arrangement of the sites is shown in Figure 5 and Figure 6.

7.5. Reporting and review

Following the implementation of each monitoring even a report will be prepared that summarises the results of the findings and provides a comparison with previous monitoring data to indicate trends.
### Table 8 Sampling site coordinates

<table>
<thead>
<tr>
<th>Site</th>
<th>Location</th>
<th>Samples Collected</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>IH05</td>
<td>Inner Harbour</td>
<td>Sediment and seawater</td>
<td>S 33° 19.429'</td>
<td>E 115° 40.032'</td>
</tr>
<tr>
<td>IH09</td>
<td>Inner Harbour</td>
<td>Sediment and seawater</td>
<td>S 33° 19.332'</td>
<td>E 115° 39.726'</td>
</tr>
<tr>
<td>IH11</td>
<td>Inner Harbour</td>
<td>Sediment and seawater</td>
<td>S 33° 19.163' E</td>
<td>E115° 39.437'</td>
</tr>
<tr>
<td>OH01</td>
<td>Outer Harbour</td>
<td>Sediment and seawater</td>
<td>S 33° 18.520'</td>
<td>E 115° 38.587'</td>
</tr>
<tr>
<td>OH02</td>
<td>Outer Harbour</td>
<td>Sediment and seawater</td>
<td>S 33° 18.392'</td>
<td>E 115° 38.739'</td>
</tr>
<tr>
<td>OH03</td>
<td>Outer Harbour</td>
<td>Sediment and seawater</td>
<td>S 33° 18.295'</td>
<td>E 115° 38.897'</td>
</tr>
<tr>
<td>N01</td>
<td>Area B</td>
<td>Sediment and seawater</td>
<td>S33°18.172'</td>
<td>E115°38.951'</td>
</tr>
<tr>
<td>N02</td>
<td>Area B</td>
<td>Sediment and seawater</td>
<td>S33°18.008'</td>
<td>E115°39.018'</td>
</tr>
<tr>
<td>N03</td>
<td>Area B</td>
<td>Sediment and seawater</td>
<td>S33°17.874'</td>
<td>E115°38.793'</td>
</tr>
<tr>
<td>C01</td>
<td>Approach Channel</td>
<td>Sediment and seawater</td>
<td>S33°17.849'</td>
<td>E115°39.078'</td>
</tr>
<tr>
<td>C02</td>
<td>Approach Channel</td>
<td>Sediment and seawater</td>
<td>S33°18.180'</td>
<td>E115°39.168'</td>
</tr>
<tr>
<td>C03</td>
<td>Approach Channel</td>
<td>Sediment and seawater</td>
<td>S33°18.712'</td>
<td>E115°39.178'</td>
</tr>
<tr>
<td>CB01</td>
<td>Casting Basin</td>
<td>Sediment and seawater</td>
<td>S 33° 19.668'</td>
<td>E 115° 39.996'</td>
</tr>
<tr>
<td>CB02</td>
<td>Casting Basin</td>
<td>Sediment and seawater</td>
<td>S 33° 19.604'</td>
<td>E 115° 40.034'</td>
</tr>
<tr>
<td>B1-1</td>
<td>Berth 1</td>
<td>Biota (blue mussels)</td>
<td>S33°18.369'</td>
<td>E115°38.699'</td>
</tr>
<tr>
<td>B1-2</td>
<td>Berth 1</td>
<td>Biota (blue mussels)</td>
<td>S33°18.379'</td>
<td>E115°38.676'</td>
</tr>
<tr>
<td>B2-1</td>
<td>Berth 2</td>
<td>Biota (blue mussels)</td>
<td>S33°18.414'</td>
<td>E115°38.605'</td>
</tr>
<tr>
<td>B2-2</td>
<td>Berth 2</td>
<td>Biota (blue mussels)</td>
<td>S33°18.422'</td>
<td>E115°38.586'</td>
</tr>
<tr>
<td>B5-1</td>
<td>Berth 5</td>
<td>Biota (blue mussels)</td>
<td>S 33° 19.203'</td>
<td>E115°39.817'</td>
</tr>
<tr>
<td>B5-2</td>
<td>Berth 5</td>
<td>Biota (blue mussels)</td>
<td>S 33° 19.220'</td>
<td>E115°39.836'</td>
</tr>
<tr>
<td>B6-1</td>
<td>Berth 6</td>
<td>Biota (blue mussels)</td>
<td>S 33° 19.296'</td>
<td>E115°39.934'</td>
</tr>
<tr>
<td>B6-2</td>
<td>Berth 6</td>
<td>Biota (blue mussels)</td>
<td>S 33° 19.324'</td>
<td>E115°39.961'</td>
</tr>
<tr>
<td>B8-1</td>
<td>Berth 8</td>
<td>Biota (blue mussels)</td>
<td>S 33° 19.394'</td>
<td>E115°40.048'</td>
</tr>
<tr>
<td>B8-2</td>
<td>Berth 8</td>
<td>Biota (blue mussels)</td>
<td>S 33° 19.450'</td>
<td>E115°40.116'</td>
</tr>
<tr>
<td>R1</td>
<td>Reference Site 1</td>
<td>Sediment and seawater</td>
<td>S 33° 18.691'</td>
<td>E115°37.830'</td>
</tr>
<tr>
<td>R2</td>
<td>Reference Site 2</td>
<td>Sediment and seawater</td>
<td>S 33° 18.778'</td>
<td>E115°37.747'</td>
</tr>
<tr>
<td>BC3</td>
<td>Reference Site</td>
<td>Biota (blue mussels)</td>
<td>S 33° 17.676'</td>
<td>E115°38.932'</td>
</tr>
<tr>
<td>BC3/CM6</td>
<td>Beacon 3</td>
<td>Sediment, seawater and biota (blue mussels)</td>
<td>S 33° 17.676'</td>
<td>E115°38.932'</td>
</tr>
</tbody>
</table>

