REPORT

2022-2032 Newcastle Port Maintenance Dredging Sea Disposal Permit

Long Term Monitoring and Management Plan

Client: Port of Newcastle

Reference: M&APA2776R001F0.1

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Royal HaskoningDHV

Enhancing Society Together

HASKONINGDHV NEDERLAND B.V.

Level 15
99 Mount Street
North Sydney NSW 2060
Water & Maritime
Trade register number: 56515154

Phone: +61 2 8854 5000
Email: project.admin.australia@rhdhv.com
Website: royalhaskoningdhv.com

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Author(s): Ali Watters

Drafted by:	Ali Watters
Checked by:	Greg Britton
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1 Introduction

1.1 General

The Port of Newcastle ("the Port") is recognised as a major economic centre for both the Hunter Region and New South Wales (NSW) and has grown to become Australia's third-largest port by volume with trade worth about $26 billion to the national economy each year. It is the world's largest coal exporting port and also has facilities to handle general cargo, break-bulk goods and containers.

The Port operates twenty four hours a day, seven days a week, with twenty berths in use. Infrastructure within the Port includes coal terminals operated by Port Waratah Coal Services (PWCS) and Newcastle Coal Infrastructure Group (NCIG), a bulk liquid terminal for vegetable oils, agri-food storage and loading, local and national road and rail access and storage sheds adjacent to berths.

Much of the recent and current Port infrastructure has been constructed on reclaimed areas of Kooragang Island or is planned for construction on remediated land in Mayfield.

In addition to shipping, the Port includes berthing for cruise liners, an 80 berth marina and the Queens Wharf entertainment precinct. A ferry service operates within the Port between Newcastle and the northern suburb of Stockton.

Port of Newcastle (PON) is responsible for maintaining the declared depths of the navigation channels and berthing boxes and batters throughout the Port (refer **Figure 1**).

Dredging commenced in the Port in 1859 and has been virtually continuous since that time. Total dredging quantities up to 1993 were estimated to have been greater than 130 million m^3 (Patterson Britton, 1992) and are estimated to be greater than 145 million up until 2023.

The Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC), now Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW), granted Newcastle Port Corporation (now PON) a 10 year maintenance dredging Sea Dumping Permit for the period from March 2012 until March 2022. The permit was reissued in 2014 to PON following privatisation for the remaining 8 year period (permit number SD2014/2642). Most recently in 2022 a 10 year maintenance dredging Sea Dumping Permit for the period 2022-2032 was issued to PON. Details of all recent Sea Dumping Permits granted to PON are shown in **Table 1** below.

Table 1 Previous disposal permits

Date	Volume	Granted / Refused
June 2000	500,000 m^3 per yr (maintenance)	Granted (5 yr)
March 2001	290,000 m^3 (capital)	Granted
June 2006	500,000 m^3 per yr (maintenance)	Granted (5 yr)
June 2011	500,000 m^3 per yr (maintenance)	Granted (1 year extension)
March 2012	Issued to Newcastle Port Corporation (NPC) in 2012 with upper limit 6,450,000 m^3 for 10 year period Re-issued permit in 2014 to PON following privatisation with upper limit 4,721,000 m^3 in remaining 8 year period	Granted (10 yr)
August 2022	Issued to PON in 2022 with upper limit 7,400,000 m^3 for 10 year period	Granted (10 yr)

A Long Term Monitoring and Management Plan (LTMMP) that covers the management of dredging at the Port over the life of the permit was submitted to the Commonwealth along with the permit application for the period 2022-2032 and approved by the Minister for Environment. Details of the LTMMP are presented in the following sections of this document.

Figure 1 Declared depths within PON channels and berthing boxes

1.2 Environmental Objectives

1.2.1 General

PON's environmental objectives relating to maintenance dredging activities include:

- Prevention, mitigation and management of any potential environmental impacts associated with maintenance dredging activities;
- Ensuring that environmental management is undertaken in accordance with relevant legislative and policy requirements, including the Sea Dumping Permit; and
- Ensuring that maintenance dredging is undertaken with due care to the environment, which includes the promotion of environmental awareness amongst PON employees, contractors, customers, port users, visitors and members of the public.

1.2.2 Objectives of the LTMMP

LTMMPs set out both the framework and specific measures for management, mitigation and monitoring of impacts with agreed performance criteria for specified acceptable levels of environmental harm. The LTMMP demonstrates how the environment at the Port and surrounds will be protected over the longer term and provides the Port with an opportunity to showcase their role as a steward for the marine environment. LTMMPs identify responsible parties, and also include mechanisms for the regular review of compliance with permit conditions, as well as a process for continuous improvement of environmental management and performance over the life of the permit.

Specifically, this LTMMP incorporates details of maintenance dredging for the Port and the associated disposal of the dredge material, and was prepared in support of the application for the 10 year Sea Dumping Permit for the period 2022-2032. Management strategies that ensure minimal impact on the environment have been developed for the LTMMP and are described in **Sections 5** and **6**.

Revision of the LTMMP has been undertaken for currency and to ensure alignment with PON's Review of Environmental Factors (REF) for maintenance dredging throughout the Port of Newcastle as required in accordance with Part 5 of the *Environmental Planning & Assessment Act, 1979* (EP&A Act).

1.3 Structure and Use of the LTMMP

This LTMMP has been prepared in accordance with guidelines provided by the Commonwealth DCCEEW in the National Assessment Guidelines for Dredging 2009 (NAGD) to enable its utilisation as a management tool for all personnel involved in the activities associated with the sea disposal of material derived from maintenance dredging of the Port. In particular, this Plan contains an outline of:

- background to the project;
- project proposal;
- statutory and regulatory requirements for the activities;
- identification of key environmental issues associated with the phases of the project;
- procedures for the implementation, monitoring and management of control provisions necessary to protect the environment during the project;
- responsibilities for the implementation, monitoring and management of control provisions necessary to protect the environment during operation; and
- procedures for reporting and corrective action as required.

Items addressed in this LTMMP as required by the NAGD are listed in **Table 2**, with a cross-reference to where each item is addressed in this LTMMP.

Table 2 Items Addressed in this LTMMP

Item	LTMMP Reference
Overall environmental management framework for the Port	1.4
Context of the regional and local environment, including a brief history of all dredging and disposal activities	1.1
Information on approvals and policy context	3
Description of the dredging and disposal activities, including materials to be dumped	2
Description of the existing environment	4
Description of potential impacts	5
Management strategies and actions	5 and 6
Contingency planning	6.14
Provisions for maintaining current sediment quality data over the life of the permit	6.9
Auditing requirements	6.15
Reporting	6.12
Continuous improvement	6.17
Stakeholder consultation, including the operation of a Technical Advisory and Consultative Committee (TACC)	6.16

1.4 Overall Environmental Management Framework

PON maintains an Environmental Management System (EMS) based on the principles of AS/NZS ISO 14001:2004 Environment Management Systems to assist in complying with all relevant environmental legislation, government policies and legal requirements. The scope of the EMS covers all operations controlled by PON in addition to operations that PON may influence. All PON facilities and activities that interact with the environment are encapsulated within the EMS. The EMS is documented, implemented, maintained and continually improved to ensure its ongoing effectiveness.

As part of this EMS, PON has devised an Environmental Policy, which is provided in **Appendix A**. The EMS also includes (but is not limited to) the following system procedures:

- EMS Management Review;
- Identification of Environmental Aspects and Impacts:
- Identification of Legal and Other Requirements;
- Environmental Objectives and Targets;
- Environmental Management Programs;
- Training;
- Environmental Incident Response and Reporting;
- Environmental Emergency Response;
- Waste Handling and Disposal;
- Monitoring and Evaluation;
- Control of Non-Conformances;
- Internal Auditing; and
- Identification of Heritage and Conservation Requirements.

Operational procedures contained in the EMS which are relevant to dredging activities include:

- Dredging;
- Bunkering;
- Environmental Inspections;
- Fuel Tank Leak and Spill Response; and
- Identifying Significant Environmental Aspects.

Forms and work instructions contained in the EMS which are relevant to dredging activities include:

- Marine Refuelling Instructions;
- Dredge Monthly Environmental Inspection; and
- Internal EMS Audit Schedule.

This LTMMP has been developed in accordance with the principles of PON's Environmental Management System and Environmental Policy.

2 PROJECT OVERVIEW

2.1 Dredging

PON undertakes maintenance dredging of the berthing boxes, navigation channels and associated batters throughout the Port entrance and along the South Arm of the Hunter River. This dredging is required to remove accumulated sediment and maintain safe, navigable depth in the Port.

The area in which maintenance dredging will be undertaken during the life of the 2022-2032 Sea Dumping Permit is shown in **Figure 2**. For the purposes of the management of dredging activities, PON has subdivided the Port into seven areas (Areas A, B, C, D, E, F and G) based on the nature of the sedimentation in the Port and the layout of the port area. The area in which maintenance dredging has been undertaken to date comprises Areas A, B, C, D, E and F as represented by the green shaded area in **Figure 2**.

Additional berths in the Port may become operational during the life of the 2022-2032 Sea Dumping Permit. PON will assume responsibility for the maintenance dredging of these berths and the adjacent shipping channel outlined in **Table 3**. These berths and the adjacent shipping channel are represented by the magenta shaded area in **Figure 2**. A flowchart showing the indicative timing of activities for the overall life of the permit is provided in **Figure 3**[1].

Table 3 Additional berths to be introduced during life of Permit

Berth	Maintenance Dredge Area
Mayfield 5 & 6	A
Mayfield 1 & 2	A
Dyke Berth 3	B
Channel upgrade (Horseshoe, Entrance and Steelworks Channel widening)	B, D, E
Wet Lease for Thales (and a nominal access channel)	C
Newcastle GasDock	G
Hydrogen exports	G

[1] *Sampling and Analysis Plans (SAP) referred to in Figure 2 are discussed in Section 6.*

Figure 2 PON Maintenance Dredge Areas

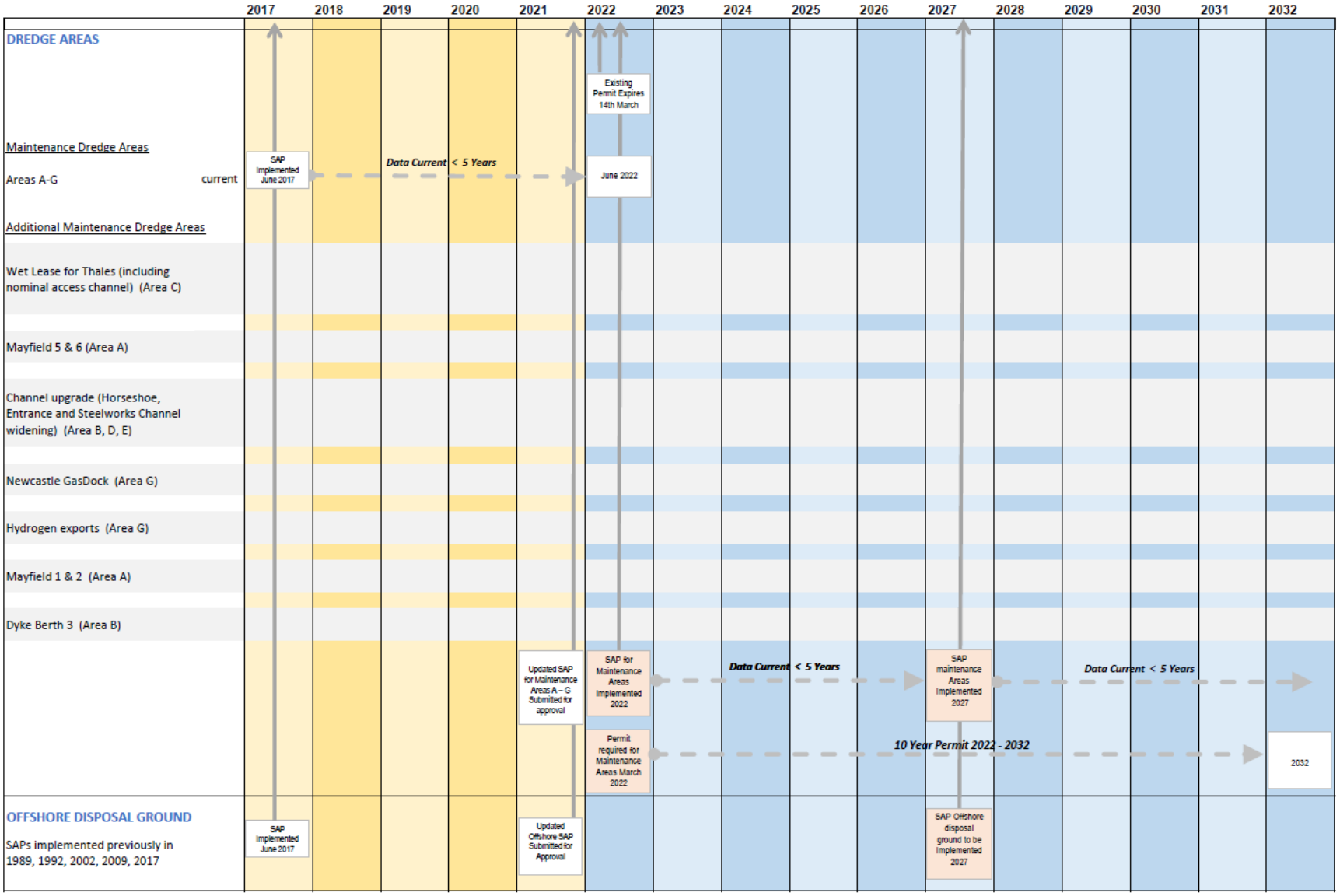

Figure 3 Flowchart with Indicative Timing of Overall Project

The maintenance dredging in Areas A, B, C, D, E, and F involves the removal of material to design dredge depths as indicated on **Figure 1**. The type of material removed for maintenance purposes comprises mostly silt and clay (mud, or fines) for Areas A to D, part of E and Area F. Based on the historical information since 2005, approximately three quarters of samples from Areas A to D and F contain sand typically <30% by weight. A summary of the historical grain size information for the maintenance dredge areas is included in **Appendix B**. The material from Area E seaward of the line between the ends of the breakwalls typically comprises poorly sorted sand with less than 8% fines. Dredged material will be derived only from the maintenance dredging of the:

- berths, navigation channels and associated batters specified as areas A, B, C, D, E, and F throughout the life of the sea dumping permit; and
- additional berths (and adjacent channels and batter slopes) as they fall under the responsibility of PON to maintain during the life of the sea dumping permit (refer **Table 3**).

Table 4 shows the total annual volume of material removed from the maintenance dredging Areas A, B, C, D, E and F over the past 12 years.

Table 4 Total annual volume of material removed from the PON maintenance dredge areas

Year	Insitu volume placed at disposal ground as reported to DCCEEW (m^3)	Insitu volume placed at Stockton (material from part of Area E) as reported to DCCEEW (m^3)	TOTAL (m^3)
2012	669,968	9,233	679,201
2013	922,096	29,845	951,941
2014 (portion as Newcastle Port Corporation prior to privatisation)	136,936	0	136,936
2014 (portion as PON)	496,320[3]	6,309	502,629
2015	601,920[2]	58,280	660,200
2016	509,250	27,945	537,195
2017	437,500	25,839	463,339
2018	389,750	25,542	415,292
2019	364,541	28,458	392,999
2020	151,903	12,146	164,049
2021	237,865		237,865
2022	335,727		335,727
2023	304,309		304,309
	TOTAL for sea disposal 5,560,000	TOTAL for beach nourishment 224,000	TOTAL Dredged 2012-2020 5,784,000
Annual Average (m^3)	**430,000**	17,000	**445,000**

[2] *Significant work was done in 2017 to determine the insitu density of the dredge material for each of the areas of the port to improve the accuracy of the reporting of dredging volumes. It was determined that 2014 and 2015 volumes had been overstated in annual reporting to DCCEEW. The revised volumes for 2014 and 2015, as presented in Table 4, were provided to DCCEEW.*

Approximate Dredge Area (m^2)	**2,920,000**	1,475,000[3]	**4,394,000**
Approximate annual average sedimentation rate (mm/year)	**147**	12	

The maintenance quantities dredged from the Port vary from year to year due to the dynamic and variable processes of siltation throughout the Port. The total annual volume of material dredged varied from a minimum of 164,049 m^3 to a maximum of 951,941 m^3 between the years 2012 and 2023.

In 2012 the dredge vessel changed from a 38hr 5day/week operation to 12hr 365days/year operation as part of the eastern steelworks channel batter restoration project. This accounts for the higher dredge volumes recorded in 2012 and 2013. The low volume dredged in 2020 was due to a significant period of dredge vessel drydocking (12 weeks away and another 4 weeks alongside in Newcastle) combined with other vessel maintenance earlier in 2020. The COVID 19 pandemic also led to crew isolation and shortages. A year of significant dry weather i.e. lack of flooding events, also contributed to the lower volumes dredged in 2020.

As shown in **Table 4**, the annual average volume dredged from the maintenance areas over the last 12 years was in the order of 445,000 m^3. Despite the variation in annual dredge volumes observed, it is anticipated that the annual average volume that may need to be dredged from the current maintenance dredge areas in any one year in the current 10 year permit will be in the order of previous annual average dredging volumes, i.e. equivalent to an annual average volume of 445,000 m^3.

However, as additional berths and associated channel areas fall under the responsibility of PON to maintain (refer **Table 3**), the annual dredge volumes from all areas of the port except Area F will generally increase over the life of the Sea Dumping Permit. The additional berths and associated channel areas represent an increase in total maintenance dredge area from 439 ha to 527 ha. Anticipated dredge volumes for Areas A to G for purposes of the current 2022-2032 Sea Dumping Permit application were estimated based on the total size of each area (following inclusion of the additional areas) and the simply determined estimated approximate annual average sedimentation rates for the Port. These volumes are summarised in **Table 5**.

[3] *The part of Area E where maintenance dredged material is suitable for beach nourishment, being seaward of the line between the ends of the breakwalls*

Table 5 Anticipated Annual Dredge Volumes, 2022-2032

Maintenance Dredge Area	Total Area (ha)	Estimated Sedimentation Rate previous permit period (2012-2022) (mm/year)	Anticipated Volume (m^3) Normal Conditions
A	85	178	156,000
B	88	178	162,000
C	54	178	99,000
D	47	178	87,000
Portion of E with material suitable only for sea disposal	23	178	42,000
Portion of E with material suitable for beach nourishment	147	17	25,000
F	37	178	68,000
G	46	178	85,000
TOTAL	**527**		**702,000**

As outlined in **Table 5**, it is anticipated that the total average annual volume that may need to be dredged from the Port in any one year in the current 10 year permit could be in the order of 705,000 m^3 (rounded up), while in any one year depending upon the occurrence of flooding events in the Hunter River, an additional 300,000 m^3 may need to be dredged due to a flood event. Assuming similar quantities of Area E sands in the 2012-2022 period will be dredged and reused for beach nourishment of Stockton Beach over the life of the current 10 year permit, and allowing for up to 2 major flood events, PON's 2022 – 2032 sea dumping permit sought approval for dredging and sea disposal of up to a total quantity of 7,400,000m^3

Maintenance dredging in the Port is currently undertaken by PON's dredger the David Allan (refer **Figure 4** and **Figure 5**). This is a trailing suction hopper dredger which is also fitted with a grab. Where necessary, depending on the rate of sedimentation in the Port, a contract dredger is employed to supplement the work of the David Allan. This vessel would also be a trailing suction hopper dredger. In the future, the David Allan may be replaced and another PON owned THSD may be used. Any dredge vessel in connection with the dumping activities and any associated vessels must comply with the relevant state, national or international standards with respect to seaworthiness, safety and environmental requirements, or any rules or conditions laid down by the certifying classification society, and be capable of dumping the dredged material at the spoil ground in accordance with the permit.

The majority of the maintenance dredging undertaken by the David Allan is carried out in trailing suction mode. This mode typically accounts for about 90% of all dredging. The trailing suction method is employed in both channel areas and berth areas, but channel dredging accounts for most of the trailer work. The typical cut depth in trailing suction mode is 0.3 to 0.4 m with a maximum of about 1 m and minimum of about 0.1 m. The width of the drag head is 1.7 m. The width of influence of the drag head is dependent on the material type but would be expected to be at least 3 to 4 m.

Figure 4 The David Allan trailing suction hopper dredger

Figure 5 TSHD David Allan splitting its hull

The grab fitted to the David Allan has a capacity of 3.5 m^3. The maximum depth of cut is about 1 m and the minimum about 0.1 m. The typical cut height is dependent on the type of material and operating location. Grab dredging is generally only undertaken where there is a constraint to operation in trailing suction mode such as safety.

As part of the channel maintenance, PON also utilises a sweep vessel to level the seabed when required. Currently some areas of the channel and most berths in the harbour are swept 1-2 times per year. Sweeping is undertaken to redistribute built up sediments on the harbour floor to deeper areas or areas more accessible for removal by the David Allan.

2.2 Disposal

2.2.1 Offshore Spoil Ground

The spoil ground off the Port for maintenance dredging material is situated approximately 3 km south-east of Nobbys Head in 25 to 30 m of water (refer **Figure 6**). This spoil ground is the same site as that used for the 2012- 2022 10 year permit. The area is approximately rectangular in shape as defined by the following coordinates in WGS84:

- 32○ 56.10’ S 151○48.94’ E
- 32○ 55.77’ S 151○49.40’ E
- 32○ 56.16’ S 151○49.79’ E
- 32○ 56.49’ S 151○49.32’ E

The David Allan will track its position over the spoil ground during the disposal activities to ensure disposal is within the defined co-ordinates, using a Global Positioning System (GPS). PON will ensure that maintenance dredge material will only be placed in the area specified by the above WGS84 co-ordinates.

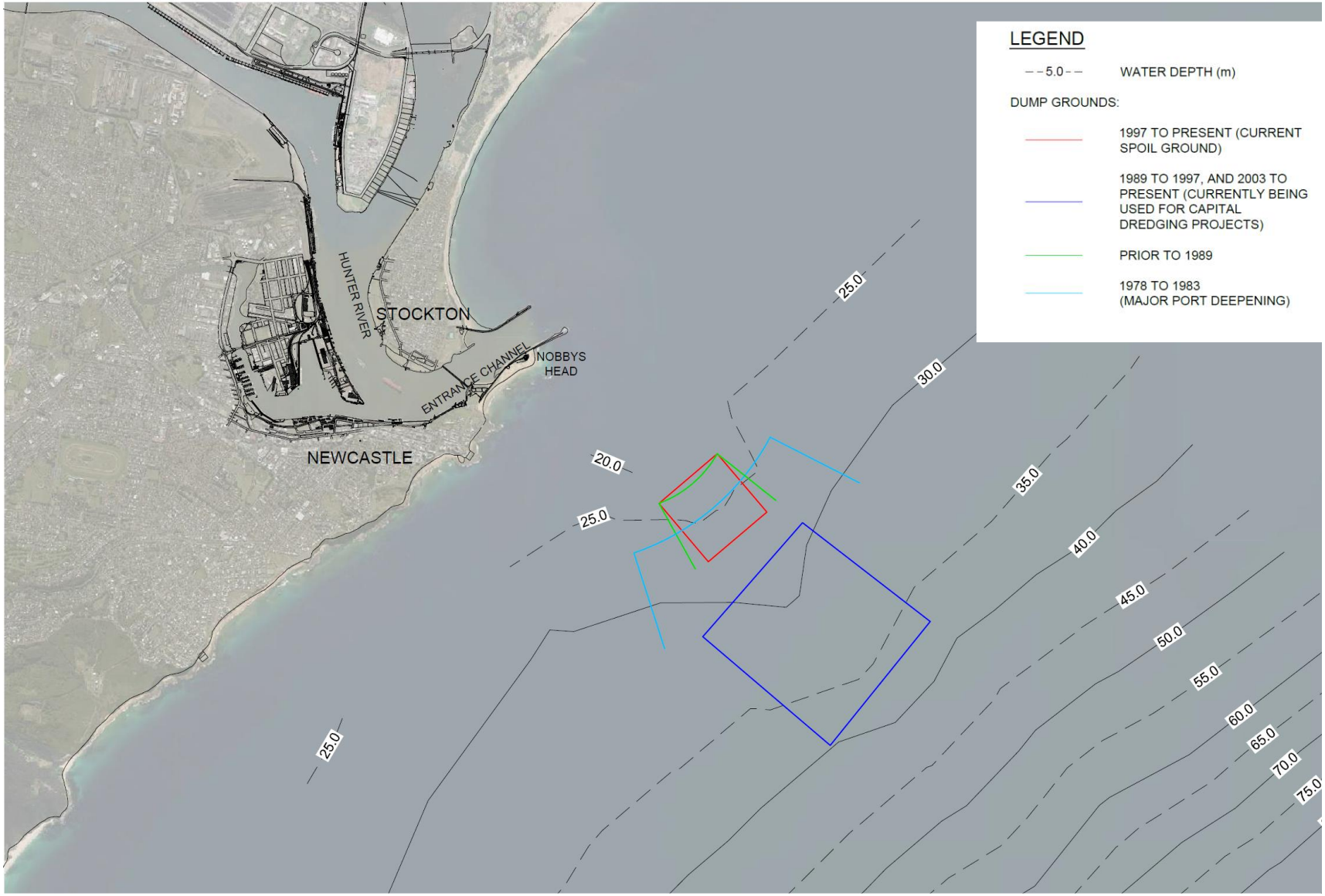

Figure 6 Proposed Spoil Ground Location Diagram

The David Allan generally operates one shift a day, approximately 12 hours per day. On average five loads per day are removed from the Port area which is equivalent to about 1600 m^3 in situ. Following high rainfall events causing significant increased sedimentation, the David Allan can sometimes operate 24 hours per day.

During the transport of the dredged material from the dredge area to the offshore spoil ground, and on the return journey, the vessel would observe all requirements of the Harbour Master in terms of vessel speed and other navigation requirements (refer further discussion in **Section 4.3.2**). Also, any appropriate maritime notices would be issued in relation to dredging and offshore disposal activities.

The dredger would navigate along the prescribed route and once at the spoil ground would open the hopper ('doors' on vessel's hull) to release the dredged material over the spoil ground.

In the longer term, the fine fraction of the sediment from the dredging (sediment in the silt and clay size fraction, i.e. mud, and some very fine sands) would be expected to disperse from the spoil ground in the manner described in previous sediment mobility studies (Patterson Britton; 1989, 1992, 2002, WorleyParsons 2002, RHDHV 2017). In these studies, the dispersion pathway of mud from the spoil ground was found to be relatively contained, bounded generally within a zone 5 km north and 6 to 7 km south of the spoil ground and out to a water depth of 60 to 100 m (refer further discussion in **Section 4.3.3**). The longer-term movement of dredge material is primarily offshore from the spoil ground into the adjacent Commonwealth Marine Area.

2.2.2 Nourishment of Stockton Beach

The sand material that has entered the PON navigation channel in Area E needs to be removed for safe navigation. The sand originated from the nearshore littoral transport zone as a consequence of the action of waves and currents. Due to the depth of the channel in Area E, the sand material does not re-enter the active coastal system under natural processes. From a coastal sediment budget/beach stability point of view, it is desirable for the material to be returned to the active coastal system by dredging and purpose placement.

In 2006, material from Area E was excluded from disposal at the designated spoil ground. The then Department of Natural Resources (DNR), now NSW Department of Climate Change, Energy, the Environment and Water (Environment and Heritage Group) preferred that Area E material be placed off Stockton Beach for purposes of beach nourishment to address erosion issues along the beach. In 2009 PON sought the necessary approvals for the placement of suitable maintenance dredge material from Area E off Stockton Beach as this material had previously been shown to contain a relatively high proportion of sand in comparison to the other maintenance dredging areas.

Subsequently, maintenance dredging of an accumulation of around 100,000 m^3 of sand from Area E was carried out in June 2010 with material placed off Stockton Beach for beach nourishment. This large quantity was due to dredging having ceased in Area E in 2006 while approvals were sought for its reuse for beach nourishment. Since 2010, material from Area E suitable for beach nourishment purposes has been dredged annually by PON and placed off Stockton Beach. As noted in **Section 2.1**, PON's total average annual maintenance dredge volumes were 445,000 m^3 and over last 12 years typically 20,000m^3 of material from Area E per year has been suitable for beach nourishment.

Stockton Beach is a highly dynamic coastal environment and has experienced numerous coastal erosion events requiring the construction of a range of temporary (e.g. sandbagging) and permanent protection measures (Bluecoast 2020). In recent years erosion has significantly impacted beach amenity and coastal assets.

In 2020, RHDHV prepared the Stockton Coastal Management Program (CMP) on behalf of City of Newcastle. The CMP includes actions to help manage, maintain, and preserve the coast between the northern breakwater of the Hunter River and Meredith Street. The program has mass sand nourishment as its primary coastal management action to improve beach amenity and protect coastal lands.

The CMP identifies three actions that relate to PON. Action CH13 requires PON to place suitable sand from maintenance dredging activities from the harbour entrance offshore of Stockton Beach. PON are supportive of this action and committed to work collaboratively with City of Newcastle on this matter.

PON does not hold the necessary approvals for the placement of suitable maintenance dredge material from Area E off Stockton Beach for the beneficial purpose of beach nourishment, as described in **Section 3.6**. It should be noted that this approvals process is separate to the Sea Dumping Permit application process. Maintenance dredging of Area E during the life of the 10 year permit will involve placement of dredged material off Stockton Beach, provided that ongoing approvals are obtained. In general, approvals will be granted if it can be demonstrated that the material is suitable for the beneficial purpose of beach nourishment and will not result in any significant adverse environmental impacts.

Currently, the maximum percentage of fines in maintenance dredge material approved under NSW legislation to be placed off Stockton Beach for the purpose of beach nourishment is 10%. This percentage was the outcome of an environmental assessment and consultation in 2009. Consultation included NSW government agencies, representatives of the local commercial fishing industry, and the then Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) (Mr Matt Johnston, Director Ports and Marine Section).

PON is prepared to place maintenance dredge material containing a greater percentage of fines than 10% off Stockton Beach but determination of an acceptable higher percentage would need to be subject to additional studies and consultation. Accordingly, it is not possible at this time to nominate the maximum percentage of fines (minimum percentage of sand) that would be acceptable.

It is also considered that the most appropriate pathway for determining the maximum acceptable percentage of fines is through the development of CMPs for the Stockton Coastline and Hunter River Estuary under the NSW Coastal Management Act 2016, which involve detailed consideration of coastal and estuary sediment processes. Preparation of the CMPs is being managed by the City of Newcastle under the direction of the NSW DCCEEW Environment and Heritage Group . PON is a key stakeholder in the process.

PON is committed to work collaboratively with CN and the NSW DCCEEW Environment and Heritage Group to determine a maximum acceptable percentage of fines as part of the studies conducted for the CMPs. This commitment and proposed additional testing is described in **Section 6.10**.

3 STATUTORY AND LEGISLATIVE FRAMEWORK

3.1 Sea Dumping Act

The Environment Protection (Sea Dumping) Act 1981 provides for the environmental assessment of the dredging and disposal of dredged material in Australian waters. Commonwealth approval from DCCEEW is required under the Environment Protection (Sea Dumping) Act 1981 for the dredging and disposal at sea of maintenance dredged material from the Port.

In the past, DCCEEW generally limited the duration of sea dumping permits to five years. However, in 2009 the Australian Government established a policy of granting permits for maintenance dredging for up to 10 years under the Environment Protection (Sea Dumping) Act 1981. A LTMMP needs to be submitted along with the permit application and approved by DCCEEW prior to the issuing of the Sea Dumping Permit.

3.2 Crown Lands Management Act 2016

To undertake activities and work on Crown land, a licence is required from the Department of Planning, Housing and Infrastructure (DPHI) – Lands (Crown Land). The license for maintenance dredging only pertains to that part of Area E beyond a line joining the position of mean high water mark at the outermost points of the northern and southern breakwaters, as this defines the boundary between Transport for NSW channel ownership (for which all maintenance dredging approvals are in place) and Crown land further offshore. A licence for the sea disposal of the maintenance dredge material is also required as the spoil ground is located on Crown land inshore from the three nautical mile limit of Coastal Waters in NSW.

PON was granted a licence under the Crown Lands Act 1989 (now repealed) from the Minister for the Environment for their maintenance dredging operations within Area E on 6 August 2009 (Licence Numbers RI 450958). Licence RI 450958 covers dredging (that part of Area E beyond a line joining the position of mean high water mark at the outermost points of the northern and southern breakwaters) and is valid until revoked. In May 2013 PON was issued a licence (RI 500434) for the disposal activities at the spoil ground. RI 500434 expired on 13 March 2022 in line with the previous PON sea dumping permit. PON has subsequently secured a new licence from the Minister under the Crown Lands Management Act 2016 for the disposal activities (522212 Section 34a Lease - Commercial 13/13551)..

3.3 Coastal Management Act 2016 (Act) and State Environmental Planning Policy (Coastal Management) 2018

PON was granted concurrence under the Coastal Protection Act 1979 (now repealed) from the Minister for the Environment for their maintenance dredging and disposal operations on 7th July 2017, which is valid until 30 June 2022.

The Coastal Management Act 2016 (Act) and State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP) commenced on 3 April 2018. The Act has repealed the Coastal Protection Act 1979 (Former Act) and implemented a number of coastal reforms for NSW.

SEPP (Coastal Management) 2018 updates and consolidates into one integrated policy SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection), including clause 5.5. of the Standard Instrument – Principal Local Environmental Plan. These policies are now repealed.

The SEPP (Coastal Management) gives effect to the objectives of the Coastal Management Act 2016 from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the coastal zone.

Coastal Management Areas and Objectives

The Coastal Management Act 2016 defines the coastal zone as comprising four coastal management areas. The four coastal management areas are:

- Coastal Wetlands and Littoral Rainforests Area — areas which display the characteristics of coastal wetlands or littoral rainforests that were previously protected by SEPP 14 and SEPP 26
- Coastal Vulnerability Area — areas subject to coastal hazards such as coastal erosion and tidal inundation
- Coastal Environment Area — areas that are characterised by natural coastal features such as beaches, rock platforms, coastal lakes and lagoons and undeveloped headlands. Marine and estuarine waters are also included
- Coastal Use Area — land adjacent to coastal waters, estuaries and coastal lakes and lagoons.

The maintenance dredge areas and spoil ground fall within the Coastal Environment Area as shown in **Figure 7**.

Figure 7: Coastal Management Designations for Study Area - Coastal Environment Area
https://webmap.environment.nsw.gov.au/PlanningHtml5Viewer/?viewer=SEPP_CoastalManagement

Development controls for the Coastal Environment Area aim to protect the processes and values of coastal waters, estuaries, coastal lakes and lagoons and the natural features on the adjoining land, including beaches, dunes, foreshores, headlands and rock platforms. Controls identify the need to minimise impacts on the environment, and PON must be satisfied that the proposed maintenance dredging and sea disposal avoids, minimises or manages impacts on:

- The integrity and resilience of the biophysical, hydrological and ecological environment;
- Coastal environmental values and natural coastal processes;
- The water quality of the marine estate, and has particular regard to cumulative impacts on sensitive coastal lakes;
- Marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms;

- Existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including people with a disability;
- Aboriginal cultural heritage, practices and places, and
- The use of the surf zone.

The objectives of the Coastal Environment Area are identified below in **Table 6**. The proposed maintenance dredging and sea disposal either meet these objectives or in no way is contrary to them.

Table 6: *Objectives of Coastal Environment Areas (Coastal Management SEPP)*

Objective No.	Objective Description	Works Compliance?
1	**To protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons.** *The maintenance dredging and sea disposal activities will not impact on the coastal environmental values or natural processes. Refer detailed impact assessment undertaken in the sea dumping permit application and summarised in **Section 5** of this LTMMP*	✓
2	**Enhance natural character, scenic value, biological diversity and ecosystem integrity** *The maintenance dredging and sea disposal activities are not contrary to the maritime and working port characteristics of the area. The maintenance dredging and sea disposal will not impact on biological diversity or ecosystem integrity.*	✓
3	**To reduce threats to, and improve the resilience of, coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change** *na*	✓
4	**To maintain and improve water quality and estuary health** *The maintenance dredging and sea disposal will not degrade the water quality and estuary health. Refer detailed impact assessment undertaken in the sea dumping permit application and summarised in **Section 5** of this LTMMP*	✓
5	**To support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons** *The maintenance dredging and sea disposal will not impact on or alter social and cultural values of the area.*	✓
6	**To maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system** *The maintenance dredging and sea disposal will maintain the presence of the shoreline in this area. In particular the beneficial reuse of sand from Area E for beach nourishment off Stockton Beach would assist with restoring the beach.*	✓
7	**To maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms** *The maintenance dredging and sea disposal will not alter public access in this area.*	✓

3.4 Protection of the Environment Operations Act

The Protection of the Environment Operations Act, 1997 (POEO Act) is the primary Act regulating pollution control and waste disposal in NSW. The Act gives the NSW Environment Protection Authority (EPA) the authority to issue licences and environment protection notices. Clause 19(1) of Schedule 1 of POEO Act was recently amended to clarify that an Environment Protection Licence (EPL) under Section

43 is required for dredging when extraction of more than 30,000m^3 for maintenance dredging of a navigation channel for vessels is carried out by or on behalf of a public authority. Schedule 1 defines extractive activities, as the extraction (by any method, including by excavation, dredging, blasting or tunnelling) or processing of extractive materials. An EPL is therefore required for the maintenance dredging. The maintenance dredging will be undertaken under PON's existing EPL (No. 21815).

3.5 Fisheries Management Act

Permits under Part 7 of the Fisheries Management Act 1994 (FM Act) are required for dredging and reclamation, temporarily or permanently obstructing fish passage, and harming marine vegetation. Section 199 of the Fisheries Management Act requires that a public authority must, before it carries out or authorises the carrying out of dredging work, give the relevant Minister written notice of the proposed work, and consider any matters concerning the proposed work that are raised by the Minister within 21 days after the giving of the notice. Following privatisation of the Port, PON is not considered a public authority. Section 201 of the Fisheries Management Act requires that a person (other than a public authority) must not carry out dredging except under the authority of a permit (unless the work is authorised by another relevant government authority). As maintenance dredging is authorised under the Crown Lands Act and POEO Act, PON does not need to obtain a permit or undertake notification to the Minister for maintenance dredging. No temporary or permanent structures (such as a weir, causeway, dam, coffer dam etc.) or damage to marine vegetation will be undertaken as part of the maintenance dredging activities, hence negating the need for Section 219 or 205 permits.

3.6 Beach Nourishment Approvals

As noted in **Section 2.2.2**, the approvals process for the placement of maintenance dredge material from Area E off Stockton Beach for the beneficial purpose of beach nourishment is separate to the Sea Dumping Permit application. In a letter to PON dated 9 July 2009, the then Department of Environment, Heritage, Water and the Arts (DEWHA), now Commonwealth DCCEEW, confirmed that a permit under the Environment Protection (Sea Dumping) Act 1981 is not required for the placement of dredged sand off Stockton Beach for the purpose of beach nourishment as this activity is genuinely for a purpose other than the mere disposal of material. The Commonwealth DCCEEW does however require notification of the activity occurring and that the material will not be disposed of at the disposal ground; and requires verification that the material from Area E is clean sand of similar nature to the material at Stockton Beach.

Dredging of uncontaminated material from Area E and its placement off Stockton Beach fall under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act) and requires preparation of a Review of Environmental Factors (REF). Placement of maintenance dredge material from Area E off Stockton Beach for the beneficial purpose of beach nourishment is covered under a REF procured by CN (Bluecoast, 2023a).

The following is a summary of the approvals that were obtained before maintenance dredging in Area E and placement of dredged material off Stockton Beach commenced in June 2010:

- Crown Lands Act 1989 – Licenses for dredging and for placement of dredge material on Crown land (Licence Numbers RI 450958 and RI 500434 respectively). Licence RI 450958 covers dredging (that part of Area E beyond a line joining the position of mean high water mark at the outermost points of the northern and southern breakwaters) and is valid until revoked. In May 2013 PON was issued a licence (RI 500434) for the placement of dredged material off Stockton Beach and the spoil ground disposal activities. RI 500434 expires on 13 March 2022 in line with the PON sea dumping permit. There is no current licence for placement of dredge material off Stockton Beach.

- Coastal Protection Act 1979 (now repealed) – Concurrence was most recently granted by the Minister for the Environment on 7 July 2017 for the maintenance dredging of up to 150,000 m^3 of material from Area E and the disposal of the material offshore of Stockton Beach. This concurrence was valid until 7 July 2022.
- Protection of the Environment Operations Act 1997 – Dredging and placement activities associated with the nourishment of Stockton Beach would require an EPL. Dredging would be covered by PON's existing EPL (No. 21815).
- Fisheries Management Act 1994 – Notification to the Minister of Primary Industries was given and issues raised by the Minister were considered during formulation of the project proposal and preparation of the REF. As noted in **Section 3.5**, following privatisation of the Port, PON is not considered a public authority. Section 201 of the Fisheries Management Act sets out circumstances in which a person (PON) may undertake dredging including circumstances in which Section 201 does not apply. As maintenance dredging is authorised under the Crown Lands Act and POEO Act, PON does not need to obtain a permit or undertake notification to the Minister for maintenance dredging.

As noted above, the approvals process for the placement of maintenance dredge material from Area E off Stockton Beach for the beneficial purpose of beach nourishment is separate to the Sea Dumping Permit application. While PON holds the necessary approvals for dredging within Area E, placement of maintenance dredge material from Area E off Stockton Beach for the beneficial purpose of beach nourishment is covered under a REF procured by CN (Bluecoast, 2023a). CN or other parties will be responsible for holding approvals for the placement activities.

