Port Hedland Outer Harbour Development

SEA DUMPING APPLICATION

- Revision 2
- 15 February 2011

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Sinclair Knight Merz
ABN 37 001 024 095
9th Floor, Durack Centre
263 Adelaide Terrace
PO Box H615
Perth WA 6001 Australia

Tel: +61 8 9469 4400
Fax: +61 8 9469 4488
Web: www.skmconsulting.com

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Australian Government
Department of Sustainability, Environment, Water, Population and Communities

APPLICATION FORM FOR A PERMIT UNDER THE *ENVIRONMENT PROTECTION (SEA DUMPING) ACT 1981* TO DISPOSE OF DREDGE OR EXCAVATION MATERIAL AT SEA

INTRODUCTION

The purpose of this form is to enable the assessment of the need for, and potential environmental impacts of, proposals to dispose of dredge or excavation material at sea. This application form should be used for capital or maintenance works. On the basis of this assessment the Minister may grant, or refuse to grant, a permit for the proposed disposal under Section 19 of the *Environment Protection (Sea Dumping) Act 1981* (the Sea Dumping Act).

This form is also designed to indicate whether the proposal should be referred under Section 160 of the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). If required, the determining authority will refer the proposal under the EPBC Act. It is not necessary for the applicant to perform this referral, however, if this has been done, the determining authority should be notified in the application.

The application form is to be read in conjunction with the **National Ocean Disposal Guidelines For Dredged Material (the Guidelines)**, released May 2002, which describe in detail the procedures which are to be followed in sampling, testing and assessing the suitability of material to be disposed at sea, and evaluating and monitoring disposal sites. Where applicants require a specialist report to fulfil these requirements, the report should be attached to the application form and brief answers to the questions provided, cross-referenced to the relevant sections of the report.

The application must clearly describe the material to be disposed at sea, its origin, quantity, physical and chemical composition, any toxicity characteristics and how it will be transported and disposed at sea. Sufficient information on the disposal locality and the potential environmental impacts must be provided so that these impacts can be properly assessed.

Under the regulations to the Sea Dumping Act (Amended 2001), the application fee for a permit is dependent on the length of the permit, the quantity of sediment to be disposed of, the presence of contaminants in the sediment and the environmental sensitivity of the dredge and disposal sites. The application fee must be forwarded before a permit may be issued. The application fee must be received within 30 days of the application being forwarded, and no assessment will commence until such fees are received. The Minister may waive the requirement for payment of all or part of such fee where it is considered necessary or desirable to do so.

Completed applications should sent to:
Director
Ports and Marine Section
Approvals and Wildlife Division
Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787, Canberra ACT 2601

Further information may be obtained from the Sea Dumping Program:
Ph: 02 6274 2995

Pretext

In application for a permit to dispose of dredged material to sea, provision of an environmental risk assessment in accordance with the current dredging assessment guidelines is required. The current assessment guidelines are the National Assessment Guidelines for Dredging (NAGD) and were released in 2009. Prior to NAGD, the guidelines were the National Ocean Disposal Guidelines for Dredge Management (NODGDM), released in 2002. Initiation of the environmental assessment process is preparation and submission of a Sampling and Analysis Plan (SAP) to be reviewed and approved by the Federal Government, ensuring the adequacy of the proposed assessment process.

The SAP and Supplemental SAP for the proposed Outer Harbour Development dredging and disposal activities was submitted to the Department of Environment, Water, Heritage and the Arts (DEWHA) in August and November 2008, respectively, and was therefore submitted under the requirements of NODGDM. Although the Proponent has the option of resubmitting a SAP under revised guidelines, they are not required to revise and resubmit a SAP in the event that revised guidelines are released during an assessment process. This was the case for BHP Billiton Iron Ore for the proposed Outer Harbour Development dredging and disposal activities. As a result, BHP Billiton Iron Ore's request for a Sea Dumping Permit for ocean disposal of dredged material will be assessed under the NODGDM.

It should be noted that BHP Billiton Iron Ore undertook the environmental risk assessment process for the ocean disposal of dredged material for Port Hedland Nelson Point Dredging. Although the assessment process commenced under NODGDM, BHP Billiton Iron Ore adjusted the process to align with requirements of NAGD primarily because the process was in the early stages of the assessment and therefore the disruption to the assessment process was minimal. This would not have been the case for the proposed Outer Harbour Development however, which had progressed substantially in the assessment process once NAGD had been released. BHP Billiton Iron Ore notes that it is familiar with the NAGD and acknowledges the recommended processes therein.

1. Part I – Summary

Name of applicant: BHP Billiton Iron Ore

General Project Description:

BHP Billiton Iron Ore proposes to develop an Outer Harbour facility adjacent to existing facilities at Port Hedland in the Pilbara Region of Western Australia to meet increasing global demand for iron ore. The proposed development will provide an export capacity of approximately 240 Mtpa of iron ore. The project description outlined below is based on the current engineering design concept and details may change as the project design is further defined and finalised. This includes the following major components (from terrestrial to marine environment):

- rail spur from the existing BHP Billiton Iron Ore mainline to the proposed stockyards at Boodarie;
- rail loops at the Boodarie stockyards;
- stockyards at Boodarie;
- infrastructure corridor from the Boodarie stockyards to the proposed wharf;
- jetty, wharf, dredged channel, basins and berth pockets to accommodate shipping vessels;
- supporting infrastructure; and
- construction camp(s).

The dredging involved in this project will be undertaken in three stages. There will be a break between dredging activities for Stage 2 and Stage 3. Volumes of material to be dredged include over-dredge allowance of one metre. The three stages and volumes from each area are as shown in **Table 1** below.

- **Table 1 Proposed project stages**

Stage	Description	Proposed Start date	Duration (months)	Approximate Volume (Mm^3)
Stage 1	Basin and links to existing channel	2010/2011	24	22
Stage 2	Basin extension, new channel and cross-link to new channel	2012/2013	25	21 (basin & link) 4 (new channel)
Programme Break	Staged delay between Stage 2 and Stage 3	2015	15	Nil
Stage 3	Basin extension	2016	7	7
Total			**71**	**54**

Type of Material Requiring Disposal:

☑	New or Capital	☑	Dredge
☐	Continuing maintenance	☐	Excavation

Location of disposal sites:

Three disposal sites and one contingency disposal site have been selected from nine potential locations identified during the spoil ground site selection study phase which is provided separately. The coordinates of these sites are provided below and shown in **Figure 1**.

Spoil Ground 2 (Contingency site)

	Latitude	Longitude	Easting	Northing
NW	S 20°05.080'	E 118°58.500'	6654647	7770023
NE	S 20°05.080'	E 118°58.500'	665617	7766886
SE	S 20°05.080'	E 118°61.830'	669101	7766853
SW	S 20°05.080'	E 118°61.830'	669131	7769989

Datum GDA94, Projection MGA94 Zone 50K

Spoil Ground 3

	Latitude	Longitude	Easting	Northing
NW	S 20°05.080'	E 118°33.601'	663114	7778387
NE	S 20°05.054'	E 118°36.542'	668240	7778386
SE	S 20°07.598'	E 118°36.568'	668240	7773692
SW	S 20°07.625'	E 118°33.626'	663114	7773692

Datum GDA94, Projection MGA94 Zone 50K

Spoil Ground 7

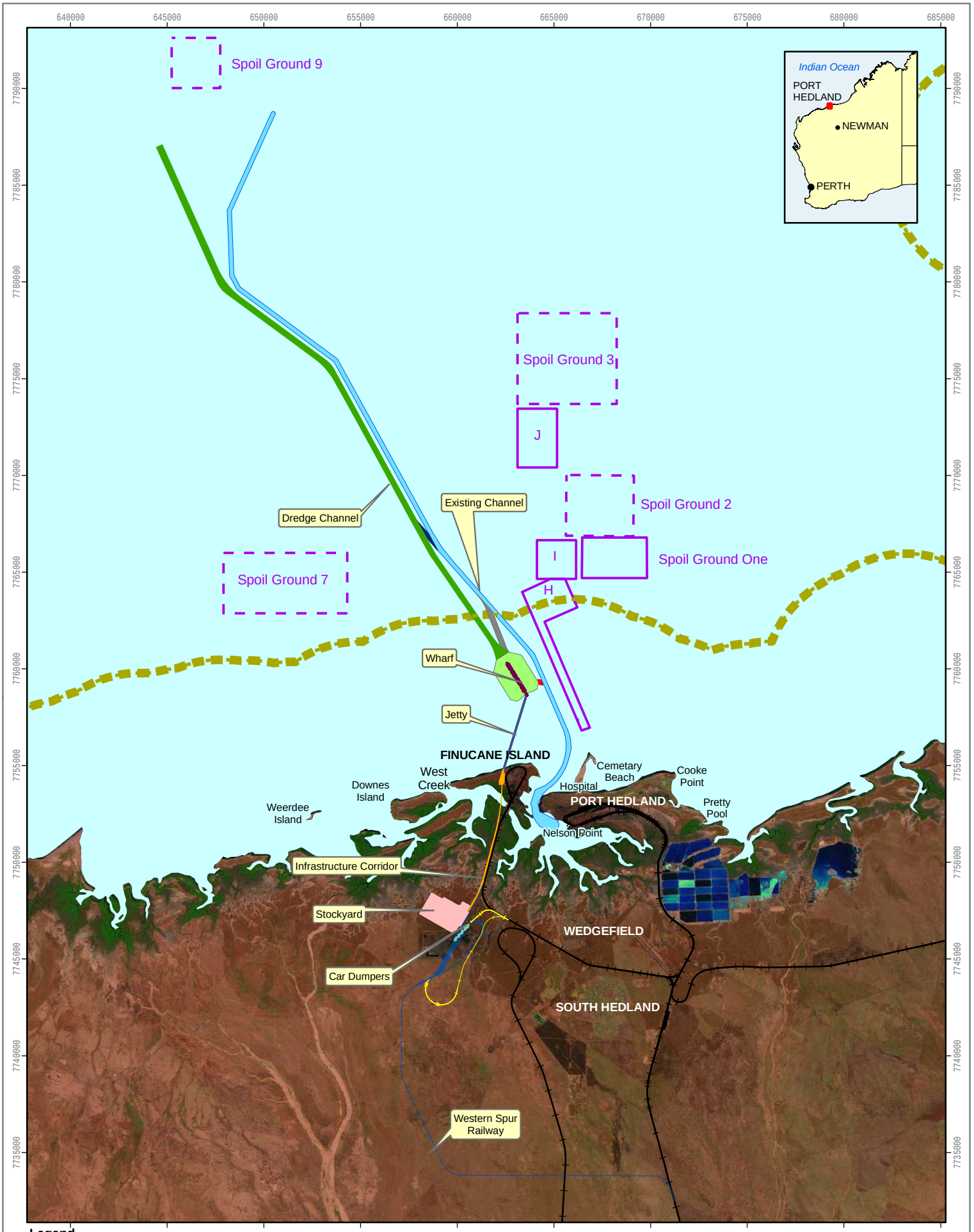
	Latitude	Longitude	Easting	Northing
NW	S 20°11.867'	E 118°24.941'	647914	7766000
NE	S 20°11.837'	E 118°28.620'	654321	7766000
SE	S 20°13.530'	E 118°28.634'	654318	7762877
SW	S 20°13.560'	E 118°24.954'	647910	7762877

