



DARWIN PORT MAINTENANCE DREDGING WORKS

REFERRAL REPORT



Prepared for: Landbridge Darwin Port
Date: 16th July 2025

Dr Daniel Spooner & Dr Adam Cohen & Harry Houridis
Managing Directors & Principal Marine Specialists
AMA Maritime Consulting
Suite 1, 242 Hawthorn Road, Caulfield North 3162.
Mobile 0404 834 164 or 0413 033 500 or 0412 969 630
ABN: 45 685 637 914 ACN: 685 637 914

Cover Photo: Google Earth Pro Image, 2024. Under Licence.

© AMA Maritime Consulting. All rights reserved.

AMA has prepared this document for the client identified above. The sole purpose of this document is to enable the client to assess the report forwarded by AMA. No other party should rely or access this information without prior written consent of AMA. This document has been prepared based on confidential information provided from the client and its description of what is required. AMA may have also relied on other information provided by third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Document Control:

Document Version	Author/ Reviewer	Date	Comment	Approved (AMA Director)
Rev A	AC / HH	16/7/2025	Draft	AC

Contents

EXECUTIVE SUMMARY	2
1 INTRODUCTION	3
1.1 Project Overview.....	3
2 PROPOSAL DESCRIPTION.....	5
2.1 Dredging and Dredge Spoil Placement Activities.....	5
2.3 Disposal Options	6
2.3.1 Harbour disposal	6
2.3.2 Onshore disposal	7
2.4 Consultation.....	7
3 ENVIRONMENTAL FACTORS.....	9
3.1 Cumulative Impacts.....	10
4 REFERENCES	11
Appendix A - SCREENING TOOL.....	12
Appendix B – DDMMP	14
Appendix C – 2025 SAP Implimentation Report	15

EXECUTIVE SUMMARY

This Referral report was prepared to inform the Northern Territory Environment Protection Authority (NT EPA) of the proposal by Landbridge Darwin Port to undertake routine maintenance dredging within selected areas of Darwin Harbour. Darwin Port has a need to periodically undertake maintenance dredging and bed levelling to remove unconsolidated sediment (e.g. clay, silt, sand) that is naturally transported and deposited into existing berth pockets at East Arm Wharf and Fort Hill Wharf, and into the berth pockets, turning basin and channel of the MSB. This dredging and bed levelling is required to maintain the required depths to provide safe access at all tides for vessels using port facilities and maintain effective operational parameters at the facilities.

The Referral Report has been prepared to enable the NT EPA to determine whether formal assessment is required pursuant to the NT EP Act.

In summary, the following is of key relevance:

- A previous maintenance dredging program involving the same dredging and disposal areas and equivalent dredge volumes was referred to NT EPA in 2017, with the NT EPA determining that the project did not require formal assessment (refer to Statement of Reasons dated 13 March 2018).
- The historical sediment characterisation data and the recent 2025 sediment sampling and analysis implementation report demonstrate that the material to be dredged or bed levelled is not contaminated, with complete absence of NADG screening level exceedances;
- The Environmental factors that have the potential to be impacted (aquatic ecosystem and coastal processes) have been assessed and the risk level is negligible/low; and
- The potential for cumulative impacts has been considered and where practicable will be avoided.

On this basis we believe that the proposed maintenance dredging and bed levelling do not pose a high risk to the environment and environmental harm will not occur. A thorough Dredging and Dredge Material Management Plan has been drafted and provides valuable information to support the NT EPA assessment.

1 INTRODUCTION

This Referral report was prepared to inform the Northern Territory Environment Protection Authority (NT EPA) of the proposal by Landbridge Darwin Port to undertake routine maintenance dredging within selected areas of Darwin Harbour. The regional context of the Project is shown in Figure 1.

Darwin Port has a need to periodically undertake maintenance dredging and bed levelling to remove unconsolidated sediment (e.g. clay, silt, sand) that is naturally transported and deposited into existing berth pockets at East Arm Wharf and Fort Hill Wharf, and into the berth pockets, turning basin and channel of the MSB (**Figure 1**). This dredging and bed levelling is required to maintain the required depths to provide safe access at all tides for vessels using port facilities and maintain effective operational parameters at the facilities.