3.7 Sweeping Approvals

As noted in **Section 2.1**, PON also utilises a sweep vessel (SV) to level the seabed when required. Currently some areas of the channel and most berths in the harbour are swept 1-2 times per year. Sweeping is undertaken to redistribute built up sediments on the harbour floor to deeper areas or areas more accessible for removal by the David Allan. A Review of Environmental Factors (REF) has been prepared for the multi-task SV to fulfil the requirements under Part 5 of the Environmental Planning & Assessment Act, 1979.

4 DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1 Processes and Climate

4.1.1 Tidal Hydrodynamics

In general, in non-rainfall periods, astronomical tides are the major factor affecting the hydrodynamics of the Hunter River. As applies to the NSW coast in general, the tides acting at the entrance to the estuary are semidiurnal[4] (with significant diurnal inequality[5]), with a strong spring-neap[6] cycle (Patterson Britton & Partners, 2003). The tidal planes in Newcastle Harbour in the vicinity of the maintenance dredge areas are provided in **Table 7**.

Table 7 Tidal Level Variation In Newcastle Harbour from Australian National Tide Centre (2013)

Tidal Plane	Level (m NHTG)[7]
Highest Recorded Tide	2.37 m
Highest Astronomical Tide	2.10 m
Mean High Water Springs	1.62 m
Mean High Water	1.49 m
Mean High Water Neaps	1.37 m
Mean Sea Level	0.99 m
Mean Low Water Neaps	0.62 m
Mean Low Water	0.49 m
Mean Low Water Springs	0.37 m

Tides in the Hunter estuary vary from the ocean entrance to the tidal limits, generally with a gradual reduction in the mean tidal range proceeding upstream (excluding slight amplification within the Williams and Paterson Rivers). The tidal limit in the Hunter River is approximately at Oakhampton (64 kilometres upstream from the ocean). The general reduction in tidal range moving upstream can be understood in terms of tidal excursion, the distance a water particle travels over a tidal cycle. In the lower estuary, the tidal excursion is about 10 kilometres (MHL, 2002).

[4] Semi-diurnal tides have high and low water approximately equally spaced in time and occurring twice daily (that is, on average, there are two high tides and two low tides in any 24 hour period).

[5] Diurnal inequality is the difference in height of the two high waters or the two low waters of each tidal day.

[6] Spring tides occur twice per month (during new or full moons) and result in higher high tides and lower low tides (that is, a larger tidal range, compared to the average). Neap tides also occur twice per month (during quarter moons) and result in lower high tides and higher low tides (that is, a smaller tidal range, compared to the average).

[7] *The Newcastle Harbour Tide Gauge (NHTG) is operated by the Port of Newcastle. Zero on the Tide Gauge is approximately the level of Lowest Astronomical Tide (LAT) and is 1.01 m below Australian Height Datum (AHD).*

Based on the tidal gauging carried out in October 1995 (MHL, 1995), tidal velocities, discharges and tidal prisms[8] were recorded in the maintenance dredge area at Walsh Point for both the north and south arms of the Hunter River, as shown in **Table 8**. It can be seen that the North Arm of the Hunter River is characterised by higher velocities and discharges compared to the South Arm, and dominates the tidal prism carrying about 80% of the tidal flow at Walsh Point.

Table 8 Tidal Velocities, Discharges and Prisms In Maintenance Dredge Area

Location	Maximum Velocity (m/s)	Maximum Discharge (m^3/s)	Tidal Prism ($m^3 \times 10^6$)
Walsh Point (North Arm)	0.94 (flood)	1680 (flood)	23.7 (flood)
Walsh Point (North Arm)	0.99 (ebb)	1550 (ebb)	25.8 (ebb)
Walsh Point (South Arm)	0.43 (flood)	360 (flood)	5.4 (flood)
Walsh Point (South Arm)	0.26 (ebb)	490 (ebb)	7.9 (ebb)

4.1.2 Wind

Predominant winds in the Port area are from the north, with north-east winds prevailing in the warmer months of the year, while north-west winds prevail in the cooler months (Bluecoast 2020). Overall and seasonal wind roses for Nobbys BoM station are shown in **Figure 8**.

4.1.3 Flooding

Flooding behaviour in the Hunter estuary has been modified substantially since European settlement, due to construction of levees, spillways, canals, floodgates, and diversion banks. Much of these works were undertaken as part of the Lower Hunter Valley Flood Mitigation Scheme, in almost immediate response to the largest flood that has occurred since European settlement, which occurred in 1955. In total, 160 km of levees and spillways, 111 km of flood canals, 175 floodgates, 14 km of bank protection works and 40 km of control and diversion banks were built as part of this scheme (MHL, 2002).

As described by MHL (2002) and Patterson Britton & Partners (1996), floodwaters tend to spill over Kooragang Island during moderate to major floods (exceeding the 10% Annual Exceedence Probability (AEP) event). The southern part of Kooragang Island is protected from floodwaters by a large railway embankment, forcing far more floodwaters into the North Arm compared to the South Arm. At Walsh Point, about 75-80% of the flood flow is carried in the North Arm, with 20-25% conveyed by the South Arm.

Design peak flood levels at Newcastle Port determined for various AEP events are provided in **Table 9**. Note that the highest astronomical tide at Newcastle Port is around 1.0 m AHD, which would occur once every 18.6 years if there were no non-astronomical water level influences. Storm surge (barometric and wind setup), wave setup, coastal trapped waves and freshwater flow may all increase water levels above the predicted astronomical tide levels, with the maximum combination of these factors expected to be less than 0.4m[9].

[8] The tidal prism is the total volume of water exchanged at a particular cross section during a complete tidal cycle.

[9] This figure is dominated by storm surge. At the downstream end of the estuary, freshwater flow is considered to have little influence. The highest recorded water level at Newcastle Port was 1.37 m AHD, measured in May 1974, during a non-flood period. The peak water level at Newcastle Port in the highest recorded flood of February 1955 was 1.34 m AHD.

The flood levels within Newcastle Harbour range between 2.22m Newcastle Harbour Tide Gauge (NHTG) (1.21m AHD) and 2.35m NHTG (1.34m AHD) for the range of design events detailed in **Table 9**.

Table 9 Design Peak Flood Levels at Newcastle Port from PWD (1994) Flood Study

5 year ARI	2.22
10 year ARI	2.25
20 year ARI	2.28
50 year ARI	2.32
100 year ARI	2.35

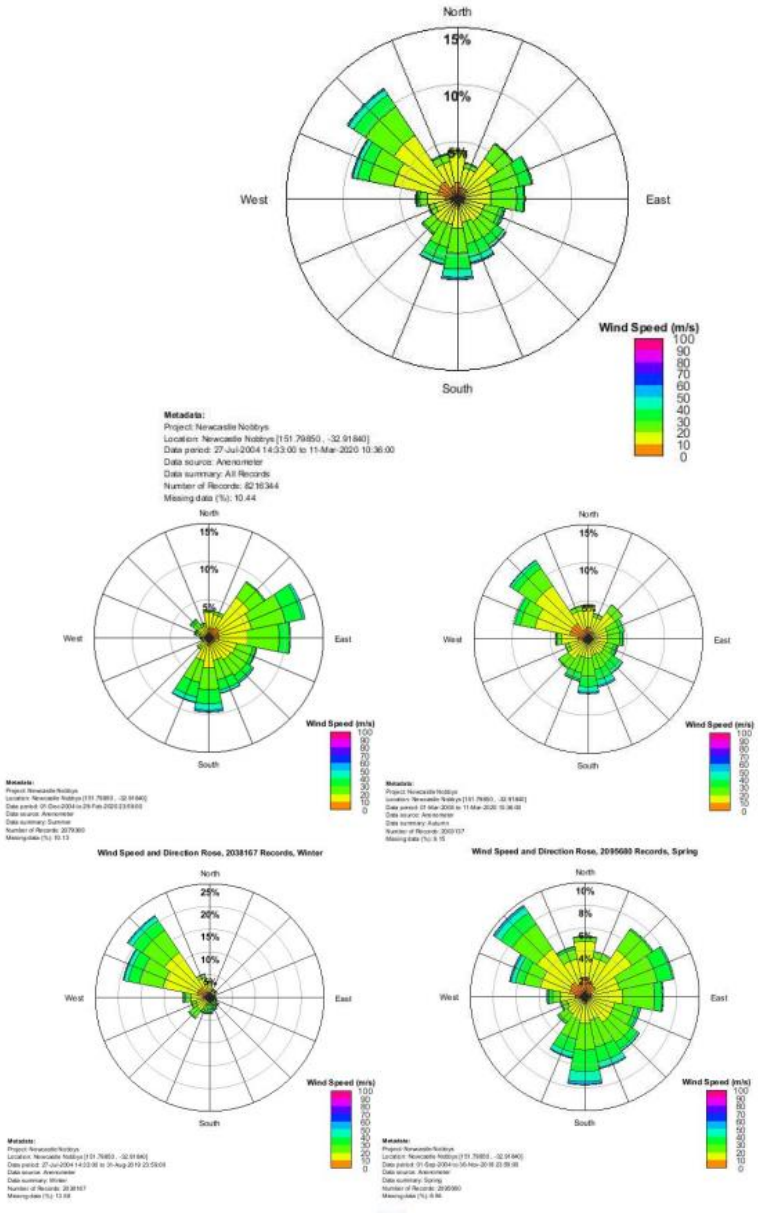

Figure 8 Windrose for Newcastle 2004-2020 (Source Bluecoast 2020)

4.1.4 Turbidity

Sanderson and Redden (2001) compiled and analysed 28 years of water quality measurements taken throughout the Hunter River estuary, including turbidity. Observations from this work included:
high turbidity values were common, with turbidity values highest during large freshwater flows; and,
the mean turbidity value was 15 NTU, with increasing values moving upstream.

Patterson Britton & Partners then undertook a substantial real-time water quality monitoring program at five background and nearfield station within the South Arm of the Hunter River as a component of the environmental obligations for the capital dredging works undertaken by Newcastle Coal Infrastructure Group (NCIG) (PBP, 2008). This program reported background turbidity levels in the Hunter River vary widely from close to 0 NTU to over 100 NTU, with a long term average of 14 NTU at Ironbark Creek. Episodes of elevated turbidity >100 NTU can last for hours or days.

Major factors affecting turbidity are tidal currents, river flow, local rainfall and vessel movements in the port (refer **Figure 9**).

The results of the baseline monitoring study indicated that the Hunter estuary is a highly dynamic and naturally turbid environment (refer **Figure 10**). Therefore, it is generally expected that any turbidity impacts related to maintenance dredging activities would be minimal.

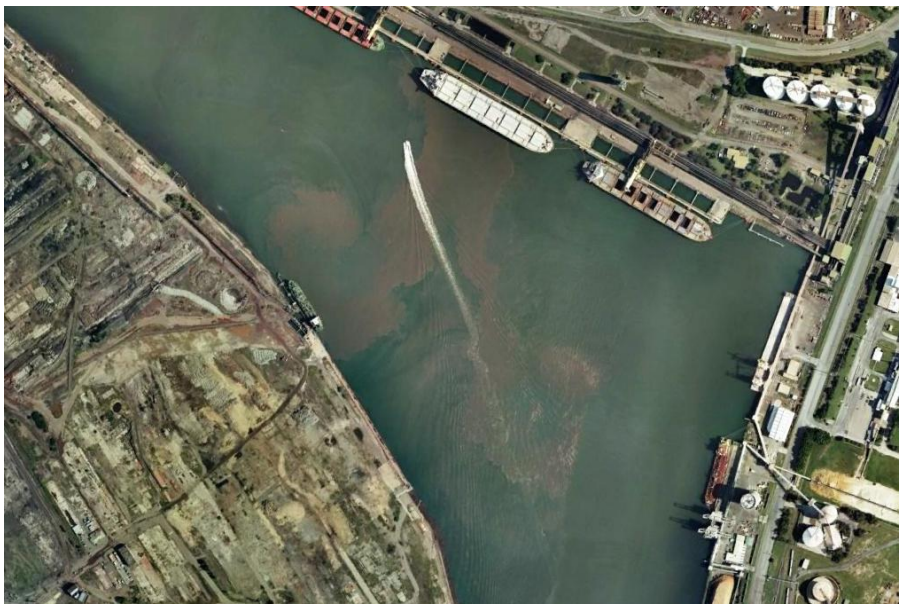

Figure 9 Turbidity Generated by Shipping Movements in the Swing Basin

Figure 10 Turbid flood waters from the Hunter River

4.1.5 Offshore Wave Climate and Currents

The spoil ground is located at around 33°S and receives waves generated in the southern Coral and Tasman Seas and the Southern Ocean. The annual wave climate is both energetic and highly variable with a distinct seasonality present. Based on an analysis of long- term records the months of March and June-July experience the largest average monthly wave heights (Harley et al, 2009). Although moderate waves dominate the climate, large waves (Hs10>4 m) and/or low swell may occur in any month (Short and Trenaman, 1992). Extreme events (Hs>6m) occur predominately in autumn and winter. Waves in the region are generated by five typical meteorological systems: east-coast lows, tropical cyclones, mid-latitude cyclones, zonal anticyclonic highs and local summer sea breezes (Short and Trenaman, 1992).

Newcastle Waverider buoy is located at the entrance to the Hunter River in approximately 22m water depth and is considered to be generally representative of the offshore conditions at the spoil ground. The Newcastle Waverider buoy has data from November 2009 to March 2020 (11 years) and is operated by Port Authority of NSW (Bluecoast 2020).

Wave roses for swell (swell waves, Tp>8s) and sea (local sea, Tp <8s) are provided in **Figure 11**. Wave roses show that the majority (approximately 65%) of offshore wave energy propagates from the S-SE sector (i.e. S, SSE and SE cardinal directions). S-SE waves originate from storms and swells in the Tasman Sea and Southern Ocean and can occur during any season. Easterly waves (i.e. ESE, E and ENE cardinal directions) make up approximately 35% of the total offshore wave energy.

Currents at the spoil ground are dominated by the East Australian Current. The southerly ocean current is located along the eastern seaboard of NSW offshore of Newcastle (Bluecoast 2020). The spoil ground experiences south-westerly currents over 60% of the time (predominantly in summer) with a current reversal in winter.

[10] H_s is the significant wave height, which is the average height of the highest one third of waves recorded in a given monitoring period.

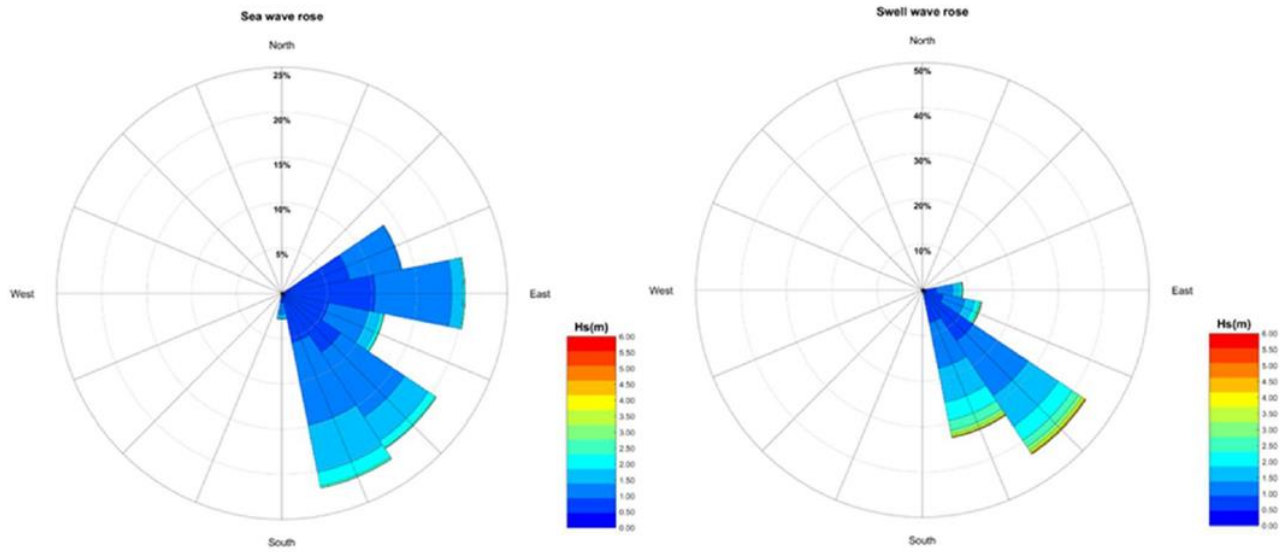

Figure 11 Long-term wave roses at Newcastle Waverider buoy November 2009 to March 2020 (Bluecoast 2020)

4.2 Maintenance Dredge Areas

4.2.1 Physical and Chemical Description of Material

A sediment sampling and testing program was undertaken in June 2017 to provide current sediment quality data for the maintenance dredge material in Areas A, B, C, D, E and F. The findings of the 2017 sediment quality investigations are documented in the Sampling and Analysis Plan (SAP) Implementation Report (RHDHV 2017a). Please note that in the SAP Implementation Report (RHDHV 2017a), MD23 should be in Area D not Area E. This is an error in the 2017 SAP Implementation Report that came about due to a boundary change. Up until the 2012 SAP, MD23 fell within Area E but the boundary was changed and it now falls within Area D.

Sediment from within each dredge area was observed to be generally uniform. The results of five representative samples taken from the dredge areas indicate that:

- samples from Areas B, C and F consisted predominantly of dark grey mud (<63µm) with mud content ranging from 68% to 97%;
- muddy sands and sandy muds were observed in Areas A and D;
- sand content in samples increased closer to the port entrance with sediment in Area E comprising fine to medium grained yellow brown sand.; and
- gravel (>2 mm) was reported in samples from Areas A and E only.

The results of the chemical analysis of the sediments were compared to the guideline values provided in the NAGD. Results were also compared to the previous results from testing of the maintenance dredge areas in 2012. The results from 2017 showed that the 95% upper confidence limit (UCL) of the mean concentration of all the contaminants were below NAGD screening levels (SL) with the exception of nickel. In addition, the 95% UCL of the mean concentration of the majority of contaminants were lower than those reported in the 2012 investigation.

Nickel typically occurs in naturally high concentrations in Australian sediments. Nickel concentrations have historically been elevated within the maintenance dredge material although the concentrations have reduced since 2012.

In 2014, NPC (now PON) implemented a Port Wide Strategy (CSIRO, 2014) that sought to inform existing and future dredging programs of the risks posed by the sediments to marine ecology. Specific comments and conclusions regarding nickel concentrations from within the port comprised:

- Background concentrations of nickel frequently exceed the SL in many Australian estuaries.
- The SL for nickel is generally considered to be very conservative, potentially over protective, when the value is compared to that of other metals and considering the sensitivity of benthic marine organisms to nickel.
- The mean concentration of nickel has been reasonably constant for the past 10 years (30-40 mg/kg range), and while this exceeds the SL, CSIRO considered nickel at these concentrations to represent a low risk of adverse biological effects to organisms.
- In the case of nickel, although the exceedance of the SL may indicate it should be classed as a contaminant of potential concern (COPC), a series of correlations between concentration of aluminium and the metal contaminants, total PAHs and TOC was made which indicated the concentrations of nickel are largely naturally occurring. Higher concentrations of nickel, as with many metals and metalloids, occur naturally for sediments with higher portions of clays and silts. It was concluded that nickel should not be classified as a COPC (concentrations not deviating from background).

Overall, CSIRO concluded that assuming concentrations of contaminants observed in the Port's 5 yearly sampling program remain comparable to, or lower than, historical results, the maintenance dredge material is suitable for unconfined sea disposal.

The 2017 sediment quality investigations showed comparable or lower concentrations of all contaminants and the maintenance dredge material was considered suitable for unconfined sea disposal.

It is expected that the maintenance dredge material for Area G and the other areas that may come under the responsibility of PON for maintenance dredging will largely comprise sediments deposited by fluvial processes and should therefore be relatively similar to maintenance dredge material derived from the current maintenance dredge areas, i.e. suitable for unconfined sea disposal. This will be verified by sediment sampling and testing programs that will provide current sediment quality data for the maintenance dredge material. These programs will be implemented prior to the commencement of maintenance dredging operations in these areas.

4.2.2 Introduced Marine Organisms

A survey of introduced marine organisms was undertaken by the Centre for Research on Introduced Marine Pests (CRIMP) for the Newcastle Port Corporation between 23 August and 3 September, 1997, with results documented in CRIMP (1999). The survey was undertaken as part of the Australian Association of Port and Marine Authorities (AAPMA)/CRIMP national port survey initiative.

The national survey is designed to determine the distribution and abundance of a targeted group of introduced species in each port. These targeted species are made up of:

- those species listed on the Australian Ballast Water Management Advisory Council (ABWMAC) schedule of introduced pest species;

- a group of species which are major pests in overseas ports and which, on the basis of their invasive history and projected shipping movements, might be expected to colonise Australian ports; and
- those known exotic species in Australian waters that currently are not assigned pest status.

Two ABWMAC targeted pest species were recorded in the Port during the survey. The pest species included the toxic dinoflagellates Alexandrium catenella and A. minutum. These two species were distributed throughout the commercial areas of the Port. No other ABWMAC targeted pest species were recorded from the Port or adjacent areas.

Several other introduced and cryptogenic (i.e., of unknown origin) species were recorded in the region. These species are recognised as having been transferred to Australia in both historic and modern times, but do not pose significant economic or environmental threat (CRIMP, 1999).

The Newcastle Introduced Species Survey report (CRIMP, 1999) includes an assessment of the risk of translocation of introduced species found in the Port. The report notes that of the introduced species detected in the port, the majority of species are not restricted to estuarine environments and may be capable of extending their range beyond the Newcastle locale.

However, dredging practices are considered unlikely to influence the distribution of species in the Port with the exception of toxic dinoflagellate species. The potential for these organisms to be transported in the dredged material is evident as cysts of both species have been identified at the spoil grounds.

National Introduced Marine Pest Information System

The National Introduced Marine Pest Information System (NIMPIS) is a central repository of information on the biology, ecology and the Australian distribution of over 100 marine pest species. It includes known marine pests that have been introduced to Australian waters and exotic marine pests that could be introduced in the future.

A search of the DCCEEW interactive map facility provided at the National System's web page (http://www.marinepests.gov.au/pests/map) was accessed on 11/08/21 to provide recent information on marine pests recorded in Newcastle. No known pests were recorded for Newcastle. However, Newcastle is within the potential range of a number of pest species.

The NIMPIS aims to prevent new marine pests entering Australian waters, respond when a new pest does arrive and minimise the spread and impact of pests already established in Australia.

4.3 Offshore Spoil Ground

4.3.1 Previous Spoil Ground Use

Dredging commenced in the Port in 1859 and has been virtually continuous since that time. Total dredging quantities up to 2023 are estimated to exceed 145 million m3, almost all of which been deposited in the current spoil ground. Four different spoil grounds have been used at various times over the years (refer **Figure 12**).

The current spoil ground corresponds to the approximate position of the original spoil ground. It was used for more than a century prior to establishment of the spoil ground for major port deepening in 1978. The current spoil ground was re-introduced in February 1997. It is now well established and is the disposal area currently approved by DCCEEW. There is no evidence in the available data to indicate any

significant adverse environmental impacts from use of this area for disposal of maintenance dredged material.

4.3.2 Disposal Route

The spoil ground is located within NSW Coastal Waters. Water depth at the spoil ground ranges from 25 to 30 m below Chart Datum. The route taken by the vessel transporting dredged material from the dredge area to the spoil ground is shown on **Figure 12**. The vessel takes the most direct route from the dredge area to the port entrance. Once out of the port entrance, the vessel turns southeast, travels to the spoil ground, swings around and when heading back to the entrance places material over the spoil ground.

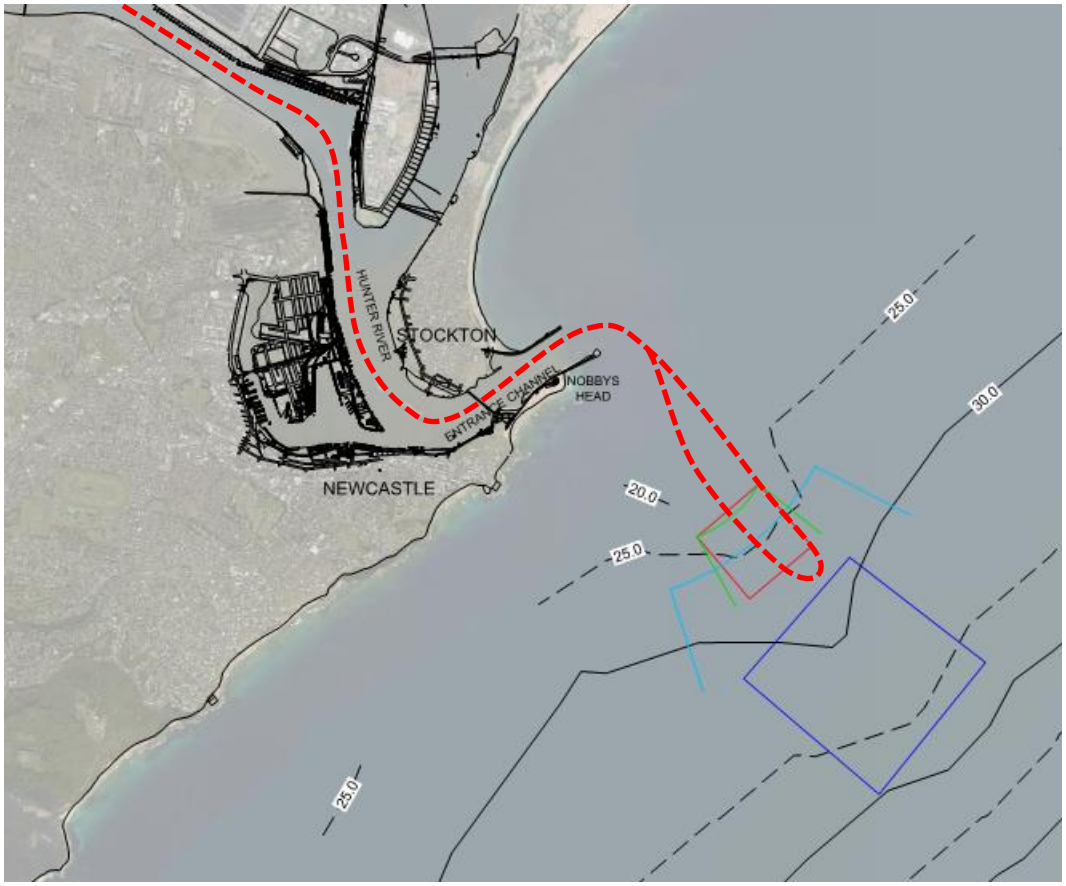

Figure 12 Indicative Route from Dredging Area to Spoil Ground

4.3.3 Description of Spoil Ground

A number of studies have been undertaken to characterise the offshore area and to ascertain the fate of material placed in the various spoil grounds over time. Studies have included chemical and physical sediment analyses, sidescan sonar, biological sampling and Remotely Operated Vehicle (ROV) video surveys. A more detailed description of the findings of the studies is presented in the maintenance dredging permit application. An overview of the key characteristics of the maintenance dredging spoil ground is provided below.

The most recent sediment sampling and testing program was undertaken in June 2017 to provide current sediment quality data for the spoil ground, in addition to broader sampling required to confirm the

dispersion pathway of the sediment using the chemical and physical properties of the sediment as tracers. Details of the program are provided in RHDHV (2017b) which included the following findings:

- chemical testing of the sediments showed that the mean concentration and the 95% upper confidence limit of the mean concentration for all areas investigated were below the NAGD screening level (SL);
- beyond typically the 60m contour, elevated concentrations of contaminants (compared to the clean sands of the inner shelf) were found in the muddy sediment. These concentrations were compared to other sediment quality data for the NSW coast and overseas and were found to be in the typical range of background levels;
- the results of the chemical testing were compared to the results from the 2009 investigation and indicated no significant changes in contaminant concentrations within in each zone;
- the benthic invertebrate assemblages at the spoil ground were found to be different to the assemblages at the control locations. Differences detected to be significant were a decrease in both number of taxa and the total abundance of invertebrates within sediments collected from the spoil ground. This agrees with previous findings in 2001 (TEL 2001). The observed decreases in diversity are potentially due to loss of the more sensitive taxa, while the decrease in abundance is likely a direct impact of smothering by dredged material. Given sufficient time, benthic invertebrates will potentially migrate vertically through the overlying dredged material;
- sediments within the spoil ground contained low levels of heavy metals and PAHs, which were found to correlate weakly with some of the differences in the assemblage of benthic invertebrates. Hence some of these contaminants may be responsible for differences in the assemblage of benthic invertebrates in the spoil ground. However, the magnitude and duration of any impacts will be species specific, and dependent on the frequency and amount of dredged material dumped at any one point within the spoil ground;
- given the ongoing disposal of dredged material to meet maintenance dredging requirements, gradual long-term change in assemblages are expected to continue. This is consistent with previous findings in 2001 (TEL 2001);
- sampling at the four inshore locations confirmed the offshore movement of the dredged material from the spoil ground, i.e. the inshore samples had a very low mud content, contamination concentrations below SL and no “exotic” rock fragments typical of dumped material. However, in any future sampling, a greater sampling density could be adopted to provide more information on the mud content and contamination concentrations inshore of the current spoil ground;
- analysis of the chemical and physical properties of the sediment at the spoil ground and surrounding area provided a consistent picture for the dispersion pathway of the sediment identified in the 2002 and 2009 investigations.

A conceptual model of the far field dispersion of dumped dredge material is provided in **Figure 13.**

The Interactive Map Search facility on DCCEEW’s Environment Protection and Biodiversity Conservation Act (EPBC) web page was accessed 09/10/24 to provide an indication of flora and fauna potentially present within the spoil ground. The results of this search are provided in **Appendix C**. The search identified 101 Threatened species, 76 Migratory species and 103 Listed Marine species that are likely to exist (or their habitat may exist) within the defined search area. Of the threatened species identified, 16 are marine birds, three are whales (Blue, Southern Right and Humpback), four are sharks (Grey Nurse, Great White and Whale Shark, and Sawfish), and five are marine reptiles (various turtle species). These species are all reported as being covered by migratory provisions of the EPBC Act, 1999.

Of the 103 Listed Marine species, 21 comprise seahorses and pipefish, and the balance is made up of marine birds, mammals and reptiles, the majority of which are included above. The exceptions are the

Yellow-bellied Seasnake and a number of bird species that are not classified as marine species, but that ‘overfly’ the marine area.

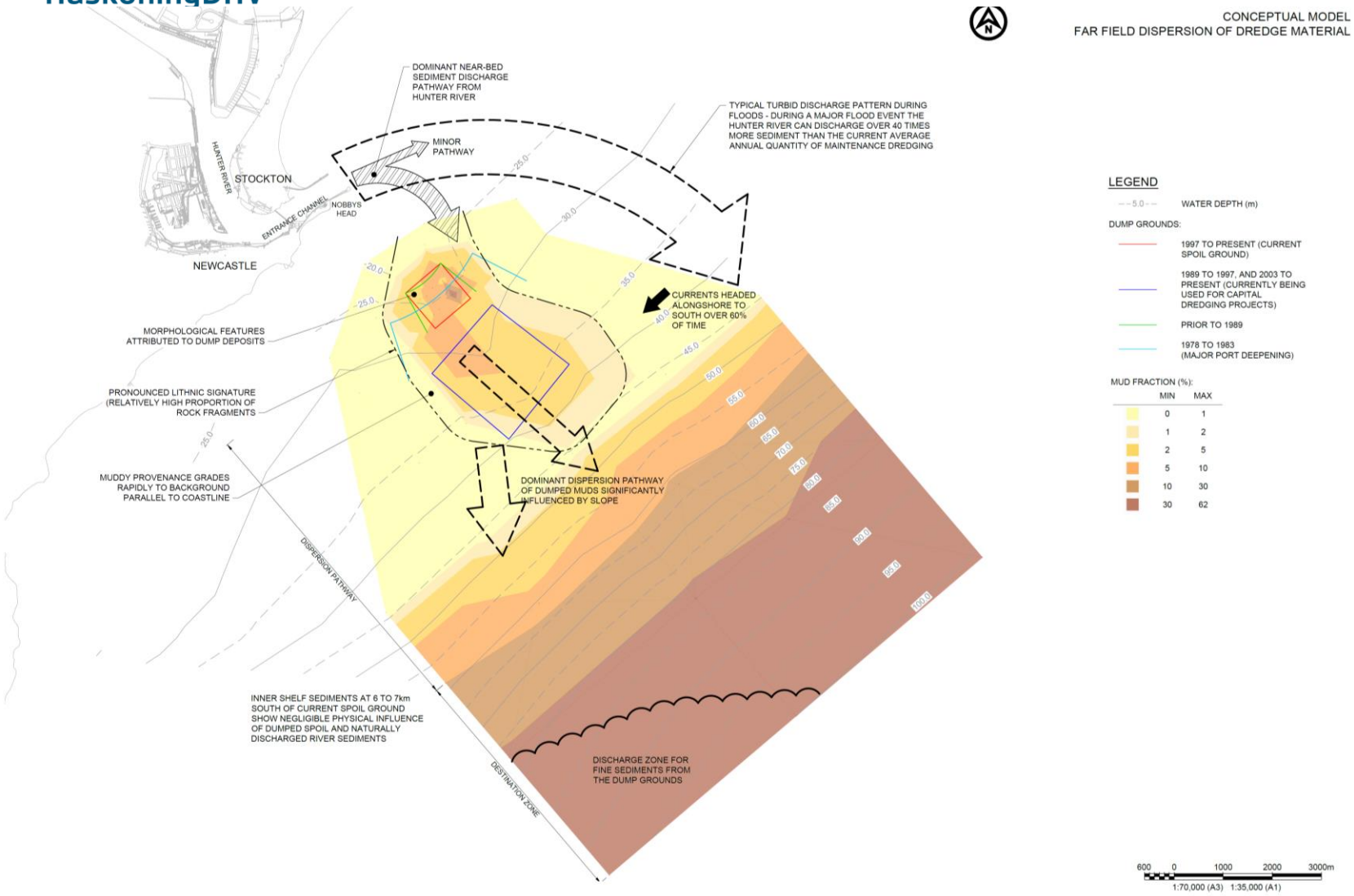

Figure 13 Conceptual Model Far Field Dispersion of Dredge Material

4.4 Fisheries

The proposed spoil ground is not subject to ‘Marine Park’ or other zoning having bearing on its intended use.

Sampling of the existing benthic communities within offshore disposal areas and two nearby control areas was undertaken by RHDHV (2017a) and by The Ecology Lab (2003). The investigations showed that there are no sensitive areas, such as seagrass meadows, coral communities or algae beds, present within the spoil ground.

Shallow, nearshore rocky reef habitat occurs along the coast of Newcastle. From the southern tip of the Hunter River mouth and further south small rocky reef habitats have been recorded (DPI 2010). The reefs in this area are shallow and continuous from the shore out to between 200 m and 1.8 km offshore (DPI 2010). These rocky reefs may support a variety of sponges, algae, sea urchins, ascidians and bryozoans. Rocky reefs are also often complex habitat with caves, rocky pinnacles and bommies or large boulders (DPI 2010). The spoil ground is located approximately 3.5 km to the east of the nearshore rocky reefs (refer **Figure 14**).

Along the Newcastle coastline there are several areas identified as fish breeding reefs and others regarded as angling reefs. These areas, such as Mudhole Reef and The Pinnacles, are several kilometres inshore from the proposed disposal area. North Reef (McEnally and McEnally 2008) is located approximately 3 km off the coastline and over 4.5 km to the north of the proposed offshore disposal area (see **Figure 14**).

No important fish, turtle, dolphin or whale habitat or breeding/calving areas have been identified within or near the spoil ground. Humpback whale migration pathways occur in this area between the months of June and September, however, humpbacks prefer the warmer waters of northern Queensland to calve and rest (DAWEa 2021). Southern right whales migrate to southern Australia in winter to give birth. While rare, they have been known to migrate as far as the north coast of NSW and have been observed to remain within several hundred metres of beaches up to several weeks (DAWEb 2021).

The Hunter River and coastal regions off Newcastle Port are utilised by recreational and commercial fishers. The commercial fisheries that operate within the area mainly use nets and include:

- Fisheries for ocean hauling;
- Ocean prawn trawling;
- Ocean Fish Trawling; and
- Ocean trap and line (Worley Parsons 2009b).

The spoil ground, nearby spoil grounds and adjacent Commonwealth waters are utilised by recreational and commercial fishers, and it has been noted that these fishing areas are productive and popular, particularly for recreational use (GHD. 2013). Commercial fishers are known to avoid the spoil ground, but operate directly offshore in Commonwealth waters.

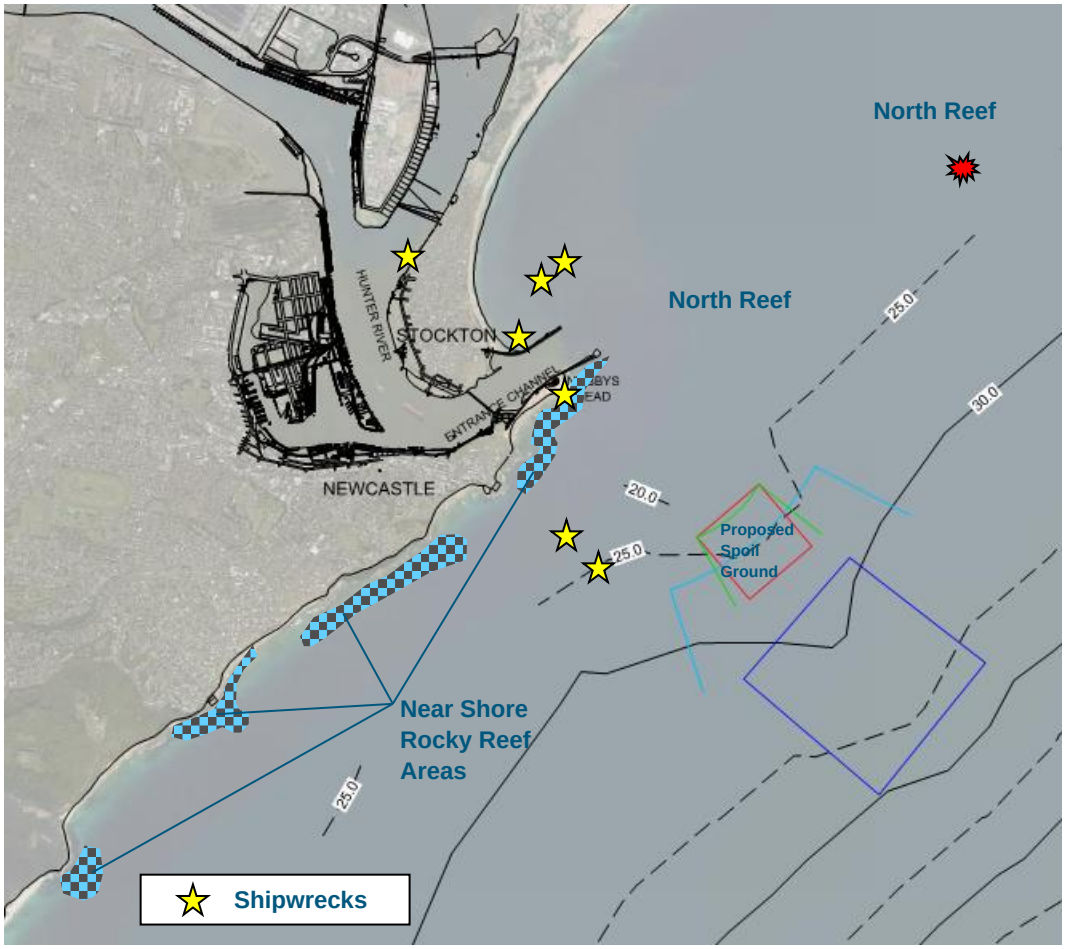

Figure 14 Location of Environmentally Sensitive Areas

An Environmental Assessment was completed on behalf of Industry & Investment NSW for deploying three Offshore Artificial Reefs (OARs) in the vicinity of Newcastle, Sydney and Wollongong to improve recreational fishing opportunities in NSW (Cardno Ecology Lab, 2010). The Newcastle OAR was deployed in 2019 approximately 3.6 km offshore from Blacksmiths Beach and the entrance to Swansea Channel at a depth of around 28 m, which allows for a depth of water over the OAR of around 16 m (refer **Figure 15**). Given that the proposed OAR site is approximately 30 km from the spoil ground, and with reference to the dispersion pathway shown in **Figure 13**, it is not expected that disposal activities will impact on ecological conditions at the OAR.

