Dredge Spoil Disposal Management Plan

Casuarina Harbour Dredging Studies

CW1146500

Prepared for
Department of Transport

6 February 2023

Cardno

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1 Introduction

1.1 Background

The Casuarina Boat Harbour, located in Bunbury, Western Australia (WA), is planned to be transformed into a marina and marine industry precinct through the Transforming Bunbury's Waterfront development project. A maximum volume of 240,000 m^3 of seabed material (including overdredge allowance and additional buffer for environmental assessment) is proposed to be dredged across two dredging programs (phases) to construct the project. Dredging is required to prepare a breakwater foundation and create a navigable channel and mooring area.

The dredged material was originally proposed to be reused for reclamation works as part of the future onshore development of the Casuarina Harbour breakwaters. However, geotechnical testing conducted by Galt Geotechnics (2019) indicated that the material is not suitable for reuse in the reclamation works. Due to the substantial volume of material to be dredged, onshore disposal is not the preferred option in terms of constructability, geotechnical or financial viability. It is preferred that all dredged material of suitable quality is disposed offshore.

A 'Sea Dumping Permit' is required by the Department of Agriculture, Water and the Environment (DAWE) for offshore disposal of the material and this application is being managed by the Department of Transport (DoT) ('the proponent'). As per the requirements of the *Environmental Protection (Sea Dumping) Act 1981* (Sea Dumping Act), the disposal material and proposed disposal site have been characterised and assessed in accordance with the *National Assessment Guidelines for Dredging* (NAGD) (Commonwealth of Australia, 2009). The benthic communities and habitats (BCH) at the disposal site have also been mapped to gain an understanding of potential environmental impact of the disposal activities. These investigations and findings are documented in the project's *Sampling and Analysis Plan - Implementation Report* (Cardno, 2022a).

1.2 Project Location

A locality plan is presented in **Figure 1-1**, showing the proposed dredging area and disposal site. The proposed disposal site is a portion of the site defined for the purpose of obtaining a Sea Dumping Permit by Lanco Resources Australia Pty Ltd (Permit No. SD2013/2482) in 2016.

1.3 Purpose and Structure of this Document

The purpose of this Dredge Spoil Disposal Management Plan (DSDMP) is to outline the management and monitoring activities required to minimise the environmental impact of dredge spoil disposal activities associated with the project. It provides management frameworks and specific methods, locations and thresholds for monitoring, as well as assigning responsibility for the activities. This operational document accompanies Offshore Disposal Impact Hypothesis (Cardno, 2022b) for the project, to demonstrate tangible mitigation measures. It also supports application for the project's Sea Dumping Permit. The DSDMP includes best practice environmental management controls and high-level dredging management controls for the proposed dredging techniques. The requirements of this DSDMP should be incorporated into the dredging contractors final Dredging and Spoil Disposal Management Plan.

The DSDMP has been structured as follows:

- This section (**1**) introduces the project background and DSDMP purpose and structure;
- **Section 2** outlines the legislative context for the proposed disposal actions;
- **Section 3** outlines the details of the proposed dredging and disposal activities;
- **Section 4** describes the environmental setting in which the actions will take place;
- **Section 5** summarises the environmental risk assessment associated with potential project impacts;
- **Section 6** details the environmental management framework for the proposed actions;

- **Section 7** details the monitoring plan associated with the disposal actions; and
- **Section 8** outlines management reporting and **Section 9** summarises responsibilities.

Proposed Disposal Site Coordinates GDA94 MGDA50		
Point	Easting (m)	Northing (m)
DS01	367,696	6,322,827
DS02	368,275	6,322,835
DS03	367,696	6,322,226
DS04	368,275	6,322,242

Legend

- Proposed Disposal Site
- Lanco Spoil Ground
- Proposed Dredge Site

N

1:40,000 Scale at A3

km
0 0.75 1.5

Localilty Plan

CASUARINA HARBOUR DREDGING STUDIES
FIGURE 1-1

Cardno

Map Produced by Cardno WA (6100)
Date: 2022-02-07
Coordinate System: GDA 1994 MGA Zone 50
Project: CW1146500
Map: CW1146500_005_SpoilGround_Locaility.mxd 01

2 Legislative Context

2.1 Environment Protection (Sea Dumping) Act 1981

Waters surrounding Australia's coastlines are protected from wastes and pollution dumped at sea by the Sea Dumping Act. The Sea Dumping Act regulates the loading and dumping of waste at sea, prohibiting the ocean disposal of material considered too harmful to be released into the marine environment. It also regulates permitted ocean waste disposal to minimise its environmental impacts. Application for a Sea Dumping Permit is to the Minister for the Environment, via DAWE. The application must assess potential environmental impacts. This assessment should include the adjacent state's environmental assessment requirements (discussed in **Section 2.4**). It should also adhere to the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and assess the proposed dredging and disposal actions with respect to the NAGD.

2.2 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides for the protection of the environment and conservation of biodiversity, particularly species and places of national significance. This act is invoked only if an action is likely to have an impact on matters of national environmental significance (MNES). An EPBC Act 'self-assessment' has been carried out for the proposed offshore disposal activities, presented in Cardno (2022b).

2.3 National Assessment Guidelines for Dredging

Sediment quality investigations for dredging projects are guided by the NAGD. The guidelines define appropriate sampling resolution, techniques and analytes for analysis and screening. The NAGD has a focus on identifying risk associated with material intended to be disposed offshore, supporting the Sea Dumping Act in this regard.

2.4 Environment Protection Act 1986

The key piece of legislation for a project with the potential to impact the environment in WA is the State's *Environmental Protection Act 1986* (EP Act). This is supported by the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual* (EPA, 2021a). The EP Act specifies the objectives and requisite procedures of environmental impact assessment (EIA) that proponents and stakeholders must comply with. Further guidance documents are provided by the EPA to define the environmental considerations expected as part of a project's EIA and environmental management.

It should be noted that the overall project (of which offshore disposal actions are a component) is subject to the highest level of environmental review under the EP Act – Strategic Public Environmental Review (SPER).

The *Statement of environmental principals, factors, objectives and aims of EIA* (EPA, 2021b) overarches the EIA environmental considerations, outlining the guiding principles and defining the specific factors to be considered and their objectives. Of particular relevance for dredging and disposal are those under the 'Sea' theme. Detailed risk assessment of the disposal actions, with respect to these factors, is presented in Cardno (2022b) and summarised below in **Section 5**.

The general purpose of environmental investigations to support a project EIA are to adequately describe:

- The values, sensitivity and quality of the environment and ecology which may be impacted;
- The extent (intensity, duration, magnitude and geographic footprint) of the likely impacts; and
- The resilience of the environment and ecology to cope with the impacts or change.

3 Dredging and Disposal Program

3.1 Dredging Plan and Program

Dredging phases are defined in **Figure 3-1** and areas, levels and quantities are defined in **Drawing Number 0691-29-04**, prepared by DoT and included below. The proposed dredging and disposal program is described in the sub-sections below.

3.1.1 Phase 1

Phase 1 of dredging is required to prepare the foundation for the new breakwater, that will be installed to create a sheltered environment for the boat harbour's internal infrastructure and ensure safe navigation through the new entrance channel. The dredging phase will involve up to 130,000 m^3 of material (including overdredge allowance and additional buffer for environmental assessment) being dredged. Approximately 95% of the Phase 1 volume is proposed to be dredged by Trailer Suction Hopper Dredge (TSHD) and disposed offshore. The maximum duration is approximately 28 days for the TSHD dredging. The remainder will be dredged by a floating Back Hoe Dredging (BHD) method and disposed of onshore, but offsite, due to the anticipated presence of debris. At this stage, Phase 1 dredging is planned for early 2024, though this may be subject to change.