This document provides supporting information to the Referral Form for the Project, submitted under Section 48 of the Environment Protection Act 2019 (EP Act) to the NT EPA. This supporting information document includes a completed NT EPA Pre-Referral Screening Tool (**Appendix A**) and has been prepared in accordance with NT EPA Environmental Impact Assessment Guidance for Proponents – Referring a Proposal to the NT EPA (NT EPA, 2022).

The Proposal is being referred to the NT EPA to determine whether formal assessment is required pursuant to the NT EP Act. It should also be noted that a previous maintenance dredging program involving the same dredging and disposal areas and equivalent dredge volumes was referred previously in 2017, with the NT EPA determining that the project did not require formal assessment (refer to Statement of Reasons dated 13 March 2018).

The maintenance dredging program has not been referred for assessment under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) as the previous program was also deemed not a controlled action.

1.1 Project Overview

Darwin Port has a need to periodically undertake maintenance dredging and bed levelling to remove unconsolidated sediment (e.g. clay, silt, sand) that is naturally transported and deposited into existing berth pockets at East Arm Wharf and Fort Hill Wharf, and into the berth pockets, turning basin and channel of the MSB (Figure 1-5). This dredging and bed levelling is required to maintain the required depths to provide safe access at all tides for vessels using port facilities and maintain effective operational parameters at the facilities.

The frequency of maintenance dredging and bed levelling is dependent upon the rates of sediment accumulation at the three locations. In turn, this will be dependent upon factors such as the nature of the seafloor materials adjacent to the port facilities and the degree of their disturbance (e.g. by tidal currents and meteorological events) following the previous dredging campaigns.

It is estimated that the berth pockets at East Arm Wharf and Fort Hill Wharf will require maintenance dredging at intervals of no less than six years, and that maintenance dredging at the MSB will be required no more frequently than every three years (Streten, Tsang & Harries 2017). Bed levelling will be used to maintain the declared depths between maintenance dredging events, where applicable.