Datum GDA94, Projection MGA94 Zone 50K

Spoil Ground 9

	Latitude	Longitude	Easting	Northing
NW	S 19°57.456'	E 118°23.276'	645234	7792610
NE	S 19°57.445'	E 118°24.713'	647742	7792610
SE	S 19°58.849'	E 118°24.726'	647742	7790020
SW	S 19°58.860'	E 118°23.288'	645234	7790020

Datum GDA94, Projection MGA94 Zone 50K



Legend

- Spoil Ground (Existing)
- Spoil Ground (Proposed)
- Proposed Car Dumper
- Proposed Jetty
- Proposed Wharf
- Proposed Tug Access Channel
- Existing Railway
- Proposed Goldsworthy Rail Loop
- Proposed Western Spur Railway
- State/Commonwealth Jurisdiction Boundary
- Proposed Infrastructure Corridor
- Proposed Stockyards
- Proposed Departure Channel
- Proposed Berth Pockets and Swing Basins
- Proposed Link Channel
- Proposed Crossover Channel
- Existing Shipping Channel

0 2.5 5
kilometres

Scale @ A4: 1:250,000
Datum: GDA94
Map Grid: MGA94 Zone 50

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Source:
Imagery: Landsat (2005)
Jurisdiction Boundary: AMBIS (2001)
Topography: Geoscience Australia, GEODATA Topo 250K V3

Figure 1 - Project Overview

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Dates of proposed disposal operations: Between December 2010 and December 2016

Permit required by: 4th Quarter 2010

Quantity of material to be disposed:

The material requiring disposal will be split into three stages as mentioned earlier. In total approximately 54 Mm^3 of material will be disposed to three spoil grounds as indicate in **Table 2**. However, this is subject to finalisation of metocean studies. Material may be disposed of at the proposed contingency spoil ground following this finalisation.

- **Table 2 Quantity of material to be disposed and destination**

Dredge Area	Surface Area	Volume	Disposal Location Approximate Distribution
Basin and link to existing channel	2.254 km^2	22 Mm^3	50% Spoil Ground 3 50% Spoil Ground 7
Basin extension, new channel and cross-link to new channel	10.852 km^2	25 Mm^3	50% Spoil Ground 3 45% Spoil Ground 7 5% Spoil Ground 9
Basin extension	1.063 km^2	7 Mm^3	50% Spoil Ground 3 50% Spoil Ground 7
Total	**14.17 km^2**	**54 Mm^3**	

Length of permit applied for in this application:

BHP Billiton Iron Ore anticipate completion of the dredging programme over approximately a 72 month period and, therefore, the permit application for six (6) years will allow for any unforeseen circumstances.

Details of previous permits applied for:

BHP Billiton Iron Ore have previously undertaken extensive dredging programmes at Port Hedland for existing iron ore related operations and have continually complied with the conditions of the related Sea Dumping Permits. Most recently these include the RGP5 and RGP6 projects.

- **Table 3 Previous Sea Dumping Permit applications submitted by BHP Billiton Iron Ore in the Port Hedland region**

Project	Date	Dredge Spoil Volume (Mm^3)	Status of Approval
	2002	0.46	Approved
RGP5	2008/9	0.8	Approved
RGP6	2009/10	6.0	Approved

2. Part II – Application Fee

1: Contaminated Sediment

☐ The sediment to be dumped contains listed substances in an amount equal to or greater than the screening levels (or twice the background level, if the background level is greater than the screening level).

The natural seafloor substrata requiring removal is considered uncontaminated and has not been exposed to anthropogenic contaminants. Elevated levels of arsenic found in the surficial sediments are naturally occurring and are found throughout the region. A preliminary waste prevention audit indicates that the nearest waste generating activities in the project area (Port Hedland Inner Harbour) have not caused any contamination of the surface seafloor sediments requiring dredging.

Whilst the sediment levels of arsenic in the material to be dumped exceed the screening level they do not exceed twice background.

Table 4 Surficial sediment analysis of dredge footprint and potential spoil grounds

Parameter	Units	Guidelines [a]		Proposed SAP Dredge Footprint			Potential Spoil Ground Areas		
		Screening	Maximum	Wharf Area (1-10)	Inner Channel (11 – 31)	Outer Channel (32 – 50)	Area 3	Area 7	Area 9
Antimony	mg/kg	2	25	0.3	0.3	0.3	0.3	1.6	0.32
Arsenic	mg/kg	20	70	**42.7**	**41.7**	**22.2**	**43.1**	**70.1**	**27.6**
Cadmium	mg/kg	1.5	10	0.1	0.1	0.1	0.17	0.19	0.1
Chromium	mg/kg	80	370	18.1	17.6	16.4	24.8	45.7	25.2
Cobalt	mg/kg	–	–	6.4	5.9	4.0	7.5	8.9	3.9
Copper	mg/kg	65	270	4.1	3.3	3.2	10.0	5.4	2.8
Lead	mg/kg	50	220	5.0	4.6	3.2	4.9	6.8	3.2
Manganese	mg/kg	–	–	249.3	649.0	494.5	1296.3	634.4	514.4
Mercury	mg/kg	0.15	1	0.005	0.005	0.005	0.005	0.11	0.03
Nickel	mg/kg	21	52	7.0	8.3	6.2	10.1	9.2	4.2
Silver	mg/kg	1	3.7	0.1	0.1	0.1	0.07	0.15	0.05
Zinc	mg/kg	200	410	7.8	8.1	5.8	14.9	8.9	6.2

a National Ocean Disposal Guidelines for Dredge Material (EA 2002).
Note: Bold values exceed screening levels.

2: Environmentally Sensitive Sites

The dredging, excavation, dumping or a related activity may significantly impact upon:

▪ a declared World Heritage property	
▪ a declared Ramsar wetland	
▪ a Commonwealth marine area	✓
▪ a Biosphere reserve	
▪ a Commonwealth reserve	
▪ a conservation zone	
▪ a listed threatened species	
▪ a listed threatened ecological community	
▪ a listed migratory species	
▪ cetaceans	
▪ a listed marine species	
▪ habitat of above species or community	

3: Application Fee Payable

The volume of the material exceeds 100,000 m^3; therefore, the fee payable is $23,500.

3. Part III - Applicant

4: Identity of Applicant

Name:	BHP Billiton Iron Ore
Address:	Cloisters Square Perth WA 6000
Postal address (if different):	PO Box 7122, Cloisters Square, Perth, Western Australia 6850
Contact person:	Gavin Price (Manager Environment and Sustainable Development)

Phone: 08 6224 4024 Fax: 08 6224 4593

Email: Gavin.Price@bhpbilliton.com

5: Identity of the Owner of the Material to be Disposed at Sea

(if different to Question 4)

Within the Port Headland Port Authority jurisdiction the owner of the material is as follows; otherwise it is as indicated in **Question 4**.

Name:	Port Hedland Port Authority
Address:	The Esplanade, Port Hedland, WA 6721
Postal address (if different):	PO Box 2, Port Hedland, WA 6721

Phone: 08 9173 1400 Fax: 08 9173 0060

Email: phpa@phpa.com.au

4. Part IV – Previous Testing and Monitoring

6: Testing and Monitoring

Provide details of any relevant testing and monitoring undertaken prior to making this application (or since the last application)

Testing was undertaken as per the Sampling and Analysis Plan (SAP) and is still current for this application. The data is summarised and assessed in **Section 5**.

The following additional studies have been undertaken:

- detailed habitat mapping of the region;
- numerical modelling of predicted plumes during dredging and disposal;
- background water quality monitoring at potential impact and reference sites;
- coral monitoring at potential impact and reference sites;
- background sedimentation monitoring at potential impact and reference sites,
- infauna monitoring at selected proposed spoil grounds; and
- turtle monitoring at known nesting and feeding areas.

The information from these reports has been summarised and included in relevant sections of this application.

In addition to the studies undertaken, the following draft management plans associated with the proposed dredging are being prepared and will be finalised once the environmental approval has been granted:

- Dredging and Spoil Disposal Management Plan;
- Marine Mammal Management Plan
- Turtle Management Pan; and
- Invasive Marine Species Management Plan.

These plans are discussed in **Section 8**.

7: Exemption

Has an exemption from detailed testing requirements been given?

No exemption for detailed testing has been given nor has any been requested. The SAP detailed the step-wise process of contaminant evaluation and if detailed testing was required it would be undertaken.