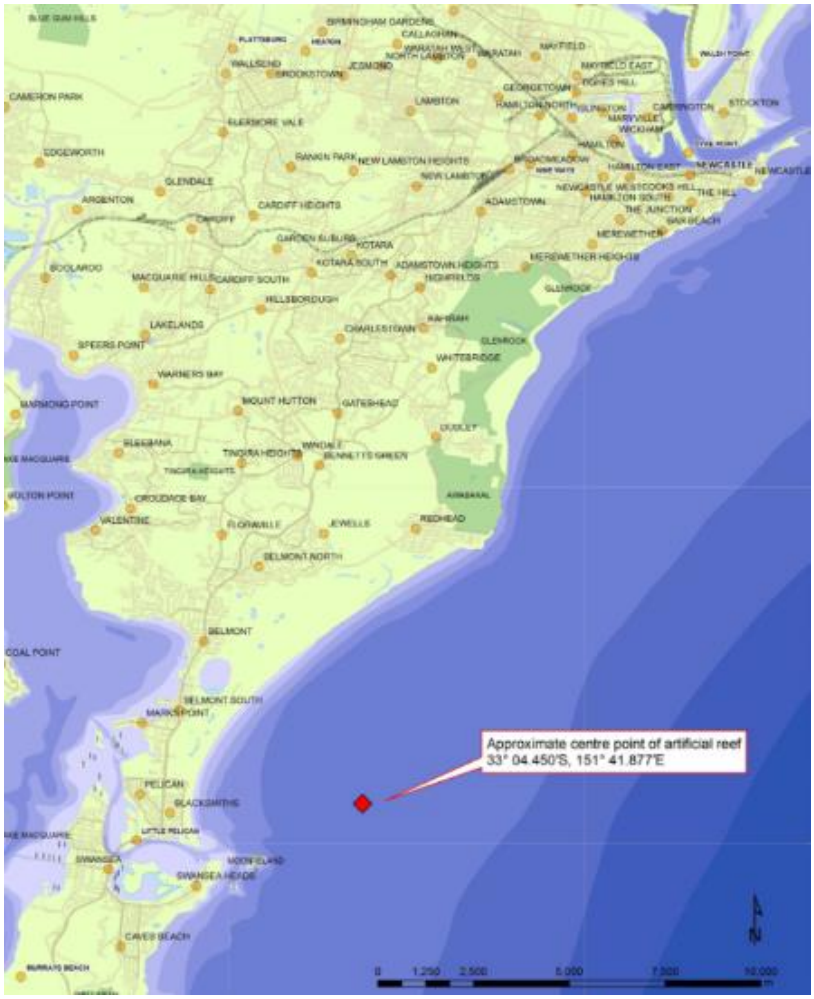

Figure 15 Newcastle Offshore Artificial reef approximately 30 km from the spoil ground (source: https://www.dpi.nsw.gov.au/fishing/recreational/resources/artificial-reef/newcastle-offshore-artificial-reef)

4.5 Indigenous Cultural Resources

The Newcastle Harbour area was the traditional country of the Awabakal and Worimi peoples. The area would have had abundant food resources in the sea, wetlands, forests and woodlands surrounding Newcastle and supported a large Aboriginal population.

Newcastle Harbour is now a highly disturbed and modified environment. A desktop assessment of potential cultural and heritage locations was undertaken. A search of the Aboriginal Heritage Information Management System (AHIMS) has shown there to be no known sites or places of Aboriginal significance within the Port declared under Section 84 of the NP&W Act.

4.6 Non-Indigenous Cultural Resources

The Interactive Map Search facility on DCCEEW'sEPBC web page (refer **Appendix C** for search results) listed no world Heritage Properties, no National Heritage Places and one Commonwealth Heritage Place within 5 km of the spoil ground. This was Nobbys Lighthouse which is located on land and will be unaffected by the maintenance dredging and disposal activities.

Several shipwrecks exist just offshore of Newcastle several kilometres either north or inshore of the proposed spoil ground (refer **Figure 14**). One unnamed wreck, lying approximately 2 km south of the spoil ground, has been reported by *Kapola*. However, it is understood that this wreck and other areas offshore of the Newcastle Harbour entrance are not utilised frequently for diving. Discussions with local dive operators have indicated these wrecks and other areas offshore of the Newcastle Harbour entrance are not utilised frequently for diving, due to the consistently poor visibility encountered.

5 POTENTIAL IMPACTS AND MANAGEMENT STRATEGIES

5.1 General

A detailed assessment of the projected physical, chemical and biological impacts on the spoil ground and surrounding areas has been undertaken in support of PON's 10 year Sea Dumping Permit application. This information has not been repeated in full in this LTMMP. However, an overview of the potential impacts that may result as a consequence of the dredging and disposal activities is provided below. Relevant management strategies for the project are also described and will be adhered to at all times.

5.2 Potential Impacts and Management Strategies

5.2.1 Turbidity Levels and Dispersal of Sediment

Turbidity is considered to be visually unappealing, symptomatic of land degradation and probably impacting many benthic processes (Patterson Britton & Partners, 2003). However, high turbidity also limits light penetration into the water and therefore limits phytoplankton blooms and growth of undesirable plants and algae. Given the high nutrient loads into the Hunter estuary, high turbidity levels are therefore considered to have some desirable side effects as far as phytoplankton control is concerned.

Negative impacts of high turbidity can occur. One ecosystem that can be affected is seagrasses. In the case of Newcastle Port, there are no seagrasses present in the port area or the offshore spoil ground. However, it has been suggested that high turbidity is the reason for the small numbers of oysters present in the Hunter estuary. Increases in turbidity may also affect the foraging behaviour of fish, and suspended sediments may abrade the protective mucus coats on fish, thereby increasing their susceptibility to disease, clogging gill filaments, or suffocating the fish (MHL, 2002).

An environmental advantage of using a trailing suction hopper dredger such as the David Allan is that the suction-head draws most of the fine materials (silts and clays) into the suction pipe, with consequently a low percentage of fines escaping during dredging. Further, as the hopper fills, water is collected from the surface of the hopper and is discharged well below the water line below the keel of the vessel ('overflow dredging'). By ensuring that all discharges will occur well below the water line, the dispersal of material within the upper portion of the water column will be reduced.

Assessment of the spoil ground has indicated that for the 25 to 30 m water depths at the spoil ground, the dumped material would be largely intact as it plummets and impacts with the seabed with only 1% to 5% by weight of the material remaining in the water column. This process is referred to as 'convective descent'. As only a small amount of the dumped material is available in the water column to create turbidity, and this material disperses on the current and settles in deeper water (much like the suspended sediments at times of natural flood events), no specific management strategy is considered necessary for the mitigation of turbidity at the spoil ground.

5.2.2 Physical Impacts at the Spoil Ground

Due to the current use of the spoil ground for disposal of maintenance dredge material, it being established for that purpose, as well as the regular impacts of significant natural sediment output from the Hunter River, it is not expected that continued placement of maintenance dredged material would further significantly affect the environment at the spoil ground. As such, no management strategy is considered

necessary for the physical impacts (e.g. smothering of biota and change in substrate) associated with the disposal of the dredged material.

Nevertheless, PON will ensure that each load of dredged material is dumped at a different location within the spoil ground so that the dumped material is distributed evenly.

5.2.3 Sediment Quality

As discussed in **Section 4.2.1**, recent sediment quality investigations have shown that the maintenance dredge material from Areas A, B, C, D, E and F is suitable for unconfined sea disposal. Furthermore, chemical testing of sediment within the spoil ground showed that levels of contamination were below NAGD screening levels.

Sediment sampling of the maintenance dredge material within the Port and at the spoil ground is therefore only proposed to confirm contamination levels and support the next maintenance dredging permit application. Details of the proposed sampling are discussed in **Sections 6.9.1** and **6.9.2** for the dredge areas and the disposal areas respectively.

5.2.4 Effects on Marine Life

Large marine fauna, such as cetaceans and turtles, can be impacted by dredging activities. However, these mammals are mobile and can generally avoid dredging activities. The management strategy that will be implemented for the protection of cetaceans includes the following:

- during June to October inclusive, PON will check, using binoculars from a suitable high observation platform on the dredge vessel, for cetaceans within the monitoring zone, i.e. within 300m of an intended dumping run;
- dumping activities will only commence if no cetaceans have been observed in the monitoring zone for 10 minutes immediately preceding commencement; and
- if any cetaceans are sighted in the monitoring zone, dumping activities must not commence until 20 minutes after the last cetacean is observed to leave the monitoring zone.

The strategy is discussed in further detail in **Section 6.7**.

As discussed in **Section 4.3.3**, the benthic invertebrate assemblages at the spoil ground were found to be different to the assemblages at the control locations (RHDHV, 2017). Differences detected to be significant were a decrease in both number of taxa and the total abundance of invertebrates within sediments collected from the spoil ground. The observed decreases in diversity are potentially due to loss of the more sensitive taxa, while the decrease in abundance is likely a direct impact of smothering dredged material. Given sufficient time, benthic invertebrates will potentially migrate vertically through the overlying dredged material.

Details of the proposed biological monitoring as part of this LTMMP are discussed in **Section 6.9.2**.

5.2.5 Impacts on the Water Column

The potential for environmental impacts to occur within the water column due to dumping has been examined in several CSIRO studies involving dredge plume monitoring, elutriate testing, acid soluble metal analyses, acid volatile sulfide (AVS) and simultaneously extractable metals (SEM) analyses, and bioaccumulation monitoring of oysters deployed in the spoil ground above the seabed (Hunter Environmental Monitoring Program). The results from these studies are noted in three long-term sea

dumping strategy documents prepared on behalf of PON by Patterson Britton & Partners (1996, 2000) and WorleyParsons (2009b). These studies have concluded that there are unlikely to be significant environmental impacts within the water column during the sea disposal of maintenance dredging material from the Port.

5.2.6 Air Quality

Impact on the air quality is expected to be negligible, being sourced only from the vessel's exhaust.

5.2.7 Noise

Due to the location of the dredging works, noise impact on the local community is not expected to be an issue of concern. Noise generated from the dredging activities will be no greater than noise generated from the numerous commercial and recreational vessels using the Port.

There is no record of noise complaints from the operations of the David Allan, which have taken place over many years.

5.2.8 Threatened Species and Communities

As noted in Section 4.3.3, an EPBC Act Interactive Map Search has identified Threatened, Migratory and Marine protected species that may occur (or their habitat occurs) in the vicinity of the spoil ground.

The listed threatened species and marine protected species (seabirds, sharks, whales, sea snakes, seahorses/pipefish and sea turtles) should not be adversely affected by the disposal activities. A primary area of concern would be any nearshore reef / seagrass / marine algae beds on which the protected seahorses and pipefish would depend. However, these areas occur along the shoreline, well inshore from disposal activities and it is well established that the sediment deposited at the spoil ground disperses in the offshore direction into deeper water.

Other species, such as protected seabirds, marine reptiles and most marine mammals, range over a much larger area than the scale of the disposal operations and are therefore not expected to be significantly impacted by the process.

Some species do, however, need to be considered more carefully. For instance, Humpback Whales migrate annually past Newcastle during the winter (travelling north) and spring / early summer (returning south), while Southern Right Whales migrate to southern Australia in winter to give birth. A management strategy for the protection of cetaceans is outlined in **Section 5.2.4**, and is discussed in further detail in **Section 6.7**.

5.2.9 Changes in Bathymetry

Significant changes in bathymetry may result in navigation hazards, including grounding or damage to vessels, and altered wave conditions and currents.

However, as outlined in **Section 4.3.3**, the results of several rounds of sediment sampling and testing have confirmed the dispersive nature of the spoil ground, with offshore movement of the dredged material from the spoil ground in a south easterly direction before settling beyond the 60 m depth contour. As such, it is not expected that significant changes in bathymetry will be experienced at the spoil ground and the spoil ground is therefore expected to have capacity for the maintenance dredge material over the life of

the ten year permit. The management strategy that will be adopted to confirm this involves annual bathymetric surveys of the spoil ground, as described in **Section 6.11**.

Post-dredging surveys of the port area are also undertaken on a regular basis to ensure that declared depths are maintained.

6 IMPLEMENTATION OF THE LTMMP

6.1 Introduction

Environmental management of the maintenance dredging at the Port and sea disposal of the dredged material will ensure that PON achieves its commitment of undertaking the maintenance dredging in an environmentally responsible and safe manner in accordance with the requirements established during the permit application process. This includes the objective of continuous improvement in environmental management practices.

This section of the document outlines the requirements for the environmental management of the maintenance dredging in terms of the following:

- responsibilities;
- training;
- monitoring;
- reporting;
- contingency plans;
- auditing and monitoring of compliance with approval conditions;
- complaints management;
- review and revision of the LTMMP; and
- publication of the LTMMP.

6.2 Responsibilities for Environmental Management

Responsibility for environmental management of this project rest ultimately with PON. PON will have suitably experienced and qualified people engaged for the dredging and dumping activities.

PON will ensure that all persons engaged in the dumping activities authorised under the permit, including owners and persons in charge of the vessel/s are made aware of and comply with the LTMMP, the permit, and the requirements of the Environmental Protection (Sea Dumping) Act 1981.

6.3 Training

It is the responsibility of the Executive Manager Marine and Operations that any new personnel associated with the permit have an induction module specific to the operation of the permit. Ongoing staff will have periodic refresher courses on the permit requirements.

PON will ensure that all PON staff on board the dredger the David Allan and any other dredger that may be used in the project, are suitably trained for dredging and disposal activities. This includes record keeping and cetacean monitoring (refer **Sections 6.6** and **6.7**).

6.4 Materials to be Disposed of at Sea

Dredged material is to be derived only from the maintenance dredging of the:

- berths, navigation channels and associated batters specified as areas A, B, C, D, E, and F throughout the life of the sea dumping permit; and
- additional berths (and adjacent channels and batter slopes) as they fall under the responsibility of PON to maintain during the life of the Sea Dumping Permit (refer **Figure 2** and **Table 2**).

Adherence to the above is the responsibility of the Dredge Master. In addition, the Executive Manager Marine and Operations will ensure that no material derived from capital dredging projects is dumped at sea under the 10 year maintenance dredging permit.

6.5 Placement of Dredged Material

It is the responsibility of the Dredge Master that PON will only place the maintenance dredge material within the area defined by the following coordinates in WGS84:

32○ 56.10’ S 151○48.94’ E
32○ 55.77’ S 151○49.40’ E
32○ 56.16’ S 151○49.79’ E
32○ 56.49’ S 151○49.32’ E

The David Allan is equipped with an electronic chart that has a visual display of both the WGS84 co-ordinates and the vessel position, therefore ensuring that material will be dumped in the appropriate position.

The David Allan will track its position over the spoil ground during the disposal activities to ensure disposal is within the defined co-ordinates using a Global Positioning System (GPS). The Dredge Master will ensure that each load of dredged material is dumped at a different location within the spoil ground so that the dumped material is distributed evenly. It is part of the Dredge Master’s duties to maintain a record of individual spoil locations on the Material Relocation record sheet (refer **Appendix D**). Each record sheet identifies the position of approximately 50 loads.

6.6 Record Keeping

PON will ensure that the following record keeping is undertaken:

- PON will record the quantities of all material dredged and dumped (in cubic metres) on a daily basis to ensure that the quantities dumped are within the total amount approved under the permit. It is the responsibility of the Dredge Master to record these quantities on the David Allan Operating Log (refer **Appendix E**);
- PON will keep records comprising either weekly plotting sheets or a certified extract of the ship’s log which detail the following:

    a) the times and dates at which each dumping run is commenced and finished. This information will be maintained by the Dredge Master of the David Allan in an Operating Log;
    b) the position of the vessel at the beginning and end of each dredging run. This information will be maintained by the Dredge Master of the David Allan in an Operating Log;
    c) the position of the vessel at the beginning and end of each dumping run with the inclusion of the path of each disposal run. This information will be recorded by the Dredge Master on the Materials Relocation record sheet (refer **Section 6.5**);
    d) the volume of dredge material (in cubic metres) dumped for the specific operational period. This information will be maintained by the Dredge Master of the David Allan in an Operating Log; and,
    e) a means of estimating, from the reported amount, the quantity in both dry tonnes and cubic metres. Significant work was done in 2017 to determine the insitu density of the dredge material for each of the areas of the port to improve the accuracy of the reporting of dredging volumes. This is the responsibility of the Dredge Master.

6.7 Cetacean Monitoring

Monitoring and mitigation for the protection of cetaceans will be undertaken by PON during the disposal activities. Cetacean monitoring is the responsibility of the Dredge Master. During the months of June – October (inclusive), PON will check for cetaceans within the monitoring zone. Current watch keeping arrangements comprise a watch kept at all times from the bridge of the David Allan. A copy of Australian National Guidelines for Whale and Dolphin Watching 2017 is included in **Appendix F**.

Dumping activities will only commence if no cetaceans have been observed in the monitoring zone (i.e. within 300 m of an intended dumping run) for 10 minutes immediately preceding commencement of the dumping activity. Any sightings will be noted on a separate Materials Relocation records sheet noting date, time, cetacean location and disposal location.

If any cetaceans are sighted in the monitoring zone, dumping activities will not commence until 20 minutes after the last cetacean is observed to leave the monitoring zone. An alternative dumping location may be selected more than 300 m from any sightings of cetaceans and within the approved spoil ground. If the vessel relocates to an alternate dumping location, the mitigation measures for protection of cetaceans, as described above, will still be met.

6.8 Introduced Marine Species

Australian Quarantine and Inspection Service (AQIS) is the lead agency for the management of ballast water taken up overseas with the intention of discharge within an Australian port. AQIS is responsible for ensuring all international ballast water has been managed in accordance with the Australian ballast water management requirements before permitting its discharge inside Australia's territorial sea (12 nautical limit generally applies).

Any ballast water that has been exchanged at sea, by an approved method, is deemed to be acceptable for discharge in Australian ports / waters. Vessels must retain all ballast water records in the AQIS ballast water log and any relevant vessel logbooks, and make these available to quarantine officers on request. Australian ballast water management requirements are consistent with International Maritime Organisation (IMO) guidelines for minimising the risk of translocation of harmful aquatic species in ships' ballast water. AQIS officers in the Port are responsible for regulating the management of internationally sourced ballast water.

With respect to domestically sourced ballast water (ie. ballast water taken up within Australian waters) a new National System is being developed addressing the potential risks associated with marine pests and domestically sourced ballast water. PON will meet any obligations imposed on it through the new National System, including any monitoring requirements.

Any international dredger contracted to undertake maintenance dredging within the Port will be subject to an underwater inspection to determine the presence of any marine pests. DCCEEW will be advised by PON if an international dredger is to be used for maintenance dredging activities. Any further management requirements will be as agreed by PON and DCCEEW.

Management associated with introduced marine species is the responsibility of the Executive Manager Marine and Operations.

6.9 Sediment Sampling

6.9.1 Maintenance Dredge Areas

SAP Implementation

PON will undertake (or contract a third party to undertake) sediment sampling and analysis in accordance with the NAGD current at the time of sampling. This is the responsibility of the PON Environment Manager. The Sampling and Analysis Plan (SAP) for maintenance dredge areas that will be implemented during the life of the 10 year permit is provided in **Appendix G**. PON will inform DCCEEW of sampling exercises undertaken in accordance with the LTMMP. Any amendments to an approved SAP will be submitted by PON for approval by DCCEEW prior to sampling.

It is proposed that sampling of the maintenance dredge material in the Port will be undertaken on two occasions during the life of the 10 year permit, while the interval between these sampling events will be no longer than five years. The most recent sediment sampling exercise was undertaken in 2022, meaning that the next sediment sampling exercise for these areas will be undertaken no later than 2027. Sediment sampling exercises would adopt an expanded sampling and testing regime than undertaken in 2017.

A total of 108 sampling locations are proposed for the 2022 and 2027 sediment sampling and testing program. This was an increase from 58 sample locations in 2017. In all previous SAP's at the Port of Newcastle, sample number locations have been based on annual volumes. However, PON has been advised that DCCEEW's policy for a long-term permit is that the volume to be adopted to determine number of sample locations should be the total volume of sediment to be dredged over five years, not the annual dredging requirement. To meet the department's policy, sampling at 108 locations is required on the basis of the estimated five-year dredging volume of 3.7 million m^3 and the formula provided in the NAGD (page 60).

Physical testing of the samples was broadened to comprise:

- Analysis of all samples (108 samples) for % mud as this is the primary issue in relation to additional opportunities for beneficial reuse of maintenance dredge material for nourishment of Stockton Beach;
- Particle size distribution analysis for the sand fraction on a minimum of 15 representative samples. This minimum number of samples is considered sufficient to gain an understanding of the variability of the sand sizing given that marine sand is expected to dominate and is derived from a single parent body. Particle size distribution analysis for the mud fraction (hydrometer) is not considered necessary.
- Petrographic analysis of the sand-sized fraction for a minimum of 10 samples. The samples for the petrographic analysis will be spaced approximately every 1 km along the channel from upstream at Area G down the channel to the entrance to inform an understanding of the fluvial processes/fluvial sediment supply. It is considered that a minimum of 10 samples throughout the maintenance dredge areas will provide an adequate baseline dataset to characterise the relative sources of the sand within the port.

Chemical testing of the samples was broadened to include dioxin and PFAS compound testing.

Future Maintenance Dredge Areas

As described in **Section 2.1**, PON will assume responsibility for the maintenance dredging of the various additional berths and channel areas at different times throughout the life of the 10 year permit (refer **Table 2**). As such, sediment sampling and testing programs will be implemented for these berths following capital dredging works and prior to the commencement of maintenance dredging operations. This will

ensure that current sediment quality data is available before maintenance dredging commences in these areas. Subsequent sediment sampling and testing for these berths will be undertaken within 5 years of the initial maintenance dredge areas sediment investigations. Based on the current program PON propose to implement the SAP in 2022 and again in 2027 (refer **Figure 3**). Where possible, PON would ideally prefer to undertake sediment sampling and testing for the new additional berths and channel areas at the same time. However, the timing on this is dependant on the capital dredging being completed and the berths coming into PON's ownership. Accordingly, additional SAPs may need to be implemented for these additional berths. This will be confirmed throughout the life of the 10 year permit.

DCCEEW will be informed in advance of the timings of all sediment sampling exercises that will be undertaken in the maintenance dredge areas during the life of the 10 year permit.

It is expected that the material to be dredged from the maintenance areas will be suitable for unconfined sea disposal at the current spoil ground, as has been the case in the previous 10 year permit. However, if the sediment sampling and analysis shows that the material is not suitable for unconfined sea disposal, PON will ensure that an appropriate methodology for disposal of the material will be developed in accordance with the NAGD and in consultation with DCCEEW.

6.9.2 Spoil Ground

The behaviour of the dumped material offshore of Newcastle is well understood and the results of recent studies indicate that frequent ongoing monitoring of the spoil ground and adjacent areas is unnecessary. However, in accordance with the NAGD and best management practices in environmental monitoring, it is considered prudent that a SAP for the spoil ground is prepared and implemented midway through the 10 year permit to confirm the biological, chemical and physical properties of the sediment at the spoil ground and adjacent areas (see below). The SAP for the spoil ground that will be implemented during the life of the 10 year permit is provided in **Appendix H**. Any amendments to an approved SAP will be submitted by PON for approval by the DCCEEW prior to sampling.

Benthic sampling and analysis of the sediment will be undertaken to determine whether dredged material disposal has had a measurable effect on benthic community structure (diversity and abundance) in the spoil ground.

Broader sampling will also be undertaken to confirm the dispersion pathway using the chemical and physical properties of the sediment as tracers. This approach has been successfully adopted for several previous investigations in the offshore area during 1989, 1992, 2002, 2009 and 2017.

It is recommended that the interval between sampling events should be no longer than 10 years. Given that the previous sampling exercise at the spoil ground was undertaken in 2017, the next exercise will be undertaken no later than 2027 (refer **Figure 3**). DCCEEW will be informed in advance of the timing of this sediment sampling exercise.

6.10 Suitability Criteria for Beach Nourishment

As discussed in **Section 2.2.2**, the maximum percentage of fines in maintenance dredge material currently approved under NSW legislation to be placed off Stockton Beach for the purpose of beach nourishment is 10%. PON is prepared to place maintenance dredge material containing a greater percentage of fines than 10% off Stockton Beach but the determination of an acceptable higher percentage would need to be subject to additional studies and consultation through the development of

CMPs for the Stockton Coastline and Hunter River Estuary under the NSW Coastal Management Act 2016.

PON is committed to work collaboratively with CN and the NSW DCCEEW Environment and Heritage Group to determine a maximum acceptable percentage of fines as part of the studies conducted for the CMPs within a two year time frame.

The expanded SAP implemented by PON in 2022 provides data on the % mud at 108 locations throughout the maintenance dredge areas which is the primary issue in relation to additional opportunities for beneficial reuse of maintenance dredge material for nourishment of Stockton Beach. The expanded SAP implemented by PON in 2022 and proposed petrographic analysis also provides data on the percentage of sand contained in maintenance dredge material consisting of dark angular rock compared to rounded quartz . The petrographic analysis of the sand-sized fraction will inform an understanding of the fluvial processes/fluvial sediment supply. The expectation is that the amount of sand consisting of dark angular rock will be small and would not be an issue for placement off Stockton Beach for the following reasons but this would be confirmed following the petrographic analysis and studies conducted for the CMPs:

- the Hunter River is not a significant source of sand sized sediment into the coastal system, as noted earlier;
- the quantities of maintenance dredge material placed off Stockton are very small compared to the total volume of sediment that comprises the Stockton coastal compartment (subaerial and subaqueous); and
- not all of the material placed off Stockton would rework onto the subaerial beach.

PON would make available the results of the SAP Implemented in 2022 to the NSW DCCEEW Environment and Heritage Group and CN and where appropriate assist with studies conducted for the CMPs to determine a maximum acceptable percentage of fines for beach nourishment.

6.11 Bathymetric Surveys

PON will undertake an annual bathymetric survey of the spoil ground. This is the responsibility of the Hydrographic Surveyor. PON currently undertakes annual bathymetric surveys of the spoil ground. Within one month of completing the bathymetric survey, PON will provide a digital copy of the survey to the Australian Hydrographic Office at the following address:

Australian Hydrographic Office
Locked Bag 8801
Wollongong NSW 2500

Within two months of completing the final survey, PON will provide a report to DCCEEW. This report will include a chart showing change in sea floor bathymetry as a result of the dumping and include a written commentary on the volumes of material disposed that appear to have been retained within the spoil ground. This is the responsibility of the Hydrographic Surveyor.

PON will also undertake regular bathymetric surveys of the maintenance dredge areas. These surveys will generally be undertaken prior to and following maintenance dredging exercises.

6.12 Spill and Waste Management

PON will ensure that all vessels associated with maintenance dredging and sea dumping activities are maintained in a manner that minimises the potential for oil and grease leaks/spills. This includes making sure that all vessels have spill response kits on board. The locations of spill response kits will be clearly indicated on all vessels, and all crew will be familiar with spill response procedures.

In accordance with the Marine Pollution Act 2012, the vessel master shall, without delay, notify the Harbour Master, NSW Maritime, and PON. In turn, PON shall notify DCCEEW and NSW EPA. As described in PON's EMS, the incidence of any spills shall be investigated, including the collection and analysis of relevant information.

PON's Environmental Management System (EMS) includes waste handling and disposal procedures. These have been developed to:

- ensure the appropriate disposal of materials and waste produced through PON operations; and
- comply with the requirements of the Waste Reduction and Purchasing Policy (WRAPP) that forms part of the NSW Government Sustainability Policy.

PON's waste handling and disposal procedures cover Port areas, ships at anchor off the Port, vessels visiting commercial berths at the Port (including product transfer) and the David Allan dredge.

PON will ensure that all vessels associated with maintenance dredging and sea dumping activities comply with the waste handling and disposal procedures.

6.13 Reporting

As outlined in **Section 6.6**, PON will record quantities of material dredged and dumped, and will keep records of either weekly plotting sheets or the ship's log. These records are to be retained for auditing purposes.

As outlined in **Section 6.11**, a report on the final bathymetric survey will be completed and submitted to DCCEEW.

PON will submit annual compliance reports to DCCEEW (on 31 January each year) in order to facilitate reporting to the International Maritime Organisation. This requirement is noted in PON's business calendar and is the responsibility of the PON Safety and Environment Manager. The report will include the following:

- permit start date;
- permit expiry date;
- approved dumping site;
- nature of dumped material;
- permit quantity;
- quantity dumped the previous year; and
- dumping method used.

6.14 Environmental Inspections

The Executive Manager Marine and Operations is responsible for ensuring that regular environmental inspections are undertaken on all vessels and properties owned and operated by PON. This will include:

- Weekly Port Inspection - including details of any environmental incidents;
- Dredge Master's Monthly Report – undertaken by the Dredge Master, including details regarding waste storage and disposal, and incident management for the dredge vessel; and
- Survey Monthly Inspection – undertaken by PON's Senior Hydrographic Surveyor, including details regarding waste storage and disposal, and incident management for survey vessels.

6.15 Contingency Measures

The Executive Manager Marine and Operations is responsible for the contingency measures and their implementation. The PON contact for this project in the case of an incident occurring is the Executive Manager Marine and Operations, who can be contacted on 0407 040 719.

If, at any time during the course of dredging/dumping activities, an environmental incident occurs or environmental risk is identified, PON will implement measures to mitigate the risk or impact. PON will notify DCCEEW within 24 hours of any incident or identified risk, which will include:

- details of the incident or risk;
- measures taken;
- success of those measures in addressing the incident or risk; and
- any additional measures proposed to be undertaken.

It is the responsibility of the Dredge Master/Dredging Manager that the David Allan complies with the relevant state, national or international standards with respect to seaworthiness, safety and environmental requirements, or any rules or conditions laid down by the certifying classification society, and be capable of dumping the dredged material to the spoil site in accordance with this LTMMP. In particular, the David Allan is kept under "Class" in accordance with the classification requirements of Lloyd's Register. This ensures compliance with international regulations adopted by the International Maritime Organisation. The safety equipment onboard the David Allan is in accordance with requirements of the Australian Maritime Safety Authority (AMSA). Any other vessel undertaking maintenance dredging within the Port will be subject to these same or equivalent requirements through means of contract documentation.

6.15.1 Breakdown of the David Allan

In case of a breakdown of the David Allan causing dredging and disposal activities to cease temporarily, another suitable vessel may be used if possible or dredging activities may be ceased until the David Allan is repaired.

If another vessel is used to undertake the dredging, the vessel will comply with the relevant state, national or international standards with respect to sea worthiness, safety and environmental requirements. In addition, the Conditions of the Permit and this LTMMP would apply to that vessel.

6.15.2 Nearby Contaminated Sediments

Capital dredging will be undertaken in various new berths during the life of the 10 year permit as listed in **Table 2** (refer **Section 2.1**). PON recognises that sediment designated for capital dredging from other berths may be potentially contaminated[11].

[11] The nature and extent of any existing contamination would be determined from sediment sampling and testing programs implemented prior to capital dredging works. The preparation and implementation of these programs is outside the scope of this LTMMP and 10 year maintenance dredging permit application.

Capital dredging work is subject to its own separate approvals process. The conditions of approval and selected work methods would likely take into account the need to avoid any dispersal of contaminated material, should it exist, and the appropriate treatment of that material. Prior to the removal of any contaminated sediment, mitigation, monitoring and management measures such as the installation of a sheet pile wall and/or turbidity curtains would likely be implemented.

Accordingly, it is not expected that sediment from these activities will impact on any of the maintenance dredging activities. However, if sediment from these activities does become dispersed within any of the maintenance dredge areas, maintenance dredging will be temporarily halted until the contamination levels in the sediment within the maintenance dredge areas can be assessed and a course of action agreed with regulatory agencies.

Responsibility for removal of any dispersed contaminants will remain with the party undertaking the capital dredging and will need to be in accordance with the approvals applicable to the capital dredging.

6.15.3 Flood Related Dredging

The process of sedimentation within the Port is a complex process. It involves interaction between the longitudinal and vertical variations of salinity in the Port, which affect flocculation and settling of silt particles, and gravitational circulations (Patterson Britton & Partners, 2000). Since the silt load of the river and the salinity structure of the Port vary during any individual flood event and from one flood to another, the processes of siltation are dynamic and variable throughout the Port.

It is anticipated that the total annual volume that could need to be dredged from Areas A, B, C, D, E, F and G in any one year may be 800,000 m^3 depending upon the occurrence of flooding events in the Hunter River. PON's 10 year maintenance dredging permit application seeks approval for dredging and disposal of up to 7,400,000 m^3 over the life of the permit assuming in the order of 250,000 m^3 of material from Area E is beneficially reused for beach nourishment of Stockton Beach.

As noted in **Section 6.6**, PON will record the quantities of all material dredged and dumped (in cubic metres) on a daily basis to ensure that the quantities dumped are within the total amount permitted under the permit. If due to flood related events, PON is approaching the permitted volume of material to be disposed of offshore (i.e. 7,400,000 m^3), a submission will be made to DCCEEW to seek approval to dredge and dispose additional material. PON will seek this approval from DCCEEW when their records indicate that the progressive disposal volume is approaching the upper limit.

6.16 Auditing and Monitoring of Compliance with Approval Conditions

Activities relating to the dredging and disposal may be audited by DCCEEW to verify that the activities are meeting the specified and defined requirements.

Audit conditions that PON will adhere to include:

- all records will be retained for auditing purposes (refer Section 6.4); and
- PON will afford access to at least two Australian Government nominees to witness, inspect, examine or audit any part of the operations, including any dumping or monitoring activity, the vessel or any other equipment, or any documented records, and will be provided with any necessary assistance in carrying out their duties. This will be the responsibility of the Dredge Master. PON operating procedures for the David Allan state that a maximum of two persons may board the David Allan at any given time. The number of persons allowed is dictated by safety equipment and other requirements outlined in the relevant state, national or international

standards. Additionally, any person boarding the David Allan will be subjected to the induction requirements of PON and operating procedures of the vessel.

PON also undertakes regular internal auditing to determine compliance to relevant legislation and standards with regard to Quality Assurance (QA), Work Health and Safety (WHS), and Electronic Information Security (EIS) Management Systems. **Table 10** summarises the scheduling of internal audits.

Table 10 Internal Auditing Scheduling and Responsibilities

Management System	Frequency	Responsibility
QA	QA procedures and work instructions - annual QA Policy – every two years	Executive Manager Marine and Operations
WHS	Yearly	Executive Manager Marine and Operations
EMS	Every two years	Executive Manager Marine and Operations
EIS	Annual	General Manager – Finance & Corporate

Unscheduled audits are also undertaken if deemed necessary. Any non-conformances identified during an internal audit are documented, while any corrective actions or suggested improvements are implemented within the respective branches of PON.

6.17 Consultation and Review of the LTMMP

This LTMMP has been prepared in consultation with the Newcastle Port Technical Advisory Consultative Committee (TACC). The TACC was established to address the long-term management of the Sea Dumping Permit by providing advice and oversight on research and monitoring, a forum for discussion and reconciliation of different viewpoints, a focus for long-term planning, and continuity of effort and direction.

Groups represented by the TACC include:

- PON;
- NSW DCCEEW Environment and Heritage Group;
- City of Newcastle;
- Hunter Central Rivers Catchment Management Authority;
- Community Representative;
- DPI;
- Transport for NSW
- Port Authority of NSW
- OceanWatch Australia;
- Hunter Water Corporation; and
- Commonwealth DCCEEW.

PON will review the LTMMP if there are any changes to the dredging, disposal or monitoring activities. Notification and where necessary consultation with the TACC will be undertaken for any modifications to

the LTMMP. Any modifications to the LTMMP will be submitted to DCCEEW for approval. The Executive Manager Marine and Operations will be responsible for this review and consultation.

6.18 Continuous Improvement

As part of PON's EMS procedures, programs are regularly reviewed and revised to reflect progress against environmental objectives and targets, ensuring continual improvement in environmental management. Improvement could refer to physical matters and processes, and include changes to specific actions, operations, responsibilities, resources and timeframes.

Specifically, PON will implement the following mechanisms in order to identify opportunities for continuous improvement to the maintenance dredging and disposal operations over the life of the 10 year permit:

- Regular consultation and review of the LTMMP with the TACC, as described in **Section 6.17**;
- Work collaboratively with CN and the NSW DCCEEW Environment and Heritage Group to determine a maximum acceptable percentage of fines as part of the studies conducted for the CMPs within a two year time frame; and
- Review the Dredging Operational Procedure (contained in the EMS) on an annual basis or more regularly as required.

6.19 Publication of the LTMMP

To ensure transparency and stakeholder understanding and acceptance of the environmental management of the Port, both the LTMMP and any monitoring or research results derived from it, should be published on the Port's website (https://www.portofnewcastle.com.au/).

6.20 Summary

A summary of the key monitoring and reporting tasks for the LTMMP is provided in **Table 11**. The anticipated timing for each task has also been identified. A summary of mitigation measures and the potential triggers for management response that may arise during the life of the 10 year permit is provided in **Table 12** and **Table 13** respectively. Actions that would be implemented in response to these triggers have also been identified.

Table 11 Proposed Monitoring, Reporting and Management Practices, 2022-2032

Activity	Purpose	Timing/Frequency	Responsibility
Maintenance Dredging	Remove accumulated sediment and maintain safe, navigable depth in the Port	Continually, 7 days per week, 52 weeks per year	PON
Record Keeping	Ensure that the quantities dumped are within the total amount approved under the permit. Maintain thorough records of all dredging and disposal activities	Daily records of dredge quantities. Weekly plotting sheets or certified extract of ship's log which detail the following: a) the times and dates at which each dumping run is commenced and finished. This information will be maintained by the Dredge Master of the David Allan in an Operating Log; b) the position of the vessel at the beginning and end of each dredging run. This information will be maintained by the Dredge Master of the David Allan in an Operating Log; c) the position of the vessel at the beginning and end of each dumping run with the inclusion of the path of each disposal run. This information will be recorded by the Dredge Master on the Materials Relocation record sheet (refer **Section 6.5**); d) the volume of dredge material (in cubic metres) dumped for the specific operational period. This information will be maintained by the Dredge Master of the David Allan in an Operating Log; and, e) a means of estimating, from the reported amount, the quantity in both dry tonnes and cubic metres.	Dredge Master
Cetacean Monitoring	Protection of cetaceans	Annually during June to October inclusive	Dredge Master
Sediment Sampling and Testing (Areas A to F) refer Figure 2	Provide current sediment quality data for the maintenance dredge material in Areas A to F	Twice during 10 year permit at an interval no longer than five years. The next sediment sampling exercise will be undertaken no later than 2027.	Environment Manager
Sediment Sampling and Testing (new berths) refer Figure 2	Provide current sediment quality data for the maintenance dredge material in Areas G and new berths	Following capital dredging works and prior to the commencement of maintenance dredging operations. Subsequent sediment sampling and testing to be undertaken within 5 years of the initial investigations.	Environment Manager
Sediment Sampling and Testing (spoil ground) refer Figure 2	Provide current sediment quality data for the spoil ground. Confirm the dispersion pathway of the sediment. Determine whether dredged material disposal has had a measurable effect on benthic community structure (diversity and abundance) in the spoil ground	Once during 10 year permit (currently set down for 2027).	Environment Manager
Bathymetric Survey (spoil ground)	Confirm there has not been significant change in sea floor bathymetry as a result of the dumping	Annual bathymetric survey submitted to Australian Hydrographic Office and report submitted to DCCEEW after final survey.	Hydrographic Surveyor
Bathymetric Survey (maintenance dredge areas)	Pre-dredging survey required to indicate required extent of dredging. Post- dredging survey required to confirm dredging was undertaken as planned	Regular surveys, generally pre and post maintenance dredging exercises	Hydrographic Surveyor
Training	Ensure that staff are suitably aware of the permit requirements	New staff to have an induction module specific to the operation of the permit. Ongoing staff to have periodic refresher courses on permit requirements	Executive Manager Marine and Operations
Compliance Reporting	Compliance with Permit	Annual compliance reports submitted to DCCEEW every 31 January, including: • permit start date; • permit expiry date; • approved dumping site; • nature of dumped material; • permit quantity; • quantity dumped the previous year; and • dumping method used.	Environment Manager
Environmental Inspections	Ensure that PON achieves its commitment of undertaking weekly and monthly environmental inspections on all properties and vessels owned and operated by PON	Weekly Port Inspection - including details of any environmental incidents. Dredge Master's Monthly Report – undertaken by the Dredge Master, including details regarding waste storage and disposal, and incident management for the dredge vessel. Survey Monthly Inspection – undertaken by PON's Senior Hydrographic Surveyor, including details regarding waste storage and disposal, and incident management for survey vessels.	Executive Manager Marine and Operations Dredge Master Senior Hydrographic Surveyor
Contingency Measures (Overall)	Mitigate environmental risks or impacts	If, at any time during the course of dredging/dumping activities, an environmental incident occurs or environmental risk is identified, PON will implement measures to mitigate the risk or impact. PON will notify DCCEEW within 24 hours of any incident or identified risk, which will include: • details of the incident or risk; • measures taken;	Executive Manager Marine and Operations

Activity	Purpose	Timing/Frequency	Responsibility
		• success of those measures in addressing the incident or risk; and • any additional measures proposed to be undertaken	
Contingency Measures (Breakdown of David Allan)	Ensure that dredging and disposal activities do not need to be delayed while the David Allan is unavailable	As required	Dredge Master
Contingency Measures (Nearby Contaminated Sediments)	Mitigate the potential dispersal of any contaminated sediments	As required	Party undertaking capital dredging
Contingency Measures (Flood Related Dredging)	Remove accumulated sediment and maintain safe, navigable depth in the Port following flood events	As required	Environment Manager
Auditing (at discretion of DCCEEW)	Verify that the activities are meeting the specified and defined requirements	As required	DCCEEW
Auditing (Internal)	Determine compliance to relevant legislation and standards with regard to QA, WHS and EIS Management Systems	Annual - QA procedures and work instructions, EIS audits Every two years – QA Policy, WHS audits	Executive Manager Marine and Operations (QA, WHS audits) General Manager – Finance & Corporate (EIS audits)

Table 12 Proposed Mitigation Measures, 2011-2021

Issue	Mitigation Measures	Performance Indicator	Responsibility
Dispersal of suspended sediment during dredging	Dredging will be undertaken by a trailing suction hopper dredger with a suction-head that draws most of the fine materials (silts and clays) into the suction pipe, with consequently a low percentage of fines escaping during dredging. As the hopper fills, water will be collected from the surface of the hopper and will be discharged well below the water line below the keel of the vessel ('overflow dredging'). By ensuring that all discharges will occur well below the water line, the dispersal of material within the upper portion of the water column will be reduced.	All discharges to occur well below the water line	Dredge Master
Transport of dredge material to spoil ground	The dredge vessel will take the most direct route from the dredge area to the port entrance. The dredge vessel will observe all relevant maritime notices, navigational requirements, and any requirements of the PON Harbour Master, including coordination of vessel movements with commercial shipping in the Port.	Zero incidents during transit	Dredge Master
Ensure that dredge material is derived from Areas A, B, C, D, E, F and G only	The dredge vessel will be fitted with GPS to ensure accurate positioning	No material derived from capital dredging projects to be dumped at the maintenance dredging spoil ground under the 10 year permit	Dredge Master Executive Manager Marine and Operations
Ensure that dredged material is dumped within designated spoil ground, i.e. the area defined by the following coordinates in WGS84: **32○ 56.10' S 151○48.94' E** **32○ 55.77' S 151○49.40' E** **32○ 56.16' S 151○49.79' E** **32○ 56.49' S 151○49.32' E**	The David Allan is equipped with an electronic chart that has a visual display of both the WGS84 co-ordinates and the vessel position, therefore ensuring that material will be dumped in the appropriate position. The David Allan will track its position over the spoil ground during the disposal activities to ensure disposal is within the defined co-ordinates using a GPS.	No disposal of dredge material outside boundary of spoil ground	Dredge Master
Significant changes in bathymetry at the spoil ground	The Dredge Master will ensure that each load of dredged material is dumped at a different location within the spoil ground so that the dumped material is distributed evenly. A record of individual spoil locations will be maintained on the Material Relocation record sheet (refer **Appendix D**) Annual bathymetric surveys will be undertaken at the spoil ground	No instances of repeated dumping of dredge material at one location	Dredge Master Hydrographic Surveyor
Protection of cetaceans	During the months of June – October (inclusive), PON will check for cetaceans within the monitoring zone (i.e. within 300 m of an intended dumping run). Current watch keeping arrangements comprise a watch kept at all times from the bridge of the David Allan. Dumping activities will only commence if no cetaceans have been observed in the monitoring zone for 10 minutes immediately preceding commencement of the dumping activity. Any sightings will be noted on a separate Materials Relocation records sheet noting date, time, cetacean location and disposal location. If any cetaceans are sighted in the monitoring zone, dumping activities will not commence until 20 minutes after the last cetacean is observed to leave the monitoring zone. An alternative dumping location may be selected more than 300 m from any sightings of cetaceans and within the approved spoil ground. If the vessel relocates to an alternate dumping location, the mitigation measures for protection of cetaceans, as described above, will still be met.	No injury or mortality incidents to marine mammals attributable to dredging	Dredge Master
Dispersal of contaminated sediments from elsewhere in the Port into maintenance dredge areas	Maintenance dredging will be temporarily halted until the contamination levels in the sediment within the maintenance dredge areas can be assessed and a course of action agreed with regulatory agencies.	No instances of cross contamination of maintenance dredge areas	
Introduced marine species	Vessels must retain all ballast water records in the AQIS ballast water log and any relevant vessel logbooks, and make these available to quarantine officers on request. Australian ballast water management requirements are consistent with IMO guidelines for minimising the risk of translocation of harmful aquatic species in ships' ballast water. AQIS officers in the Port of Newcastle are responsible for regulating the management of internationally sourced ballast water. With respect to domestically sourced ballast water (ie. ballast water taken up within Australian waters), PON will meet any obligations imposed on it through the National System, including any monitoring requirements to address the potential risks associated with marine pests and domestically sourced ballast water. Any international dredger contracted to undertake maintenance dredging within the Port of Newcastle will be subject to an underwater inspection to determine the presence of any marine pests. DCCEEW will be advised by PON if an international dredger is to be used for maintenance dredging activities. Any further management requirements will be as agreed by PON and DCCEEW.	Zero establishment of Introduced Marine Pests as a result of the dredging and spoil disposal activities	Environment Manager
Spill and Waste management	The locations of spill response kits will be clearly indicated on all vessels, and all crew will be familiar with spill response procedures. In accordance with the Marine Pollution Act 2012, the vessel master shall, without delay, notify the Harbour Master, NSW Maritime, and PON. In turn, PON shall notify DCCEEW and NSW EPA. The incidence of any spills shall be investigated, including the collection and analysis of relevant information.	Zero incidents involving the loss of oil, grease or any other waste into the marine environment	Dredge Master Environment Manager

Table 13 Triggers and Subsequent Actions, 2011-2021

Trigger	Action
Changes to timings when PON will assume responsibility for maintenance dredging of new berths (refer Section 2.1)	PON to notify DCCEEW. Revise timings for implementation of SAPs (if required)
PON is approaching the permitted total volume of material to be disposed of offshore (i.e. 7,400,000 m^3)	Submission will be made to DDCCEEWAWE to seek approval to dredge and dispose additional material.
Cetaceans sighted in monitoring zone	Dumping activities will not commence until 20 minutes after the last cetacean is observed to leave the monitoring zone. An alternative dumping location may be selected more than 300 m from any sightings of cetaceans and within the approved spoil ground
New staff begin work related to permit	All new staff to have an induction module specific to the operation of the permit
Breakdown of the David Allan	Dredge Master to notify Executive Manager Marine and Operations Another suitable vessel may be used if possible or dredging activities may be ceased until the David Allan is repaired. If another vessel is used to undertake the dredging, the vessel will comply with the relevant state, national or international standards with respect to sea worthiness, safety and environmental requirements.
International dredger contracted to undertake maintenance dredging	PON to notify DCCEEW. Dredger must be subjected to an underwater inspection to determine the presence of any marine pests.
Sediments unsuitable for unconfined sea disposal identified in maintenance dredge areas	PON to notify DCCEEW. PON will ensure that an appropriate methodology for disposal of the material will be developed in accordance with the NAGD and in consultation with DCCEEW. In addition, the chemical and physical testing of samples from the spoil ground and adjacent areas would be brought forward, and a biological testing program would be undertaken.
Flooding in Hunter River	Consider undertaking bathymetric survey of maintenance dredge areas. If required, undertake maintenance dredging to maintain navigable depths.
Any changes to dredging, disposal and monitoring activities	Review the LTMMP (if required). Any modifications to the LTMMP will be submitted to DCCEEW for approval.
Audit	PON will afford access to at least two Australian Government nominees to witness, inspect, examine or audit any part of the operations, including any dumping or monitoring activity, the vessel or any other equipment, or any documented records, and will be provided with any necessary assistance in carrying out their duties.
Oil Spill	Immediately implement spill response procedures. In accordance with the Marine Pollution Act 2012, the vessel master shall, without delay, notify the Harbour Master, NSW Maritime, and PON. In turn, PON shall notify DCCEEW and NSW EPA. The incidence of any spills shall be investigated, including the collection and analysis of data.
Environmental Incident occurs / Environmental Risk identified	PON will implement measures to mitigate the risk or impact. PON will notify DCCEEW within 24 hours of any incident or identified risk.