3.1.2 Phase 2

Phase 2 of dredging will be undertaken to deepen the inner harbour, allowing safe navigation and mooring for vessels. The dredging phase is divided into two portions, due to different contamination status and required disposal. It should be noted that the Northern Breakwater will have been constructed before the Phase 2 dredging occurs, which means this will be occurring within an enclosed harbour. Overall, the Phase 2 dredge volume is up to 110,000 m^3 (including overdredge allowance and additional buffer for environmental assessment). At this stage, the timing of Phase 2 dredging is uncertain. It will not occur in conjunction with Phase 1 and is likely to occur several years after.

3.1.2.1 Phase 2A

Phase 2A material (up to 6,200 m^3 including overdredge allowance) will be dredged by BHD and transferred onshore with necessary containment and treatment, due to its classification as a contaminant 'hotspot' (see Cardno, 2022a). It will then be relocated offsite to an appropriate waste receiving facility. The anticipated duration of the Phase 2A dredging is up to 20 days.

3.1.2.2 Phase 2B

Phase 2B of the dredging will involve up to 83,400 m^3 of material, including overdredge allowance, which will be dredged by BHD and placed into barges for transport and disposal offshore. The anticipated duration of the Phase 2B dredging is a maximum of 80 days.

3.2 Spoil Disposal

3.2.1 Offshore Disposal

Dredged material will be transported by barge to the disposal site and released over water, approximately 9.5 km north northeast of the dredge area (see **Figure 1-1**). Average offshore disposal rates are expected to align with the estimated dredging rates described above. Approximated as:

- Phase 1: 4,000 m^3/day; and
- Phase 2B: 1,120 m^3/day.

A higher disposal rate is anticipated for Phase 1, making it the focus of environmental impact and risk assessment (prevailing risk).

3.2.2 Onshore Disposal

Material to be disposed onshore will be contained in impermeable holding ponds or geotubes, where it will be dewatered prior to transport offsite. Return-water will require testing to confirm suitability for release back into the marine environment.

Dredging Phases

CASUARINA HARBOUR DREDGING STUDIES
FIGURE 3-1

N

1:3,000 Scale at A3

km
0 0.055 0.11

Cardno

Map Produced by Cardno WA (6100)
Date: 2022-02-07
Coordinate System: GDA 1994 MGA Zone 50
Project: CW1146500
Map: CW1146500_Dredging Phases.mxd 01

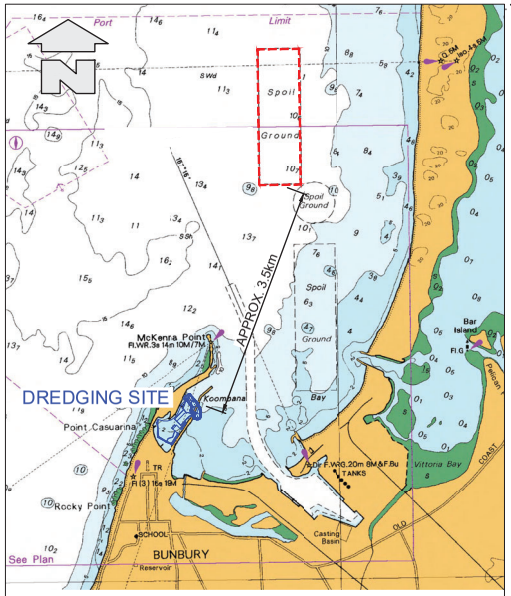
COLOUR CODED DIFFERENCES
(EXISTING SURFACE TO DESIGN)

0.0
0.2
0.7
1.0
2.0
3.0
4.0
5.0

SHALLOWER THAN DESIGN

GENERAL
THE VALUES ON THE PLAN HAVE BEEN CALCULATED USING DATA INTERPOLATED FROM THE ORIGINAL SURVEYS

GRIDDING PARAMETERS 2.0m GRID



SPOIL GROUND LOCALITY PLAN
SCALE 1:40,000

0 500 1000 1500 2000 2500
1:40,000

QUANTITIES

DREDGE AREA	ESTIMATED VOLUME ABOVE DESIGN (m³)	ESTIMATED SURFACE AREA ABOVE DESIGN (m²)
AREA 1	4,420	11,600
AREA 2	34,730	40,450
AREA 3	17,180	14,990
AREA 4	1,550	4,720
AREA 5	1,540	8,190
AREA 6	3,790	4,200
AREA 7	106,390	51,150
AREA 8	4,820	4,520
AREA 9	880	855
TOTAL	**175,300**	**140,675**

VOLUME NOTES:

1. NO OVERDREDGE VOLUME INCLUDED.
2. ALL BATTERS ASSUMED TO BE 1:10.
3. ROCK VOLUME OF SPUR GROYNE REMOVAL NOT INCLUDED IN THE DREDGE VOLUME.

ASSUMPTIONS / COMMENTS

[A]* INVESTIGATION REQUIRED ON HOW CLOSE THE DREDGING CAN OCCUR TO THE EXISTING REVETMENT TOE

[B]* DREDGING INTERFACE ALONG THE CAUSEWAY REVETMENT ALLOWS A 1:10 BATTER AND MIN. 6m TOLERANCE FROM THE ESTIMATE REVETMENT TOE. THIS INFORMATION WAS PROVIDED BY ADVISIAN (EMAIL 06/04/2018).

[C]* POSITION OF TOE LINES ALONG NORTH/WESTERN REVETMENT TAKEN FROM SEASHORE ENGINEERING DESIGN (DRAWING REFERENCE TBA)

[D]* DREDGING TO BASALT LAYER UNDER THE PROPOSED NORTHERN BREAKWATER (AREA 9) ASSUMES A 5m OFFSET FROM THE PROPOSED TOE. BASALT LAYER ASSUMED FROM HISTORICAL BOREHOLES AND PROBES (REFER DRG No. 691-32-01).

1:1500 0 20 40 60 80

REVN	DATE	AMENDMENT	DRN	DESIGN APPROVAL
B	18/06/19	SPOIL GROUND LOCALITY PLAN ADDED	CJL	
A	30/05/19	INITIAL ISSUE	CJL	

ORIG SIZE A1 | FILE No | © CROWN COPYRIGHT

GENERAL NOTES
1. EXISTING SURFACE FROM DoT SURVEY APRIL 2019, OCT 2018 & FEB 2018 COMBINED

SCALE: 1 : 1500 @ A1
UNLESS OTHERWISE STATED DIMENSIONS IN METRES
HORIZ: MAP GRID OF AUSTRALIA BASED ON GDA94 - ZONE 50
VERT : LAT (2009) WHICH IS 3.869m BELOW TIDAL BM (BUNBURY) 2001 AND 0.570m BELOW AHD 1971
BAR MEASURE INDICATES IF SCALES HAVE BEEN VARIED

DESIGNED
CHECKED
DRAWN C LIVINGSTONE
CHECKED
PROJECT MANAGER M WILLIS
APPROVED
APPROVED
APPROVED
AUTHORISED

Department of Transport

BUNBURY - CASUARINA BOAT HARBOUR
CONCEPTUAL DESIGN
DREDGING (MAY 2019 OPTION)

DRAWING NUMBER 0691 - 29 - 04 REVN B

\CAD\BU091-29-04_B.dwg

3.3 Operating Hours

> Dredging and disposal activities will be 24-hour operations; and

> TSHD and BHD may operate simultaneously in different areas during Phase 1.

3.4 Equipment

3.4.1 Trailer Suction Hopper Dredge

A TSHD is a (sea-going) ship equipped with one or two suction pipes (**Figure 3-2**). At the end of each suction pipe is a drag-head, which can be lowered onto the seabed while the TSHD navigates at a reduced speed. The material loosened by the drag-head, together with some transport water, is sucked into the suction pipe by means of a centrifugal pump, and subsequently pumped into the hopper of the dredger.