5. Part V - Description of Material to be Dumped

8: Description of the Material to be Dumped at Sea

8.1: Type of Material

- Dredge spoil ☑
- Excavation material ☐
- Other (describe) ☐

8.2: Volume of Material (*in situ*)

The volume of dredge spoil to be disposed of from the capital dredging including estimated over-dredging and approximate spoil distribution is as follows:

- **Table 5 Approximate quantities of material to be disposed and destination**

Source	Approximate Volume	Disposal Location Approximate Distribution
Basin and link to existing channel	22 Mm^3	50% Spoil Ground 3
		50% Spoil Ground 7
Basin extension, new channel and cross-link to new channel	25 Mm^3	50% Spoil Ground 3
		45% Spoil Ground 7
		5% Spoil Ground 9
Basin extension	7 Mm^3	50% Spoil Ground 3
		50% Spoil Ground 7
Total	**54 Mm^3**	

8.3: Works to be Covered by This Application

BHP Billiton Iron Ore is seeking parallel approval under the State *Environmental Protection Act 1986* (EP Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to undertake the Outer Harbour Development, located in Port Hedland, Western Australia.

The Outer Harbour Development will provide an export capacity of approximately 240 Mtpa of iron ore. This will be established in four stages, with incremental expansions brought on line to reach the maximum capacity. Expansion stages will occur through four separate modules, each with a nominal capacity of up to 60 Mtpa. Regulatory approvals are being sought for the infrastructure required to deliver the total capacity of 240 Mtpa.

The Outer Harbour Development will involve the construction and operation of landside and marine infrastructure for the handling and export of iron ore.

Key marine structures and activities will include:

- an abutment, jetty and wharf;
- mooring and associated mooring dolphins;
- transfer station and deck;
- associated transfer stations, ore conveyors and shiploaders;
- dredging for berth pockets, basins and channels; and
- aids to navigation.

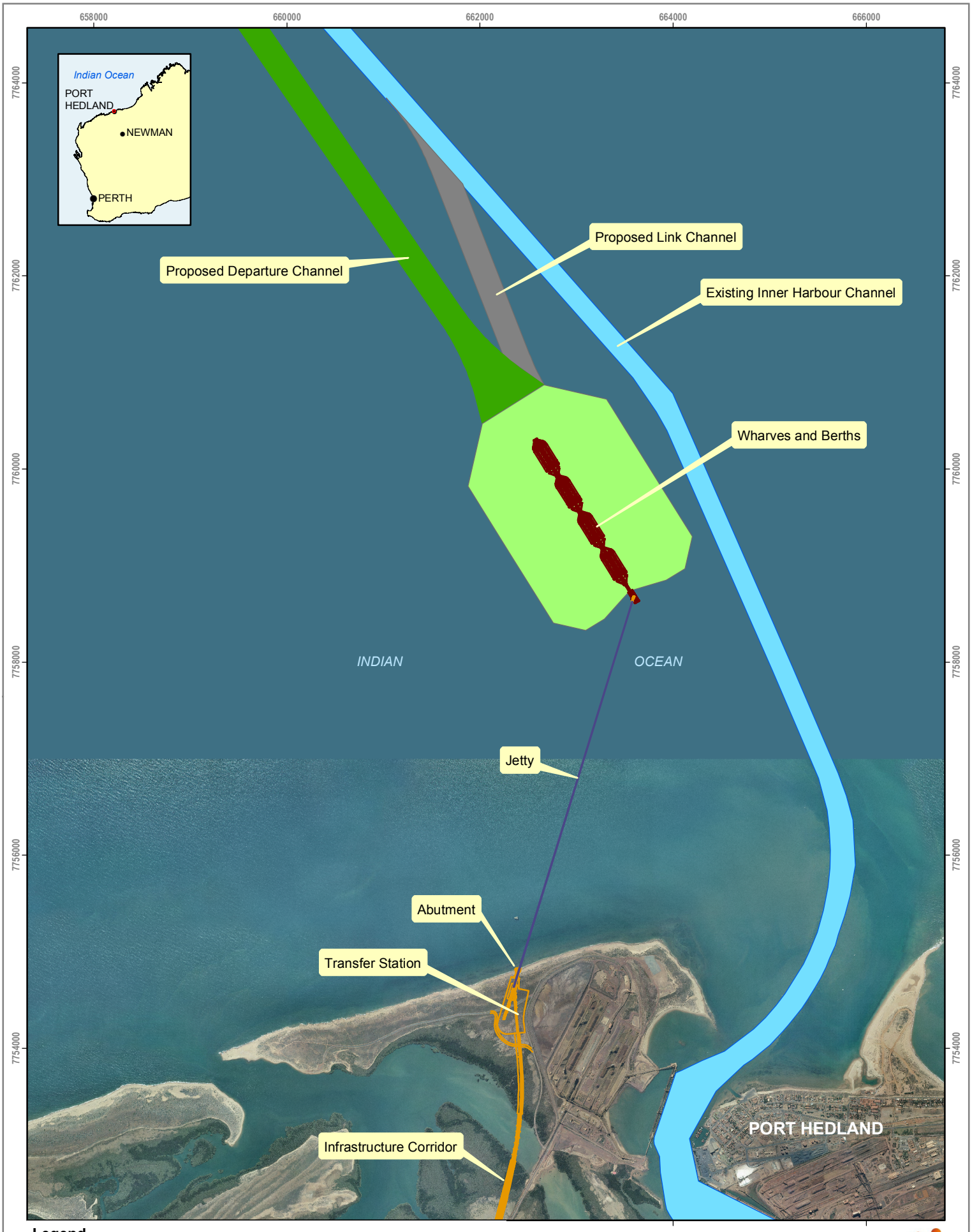
This project description is based on the engineering investigation and design completed to date (December 2008) and incorporates alternatives and/or options which are still being considered. Alternatives will be evaluated as BHP Billiton Iron Ore continues with the detailed engineering and design process prior to construction commencing.

The key marine related characteristics for the project are outlined in **Table 6**. An overview of the project's location, layout and footprint is shown in **Figure 1**.

Table 6 Project key marine characteristics

Element	Description
Wharf	approximately 2 kilometres (km) in length.
	Comprises eight berths, four shiploaders, shiploader rail system, access roadway and walkways, maintenance bays and conveyor system.
Vessel Sizes	Up to 320,000 dead weight tonnes (DWT).
Jetty	Approximately 4 km in length.
Shipping Channel	Approximately 34 km in length.
Dredge Material	Volume: approximately 54 million cubic metres (54 Mm^3).
	Disposal: Three offshore spoil grounds in Commonwealth waters

This application relates to the dredging associated with the establishment of a basin which will form the berth pockets and turning areas, a link to the existing channel, a new channel parallel to the existing channel and a cross-link from the existing channel into the new channel (see **Figure 2**). This dredging will be undertaken in stages and will require the disposal of 54 Mm^3 to sea on three spoil grounds.



Legend

- Proposed Jetty
- Proposed Wharf
- Proposed Infrastructure Corridor
- Proposed Stockyards
- Proposed Departure Channel
- Proposed Berth Pocket and Swing Basins
- Proposed Link Channel
- Proposed Crossover Channel
- Existing Shipping Channel

0 1 2
kilometres

Scale @ A4: 1:50,000
Datum: GDA94
Map Grid: MGA94 Zone 50

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Source:
Orthorectified Aerial Photograph: 15/06/2007 (BHPBIO)
Topography: Geoscience Australia, GEODATA Topo 250K V3
Channel: Navy Hydrographer (Aus00740)
Wharf: 113-SK-00002 Rev A 22/10/2008 (FAST)

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Figure 2 General arrangement of marine infrastructure

The construction of the Outer Harbour Development will require dredging to enable vessel access to the wharf. A bathymetric survey conducted in 2008 indicated that the depth of the existing seabed varies within the project footprint from less than +1.4 m CD to over -25 m CD.

Dredging operations will create new berth pockets, swing basins and departure basins, a departure link channel to the existing Inner Harbour shipping channel, a new departure channel and a cross-over link channel enabling access for departing, laden vessels from the Inner Harbour shipping channel into the new departure channel. This new departure channel will be approximately 34 km in length to accommodate vessels as shown in **Figure 1**.

The new departure channel is aligned approximately parallel to the existing Port Hedland Inner Harbour shipping channel. However, the route deviates to the north-west from the existing channel at the outer end. The chosen alignment is the shortest possible route to deep water from the wharf site. It has been selected to:

- avoid charted shallow water;
- avoid sensitive marine habitat;
- to maximise synergies with existing shipping infrastructure; and
- contain proposed disturbance and activities as close to existing developed areas as possible.

The layout and widths of channels, swings basins and departure basins and berth pockets have been designed for the proposed vessel types in accordance with international standards. The required depths will be approximately -22 m CD for the berth pockets, -23 m CD for the wharf footprint area, -11 m CD for the swing basins and -16 m CD for the departure basins, based upon a 320,000 DWT vessel. The swing basins, departure basins, berth pockets and up to 3 km of the new departure channel will be located in State waters, with the remainder of the departure channel being in Commonwealth waters. The depths along the departure channel will range from -15.2 m CD to -16.7 m CD.

The total volume of dredged material is estimated to be approximately 54 Mm^3 (inclusive of over-dredging). A range of material types are present within the proposed dredge footprint, requiring the use of a trailing suction hopper dredgers (TSHD) for unconsolidated materials, whilst harder materials will first require cutting and/or crushing using a cutter suction dredger (CSD) with the material being left on or placed back onto the sea floor via a spreader barge and subsequently being removed with a TSHD.

Based on the geotechnical studies completed to date, there have been no areas identified in the dredging footprint that would necessitate marine blasting operations for material extraction. However, offshore geotechnical investigations are ongoing to further characterise the dredge material, determine dredging techniques and optimise engineering design. If exceptionally hard

materials are identified that would require marine blasting to enable dredging, a work methodology and programme will be prepared, including environmental management procedures, to mitigate potential adverse impacts.