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8 GLOSSARY

Bathymetric survey - A map showing the measurement of the depth of bodies of water with depth contours. Bathymetry is the underwater equivalent to topography.

Benthic communities - Animals dwelling on the bottom of a water body. These organisms inhabit the sediment on lake, river, or ocean bottoms, as well as the sediment in marshes, tidal flats, and other wetlands.

Cetacean – A member of the sub-order Mysticeti or Odontoceti of the order Cetacea. Cetaceans are whales, dolphins and related marine mammals.

Conditions of the Permit – Conditions outlined in a permit by which the relevant party must abide.

Dredging – The practice of excavating or displacing the bottom or shoreline of a water body. Dredging can be accomplished with mechanical or hydraulic machines. Most is done to maintain channel depths or berths for navigational purposes.

Spoil ground – Designated area for dredged material placement. Designated areas must be co- ordinated with relevant government agencies for environmental compliance and acceptability.

Elutriate test - A test, which involves mixing sediment with 4 times its volume of seawater under specified conditions, to estimate the amounts of contaminants that will be released during sea disposal.

Long Term Monitoring and Management Plan - A site specific plan developed to ensure that the proposed activities associated with a project comply with all relevant environmental components and that all environmental risks are properly managed.

Heavy metals - are metals or metalloids found in the periodic table of elements from Group IIA through VIA. Metals exist in elemental form or as ions dissolved in water, or as vapours, or as salts or minerals in rock, sand, and dust, and form a variety of inorganic or organic compounds.

Maintenance dredging – The dredging to ensure that channels, berths or construction works are maintained at their designed dimensions.

Sediment - Any particulate matter that can be transported by fluid flow and which eventually is deposited as a layer of solid particles on the bed or bottom of a body of water

Sedimentation - The accumulation of sediments on the bottom of waterways or bodies of water.

Toxicity testing - Procedures that evaluate the toxic effects of sediments on organisms.

Turbidity – A condition of a liquid due to fine visible material in suspension, which may not be of sufficient size to be seen as individual particles by the naked eye but which prevents the passage of light through the liquid. A measure of fine suspended matter in liquid.

Water column – Volume of water between the surface of the water and the ocean bottom.

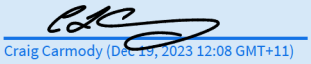
Appendix A – PON ENVIRONMENTAL POLICY

PORT of NEWCASTLE

Environment Policy

ENVP 001

DOCUMENT PROPERTIES

Document Title	**Environment Policy**
Owner	Brigid Kelly
Approved By	Craig Carmody
Approval Signature	 Craig Carmody (Dec 19, 2023 12:08 GMT+11)
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CONTENTS

1. PURPOSE

The purpose of this policy is to define our commitment to responsible and sustainable environmental management.

2. SCOPE

This Policy applies to Port of Newcastle (PON) controlled development, operations and activities.

3. POLICY STATEMENT

The mission of PON is to promote and support prosperity of the Hunter Region and New South Wales in a sustainable manner. This is achieved through safe, efficient and sustainable operations.

As the custodian of the Port for the NSW government and the people of NSW, PON recognises its responsibilities in providing and promoting a sustainable environment for its employees, contractors, customers, port users, visitors and members of the public.

PON operates within an Environmental Management System (EMS) based on the principles of ISO 14001:2015 and EcoPorts SLC.

Key environmental aspects identified for the Port of Newcastle are biodiversity, energy and fuel usage and associated emissions, stormwater, historical land contamination and pollution. These aspects are linked to port development in sensitive areas, operation of the port and our vehicle and vessel fleet and projects and development that involve ground penetration works.

Managing Our Environmental Footprint:

- fostering sustainability awareness, pollution prevention and encouraging a genuine respect for environmental protection in all our employees through the provision of training and information
- considering environmental, social and economic aspects when procuring goods and services
- ensuring responsible consumption and disposal of resources
- investing in infrastructure to prevent environmental impacts
- Reducing our Scope 1, 2 and 3 carbon emissions to meet our 2040 net zero target

Delivering beyond our boundaries:

- proactively supporting initiatives that go beyond compliance obligations
- exhibiting leadership in environmental practices and sustainability whilst encouraging port tenants and licensees to adopt similar standards
- actively contributing to local environment and sustainability initiatives

Having in place robust systems and support:

- enabling compliance, commerciality and efficiency within a culture of mutual respect
- ensure compliance with all relevant legislation, regulations and other requirements to which PON subscribe
- supporting PON employee health and wellbeing
- continually improving and innovating to enhance environmental performance
- identifying and managing environmental risks and impacts
- setting objectives and management programs based on key aspects including; decarbonisation, waste to landfill reduction; pollution prevention; improved air quality, biodiversity protection and support for our communities
- The circular economy

- regularly review environmental objectives and targets and report on progress to senior management
- developing and maintaining an effective Environmental Management System
- communicating our policy and systems to employees, tenants and contractors
- ensuring contractors engaged by PON meet minimum environmental standards and demonstrate a commitment to sustainable practices
- working in partnership with our stakeholders to drive active and sustainable environmental management
- managing the presence, handling and storage of hazardous substances
- effective lighting design to reduce light pollution
- setting hours of operation and where appropriate, mitigation methods, to minimise public nuisance from noise and vibration
- installing operational controls for water outflows/discharges and water inflows/withdrawals

Being committed stewards:

- complying with all applicable legal and other requirements
- sustainable management of our heritage assets
- incorporating sustainable design principles into new developments
- measuring understanding and minimising environmental impacts
- ensuring effective environmental management clauses are included in all new leases and licenses

City-Port Relations

- having a framework for stakeholder communication that will include communications on our environmental program
- working to maintain a social license to operate
- prepare and make publicly available environment reports
- contributing to a sustainable city and community

PON will ensure we have the people, the resources, the assets, the know-how and the culture to deliver a consistently high standard of service to our customers and deliver the future needs of our customers in a sustainable manner and to ensure that this policy can be implemented.

4. DEFINITIONS

Term	Definition
PON	Port of Newcastle
EcoPorts SLC	EcoPorts Sustainable Logistics Chain (SLC) is the main environmental initiative of the European port sector. It was initiated by a number of proactive ports in 1997 and has been fully integrated into the European Sea Ports Organisation since 2011. The overarching principle of EcoPorts is to raise awareness on environmental protection through cooperation and sharing of knowledge between ports and improve environmental management.
CC	Consultative Committee
CLG	Community Liaison Group

5. REVISION HISTORY

This document shall be reviewed every two years or sooner in the event of a change in legislation or otherwise approved.

Version	Release date	Modified by	Comment
1	12/06/2014	Jackie Spiteri	
2	12/10/2015	Jackie Spiteri	
3	06/09/2018	Jackie Spiteri	
4	16/12/2019	Jackie Spiteri	
5	16/12/2021	Brigid Kelly	
6	19/12/2023	Brigid Kelly Alicia Marix-Evans	
	Last Review Date:	19/12/2023	
	Next Review Date:	19/12/2025	

Appendix B – SUMMARY OF HISTORICAL GRAIN SIZE INFORMATION

SUMMARY OF PORT OF NEWCASTLE GRAIN SIZE DATA

2005 SAP Implementation Report - Maintenance Dredge Areas (Patterson Britton & Partners)

Dredge Area	Sample ID	% MUD (< 63µm)	% SAND (> 63µm)	% GRAVEL (> 2mm)
A	MD4	91.4	8.6	0
B	MD9	81.8	17.8	0.3
C	MD18	83	17	0
D	MD22	16.3	83.4	0.4
E	MD24	6.4	93.5	0.1

2009 SAP Implementation Report - Maintenance Dredge Areas (WorleyParsons)

Dredge Area	Sample ID	% MUD (< 63µm)	% SAND (> 63µm)	% GRAVEL (> 2mm)
A	MD4	70	30	<1
B	MD11A	96	4	<1
C	Basin 7	98	2	<1
D	MD21	63	37	<1
E	MD24	14	84	1
E*	MD23	13	86	1

* prior to Area D/E boundary change in 2012, MD23 located in Area E

2012 SAP Implementation Report - Maintenance Dredge Areas (WorleyParsons)

Dredge Area	Sample ID	% MUD (< 63µm)	% SAND (> 63µm)	% GRAVEL (> 2mm)
A	MD1	82	18	<1
A	MD2	39	59	2
A	MD3	96	4	<1
A	MD4	99	1	<1
A	MD5	86	16	<1
A	MD6	92	8	<1
B	MD7	88	12	<1
D	MD22	21	79	<1
D	MD23	11	88	1
E	MD24	14	85	1
E	MD25	21	69	10
C	Basin 3	99	1	<1

* percentages interpreted from Figure 3 of SAP Implementation Report

* following Area D/E boundary change in 2012, MD23 located in Area D

2017 SAP Implementation Report - Maintenance Dredge Areas (RHDHV)

Dredge Area	Sample ID	% MUD (< 63µm)	% SAND (> 63µm)	% GRAVEL (> 2mm)
A	MD4	41	56	3
B	MD9	91	9	<1
C	Basin 6	97	3	<1
D	MD21	35	65	<1
D	MD23	12	87	1
F	MA7	68	32	<1
F	K10-4	93	7	<1

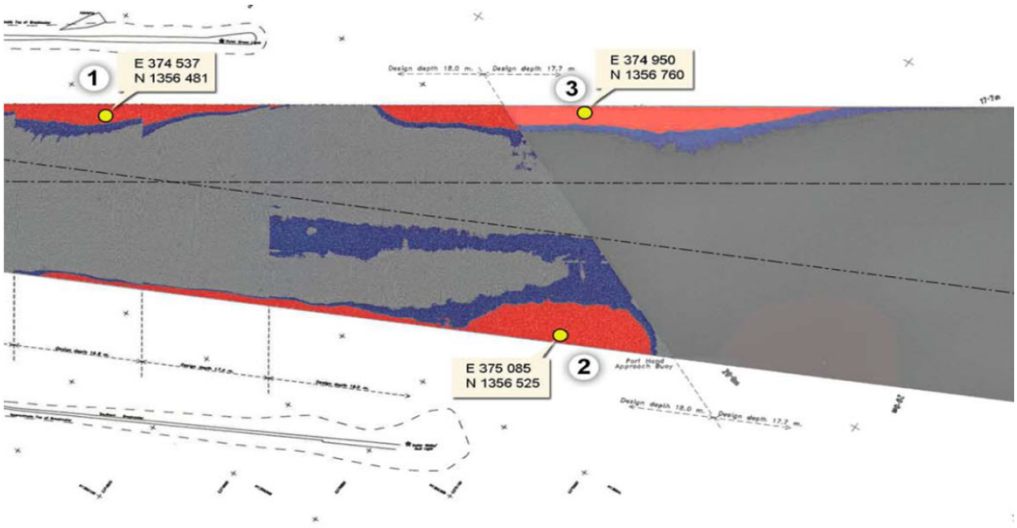
* following Area D/E boundary change in 2012, MD23 located in Area D

SUMMARY OF PORT OF NEWCASTLE GRAIN SIZE DATA

2009 Area E Sediment Sampling and testing (WorleyParsons)
15 samples from 3 vibrocores within Area E

Dredge Area	Sample ID	% MUD (< 63µm)	% SAND (> 63µm)	% GRAVEL (> 2mm)
E	Core 1 0-0.5m	8	91	1
E	Core 1 0.5-1.0m	5	93	2
E	Core 1 1.0-1.5m	7	89	3
E	Core 1 1.5-2.1m	8	86	6
E	Core 2 0-0.5m	<1	99	<1
E	Core 2 0.5-1.0m	<1	99	1
E	Core 2 1.0-1.5m	3	96	<1
E	Core 2 1.5-2.0m	2	98	<1
E	Core 3 0-0.5m	4	96	1
E	Core 3 0.5-1.0m	2	97	1
E	Core 3 1.0-1.5m	5	93	2
E	Core 3 1.5-2.0m	2	98	<1
E	Core 3 2.0-2.5m	4	92	3
E	Core 3 2.5-2.9m	91	9	<1

2009 Area E Coring Locations (WorleyParsons)



CSIRO (2014) Newcastle Port Corporation Port-wide Strategy
Area 1 (Areas A, B, D & F)

Statistics	% CLAY (< 2µm)	% SILT (< 60µm)	% SAND (> 60µm)	% GRAVEL (> 2mm)	% COBBLES (6cm)
Number of samples	5	5	5	2	6
Mean	28.2	33	38.6	<1	<1
Standard Deviation	11.21	17.42	28.03	na	na
Minimum	12	9	10	na	na
Maximum	39	52	78	na	na

Area 2 (Area C, The Basin)

Statistics	% CLAY (< 2µm)	% SILT (< 60µm)	% SAND (> 60µm)	% GRAVEL (> 2mm)	% COBBLES (6cm)
Number of samples	3	3	3	3	3
Mean	37.33	59.67	3	<1	<1
Standard Deviation	8.33	5.68	2.64	na	na
Minimum	28	55	1	na	na
Maximum	44	66	6	na	na

SUMMARY OF PORT OF NEWCASTLE GRAIN SIZE DATA

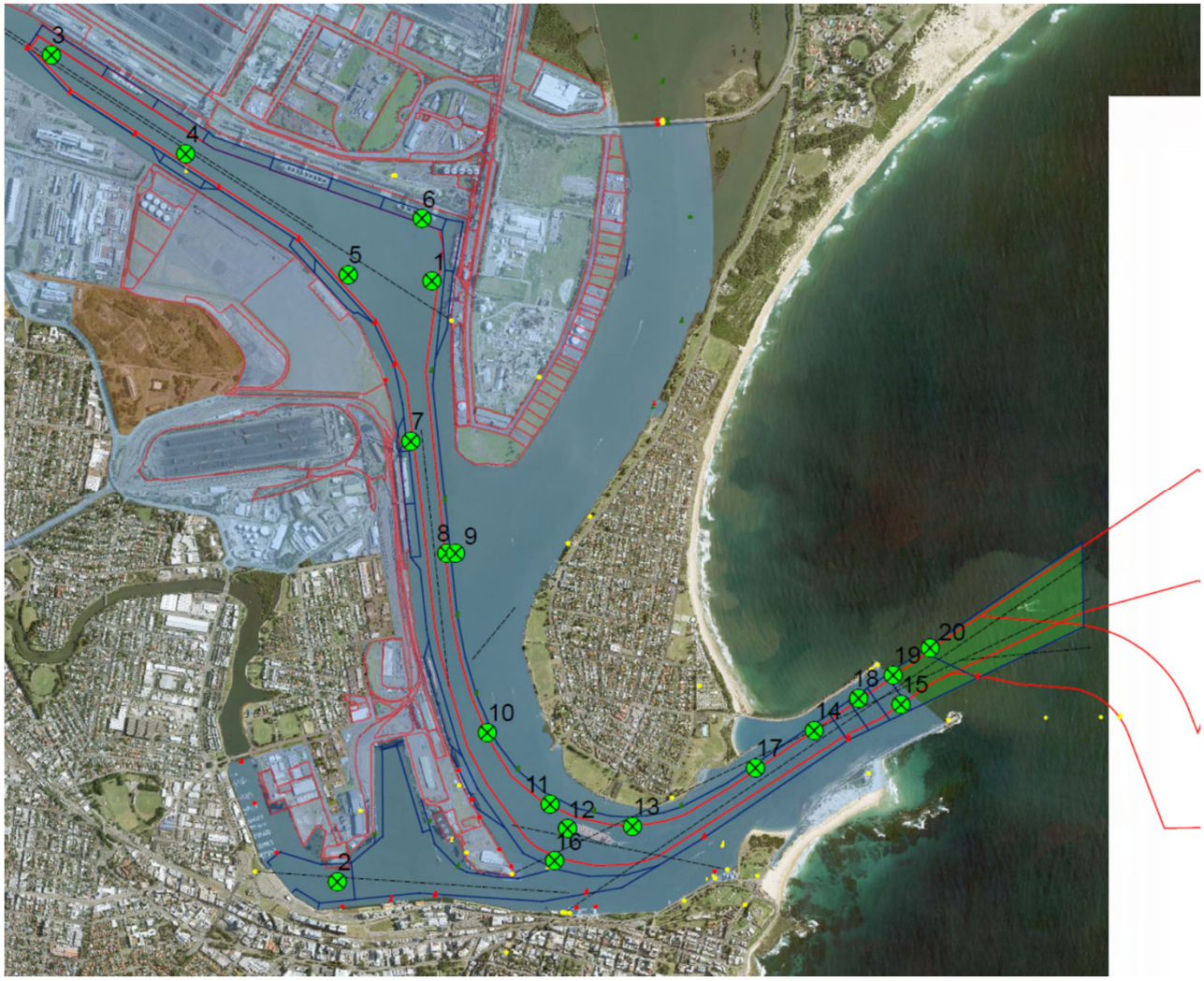
2016 Sediment Insitu Density Assessment PON Maintenance Dredging Areas (RHDHV) Observations by Geochemical Assessments Pty Ltd

Coring Location	Subsection Interval (m)	Texture and Description	Comments
1	0.00-0.40	Mud. Black, soft	Refusal on clay or dense sand
1A	0.00-0.41	Mud. Black, soft	Duplicate cores. Refusal on clay or dense sand
2	0.00-0.5	Mud. Black, soft	
	0.50-1.0	Mud. Black, soft to firm	
	1.00-1.4	Mud. Black, firm	
2A	0.00-0.50	Mud, nil sand. Soft	Duplicate core
	0.50-1.00	Mud, nil sand. Soft	
	1.00-1.38	Mud. Black, soft	
3	0.00-0.39	Mud, nil sand. Very soft to soft	Refusal on clay or densely packed sand
4	0.05-0.41	Mud (2 to 5 cm thick- NOT sampled) overlying densely-packed, fine grained clayey sand (pale grey/yellowish)	Mud layer disturbed and too thin to sample. Refusal in densely packed sand
5	0.00-0.215	Mud, trace sand. Black	Refusal on rock. Core contained rock fragments to 3 cm dia. (not sampled)
6	0.00-0.44	Sandy mud 0-0.44 m, black, some vesicles. Fine grained quartzose sand 0.44 to 0.55 m (lost)	Moved 20 m south due to vessel in berth. Refusal in densely-packed sand
7	0.00-0.50	Mud, trace sand, black. Soft to firm	
	0.50-1.00	Sandy mud, black. Soft to firm	
	1.00-1.10	Sandy mud, black. Coarse grained sand at 1.10 m	Refusal in densely packed sand
8	0.00-0.53	Mud, some sand. Black, very soft to firm. Some gas vesicles. Vegetative debris	Refusal on clay or densely packed sand
9	0.00-0.50	Sandy mud. Grey to black, soft to firm. Abundant gas vesicles	Steep batter
	0.50-1.00	Mud, trace sand. Black, firm	
	1.00-1.18	Sandy mud, black, firm. Thin (<1 mm) layers of fine sand	Refusal

Coring Location	Subsection Interval (m)	Texture and Description	Comments
9A	0.00-0.50	Muddy sand to sandy mud. Black, firm. Abundant vegetation debris and gas vesicles	Duplicate core. Large variation in sediment stratigraphy within several meters
	0.50-1.02	Mud, some sand. Black. Abundant vegetation debris and gas vesicles	Refusal. Sediment finer than in Core 9, 0.50-1.00 m
10	0.00-0.50	Sandy mud to muddy sand. Black, firm. Abundant vegetation debris and gas vesicles	Abundant gas vesicles
	0.50-0.93	Sandy mud. Grey to black. Gas vesicles	Refusal
11	0.00-0.14	Mud, some sand	Refusal on rock
11A	0.00-0.21	Sandy mud, traces of orange clay 0-0.21 m. Orange clay 0.21 to 0.25 m	Duplicate core. Location moved 10 m west. Refusal on clay. Clay at base of core was disturbed and not sampled. Bright green vegetative material in core
12	-	No core	Multiple coring attempts. Less than 5 cm unconsolidated, muddy sand overlying very hard substrate
13	0.00-0.50	Muddy sand. Grey to black, firm	Refusal
14	0.00-0.23	Muddy sand. Mud increasing with depth. Grey to dark grey.	Refusal. 0.23 to 0.5 m lost
14A	0.00-0.125	Muddy sand	Duplicate core. Refusal
15	-	No core	Coring attempted - no core recovered. Deep water, swell and wind. Hard, densely-packed sand
16	0.00-0.33	Sandy mud. Black, soft	Refusal
16A	0.00-0.34	Sandy mud. Black, soft	Duplicate core. Refusal
17	0.00-0.27	Muddy sand, trace gravel (shell fragments). Pale grey, firm	Location moved 30 m north. Refusal on hard base - rock?
18	0.00-0.29	Gravelly, muddy sand. Pale grey to dark grey, firm	Location moved 30 m north. Refusal
19	-	-	Coring not attempted at this location
20	-	No Core	Coring attempted- no core recovered. Deep water, swell and wind. Broken core barrel on hard, densely-packed sand

SUMMARY OF PORT OF NEWCASTLE GRAIN SIZE DATA

2016 Sediment Insitu Density Assessment PON Maintenance Dredging Areas (RHDHV)
Sample Locations



Appendix C – EPBC ACT PROTECTED MATTERS REPORT

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 09-Oct-2024

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	101
Listed Migratory Species:	76

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	22
Commonwealth Heritage Places:	2
Listed Marine Species:	103
Whales and Other Cetaceans:	14
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	2
Regional Forest Agreements:	1
Nationally Important Wetlands:	1
EPBC Act Referrals:	26
Key Ecological Features (Marine):	None
Biologically Important Areas:	10
Bioregional Assessments:	1
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity	Buffer Status
Hunter estuary wetlands	Within Ramsar site	In feature area

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name	Buffer Status
Commonwealth Marine Areas (EPBC Act)	In buffer area only

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community may occur within area	In buffer area only
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area	In buffer area only
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	Endangered	Community may occur within area	In buffer area only
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community likely to occur within area	In buffer area only
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area	In buffer area only
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	Endangered	Community likely to occur within area	In buffer area only

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Ardenna grisea Sooty Shearwater [82651]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area	In buffer area only
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area	In buffer area only
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area	In buffer area only
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Climacteris picumnus victoriae Brown Treecreeper (south-eastern) [67062]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In buffer area only
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat known to occur within area	In feature area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Melanodryas cucullata cucullata South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093]	Endangered	Species or species habitat may occur within area	In buffer area only
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	In feature area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area	In buffer area only
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area	In feature area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area	In feature area
Pycnoptilus floccosus Pilotbird [525]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Stagonopleura guttata Diamond Firetail [59398]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area	In feature area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area	In buffer area only
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area	In buffer area only
FISH			
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Seriolella brama			
Blue Warehou [69374]	Conservation Dependent	Species or species habitat known to occur within area	In feature area
FROG			
Litoria aurea			
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Mixophyes balbus			
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Uperoleia mahonyi			
Mahony's Toadlet [89189]	Endangered	Species or species habitat may occur within area	In buffer area only
MAMMAL			
Balaenoptera borealis			
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Balaenoptera musculus			
Blue Whale [36]	Endangered	Species or species habitat may occur within area	In feature area
Balaenoptera physalus			
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Chalinolobus dwyeri			
Large-eared Pied Bat, Large Pied Bat [183]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Dasyurus maculatus maculatus (SE mainland population)			
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Eubalaena australis			
Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Notamacropus parma Parma Wallaby [89289]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Petauroides volans Greater Glider (southern and central) [254]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Petaurus australis australis Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area	In buffer area only
Potorous tridactylus tridactylus Long-nosed Potoroo (northern) [66645]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area	In buffer area only
PLANT			
Angophora inopina Charmhaven Apple [64832]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Commersonia prostrata Dwarf Kerrawang [87152]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Diuris praecox Newcastle Doubletail [55086]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Eucalyptus camfieldii Camfield's Stringybark [15460]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Eucalyptus parramattensis subsp. decadens Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Grevillea shiressii [19186]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area	In buffer area only
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat likely to occur within area	In buffer area only
Rutidosis heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Tetratheca juncea Black-eyed Susan [21407]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area	In buffer area only
REPTILE			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In feature area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area	In feature area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
SHARK			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Carcharias taurus (east coast population)			
Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Carcharodon carcharias			
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area	In feature area
Galeorhinus galeus			
School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453]	Conservation Dependent	Species or species habitat may occur within area	In feature area
Rhincodon typus			
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In feature area
Sphyrna lewini			
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area	In feature area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Anous stolidus			
Common Noddy [825]		Species or species habitat likely to occur within area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Ardenna carneipes			
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Ardenna grisea			
Sooty Shearwater [82651]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calonectris leucomelas			
Streaked Shearwater [1077]		Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In feature area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area	In feature area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area	In feature area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat known to occur within area	In feature area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	In feature area
Sternula albifrons Little Tern [82849]		Breeding may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area	In feature area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area	In feature area
Migratory Marine Species			
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area	In feature area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area	In feature area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area	In feature area
Carcharias taurus Grey Nurse Shark [64469]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area	In feature area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In feature area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area	In feature area
Dugong dugon Dugong [28]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area	In feature area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area	In feature area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In feature area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat may occur within area	In feature area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat may occur within area	In feature area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area	In feature area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In buffer area only
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area	In buffer area only
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area	In buffer area only
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area	In feature area
Calidris pugnax as Philomachus pugnax Ruff [91256]		Roosting known to occur within area	In buffer area only
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area	In buffer area only
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area	In buffer area only
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area	In buffer area only
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area	In buffer area only
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area	In buffer area only
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area	In buffer area only
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In feature area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area	In buffer area only
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area	In buffer area only
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area	In buffer area only
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area	In buffer area only
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area	In buffer area only
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Commonwealth Bank of Australia		
Commonwealth Land - Commonwealth Bank of Australia [11596]	NSW	In buffer area only
Communications, Information Technology and the Arts - Australian Postal Corporation		
Commonwealth Land - Australian Postal Commission [11592]	NSW	In buffer area only
Commonwealth Land - Australian Postal Commission [11593]	NSW	In buffer area only
Commonwealth Land - Australian Postal Commission [11594]	NSW	In buffer area only
Communications, Information Technology and the Arts - Telstra Corporation Limited		
Commonwealth Land - Australian Telecommunications Commission [11600]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [11597]	NSW	In buffer area only
Defence		
Commonwealth Land - Defence Service Homes Corporation [11598]	NSW	In buffer area only
Defence - ADF CAREERS REFERENCE CENTRE [11228]	NSW	In buffer area only
Defence - ADF CAREERS REFERENCE CENTRE [11229]	NSW	In buffer area only
Defence - ADF CAREERS REFERENCE CENTRE [11224]	NSW	In buffer area only
Defence - ADF CAREERS REFERENCE CENTRE [11225]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Defence - ADF CAREERS REFERENCE CENTRE [11219]	NSW	In buffer area only
Defence - ADF CAREERS REFERENCE CENTRE [11223]	NSW	In buffer area only
Defence - ADF CAREERS REFERENCE CENTRE [11222]	NSW	In buffer area only
Defence - ADF CAREERS REFERENCE CENTRE [11221]	NSW	In buffer area only
Defence - ADF CAREERS REFERENCE CENTRE [11220]	NSW	In buffer area only
Defence - ADF CAREERS REFERENCE CENTRE [11226]	NSW	In buffer area only
Defence - ADF CAREERS REFERENCE CENTRE [11227]	NSW	In buffer area only
Defence - OFFICES [11195]	NSW	In buffer area only
Defence - STOCKTON RIFLE RANGE [10057]	NSW	In buffer area only
Defence - TS TOBRUK [10053]	NSW	In buffer area only
Unknown		
Commonwealth Land - [11599]	NSW	In buffer area only

Commonwealth Heritage Places [Resource Information]

Name	State	Status	Buffer Status
Historic			
Fort Wallace	NSW	Listed place	In buffer area only
Nobbys Lighthouse	NSW	Listed place	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Ardenna grisea as Puffinus griseus Sooty Shearwater [82651]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area	In buffer area only
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Breeding likely to occur within area overfly marine area	In buffer area only
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area	In feature area
Calidris pugnax as Philomachus pugnax Ruff [91256]		Roosting known to occur within area overfly marine area	In buffer area only
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area overfly marine area	In buffer area only
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area overfly marine area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area	In feature area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area overfly marine area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area	In buffer area only
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area overfly marine area	In buffer area only
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea antipodensis gibsoni as Diomedea gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In feature area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In buffer area only
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area overfly marine area	In buffer area only
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area overfly marine area	In buffer area only
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In buffer area only
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area overfly marine area	In buffer area only
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In buffer area only
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In buffer area only
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area overfly marine area	In buffer area only
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In feature area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area overfly marine area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In buffer area only
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat may occur within area overfly marine area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area overfly marine area	In buffer area only
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat known to occur within area	In feature area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	In feature area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area	In buffer area only
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area overfly marine area	In buffer area only
Pterodroma cervicalis White-necked Petrel [59642]		Species or species habitat may occur within area	In feature area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area overfly marine area	In buffer area only
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In buffer area only
Stercorarius antarcticus as Catharacta skua Brown Skua [85039]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Sterna striata White-fronted Tern [799]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Breeding may occur within area	In buffer area only
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche bulleri platei as Thalassarche sp. nov. Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area	In feature area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area	In feature area
Tringa brevipes as Heteroscelus brevipes Grey-tailed Tattler [851]		Roosting known to occur within area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area overfly marine area	In buffer area only
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area overfly marine area	In buffer area only
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area overfly marine area	In buffer area only
Fish			
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area	In feature area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area	In feature area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area	In feature area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area	In feature area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area	In feature area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]	Endangered	Species or species habitat likely to occur within area	In feature area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area	In feature area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area	In feature area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area	In feature area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area	In feature area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area	In feature area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area	In feature area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area	In feature area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area	In feature area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area	In feature area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area	In feature area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area	In feature area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area	In feature area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area	In feature area
Mammal			
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area	In feature area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area	In feature area
Dugong dugon Dugong [28]		Species or species habitat may occur within area	In feature area
Reptile			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In feature area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area	In feature area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area

Whales and Other Cetaceans [Resource Information]

Current Scientific Name	Status	Type of Presence	Buffer Status
Mammal			
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area	In feature area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In feature area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area	In feature area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area	In feature area

Current Scientific Name	Status	Type of Presence	Buffer Status
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area	In feature area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area	In feature area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area	In feature area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In feature area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area	In feature area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area	In feature area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area	In feature area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area	In feature area

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State	Buffer Status
Hunter Wetlands	National Park	NSW	In buffer area only
Worimi	Regional Park	NSW	In buffer area only

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

RFA Name	State	Buffer Status

RFA Name	State	Buffer Status
North East NSW RFA	New South Wales	In buffer area only

Nationally Important Wetlands [Resource Information]

Wetland Name	State	Buffer Status
Kooragang Nature Reserve	NSW	In buffer area only

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
1440- Newcastle Golf Course Alterations	2024/09899		Referral Decision	In buffer area only
Eastern Rise Offshore Wind Project	2023/09544		Assessment	In buffer area only
Eastern Rise Offshore Wind Project Initial Marine Field Investigations	2023/09555		Completed	In buffer area only
Controlled action				
Former Rifle Range Residential Development, Popplewell Road, Fern Bay, NSW	2017/7993	Controlled Action	Proposed Decision	In buffer area only
Newcastle LNG export facility	2011/5915	Controlled Action	Completed	In buffer area only
Nobby's Lighthouse redevelopment	2006/3179	Controlled Action	Completed	In buffer area only
Port Site and Materials Handling Development	2001/242	Controlled Action	Completed	In buffer area only
Protech Cold Mill Facility	2001/274	Controlled Action	Post-Approval	In feature area
Queensland Hunter Gas Pipeline, approximately 825 km in length	2008/4483	Controlled Action	Completed	In buffer area only
River Dredging Operations	2001/249	Controlled Action	Completed	In feature area
Rutile and Zircon Mining on Stockton Rifle Range	2000/8	Controlled Action	Post-Approval	In buffer area only
Not controlled action				
Demolition of Ablutions Block, Snapper Island, NSW	2018/8303	Not Controlled Action	Completed	In buffer area only
Expansion to Kooragang Coal Terminal	2007/3352	Not Controlled Action	Completed	In buffer area only
Fort Scratchley refurbishment works	2005/2283	Not Controlled Action	Completed	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Fort Scratchley site remediation	2005/2075	Not Controlled Action	Completed	In feature area
Geological exploration and historical research of convict coal mines beneath For	2004/1421	Not Controlled Action	Completed	In feature area
Green & Golden Bell Frog Habitat Enhancement Project	2004/1795	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In buffer area only
Nobbys Headland Redevelopment	2008/4672	Not Controlled Action	Completed	In buffer area only
sale of property located at 96, Hunter Street	2003/1097	Not Controlled Action	Completed	In feature area
Shorebird and wader habitat rehabilitation	2001/457	Not Controlled Action	Completed	In buffer area only
Tomago to Tomaree Electricity Supply Upgrade	2003/1023	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
2D marine seismic survey in PEP-11 permit area, NSW	2002/879	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Fort Wallace Residential Development Proposal, north of Newcastle, NSW	2017/7951	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Rehabilitation of Hexham Swamp	2003/1244	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Referral decision				
Breeding program for Grey Nurse Sharks	2007/3245	Referral Decision	Completed	In feature area

Biologically Important Areas

[Resource Information]

Scientific Name	Behaviour	Presence	Buffer Status
Dolphins			
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Breeding	Likely to occur	In feature area
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Foraging	Known to occur	In feature area

Scientific Name	Behaviour	Presence	Buffer Status
Seabirds			
Ardenna carneipes Flesh-footed Shearwater [82404]	Foraging	Known to occur	In buffer area only
Ardenna grisea Sooty Shearwater [82651]	Foraging	Likely to occur	In feature area
Ardenna tenuirostris Short-tailed Shearwater [82652]	Foraging	Likely to occur	In feature area
Ardenna tenuirostris Short-tailed Shearwater [82652]	Foraging	Likely to occur	In feature area
Diomedea exulans antipodensis Antipodean Albatross [82269]	Foraging	Known to occur	In buffer area only
Procellaria parkinsoni Black Petrel [1048]	Foraging	Likely to occur	In buffer area only
Sharks			
Carcharias taurus Grey Nurse Shark [64469]	Foraging	Known to occur	In feature area
Whales			
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur	In feature area

Bioregional Assessments [Resource Information]

SubRegion	BioRegion	Website	Buffer Status
Hunter	Northern Sydney Basin	BA website	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Appendix D – PON MATERIAL RELOCATION RECORD SHEET

PORT of NEWCASTLE

PORT OF NEWCASTLE
NEWCASTLE SPOIL GROUND
MATERIAL RELOCATION RECORD

SCALE BAR:

0 100 200 300 400

Metres

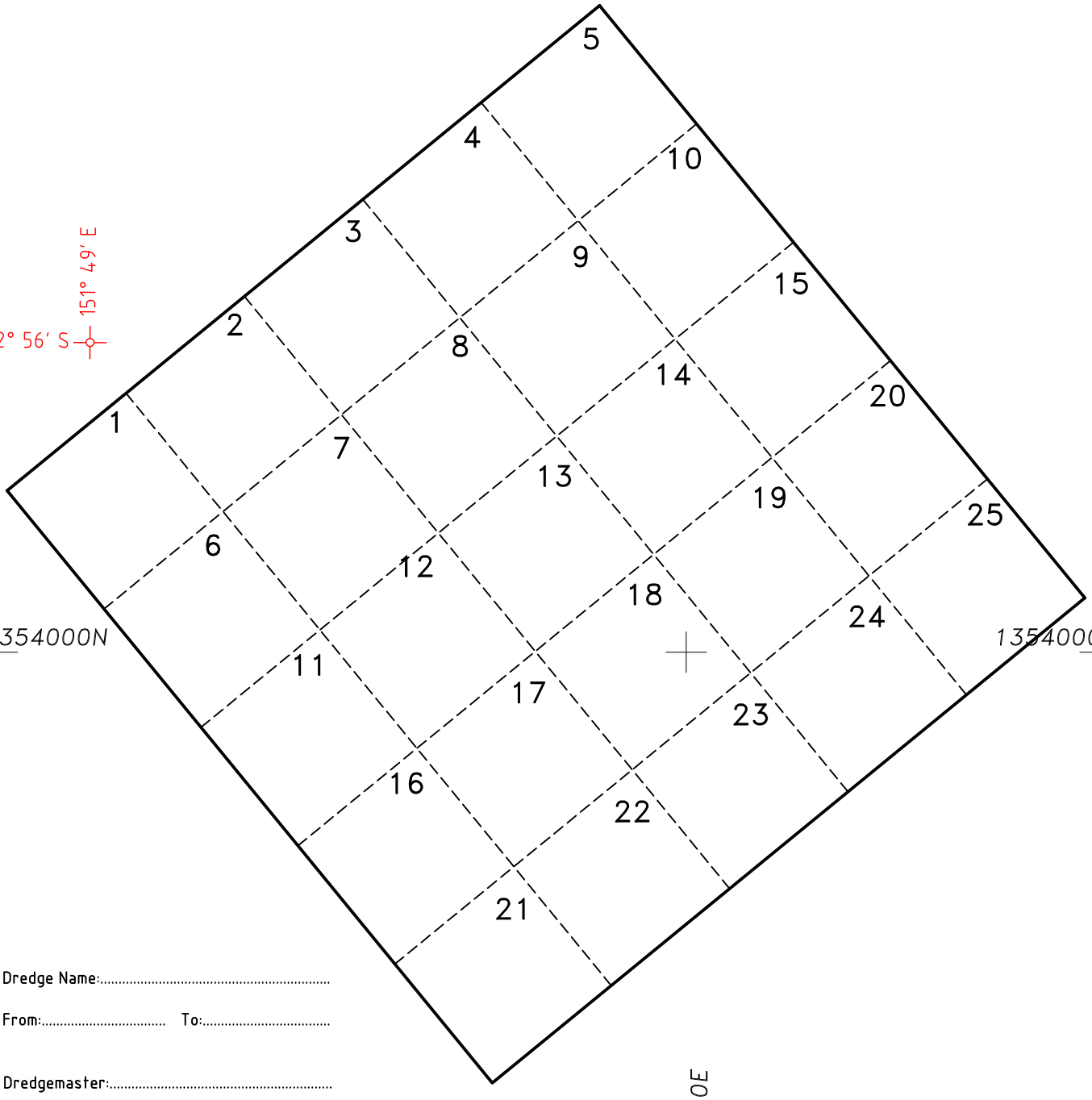
377000E

1355000N

1355000N

32° 56' S

151° 49' E



1354000N

1354000N

377000E

Dredge Name:.....