Once loaded the TSHD may sail to a designated offshore disposal site where its load can be discharged by opening doors in the bottom of the hull of the ship. Material then travels through the water column to the seabed. The range of TSHDs is large, varying from very small to very large. Degrees of automation, the level of technology and operating options all vary significantly.

Figure 3-2 Trailer suction hopper dredge (confluence.qps.nl, 2021)

3.4.2 Backhoe Dredger

A backhoe dredger is a hydraulic excavator placed onto a pontoon/barge (**Figure 3-3**). Backhoe dredgers are often used to excavate rock or clay; however, they might also be preferred when there is a desire to have relatively low losses of sediment to the surrounding marine environment. Backhoe dredgers are able to remove material from difficult to reach places relatively efficiently. Rocks and sediments excavated with such plant are generally loaded into barges. The excavating force comes from hydraulic cylinders of the excavator.

Due to one bucket of material being removed at a time, dredging production rates are relatively low. Developments in backhoe dredgers have resulted in increasing the maximum size, excavation power and

dredging depths. This has expanded the range of dredging tasks for which a backhoe dredger might be a feasible and/or economical option.

Figure 3-3 Backhoe dredger (Cardno, 2011)

3.5 Dredge Material Management

3.5.1 Management of Physical Effects

Dredging can lead to physical effects such as increased suspended sediment concentration and sedimentation, at both the dredging and disposal site. These effects have been modelled for disposal activities and are discussed further, with respect to environmental risk, in **Section 5**.

Dredged sediment (other than contaminated material) will be disposed of at the offshore location shown in **Figure 1-1**. The spoil ground location was determined through analysis of BCH, bathymetry and metocean conditions (discussed further in **Section 4**). No confinement techniques, such as silt curtains, are proposed to be used for offshore disposal with the placement location to be selected for minimal impact to BCH being the primary management technique.

3.5.2 Management of Onshore Material

Sediment quality testing has indicated the presence of a Tributyltin (TBT) hot spot (as well as elevated concentrations of Copper, DDT and DDE) – Area 8 of the Phase 2 dredge area (detailed further in Cardno, 2022a). Dredged material within the hot spot is not considered suitable for offshore disposal, instead it will be transferred onshore and temporarily stored, dewatered then transferred to a waste receival facility. This could involve lined holding ponds or geotextile tubes (geotubes). Geotubes provide a temporary storage area for the dredged slurry, before determination of appropriate disposal methods for liquid and solid phases. Environmentally safe polymers may be added to the slurry to bind sediment and help separate solids from the

liquid. Once separated, water within the tubing is required to be tested to determine its suitability for return to the ocean. Remaining sediment is to be disposed of at a receiving waste facility.

3.5.2.1 Marine Construction Monitoring and Management Plan

Once material has been deposited on land and dewatered, management of its handling is considered to be covered by the project's Marine Construction Monitoring and Management Plan.

4 Environmental Setting

4.1 Physical Environment

4.1.1 Climate

Bunbury has a Mediterranean climate that ranges from cool, wet winters to warm, dry summer seasons. Mean annual maximum and minimum temperatures at the Bunbury Weather station are reported as 23.2° C and 11.1 ° C, respectively. The hottest month is February, with an average maximum temperature of 30.0° C, while July has the lowest mean maximum temperature (17.3° C). Winter is associated with low-pressure system storms and high precipitation, with the majority of rainfall occurring during May to August. June and July have the highest average rainfall totals of 135.5 mm and 142.4 mm respectively (BoM, 2021).

The wind climate is relatively consistent during summer, with calm mornings and the seabreeze cycle generating strong south to south westerly winds in the afternoon. Winter is characterised by calm conditions, interrupted by very strong winds during storm events. The wind climate is generally mild during the seasonal transition periods of Autumn and Spring, with varying direction (BoM, 2021).

4.1.2 Oceanography

Bunbury exhibits a diurnal tidal regime, meaning there is one high and one low tide per day. It is considered micro-tidal, with a maximum tidal range of approximately 0.8 m. The lack of tidal movement allows other drivers, predominantly wind, to have the main influence on nearshore currents. These currents are strongest, in a northward direction, during summer, driven by persistent southerly winds (the 'Capes Current'). During winter, the lack of consistent wind direction allows alongshore currents to turn southwards for a brief period, influenced by the offshore Leeuwin Current (DoT, 2021).

Bunbury's offshore wave climate, in the vicinity of the proposed disposal location, is characterised by a combination of locally generated seas and offshore derived swell. There is a persistent, low-amplitude swell that is present all year round, with a significant wave height (H_s) generally less than 0.5 m. The summer winds described above generate corresponding, local seas that can reach up to 2 m H_s. Winter storm conditions generate a combination of seas and swell over 2.5 m H_s, with usually at least one storm per year generating waves above 5 m H_s (DoT, 2021).

4.1.3 Bathymetry

The proposed disposal site is located approximately 8.5km directly west from the mainland coastline, and 11.5 km north-west from the Bunbury Inner Harbour (approximately 9.5 km north northeast of the dredge area). The bathymetry of the site is relatively flat, with an average depth of approximately 22 m below mean sea level (MSL).

4.1.4 Sediment Quality

The physical and chemical characteristics of surficial sediments at the proposed disposal site were sampled to inform this project and have been reported in Cardno (2022a). Particle size distribution (PSD) analysis showed that median grain size (D_{50}) ranged from 320 µm (medium sand) to 1330 µm (very coarse sand), averaging 770 µm (coarse sand). The results appear to be comparable to the results reported in Wave solutions (2012), though their maximum size fraction reported was '> 500 µm'.

Chemical analysis of the surface samples at the disposal site found the material to be 'clean', with results below the relevant guideline values stipulated by NAGD. This is consistent with surface sediment testing results reported at the disposal site in Wave solutions (2012).

4.1.5 Water Quality

Physical water quality at the disposal site was interpreted from the measurements of an acoustic wave and current (AWAC) device, deployed at the seabed during July-August 2011 (Wave solutions, 2012). The acoustic backscatter recorded by such instruments can be analysed to infer total suspended solids (TSS)

concentrations. It demonstrated the potential for winter wave conditions to generate elevated turbidity through the water column, with substantial periods of TSS approximated as greater than 20 mg/L.

Being an open ocean environment, the disposal site is expected to have typically good marine water quality, in terms of its chemistry, with no known sources of contamination nearby.

4.2 Biological Environment

4.2.1 Benthic Communities and Habitats

BCH mapping of the disposal action's zone of influence (based on preliminary plume modelling) was undertaken to inform the project, and is reported in Cardno (2022a). A BCH map was prepared based on towed video observations at thirty sites. The BCH for both areas is presented later in **Figure 7-1**, alongside monitoring locations. Seagrass communities (*Posidonia* spp and *Amphibolis* spp) were identified as the primary sensitive environmental receptor in the study area, consistent with the findings reported in Wave solutions (2012). Significant portions of bare seabed were identified, as well as relatively dense seagrass coverage, within the Lanco disposal site. The disposal site for this proposal was reduced to be entirely above seabed identified as bare.

4.2.2 Marine Biota

An EPBC Act 'Protected Matters Report' was generated to identify key marine fauna with the potential to be present in the vicinity of the disposal site. The report indicated that 73 listed species of marine fauna have the potential to be present in the project area, including:

- 31 species of marine bird;
- 23 species of fish;
- 2 species of mammal;
- 4 species of turtle (reptiles); and
- 13 species of whales and dolphins (cetaceans).

Listed species identified as 'likely' or 'known' to occur in the area included:

- Several species of seabird – due to fly-over and nearshore habitat;
- 4 species of turtle:
  - Loggerhead Turtle (*Caretta caretta*);
  - Green Turtle (*Chelonia mydas*);
  - Flatback Turtle (*Natator depressus*); and
  - Leatherback Turtle (*Dermochelys coriacea*);
- Indian Ocean Bottlenose Dolphin (*Tursiops aduncus*); and
- 3 species of whale:
  - Southern Right Whale (*Eubalaena australis*);
  - Blue Whale (*Balaenoptera musculus*); and
  - Humpback Whale (*Megaptera novaeangliae*).