Typically dredging will start with TSHD(s) removing the top layers of unconsolidated materials. This is the material that can be economically trailed directly. Once a sufficiently large area has been cleared down to the hard layer, a CSD will then be deployed to crush a first layer of the harder material. The CSD crushes the material and deposits it back onto the seabed immediately behind the cutter head using its submerged ladder pump. In the meantime, the TSHD(s) will be clearing unconsolidated materials from the top layer of adjacent areas. After finalising cutting/crushing of the first hard layer of the initial area, the CSD will move to the next area the TSHD(s) has cleared and commence crushing. The TSHD(s) at this stage will then return to the previous area to remove the crushed materials.

If necessary, the CSD will then return to this area if more cutting/crushing is required. The sequence of cutting and crushing per layer in a certain area and subsequent removal by a TSHD will be repeated until the design depth is reached. In areas where the surface is of harder material, the CSD will be required as the first pass to cut and crush material before the TSHD is deployed. In the shallow areas irrespective of the material types it may be necessary to first create sufficient water depth for the TSHD by using the CSD. In this case the dredged materials will be stockpiled into deeper water within the dredge footprint away from the CSD using floating pipeline and a spreader barge discharging at near seabed level, from where it will subsequently be removed by TSHD.

Dredging operations will involve a workforce of up to 160 persons at any one time and be conducted on a 24 hours per day, 7 days per week basis. Careful planning of the dredging programme will be required for tidal influences in the shallow areas of the wharf and berth area. Dredging of Stages 1 and 2 is likely to occur consecutively, whilst dredging of stage 3 may be delayed dependant on Market demands, and the timing of infrastructure construction for stage 3 and stage 4. It is envisaged that dredging will occur in a staged manner, as follows:

- **Stage 1** – dredging of berth pockets, eastern swing and departure basins and a link channel to the existing channel to provide two loading berths with a single shiploader;
- **Stage 2** – dredging of the western swing and departure basins to provide two additional loading berths and a shiploader. This module also includes the dredging works for the new 34 km departure channel; and the cross-link channel
- **Stage 3** – dredging for the extension of the wharf with additional berth pockets and the swing and departure basins to accommodate another four loading berths and an additional two shiploaders.
- **Stage 4 –** No dredging activity proposed.

The disposal of dredged materials will be carried out in accordance with a Dredging and Spoil Disposal Management Plan. This plan includes the division of each spoil ground area into compartments for the deposition of respective major material types. This could include separate receiving areas for higher quality engineering grade materials *versus* mixed fine and non-engineering quality grade materials. This method would enable the potential for subsequent future retrieval of materials suitable for fill or other purposes to be brought onshore. The dredge contractor will prepare and implement a spoil disposal plan to ensure the proper management of placing material into the spoil grounds in a controlled manner.

In accordance with the Dredging and Spoil Disposal Management Plan, the dredging contractor will regularly survey the spoil grounds, typically on a monthly basis, to verify the distribution of materials and to cross-reference volumes placed in the spoil grounds against the volume of material removed from the dredge footprint.

The suitability of a number of potential offshore spoil ground locations has been investigated and there are three preferred locations. A report on the spoil ground site selection study will be provided to support this application. The locations of these three preferred sites, designated as Spoil Grounds 3, 7 and 9, are shown in **Figure 3**. It has been determined that these three spoil areas are of sufficient size to accommodate the entire volume of dredged materials. All of these offshore spoil grounds are located in Commonwealth waters in depths of greater than -10 m CD (water depths for spoil areas 3, 7 and 9 are 13 m, 12 m and 20 m, respectively). These areas are located clear of existing and proposed channels and anchorages and are not known to support any significant benthic habitat.

8.4: Composition of Material

Is the material to be disposed of the same composition as the material disposed of under your previous permit?

BHP Billiton Iron Ore have not previously applied for a sea dumping permit for disposal of material dredged in the Outer Harbour area. However, sea dumping permits have been granted for the RGP5 and RGP6 programs which dredged material from the Inner Harbour and dumped offshore. these two programs have dumped material which is of different composition to that being applied for in this application. However, the material proposed to be dumped under this application will be placed in new spoil grounds not used by the RGP5 and RGP6 programs.

8.5: Location of Material to be Disposed

The location of the material to be dredged and disposed to sea is shown in **Figure 1** and **Figure 2** whilst the volumes are presented in **Table 5**.

8.6: History of Dredging or Excavation Project

Historical dredging of the approach channel to the Port Hedland Harbour, manoeuvring area and berthing pockets has considerably altered the bathymetry and configuration of the harbour from its natural state (GHD 2008). Dredging of the Port Hedland Harbour commenced in 1965 in association with the development of the iron ore industry in the region. Between 1965 and 1984 substantial dredging was under taken to deepen the port and access channels. Ongoing maintenance and capital dredging projects since 1974 have removed more than 22 Mm^3 of dredged material from the harbour (GHD 2008) (**Table 7**).

- **Table 7 Maintenance and capital dredging of Port Hedland Harbour between 1974 and 2010**

Year	Dredge Volume (m3)	Proponent	Purpose of Dredge
1974	700,000	PHPA	Maintenance Dredging
1978	300,000	PHPA	Maintenance Dredging
1981	268,000	PHPA	Maintenance Dredging
1985	7,000,000	PHPA	Capital/Maintenance Dredging
1986	13,600,000	BHP BIO	Capital Dredging
1990	350,000	PHPA	Maintenance Dredging
1993	200,000	PHPA	Maintenance Dredging
1997	500,000	PHPA	Maintenance Dredging
2001	500,000	PHPA	Maintenance Dredging
2002	460,000	BHP BIO	Capital Dredging
2004	550,000	PHPA	Maintenance Dredging
2006–07	5,000,000	FMG	Capital Dredging
2007	825,000	PHPA	Maintenance Dredging
2008	3,400,000	FMG	Capital Dredging
2009	3,900,000	BHPBIO	Capital Dredging
2010	6,000,000	BHPBIO	Capital Dredging

Source: GHD 2008.

Other significant modifications to the bathymetry of the harbour have occurred as a result of reclamation activities in the Port Hedland area. These include:

- reclamation of East Creek to accommodate developments at Nelson Point;
- modification of West Creek through the construction of the Finucane Island causeway;
- development of the spoil bank immediately to the east of the harbour entrance during deepening of the existing channel; and
- reclamation of land between Hunt and Utah Points as part of installation and upgrades to Berths C and D at Finucane Island.
- reclamation of land between Hunt and Utah Points undertaken as part of Finucane Island dredging material management (DMMA B1 and B2).

The PHPA maintains the approach channel to the harbour at a depth of -14.2 m CD and the inner channel to a depth of -14.8 m lowest astronomical tide (LAT). The inner channel is 20 nautical miles (nm) in length and has a minimum width of 183 m (DALSE 2004).

Historically, dredge material has been disposed of at ocean disposal grounds and onto land for reclamation. A reclamation project by PHPA produced the area locally known as "Spoil Bank", a northward projecting spit of sediment immediately to the east of the harbour entrance.

8.7: Physical Description of Material

Dredge material has been classified according to the following types shown in **Table 8**. An approximation of the quantity of each material type in each dredge area based on geological cross-sections developed from borehole results and geophysical surveys has been made and provided in **Table 9**. Soil units within the material sampled during collection of geotechnical bores varied between 0.3 and 15.5 m in thickness.

Table 8 Dredge material classification

Soil Unit	Unit Name	General Soil Description	Generalised Dredgeability Description
2a	Sand dunes, beach and stream deposits	Silica or calcareous sand	Generally easily dredged by trailer dredger. As dredged PSD will be as per natural *in situ* pre-existing condition
2b	Sand dunes, beach and stream deposits	Gravelly or clayey Sand / mixed sand, gravel and clay	
4a	Lithified beach material	Siliceous calcarenite / calcareous sandstone	May require crushing by CSD, otherwise will be ripped by TSHD. As dredged PSD will be predominantly coarse sand size to cobble size. Typically finer fractions expected to be less than 10% by volume.
4b	Lithified beach material	Siliceous calcarenite / calcareous sandstone	
4c	Unlithified beach material	Calcareous clayey and/or calcareous sand /sandstone	Should not require crushing by CSD, and will be ripped by TSHD. As dredged PSD will be predominantly coarse sand size to cobble size. Typically finer fractions expected to be less than 10% by volume.
6a	Upper Red Beds	Clayey and/or calcareous sand /sandstone	Typically will require cutting by CSD the re-handling by TSHD. Material expected to fragment with a small percentage, say 10% approx. being in the order of 5–10 mm, with considerable percentage in the range of fine to coarse sand size, typically quartz content is noted to be 40–60%. The remainder typically 10–30% will be as per sample test PSD results
6b	Lower Red Beds	Sandstone	May be able to be ripped by TSHD. As dredged PSD typically ranging from coarse sand size to cobble with release of clay fractions as per sample test PSD. Typically finer fractions expected to be less than 10% by volume. Quartz content noted to be in the order of 30–60%.

- **Table 9 Assumed percentage of each material type to be dredged in each area**

Dredge Area	2a	2b	4a	4b	4c	6a	6b
Berth Pocket / Wharf Area	5.4%	7.6%	0.0%	0.0%	2.7%	66.8%	17.5%
Departure Channel	8.5%	12.7%	0.0%	0.0%	4.1%	71.8%	2.8%
Swing Basin	21.1%	25.1%	0.0%	5.2%	14.3%	34.3%	0.0%
Link Channel	6.5%	12.3%	13.4%	33.6%	11.3%	20.0%	2.9%

Particle Size Distribution (PSD) results from geotechnical investigations give a distribution of material particle sizes in an *in situ* condition. The cementation and cohesive properties of materials are not represented in the PSD results. Values in **Table 10** below were calculated by utilising these assumptions and the results from the geotechnical investigation. The table represents particle size distributions for:

- material *in situ*; and
- material post-handling by dredge plant.