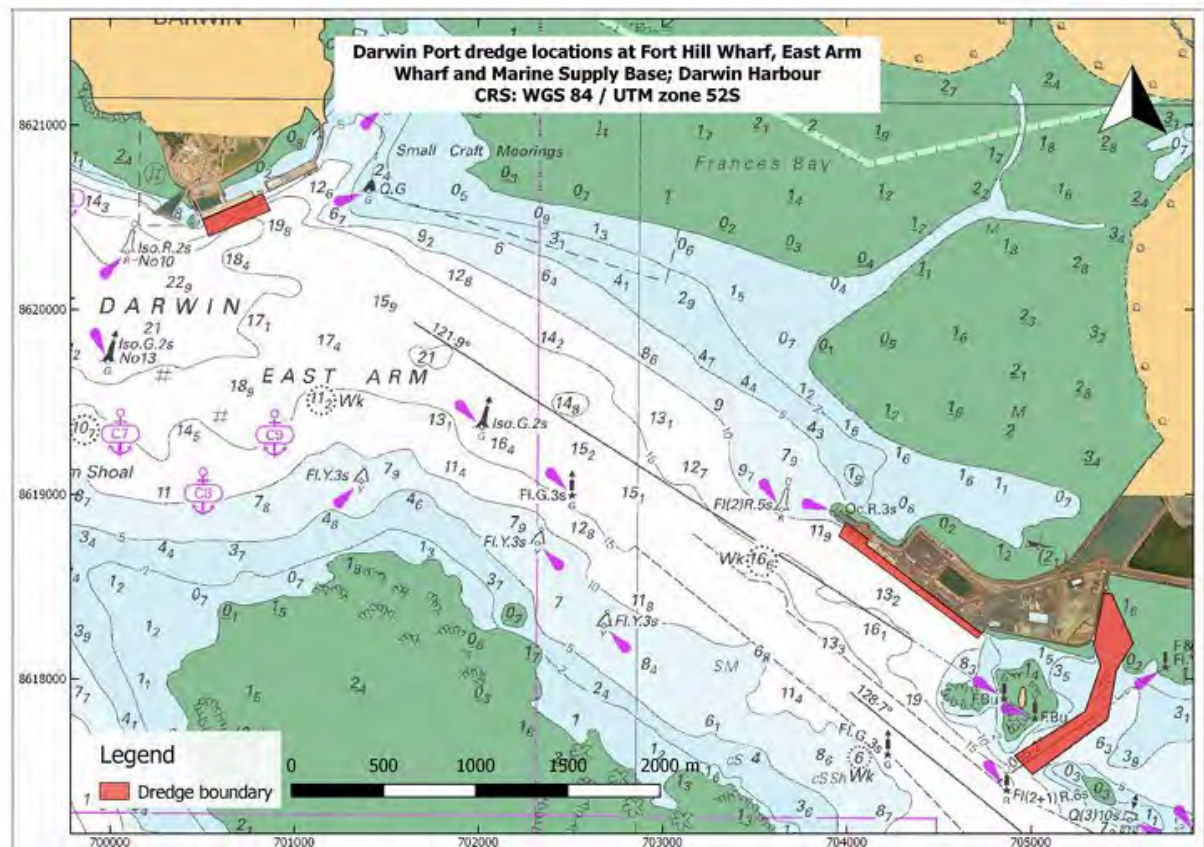


Figure 1. Maintenance Dredging Locations

2 PROPOSAL DESCRIPTION

2.1 Dredging and Dredge Spoil Placement Activities

The dredging methodology must comply with the Dredging and Dredge Material Management Plan (DDMMP) (**Appendix B**) (AMA, 2025). Dredging works will be carried out using bed levelling equipment and /or a cutter suction dredge (CSD) depending on the depth and composition of the accumulated materials. These different dredging works will be carried out separately and the timing of which is described in **Section 2.6**.

The Cutter Suction Dredge (CSD) works include pumping the material to a barge, which can then direct the material to the seabed within each of the adjacent spoil placement areas. Bed Levelling (also known as sweep bar works or ploughing) will be employed to redistribute sediment on the seabed (e.g. sweeping shallow areas into deeper areas or outside of navigation areas entirely) and does not involve the 'removal' of material.

For longer distances between dredging areas and dredge spoil placement areas, the use of booster pumps may be required. Any departures from this methodology will require consultation with and agreement from Darwin Port. Any major departures (such as using significantly different dredging equipment, or the use of hopper barges for disposal) may require amendments to the DDMMP to ensure that all environmental guidelines and objectives can be met as well as ensuring updates to associated consent/permits. The final detailed methodology for dredging shall be determined by the *Contractor* in consultation with Darwin Port prior to the commencement of dredging.

2.2 Dredge Areas and Volumes

The estimated total volume of material requiring removal by maintenance dredging using a cutter suction dredge (CSD) and bed levelling is approximately **26,521 m³** (based on the November 2024 hydrographic survey results, including 300mm over dredge allowance, see dredging volume drawings for each site in DDMMP). A total of four of the eight areas will be bed levelled, three will be dredged and a combination of bed levelling and dredging proposed at EAW Berth 2 (see **Table 1** footnotes for specific guidance).

Table 1: Estimated Dredge / Bed Levelling volumes (November 2024)