Datum is GDA94.
Figure 5 Spatial distribution of sampling sites

Note: Green dots indicate sampling sites for mussels.
Red dots indicate sampling sites for both sediment and seawater.
Green and Red bicolour dot indicates sampling for sediment and mussels.

Figure 6 Inner Harbour sampling sites

Note: Red dots indicate sites where sediment and seawater are collected.
Green dots indicate sites where mussels are collected.
Red/Green dots indicate where sediment, seawater and mussels are collected.
8. INVASIVE MARINE SPECIES SURVEILLANCE

An overall increase in international trade and recreation has brought with it an increase in the rate of Invasive Marine Species (IMS) introduction, establishment and spread in some ports in Australia. In response, increased awareness has resulted in the development and implementation of a range of international national and state legislation and management arrangements.

8.1. Sampling Frequency

A number of biennial IMS surveys have previously been undertaken in the Port of Bunbury and its surrounding areas. In 1996, the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) – Centre for Research on Introduced Marine Pests (CRIMP) conducted an extensive baseline survey of the Port (CRIMP 1996). The SP-Bun then commissioned subsequent biennial surveillance surveys following the key recommendations of this CRIMP (1996) survey.

8.2. Survey Locations

The Port was divided into three locations for sampling; the Outer Harbour, the Inner Harbour and the Spoil Ground. The locations were selected based on numbers of shipping movements, variations in habitats and the requirement to examine the Spoil Ground for translocated IMS. Annual water temperatures vary between 15°C and 21°C and Salinity between 34 and 36 psu. Light attenuation is particularly poor across all areas within and outside the harbour for most months of the year.
- Figure 7 Outer Harbour survey location and survey methods used at each site

- Figure 8 Inner Harbour survey location and survey methods used at each site

- Figure 9 Spoil Ground survey location and survey methods used at each site
8.3. Monitoring Sampling Methods
The sampling methods consisted of:

- Beam trawls;
- Seabed sediment grabs;
- Phytoplankton tows;
- Crab/fish traps;
- Shoreline visual searches; and
- Diver visual searches and pylon scrapes.

The monitoring approach and methods for this survey were consistent with the Australian Marine Pest Monitoring Manual (Commonwealth of Australia, 2009) and target IMS were identified according to Western Australian Prevention List for Introduced Marine Pests (Department of Fisheries, June 2014). The design of this survey was discussed with the Department of Fisheries and an Instrument of Exemption was granted to remove organisms taken during the sampling regime for further species identification.

9. AUDITING, REPORTING AND CONTINUOUS IMPROVEMENT
The process of auditing, reporting and continuous improvement is a key component of the Australian/ New Zealand ISO 14001:2004 environmental management systems – requirements with guidance for use. The SP-Bun achieved ISO 14001:2004 accreditation in Jan 2013. The Environmental Management System (EMS) will address all the environmental aspects mentioned in this plan.
10. REFERENCES


PWD. 1978. Bunbury outer harbour Siltation Investigations. Prepared by the Coastal Investigations Section of the Harbours and Rivers Branch within the Public Works Department of Western Australia.

Rochford, D.J. 1969. Seasonal interchange of high- and low-salinity surface waters off South-west Australia. CSIRO Division of Fisheries and Oceanography Technical Paper 29, 8pp


APPENDIX A

SP-Bun Environmental Management System

Current Version of the EMS is available on the Intranet
APPENDIX B

Historical Dredging and Disposal Programmes

Current Version of the Historical Dredging and Disposal Programmes is available on the Intranet
APPENDIX C
Sampling Analysis Plan

Current Version of the Historical Dredging and Disposal Programmes is available on the Intranet