- **Table 10 Particle size of material *in situ* and post-handling**

Soil Unit	% < 5 µm		% 5–20 µm		% 20–100 µm		% 100–500 µm		% >500 µm	
	In situ	Post-handling	*In situ*	Post-handling	*In situ*	Post-handling	*In situ*	Post-handling	*In situ*	Post-handling
2a	3.0	3.0	1.0	1.0	3.0	3.0	58.4	58.4	34.7	34.7
2b	21.0	21.0	10.0	10.0	8.8	8.8	22.0	22.0	38.3	38.3
4a	0.8	21.0	0.5	1.2	0.5	1.2	2.3	5.6	96.0	90.0
4b	0.7	1.6	0.6	1.4	.4	0.9	2.6	6.0	95.7	90.0
4c	21.4	3.5	7.6	1.2	9.3	1.5	23.2	3.8	38.6	90.0
6a	19.8	8.4	7.5	3.2	9.8	4.2	33.3	14.2	29.6	70.0
6b	0.3	1.4	0.3	1.4	0.3	1.4	1.3	5.9	97.8	90.0

* Post-handling values presented are assumptions and are based on previous experience and geotechnical investigations, it is not until dredging takes place that the predictions, like the modelling, will be able to be tested.

8.8: Chemical Description of Material

The sediments at all sampling locations can be classified as clean material. The only contaminant above screening was arsenic. Arsenic is known to be elevated in many areas of Western Australia including the north-west. The guideline screening levels recognise this and state "Sediments in Australia commonly have high natural levels of As and Ni" as a footer to Table 2 of NODGDM. Considering that arsenic levels measured were elevated in all samples and were widely distributed it can be considered to be naturally elevated in the region. In accordance with the guidelines, comparison to background samples indicated that the levels in the project area were similar to background levels at the disposal site and the region (**Table 4**) and, therefore, not a contaminant of concern (see below).

8.8.1: Contaminants Above Screening

Is the concentration of any chemical constituent above the Screening Levels in Table 5 of the Guidelines?

Yes ☑ No ☐

If 'No', go to **Question 8.12**.

If 'Yes', list the chemical constituents and their levels.

All contaminants were found to be below screening with the exception of arsenic.

8.8.2: Contaminants Above Background

Are any of the chemical constituents listed in 0 (that is, those above Screening Levels) also above the background levels at the disposal site?

Yes ☐ No ☑

Arsenic levels were comparable to those of the background sampling locations and found to be naturally occurring in the region.

If 'No', go to **Question 8.12**.

8.9: Elutriate Testing

Are all results of elutriate testing below the ANZECC/ARMCANZ (2000) criteria for all chemical parameters after allowable dilution? (refer Appendix 6 of the Guidelines)?

Yes ☐ No ☐

If 'Yes', go to **Question 8.10**

If 'No', consult with the Sea Dumping Program on further actions. The applicant has the option of carrying out detailed toxicity and bioavailability testing, and evaluating control measures to minimise the impact (such as treatment of the waste or confined disposal). If control measures would not be effective, the material is considered unacceptable for ocean disposal.

8.10: Bioavailability Testing

8.10.1: Testing

Has bioavailability testing been undertaken for all chemical constituents listed at Question 8.8.2?

Yes ☐ No ☐

If "No", proceed to **Question 8.11**.

8.10.2: Results of Testing

Are all chemical constituents below relevant bioavailability criteria?

Yes ☐ No ☐

If "Yes", proceed to **8.12**.

8.11: Sediment Toxicity Testing

8.11.1: Acute Toxicity

Are the sediments to be dredged acutely toxic?

Yes ☐ No ☐

8.11.2: Sub-acute/chronic Toxicity

Are the sediments to be dredged sub-acutely/chronically toxic?

Yes ☐ No ☐

If 'No' to both questions, go to **Question 8.12**.

8.12: Biological Assessment

8.12.1: Marine Pest Species Surveys

Have any introduced marine organism surveys been undertaken at or near the dredging location?

Yes ☑ No ☐

If "No", go to **Question 9**.

A biological baseline survey of the port region of Port Hedland was carried out in May 1998 by CSIRO Marine Research Centre for Research on Introduced Marine Pests (CRIMP). Collection methods employed include pylon scrapings, sediment cores, crab traps, plankton nets, and qualitative visual inspection and photographs (both still and video) (CSIRO 1999).

A Fisheries Research Report [Western Australia] No. 207 (Huisman et al. 2010) reviewed the introduced marine biota in Western Australian waters. This review summarised the distribution of know introduced marine species within Western Australia, including the Port Hedland Marine Area and Pilbara Coast. Thirteen introduced species are identified by Huisman et al. (2010) as occurring in Port Hedland, ten of which were in addition to those identified in the CSIRO survey undertaken in May 1998.

No surveys targeting introduced marines species have been undertaken with respect to the Outer Harbour Development. To date, there have been no introduced species recorded at the site of the proposed Outer Harbour Development. Given that the proposed development location is more than 4 km beyond the existing Inner Harbour operation and is not presently used for any shipping activities including anchoring or loading, there is a very low likelihood of any IMS being present in the area.

8.12.2: Introduced Marine Organisms

Have any introduced marine organisms (including micro-organisms) been identified?

Yes ☐ No ☑

The CSIRO baseline marine pest survey for the Port of Port Hedland (1999) plus more recent surveys of the Port Hedland inshore region have not found any marine pests, as listed on the Consultative Committee on Introduced Marine Pest Emergencies (CCIMPE) or National Marine Pest Monitoring Lists.

The potential for the dredge equipment to inadvertently introduce and/or translocate unwanted marine pests will be assessed during project planning and environmental assessment studies.

If “No”, go to **Question 9**.

8.12.3: Potential for Translocation

Has the potential for these organisms to be transported in the dredge material been assessed?

Yes ☐ No ☐

If Yes, please include detail.

If 'No' then proceed to **Question 9**.

9: Waste Audit and Waste Management Options

9.1: Waste Prevention Audit

Has a waste prevention audit been undertaken? Provide details.

Studies into the emissions, discharges and wastes expected to be generated during the construction and operation phases of the Proposed Outer Harbour Development have been undertaken. The result of this study is described in Chapter 8 of the PER/EIS document.

Discharges and wastes that may potentially affect sediment quality (i.e. marine discharges) will largely be restricted to sediment (i.e. dredged spoil) during the construction phase, and stormwater discharges during operations phase.

A preliminary waste prevention audit indicates that the nearest waste generating activities in the project area (Port Hedland Inner Harbour) will not have caused any contamination of the surface seafloor sediments requiring dredging. Further investigation as detailed in the Sediment Sampling and Analysis Plan – Implementation report, indicated that the material within the proposed dredged footprint is clean of contaminants and suitable for unconfined ocean disposal at the designated spoil grounds.

The amount of dredged spoil requiring disposal to the marine environment has been minimised via the following mechanisms:

- extensive options analysis with regards to channel and berth alignment to minimise dredging requirements;
- channel design refinement to minimise dredging requirements; and
- selection of dredging techniques and technologies that will limit over-dredging thus minimising dredge volumes.

It should be noted that BHP Billiton Iron Ore will continue to investigate the possibility of further reducing the amount of dredged spoil requiring disposal as the project design is refined.

The management of the discharge of dredge spoil to the marine environment will be via the Dredging and Dredge Spoil Management and Monitoring Plan.

During operation marine discharges will largely be restricted to stormwater releases, being discharged through BHP Billiton Iron Ore's existing port surface water drainage network.

A variety of solid and liquid wastes, requiring safe disposal, will be produced during the construction and operation of the proposed Outer Harbour Development. The generation of waste will be minimised through a waste hierarchy program. Any waste products will be handled and disposed of in an acceptable manner. No controlled waste (as defined by the Environmental Protection [Controlled Waste] Regulations 2004) will be discharged to the environment.

9.2: Alternatives to Sea Disposal

BHP Billiton Iron Ore has undertaken extensive options analysis with regards to the management of the dredged spoil. As detailed below, at this stage, there is no suitable option for the beneficial re-use of the dredged material. BHP Billiton Iron Ore however, is continuing to investigate the technical, logistic, economical and environmental feasibility of reusing a portion of the dredged material onshore. At this stage no feasible options are available, and as such BHP Billiton Iron Ore is applying for the full volume of dredged material to be disposed of offshore. It should also be noted, that much of the dredge spoil will be unsuitable for beneficial re-use onshore due to its geotechnical characteristics.

Re-use (land creation, beach nourishment, offshore berms, fill etc)

BHP Billiton Iron Ore investigated the potential to bring dredged spoil onshore for beneficial uses such as engineering fill. BHP Billiton Iron Ore recognised the potential value of this resource in the Port Hedland area and conducted an evaluation of potential options from a technical, financial, environmental and social perspective.

At this stage, no viable land reclamation options are available for the beneficial re-use of the spoil. This is primarily due to the lack of proponents currently requiring fill for reclamation purposes. Furthermore, the following major constraints to the beneficial re-use of a portion of the dredged spoil were identified:

- the potential impact to turbidity and water quality through the rehandling of dredge spoil and the discharge from onshore reclamation areas;
- land use for reclamation onshore of Finucane Island is constrained due to activities potentially increasing dust and noise levels at Port Hedland;
- the limited proportion of dredged material which would be suitable for as land fill material; and
- the lack of a suitable berth and mooring facility for dredge and barge access to enable pumping of transported dredged material to land.

Off-site recycling (for example, as construction material)

The material has no economic value in the region for recycling or construction purposes.

Treatment to destroy or remove hazardous constituents for beneficial use

The material is clean and does not contain hazardous constituents thus no treatment is required. No beneficial use has been identified.

Disposal on land

BHP Billiton Iron Ore investigated the potential to bring dredged material for disposal onshore. BHP Billiton Iron Ore recognised the potential future value of this resource in the Port Hedland area and conducted an evaluation of potential options from a technical, financial, environmental and social perspective.

Onshore disposal of dredge spoil was considered not to be a viable option due to the following major constraints identified:

- the large volume of material that would require onshore disposal ;
- the lack of space in the vicinity of Port Hedland Inner Harbour for reclamation or land disposal of this quantity of material;
- the logistical, economic and environmental challenges of pumping such a large volume of material between 4 and 34 km from the dredge areas to land;
- the ability of BHP Billiton Iron Ore to access and gain tenure over an appropriate land area (which is significantly larger than the current facilities for onshore disposal of Inner Harbour dredge spoil);
- the limited proportion of dredged spoil which would be suitable for as land fill material;
- the potential impact to turbidity and water quality through the rehandling of dredge material and the discharge from onshore reclamation areas;
- additional large vessel movements causing increased marine traffic within the already constrained harbour, potentially resulting in restricted public access; and
- the lack of a suitable berth and mooring facility for dredge and barge access to enable pumping of transported dredged material to land.