4.2.3 Marine Pests and Invasive Species

Marine pests considered a significant threat to WA waters include:

- European fan worm (*Sabella spallanzanii*);
- Northern Pacific seastar (*Asterias amurensis*);

- Asian date mussel (*Arcuatula senhousia*);
- European green crab (*Carcinus maenas*);
- Pacific oyster (*Crassostrea gigas*);
- Basket Shell Clam (*Corbula gibba*);
- New Zealand green-lipped mussel (*Perna canaliculus*);
- Black-striped mussel (*Mytilopsis sallei*);
- Asian paddle crab (*Charybdis japonica*);
- Brown and Asian green mussel (Perna perna, *P. viridis*); and
- Harris Mud Crab (*Rhithropanopeus harrisii*).

These species are listed as priority marine pests and are found overseas in countries frequently visited by boats that travel to WA (Wiltshire et al., 2020). The European fan worm is of particular concern, as it invaded Bunbury Port in 1995. The fan worm spreads via hulls and in the internal seawater plumbing of commercial or recreational vessels, establishing dense groups that can reduce local biodiversity. Marine pests were surveyed by SARDI as part of the Molecular Surveys in 2020 of priority marine pests for the ports of Bunbury, Kwinana, Fremantle and Geraldton. Only one European fan worm was detected (Wiltshire et al., 2020). Therefore, they are believed to be present in low abundance in the area.

4.3 Social Environment

Casuarina Harbour is located approximately 175km south of Perth, within the City of Bunbury's retail and tourist district, a short distance from the central business precinct. It lies within the Greater Bunbury Region, and is controlled by both Southern Ports Authority (SPA) and the DoT. The waters of Casuarina Harbour and Greater Bunbury are widely utilised for recreational fishing, boating, sailing, swimming, and other activities. The waters offshore Casuarina Harbour and in the vicinity of the disposal site are not known to have particular social importance (e.g. fishing or scuba diving).

5 Environmental Risk Assessment

An environmental risk assessment has been carried out for the project to meet the requirements of the EP Act, accompany application for a Sea Dumping Permit and to inform self-assessment under the EPBC Act. The risk assessment is detailed in Cardno (2022b). The EPA's environmental factors, as listed in the *Statement of environmental principles, factors, objectives and aims of EIA* (EPA, 2021b) have been used as the basis for risk-assessing project actions with the potential to impact the environment. The factors considered relevant to dredge spoil disposal actions are those under the 'Sea' and 'People' themes, as listed in **Table 5-1**.

Table 5-1 Relevant EPA environmental factors for dredge spoil disposal (EPA, 2021b)

Theme	Factor	Environmental Objective
Sea	Marine Environmental Quality	*To maintain the quality of water, sediment and biota so that environmental values are protected.*
	Benthic Communities and Habitats	*To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.*
	Marine Fauna	*To protect marine fauna so that biological diversity and ecological integrity are maintained.*
	Coastal Processes	*To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.*
People	Social Surroundings	*To protect social surroundings from significant harm.*

A risk assessment has been carried out under each environmental factor, identifying:

- Environmental aspect/receptor;
- Risk pathway(s);
- Potential impacts;
- Likelihood, consequence and derived risk rating;
- Risk management and mitigation measures; and
- The residual risk rating and level of certainty for this.

The full risk assessment framework table and outcomes are detailed in Cardno (2022b). A summary of the table is provided below in **Table 5-2**.

Table 5-2 Risk assessment summary table relevant to dredge spoil disposal actions

Environmental Aspect	Risk Pathway(s)	Potential Impacts	Inherent Risk Rating	Risk Management / Mitigation	Residual Risk Rating
Marine Environmental Quality					
Disturbance of marine sediments	> Spoil transfer and disposal	Impact to physical marine environmental quality: > Elevated suspended sediment concentration in marine water > Sedimentation in marine environment > Potential associated impacts to factors – *benthic communities and habitats, marine fauna and social surroundings*)	**High**	> Model dredging and disposal actions to properly understand dredge plume dispersion > Gain an understanding of background conditions > Gain an understanding of sensitive marine environmental receptors and their tolerance > Control and monitor actions to maintain water quality (timing, production rates, disposal location(s))	**Low**
Release of contaminants and nutrients from marine sediments	> Spoil transfer and disposal	> Toxic contaminants made available to marine ecosystem for biological uptake and bioaccumulation > Eutrophication due to nutrient release (algal blooms) > Potential impact to ecosystem health	**Medium**	> Characterise material to be disturbed to understand locations and levels of contamination > Assess levels of contaminants and analytes against appropriate thresholds, given the nature of the receiving environment > Isolate, remove and confine areas where contamination is potentially toxic to the marine environment	**Low**
Introduction of contaminants/pollution to marine environment by dredging vessels/equipment	> Dredger and associate vessel operations	> Toxic contaminants introduced to marine ecosystem for degradation/destruction, biological uptake and bioaccumulation > Potential impact to ecosystem health	**Medium**	> Inspection and audit of vessels and plant, controlled via DSDMP > Reporting and response protocols should a spill occur - oil/chemical spill response etc.	**Low**
Benthic Communities and Habitats					
Dredge spoil disposal	> Elevated suspended sediment concentration (turbidity) at disposal site	> Impact to sensitive BCH such as seagrass (blocking of light)	**High**	> Select disposal area for optimum dispersion and minimum sensitive receptors > Characterise disposal dispersion to understand changes to water quality with respect to tolerance of BCH > Monitor disposal to confirm water quality is within expected range > Implement reactive dredging controls if required	**Low**
Dredge spoil disposal	> Sedimentation of seabed at disposal site	> Impact to sensitive BCH such as seagrass (smothering)	**High**	> Select disposal area for optimum dispersion and minimum sensitive receptors > Characterise disposal dispersion to understand sedimentation levels with	**Low**

				respect to tolerance of BCH > Monitor disposal to confirm plume dispersion is as expected > Implement reactive dredging controls if required	
Marine Fauna					
Dredger/vessel movement	> Vessel collision > Underwater noise impacts > General disturbance to marine fauna	> Vessel strike (injury, death) > Change in behaviour	**Medium**	> Vessel movement controls, speed limits, no-go zones > Marine fauna observation and avoidance	**Low**
Dredging, transport and spoil disposal	> Elevated suspended sediment concentrations	> Impact to marine fauna due to ingestion/dermal contact	**Low**	> Marine fauna observation and avoidance (i.e. at disposal)	**Low**
Coastal Processes					
Bathymetry	> Seabed sedimentation	> Changed bathymetry and associated metocean conditions	**Medium**	> Modelling of change to metocean climate and coastal processes associated with changed bathymetry (i.e. due to disposal). > Adjust disposal plan (if necessary)	**Low**
Sediment transport regime	> Introduced sediment load	> Changed sediment transport regime	**Medium**	> Modelling of sediment fate > Adjust disposal plan (if necessary)	**Low**
Social Surroundings					
Public amenity and perception	> Turbid plumes > Noise and vessel movements	> Reduction in recreational value and aesthetics (temporary)	**Medium**	> Adequate stakeholder engagement > Avoid high public use areas > Avoid peak periods (e.g. summer)	**Low**
Navigational hazards	>Vessel movements	> Public safety incidents	**Medium**	> Marine safety will be monitored and managed throughout the disposal operation. > Vessel movement controls, speed limits, no go zones.	**Low**

6 Management Framework

6.1 Overview

To ensure the management objectives, identified in **Section 5** (see **Table 5-2**), are met, a management framework has been established. Adherence to the framework will be controlled by contractor reporting, monitoring activities (see **Section 7**) and audit by the Principal. The framework for managing operational and administrative aspects, as well as to manage risk to each environmental factor, are detailed in the sections below.