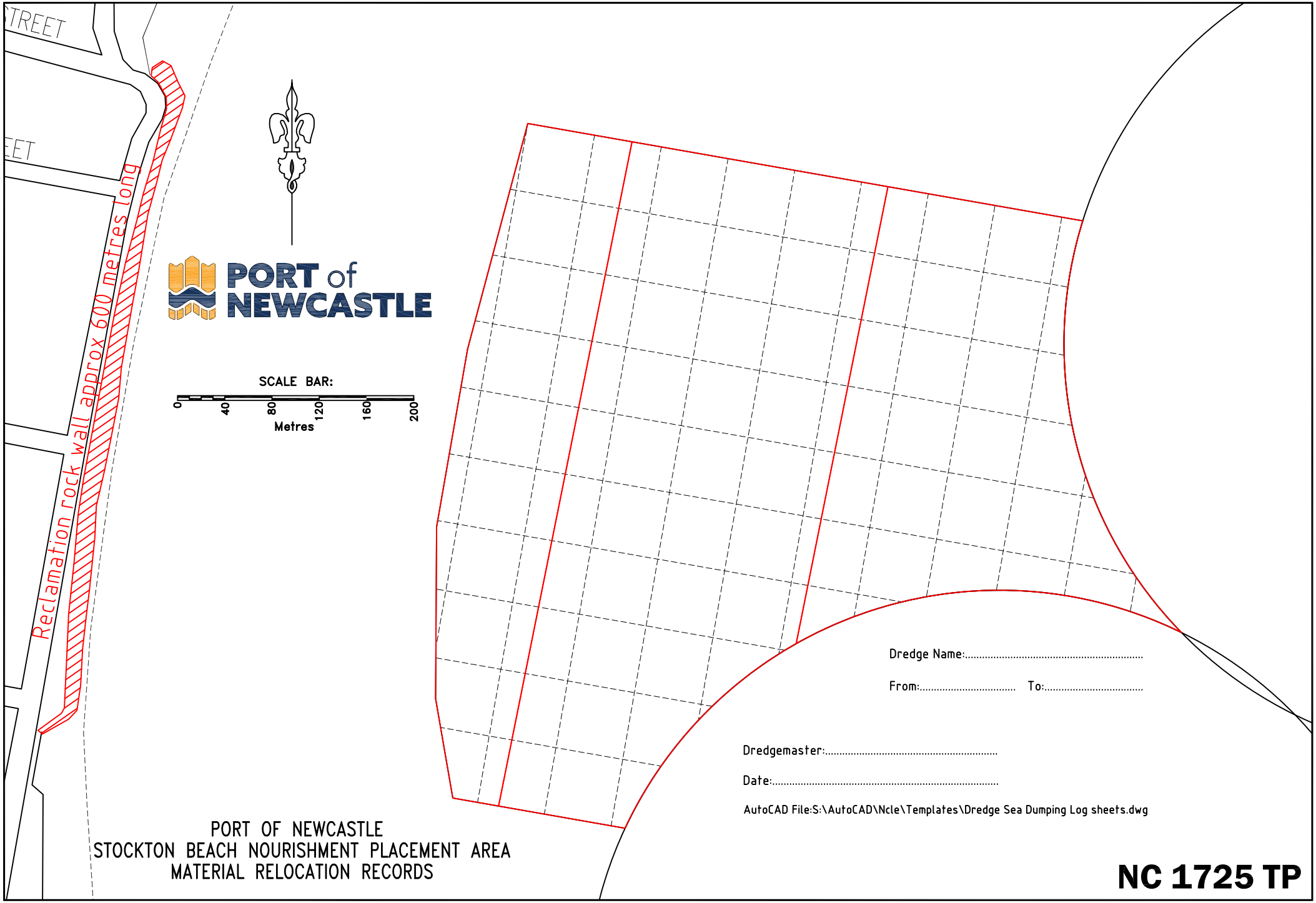
From:..... To:.....

Dredgemaster:.....

Date:.....

AutoCAD File:S:\AutoCAD\Ncle\Templates\Dredge Sea Dumping Log sheet NC 1706.dwg

NC 1706



PORT OF NEWCASTLE
STOCKTON BEACH NOURISHMENT PLACEMENT AREA
MATERIAL RELOCATION RECORDS

NC 1725 TP

Appendix E – PON OPERATING LOG SHEET

PORT of NEWCASTLE

DAVID ALLAN OPERATIONS LOG

Date:.....

Personnel on board			
Master:			
Mate:			
Engineer:			
Helm:			
Pipe operator:		Day work:	
Extras:			

Safety alerts / WHS issues / Isolations
Dump square #

Wind and swell	Tides		
At 0600:	HW/LW	Hrs	m
	HW/LW	Hrs	m
At 1000:	HW/LW	Hrs	m
	HW/LW	Hrs	m
At 1400:	HW/LW	Hrs	m

Dredge no.	Wind speed & direction	Tide (m)	Berth box	Channel & survey area	Start time	Finish time	Dredge time	Spoil type	Wartsila loaded tonnes	Wartsila load Density	Watsila Mud Volume	Dump time	Dump location	OOW	Comments

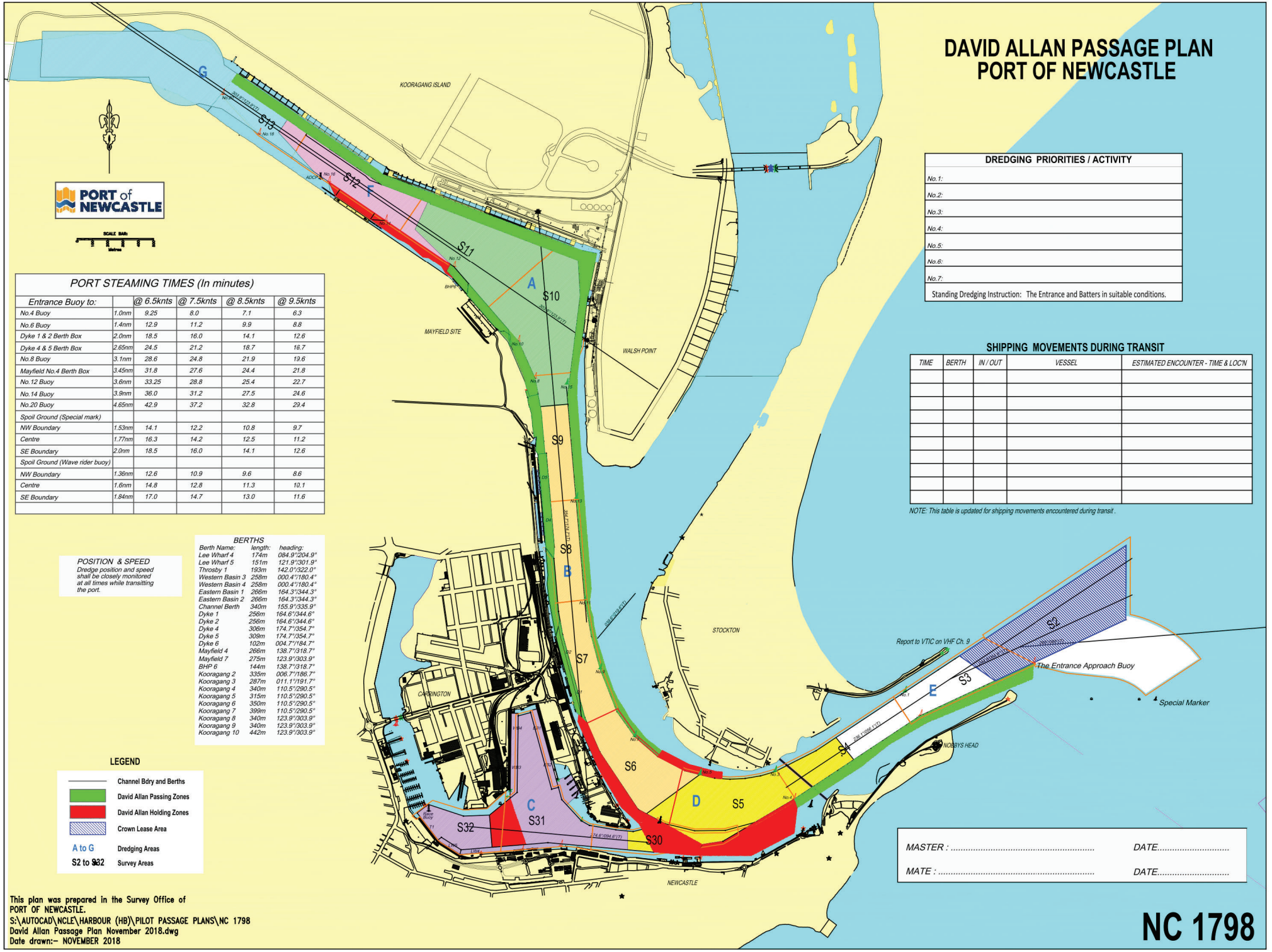
Draughts			
Fwd:			
Midships:			
Aft:			

Shipboard operations / Training / Drills

Marine mammal sighting record

Master: _____

DAVID ALLAN PASSAGE PLAN
PORT OF NEWCASTLE



PORT of NEWCASTLE

SCALE BAR: Metres

PORT STEAMING TIMES (In minutes)

Entrance Buoy to:		@ 6.5knts	@ 7.5knts	@ 8.5knts	@ 9.5knts
No.4 Buoy	1.0nm	9.25	8.0	7.1	6.3
No.6 Buoy	1.4nm	12.9	11.2	9.9	8.8
Dyke 1 & 2 Berth Box	2.0nm	18.5	16.0	14.1	12.6
Dyke 4 & 5 Berth Box	2.65nm	24.5	21.2	18.7	16.7
No.8 Buoy	3.1nm	28.6	24.8	21.9	19.6
Mayfield No.4 Berth Box	3.45nm	31.8	27.6	24.4	21.8
No.12 Buoy	3.6nm	33.25	28.8	25.4	22.7
No.14 Buoy	3.9nm	36.0	31.2	27.5	24.6
No.20 Buoy	4.65nm	42.9	37.2	32.8	29.4
Spoil Ground (Special mark)					
NW Boundary	1.53nm	14.1	12.2	10.8	9.7
Centre	1.77nm	16.3	14.2	12.5	11.2
SE Boundary	2.0nm	18.5	16.0	14.1	12.6
Spoil Ground (Wave rider buoy)					
NW Boundary	1.36nm	12.6	10.9	9.6	8.6
Centre	1.6nm	14.8	12.8	11.3	10.1
SE Boundary	1.84nm	17.0	14.7	13.0	11.6

POSITION & SPEED

Dredge position and speed shall be closely monitored at all times while transitting the port.

BERTHS

Berth Name:	length:	heading:
Lee Wharf 4	174m	084.9°/204.9°
Lee Wharf 5	151m	121.9°/301.9°
Throsby 1	193m	142.0°/322.0°
Western Basin 3	258m	000.4°/180.4°
Western Basin 4	258m	000.4°/180.4°
Eastern Basin 1	266m	164.3°/344.3°
Eastern Basin 2	266m	164.3°/344.3°
Channel Berth	340m	155.9°/335.9°
Dyke 1	256m	164.6°/344.6°
Dyke 2	256m	164.6°/344.6°
Dyke 4	306m	174.7°/354.7°
Dyke 5	309m	174.7°/354.7°
Dyke 6	102m	004.7°/184.7°
Mayfield 4	266m	138.7°/318.7°
Mayfield 7	275m	123.9°/303.9°
BHP 6	144m	138.7°/318.7°
Kooragang 2	335m	006.7°/186.7°
Kooragang 3	287m	011.1°/191.7°
Kooragang 4	340m	110.5°/290.5°
Kooragang 5	315m	110.5°/290.5°
Kooragang 6	350m	110.5°/290.5°
Kooragang 7	399m	110.5°/290.5°
Kooragang 8	340m	123.9°/303.9°
Kooragang 9	340m	123.9°/303.9°
Kooragang 10	442m	123.9°/303.9°

LEGEND

- Channel Bdry and Berths
- David Allan Passing Zones
- David Allan Holding Zones
- Crown Lease Area
- A to G — Dredging Areas
- S2 to S32 — Survey Areas

DREDGING PRIORITIES / ACTIVITY

No.1:
No.2:
No.3:
No.4:
No.5:
No.6:
No.7:
Standing Dredging Instruction: The Entrance and Batters in suitable conditions.

SHIPPING MOVEMENTS DURING TRANSIT

TIME	BERTH	IN / OUT	VESSEL	ESTIMATED ENCOUNTER - TIME & LOC'N

NOTE: This table is updated for shipping movements encountered during transit .

MASTER : ..... DATE.....

MATE : ..... DATE.....

This plan was prepared in the Survey Office of
PORT OF NEWCASTLE.
S:\AUTOCAD\NCLE\HARBOUR (HB)\PILOT PASSAGE PLANS\NC 1798
David Allan Passage Plan November 2018.dwg
Date drawn:- NOVEMBER 2018

NC 1798

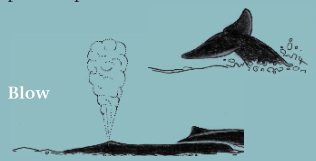
Appendix F – DCCEEW WHALE AND DOLPHIN IDENTIFICATION GUIDE

BLUE WHALES

Description Blue/grey or slate blue. Head has a distinctive broad based pointed arch shape.

Surfacing/diving

Fins/flukes Small dorsal fin, long, pointed pectoral fins.



Blow

Other characteristics May travel in pairs, often alone.

Where you might see them
Open ocean, rarely seen near coast. Southern waters, western Bass strait and offshore from Perth and south-western coast.

Size Largest whale species (to 30m).

MINKE WHALES

Description Sharply V-shaped head, throat grooves present. Black/dark grey back, wavy boundary to white underside.

Surfacing/diving

Fins/flukes Curved dorsal fin, short pectoral fins.

Blow

Other characteristics Blow and dorsal fin often appear simultaneously.

Where you might see them
Generally offshore in Australian waters during winter migration.

Size Medium (to 11m).

KILLER WHALES

Surfacing/diving

Fins/flukes Males have very tall (2m) dorsal fin.

Blow

Other characteristics Highly social, form lifelong family groups, occasionally seen singly or in small groups.

Where you might see them
All waters from polar to tropical, all seasons.

Size Medium (to 10m).

Description Distinctive black and white pattern.

SOUTHERN RIGHT WHALES

Description Black body with white callosities (bumps) on head.

Surfacing/diving

Fins/flukes No dorsal fin, short paddle-like pectoral fins.

Blow

Other characteristics May raise flukes on diving.

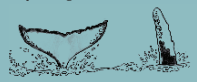
Where you might see them
Inshore waters particularly along southern coastline between May and October. Also seen on the south-eastern and south-western coastlines. Have been known to enter Sydney harbour.

Size Large, stocky whale (to 17m).

HUMPBACK WHALES

Surfacing/diving

Fins/flukes Long pectoral fins (about 1/3 body length).



Blow

Other characteristics Humpbacks are a most spectacular whale – often doing full body breaches, rolls and tail slaps.

Where you might see them
Inshore along length of east and west coasts between May and December.

Size Large (to 16m).

Description Dark grey back. White underside, fins and flukes.

BOTTLENOSE DOLPHINS

Where you might see them
All waters from tropical to temperate, all seasons.

Size Small (to 3m).

Description Dark grey upper body with light grey underneath, robust head with a short and stubby bottle shaped beak for which the species is named.

Other characteristics Highly social, can occur in very large groups.

COMMON DOLPHINS

Where you might see them
All waters, open ocean and inshore, all seasons.

Size Small (to 2.6m).

Description Dark grey upper body, white belly, distinctive dark stripes sweeping down body, some tan – ochre/yellow on flanks.

Other characteristics Often seen bow-riding, and usually in large groups.

FURTHER INFORMATION

For a copy of the Australian National Guidelines for Whale and Dolphin Watching and more information about whales and dolphins, go to www.saveourwhales.gov.au or contact the Australian Government Department of the Environment and Water Resources Community Information Unit - email ciu@environment.gov.au or call 1800 803 772.

BEHAVIOUR YOU MAY SEE

FLUKE
– the whale lifts its tail before diving, usually after arching its back.

BLOW (SPOUT)
– the whale breathes out as it surfaces,blowing a cloud of vapour through its blowhole.

TAIL SLAP
– the whale slaps its flukes on the surface.

TAIL LOB
– the whale waves its flukes in the air.

SPY HOP
– the whale lifts its head out of the water.

BREACH
– the whale leaps out of the water, often turning to land on its back, side or front.

PEC SLAP
– the whale slaps its pectoral fins on the water.

BOW RIDE
– the dolphin rides the wave in the front (or occasionally the rear) of a boat.

Illustrations by Tony Pyrzakowski. Photos: Killer whale by Gordon Bain, courtesy AAD; Humpback whale by Dave Paton; Southern right whale courtesy AAD; Blue whale by Peter Gill and Margie Morrice; Bottlenose dolphin courtesy GBRMPA; Minke whale courtesy AAD.

Appendix G – SAP FOR MAINTENANCE DREDGE AREAS, 2022 -2032

REPORT

Maintenance Dredge Areas Sampling and Analysis Plan

2022-2032 Ten Year Maintenance Dredging
Sea Dumping Permit

Client: Port of Newcastle

Reference: PA2776_RP-MDSAP

Status: Final/P01.02

Date: 14 February 2022

Royal HaskoningDHV
Enhancing Society Together

HASKONING AUSTRALIA PTY LTD.

Level 15
99 Mount Street
North Sydney NSW 2060
Water & Maritime
Trade register number: ACN153656252

+61 2 8854 5000 **T**
project.admin.australia@rhdhv.com **E**
royalhaskoningdhv.com **W**

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Reference: PA2776_RP-MDSAP
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Project number: PA2776
Author(s): Ali Watters

Drafted by: Ali Watters

Checked by: Greg Britton

Date: 14.02.22

Approved by: Greg Briton

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Classification
Project related

Royal HaskoningDHV

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1 INTRODUCTION

1.1 Background

Port of Newcastle (PON) undertakes regular maintenance dredging of Newcastle Port ('the Port"). Maintenance dredging is required for the navigation channel, swing basin and berthing basins throughout the Port entrance and along the South Arm of the Hunter River.

PON is responsible for maintaining the declared depths of the navigation channels swing basin and berthing boxes and batters throughout the Port (refer **Figure 1**). The former Department of Sustainability, Environment, Water, Population and Communities (SEWPaC), now Department of Agriculture, Water and the Environment (DAWE), granted Newcastle Port Corporation (now PON) a 10 year maintenance dredging Sea Dumping Permit for the period from March 2012 until March 2022. The permit was reissued in 2014 to PON, following privatisation of the Port, for the remaining 8 year period (permit number SD2014/2642).

PON is submitting the next ten year maintenance dredging sea dumping permit (2022 to 2032) to DAWE. A Long Term Monitoring and Management Plan (LTMMP) that covers the management of dredging at the Port over the life of the permit needs to be submitted along with the permit application and be approved by DAWE prior to the issuing of the new Sea Dumping Permit.

The LTMMP (RHDHV, 2021) includes a proposed program of sediment sampling and analysis in accordance with the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009) within the maintenance dredge areas.

1.2 Overview

The area in which maintenance dredging will be undertaken during the life of the new 2022-2032 Sea Dumping Permit is shown in **Figure 2**. For the purposes of the management of dredging activities, PON has subdivided the Port into seven areas (Areas A, B, C, D, E, F and G) based on the nature of the sedimentation in the Port and the layout of the port area. The area in which maintenance dredging has been undertaken to date comprises Areas A, B, C, D, E and F as represented by the green shaded area in **Figure 2**.

Additional berths in the Port may become operational during the life of the new 2022-2032 Sea Dumping Permit. PON will assume responsibility for the maintenance dredging of these berths and the adjacent shipping channel at the estimated timings outlined in **Table 1**. These berths and the adjacent shipping channel are represented by the magenta shaded areas in **Figure 2**. A flowchart showing the indicative timing of activities for the overall life of the permit is provided in **Figure 3**.

Sampling and testing are to be undertaken to determine sediment conditions during the 2022-2032 maintenance dredging sea dumping permit period. In accordance with the NAGD (2009), sediment sampling and testing needs to remain current (i.e., within five years where there is no change to activities that could affect the contamination status) for maintenance dredging to be undertaken.

Sampling and testing would be undertaken within the five year data currency requirement and as appropriate when additional berths come into PON responsibility.

Figure 1 Declared depths within PON channels and berthing boxes

Figure 2 PON Maintenance Dredge Areas

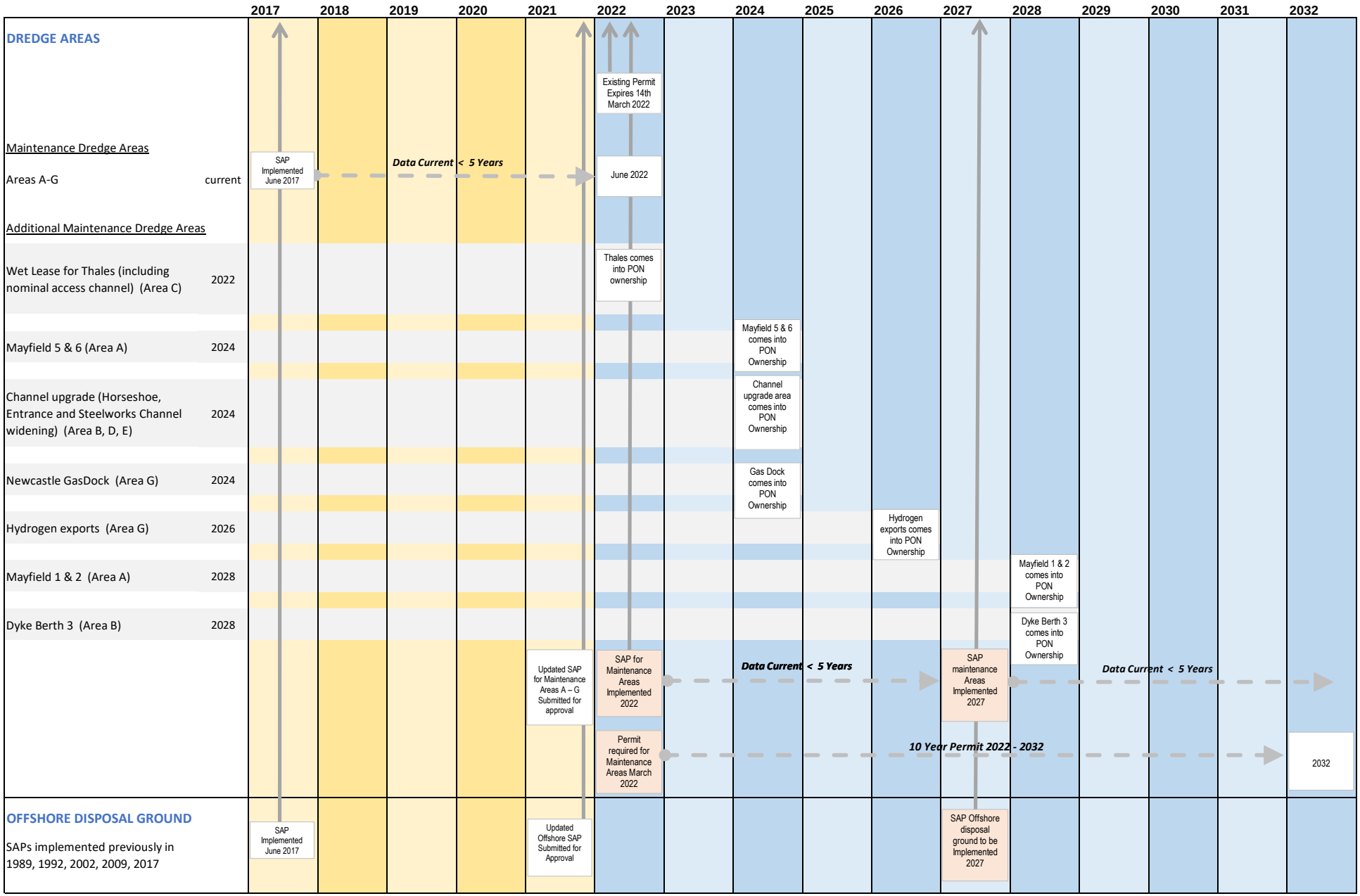

Figure 3 Flowchart with Indicative Timing of Overall Project

Table 1 Additional berths to be introduced during life of Permit

Berth	Maintenance Dredge Area	Expected timing when PON will assume responsibility for maintenance-dredging[1]
Mayfield 5 & 6	A	2024
Mayfield 1 & 2	A	2028
Dyke Berth 3	B	2028
Channel upgrade (Horseshoe, Entrance and Steelworks Channel widening)	B, D, E	2024
Wet Lease for Thales (and a nominal access channel)	C	2022
Newcastle GasDock	G	2024
Hydrogen exports	G	2026

This report outlines the proposed Sampling and Analysis Plan (SAP) for the sediment sampling and testing program for all the maintenance dredge areas. The SAP has been prepared in accordance with recommendations outlined in the NAGD (Commonwealth of Australia, 2009). The SAP includes the following elements:

- evaluation of the site history and available data;
- objectives of the SAP;
- map showing the proposed sampling locations;
- estimates of the number of samples including field and split triplicates;
- methods and procedures for sampling;
- details of methods for sample handling, preservation, storage and quality control and quality assurance (QC/QA); and
- list of analyses required, detection limits and laboratory QC/QA procedures.

[1] *These timings are based on the best available information at the current time, although it should be noted that these timings may change due to a range of factors. DAWE will be notified of any changes to the timings presented herein.*

2 COMPILATION & REVIEW OF EXISTING DATA

2.1 Site History

As noted in **Section 1**, PON is responsible for maintaining the declared depths of the navigation channels, swing basin and berthing pockets throughout the Port of Newcastle (refer **Figure 1**). Dredging commenced in the Port in 1859 and has been virtually continuous since that time. PON holds a 10 year permit from DAWE to undertake their maintenance dredging activities (valid until March 2022).

The NAGD (Commonwealth of Australia, 2009) notes that sediment quality data has a maximum currency of five years where there is no reason to believe that the contamination status has changed significantly.

In recent years, there have been no changes in Port or catchment wide activities to suggest contamination levels in the sediment would have increased. To the contrary, the main changes have been the closure of the BHP Steelworks, remediation of the South Arm of the Hunter River adjacent to the former BHP Steelworks site, ongoing improvement of urban runoff controls and the implementation of pollution reduction programs for industry.

In addition, the International Maritime Organisation (IMO) Anti-fouling systems (AFS) convention was adopted on 5 October 2001 and entered into force on 17 September 2008. The IMO AFS convention prohibited the application of organotin compounds on ships. By 2008, ships either:

a) shall not bear such compounds on their hulls or external parts or surfaces; or
b) shall bear a coating that forms a barrier to such compounds leaching from the underlying non-compliant anti-fouling system (IMO, 2010)

All of these factors have led to a reduction in contamination levels in the sediment within the Port over time. PON's LTMMP (RHDHV, 2021) proposes that sampling within the maintenance dredge areas be undertaken every 5 years. The most recent sediment sampling exercise within the current maintenance dredge areas was undertaken in 2017 (refer **Section 2.2.2**).

2.2 Existing Sediment Data

2.2.1 Areas A to F

Sampling for a number of separate studies in the South Arm of the Hunter River has included sampling of maintenance dredge material in Areas A to F. The following list of testing and monitoring work has been undertaken within the maintenance dredge areas:

- Newcastle Port Corporation surface sampling 1985-1997
- Patterson Britton & Partners 1999 Walsh Point vibrocoring;
- Robert Carr & Associates 1999 MPT Stage 1 sampling;
- Patterson Britton & Partners 2000 MPT Stage 1 vibrocoring;
- GHD-Longmac 2001 MPT Stage 1 vibrocoring;
- Patterson Britton & Partners 2003 surface sampling in Kooragang Swing Basin;
- Patterson Britton & Partners 2006 Sediment Sampling & Testing for NPC's Five Year 2006- 2011 Maintenance Dredging Sea Disposal Permit Application;
- WorleyParsons 2009 Newcastle Maintenance Dredge Areas Mid-permit Sediment Sampling and Testing, 2006-2011 Five Year Maintenance Dredging Sea Dumping Permit

- WorleyParsons 2012, Maintenance Dredge Areas Sampling and Analysis, 2011-2021 Ten Year Maintenance Dredging Sea Dumping Permit; and
- RHDHV 2017, Newcastle Maintenance Dredge Areas Mid-permit 2012-2022 Sediment Sampling and Testing.

In general, contaminants historically recorded in the soft silty clays of Areas A to D and the silty sands in Area E include PAHs, Tributyltin (TBT), and metals (Cd, Ni, Pb, Hg, Zn, Cr, Cu and As). **Table 2** presents the mean levels of contamination for key contaminants for the historical sediment quality data broken down into 5 year periods from 1985 to 2015. A more detailed discussion of the recent investigations which were undertaken in 2017 is provided in **Section 2.2.2**.

Table 2 Historical sediment quality data for the maintenance dredge areas A to E broken down into 5 year periods

	Date	1985 to 1989	1990 to 1994	1995 to 1999	2000 to 2004[3]	2005 to 2010	2010 to 2015
Total PAH[1]	n[2]	-	27	61	28	67	41
	mean (mg/kg)	-	5	2	6	2.0	1.79
	95 % UCL	-	7	3	7	2.7	2.3
Zinc	n	21	130	94	28	67	41
	mean (mg/kg)	154	380	287	247	223	198
	95 % UCL	207	483	320	297	253	223
Nickel	n	11	120	118	28	67	41
	mean (mg/kg)	22	77	39	30	36.8	43.8
	95 % UCL	28	93	42	32	39.2	54.9
Lead	n	10	109	118	28	67	41
	mean (mg/kg)	60	54	50	48	43.6	32.3
	95 % UCL	80	61	56	58	52.1	39
Mercury	n	21	94	118	11	67	41
	mean (mg/kg)	0.26	0.12	0.17	0.11	0.07	0.05
	95 % UCL	0.38	0.15	0.21	0.16	0.07	0.1
Cadmium	n	21	105	118	11	67	41
	mean (mg/kg)	1.95	4.74	2.34	0.75	0.33	0.3
	95 % UCL	2.78	5.73	3.29	1.08	0.42	0.4

Notes
1. normalised to 1 % Total Organic Carbon (TOC) (within limits of 0.2% to 10% TOC).
2. number of samples
3. primarily results for the 2003 assessment of the maintenance dredge material in the Swing Basin adjacent to the BHP site.

The results show that contamination levels have been found to be relatively consistent over time with evidence of an improvement in the quality of the maintenance dredge material over the last 20 years.

2.2.2 Recent sediment sampling & testing for the 10 year 2012-2022 maintenance dredging sea disposal permit application

The findings of the 2017 sediment quality investigations are documented in the SAP Implementation Report (RHDHV 2017). The results were compared to the guideline values provided in the NAGD (2009). Results were also compared to the previous results from testing of the maintenance dredge areas in 2012 and 2009. The results from 2017 showed that the 95% upper confidence limit (UCL) of the mean concentration of all the contaminants were below NAGD screening levels (SL) with the exception of nickel

(refer **Table 3**). In addition, the 95% UCL of the mean concentration of the majority of contaminants were lower than those reported in the 2012 investigation.

Due to the historically elevated concentration of TBT in The Basin (Area C), the 95% UCL of the mean TBT concentrations was calculated for the whole maintenance dredge area including and excluding The Basin results, and also separately for The Basin results only. All 95% UCL of the mean TBT concentrations were below the NAGD SL for the 2017 investigations.

Table 3 Mean and 95% UCL of the mean concentration of contaminants for the maintenance dredge material for 2017, 2012 and 2009

Contaminant	Units	SL	2017				2012				2009			
			No.	Mean	SD	95% UCL	No.	Mean	SD	95% UCL	No.	Mean	SD	95% UCL
arsenic	mg/kg	**20**	58	9.4	2.9	10.1	41	9.8	2.8	10.5	34	9.2	2.3	9.8
cadmium	mg/kg	**1.5**	58	0.2	0.2	0.3	41	0.3	0.2	0.4	34	0.3	0.3	0.4
chromium	mg/kg	**80**	58	31.2	13.1	34.1	41	50.9	18.4	63.4	34	45.2	16.9	49.9
cobalt	mg/kg	**--**	58	13.3	2.4	14.8	14	14.6	8.8	18.7	8	13.5	6.7	17.2
copper	mg/kg	**65**	58	32.3	19.7	36.7	41	41.6	20.8	47.1	34	43.8	23.8	50.7
lead	mg/kg	**50**	58	30.8	23.6	36.7	41	32.3	22.4	39.0	34	40.7	28.2	48.7
manganese	mg/kg	**--**	11	259	71	298	14	379	275	547	8	311.1	128.2	397
mercury	mg/kg	**0.15**	58	0.1	0.04	0.1	41	0.05	0.02	0.1	34	0.1	0	0.1
nickel	mg/kg	**21**	58	27.5	10.5	29.9	41	43.8	16.4	54.9	34	37.7	13.7	41.5
selenium	mg/kg	**--**	11	1.5	0.5	1.8	14	0.7	0.3	0.9	8	0.5	0.2	0.6
vanadium	mg/kg	**--**	11	52.3	10.3	58.7	41	51.3	29.6	65.3	8	50.4	25.3	67.4
zinc	mg/kg	**200**	58	175	98.3	197	41	198	97	223	34	205	102.6	234.7
total PAH[2]	mg/kg	**10**	58	2.0	1.6	2.5	41	1.79	1.5	2.3	34	3.04	2527	4.03
TBT[2] All locations	µg Sn/kg	**9**	58	1.0	1.2	1.7	41	2.3	4.9	5.6	34	8.4	16	12.8
TBT[2] Excluding The Basin	µg Sn/kg	**9**	45	1.0	1.3	1.4	28	0.3	0.3	0.5	21	1.22	0.85	1.5
TBT[2] In The Basin	µg Sn/kg	**9**	13	1.2	0.9	1.7	13	6.5	7.2	11.1	13	20	21.7	29.4
OC Pesticides	µg/kg	**5**	11	nd	-	nd	14	nd	-	nd	8	nd	-	nd
PCBs	µg/kg	**23**	11	nd	-	nd	14	nd	-	nd	8	nd	-	nd

1. **>SL**
2. **organics normalised to 1% TOC (within limits of 0.2% to 10% TOC)**
3. **nt = not tested**
4. **nd = not detected**

Nickel typically occurs in naturally high concentrations in Australian sediments. Nickel concentrations have historically been elevated within the maintenance dredge material although the concentrations have reduced since 2012.

In 2014, PON implemented a Port Wide Strategy (CSIRO, 2014) that sought to inform existing and future dredging programs of the risks posed by the sediments. Specific comments and conclusions regarding nickel concentrations from within the Port comprised:

- Background concentrations of nickel frequently exceed the SL in many Australian estuaries.
- The SL for nickel is generally considered to be very conservative, potentially over protective, when the value is compared to that of other metals and considering the sensitivity of benthic marine organisms to nickel.
- The mean concentration of nickel has been reasonably constant for the past 10 years (30-40 mg/kg range), and while this exceeds the SL, CSIRO considered nickel at these concentrations to represent a low risk of adverse biological effects to organisms.
- In the case of nickel, although the exceedance of the SL may indicate it should be classed as a contaminant of potential concern (COPC), a series of correlations between concentrations of aluminium and the metal contaminants, total PAHs and TOC was made which indicated the concentrations of nickel are largely naturally occurring. Higher concentrations of nickel, as with many metals and metalloids, occur naturally for sediments with higher portions of clays and silts. It was concluded that nickel should not be classified as a COPC (concentrations not deviating from background).

Overall, CSIRO concluded that assuming concentrations of contaminants observed in the Port's 5 yearly sampling program remain comparable to, or lower than, historical results, the maintenance dredge material is suitable for unconfined sea disposal.

2.2.3 Additional maintenance dredging areas

Additional maintenance dredging areas identified in **Table 1** and **Figure 2** will come under the control of PON following capital dredging programs to expand the Port.

In the event that any of the additional berths and related channels listed in **Table 1** fall under the control of PON and the schedule of commencing maintenance dredging of these additional areas does not fit in with the overall SAP implementation program in 2022 and 2027, an additional SAP for the particular area would be prepared. The SAP would assess the dredging volume and required number of samples for the particular area and would be prepared in accordance with recommendations outlined in the NAGD (2009).

For example, if this SAP is implemented in 2022 as planned, but Mayfield 5 and 6 come under PON control in 2024, an additional SAP for Mayfield 5 and 6 would need to be prepared and implemented prior to it being included in the PON maintenance dredging and sea disposal activities. Once the maintenance dredge material at Mayfield 5 and 6 is confirmed to be suitable for sea disposal, Mayfield 5 and 6 would then be sampled and tested again in 2027 as part of the wider maintenance dredge area SAP described in this document so that future sampling and testing is then in sync with the port wide 5 yearly maintenance dredge material sampling and testing.

2.3 Contaminants of Potential Concern

As noted above, previous investigations show that contamination levels have been found to be relatively consistent over time with evidence of an improvement in the quality of the maintenance dredge material over the last 20 years.

Based on the history of the harbour catchment and previous sediment sampling, the contaminants of potential concern (CoPC) identified for the maintenance dredge material include:

- cadmium;
- lead;
- mercury;
- zinc;
- antimony;
- arsenic;
- chromium;
- copper;
- silver;
- polynuclear aromatic hydrocarbons (PAHs); and
- tributyltin (TBT).

Although nickel is not considered a contaminant of concern, all samples will also be tested for nickel to confirm concentrations have not changed throughout the port.

In correspondence with PON in July 2021, DAWE advised the following.

“Adequate characterisation of material proposed to be disposed of at sea is a requirement of the *Environment Protection (Sea Dumping) Act 1981 (Sea Dumping Act)* and the London Protocol, to which Australia is a Contracting Party. To satisfy this requirement, the department recommends that the Port of Newcastle includes dioxins, and dioxin like compounds in the suite of analytes tested in the 2022 SAP”. Testing for dioxins/flurans has therefore been included in the proposed suite of testing listed below.

PFAS compounds in sediments have not historically been tested for by PON. PFAS (per- and poly-fluoroalkyl substances) are man-made chemicals that have been widely used in industrial and consumer products since the mid-1900s. Three types of these chemicals – Perfluorooctane Sulfonate (PFOS), Perfluorooctanoic Acid (PFOA) and Perfluorohexane Sulfonate (PFHxS) – used to be common ingredients in firefighting foams. These foams were historically used at several defence bases, airports and Fire and Rescue NSW and Rural Fire Service sites across the State. Like many chemicals, traces of PFAS are likely to be found in groundwater, surface water and soils in many urban areas due to their wide-spread use in everyday household items and their persistence in the environment.

No PFAS sediment quality data for the Port or immediate surrounds has been identified. PON operations currently do not utilise PFAS compounds and as a rule PON would like these substances removed entirely from usage around the Port. However, it is noted that other parties, whether tenanted or landowners in the Port area, may use PFAS substances, for instance in deluge systems or standalone extinguishers.