9.3: Comparative Risks to Human Health and the Environment

No contamination risks to either human health or the environment are expected, owing to the natural, clean nature of the seafloor substrates.

9.4: Reasons for Discarding Options

As detailed above, engineering studies undertaken to evaluate options for onshore spoil disposal or beneficial re-use of all or a portion of the dredge spoil indicate that there are presently no feasible opportunities to beneficially re-use or dispose of the spoil onshore. As such, the only feasible

option for the management of the dredged spoil at this time is the minimisation of the volume were possible, and the disposal of the full volume offshore. As detailed above, BHP Billiton Iron Ore will continue to investigate the technical, logistic, economical and environmental feasibility of reusing a portion of the dredged spoil onshore.

6. Part VI - Disposal Site and Procedures

10: Carrier of Material

10.1: Name and Port of Registration of Vessel

The contractor for the dredging and disposal operation has yet to be appointed. A tendering process will be employed to determine the successful award of the contract to a reputable contractor.

10.2: Owner of Vessel

To be appointed.

10.3: Person to be in Charge of Disposal Vessel

To be appointed after award of tender.

10.4: Dredging or Loading Procedures

It is proposed to use a combination of cutter suction dredge (CSD) and trailer suction hopper dredge (TSHD) using standard procedures to ensure minimal spillage. Details of the proposed dredging and disposal are provided in **Question 8.3**.

11: Description of Proposed Disposal Sites

Disposal is proposed at three spoil grounds with one contingency spoil ground (Spoil Ground 2) due to the volumes involved and the distances involved. The spoil ground numbers 2, 3, 7 and 9 refer to the three areas that have been selected from a potential nine sites originally investigated as part of a spoil ground site selection study. These numbers have been maintained as they are consistent with the PER document. The sediment chemistry at all four proposed spoil grounds can be classified as clean; however, naturally occurring levels of arsenic exceed the NOGDM screening level (see discussion in **Question 8.8**).

Spoil Ground 2 (Contingency)

It is proposed that Spoil Ground 2 be a contingency for material to be dredged from the berth pockets, swing basin and departure channel areas into Spoil Ground 2 if required (**Figure 3**). The footprint of the spoil ground is approximately 1,093 ha so that if any spoil were disposed it would create a layer no deeper than 2 m and provide sufficient area for future maintenance dredging disposal. The disposal site is in approximately 12 m of water with a bare sandy bottom depauperate in macro-benthic flora and fauna.

Spoil Ground 3

Given the volume of material to be dumped, it is proposed to place approximately half of the material to be dredged from the berth pockets, swing basin and departure channel areas into Spoil Ground 3 (**Figure 3**). The footprint of the spoil ground is approximately 2,400 ha so that the

disposed spoil would create a layer no deeper than 2 m and provide sufficient area for future maintenance dredging disposal. The disposal site is in approximately 13 m of water with a bare sandy bottom depauperate in macro-benthic flora and fauna.

Spoil Ground 7

Given the volume of material to be dumped, it is proposed to place approximately half of the material to be dredged from the berth pockets, swing basin and departure channel areas into Spoil Ground 7 (**Figure 3**). The footprint of the spoil ground is approximately 2,000 ha so that the disposed spoil would create a layer no deeper than 2 m and provide sufficient area for future maintenance dredging disposal. The disposal site is in approximately 12 m of water with a bare sandy bottom depauperate in macro-benthic flora and fauna.

Spoil Ground 9

Given the length of the shipping channel, the excavated material from the outer portion of the channel area is proposed to be disposed of at Spoil Ground 9 (**Figure 1**). The footprint of the spoil ground is approximately 700 ha so that the disposed spoil would create a layer no deeper than 2 m and provide sufficient area for future maintenance dredging disposal. The disposal site is in approximately 20 m of water with a bare sandy bottom depauperate in macro-benthic flora and fauna.

11.1: Location of Sites

Spoil Ground 2

The boundary GPS coordinates (GDA94) for Spoil Ground 2 are:

	Latitude	Longitude	Easting	Northing
NW	S 20°05.080'	E 118°58.500'	6654647	7770023
NE	S 20°05.080'	E 118°58.500'	665617	7766886
SE	S 20°05.080'	E 118°61.830'	669101	7766853
SW	S 20°05.080'	E 118°61.830'	669131	7769989

Datum GDA94, Projection MGA94 Zone 50K

Spoil Ground 3

The boundary GPS coordinates (GDA94) for Spoil Ground 3 are:

	Latitude	Longitude	Easting	Northing
NW	S 20°05.080'	E 118°33.601'	663114	7778387
NE	S 20°05.054'	E 118°36.542'	668240	7778386
SE	S 20°07.598'	E 118°36.568'	668240	7773692
SW	S 20°07.625'	E 118°33.626'	663114	7773692

Datum GDA94, Projection MGA94 Zone 50K

Spoil Ground 7

The boundary GPS coordinates (GDA94) for Spoil Ground 7 are:

	Latitude	Longitude	Easting	Northing
NW	S 20°11.867'	E 118°24.941'	647914	7766000
NE	S 20°11.837'	E 118°28.620'	654321	7766000
SE	S 20°13.530'	E 118°28.634'	654318	7762877
SW	S 20°13.560'	E 118°24.954'	647910	7762877

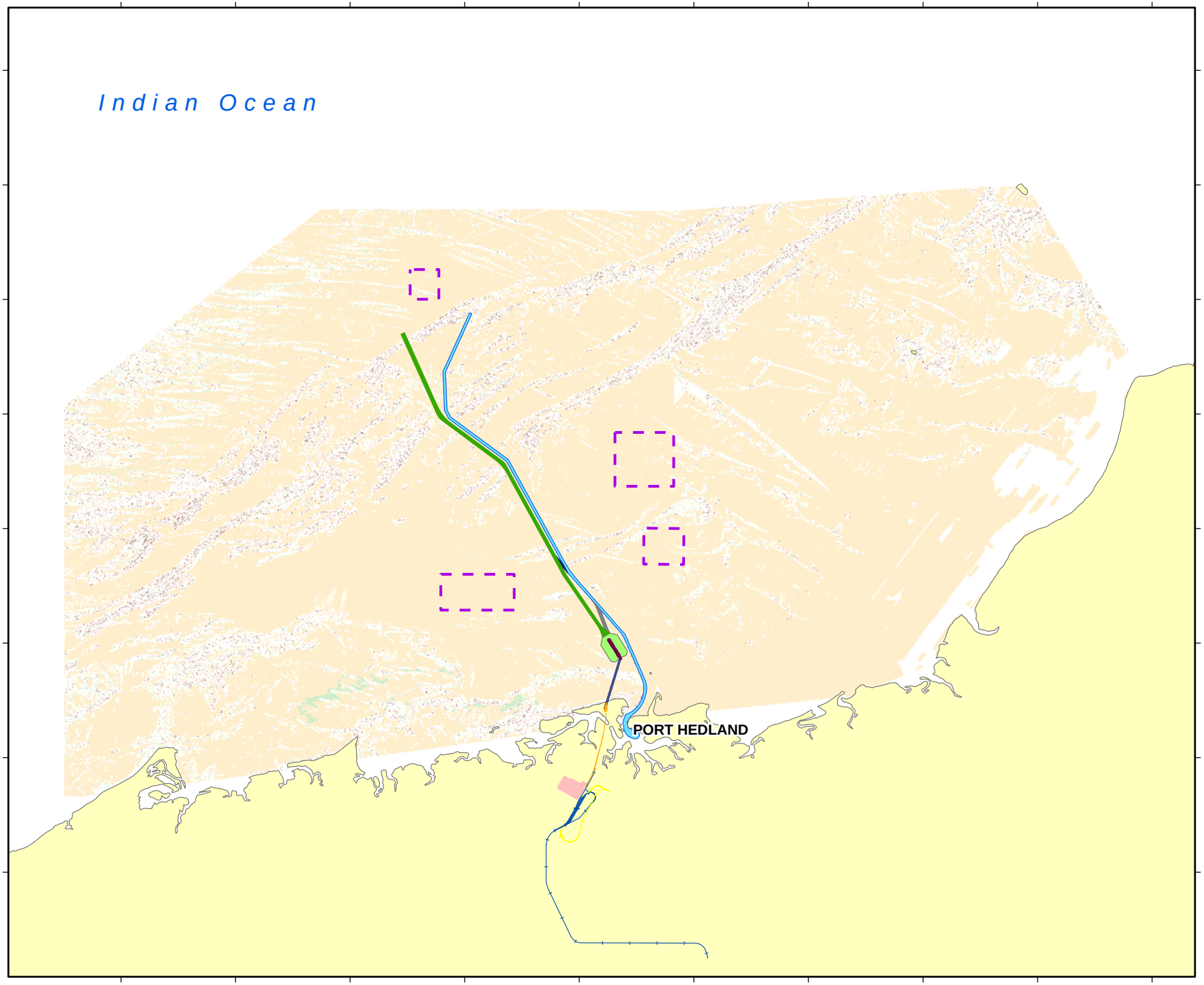
Datum GDA94, Projection MGA94 Zone 50K

Spoil Ground 9

The boundary GPS coordinates (GDA94) for Spoil Ground 9 are:

	Latitude	Longitude	Easting	Northing
NW	S 19°57.456'	E 118°23.276'	645234	7792610
NE	S 19°57.445'	E 118°24.713'	647742	7792610
SE	S 19°58.849'	E 118°24.726'	647742	7790020
SW	S 19°58.860'	E 118°23.288'	645234	7790020

Datum GDA94, Projection MGA94 Zone 50K



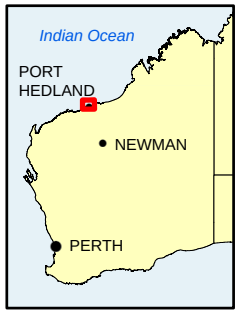
bhpbilliton

Legend

- Spoil Ground (Proposed)
- Proposed Jetty
- Proposed Wharf
- Proposed Goldsworthy Rail Loop
- Proposed Western Spur Railway
- Proposed Departure Channel
- Proposed Berth Pockets and Swing Basins
- Proposed Link Channel
- Proposed Crossover Channel
- Existing Shipping Channel

Habitat Type

- Hard Substrate with/without BPP
- Sediment/Hard Substrate with BPP
- Sediment with BPP
- Bare Sediment
- None modelled with confidence



0 5 10
kilometres

Scale @ A4: 1:450,000

Datum: GDA94
Map Grid: MGA94 Zone 50

Source:
Substrate, Habitat: SKM (Dec, 2008)
Topography: GEODATA Topo 250K V3
© Commonwealth of Australia (GA), 2006

Figure 3 Location of Spoil Grounds Relative to Sensitive Habitats

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11.2: Position Fixing

Vessel positioning will use the Differential Global Positioning System (DGPS) to ensure that all dredge material disposal occurs within the boundaries of the designated spoil ground permit area.