6.2 Operational Controls

Responsibility for the implementation of management options or monitoring programs has been assigned to relevant parties. **Table 6-1** contains operational management targets that also have relevance to all environmental factors. Operational controls for dredging and disposal should be further specified in the contractor's final Marine Construction Monitoring and Management Plan (MCMMP).

Table 6-1 Management actions to limit dredging to proposed footprint

Management Target	Management Actions	Responsibility	Reporting	Frequency
Dredging and disposal activities are confined to the proposed footprint and levels	Dredge vessel to navigate using on-board GPS with appropriate accuracy	Contractor	Navigation equipment inspection and testing	Prior to commencement of dredging operations
			Daily dredge planning	Daily, 24 hours prior in dredge log
			Weekly dredging forecast	Weekly 48 hours prior in dredge log
Dredging activities conform with monitoring and response requirements of DSDMP	As defined in this DSDMP	Contractor	Daily and weekly conformance reporting Trigger/incident response reporting	As stipulated
	Audit	Principal	Audit report, daily review	Daily

6.2.2 Daily Dredge Log

The dredging Contractor shall submit daily dredge logs to the site superintendent capturing the previous day's works. Log sheets shall contain, but not be limited to, the following:

- Date;
- Vessel and operator name;
- Commencement and finish times, downtime;
- Dredged footprint and levels;
- Total production and average production rates;
- Disposal, location and rates;
- Safety incidents or near misses;
- Marine Fauna strikes or near misses;

- Water quality trigger exceedances;
- Significant delays;
- Adverse interactions with public;
- Any environmental incidents such as chemical spills, oil leaking etc.; and
- 48-hour look-ahead dredging plan.

6.2.3 Weekly dredge report

The dredging Contractor shall submit a weekly report to the site superintendent capturing the previous week's works. Reports shall contain, but not be limited to, the following:

- Operating dates and daily commencement and finish times, including downtime etc.;
- Dredged footprint and levels;
- Total production and average production rates;
- Total disposal and average disposal rates;
- Assessment of progress relative to overall campaign;
- Anticipated delays or changes to the dredge plan;
- Safety incidents or near misses;
- Marine Fauna strikes;
- Significant delays;
- Adverse interactions with public;
- Any environmental incidents such as chemical spills, oil leaking etc.; and
- Weekly look-ahead dredging plan.

The exact details and format of ongoing reporting will be confirmed in the contractors MCMMP, which must demonstrate reporting of adherence to the management framework and monitoring activities in this DSDMP.

6.3 Marine Environmental Quality

Table 6-2 lists the management actions assigned relevant to marine environmental quality.

Table 6-2 Management actions to control impacts to marine environmental quality

Management Target	Management Action	Responsibility	Reporting	Frequency	Response(s)
Measured TSS (NTU) concentrations remain within expected range predicted by sediment plume dispersion modelling	Ongoing (fortnightly) water quality monitoring at impact and reference locations across dredging program	Contractor	Water quality data available to principal and stakeholders Daily dredge log noting exceedances	Continuous / daily	Investigate against reference monitoring sites Modify dredging/disposal activities by disposing in different portion of disposal site or spreading disposal Reduce or pause dredging/disposal activities

Management Target	Management Action	Responsibility	Reporting	Frequency	Response(s)
Contaminated material is not released to the marine environment	TBT hotspot is removed and confined (e.g. geotubes, holding ponds) Return water tested prior to return to ocean. Or evaporated. Dispose to receiving waste facility once dewatered	Contractor	To be confirmed based on specific management methodology and containment/treatment location		
			Daily return water monitoring Daily dredge log noting exceedances Confirm hotspot area removed before proceeding with remaining dredging (e.g. dedicated survey)	Continuous / daily	Hold release of return water Reduce or pause onshore disposal activities

6.4 Benthic Communities and Habitats

Table 6-3 lists the management actions assigned relevant to BCH.

Table 6-3 Management actions to control impacts to BCH

Management Target	Management Actions	Responsibility	Reporting	Frequency	Response(s)
No long-term impact to benthic communities (seagrass) due to excess TSS (shading)	Real time water-quality criteria are met at source and disposal site throughout dredging campaign Compliance reporting	Contractor	Realtime water quality monitoring and reporting Daily logs with any exceedances	Continuous Daily	Investigate Modify dredging activities Reduce or pause dredging activities
No long-term impact to benthic communities (seagrass) due to sediment deposition	Real time water-quality monitoring comparable to modelled concentrations – inferring the sedimentation rates are as modelled (well below seagrass tolerance thresholds) Compliance reporting	Contractor	Realtime water quality monitoring Sediment trap monitoring	Continuous Weekly sedimentation	Investigate Modify disposal activities (release site) Reduce or pause dredging activities

6.5 Marine Fauna

Table 6-3 6-4 lists the management actions assigned relevant to marine fauna.

Table 6-4 Management actions to control impacts to marine fauna

Management Target	Management Actions	Responsibility	Reporting	Frequency	Response(s)
No death or injury to marine fauna or significant benthic communities due to direct impact/strike	Marine fauna observation and avoidance procedures Maintain vessels and plant in designated dredge area	Contractor	Occurrences to be noted in daily and weekly logs Weekly dredge report detailing dredge path and depths	Daily / weekly or immediately if strike occurs	Observer onboard to help sight marine fauna within 300 m of dredge/disposal vessel Reduction in speed of vessel Stop vessel
No introduction of invasive species	Adherence to Commonwealth Department of Agriculture and Water Resources – Australian Ballast Water Management Requirements National Biofouling Management Guidelines for commercial vessels	Contractor	Cleaning report if overseas vessel Evidence of previous vessel locations, loads and exchanges of ballast water	Once off, preceding dredging	Report known or suspected invasive species to Department of Agriculture, Water and the Environment (DAWE)

6.6 Social Surroundings

Table 6-5 lists the management actions relevant to social surroundings.

Table 6-5 Management actions to control impacts to social surroundings

Management Target	Management Actions	Responsibility	Reporting	Frequency	Response(s)
No public or navigational safety incidents	Stakeholder/community notification of proposed works, compliance with DoT Communications Plan. Maintenance of ongoing complaints register	DoT / Contractor	Weekly update of complaints register	As specified in DoT Communications Plan As required if complaints are made	Assessment of complaints by DoT and corrective action to avoid further incidence if appropriate
	Issue Temporary Notice to Mariners (TNTM) at least 14 days prior to works in consultation Southern Ports Authority and DoT Vessels and plant to be in survey with all	Contractor	Confirmation of issued NTM Inspection of vessel logs / survey certification	Once-off prior to operations	Delay of commencement until all requirements in place

	appropriate safety equipment				

7 Monitoring Plan

7.1 Water Quality Monitoring

7.1.1 Objectives

Key objectives for monitoring water quality at the disposal site are to:

- Measure total suspended solids (TSS) concentrations for comparison against modelled predictions (model validation) and background concentrations;
- Establish a relationship between TSS and turbidity;
- Measure additional physio-chemical water quality parameters within disposal plumes for comparison to background conditions;
- Inform ongoing spoil disposal activities and any requirement to manage these; and
- Assess potential impacts to BCH (i.e. seagrass shading) should measurements be outside of the modelled range (trigger exceedance).

7.1.2 Monitoring

Fortnightly water quality profiling and water sampling is to be undertaken at eight sites within the modelled dredge plume extent and four sites beyond the modelled dredge plume extent (background). This is to include a sampling campaign 2 weeks post-disposal activities. The campaigns during disposal actions should collect data immediately after an individual disposal action, and then spaced equally in time as the plume disperses until just prior to the next disposal action, for 3 repeats (4 sample repeats total). The composition of the sampling is to include:

- Vertical profiling of:
  - Turbidity (NTU);
  - Photosynthetically active radiation (PAR);
  - Conductivity;
  - Temperature;
  - Dissolved oxygen; and
  - Depth; and
- Collection of water samples at targeted locations and depths.