NSW EPA is leading an investigation program to assess the legacy of PFAS use across NSW and provide mapping of sites where it is likely that large quantities of PFAS have been used. There are 5 sites shown near Newcastle Port:

1) Williamtown RAFF Base - PFAS investigation site due to historical use of fire-fighting foams
2) Total Fire Solutions at Heatherbrae - PFAS investigation site due to historical use of fire-fighting foams
3) Our Lady of Lourdes Primary School at Tarro - PFAS investigation site due to historical use of fire-fighting foams
4) Fuchs at Wickham - PFAS investigation site due to historical use of fire-fighting foams

5) Swanson Industries at Broadmeadow – PFAS investigation site due to historical use of PFAS as a mist suppressant at the site

A significant body of work has been undertaken by the Department of Defence at the Williamtown RAAF Base over the last 10 years including sediment sampling and testing in Fullerton Cove to the north of the Port of Newcastle on the North Arm of the Hunter River. The RAAF Base Williamtown Environmental Site Assessment (Aecom 2017) noted that Hunter River flooding could disperse PFAS but such events are broad in spatial extent and would contribute to low concentrations of surface water and sediment contamination across a broad area. Reporting on the most recent monitoring (Aecom 2020) indicated no significant change was observed in PFAS concentrations in off site soil or sediments over the last 12 month monitoring period. In addition it was noted that there had been no major flooding event or PFAS release events which could have resulted in the increase of PFAS concentrations within the wider area during this time.

While the Williamtown RAAF Base and other sites identified on the NSW EPA mapping are not considered direct point sources immediately adjacent to the Port, they do fall within the catchment.

It is proposed that all samples will be tested for the CoPC and TOC (for normalisation of organics results). In addition, it is proposed to test 20% of the samples for the following contaminants listed in the NAGD to confirm they are not a concern in the harbour.

- dioxins/furans
- PFAS/PFOS/PFOA compounds
- organochlorines (OC) pesticides;
- polychlorinated biphenyl (PCBs);
- manganese;
- cobalt;
- vanadium; and
- selenium.

3 DESCRIPTION OF MAINTENANCE DREDGING

Maintenance dredging activities have been undertaken in the Port for over 100 years. The areas in which maintenance dredging may be undertaken during the life of the new 2022-2032 Sea Dumping Permit are shown in **Figure 2**. As previously discussed, for the purposes of the management of dredging activities, PON has subdivided the Port into seven areas (Areas A, B, C, D, E, F and G) based on the nature of the sedimentation in the Port and the layout of the port area.

The maintenance dredging in Areas A, B, C, D, E, and F involves the removal of material to design dredge depths, as indicated on **Figure 1**. Dredge material will be derived only from the maintenance dredging of the:

- Berths, channels and batter slopes specified as Areas A, B, C, D, E and F throughout the life of the new sea dumping permit; and
- additional berths (and adjacent channels and batter slopes) as they fall under the responsibility of PON to maintain during the life of the new sea dumping permit (refer **Table 1**).

Table 4 shows the total annual volume of material removed from the maintenance dredging Areas A, B, C, D, E and F over the past 9 years.

Table 4 Total annual volume of material removed from the PON maintenance dredge areas

2012	669,968	9,233	679,201
2013	922,096	29,845	951,941
2014 (portion as Newcastle Port Corporation prior to privatisation)	136,936	0	136,936
2014 (portion as PON)	496,320[2]	6,309	502,629
2015	601,920[2]	58,280	660,200
2016	509,250	27,945	537,195
2017	437,500	25,839	463,339
2018	389,750	25,542	415,292
2019	364,541	28,458	392,999
2020	151,903	12,146	164,049
	TOTAL for sea disposal 4,680,000	TOTAL for beach nourishment 224,000	TOTAL Dredged 2012-2020 4,904,000
Annual Average (m^3)	**520,000**	25,000	**545,000**
Approximate Dredge Area (m^2)	**2,920,000**	1,475,000[3]	**4,394,000**
Approximate annual average sedimentation rate (mm/year)	**178**	17	

The maintenance quantities dredged from the Port vary from year to year due to the dynamic and variable processes of siltation throughout the Port. The total annual volume of material dredged varied from a minimum of 164,049 m^3 to a maximum of 951,941 m^3 between the years 2012 and 2020.

In 2012 the maintenance dredge vessel changed from a 38hr 5day/week operation to a 12hr 365days/year operation as part of the eastern steelworks channel batter restoration project. This accounts for the higher dredge volumes recorded in 2012 and 2013. The low volume dredged in 2020 was due to a significant period of dredge vessel drydocking (12 weeks away and another 4 weeks alongside in Newcastle) combined with other vessel maintenance earlier in 2020. The COVID 19 pandemic also led to crew isolation and shortages. A year of significant dry weather i.e. lack of flooding events, also contributed to the lower volumes dredged in 2020.

[2] Significant work was done in 2017 to determine the insitu density of the dredge material for each of the areas of the port to improve the accuracy of the reporting of dredging volumes. It was determined that 2014 and 2015 volumes had been overstated in annual reporting to DAWE. The revised volumes for 2014 and 2015, as presented in Table 4, were provided to DAWE.
[3] The part of Area E where maintenance dredged material is suitable for beach nourishment, being seaward of the line between the ends of the breakwalls.

As shown in **Table 4**, the annual average volume dredged from the maintenance areas over the life of the previous permit was in the order of 545,000 m^3. Despite the variation in annual dredge volumes observed during the last 10 year permit, it is anticipated that the annual average volume that may need to be dredged from the current maintenance dredge areas in any one year in the new 10 year permit will be in the order of previous annual average dredging volumes, i.e. equivalent to an annual average volume of 545,000 m^3.

However, as additional berths and associated channel areas fall under the responsibility of PON to maintain (refer **Table 1**), the annual dredge volumes from all areas of the port except Area F will generally increase over the life of the new Sea Dumping Permit. The additional berths and associated channel areas represent an increase in total maintenance dredge area from 439 ha to 527 ha. Anticipated dredge volumes for Areas A to G for purposes of the new 2022-2032 Sea Dumping Permit application have been estimated based on the total size of each area (following inclusion of the additional areas) and the simply determined estimated approximate annual average sedimentation rates for the Port. These volumes are summarised in **Table 5**.

Table 5 Anticipated annual dredge volumes, 2022-2032

Maintenance Dredge Area	Total Area (ha)	Estimated Sedimentation Rate (mm/year)	Anticipated Volume (m^3) Normal Conditions
A	85	178	156,000
B	88	178	162,000
C	54	178	99,000
D	47	178	87,000
Portion of E with material suitable only for sea disposal	23	178	42,000
Portion of E with material suitable for beach nourishment	147	17	25,000
F	37	178	68,000
G	46	178	85,000
TOTAL	**527**		**702,000**

As outlined in **Table 5**, it is anticipated that the total average annual volume that may need to be dredged from the Port in any one year in the new 10 year permit could be in the order of 705,000 m^3 (rounded up), while in any one year depending upon the occurrence of flooding events in the Hunter River, an additional 300,000 m^3 may need to be dredged due to a flood event. Assuming similar quantities of Area E sands in the 2012-2022 period will be dredged and reused for beach nourishment of Stockton Beach over the life of the next 10 year permit, and allowing for up to 2 major flood events, PON's 2022 – 2032 sea dumping

permit seeks approval for dredging and sea disposal at the current spoil ground of up to a total quantity of 7,400,000m^3 i.e. 705,000 m^3 per year for 10 years minus the estimated Area E material suitable for beach nourishment (25,000 m^3 per year) plus an additional 600,000 m^3 for up to 2 major flood events over the life of the 10 year permit.

4 PROPOSED SEDIMENT SAMPLING AND ANALYSIS

4.1 Objective

The sampling and testing are to be undertaken to confirm the physical and chemical properties of the sediment from Areas A to F as well as any additional proposed maintenance dredge areas over the life of PON's next maintenance dredging permit.

Proposed Data Quality Objectives for the field and analytical program are outlined in **Table 6**.

Table 6 Data Quality Objectives

Parameter	Data Quality Objective
Blank Samples	At or near the Limit of Reporting (LOR)
Sample	Samples received intact and cold
Holding Time	Samples analysed within specified holding time
Field Triplicate Samples (1 in 10 samples)	RPD <50%
Field Split Triplicate Samples (1 in 20 samples)	RPD <50% or as per laboratory requirement
Lab Duplicate Samples (1 in 10 Samples)	RPD <35% or as per laboratory requirement
Laboratory Control Samples (LCS) (1 in 20 Samples)	RPD <35% or as per laboratory requirement
MS (1 in 20 Samples)	RPD <35%, recovery 75–125% or as per laboratory requirement
Surrogate (Every Sample)	Recovery as per laboratory requirement

4.2 Sample Locations

A total of 108 sampling locations are proposed for the sediment sampling and testing program (refer **Table 7**). This is an increase from 58 sample locations in 2017. The proposed sampling locations are shown on **Figure 4**. The coordinates for each proposed sampling location are included in **Appendix 1**. In all previous SAP's at the Port of Newcastle, sample number locations have been based on annual volumes. However, PON has been advised that DAWE's policy for a long-term permit is that the volume to be adopted to determine number of sample locations should be the total volume of sediment to be dredged over five years, not the annual dredging requirement. To meet the department's policy, sampling at 108 locations is required on the basis of the estimated five-year dredging volume of 3.7 million m^3 and the formula provided in the NAGD (page 60).

Table 7 Sample location numbers

Area Reference	Proposed number of sample locations
A, B, F & G	62
C	18
D	14
E (outside breakwalls)	14
E (inside breakwalls)	
	TOTAL = 108 locations

Sample locations have historically been randomly selected within each area.

In order to provide information regarding the change in contamination levels over time, it is proposed to return to those locations throughout the maintenance dredge Areas A to F that were sampled for the 2009, 2012 and 2017 investigations.

Due to the historical elevated concentration of TBT observed within The Basin, the high density of sampling within Area C has been retained (as was done in 2012 and 2017). As described in **Section 2.2.2**, a trend of decreasing TBT has been observed in Area C and, in 2017, for the first time, the 95% UCL of the mean TBT concentration within Area C was below the SL. However, the higher sample density resulting from historically treating Area C as a separate site has been retained to confirm this trend and meet the recommendations of the DAWE Explanatory Note for TBT (refer **Appendix 3**).

If the 95% UCL of the mean TBT concentration within Area C is greater than the SL, then elutriate testing would be undertaken on four selected samples (refer **Section 4.8.2**).

It is proposed to also undertake a higher density of sampling within Area D and Area E. The part of Area E where maintenance dredge material is suitable for beach nourishment based on current approvals is generally that part seaward of the line between the ends of the breakwalls. A higher sampling density is proposed to ensure any material suitable for beach nourishment is identified. This includes additional sample locations inside and adjacent to the breakwalls and along the entrance channel where PON typically observes sediment accumulation.

As the distribution of contaminant levels is relatively uniform across Areas A, B, and F, the remainder of the sample locations have been distributed across these areas. It is expected that a similar distribution would be observed for Area G[4] therefore it has also been included with Areas A, B, and F. Judgmental sample locations for the additional locations have been adopted to allow targeting of areas where sediment accumulation is typically observed, and to assess the suitability of sediment for beach nourishment.

[4] Area G is upstream of the former steelworks. Remediation of the South Arm of the Hunter River adjacent to the former steelworks has been completed and validation of the remediation was confirmed. Capital dredging has not yet been undertaken in Area G. The existing, and any future capital dredging approvals for Area G, will address any legacy sediment contamination and the need for remediation. Therefore the future Area G maintenance dredge material would comprise sediment accumulated following capital dredging of Area G and will not have been influenced by the former steelworks i.e. sediment from the Hunter River catchment and reworked port sediment from vessel movements/floods/tides.

Allowing for the potential additional maintenance dredge areas, an additional 18 locations have been included in these future potential maintenance dredge areas. These additional locations would be sampled when the SAP is implemented in both 2022 and 2027 only if the additional maintenance dredge areas have come into PON management. Suitable sampling and testing would have been undertaken following completion of capital dredging in these areas prior to hand over to PON. The locations shown on **Figure 4** therefore represent locations to be sampled once these areas have been shown to be suitable for maintenance dredging and brought into this wider SAP.

As noted in **Section 2.2.3**, in the event that any of the additional berths and related channels listed in **Table 1** fall under the control of PON and the schedule of commencing maintenance dredging of these additional areas does not fit in with the overall SAP implementation program in 2022 and 2027, an additional SAP for the particular area would be prepared and implemented to demonstrate the suitability of sediments from the area for sea disposal. The SAP would assess the dredging volume and required number of samples for the particular area and would be prepared in accordance with recommendations outlined in the NAGD (2009).

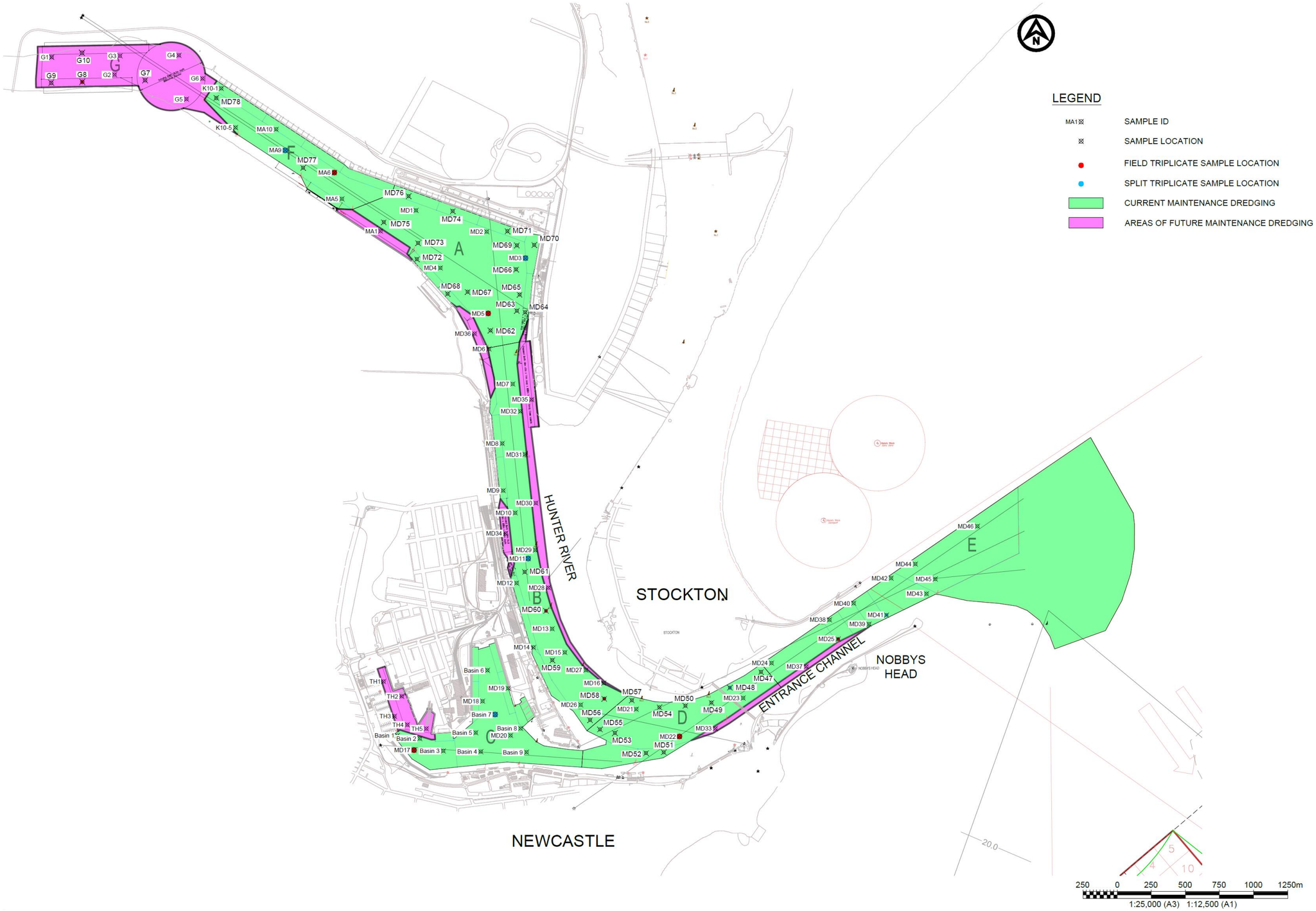

Figure 4 Proposed Sample locations

4.3 Sample Collection

The proposed sample collection methodology is consistent with the methodology in previous SAPs which were approved by SEWPaC (now DAWE).

PON's onboard GPS will be used to position the sampling vessel at the nominated sampling locations. The GPS has an accuracy of ±0.1 m. However, following manoeuvring of the vessel into position and recovery of the sample from the harbour bed, the sampling is likely to have an accuracy of ±5 m.

Collection of the sediment samples will be undertaken by PON personnel using a stainless steel Van Veen grab sampler deployed from the PON survey vessel. Prior to use, the survey vessel will be thoroughly inspected and washed down. Any evident sources of contamination would be cleaned and covered in plastic to avoid accidental contamination of any samples.

The grab sampler will be lowered to the harbour bed at each sampling location where the jaws of the grab are triggered to close, penetrating the sediment. Standard operating procedures for the sediment sampling and sub sampling are included in **Appendix 2**.

Sample processing will take place on the survey vessel immediately following recovery of the grab sample. From each sample retrieved by the grab sampler at each location, the following sampling process will be undertaken using a stainless steel spoon:

- two thoroughly homogenised sub-samples will be taken for chemical analysis in a 150 ml and a 250 ml glass sampling jar with teflon lined lids;
- one thoroughly homogenised sub-samples will be taken for dioxin analysis in a 250 ml laboratory pre-washed glass sampling jar with aluminium foil lined lid;
- one thoroughly homogenised sub-sample will be taken for physical analysis in a 250 ml ziplock bag.

At each location within The Basin (Area C), one 500 ml non-homogenised sub-sample will be taken for possible elutriate testing in two 250 ml glass sampling jars with Teflon lined lids.

Each jar and bag will be filled with zero headspace. The lid of each sample container will be tightly screwed on to avoid loss of sample and the jar/bag labelled with a unique identification number.

Sediment will typically adhere to the outside of the sample containers. To avoid cross contamination, after the lid is secured, the outside of each sample container will be thoroughly washed with harbour water.

Powder-free nitrile gloves would be used and changed after each sample.

Sampling date, time, water depth and sediment characteristics will be recorded in a field log. Photographs of each sample would be undertaken.

4.4 Estimated Number of Samples

Field triplicate samples[5] will be collected from eleven nominated sample locations within the maintenance dredge area (refer **Figure 4**). At all other sample locations (97 locations) only one sample will be retrieved. In accordance with Appendix F of the NAGD (Commonwealth of Australia, 2009), at the nominated field triplicate sampling locations, three separate grab samples will be collected. The field triplicate samples will be used to give an indication of the variability in the chemical properties of the sediment at a sample location.

In addition, as part of QA/QC procedures, it is proposed to submit six split triplicates[6].

4.5 Sample Preservation

Samples for chemical and possible elutriate analysis will be packed in ice in an esky immediately after sampling to maintain the temperature below 4°C. Samples will then be submitted to the analytical laboratories on the same day or the following morning. Should overnight storage be required samples will be placed in a freezer.

4.6 Equipment Decontamination Procedures

All sampling equipment will be decontaminated between each sampling event. Decontamination procedures will include rinsing equipment in harbour water to remove visible sediment, followed by a Decon 90 rinse.

4.7 Sample Shipment

All sample containers will be clearly labelled with unique sample identification numbers. Samples for chemical and possible elutriate analysis will be transported in an esky in ice to the nominated NATA registered analytical laboratory under chain of custody procedures.

4.8 Analysis Schedule

4.8.1 Chemical analysis

The chemical testing will be undertaken by NATA registered laboratories experienced in the testing of sediments in accordance with the NAGD (Commonwealth of Australia, 2009). Chemical testing of the sediment samples will include a suite of heavy metals, TOC, OC Pesticides, TBT, dioxins/furans, total PCBs and PAHs. The contaminants and the detection limit of the proposed analytical methods are listed in **Table 7**.

It is proposed to analyse 20 % of the samples for the full suite of tests. All samples will be tested for cadmium, lead, zinc, mercury, nickel, antimony, arsenic, chromium, copper, silver, PAHs and TBT. All samples will also be tested for TOC (for normalisation of organics results). If any contaminant(s) in the 20% of samples tested for the full suite of tests are detected above SL, all remaining samples will be tested for the detected contaminant(s).

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[5] *Field triplicates – 3 samples (separate grab samples) are taken at the same location to determine the variability of the sediment chemical properties.*
[6] *Split triplicates – at a location the sample is homogenised and split into three containers to assess variation associated with subsample handling. One of the three samples is sent to a second laboratory for analysis.*

Table 8 Contaminant detection limits

Contaminant	Detection Limit	Method
Arsenic	1 mg/kg	USEPA 6020
Cadmium	0.1 mg/kg	USEPA 6020
Cobalt	0.5 mg/kg	USEPA 6020
Chromium	1 mg/kg	USEPA 6020
Copper	1 mg/kg	USEPA 6020
Lead	1 mg/kg	USEPA 6020
Nickel	1 mg/kg 1 mg/kg	USEPA 6020
Mercury	0.01 mg/kg	APHA 3112 Hg-B
Selenium	0.1 mg/kg	USEPA 6020
Zinc	1 mg/kg	USEPA6020
TOC	0.1%	in-house/Leco
PAHs	0.1 mg/kg (sum) 0.005 mg/kg (individual species)	USEP3640/8270D
tributyltin	1 µg Sn/kg	USEPA 8270D GC/MS
OC Pesticides	0.5 µg/kg	USEPA 360/3620
PCBs	5 µg/kg	USEPA 360/3620
PFAS – full suite (28 analytes)	0.0002-0.001 mg/kg	LC/MS-MS
Dioxins/furans	0.5-10 pg/kg	USEPA 1613B/8290

4.8.2 Elutriate analysis (if required)

Historically elevated concentrations of TBT have been observed in The Basin (Area C). However, the most recent round of sediment testing (RHDHV 2017) showed that the concentrations of TBT within The Basin (Area C) had reduced to below the NAGD SL and an isolated individual result (location MD2) in the Swing Basin was re-sampled and tested in triplicate to demonstrate it was an outlier.

Following testing of the total concentration of TBT for the samples recovered from the 18 locations within The Basin, the 95% UCL of the mean concentration of TBT within the Basin will be calculated. If the 95% UCL of the mean concentration of TBT exceeds the SL, elutriate TBT testing will be undertaken within the 14 day holding time on four samples with TBT concentrations similar to, or higher than, the 95% UCL of the mean concentration of TBT found in The Basin.

In accordance with the NAGD (Commonwealth of Australia, 2009), a sample of clean seawater representative of the current spoil ground will also be tested for TBT.

Other maintenance dredge areas are not expected to be contaminated with TBT. However, if the 95% UCL of the mean concentration of TBT for the samples recovered within the remainder of the maintenance dredge areas exceed the SL, then elutriate tests will be undertaken within the 14 day holding time for the number of samples specified in Table 7 of NAGD (Commonwealth of Australia 2009).

The TBT elutriate data will then be compared to the marine water quality guideline value (WQ GV) after 4-hour dilution (dilution calculation methods, pages 39-40 NAGD). This assesses potential impacts on water column organisms during disposal. Test results are normally compared to the relevant ANZECC/ARMCANZ (2000a, b) marine WQ GV (called trigger value in that document) for 95% protection (0.006 µg Sn/L), or subsequent updates to these values (ANZG, 2018).

If exceedences of the marine water quality guideline value is observed, bioavailability and toxicity testing should be undertaken. Bioavailability and toxicity are assessed by comparing TBT pore water data to relevant marine WQ GV – without dilution. This test assesses potential impacts on benthic organisms exposed to sediment pore water after disposal. Toxicity testing does not apply to TBT because standard tests are unresponsive except at high levels (page 43), however the marine WQ GVs are based on chronic toxicity and, if exceeded, indicate that TBT is bioavailable and likely to be toxic.

In June 2021, DAWE issued an explanatory note regarding TBT assessment titled:
“Clarification of the National Assessment Guidelines for Dredging 2009, Decision tree and explanatory note for assessment of tributyltin (TBT) in dredge spoil”

A copy of the explanatory note is included in **Appendix 3**. Any elutriate testing for TBT required for Area C would follow the DAWE decision tree presented in the explanatory note.

Of specific relevance for Area C is that the explanatory note states that:
“If pore water cannot be obtained, which needs to be established to the satisfaction of the determining authority (DA), elutriate data can be used to estimate pore water concentrations.”

Dr Graeme Batley at CSIRO has previously provided advice to PON that it would not be possible to extract sufficient pore water from the Area C sediments without altering the chemical composition of the pore water and hence affecting bioavailability results. As such, the only suitable test to assess the in-situ bioavailability and toxicity of TBT for Area C is the elutriate test and comparison to the relevant marine WQ GV without taking dilution into account.

4.8.3 Physical analysis

A geologist/laboratory will be engaged to undertake the physical analysis of the samples. One sample will be collected from each location for physical analysis. The following analyses are proposed:

- all samples (108 samples) would be analysed for % mud as this is the primary issue in relation to additional opportunities for beneficial reuse of maintenance dredge material for nourishment of Stockton Beach;
- particle size distribution for the sand fraction would be undertaken on a minimum of 15 representative samples. This minimum number of samples is considered sufficient to gain an understanding of the variability of the sand sizing given that marine sand is expected to dominate and is derived from a single parent body;
- particle size distribution analysis for the mud fraction (hydrometer) is not considered necessary.

Petrographic analysis of sediments in the offshore area has been a useful tool for assessing sediment dispersion pathways since identifiable amounts of fluvial sediments are placed in an otherwise marine sediment dominated environment as part of the maintenance dredging disposal activities. It is otherwise accepted that the Hunter River is not a significant source of sand sized sediments to the offshore area and beaches (DHI, 2006).

Petrographic analysis of the sand-sized fraction for a minimum of 10 samples from the port would be undertaken. The samples for the petrographic analysis will be spaced approximately every 1 km along the channel from upstream at Area G down the channel to the entrance to inform an understanding of the fluvial processes/fluvial sediment supply. It is considered that a minimum of 10 samples throughout the maintenance dredge areas will provide an adequate baseline dataset to characterise the relative sources of the sand within the port.

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4.8.4 Data management procedures

Data management of the analysis results will be in accordance with the requirements of NAGD (Commonwealth of Australia, 2009). Validation of data will include evaluating the results from laboratory blanks, standard samples, field triplicate samples and split triplicate samples. After data validation, the data will be tabulated and the 95% UCL of the mean concentration for each contaminant will be calculated.

The 95% UCL of the mean TBT concentration will also be calculated for samples specifically from Area C.

Samples will be traceable from the time of collection until the results are verified and reported. Sample chain of custody procedures provide a system for documentation of all information related to sample collection and handling to achieve the data objectives. Field data sheets and Chain of Custody (COC) forms will be used as the primary documentation to ensure that relevant information for each sample is properly recorded. The laboratory will issue a sample receipt notification (SRN) following receipt of the samples which will be checked against field notes and the SAP. Copies of the SRN, COC forms, and the field notes will be retained and included in the SAP Implementation Report.

Following laboratory analysis, the laboratory results and QA/QC results will be emailed for review so that any missing, unusual values / results (outside the data quality limits) can be queried and, if necessary, re-analysis carried out before the holding time for the samples has expired.

Field and analytical data quality indicators covering precision, accuracy, representativeness, comparability and completeness are outlined in **Table 9** and **Table 10** below.

Table 9 Field Data Quality Indicators

Indicator	Frequency	Acceptance Criteria
PRECISION (a quantitative measure of the data variability)		
Sampling methodologies	All samples	Appropriate and complied with
Intra-lab duplicates/splits	5% of samples	<+/- 50% RPD
Inter-lab duplicates/splits	5% of samples	<+/- 50% RPD
Trip blanks/spikes (volatiles only)	1 per sampling	</= LOR for blanks, as per lab spec for spikes
ACCURACY (a quantitative measure of the closeness of reported data to the true value)		
Collection of rinsate blanks for re-used sampling or subsampling equipment	Where equipment re-used, 1 sample/day per item of equipment	CoCs below detection limit
Sampling methodologies	All samples	Appropriate and complied with
REPRESENTATIVENESS (qualitative confidence that data obtained are representative of each sampled medium)		
Sampling, subsampling, sample handling and storage appropriate for the history and contamination status of the sediments, the study objectives and the media/analytes	All media & all analytes	All samples collected and handled according to SAP
COMPARABILITY (qualitative confidence that data collected in separate sampling events is equivalent)		
SAP for sample collection, subsampling and handling. Same methods used each day; same types of samples collected	All samples	All samples collected and handled in accordance with SAP, by experienced professionals
COMPLETENESS (the amount of useable data, as a % of total data collected. Goal is 95% or more valid data)		
Chain-of-Custody forms (COCs), sample descriptions and sample location data complete	All samples	All samples
All critical locations sampled; all samples collected	All samples	All samples collected & analysed according to SAP
Completeness objective met (ie percentage of data suitable for use, 95% of all data)	All data	Minimum 95% of all data on submitted samples validated as suitable for use
Methodologies	All samples	Sampling in accordance with NAGD, 2009, and other relevant standards for marine sampling, as appropriate

Table 10 Laboratory Data Quality Indicators

Indicator	Frequency	Acceptance Criteria
PRECISION (a quantitative measure of the data variability)		
Lab duplicates (separate subsamples from jar, not aliquot splits)	1 per batch or 20 samples	<5 x LOR = no limit on RPD. >5 x LOR = 0-50% RPD
ACCURACY (a quantitative measure of the closeness of reported data to the true value)		
Matrix spikes Matrix spike duplicates	1 per lab batch or 20 samples 1 per lab batch or 20 samples	Recovery 70% - 130% for inorganics/metals, 60-140% for organics, or as per lab requirement RPDs should be less than 35%
Surrogate spikes	All organic analyses	Recovery 70% - 130% for inorganics/metals, 60-140% for organics, or as for lab requirement
Lab method and reagent blanks	1 each per batch	</= LOR
Control samples	1 per lab batch or 20 samples	Recovery 70% - 130% or as for lab requirement
Analysis of CRMs (for metals) or in-house standards certified against CRMs	All sediment metal analyses, 1 per batch	<+/- 35% RPD, recovery 70% - 130% or as per lab requirement
REPRESENTATIVENESS (qualitative confidence that data obtained are representative of each sampled medium)		
Sample handling and storage appropriate for media/analytes	All media, all analytes	All samples
Holding times (HTs)	All samples	All samples extracted and analysed within HTs
COMPARABILITY (qualitative confidence that data collected in separate sampling events is equivalent)		
Standard analysis methods	All samples	All samples subsampled, extracted/ digested & analysed at NATA-certified labs, by standard methods
LORs consistent between labs and batches	All samples	All samples
LORs met for all analytes	All samples	All samples
Outliers and inter-lab discrepancies resolved	Affected samples	Affected samples re-extracted and analysed in replicate.
COMPLETENESS (the amount of useable data, as a % of total data collected. Goal is 95% or more valid data)		

All critical locations sampled, all required samples collected, and all samples analysed according to this SAQP	All samples	All required data obtained
Chain-of-Custody forms (COCs), field logs, sample descriptions and sample location data complete	All samples	All samples
Samples received at laboratory as specified on COC forms	All samples	All bottles and jars received and unbroken, seals intact and samples cool
QC samples sufficient, and acceptable results	All QC/QAs	100%
SENSITIVITY (ability of analysis methods to reliably determine the analytes at lowest environmental concentrations)		
Analysis methods and LORs appropriate for media, expected background levels of analytes and adopted site assessment criteria	All media, all analytes	All samples
SECONDARY DATA (quality assessment of any pre-existing data to be used in this project)		
All secondary data	All pre-existing data	Establish DQIs and assess data quality

4.9 Equipment and Personnel

The equipment required for the sampling program is summarised as follows:

- PON survey vessel with PON's onboard GPS;
- PON stainless steel Van Veen grab sampler;
- stainless steel spoon and bowl;
- sample containers and zip lock bags;
- eskies and ice;
- data forms for recording field measurements and logging samples;
- nitrile gloves and PPE;
- Decon 90; and
- camera.

Experienced environmental scientists/engineers will coordinate the sampling program. PON personnel will operate the PON survey vessel and Van Veen grab sampler.

4.10 Health and Safety Precautions

The sampling program will adhere to health and safety systems of PON. In particular, care will be taken when handling potentially contaminated sediments.

4.11 Contingency Plan

The sampling program is unlikely to be affected by weather or equipment failure, being located within the sheltered Port and due to the use of robust mechanical sampling equipment. In the event of adverse weather or critical failure of equipment, the sampling would be recommenced following improvement in the weather or fixing of the equipment.

5 QA/QC PROCEDURES

5.1 Field/QA/QC Procedures

Field QA/QC procedures will include the following:

- Sample Location: PON's onboard position fixing system will be used to locate the sampling locations.
- Decontamination of Sampling Equipment: Prior to use, the survey vessel will be thoroughly inspected and washed down. Any evident sources of contamination would be cleaned and covered in plastic to avoid accidental contamination of any samples. All sampling equipment that comes into contact with the sediment samples will be decontaminated (using Decon 90) prior to each sampling event.
- Field triplicates: Three samples from the nominated field triplicate sampling locations (10% of the locations for chemical analysis) will be analysed and used to give an indication of the variability in the chemical properties of the sediment at a sample location. For elutriate testing, 20% of the locations and a minimum of one field triplicate sample would be analysed. All field triplicate samples will be blind labelled with sample numbers that do not relate to the sampling location name.
- Field Documentation: Each sample location will be numbered on a sampling plan in the field logbook. All other observations including water depth, weather, time, date of sampling and appearance of the sediments eg texture, colour and odour, will be noted in the field logbook. A photograph of each sample will also be taken.
- Cross Contamination: Following sampling, to avoid cross contamination, each sample jar will be tightly sealed and washed with harbour water to remove sediment adhering to the outside of the sample containers.
- Split triplicates: At 5% of the locations, split triplicate samples will be submitted for analysis with one of the three samples sent to a second laboratory for analysis. All split triplicate samples will be blind labelled with sample numbers that do not relate to the sampling location name.
- Sample Control: Each sample will have a unique identification number, which will be recorded in the field log book and chain of custody form. A chain of custody form will accompany the sediment samples at all times and will include the analysis method required of the laboratory.

5.2 Laboratory QA/QC Procedures

Laboratory QA/QC procedures will include the following:

- Analysis Blanks: One per analytical run or one in every 20 samples, whichever is the smaller.
- Laboratory Duplicate: One in every 10 samples or client batch, whichever is the smaller
- Laboratory Control Standard: One per analytical run or one in every 20 samples, whichever is the smaller.
- Laboratory Matrix Spike: One in every 20 samples or client batch, whichever is the smaller.
- Matrix Spike: One in every 20 samples or client batch, whichever is the smaller.
- Surrogate Spike: For determinations that are appropriate, surrogate spikes will be added to all samples for analysis.
- Calibration Blank and Mid Range Calibration Verification: One per analytical run or one in every 20 samples, whichever is the smaller.

6 REPORTING

An SAP implementation report will be prepared presenting the outcomes of the offshore sampling and analysis program. The report will include:

- a summary or a copy of the SAP;
- a description of the sampling program;
- tabulation of all laboratory results and a copy of the original laboratory sheets;
- results for organic analytes will be normalised to 1% total organic carbon (within limits of 0.2 to 10% TOC);
- results for elutriate testing (if required)
- statistical analysis of the results for each analyte to calculate the mean, standard deviation and the 95% upper confidence limit of the mean (95% UCL). The 95% UCL will be used for comparison to the NAGD SL and selection of samples for possible elutriate testing;
- where values are less than the detection limit, a nominal value of one half of the detection limit will be used in the statistical analysis of the results;
- reporting of all QA/QC;
- environmental data quality objectives to be achieved;
- conclusions for the feasibility of sea disposal of the maintenance dredge material; and
- recommendations for further work (if required).

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Appendix 1 – Coordinates of Proposed Sample Locations

SAMPLE SITE LOCATION

	MGA 94 Coordinates Zone 56	
Sample ID	**Easting**	**Northing**
G1	381769	6361576
G2	382231	6361449
G3	382271	6361585
G4	382703	6361589
G5	382758	6361269
G6	382876	6361419
G7	382455	6361405
G8	381993	6361395
G9	381767	6361386
G10	381997	6361609
K10-1	383013	6361346
K10-5	383162	6361126
MA1	384181	6360301
MA5	383871	6360499
MA6	383819	6360724
MA9	383482	6360893
MA10	383416	6361047
MD1	384441	6360453
MD2	384959	6360297
MD3	385243	6360103
MD4	384619	6360031
MD5	384970	6359698
MD6	384975	6359438
MD7	385150	6359181
MD8	385073	6358745
MD9	385080	6358400
MD10	385168	6358237
MD11	385263	6357902
MD12	385178	6357722
MD13	385439	6357387
MD14	385302	6357251
MD15	385532	6357214
MD16	385817	6356989
MD17	384426	6356498
MD18	384929	6356857
MD19	385117	6356951
MD20	385134	6356606
MD21	386055	6356798
MD22	386372	6356598
MD23	386839	6356880
MD24	387073	6357168
MD25	387423	6357439
MD26	385648	6356830
MD27	385686	6357084
MD28	385379	6357682
MD29	385316	6357964
MD30	385279	6358304
MD31	385240	6358665
MD32	385206	6358980
MD33	386635	6356657
MD34	385098	6358086
MD35	385289	6359067
MD36	384870	6359550
MD37	387302	6357110
MD38	387471	6357453
MD39	387761	6357421

	MGA 94 Coordinates Zone 56	
Sample ID	**Easting**	**Northing**
MD40	387649	6357574
MD41	387889	6357488
MD42	387924	6357758
MD43	388182	6357644
MD44	388101	6357862
MD45	388247	6357752
MD46	388556	6358138
MD47	386971	6357071
MD48	386741	6356959
MD49	386607	6356845
MD50	386415	6356825
MD51	386257	6356484
MD52	386128	6356477
MD50	386415	6356825
MD53	385899	6356625
MD54	386227	6356814
MD55	385790	6356650
MD56	385717	6356718
MD57	386022	6356863
MD58	385821	6356874
MD59	385443	6357157
MD60	385394	6357519
MD61	385240	6357809
MD62	384984	6359574
MD64	385177	6359718
MD63	385241	6359705
MD65	385200	6359837
MD66	385177	6360022
MD67	384818	6359857
MD68	384672	6359844
MD69	385182	6360198
MD70	385310	6360202
MD71	385113	6360302
MD72	384448	6360094
MD73	384456	6360213
MD74	384711	6360445
MD75	384204	6360368
MD76	384387	6360558
MD77	383613	6360763
MD78	382977	6361275
Basin 1	384304	6356605
Basin 2	384469	6356583
Basin 3	384641	6356492
Basin 4	384916	6356487
Basin 5	384879	6356626
Basin 6	384965	6357083
Basin 7	385021	6356759
Basin 8	385208	6356657
Basin 9	385251	6356483
TH1	384203	6357001
TH2	384336	6356892
TH3	384283	6356746
TH4	384377	6356685
TH5	384516	6356655

Appendix 2 – Standard Operating Procedures for Sediment Sampling and Subsampling

Standard Operating Procedures for Sediment Sampling & Subsampling

Two sub-samples for chemical analysis (150 and 250 ml glass jar), one thoroughly homogenised sub-samples will be taken for dioxin analysis in a 250 ml laboratory pre-washed glass sampling jar with aluminium foil lined lid; one sub-sample for grainsize analysis (250 ml zip lock bag) and a 500 ml sample (two 250 ml glass jars) for possible elutriate analysis (Area C only) should be collected from the grab sample at each location, except at field triplicate sampling locations and split triplicate locations.

At the field triplicate locations, three grab samples should be retrieved and sub-sampled, i.e. three separate casts of the grab sample at the one location. From each cast one sub-sample for chemical analysis should be collected.

At the split triplicate locations, a sample should be recovered from the grab and placed in a stainless steel bowl. The sample should be thoroughly homogenised and split into three sample jars with a unique label each.

1. Location of sampling to be confirmed by on-board GPS.
2. Coordinates of the sample location, date, time, weather conditions and water depth should be recorded in the field log book.
3. Van Veen grab sampler deployed and lowered to harbour bed.
4. Jaws of grab sampler triggered to close upon contact with harbour bed.
5. Van Veen grab sampler recovered, placed on vessel deck and opened for inspection.
6. Integrity of grab sample assessed by visual inspection for any evidence of loss of fines due to grab not sealing correctly or the jaws being held open, e.g. by a shell or a piece of gravel.
7. If grab sample is considered unsatisfactory, sample should be discarded and steps 1 to 6 should be repeated.
8. If grab sample is considered satisfactory, sub-sampling from grab sample should proceed.
9. From each grab sample one 150 ml and two 250 ml thoroughly homogenised sub-sample should be taken for chemical analysis, one 250 ml thoroughly homogenised sub-sample should be taken for physical analysis and one 2,000 mL bulk sample (non-homogenised) should be taken for possible elutriate analysis (Area C only).
10. Sub-samples for chemical analysis should be transferred to laboratory pre-washed 150 ml and 250 ml glass sampling jar with a teflon lined lid using a stainless steel sampling spoon. Sub Sample for dioxin testing will have the Teflon lined lid removed,
11. Sub-samples for physical analysis should be transferred to plastic zip lock bags using a stainless steel sampling spoon.
12. Sub-samples for possible elutriate analysis should be transferred to two laboratory pre-washed 250 ml glass sampling jars with a teflon-lined lid using a stainless steel sampling spoon.
13. Powder-free nitrile gloves would be used and changed after each sample.
14. Lid of each sample container should be tightly screwed on to avoid loss of sample and the jar and lid labelled with a unique identification number. All field and split triplicates will be blind labelled with sample numbers that do not relate to the sample location ID.
15. To avoid cross contamination, the outside of each sample container should be washed with ambient water.