11.3: Sensitive Areas and Marine Park

The areas being studied are not within or near any Marine Park or special zoning system. Studies have been undertaken to ensure the selected area does not occupy or lie too close to any locally or regionally important sensitive marine areas.

11.4: Physical Characteristics of the Disposal Sites

The water depths at spoil grounds 2, 3, 7 and 9 are 12 m, 13 m, 12m and 20 m respectively. Detailed bathymetry charts compiled from information collected from LIDAR surveys indentified that the spoil grounds were located in areas of very low seabed relief. This was then confirmed by diver surveys and towed video surveys which also identified that no sensitive benthic habitats were present. The seabed at each location is bare sand depauperate in macro-benthic flora and fauna (see **Figure 3**). Detailed habitat mapping indicated that there is an elevated area of seabed to the east of spoil ground 3 which contained sensitive benthic primary producers, following this spoil ground 3 was reduced in size, thereby avoiding direct impacts on the predicted sensitive habitat. The proposed spoil grounds are deemed to have comparable sediment characteristics to that of the surficial sediments of the dredge footprint, and were characterised by medium grain sand or larger. The sediment characteristics at each spoil ground are shown in **Figure 4**.

11.5: History of the Disposal Site

No previous port disposal uses or agro / industrial waste disposal history at any of the proposed spoil grounds.

12: Disposal Procedures

It is proposed to use standard procedures including the TSHDs being fitted with hopper overflow green valves and discharge at keel level to ensure minimal spillage. Dredged material will be transported to the disposal site by the TSHD and placed below the sea surface such that that material is uniformly placed. This will be achieved using DGPS. The percentage of the material proposed to be disposed at each spoil ground is approximate to allow flexibility for management of the disposal process.

12.1: Disposal Operations and the Quantities of Spoil

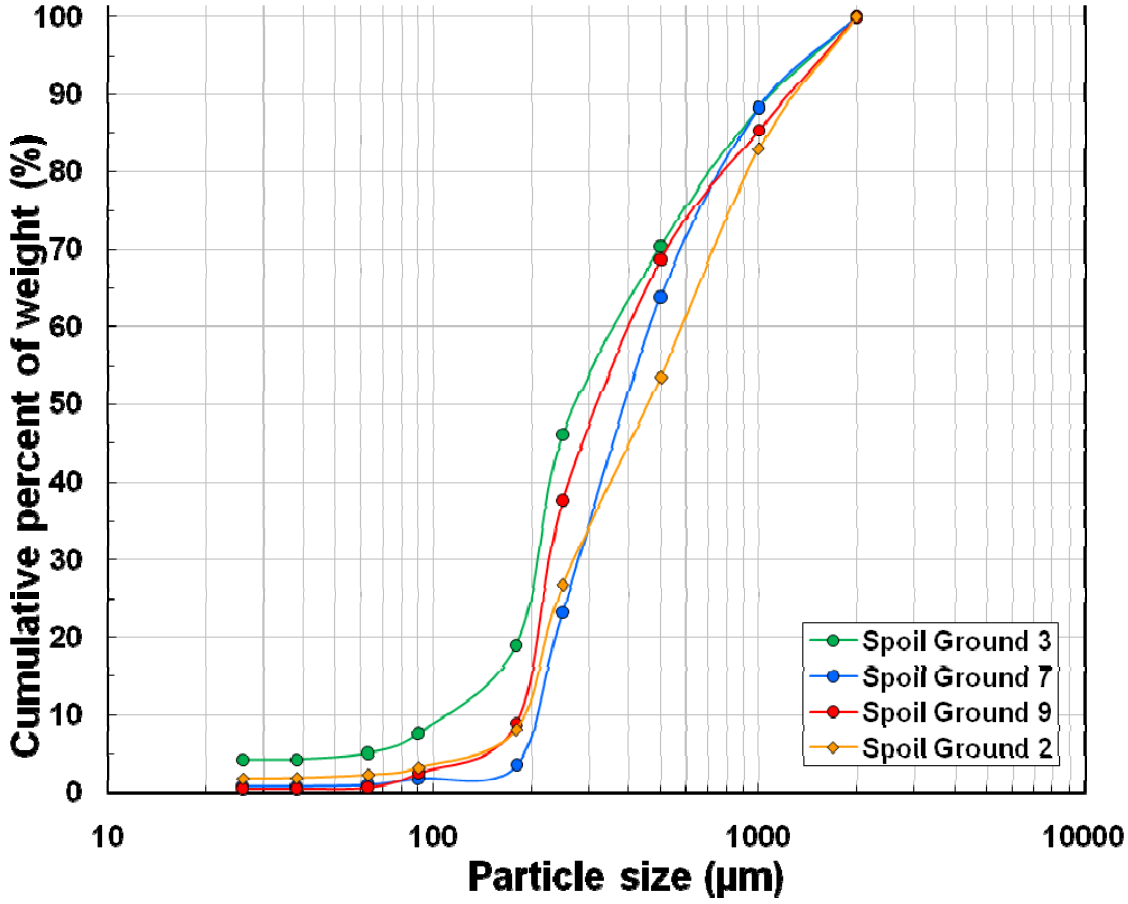
The volume of dredge spoil to be disposed of to each spoil ground from the dredging programme, including over-dredging, is provided in **Table 5**.

12.2: Route from Loading to Disposal Site

The route from loading to the disposal site is a direct line with no obstacles or sensitive habitats subject to vessel safety requirements.

12.3: Method of Disposal and Precautions Taken During Disposal

The accuracy of spoil placement on each spoil ground will be verified by dredge logs and will be achieved using DGPS. Records of every load of dredge spoil placed will be taken and maintained.



- **Figure 4 Sediment characteristics at the proposed spoil grounds**

7. Part VII - Impact Hypothesis

13: Projected Impact of Disposal

A detailed impact assessment of the dredging and disposal activities has been undertaken as part of the Public Environmental Review (PER) process. Chapter 10 of the PER should be consulted for the detailed impact assessment on the environment and Chapter 11 for impacts on regular users of the area.

A summary of the projected impacts of disposal to sea of spoil derived from dredging are as follows:

- Minor impacts on the activities of other users including commercial fishing, shipping and recreational users.
- Smothering of biota at the spoil ground; and
- Mortality and/or stress to benthic fauna, including corals on nearby ridge lines, resulting from sedimentation and turbidity plumes generated by disposal at the spoil ground and nearby dredging.

Turbidity:

Turbidity effects outside of the spoil ground will primarily affect the light climate and thus impact on organisms with photosynthetic capabilities. Nearby sensitive habitats include corals and macroalgae that rely on light for their existence and may be impacted by a reduction in the light available to them. There is limited coral and macroalgal habitat in the immediate proximity to the spoil grounds; however, turbidity plumes are predicted to travel several kilometres and may impact on habitat supporting corals. Dredging and disposal operations are highly unlikely to generate total suspended solid concentrations above levels which could cause injury or mortality to fauna except directly below disposal operations. The assessment of these impacts is described in detail in the PER document.

Smothering:

Smothering should be limited to effects within the spoil ground as a result of dumping material to a depth of 1–2 m. It is unlikely that any fauna with limited mobility which is present within the spoil ground will survive the dumping process. However, once completed, the substrate will provide habitat for recolonisation by a community which may, in time, resemble that which was lost.

The effects of sedimentation outside of the spoil ground boundary will be a gradual process and both infauna and epibenthic fauna should be able to survive this process. The sedimentation of fine material should approximate the existing seabed characteristics and thus provide similar conditions for the existing fauna. It is unlikely that macroalgae and seagrass will be vulnerable to any long-term changes as a result of smothering outside of the spoil grounds. The assessment of these impacts is described in detail in the PER document.

Other users of the area:

Taking into account the management measures proposed to minimise the potential impacts on fisheries in the Port Hedland Inner and Outer Harbour, the residual risks have been determined to be low. Taking into account scheduling of the dredging and disposal process along with the footprint being outside of the existing shipping routes, the residual risks have been determined to be low. Taking into account the management measures proposed to minimise the potential impacts on recreation in the Port Hedland area, the residual risks have been determined to be medium.

8. Part VIII - Monitoring

14: Proposed Monitoring Programmes

Monitoring programs will be implemented for water quality, coral health and benthic infauna in addition to inspections of dredged for introduced marine species.

Water Quality Monitoring Programme

A detailed monitoring programme for water quality will be implemented for the dredging and disposal of material to the three spoil grounds. This detailed monitoring programme is provided in the Dredging and Spoil Disposal Management Plan (DSDMP) contained in the PER/EIS.