Turbidity (Nephelometric Turbidity Units [NTU]) readings can be used to approximate TSS concentration, which is not practicable to measure on an ongoing basis. Modelled values of TSS concentration can then be converted to NTU values once a site-specific relationship is established, for comparison purposes. The relationship is established by collecting water samples directly alongside a turbidity sensor (i.e. during profiling) and having the samples analysed for TSS by an accredited laboratory. The program proposes to collect 48 samples to establish this relationship, at a range of locations and water depths, during the first disposal monitoring campaign.

There will also be a requirement to understand how the turbidity/TSS depth profile (vertical position in the water column) relates to the depth-averaged TSS presented in water quality modelling (GHD, 2022). This is established by converting measured NTU profiles to TSS profiles, based on the NTU vs TSS relationship established.

Additionally, profiling at reference sites will be required so that trigger exceedances can be assessed against background (i.e. unaffected by dredging/disposal) levels.

The purpose of monitoring the other physiochemical parameters, is for further analysis should TSS concentrations be outside of the expected (modelled) range, which has been assumed when assessing potential impacts of the project.

7.1.3 Triggers

GHD (2022) have developed elevated TSS concentration thresholds for the purpose of mapping spatial zones of influence and impact for the project's dredging and disposal action, with respect to BCH. The thresholds/zones were defined as follows:

- Zone of Influence (ZoI): At least once (i.e. instantaneous duration threshold).
- Zone of Medium Impact (ZoMI): Continually for 18 days.
- Zone of High Impact (ZoHI): Continually for 90 days.

The modelling has not demonstrated that ZoMI or ZoHI will be formed during the disposal actions. Triggers have been established to monitor the accuracy of the modelling predictions. A response will be triggered should monitoring infer that ZoMI may exist, in areas where seagrass has been mapped. Triggers are described as follows:

Trigger 1

Depth- and time-averaged (across individual monitoring campaign) TSS concentration at any of the near disposal monitoring sites (DIS01 to DIS04) is greater than 2 mg/L above average background levels (average of sites REF01-REF04) for a measurement campaign.

Trigger 2

Depth- and time-averaged (across individual monitoring campaign) TSS concentration at any of the far disposal monitoring sites (DIS05 to DIS08) is greater than 2 mg/L above average background levels (average of sites REF01-REF04) for a measurement campaign.

7.1.4 Responses

Trigger exceedances are to be included in a fortnightly monitoring summary report, provided within 7 days of completion of each campaign. The response to trigger exceedances are as follows:

- **Trigger 1**: Investigate if **Trigger 2** has been exceeded for any sites;
- **Trigger 2**: The following response is required:
  - Assess metocean conditions data available from BoM and DoT to determine if the exceedance at the site(s) in question is likely to exist for a continuous period of greater than 18 days (e.g. continuous prevailing winds in one direction);
  - Investigate how the disposal rate during the monitoring campaign compares with historical and planned disposal rates (typical, higher than average, lower than average);
  - Further investigate light attenuation (PAR profile data) associated with site(s) of elevated TSS to determine if stress may be placed on seagrass, with respect to the light attenuation stress thresholds presented in RPS (2022) for *Posidonia* and *Amphibolis* species and PAR at reference sites. This should include temporal assessment of shading across the monitoring campaign, as the plume dissipates (i.e. is the average exceedance prolonged, or due to a short, very high elevation);
  - Provide a statement as to whether, based on the above, seagrass quality in the vicinity of the disposal site is likely to suffer permanent reduction in quality as a result of the ongoing and proposed disposal schedule.

  If impact to seagrass quality is predicted, the following actions should be undertaken:

  - Dispose in different portion of disposal site;
  - Dispose in certain portions of the site for certain metocean conditions (i.e. 'upstream side'); and

- Consider additional monitoring campaign to confirm effectiveness of varied placement; and
- Consider reduction in disposal rate during daylight hours.

Note that the proposed dredging and disposal schedule is much shorter than the shading stress duration thresholds for *Posidonia* and *Amphibolis* species (RPS, 2022), so these responses are not expected to be required.

7.2 Monitoring Locations

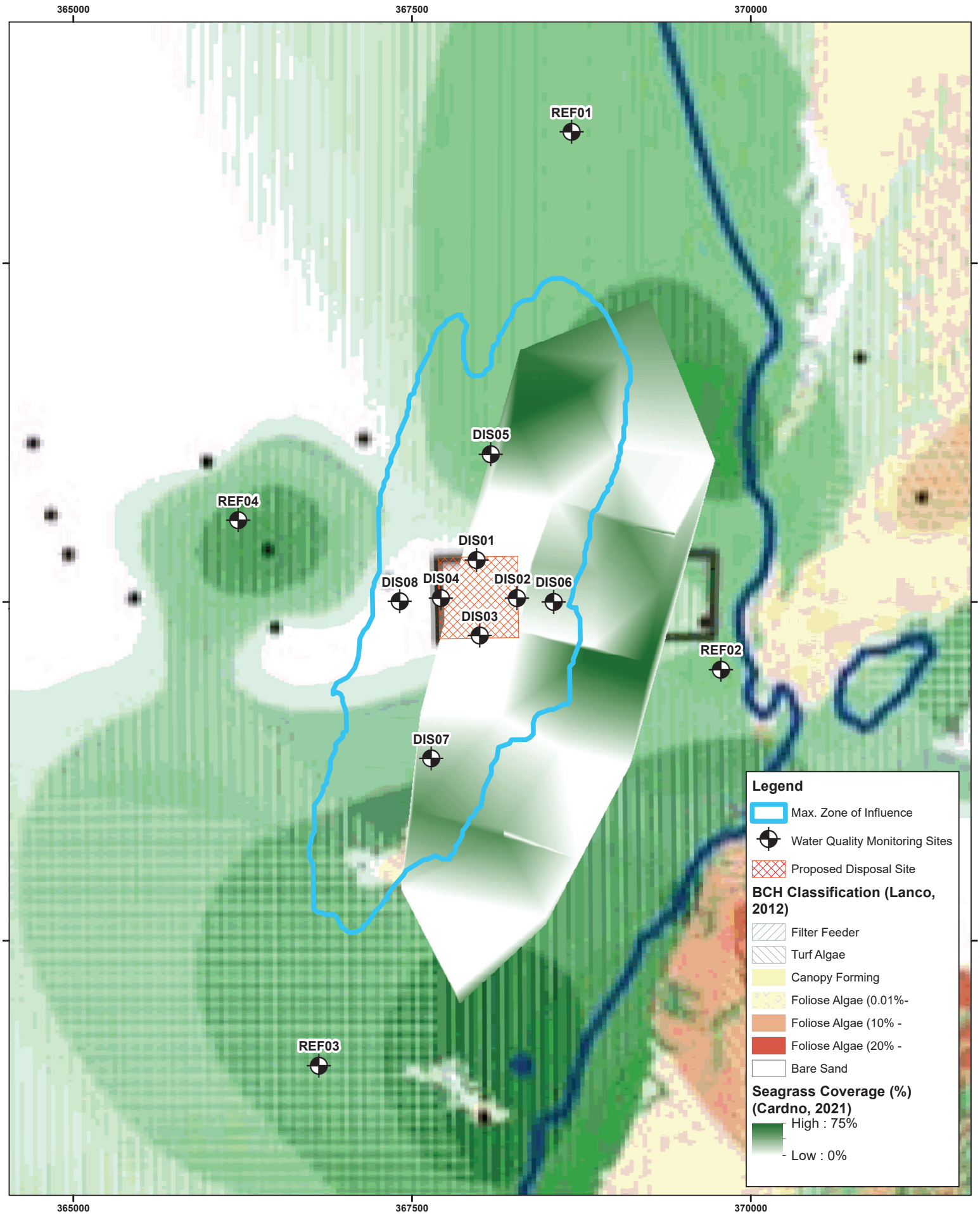
Proposed monitoring locations are detailed in **Table 7-1** and depicted in **Figure 7-1**. Locations of monitoring sites have been chosen considering calculated zones of influence as well as BCH mapping, specifically, locations of seagrass coverage.