Appendix 3 – DAWE Explanatory Note for TBT

June 2021

Clarification of the National Assessment Guidelines for Dredging 2009

Decision tree and explanatory note for assessment of tributyltin (TBT) in dredge spoil

Introduction

The National Assessment Guidelines for Dredging 2009 (NAGD) set out a framework for the environmental impact assessment and permitting of the ocean disposal of dredged material under the *Environmental Protection (Sea Dumping Act) 1981.*

The NAGD seeks to provide clear, consistent standards and criteria for assessment of dredged material. This helps facilitate better decision-making by regulators through improving the quality of information on which assessments are based. In order to provide up to date guidance on emerging science of contaminants, clarifications to the NAGD can be periodically published.

Clarified NAGD TBT assessment process

Tributyltin (TBT) is largely present in anti-fouling paint flakes and as such, its distribution in marine sediments is likely to be concentrated or localised. Due to the nature and distribution of TBT, the NAGD refers to a number of exceptions when assessing TBT. Procedures for assessing TBT including these exceptions are summarised in the below explanatory note and decision tree at Figure 1 available on page 2 of this document. This decision tree is to be referred to in place of Figure 3 of the NAGD (page 12) when assessing TBT. Page number, table and figures refer to the NAGD except where noted otherwise.

PHASE I – Evaluation of existing information

Phase I involves reviewing existing information on the material proposed for sea disposal, to determine which contaminants need investigation and to assess whether the existing information sufficiently characterises the sediments without further testing. Further detail is provided in the NAGD Section 4.2.1 and Appendix A.

PHASE II – Sampling and analysis requirements

If TBT is identified as possibly being at elevated levels in the sediments of the dredge area, the following processes apply.

Having a sufficient number of samples and sample density is a critical component of site characterisation. Where the TBT data from a dredging area is highly variable, it may be necessary to

collect more sediment samples, or a significantly higher number of replicates, than the minimum numbers specified in the NAGD (page 33 and Table 6). TBT variability will often be known from previous sampling. The number of samples required to adequately characterise an area can be determined, if there is existing data on TBT, by power analysis (pages 38 and 60). Where previous TBT data is lacking, it is prudent to collect more samples or replicates, otherwise, if high variability is found, it may be necessary to resample to obtain sufficient data for the assessment. If in doubt, refer to the determining authority (DA) for approval.

Where an outlier is reassessed and subsequently discarded, the process is to be documented and justified to the DA. See also the procedures for dealing with outliers (page 35).

Screening level assessment

Compare the 95% upper confidence limit (UCL) of total organic carbon (TOC) normalised sediment data to the screening level (SL) in Table 2 (9 µg Sn/kg). TBT is normalised to 1% TOC over the TOC range 0.2% to 10% (equates to multiplication factors of 5 times to 0.1 times, respectively) by dividing the TBT value by the % TOC value. Outside this range, use the end value which applies (e.g. for less than 0.2% TOC, use 5 times the TBT value measured).

If the 95% UCL exceeds SL, the spoil is potentially contaminated and requires further assessment. Generally, there should be a minimum of 10 samples for accurate calculation of the 95% UCL although it can be calculated with fewer (USEPA, 2015). If a 95% UCL cannot be determined or, in a small data set the calculated 95% UCL is greater than the highest analysis value, use the maximum value in the data set (USEPA 2015, Section 1.10, pp 56-57).

Hot spot assessment

Reference pages 20 and 44-45. A hot spot is a cluster of 2 or more samples exceeding the SL. If a hot spot is present, can it be selectively dredged? If it can, assess as a separate dredge spoil unit.

Comparison of Data to Ambient Baseline Concentration

Compare TBT data to ambient background concentration at a reference area near disposal site.

A reference area is an area with similar sediment grainsize and oceanographic characteristics as the disposal site, and nearby, but outside the area whose sediment chemistry could be affected by disposal at the site (page 38, 76, 80). Refer to the Screening Level assessment (above) for the minimum sample numbers for calculation of the 95% UCL. The spoil data (95% UCL) is compared to the 80th percentile for reference site sediments (page 38).

PHASE III – Elutriate and bioavailability testing

Compare TBT elutriate data to marine water quality guideline value (WQ GV) after 4-hour dilution (dilution calculation methods, pages 39-40).

This assesses potential impacts on water column organisms during disposal. Test results are normally compared to the relevant ANZECC/ARMCANZ (2000a, b) marine WQ GV (called trigger value in that document) for 95% protection (0.006 µg Sn/L), or subsequent updates to these values (ANZG, 2018). Except where the water body has been zoned to have a higher (or lower) level of protection, in which case the relevant ANZECC/ ARMCANZ (2000a, b) trigger values, or subsequent updates to these values, are to be used (Section 4.2.3, page 14). ANZG, 2018, recommends that, for bioaccumulating contaminants (such as TBT) the next most protective DGV should be used (e.g. 99% species protection rather than 95%, if the water body is zoned 95%).

Bioavailability and toxicity assessment

Bioavailability and toxicity are assessed by comparing TBT pore water data to relevant marine WQ GV – without dilution. This test assesses potential impacts on benthic organisms exposed to sediment pore water after disposal. Toxicity testing does not apply to TBT because standard tests are unresponsive except at high levels (page 43), however the marine WQ GVs are based on chronic toxicity and, if exceeded, indicate that TBT is bioavailable and likely to be toxic.

Test results are normally compared to the relevant ANZECC/ARMCANZ (2000a, b) marine water quality trigger values for 95% protection (0.006 µg Sn/L), or subsequent updates to these values. Except where the water body has been zoned to have a higher (or lower) level of protection, in which case the relevant ANZECC/ ARMCANZ (2000a, b) trigger values, or subsequent updates to these values, are to be used. ANZG, 2018, recommends that, for bioaccumulating contaminants (such as TBT) the next most protective DGV should be used (e.g., 99% species protection rather than 95%, if the water body is zoned 95%).

If pore water cannot be obtained, which needs to be established to the satisfaction of the DA, elutriate data can be used to **estimate** pore water concentrations. If the TBT data is above the GV without dilution, the spoil is unacceptable for sea disposal. For marine areas zoned for a high level of ecological protection, any significant toxicity may render the sediments unacceptable for ocean disposal in that area (Section 4.2.4, page 14).

If the TBT data for pore water or elutriate water is below the relevant marine WQ GV, but the sediment TBT level (95% UCL) exceeds the sediment quality guidelines (SQG)-High value of 70 µg Sn/kg in Table 4, bioaccumulation testing is required in PHASE IV. Organisms can also be exposed to contaminants by contact with or consumption of the sediment, or by consuming other organisms, and bioaccumulation may be of concern even where toxicity has not been identified.

PHASE IV – Assess TBT bioaccumulation

Reference:

- Section 4.2.4, page 14
- Appendix A, pages 43, 44-46
- Appendix D, pages 62-63
- Simpson et al., 2013.

Where bioaccumulation is rated as very significant or significant (columns 2 and 3 of Table 3, respectively) **in any of the tests on any of the samples**, if the proponent wishes to dispose of this material at sea they would need to check existing data to see if a hot spot can be identified. If not, carry out step-out sampling (i.e. collect two or more samples stepped out at appropriate distances from the sample or samples in which bioaccumulation has been identified, in order to determine the extent of the contamination).

These samples would be tested for chemistry as per NAGD PHASE II (page 13) and bioaccumulation as per PHASE IV (page 14). Then:

- If any hot spots are identified, sediments within them are unacceptable for sea disposal.
- If no hot spot is found, and bioaccumulation only occurs in one sample, the spoil is acceptable.

- If bioaccumulation is identified at scattered locations throughout the dredge area that do not constitute hot spots, with the agreement of the DA a Weight-of-Evidence (WOE) assessment may be carried out.

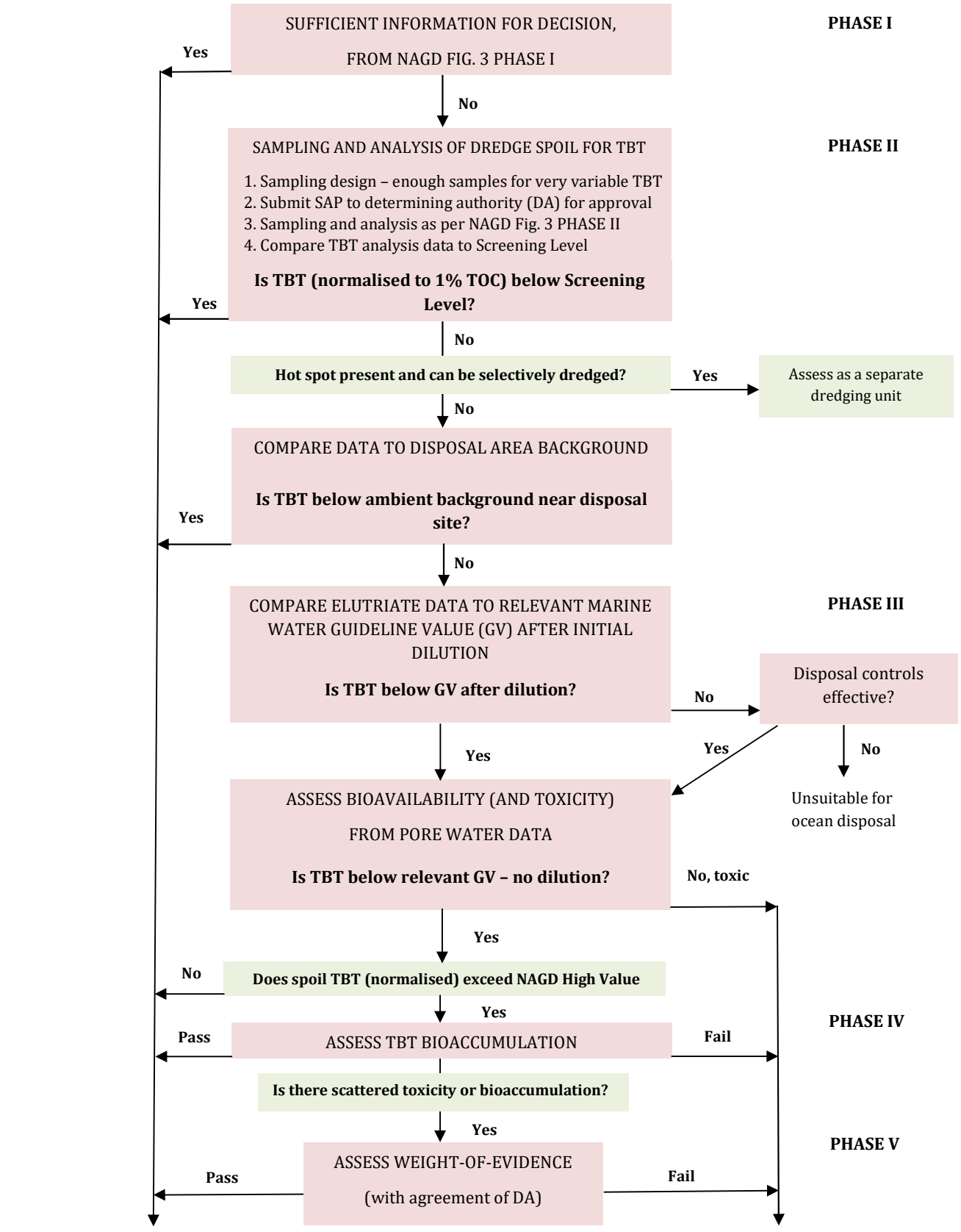
PHASE V – Assess Weight-of-Evidence

Reference:

- Section 4.2.4, page 15
- Appendix A, page 48
- Table 3, page 46

More detailed WOE procedures, and examples, are set out in Simpson et al., 2013. If the WOE is passed the spoil is acceptable for sea disposal. If the WOE is failed, the spoil is unacceptable for unconfined ocean disposal.

Figure 1. Clarification of the National Assessment Guidelines for Dredging 2009 (NAGD) decision tree for assessment of tributyltin (TBT) in dredge spoil



TBT content of spoil suitable for unconfined ocean disposal. Evaluate impacts etc.

TBT content of spoil not suitable for unconfined ocean disposal. Investigate treatment, confined disposal options or on-land disposal.

References

ANZECC, ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Volume 1: The Guidelines. Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT, October 2000.

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Simpson, SL, Batley, GE and Chariton, AA 2013. Revision of the ANZECC/ARMCANZ 2000 Sediment Quality Guidelines. CSIRO Land and Water Science Report 08/07. Prepared for the Department of Sustainability, Environment, Water, Population and Communities.

USEPA 2015. ProUCL Version 5.1, User Guide. US Environmental Protection Agency, EPA/600/R-07/041, October 2015.

Further information

Email: seadumping@awe.gov.au

Web: http://www.environment.gov.au/marine/publications/national-assessment-guidelines-dredging-2009

Appendix H – SAP FOR OFFSHORE SPOIL GROUND, 2022 - 2032

REPORT

Offshore Spoil Ground Sampling and Analysis Plan

2022-2032 Ten Year Maintenance Dredging
Sea Dumping Permit

Client: Port of Newcastle

Reference: PA2776_RP2108121505
Status: Final/P01.02
Date: 14 February 2022

Royal HaskoningDHV
Enhancing Society Together

HASKONING AUSTRALIA PTY LTD.

Level 15
99 Mount Street
North Sydney NSW 2060
Water & Maritime
Trade register number: ACN153656252

+61 2 8854 5000 **T**
project.admin.australia@rhdhv.com **E**
royalhaskoningdhv.com **W**

Document title: Offshore Spoil Ground Sampling and Analysis Plan

Document short title: Offshore Spoil Ground SAP
Reference: PA2776_RP2108121505
Status: P01.02/Final
Date: 14 February 2022
Project name: SAP Report
Project number: PA2776
Author(s): Ali Watters

Drafted by: Ali Watters

Checked by: Greg Britton

Date: 14/02/22

Approved by: Greg Britton

Date: 14/02/22

Classification
Project related

Royal HaskoningDHV

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Appendices

1 INTRODUCTION

Port of Newcastle (PON) undertakes regular maintenance dredging of Newcastle Port ('the Port"). The current spoil ground for disposal of the maintenance dredge material is located off Newcastle approximately 3 km south-east of Nobbys Head in 25 to 30 m of water (refer **Figure 1**).

PON is responsible for maintaining the declared depths of the navigation channels, swing basin and berthing boxes and batters throughout the Port. The former Department of Sustainability, Environment, Water, Population and Communities (SEWPaC), now Department of Agriculture, Water and the Environment (DAWE), granted Newcastle Port Corporation (now PON) a 10 year maintenance dredging Sea Dumping Permit for the period from March 2012 until March 2022. The permit was reissued in 2014 to PON, following privatisation of the Port, for the remaining 8 year period (permit number SD2014/2642).

PON is submitting the next ten year maintenance dredging sea dumping permit application (2022-2032) to DAWE. A Long Term Monitoring and Management Plan (LTMMP) that covers the management of dredging at the Port over the life of the permit needs to be submitted along with the permit application and be approved by DAWE prior to the issuing of the new Sea Dumping Permit.

The LTMMP (RHDHV, 2021) includes a proposed program of sediment sampling and analysis in accordance with the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009) within the maintenance dredge areas and at the offshore spoil ground.

Previous offshore spoil ground sampling and analysis plans (SAPs) were implemented in 1989, 1992, 2002, 2009 and 2017 i.e. at about 7 to 10 year intervals. Accordingly, PON proposes to implement this offshore spoil ground SAP within the ten year timeframe of the new Sea Dumping Permit.

A flowchart showing how this offshore spoil ground SAP fits in with the overall timing of other monitoring activities associated with LTMMP, such as the SAP for the Maintenance Dredge Areas (referred to as Areas A to G) is provided in **Figure 2**, giving an indicative implementation date for the offshore spoil ground SAP of 2027. Figure 2

Although the behaviour (dispersion) of the maintenance dredge material placed offshore of Newcastle is well understood, sampling is required to confirm the biological, chemical and physical properties of the sediment at the spoil ground. Broader sampling is also required to re-confirm the dispersion pathway of the sediment using the chemical and physical properties of the sediment as tracers.

This report outlines the proposed SAP for the sediment sampling and testing program at the offshore spoil ground, together with the broader offshore sampling and testing program. The SAP has been prepared in accordance with recommendations outlined in the NAGD (Commonwealth of Australia, 2009). The SAP includes the following elements:

- evaluation of the site history and available data;
- objectives of the SAP;
- maps showing the proposed sampling locations;
- estimates of the number of samples including field and split triplicates;
- methods and procedures for sampling;
- details of methods for sample handling, preservation, storage and quality control and quality assurance (QC/QA); and
- list of analyses required, detection limits and laboratory QC/QA procedures.

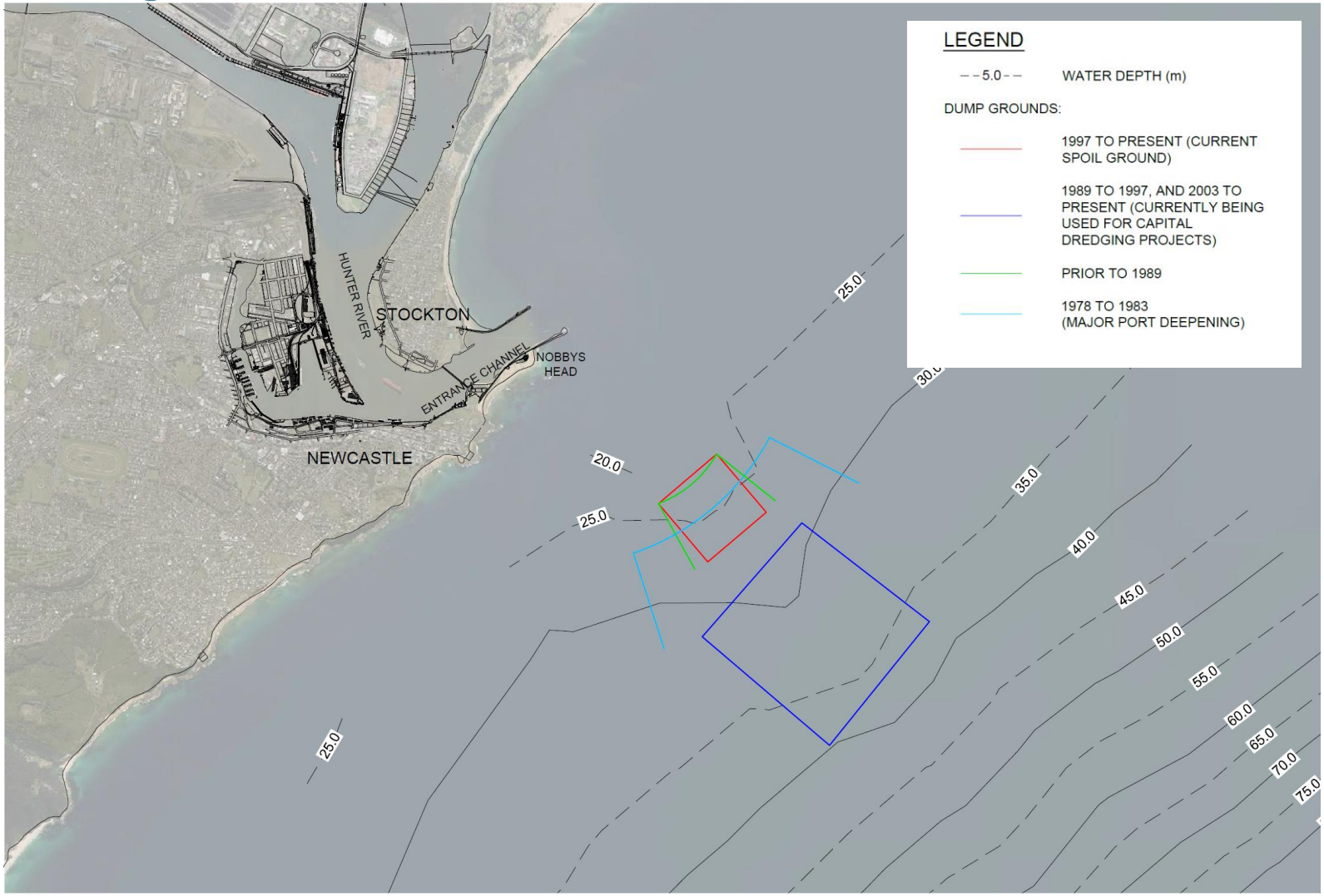

Figure 1 Proposed Spoil Ground Location for Maintenance Dredge Material (red outline)

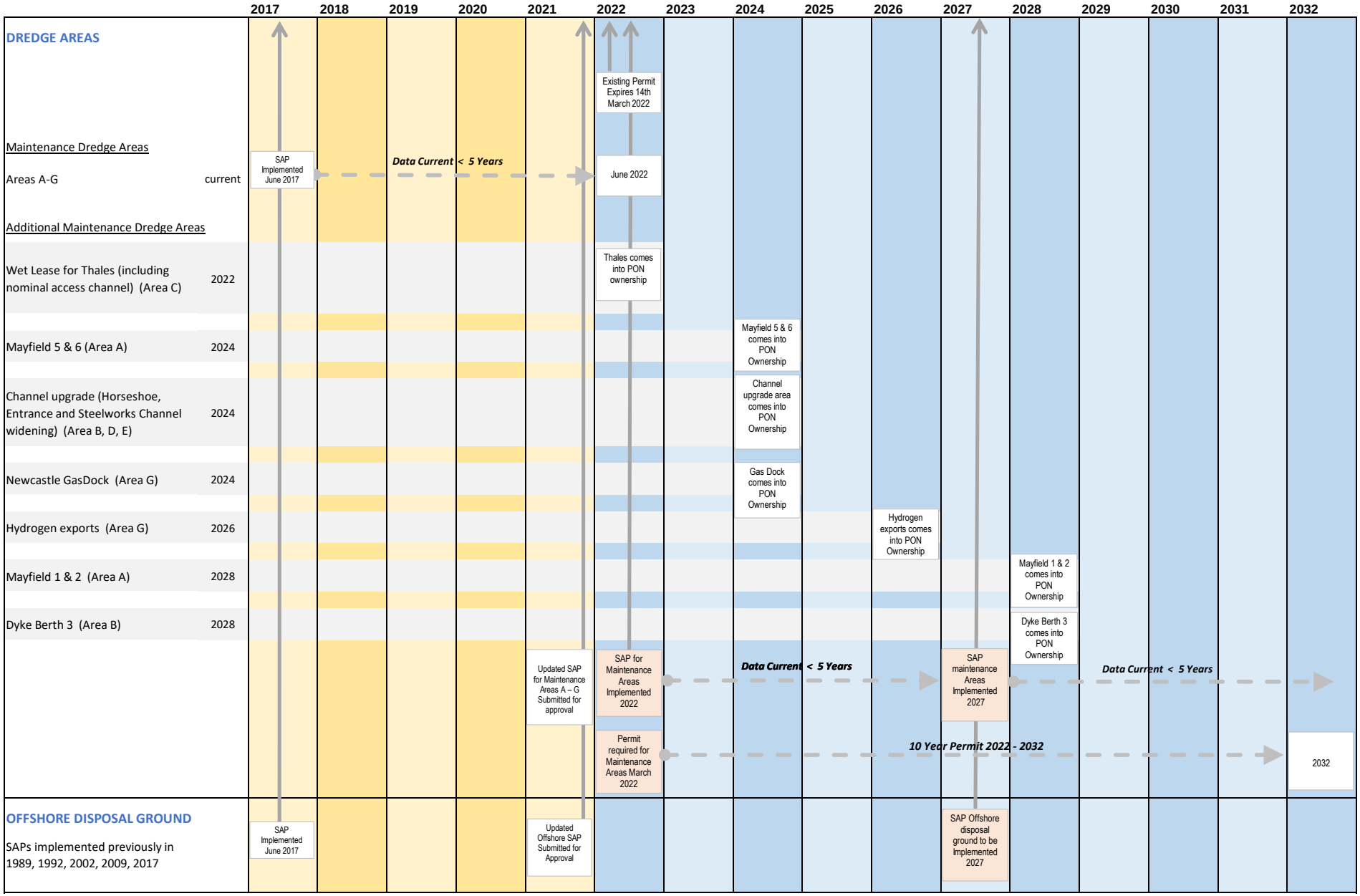

Figure 2 Flowchart with Indicative Timing of Offshore Spoil Ground SAP Implementation

2 COMPILATION & REVIEW OF EXISTING DATA

2.1 Site History

The spoil ground off the Port for maintenance dredging material is situated approximately 3 km south-east of Nobbys Head in 25 to 30 m of water (refer **Figure 1**). This spoil ground is the same site as that used for the 2012- 2022 10 year permit. The area is approximately rectangular in shape as defined by the following coordinates in WGS84:

- 32○ 56.10' S 151○48.94' E
- 32○ 55.77' S 151○49.40' E
- 32○ 56.16' S 151○49.79' E
- 32○ 56.49' S 151○49.32' E

Between 1989 and February 1997, the disposal site was located further offshore, some 4.5 km south-east of Nobbys Head in water depths of 30 to 40 m (refer **Figure 1**). This disposal site is referred to as the "former spoil ground" in this report. A spoil ground was also been set aside for the major port deepening project between 1978 and 1983 (refer **Figure 1**). This spoil ground was used until 1989.

The former spoil ground has recently been used for disposal of capital dredge material from the M7 berth expansion by Stolthaven (2017-2018) and is located in the sediment dispersion pathway from the current maintenance dredging spoil ground. Disposal of capital dredge material from the M7 berth and/or other capital dredging and disposal activities proposed before 2027 may have an effect on the results of the sediment sampling and testing proposed herein.

The dredging and disposal activities undertaken for capital dredging projects are carried out under separate approvals and capital dredging permits and not under PON's maintenance dredging permit.

2.2 Existing Sediment Data

A number of offshore sediment studies have been conducted for the current and former spoil grounds, which are discussed below.

2.2.1 Mobility studies for dumped dredge spoil

Sediment sampling and testing was undertaken in 1992 as part of the Stage 2 Mobility Study for Dumped Dredge Spoil off the Port of Newcastle (Patterson Britton & Partners, 1992). This study can be summarised as follows:

- Physical analyses were undertaken on 167 sediment samples collected in the vicinity of the former spoil ground and around the mouth of the Hunter River. The purpose of this testing was to determine the main dispersion zone of sediments from the former spoil ground area.
- Chemical analyses were carried out on 7 sediment samples collected in the vicinity of the former spoil ground and around the mouth of the Hunter River. The purpose of this testing was to assist in verification of the sediment dispersion model and to give some context to the pollution impacts of the dredge spoil disposal.
- Sidescan sonar data collected at locations near the mouth of the Hunter River revealed the existence of sand, surface mud and zones of strewn rock, likely associated with the major port deepening works undertaken in the late 1970s and early 1980s (The Ecology Lab, 2003).

- Results of the physical analyses showed localised accumulation of muddy sediments in the former spoil ground and around the mouth of the Hunter River. The dispersion pathway of mud from the former spoil ground was found to be relatively contained, bounded generally within a zone 5 km north and south of the former spoil ground and out to a water depth of 60-80 m. The destination zone for the finer muddy fraction of the dredge material was found to be south to south-east of the former spoil ground in a water depth of 60 m and possibly out to 100 m water depth.
- Relatively high proportions of rock fragments were identified at placement locations, while a "lithic corridor" was shown to join the former spoil ground zone with the entrance to the Hunter River.
- Results of the chemical analyses showed that the spoil ground mud contamination levels were significantly lower than the harbour mud contamination levels. Muds from the spoil ground contained elevated levels of contaminants compared to the natural sediments of the surrounding inner shelf. However, once dispersed, the spoil ground "signature" sediments (rock fragment rich) do not retain the contaminants and background levels appear to be effectively re-established.

2.2.2 Hunter Environmental Monitoring Program

Sediment sampling and analysis was undertaken from 1992 to 1995 in the former spoil ground by the NSW Environment Protection Authority (EPA), forming part of the EPA's Hunter Environmental Monitoring Program. This study is documented in Patterson Britton & Partners (1996) which can be summarised as follows:

- Physical and chemical analyses were undertaken on over 60 sediment samples collected from the former spoil ground and reference areas.
- Results of the physical analyses indicated high variability within the sediment samples, which included harbour material and other samples that contained more sand, probably from the original substratum.
- Sediments at the spoil ground were found to be finer and had a greater proportion of total organic carbon (TOC) compared to sediments sampled at the reference areas.
- Heavy metals testing showed significant spatial and temporal variation which may be explained by sediment heterogeneity and/or the dumping history. Metals in sediments were found to be significantly higher at the spoil ground than at the controls but this may have been partly due to the spoil ground sediments having a greater proportion of mud.

2.2.3 ROV investigations

A remotely operated vehicle (ROV) investigation of the current spoil ground and adjacent areas was undertaken in July 2001 to provide comparative data on their biological and physical status. This study is documented in Patterson Britton & Partners (2001) which can be summarised as follows:

- Physical and chemical analyses were undertaken on 18 sediment samples.
- Sediments at the current spoil ground were shown to differ from sediments in similar depths elsewhere off Newcastle in that they contain significant, albeit variable, quantities of mud and other material derived from disposal activities.
- Contaminant concentrations in the current spoil ground were elevated compared to control sites however were generally below ANZECC/ARMCANZ (2000) interim sediment quality guideline (ISQG)-Low Values.

- ROV footage showed the current spoil ground contained areas of gravel, rock and boulders, particularly in the south-eastern portion of the spoil ground, which would have been the result of capital dredging activities associated with the major port deepening between 1978 and 1983.
- It was concluded that the mud content and existence of other materials in the sediments from the current spoil ground (rock fragments, brick fragments, slag and the like), which could only have been introduced by disposal activities, would continue to serve as powerful “tracers” to verify the sediment dispersion pathway from the current spoil ground into deeper water.
- The biodiversity and benthic productivity in the sediments at the spoil ground was found to be reduced compared to nearby areas in similar water depths, situated beyond the influence of the disposal activities. This was considered most likely due to the differing physical characteristics of the sediment samples from the spoil ground, i.e. mud content, rather than due to contamination concentrations since the concentrations of contaminants in the samples from the spoil ground were generally below the ANZECC/ARMCANZ (2000) interim sediment quality guideline (ISQG)-Low Values (hence there is a low probability there would be effects on benthic biota).

2.2.4 Benthic investigations

Sediment sampling and testing was undertaken in 2003 as part of a baseline study of the benthic ecology prior to disposal of capital dredged material from the South Arm of the Hunter River. This study is documented in The Ecology Lab (2003) which can be summarised as follows:

- In total, 72 sediment samples were taken from the former spoil ground and at two control sites.
- Analysis of the physical properties of the sediment samples revealed that the former spoil ground had a different sediment composition to the control sites, particularly in the shallow depth stratum. The sediments within the spoil grounds were shown to have a higher proportion of rock fragments, whilst also exhibiting higher mud contents, consistent with the convective descent model for bottom dumping of dredged material
- In general, these results indicated that there is a strong sedimentological signature in the spoil ground areas, which is consistent with the findings from the 1992 and 2002 sampling. Sediments in the former spoil ground had undergone little change since 1992, despite the placement of approximately 1 million m^3 of dredge material between 1992 and 1997

2.2.5 Sediment sampling and testing for the PON Long Term Permits

Sediment sampling and testing was most recently undertaken in 2017 for the 2012 to 2022 permit in accordance with the approved SAP. This study and the results outlined below are documented in RHDHV (2017).

Sediment sampling and testing was also undertaken in 2002 (Patterson Britton & Partners, 2002) for the disposal activities between 2002 and 2005 and in 2009 (WorleyParsons, 2009) for disposal activities from 2005 to 2012. The findings from 2017 were generally consistent with the 2002 and 2009 investigations.

Sediment Sampling and Testing

Physical and chemical testing of sediment samples retrieved from the current spoil ground and surrounding offshore area during the Offshore Sediment Sampling and Testing program (RHDHV 2017) included physical analysis of 42 samples for:

- mud, sand and gravel content;
- particle size distribution of the sand and gravel fraction;
- percentage rock fragments in the sand and gravel fraction; and

- sediment facies type according to one of the six facies types found on the inner shelf in the Newcastle region as described in Patterson Britton & Partners (1992).

Chemical analysis of 42 samples (including field triplicates, split triplicates and a field blank) involved testing for:

- a suite of heavy metals;
- total organic carbon (TOC);
- tributyltin (TBT); and
- Polynuclear Aromatic Hydrocarbons (PAHs).

Physical Analysis Results

Similar to the 2009 investigation, the mud fraction plot in **Figure 3** shows that very little mud (0-trace 5%) was found in the inner shelf plain sediments to the north and south of the current spoil ground as well as inshore of the current spoil ground. A localised accumulation of muddy sediment is evident within the offshore half of the current spoil ground.

Patterson Britton & Partners (1992) found that offshore at around the 50m depth contour, the regional distribution of the naturally dispersed muddy sediments of the outer areas of the inner shelf plain and of the inner shelf slope dominate, masking the current spoil ground mud dispersion pathway. In addition, regionally, the mud content of the sediments was found to increase across the inner shelf from a depth of about 50m where 5% mud is typical to a depth of about 100m where approximately 50% mud occurs with carbonate sands (Patterson Britton & Partners, 1992). This typical regional distribution of mud was evident in the mud fraction results for the 2017 sampling exercise and is clearly shown in **Figure 3**.

The contour plot showing the rock fragments in the sand fraction clearly shows where disposal activity has taken place, with areas of the former spoil ground and current spoil ground containing sediments with greater than 5% rock fragments (refer **Figure 4**). The contours were drawn by linear interpolation with limited smoothing.

The sedimentary facies identified were the same as the six types defined in Patterson Britton & Partners (1992) and in general their distribution was the same as demonstrated in the 1992, 2002 and 2009 work.

Chemical Analysis Results

The mean concentrations and the 95% upper confidence limit of the mean concentrations for contaminants in all areas investigated were below the NAGD screening level and showed no significant changes in contamination concentrations within each zone compared to the 2009 investigation results (refer **Table 1**).

Although the 95% upper confidence limit of the mean concentrations were below the NAGD screening level, the destination zone for muds, located offshore of Newcastle Port in water depths of around 60 to 100 m, contained sediments with elevated concentrations of contaminants compared to the clean sands of the inner shelf. However, the concentrations of contaminants detected in the destination zone are typical of background concentrations found worldwide, including along the NSW coast.

Conceptual Model of Dispersion of Dumped Material

The Stage 2 Mobility Study for Dumped Dredge Spoil (Patterson Britton & Partners, 1992) presented a conceptual model of the far field dispersion of dumped dredge material from Newcastle Port. The conceptual model was developed when the spoil ground was located further offshore in water depths of 30 to 40m (the former spoil ground).

The model indicated that a “convective decent/dynamic collapse” process takes place with some 95% to 99% of the dumped material falling directly to the seabed.

The far field dispersion pathway of the dumped sediment to the destination zone as described by the 1992 model investigations is as follows:

- the dispersion pathway for dumped mud is in a south easterly direction away from the current spoil ground;
- a zone with boundaries approximately 5km north and south of the current spoil ground and out to a water depth of around 60m is influenced by sediments dispersed from the current spoil ground; and,
- the destination zone for the dumped muds is south east of the current spoil ground in water depths of 60 to 100m.

Further sediment investigations at the spoil ground and surrounding area were undertaken in 2002 (Patterson Britton & Partners, 2002) and again in 2009 (Worley Parsons, 2009) to meet the requirements of the PON’s sea dumping permits. The 2002 and 2009 investigations used the physical and chemical properties of sediments offshore of Newcastle Port (in particular the physical properties of mud content and rock fragments) as tracers to confirm the dispersion pathway of dumped sediment from the current spoil ground to the destination zone identified in the 1992 investigations.

The only minor amendment to the conceptual model of the far field dispersion of dredge material developed for the Stage 2 Mobility Study for Dumped Dredge Spoil (Patterson Britton & Partners, 1992) was that due to the relocation of the current spoil ground closer inshore, the mud fraction results indicate the dispersion pathway now extends approximately 6 to 7km south of the current spoil ground rather than 5km as determined in the 1992 work.

The recent 2017 sediment sampling and testing provided a consistent picture for the dispersion pathway of the sediment identified in the 2002 and 2009 investigations. The conceptual model of the dispersion pathway is presented in **Figure 5**. In particular, the results of the physical and chemical testing of the samples recovered at the four locations inshore of the current spoil ground (IS1, IS2, IS3 and IS4) confirmed the offshore movement of the mud from the spoil ground. Samples at these inshore locations had very low mud content, contamination concentrations below NAGD screening level (SL) and no “exotic” rock fragments typical of dredged material.