Baseline water quality monitoring is taking place at a number of locations in the vicinity of the spoil grounds to assess the impact of sedimentation and turbidity plumes on sensitive habitats. Additional sites may be included pending the finalisation of the approval process and the DSDMP contained in the PER/EIS.

The monitoring schedule will be as follows:

- Baseline monitoring: collection of baseline data via fortnightly surveys will commence at all impact, influence and reference monitoring sites three months before the commencement of dredging and disposal activities.
- Dredging and spoil disposal monitoring: fortnightly monitoring of the impact, influence and reference monitoring sites (according to seasonal function) will occur throughout the duration of the dredging and disposal activities.
- Post-dredging and spoil disposal monitoring: surveys of the impact, influence and reference monitoring sites will occur at a fortnightly frequency until 6 months post-dredging and spoil disposal activities.

The monitoring approach will be as follows:

The monitoring approach will incorporate a number of water quality parameters, integrated in the baseline study to detect any changes within the water column due to dredging and spoil disposal activities. These parameters will focus on the reduction of light to benthic primary producers (BPP) or the smothering of BBP. The number of parameters that will be incorporated in the dredge and spoil disposal monitoring program, to monitor loss of light to benthic primary producers BPP at all monitoring sites, include:

- Turbidity (NTU);
- Light Attenuation Coefficient (LAC);

- TSS (mg/L);
- Sedimentation (mg/cm^2/day); and
- Temperature (ºC).

Coral Health Monitoring Programme

A detailed monitoring programme for coral health will be implemented for the dredging and disposal of material to the three spoil grounds. This detailed monitoring programme is provided in the Dredging and Spoil Disposal Management Plan (DSDMP) contained in the PER/EIS.

Baseline coral monitoring is taking place at a number of locations in the vicinity of the spoil grounds to assess the impact of sedimentation and turbidity plumes on sensitive habitats. Additional sites may be included pending the finalisation of the approval process and the DSDMP contained in the PER/EIS.

The monitoring schedule will be as follows:

- Baseline monitoring: collection of baseline data via fortnightly surveys will commence at all impact, influence and reference sites three months before commencement of dredging and disposal activities. In the case of the area of 100% morality in the zone of potential impact, a single 'before' survey will occur within three months prior to the commencement of dredging and spoil disposal activities.
- Dredging and spoil disposal monitoring: coral health monitoring will occur at sites within the zone of potential impact and reference sites on a fortnightly basis. Within the zone of potential influence, coral health monitoring will occur on a monthly basis, unless management responses are triggered that require more frequent monitoring.
- Post-dredging and spoil disposal monitoring: coral health surveys at impact, influence and reference sites will occur one month, two months and six months after the completion of dredging and spoil disposal activities. In the case of the area of 100% morality in the zone of potential impact a single after survey will occur within six months of the completion of dredging and disposal activities.

The monitoring approach will be as follows:

- At each monitoring site, a minimum of 50 tagged coral colonies will be inspected to determine the percent live coral cover. These colonies will be a subset of a larger number to allow for contingency colonies over the life of the monitoring program. A fixed transect will be established at each site to ensure consistency in the assessment of coral health. The number of

colonies assessed at each monitoring site will be determined by power analyses of baseline data.

- The species targeted for monitoring at each site will be selected on the basis of their dominance, an initial appraisal of health, and that the size will be conducive to photography using a fixed frame camera (30–80 cm in diameter). There will also be a requirement to have comparative corals at the selected reference sites.
- Each colony will be photographed using a digital camera mounted on a frame. Trained observers will also record biological (predation, mucous production) and physical (colour and sediment coverage) changes in the state of the coral in comparison to a reference (baseline) photograph. Training the observers will ensure a consistency between measurements taken by different people.
- Coral mortality will be recorded where there is no live tissue and subsequent algal growth or sediment accumulation has occurred.
- Coral mortality will be assessed by analysing each coral photo with Coral Point Counter with Excel Extensions (CPCe). This software was developed by the US National Coral Reef Institute (Dania Beach, Florida) and is used to estimate percentage cover mortality. This software is used by numerous organisations including the US National Oceanic and Atmospheric Administration (NOAA).
- Tagged colonies will be assessed for colour *in situ* before being photographed. Photographs can distort colour so field assessments are preferable. Coral colour will be measured using a reference card developed by the University of Queensland. The card uses a six-point brightness/saturation scale within four colour hues to record changes. The six-point scale is an indicator of coral symbiont density and chlorophyll a content; changes of two units or more on the scale reflect a change in symbiont density and chlorophyll a content.
- The colour card method is appropriate for measuring changes in the same species or colony over time, rather than an absolute measure of differences among species, given that different species of corals will often have different colour scores even when they are in a healthy condition. Large changes in colour score also provide a relative measure of bleaching status in corals. A shift of three points or more, averaged across all tagged corals on the six-point scale, will constitute an adverse change in coral health.
- A general qualitative assessment of coral health, including production of mucous, will be undertaken on each colony by a trained observer before the colony is photographed. Each colony will be compared to a reference photograph taken prior to dredging (baseline), to make a qualitative assessment of the presence of mucous in terms of percent cover, and relative thickness of mucous. An average of more that 50% mucous cover, over more than 50% of corals will be counted as detection of an adverse change in coral health. These observations will be recorded on datasheets and evaluated together with the coral colour assessments to determine whether an adverse change in coral health has been detected.

Introduced Marine Species Inspections

A detail introduced marine species management plan has been prepared for this project. The plan requires that all vessel inspections will be undertaken by a suitably qualified marine scientist, experienced in the identification of IMS and the assessment of the risk posed by each species. The inspections will focus on the presence of excessive sediments or known or suspected marine pests on the vessels. The Revised Coordinating Committee for Introduced Marine Pest Emergencies (CCIMPE) Trigger List (2006) will be used as the basis for the identification of a marine species as a marine pest. However, the presence of other species that may present similar risks will also be investigated.

Each inspection will involve:

- a general inspection of the vessel hull including the external niches;
- an inspection of the dredging equipment (hoppers, cutter heads, grabs/buckets);
- an inspection of the internal niches including bilge spaces, anchor cables locker, seawater systems; and
- an inspection and assessment of the state of the anti fouling coating.

Each of these items will be visually inspected and video/photographs will be taken.

The ballast water logs will also be inspected to confirm compliance with the AQIS Mandatory Ballast Water Requirements.

In the event that sediment or known or suspected IMS are identified, a photograph or video image showing the species will be taken and a sample will be taken and sent for expert taxonomic identification (if found on vessels within Australian waters). It should be noted however, that the management strategy will apply when suspected marine pest are identified and implementation of the strategy will not depend on the taxonomic identification due to the time required for such the taxonomic study.

9. Part IX – National Environmental Significance

15: Referring Actions under the EPBC Act

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) requires Commonwealth assessment and approval for any action that will have, or is likely to have a significant impact on a matter of national environmental significance. For a detailed discussion of assessment under the EPBC Act and how it interacts with the Sea Dumping Act refer to Section 1.3.2 of the National Ocean Disposal Guidelines for Dredged Materials.

Where an action includes only those activities for which approval is required under the Sea Dumping Act, the applicant is not required to separately refer that action under the EPBC Act. If a referral is required, this will be done by the determining authority as part of the assessment of the permit application.

The proponent will need to refer the proposal for a separate assessment and approval under the EPBC Act where the action also includes activities not covered by the Sea Dumping Act which may significantly impact on matters of national environmental significance.

To ensure efficient co-ordination of the assessment process, it is important that the determining authority is aware of any referrals the proponent has made under the EPBC Act. As such, it is advisable that proponents discuss proposed actions with Environment Australia and answer the following questions:

15.1: Referral

Has the proposed action been referred to the Commonwealth Environment Minister under the EPBC Act?

Yes ☑ No ☐

15.2: Decision

Has a decision on this proposed action been reached?

Yes ☑ No ☐

The project was determined to be a controlled action and resulted in the preparation of the Public Environmental Review (PER) to be assessed jointly by the Department of the Environment, Water, Heritage and the Arts and the WA Environmental Protection Authority.

The list of matters of National Environmental Significance that could potentially be impacted upon by this project is provided in Chapter 6 of the PER/EIS.

10. Part X – Consultation

16: Consultation with Stakeholders

BHP Billiton Iron Ore has conducted extensive Social Impact Assessments (SIA) since 2004 together with regular community focussed surveys and has collected substantial data on issues of community interest and concern during periods of rapid expansion.

The public engagement programme for BHP Billiton Iron Ore's expansion projects involves consultation with a range of stakeholders representing the following main groups:

- members of the public;
- business associations;
- contactors and partners;
- conservation groups;
- native title claimant groups;
- local community groups;
- non-government organisations (NGOs); and
- local council, state and Commonwealth government departments.

BHP Billiton Iron Ore has identified a list of stakeholders who have specific interests in the proposed Outer Harbour Development, and they include, but are not limited to:

- Australian Maritime Safety Authority (AMSA);
- Care for Hedland Environmental Association;
- Communities of Port Hedland, South Hedland and Wedgefield, particularly recreational marine enthusiasts;
- Department for Planning and Infrastructure (DPI);
- Department of Environment and Conservation (DEC);
- Department of Environment, Water, Heritage and the Arts (DEWHA), recently renamed the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC);
- Department of Fisheries (DoF);
- Department of Indigenous Affairs (DIA);
- Department of State Development (DSD);
- Department of Water (DoW);
- Environmental Protection Authority (EPA);
- Landcorp;

- Main Roads Western Australia (MRWA);
- Neighbouring onshore industries, including fishing operators;
- Pilbara Development Commission;
- Pilbara Dialogue – Growth Forum;
- Port Hedland Chamber of Commerce and Industry;
- Port Hedland Port Authority (PHPA);
- Port Hedland Yacht Club;
- Regional Health Executive Council;
- Representatives of the Kariyarra native title claimant group.
- Shire of Ashburton;
- Shire of East Pilbara;
- Tourism operators;
- Town of Port Hedland (ToPH); and
- Traditional owners.

Outcomes of this consultation are described in detail in Chapter 4 of the PER/EIS.