Table 7-1 Proposed water quality monitoring sites and details

Area	Site ID	Purpose	Parameters	Timing	Compare against	Easting	Northing
Disposal Sites - Near	DIS01	Measure turbidity levels in near vicinity of disposal activities (north)	<u>Profiling:</u> NTU PAR Conductivity Temperature Dissolved Oxygen (DO) Depth <u>Water sampling for TSS analysis (in conjunction with profiling):</u> Near-surface Mid-water Near-bed	Fortnightly campaigns including 1 campaign 2 weeks pre- and post-disposal.	Triggers (see **Table 6-1**) Reference sites' conditions	367977	6322812
				Profiling immediately after individual disposal action (barge release) and 3 further sets, equally spaced in time until just prior to the next disposal action (4 repeats).			
				Collection of water samples during first disposal monitoring campaign only, in conjunction with all profiles.	Develop relationship between NTU and TSS to infer TSS from future NTU profiling		
	DIS02	Measure turbidity levels in near vicinity of disposal activities (east)	As above			368275	6322528
	DIS03	Measure turbidity levels in near vicinity of disposal activities (south)	As above			368000	6322252
	DIS04	Measure turbidity levels in near vicinity of disposal activities (west)	As above			367714	6322532

Area	Site ID	Purpose	Parameters	Timing	Compare against	Easting	Northing
Disposal Sites - Far	DIS05	Measure turbidity levels in far vicinity of disposal activities (north)	As above (excluding water sampling for TSS)			368082	6323592
	DIS06	Measure turbidity levels in far vicinity of disposal activities (east)	As above (excluding water sampling for TSS)			368546	6322503
	DIS07	Measure turbidity levels in far vicinity of disposal activities (south)	As above (excluding water sampling for TSS)			367642	6321344
	DIS08	Measure turbidity levels in far vicinity of disposal activities (west)	As above (excluding water sampling for TSS)			367411	6322505
Reference / Background Sites	REF01	Provide background data for assessment of natural vs dredging/disposal induced triggers (north)	As above (excluding water sampling for TSS)		Disposal monitoring sites	368678	6325970
	REF02	Provide background data for assessment of natural vs dredging/disposal induced triggers (east)	As above			369781	6322003
	REF03	Provide background data for assessment of natural vs dredging/disposal induced triggers (south)	As above			366814	6319079
	REF04	Provide background data for assessment of natural vs dredging/disposal induced triggers (west)	As above			366218	6323104

Area	Site ID	Purpose	Parameters	Timing	Compare against	Easting	Northing
Return water	TBC	Test water quality for acceptability to return to marine environment	To be confirmed once management approach is confirmed.			TBC	TBC



N

1:25,000 Scale at A3

km
0 0.4 0.8

Water Quality Monitoring Sites

CASUARINA HARBOUR DREDGING STUDIES
FIGURE 7-1

Cardno

Map Produced by Cardno WA (6100)
Date: 2022-04-08
Coordinate System: GDA 1994 MGA Zone 50
Project: CW1146500
Map: CW1146500_Water Quality Monitoring Sites_Rev2022.mxd 01

7.3 Marine Fauna Monitoring

7.3.1 Objective

To minimise the risk of impact to marine fauna from dredging and disposal activities and general vessel movement.

7.3.2 Monitoring

To lessen the risk of vessel strike and potential impact due to noise, it is required that a minimum of one crew member aboard the dredging vessel(s) hold an accreditation to act as a Marine Fauna Observer (MFO). Before the commencement of dredging, the crew member is responsible for undertaking a visual assessment. An exclusion zone of 150 m is to be maintained around the dredging vessel at all times for the following marine fauna:

- Dolphins;
- Whales;
- Turtles; and
- Sharks.

At half hourly intervals whilst dredging and disposing, a visual inspection is also required (actions can continue through this time).

Table 7-2 Visual assessment frequency

Stage	Timing	Responsibility	Observation Radius	Observation Duration
Pre-commencement	Preceding dredging	MFO	300 m	10 minutes
Whilst dredging/disposing	Every 30 minutes	MFO	300 m	5 minutes

7.3.3 Response

All marine fauna sightings are to be included in the daily dredge log submitted to the Principal the following day. Responses to various interactions are described in **Table 6-5**.

Table 7-3 Response to triggers

Trigger	Response	Cease response
Sighting of marine fauna including whales, sharks, dolphin, or marine reptiles within 300 m during transit	Limit dredge vessel speed to 6 kn and report observance in daily log	When MFO has sighted fauna leaving the 300 m zone
Sighting of marine fauna including whales, sharks, dolphin, or marine reptiles within 300 m in the 30 minutes before commencing, or during, dredging or disposal	Do not commence dredging or disposal	No sighting within 300 m for 30 minutes
Marine fauna strike	Halt dredging and report to injured wildlife number immediately. Report incident to DoT to report to Department for Biodiversity, Conservation and Attractions and Department of Agriculture, Water and the Environment within 48 hours. Report in daily and weekly logs.	Appropriate care has been given to animal and MFO is confident there is no fauna within the 300 m zone

7.4 Invasive Marine Species Management Framework

7.4.1 Objective

Minimise the risk of invasive species attached to the hull of a dredging vessel or in its ballast water system being introduced to the project area/region. Note that Southern Ports undertake biennial marine pest monitoring, as well as 10-yearly comprehensive baseline surveys (Southern Ports, 2021).

7.4.2 Management actions

Table 7-4 contains management options and triggers related to the transfer of invasive marine species by dredging vessels.

Table 7-4 Management actions for the prevention of invasive species

Trigger	Management Action
Any dredging works	> Determine vehicle risk of introducing invasive marine species due to previous dredging activities or movement referring to the National biofouling management guidelines for recreational vessels (Marine Pest Sectoral Committee, 2018) > Regular maintenance of vehicle including the application of biofouling paint within its recommended lifespan > Maintenance of 10 km buffer between vessel and commercial oyster farms
Dredger determined to be 'high risk' in risk assessment	> Vessel will require inspection, hull cleaning, dry docking and/or treatment of internal seawater systems dependant on reason for 'high' rating
Dredger has been overseas	> If vessel has been procured overseas, it is required that it undergoes cleaning in dry-dock before arrival in Australia > Ballast water from overseas waters must be exchanged at least 200 nautical miles from Australia's coastline in waters > 200 m deep (DAWE, 2020) > Ballast exchange much replace at least 95% of their volume via flow-through or emptying and refilling. To achieve this the IMO (2004) recommends that three times the capacity of ballast tanks is pumped through the system

7.4.3 Reporting

The following reporting related to invasive marine species is required:

> Inspection report of dry-dock cleaning by specialised consultant (overseas vessels only) is to be submitted to the DoT before mobilisation of dredge; and

> Prior to mobilisation logs detailing vehicle loads, exchanges or discharges of ballast water shall be submitted to the DoT.

7.4.4 Corrective actions

Should an invasive species be detected or is suspected the following actions should be undertaken:

> Notification of the Department of Agriculture Water and the Environment (DAWE) including location of dredger when discovered, suspected species and sample of species; and

> Development of action plan to remove invasive species from vessel and any necessary remediation of the affected marine environment. Plan is to be drafted in consultation with DAWE.