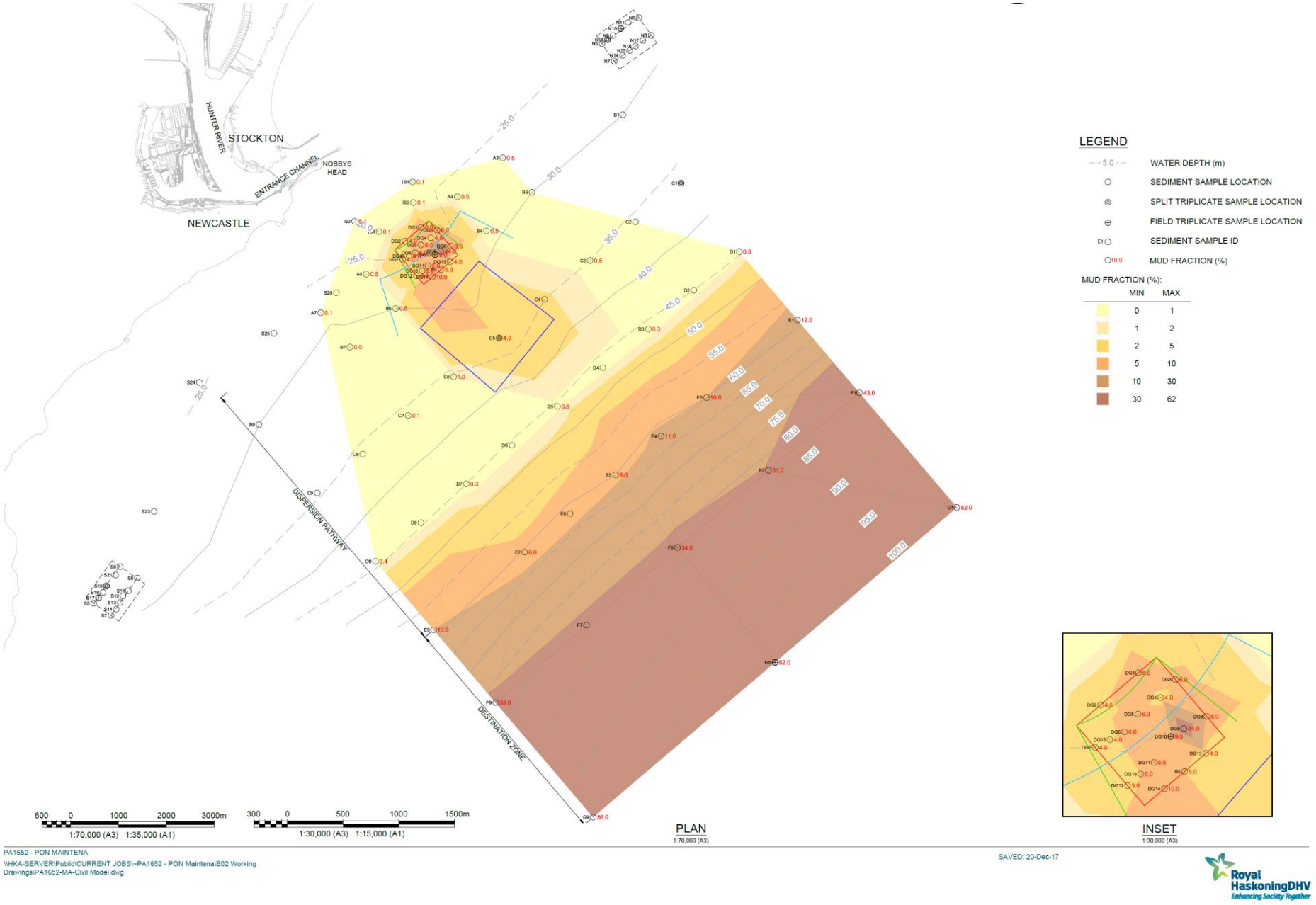

Figure 3 Mud Fraction (Source: RHDHV 2017)

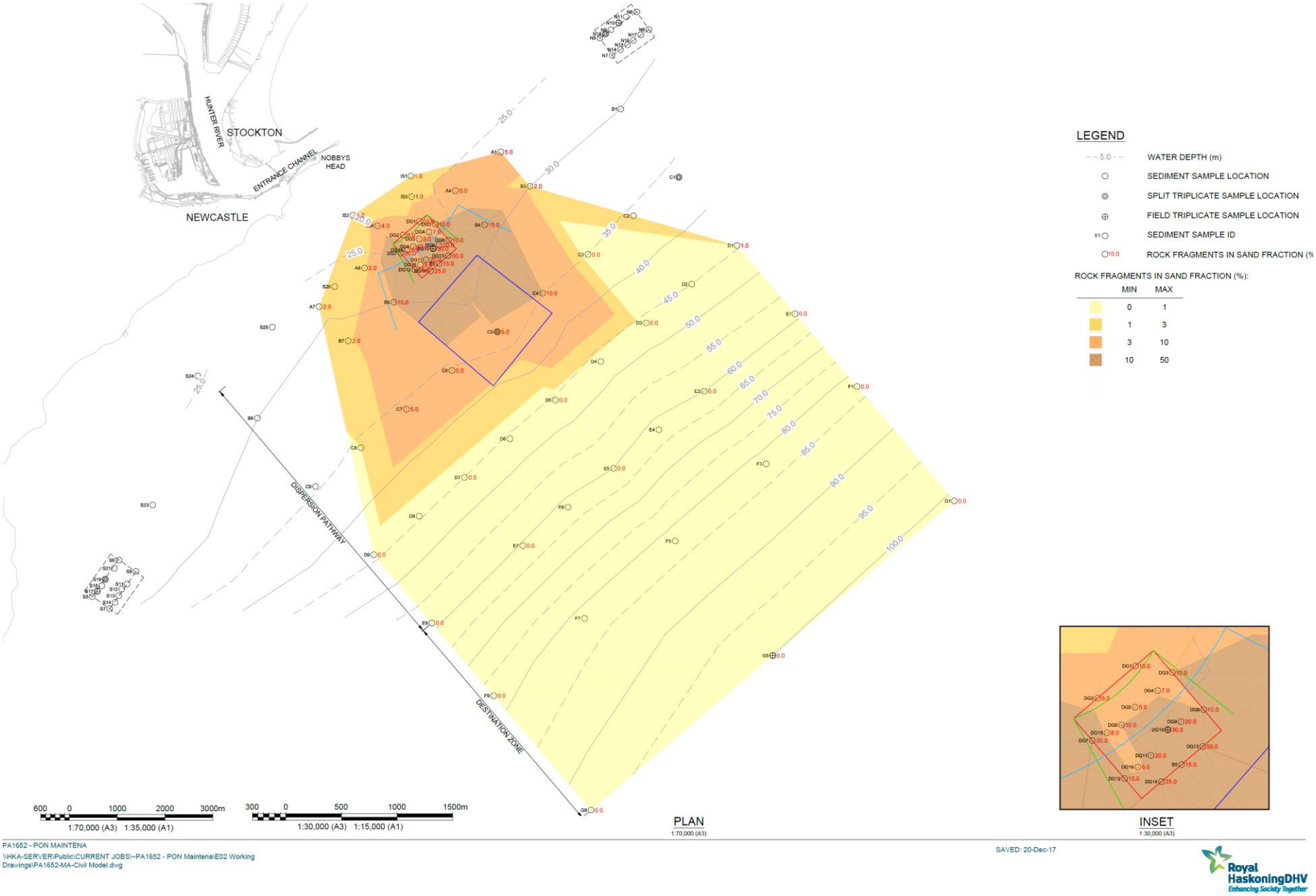

Figure 4 Rock Fragments in the Sand Fraction (Source: RHDHV 2017)

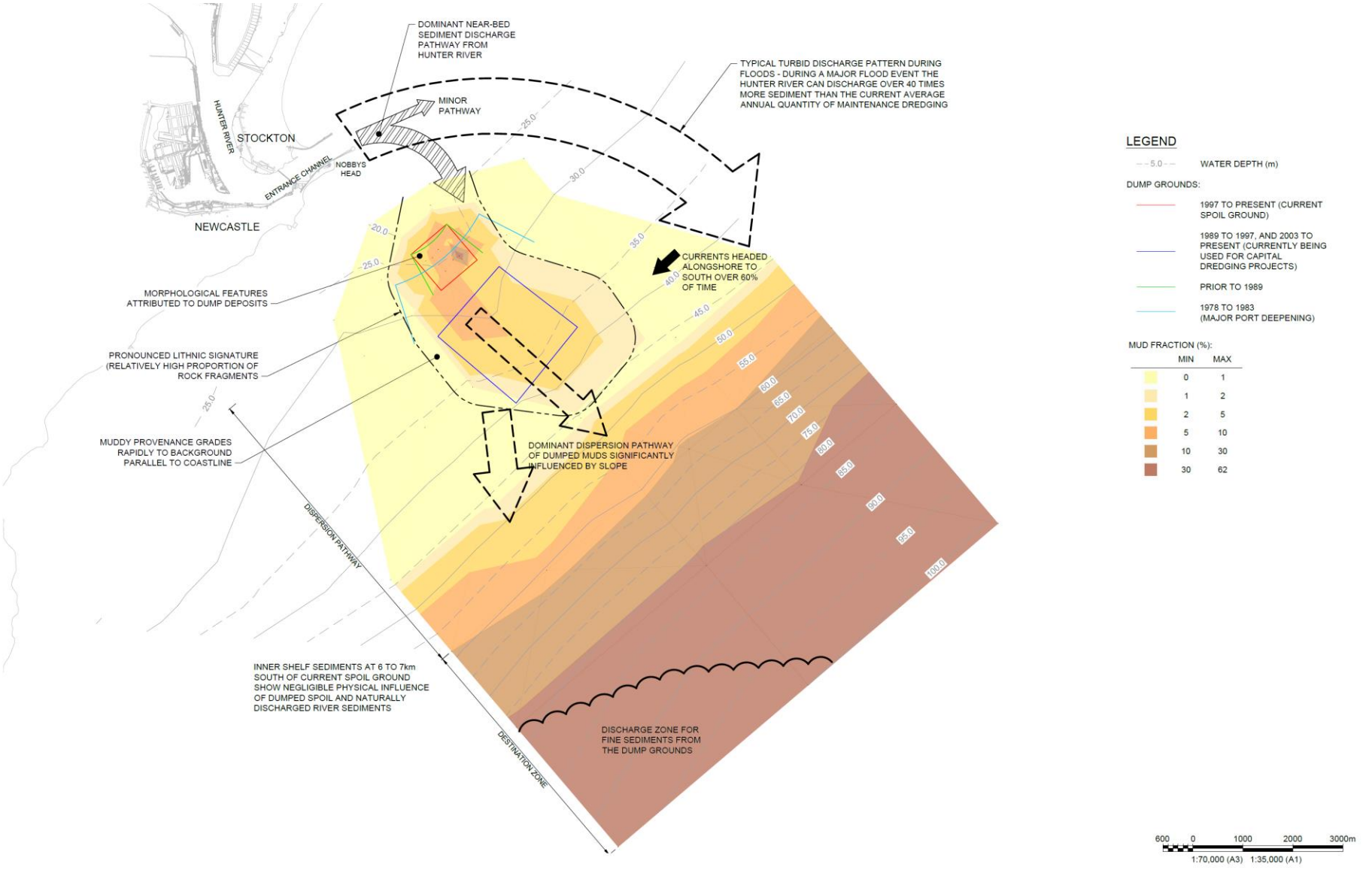

Figure 5 Conceptual Model of Far Field Dispersion of Dredge Material (Source: RHDHV 2017)

Table 1: Mean and 95% UCL of the mean concentration of contaminants for the spoil ground for the 2017 investigation and 2009 investigation

Contaminant	Screening Levels	Results for 2017 Investigation								Results for the 2009 Investigation							
		Inshore Zone		Current Spoil Ground		Dispersion Pathway		Destination Zone		Inshore Zone		Current Spoil Ground		Dispersion Pathway		Destination Zone	
	SL	mean (mg/kg)	95% UCL (mg/kg)	mean (mg/kg)	95% UCL (mg/kg)	mean (mg/kg)	95% UCL (mg/kg)	mean (mg/kg)	95% UCL (mg/kg)	mean (mg/kg)	95% UCL* (mg/kg)	mean (mg/kg)	95% UCL* (mg/kg)	mean (mg/kg)	95% UCL* (mg/kg)	mean (mg/kg)	95% UCL* (mg/kg)
arsenic	20	4.07	5.18	4.42	4.78	4.66	5.53	5.01	5.62	3.67	5.19	4.37	4.76	4.90	5.78	5.04	5.82
cadmium	1.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.07	<0.05	<0.05	<0.05	<0.05
chromium	80	2.17	4.41	5.26	7.45	2.68	3.11	13.88	18.23	2.25	7.62	6.34	9.39	4.22	5.38	19.90	25.77
cobalt	--	1.87	2.38	3.96	4.85	0.59	0.97	2.59	3.38	1.20	2.46	3.18	4.66	0.91	1.51	3.72	5.22
copper	65	6.03	18.54	3.00	4.74	0.62	0.81	3.87	5.18	2.55	3.50	4.33	7.21	1.56	2.62	5.84	8.30
lead	50	4.87	8.00	6.42	8.47	1.64	1.93	5.31	6.67	5.40	16.13	6.11	7.99	2.68	3.91	6.88	8.93
mercury	0.15	0.02	0.06	0.04	0.04	0.01	N/A	0.02	0.03	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.03	0.04
nickel	21	0.88	2.15	5.40	8.63	0.35	0.95	8.13	11.05	1.10	4.89	5.04	7.84	1.43	2.42	11.91	16.54
selenium	--	0.07	0.12	0.13	0.25	0.05	N/A	0.26	0.34	0.05	0.05	0.18	0.21	0.09	0.14	0.44	0.58
zinc	200	17.90	40.43	32.82	45.49	4.61	5.82	22.78	29.34	12.70	45.53	31.24	47.79	9.68	16.61	25.82	34.27
total PAH	10	0.17	0.47	0.94	2.51	0.04	0.13	0.60	0.78	0.17	1.18	0.90	1.46	0.25	0.41	0.88	1.05
Number of samples		4		16		15			10	2		8		13		10	

Notes

95% upper confidence limit of the mean level. eg if the 95% UCL=4.3 mg/kg there is a 95% probability that the mean level of the contaminant will not exceed 4.3 mg/kg.

Screening Levels (SL) as per the National Assessment Guidelines for Dredging (Commonwealth of Australia, 2009).

** 95% confidence limit of the mean level calculated using the recommendations of the National Assessment Guidelines for Dredging (2009).*

3 PROPOSED SEDIMENT SAMPLING AND ANALYSIS

3.1 Sampling Program Design

The objectives of this SAP are to:

- confirm the biological, chemical and physical properties of sediments at the current spoil ground;
- confirm the dispersion pathway of the dredge spoil placed at the current spoil ground using the chemical and physical properties of the sediments as tracers; and
- determine whether dredged material disposal has had a measurable effect on benthic community structure (diversity and abundance) in the current spoil ground.

Previous sampling and analysis exercises described in **Section 2** demonstrate that the physical properties of surface sediments offshore of Newcastle Port can be used to identify the dispersion pathway of dredge material from the current spoil ground to its destination zone. In particular, mud content and rock fragments serve as powerful 'tracers' to confirm the dispersion pathway.

It is therefore proposed to continue to use the physical properties of the surface sediments to confirm the dispersion pathway of dumped sediment from the current spoil ground to its destination zone. Sediment contamination data will also be used to assist in verification of the dispersion pathway. Sediment contamination levels can also be compared to NAGD (Commonwealth of Australia, 2009) Screening Levels to assess the likelihood of adverse biological impacts.

As was undertaken for the 2017 investigations of the current spoil ground, sampling from four zones is proposed in order to confirm the dispersion pathway and compare bottom compositions (refer **Figure 6**). The four zones to be investigated are the:

- inshore zone;
- current spoil ground;
- dispersion pathway; and
- destination zone.

The bottom compositions in the current spoil ground will be compared to those throughout the dispersion pathway and destination zone. Previous studies have shown the dispersion pathway is bounded within 5 km north and 6-7 km south of the current spoil ground, while the destination zone for the muds is south-east of the current spoil ground in water depths of 60-100 m.

In addition to the four locations inshore of the current spoil ground added in 2017 (locations IS1, IS2, IS3 and IS4), six new locations inshore of the current spoil ground are proposed to be added to provide a greater sampling density and to provide more information inshore of the current spoil ground (this also allows better contouring of the data).

Sediment samples will also be collected from the two control sites previously sampled in 2017. This will allow an assessment of temporal variability to be undertaken at both the current spoil ground and control sites and to provide a measure of impact (and recovery) at the current spoil ground. The two control sites are located within 15km to the north and south of the current spoil ground. The control sites are in comparable water depths and have comparable dimensions to the current spoil ground.

3.2 Sample Locations

Samples for both physical and chemical analysis will be collected from 10 locations inshore of the current spoil ground, 14 locations within the current spoil ground, 29 locations within the dispersion pathway and 15 locations within the destination zone (refer **Figure 7**). In order to allow comparison of results over time, these sample locations are the same as those adopted for the 2009 and 2017 spoil ground investigations (except for 6 additional inshore locations).

Consistent with the recommendations made in the previous Ecology Lab (2001) survey, and as undertaken in 2017, twelve samples will be collected for biological analysis from each of the sites (current spoil ground, southern and northern control sites) (refer **Figure 7**). All samples at the control sites will also be analysed for chemical and physical properties.

PON's onboard GPS will be used to position the vessel at the nominated sampling locations. The GPS has an accuracy of +/- 0.1 m. However, following manoeuvring of the vessel into position and recovery of the sample from the ocean bed, the sampling is likely to have an accuracy of +/- 5 m, depending on ocean conditions.

3.3 Sample Collection

Collection of the sediment samples will be undertaken by PON personnel using a stainless steel Van Veen grab sampler deployed from the PON survey vessel. Prior to use, the survey vessel will be thoroughly inspected and washed down. Any evident sources of contamination would be cleaned and covered in plastic to avoid accidental contamination of any samples.

The grab sampler will be lowered to the ocean bed at each sampling location where the jaws of the grab are triggered to close, penetrating the sediment. Standard operating procedures for the sediment sampling and subsampling are included in **Appendix 1**. The sampling will be supervised by a suitably experienced environmental scientist or engineer.

Sample processing will take place on the vessel immediately following recovery of the sample. From each sample retrieved by the grab sampler at each location, the following sampling process will be undertaken using a stainless steel spoon:

- two thoroughly homogenised sub-samples will be taken for chemical analysis in a 150 ml and a 250 ml laboratory pre-washed glass sampling jar with telfon lined lid;
- one thoroughly homogenised sub-sample will be taken for dioxin analysis in a 250 ml laboratory pre-washed glass sampling jar with aluminium foil lined lid;
- one thoroughly homogenised sub-sample will be taken for mud, sand and gravel content, and particle size distribution in a 250 ml ziplock bag; and
- one thoroughly homogenised sub-sample will be taken for analysis of composition and facies type in a 100 ml plastic specimen jar.
- A 1.5 litre sample will be taken for the analysis of benthos. Samples will be sieved and preserved as described in **Section 3.5**.

The lid of each sample container will be tightly screwed on to avoid loss of sample and the jar labelled with a unique identification number.

Sediment will typically adhere to the outside of the sample containers. To avoid cross contamination, after the lid is secured, the outside of each sample container will be thoroughly washed with ocean water.

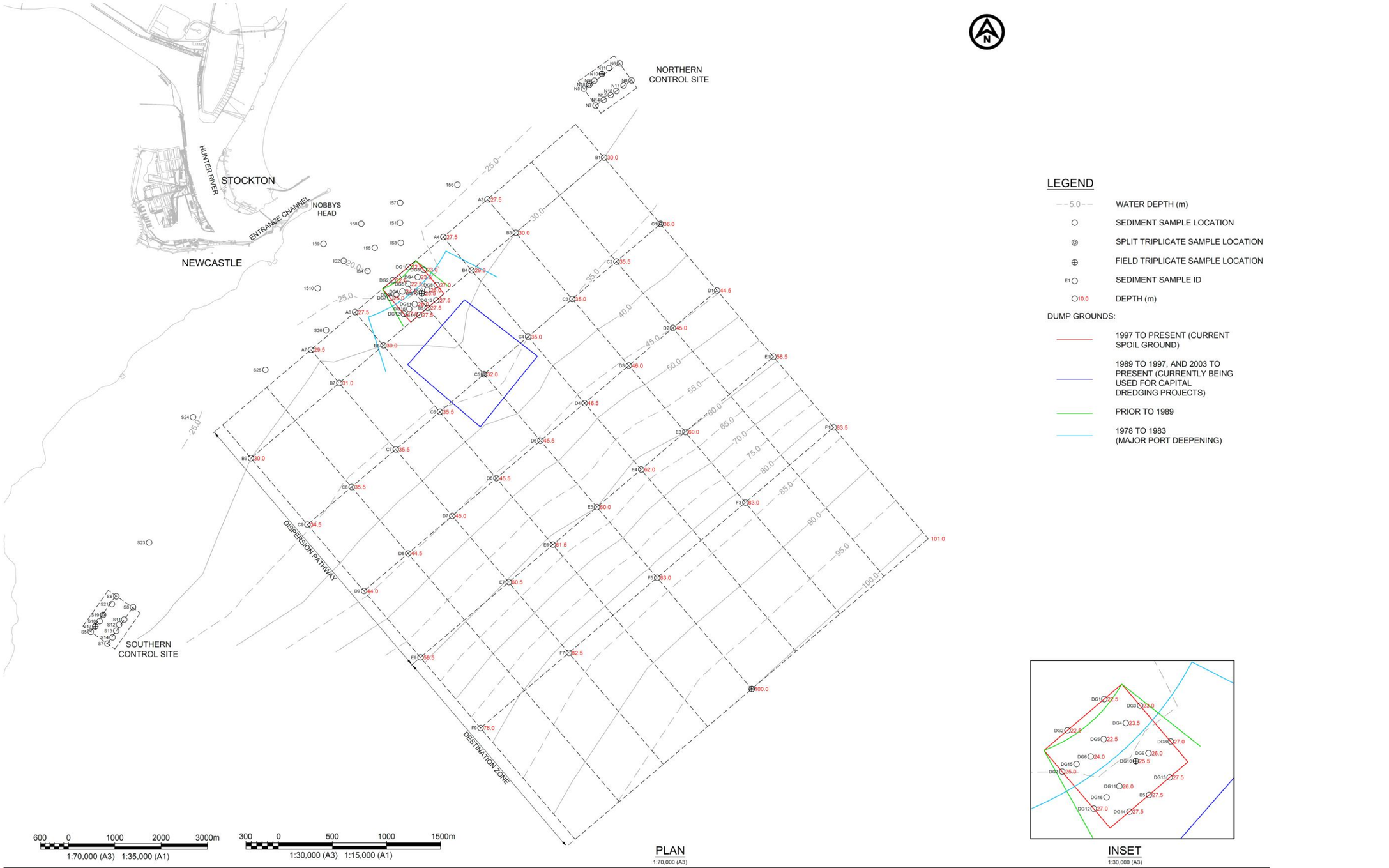

Figure 6 Sample Locations

Powder-free nitrile gloves would be used in the sampling process and changed after each sample.

Sampling date, time, water depth and sediment characteristics would be recorded in a field log. Photographs of each sample would be taken.

3.4 Field and Split Triplicate Samples

Field triplicate samples[1] will be collected from a total of eight locations comprising the following:

- one nominated sample location within the inshore zone;
- one nominated sample location within the current spoil ground;
- three nominated sample locations within the dispersion pathway;
- one nominated sample location within the destination zone;
- one nominated sample location within the northern control site; and
- one nominated sample location within the southern control site.

At all other sample locations only one sample will be retrieved. The nominated sample locations for field triplicate sampling are shown on **Figure 6**. Three samples (separate grab samples) will be collected from each nominated field triplicate sampling location. The field triplicate samples will be used to give an indication of the variability in the chemical and physical properties of the sediment at a sample location.

In addition, as part of QA/QC procedures, five split triplicate[2] samples will be collected comprising the following:

- one nominated sample location within both the current spoil ground;
- one nominated sample location within the dispersion pathway;
- one nominated sample location within the destination zone;
- one nominated sample location within the northern control site; and
- one nominated sample location within the southern control site.

3.5 Sample Preservation

Samples for chemical analysis will be packed in ice in an esky immediately after sampling to maintain the temperature below 4^{o}C. Samples will then be submitted to the analytical laboratories on the same day or the following morning. If overnight storage is required samples will be placed in a freezer.

All sediments for biological analysis will be sieved through a 1 mm mesh in the field and all retained material preserved in 10% formalin. A stain (Rose Bengal) will be added to facilitate sorting in the laboratory.

3.6 Equipment Decontamination Procedures

All sampling equipment will be decontaminated between each sampling event. Decontamination procedures will include rinsing equipment in ocean water to remove visible sediment, followed by a Decon 90 rinse.

[1] Field triplicates – 3 samples (separate grab samples) are taken at the same location to determine the variability of the sediment chemical properties.
[2] Split triplicate – at a location the sample is homogenised and split into three containers to assess variation associated with subsample handling. One of the three samples is sent to a second laboratory for analysis.

3.7 Sample Shipment

All sample containers will be clearly labelled with unique sample identification numbers. Samples for chemical analysis will be transported in an esky in ice to the NATA registered analytical laboratory.

All samples will be transported under chain of custody procedures.

3.8 Analysis Schedule

3.8.1 Analysis approach

Given that the behaviour of the maintenance dredge material disposed of offshore of Newcastle is well understood, it is proposed to carry out the analysis in a staged approach as undertaken in the WorleyParsons (2009) investigations and RHDHV (2017) investigations. As a first stage (Stage 1), analysis of samples from 38 locations (refer **Figure 7**) will be undertaken. These locations correspond with the 32 Stage 1 locations from the RHDHV (2017) investigation along with the 6 additional inshore locations in this investigation. If this number of locations is not sufficient to confirm the chemical and physical properties of the sediment at the current spoil ground and/or to confirm the dispersion pathway (e.g. insufficient data points to draw reliable contours of mud content), analysis of additional samples will be undertaken (ie. Stage 2).

All samples collected for biological analysis at the current spoil ground, northern control site and southern control site will be analysed as part of Stage 1

3.8.2 Biological analysis

Benthic fauna will be sorted to the lowest taxonomic level practicable, identified and counted. Samples will be sorted by qualified biologists, experienced with the processing of marine benthic samples. All taxonomic data will be checked against original data sheets.

3.8.3 Physical analysis

PON intends to engage a geologist/laboratory to undertake the physical analysis of the samples. The testing will include:

- mud (<63 µm), sand and gravel (>2 mm) content;
- particle size distribution of the sand and gravel fraction;
- percentage rock fragments in the sand and gravel fraction; and
- sediment facies type according to one of the six facies types on the inner shelf in the Newcastle region as described in Patterson Britton & Partners (1992).

3.8.4 Chemical analysis

The chemical testing will be undertaken by a NATA registered laboratory experienced in the analysis of sediments in accordance with the NAGD (Commonwealth of Australia, 2009). Chemical testing of each sediment sample will include a suite of heavy metals, total organic carbon (TOC), Polynuclear Aromatic Hydrocarbons (PAHs), tributyltin (TBT) and potentially dioxins. The contaminants and their required detection limit, as specified in the NAGD (Commonwealth of Australia, 2009), are listed in **Table 2**.

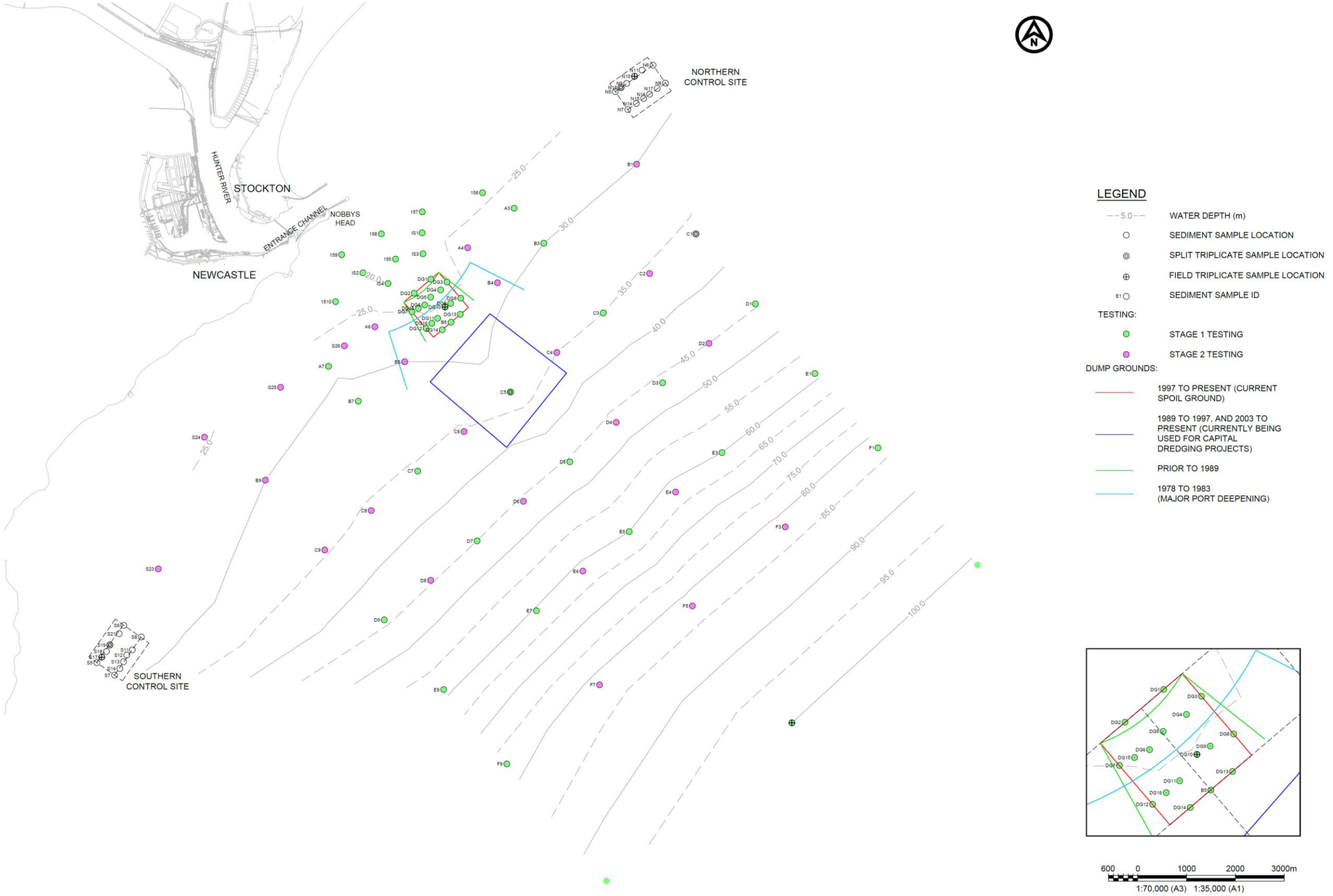

Figure 7 Proposed Stage 1 and Stage 2 Testing

In correspondence with PON in July 2021, DAWE advised the following.

> "Adequate characterisation of material proposed to be disposed of at sea is a requirement of the *Environment Protection (Sea Dumping) Act 1981 (Sea Dumping Act)* and the London Protocol, to which Australia is a Contracting Party. To satisfy this requirement, the department recommends that the Port of Newcastle includes dioxins, and dioxin like compounds in the suite of analytes tested in the 2022 SAP".

This advice from DAWE relates to testing the maintenance dredge material. However, if measurable quantities of dioxins, and dioxin like compounds are detected in the maintenance dredge material, testing for dioxins, and dioxin like compounds will also be undertaken for the spoil ground investigations in 2027.

Similarly, testing for PFAS compounds have been included in the maintenance dredge material SAP for the first time. If measurable quantities of PFAS compounds are detected in the maintenance dredge material in 2022, testing for PFAS compounds will also be undertaken for the spoil ground investigations in 2027.

Table 2 Contaminant detection limits

Contaminant	Detection Limit	Method
Arsenic	1 mg/kg	USEPA 6020
Cadmium	0.1 mg/kg	USEPA 6020
Cobalt	0.5 mg/kg	USEPA 6020
Chromium	1 mg/kg	USEPA 6020
Copper	1 mg/kg	USEPA 6020
Nickel	1 mg/kg	USEPA 6020
Lead	1 mg/kg	USEPA 6020
Mercury	0.01 mg/kg	APHA 3112 Hg-B
Selenium	0.1 mg/kg	USEPA 6020
Zinc	1 mg/kg	USEPA6020
PAHs	0.1 mg/kg (sum) 0.005 mg/kg (individual species)	USEPA6020
TOC	0.1%	in-house/Leco
tributyltin	1 µg Sn/kg	In-house GC/MS
PFAS – full suite (28 analytes)	0.0002-0.001 mg/kg	LC/MS-MS
Dioxins/furans	0.5-10 pg/kg	USEPA 1613B/8290

3.8.5 Data management procedure

Data management of the analysis results will be in accordance with the requirements of NAGD (Commonwealth of Australia, 2009). Validation of data will include evaluating the results from laboratory blanks, standard samples, field triplicate samples and split triplicate samples. After data validation, the data will be tabulated and the 95% UCL of the mean concentration for each contaminant will be calculated for each zone of the conceptual model of dispersion (ie. inshore zone, current spoil ground, dispersion pathway and destination zone). Results would be compared to results from previous investigations. Stage 2 testing of additional samples would be commissioned if necessary, to confirm the dispersion pathway of

sediments placed in the current spoil ground and chemical and physical properties of the sediments within the current spoil ground.

Samples will be traceable from the time of collection until the results are verified and reported. Sample chain of custody procedures provide a system for documentation of all information related to sample collection and handling to achieve the data objectives. Field data sheets and Chain of Custody (COC) forms will be used as the primary documentation to ensure that relevant information for each sample is properly recorded. The laboratory will issue a sample receipt notification (SRN) following receipt of the samples which will be checked against field notes and the SAP. Copies of the SRN, COC forms, and the field notes will be retained and included in the SAP Implementation Report.

Following laboratory analysis, the laboratory results and QA/QC results will be emailed for review so that any missing, unusual values / results (outside the data quality limits) can be queried and, if necessary, re-analysis carried out before the holding time for the samples has expired.

Field and analytical data quality indicators covering precision, accuracy, representativeness, comparability and completeness are outlined in **Table 3** and **Table 4** below.

Infauna data will be analysed using both multivariate and univariate procedures.

Multivariate analysis will be used to compare the abundance of all benthic invertebrate taxa between sites and also between survey periods. Multivariate analysis will also be used to correlate abundances of taxa with physical and chemical properties of the sediments.

Univariate analysis will be used to compare the abundances of the most common, individual taxa and also the total number of taxa and individuals. ANOVA will be used to test for differences between the current spoil ground and the average of the two control sites.

Table 3 Field Data Quality Indicators

Indicator	Frequency	Acceptance Criteria
PRECISION (a quantitative measure of the data variability)		
Sampling methodologies	All samples	Appropriate and complied with
Intra-lab duplicates/splits	5% of samples	<+/- 50% RPD
Inter-lab duplicates/splits	5% of samples	<+/- 50% RPD
Trip blanks/spikes (volatiles only)	1 per sampling	</= LOR for blanks, as per lab spec for spikes
ACCURACY (a quantitative measure of the closeness of reported data to the true value)		
Collection of rinsate blanks for re-used sampling or subsampling equipment	Where equipment re-used, 1 sample/day per item of equipment	CoCs below detection limit
Sampling methodologies	All samples	Appropriate and complied with
REPRESENTATIVENESS (qualitative confidence that data obtained are representative of each sampled medium)		
Sampling, subsampling, sample handling and storage appropriate for the history and contamination status of the sediments, the study objectives and the media/analytes	All media & all analytes	All samples collected and handled according to SAP
COMPARABILITY (qualitative confidence that data collected in separate sampling events is equivalent)		
SAP for sample collection, subsampling and handling. Same methods used each day; same types of samples collected	All samples	All samples collected and handled in accordance with SAP, by experienced professionals
COMPLETENESS (the amount of useable data, as a % of total data collected. Goal is 95% or more valid data)		
Chain-of-Custody forms (COCs), sample descriptions and sample location data complete	All samples	All samples
All critical locations sampled; all samples collected	All samples	All samples collected & analysed according to SAP
Completeness objective met (ie percentage of data suitable for use, 95% of all data)	All data	Minimum 95% of all data on submitted samples validated as suitable for use
Methodologies	All samples	Sampling in accordance with NAGD, 2009, and other relevant standards for marine sampling, as appropriate

Table 4 Laboratory Data Quality Indicators

Indicator	Frequency	Acceptance Criteria
PRECISION (a quantitative measure of the data variability)		
Lab duplicates (separate subsamples from jar, not aliquot splits)	1 per batch or 20 samples	<5 x LOR = no limit on RPD. >5 x LOR = 0-50% RPD
ACCURACY (a quantitative measure of the closeness of reported data to the true value)		
Matrix spikes Matrix spike duplicates	1 per lab batch or 20 samples 1 per lab batch or 20 samples	Recovery 70% - 130% for inorganics/metals, 60-140% for organics, or as per lab requirement RPDs should be less than 35%
Surrogate spikes	All organic analyses	Recovery 70% - 130% for inorganics/metals, 60-140% for organics, or as for lab requirement
Lab method and reagent blanks	1 each per batch	</= LOR
Control samples	1 per lab batch or 20 samples	Recovery 70% - 130% or as for lab requirement
Analysis of CRMs (for metals) or in-house standards certified against CRMs	All sediment metal analyses, 1 per batch	<+/- 35% RPD, recovery 70% - 130% or as per lab requirement
REPRESENTATIVENESS (qualitative confidence that data obtained are representative of each sampled medium)		
Sample handling and storage appropriate for media/analytes	All media, all analytes	All samples
Holding times (HTs)	All samples	All samples extracted and analysed within HTs
COMPARABILITY (qualitative confidence that data collected in separate sampling events is equivalent)		
Standard analysis methods	All samples	All samples subsampled, extracted/ digested & analysed at NATA-certified labs, by standard methods
LORs consistent between labs and batches	All samples	All samples
LORs met for all analytes	All samples	All samples
Outliers and inter-lab discrepancies resolved	Affected samples	Affected samples re-extracted and analysed in replicate.
COMPLETENESS (the amount of useable data, as a % of total data collected. Goal is 95% or more valid data)		
All critical locations sampled, all required samples collected, and all samples analysed according to this SAQP	All samples	All required data obtained
Chain-of-Custody forms (COCs), field logs, sample descriptions and sample location data complete	All samples	All samples
Samples received at laboratory as specified on COC forms	All samples	All bottles and jars received and unbroken, seals intact and samples cool
QC samples sufficient, and acceptable results	All QC/QAs	100%

SENSITIVITY (ability of analysis methods to reliably determine the analytes at lowest environmental concentrations)		
Analysis methods and LORs appropriate for media, expected background levels of analytes and adopted site assessment criteria	All media, all analytes	All samples
SECONDARY DATA (quality assessment of any pre-existing data to be used in this project)		
All secondary data	All pre-existing data	Establish DQIs and assess data quality

3.9 Equipment and Personnel

The equipment required for the sampling program is summarised as follows:

- PON survey vessel with PON's onboard GPS;
- PON stainless steel Van Veen grab sampler;
- stainless steel spoon and bowl;
- 1 mm mesh sieve;
- 10% formalin;
- stain (Rose Bengal) ;
- sample containers and zip lock bags;
- eskies and ice;
- data forms for recording field measurements and logging samples;
- Nitrile gloves and PPE;
- Decon 90; and
- camera.

Experienced scientists or engineers will coordinate the sampling program. PON personnel will operate the PON survey vessel and Van Veen grab sampler.

3.10 Health and Safety Precautions

The sampling program will adhere to HSE systems of RHDHV and PON. In particular, care will be taken when handling potentially contaminated sediments.

3.11 Contingency Plan

The sampling program has the potential to be affected by offshore swell conditions. In the event of adverse weather or critical failure of equipment, the sampling would be recommenced following improvement in the weather or fixing of the equipment.

All efforts would be made to ensure completion of sampling and Stage 1 testing within the 14 day holding time (for PAHs) in the event that Stage 2 testing is required.

4 QA/QC PROCEDURES

Proposed Data Quality Objectives for the field and analytical program are outlined in **Table 3**.

Table 5 Data Quality Objectives

Parameter	Data Quality Objective
Blank Samples	At or near the Limit of Reporting (LOR)
Sample	Samples received intact and cold
Holding Time	Samples analysed within specified holding time
Field Triplicate Samples (1 in 10 samples)	RPD <50%
Field Split Triplicate Samples (1 in 20 samples)	RPD <50% or as per laboratory requirement
Lab Duplicate Samples (1 in 10 Samples)	RPD <35% or as per laboratory requirement
Laboratory Control Samples (LCS) (1 in 20 Samples)	RPD <35% or as per laboratory requirement
MS (1 in 20 Samples)	RPD <35%, recovery 75–125% or as per laboratory requirement
Surrogate (Every Sample)	Recovery as per laboratory requirement

4.1 Field/QA/QC Procedures

Field QA/QC procedures for the first stage of analysis will include the following:

- Sample Location: PON onboard position fixing system will be used to locate the sampling locations.
- Decontamination of Sampling Equipment: Prior to use, the survey vessel will be thoroughly inspected and washed down. Any evident sources of contamination would be cleaned and covered in plastic to avoid accidental contamination of any samples. All sampling equipment that comes into contact with the sediment samples will be decontaminated (using Decon 90) prior to each sampling event.
- Field triplicates: Three samples from each nominated field triplicate sampling locations will be analysed and used to give an indication of the variability in the chemical and physical properties of the sediment at a sample location. All field triplicate samples will be blind labelled with sample numbers that do not relate to the sampling location name.
- Field Documentation: Each sample location will be numbered on a sampling plan in the field logbook. All other observations including water depth, weather, time and date of sampling, and appearance of the sediments (e.g. texture, colour and odour) will be noted in the field logbook. A photograph of each sample will also be taken.
- Cross Contamination: Following sampling, to avoid cross contamination, each sample jar will be tightly sealed and washed with ocean water to remove sediment adhering to the outside of the sample containers.
- Split triplicates: At five locations, split triplicate samples will be submitted for analysis with one of the three samples sent to a second laboratory for analysis. The split triplicate results will be

analysed to assess chemical variability in sub-sampling. All split triplicate samples will be blind labelled with sample numbers that do not relate to the sampling location name.

- Sample Control: Each sample will have a unique identification number, which will be recorded in the field log book and chain of custody form. A chain of custody form will accompany the sediment samples at all times and will include the analysis method required of the laboratory.

4.2 Laboratory QA/QC Procedures

Laboratory QA/QC procedures will include the following:

- Analysis Blanks: One per analytical run or one in every 20 samples, whichever is the smaller.
- Laboratory Duplicate: One in every 10 samples or client batch, whichever is the smaller
- Laboratory Control Standard: One per analytical run or one in every 20 samples, whichever is the smaller.
- Laboratory Matrix Spike: One in every 20 samples or client batch, whichever is the smaller.
- Matrix Spike: One in every 20 samples or client batch, whichever is the smaller.
- Surrogate Spike: For determinations that are appropriate, surrogate spikes will be added to all samples for analysis.
- Calibration Blank and Mid Range Calibration Verification: One per analytical run or one in every 20 samples, whichever is the smaller.
- Certified reference material (marine sediment): One in every 20 samples.

5 REPORTING

A SAP implementation report will be prepared presenting the outcomes of the offshore sampling and analysis program. The report will include:

- a summary or a copy of the SAP;
- a description of the sampling program;
- all laboratory results including laboratory QA/QC report;
- assessment of the biological, physical and chemical properties of the sediments including comparison of contamination data to NAGD screening levels;
- plots showing:
  - contours of the concentration of key contaminants;
  - the distribution of mud fraction in the sediments;
  - the distribution of rock fragments in the sand and gravel fraction of the sediments;
  - updated conceptual model of the dispersion of the dredge material placed at the current spoil ground;
- recommendations for further work (if required); and
- discussion as to how the program has met the objectives of this SAP (refer **Section 3.1**).

6 REFERENCES

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Appendix 1 - Standard Operating Procedures for Sediment Sampling and Sub-Sampling

Royal HaskoningDHV

Standard Operating Procedures for Sediment Sampling & Sub-Sampling

Two sub-samples for chemical analysis (150 ml and 250 ml glass jar), two sub-sample for physical analysis (100 ml plastic jar and 250 ml ziplock bag) and one sub-sample for biological analysis (1.5 litre) should be collected from the grab sample at each location except at field triplicate sampling locations and split triplicate locations.

At the field triplicate locations, three grab samples should be retrieved and sub-sampled i.e. 3 separate casts of the grab sample at the one location. From each cast sub-samples for chemical analysis should be collected as above.

At the split triplicate locations, a sample should be recovered from the grab and placed in a stainless steel bowl. The sample should be thoroughly homogenised and split into three lots of sample jars each identified with a unique label.

1. sampling should be supervised by a suitably qualified environmental scientist or engineer
2. location of sampling to be confirmed by on-board GPS
3. Van Veen grab sampler deployed and lowered to sea bed
4. jaws of grab triggered to close upon contact with sea bed
5. Van Veen grab recovered and placed on vessel deck and opened for inspection
6. integrity of grab sample assessed by visual inspection for any evidence of loss of fines due to grab not sealing correctly or the jaws being held open, e.g. by a shell or piece of gravel
7. if grab sample not considered satisfactory by supervising environment scientist or engineer, sample should be discarded and steps 1 to 5 should be repeated
8. if sample is considered satisfactory by supervising environmental scientist or engineer, sub-sampling from grab sample should proceed
9. from each grab sample 150ml and 250 ml sub-samples should be taken for chemical analysis, 100 ml and 250 ml sub-samples taken for physical analysis and a 1.5 L sub-sample taken for biological analysis.
10. the sub-samples for chemical analysis should be thoroughly homogenised and transferred to laboratory pre-washed 150ml and 250 ml glass sampling jars with a teflon lined lid using a stainless steel spoon
11. the sub-samples for physical analysis should be thoroughly homogenised and transferred to a 100 ml plastic jar and 250 ml ziplock bag
12. the sub-samples for biological analysis should be sieved through a 1 mm mesh and all retained material preserved in 10% formalin. A stain (Rose Bengal) should be added to facilitate sorting in the laboratory
13. the lid of each sample container should be tightly screwed on to avoid loss of sample and the jar labelled with a unique identification number. All field and split triplicates will be blind labelled with sample numbers that do not relate to the sampling location name.
14. to avoid cross contamination, after the lid is secured, the outside of each sample container should be washed with ocean water.
15. samples for chemical analysis should be packed in ice in an esky immediately after sampling to maintain the temperature below 4°C
16. all sampling equipment should be decontaminated before the next sampling event by rinsing equipment in ocean water to remove visible sediment, followed by a Decon 90 rinse