8 Reporting

8.1 General

8.1.1 Daily Reporting

Daily reports (succinct) shall be provided by the Contractor to the Superintendent including:

- Dredge/disposal log, as per **Section 6.2.2**;
- Incident of accidental spills or collision with protected marine species. Furthermore:
  - Incidents are required to be reported to the Superintendent immediately after the initial response to the incident is complete;
  - Marine pollution incidents are also required to be reported to the Marine Environmental Emergency Response unit (MEER); and
- Dredging and disposal 48 -hour lookahead - any changes to dredge plan.

8.1.2 Weekly Reporting

Weekly reporting shall be provided by the Contractor to the Superintendent including:

- Weekly dredge report, as per **Section 6.2.3**;
- Implementation of responses to any trigger exceedances or protected marine species sightings/interactions;
- Summary of protected marine species encountered; and
- Dredging schedule update.

8.1.3 Water Quality Monitoring Reporting

Water quality monitoring campaign summary reports are to be in a format agreed upon by DoT and delivered within 7 days of data being collected in the field. They should include, as a minimum:

- Plots and statistical summary of vertical profiling data for all parameters and profiles;
- Calculation of depth averaged TSS at each monitoring site;
- Summary of laboratory TSS data and established relationship between TSS and NTU;
- Identification of any trigger exceedances;
- Summary of disposal rates associated measurement campaign;
- Assessment of trigger exceedance with respect to potential impacts to seagrass; and
- Recommendation for management should impacts be predicted.

8.2 Compliance Monitoring

A Sea Dumping Permit is required for the disposal of spoil material offshore. As the proponent of the disposal activities, DoT or its representative will be responsible for the submission of any logs, reports or data required by the Sea Dumping Permit to DAWE. DoT or its representative will also be responsible for reporting any non-compliance with the requirements of the Sea Dumping Permit to DAWE.

8.3 Public Complaints

Complaints by the public made to the Contractor are to be reported to the Superintendent in the daily dredging log with the following information:

- Date and time of complaint;

- Description of complaint;
- Complaint details (may be anonymous); and
- Perceived cause of complaint and proposed action, including complaint owner and action date.

The Superintendent is to determine the validity of the complaint, if deemed valid, the contractor is to initiate proposed action to complaint.

8.4 Summary of Reporting

Table 8-1 summarises required reporting associated with the dredging program.

Table 8-1 Summary of reporting requirements

Reporting	Responsibility	Timing	Recipient	Content
General				
Daily reporting	Contractor	Daily	Proponent (DoT)	See Section 8.1.1
Weekly monitoring report	Contractor	Weekly	Proponent (DoT)	See Section 8.1.2
End of dredging phase reporting	Contractor	Within four weeks of the conclusion of dredging activities	Proponent (DoT)	Summary of dredging activities including footprint, levels, turbidity, exceedances, complaints and environmental and safety incidences
Water quality monitoring	Contractor	Within 7 days of fortnightly monitoring campaign	Proponent (DoT)	See Section 8.1.3
Compliance reporting	Proponent (DoT)	As per Sea Dumping Permit conditions	DAWE	As per Sea Dumping Permit conditions
Exceedance				
Water quality monitoring summary report	Contractor	7 days post fortnightly monitoring campaign	Proponent (DoT)	See Section 7.1.3 - 7.1.4
Incident				
Death or injury of a protected marine species	Contractor (MFO to assist)	Within 24 hours (with daily dredge log)	Proponent (DoT)	Time, location, species and statement from MFO and proposed mitigation measures to prevent further occurrences. Incidents required to be reported to the Superintendent immediately after the initial response to the incident is complete.
Dredger history	Contractor	Prior to mobilisation	DAWE	Vehicle locations, loads, exchanges or discharges of ballast water
Dredger cleaning	Contractor	Prior to mobilisation (if overseas vessel)	DAWE	Inspection and cleaning report. Statement from qualified inspector

Invasive species detection	Contractor	Immediately	DAWE	Time, location, suspected species, sample, remedial actions
Chemical, oil spills etc	Contractor	Immediately	24-hour spill report line	Time, location, substance, quantity, cause, clean up attempts and proposed mitigation measures to prevent further occurrences. Incidents are required to be reported to the Superintendent immediately after the initial response to the incident is complete. Marine pollution incidents are also required to be reported to the Marine Environmental Emergency Response unit (MEER).
		Within 24 hours (with daily dredge log)	Proponent (DoT)	
Complaints Reporting				
Complaints	Contractor	Within 24 hours (with daily dredge log)	Proponent (DoT)	See Section 8.3

9 Roles and Responsibilities

To ensure the objectives of this DSDMP are met, defined roles and responsibilities for the Principal, Contractor and wider project team are listed in **Table 9-1**.

Table 9-1 DSDMP responsibilities

Position	Responsibilities
Principal / Proponent (DoT)	> Overall responsibility for the project > Responsibility for Sea Dumping Permit conditions being met > Overall responsibility for complying with relevant legislation, standards and guidelines > Engagement with stakeholders regarding environmental impacts and progress of dredging plan including reporting and monitoring
Contractor(s)	> Complete dredging and disposal works as per technical specifications > Completion of final Marine Construction Monitoring and Management Plan (MCMMP) incorporating management actions contained in this DSDMP > Compliance with monitoring and reporting requirements of DSDMP / MCMMP > Safety of staff, public and the environment > Reporting daily/weekly reports, incidents, complaints to the relevant bodies
Wider project team	> Comply with the requirements of the DSDMP > Comply with all the legal requirements under the project's approval and relevant legislation > Ensure environmental factor objectives are met

10 References

ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments*, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines.

Australian Government (2021) *Environment Protection and Biodiversity Conservation Act 1999*.

Australian Government (2016) *Environment Protection (Sea Dumping) Act 1981*.

Cardno (2022a) *Casuarina Harbour Dredging Studies: Sampling and Analysis Plan - Implementation Report*. Prepared for DoT.

Cardno (2022b) *Casuarina Harbour Dredging Studies: Offshore Disposal Impact Hypothesis Report*. Prepared for DoT.

Commonwealth of Australia (2009) *National Assessment Guidelines for Dredging*. Canberra.

Commonwealth of Australia (2013) *Matters of National Environmental Significance: Significant impact guidelines 1.1*. Australian Government Department of the Environment.

EPA (2021a) *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual*. Published October 2021.

EPA (2021b) *Statement of environmental principles, factors, objectives and aims of EIA*. Published October 2021.

Galt Geotechnics (2019) *Interpretive Report on Geotechnical Study – Transforming Bunbury's Waterfront Stage 3 Coastal & Marine Structures.* Prepared for Seashore Engineering, 16 May 2019.

Government of Western Australia (2021) *Environmental Protection Act 1986.*

GHD (2022) *Marine Environmental Quality Modelling – Koombana Bay Marine Structures SPER*. Prepared for Southwest Development Commission, 18 March 2022.

Minister for the Environment (2016) *Sea Dumping Permit No. SD2013/2482.* Provided to Lanco Resources Australia Pty Ltd, 7 June 2016.

RPS (2017) *SAP Implementation Report – Casuarina Harbour*. Prepared for DoT, 1 December 2017.

RPS (2022) *Benthic Communities and Habitat Study*. Prepared for the South West Development Commission for KBMS SPER. Ref No EEL16056.A00.

Southern Ports (2021) *Marine Environmental Management Plan*.

Vasblom, Prof. Ir. W.J. (2003), *Introduction to Dredging Equipment*, 27 May 2003

Wave solutions (2012) *Technical Report 2 – Site selection and assessment for offshore placement of dredge material*. Prepared for Lanco Resources Australia Pty Ltd, 23 April 2012.

Wiltshire, K.H., Theil, M.J., Giblot-Ducray, D. and Deveney, M.R (2020) *Molecular surveys in 2020 of priority marine pests for the ports of Bunbury, Kwinana, Fremantle and Geraldton.* Report to the Department of Agriculture, Water and the Environment. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2020/000354-01. SARDI Research Report Series No. 1082. 48pp.