Site	Description	Base Level (m LAT)	Design Dredge Volume (m ³)	Dredge Volume Incl. Overdredge (m ³)
Marine Supply Base				
MSB Berth 1	Southern most berth on the MSB wharf	-8.7	578	1,655
MSB Berth 2 & 3	Two berths immediately to the north of berth 1	-7.7	848	1,938
MSB turning area	Area defined as the navigable area adjacent to both ends of the MSB wharf	-7.7	1,309	6,068
MSB entrance	Entrance to MSB channel near the East Arm sand bar	-7.7	961*	961
East Arm Wharf				
East Arm Wharf Berth 1	Berth at the south-east end of the wharf key line	-12.0	283*	283
East Arm Wharf Berth 2	In the centre area of East Arm Wharf	-13.5	8,137 [#]	12,438
East Arm Wharf bulk liquid berth	At the north-west end of East Arm Wharf	-12.0	413*	413
Fort Hill Wharf				
Fort Hill Wharf	Area adjacent to the face of, and extending to the northeast of the wharf	-10.0	2,765 [^]	2,765
TOTALS			15,295	26,521

* These areas will be subject to bed levelling; therefore the over-dredge volume is not of relevance. The works proposed will be in accordance with the sweep bar / plough work context presented in Section 2.1. [#]This area will also be subject to bed leveling to level out high spots, but the volume bed levelled will not exceed 1000m³.

[^]This area is adjacent to deep water (See Appendix B) and bed levelling is proposed at this location to improve access and remove the 2,765m³.

2.3 Disposal Options

2.3.1 Harbour disposal

Dredge spoil from East Arm Wharf and Fort Hill Wharf will be disposed of into areas around 500m from the wharves. Spoil will be relocated into deeper water adjacent to the berths using the sweep bar or pumped through a floating pipeline by the CSD to the disposal location where it will be

discharged through the submerged end of the pipeline. To prevent mounding of the dredged material by the CSD method, the spoil will be disposed across areas that are 100 m wide and 800 m long, aligned along the tidal axes which are parallel to the wharf faces.

The spoil from maintenance dredging at the MSB Channel will also be will be disposed into deeper water offshore using the sweep bar or pumped through a floating pipeline by the CSD to the disposal location located around 300m from the end of the channel.

2.3.2 Onshore disposal

Placement into the existing decant ponds at East Arm Wharf is the preferred option for material dredged from the MSB wharf and turning basin areas due to the ready accessibility of the ponds without impacting upon shipping movements and other operations at East Arm Wharf. These ponds have been used to dispose of dredge spoil from several dredging programs in East Arm Wharf precinct, including the dredging associated with the construction of the MSB, the East Arm barge ramp and the Darwin Shiplift Project (DSL). In the unlikely event that PASS is detected during the geochemical assessment of dredge material, dredge spoil will be placed at an alternative location approximately 600m east of the MSB to avoid exposure to PASS to oxidising environments (SAP confirmed concentrations of all toxicants are below Commonwealth of Australia [2009] screening levels) (AMA, 2025b) (**Appendix C**). Maintenance material dredged from the East Arm Wharf berth pockets and MSB Channel cannot be safely, economically or practically disposed into the decant ponds as disposal pipelines would cross shipping channels and/or critical wharf operational areas.

2.4 Consultation

Darwin Port has engaged in early consultation with the NTG. The initial focus was on distinguishing the need for any NTG permitting for small-scale bed levelling/sweeping works. In February 2025, Ms Lisa Bradley (Director Environmental Assessment - Environmental Assessment Unit / Environment Division - Department of Lands, Planning and Environment) confirmed that the NTG Environmental Assessments team had looked at the draft DDMMP, and concluded that the bed levelling activities described are likely to be a low risk to the environment. This is due to the low volume and short duration of works; the methods proposed; the context of East Arm and Fort Hill wharves being highly disturbed and previously dredged; and the current amount of dredging activity in the Harbour. The review of potential significant impacts for each mechanical dredging proposal, is supported.

Lisa also suggested that the MSB footprint is close to south shell island and might have a cumulative impact if the timing is similar to the adjacent ship lift. This will be considered prior to any proposed dredging at this location.

Further advice was received from Claire Carter (Manager (Water) Environmental Regulation - Environment Division - Department of Lands, Planning and Environment) in May 2025. Her team had discussed the proposed activity of seabed levelling/sweeping and what is required in the licencing space. Claire noted that seabed levelling is different to that of Dredging activity which specifies a discharge point and is regulated via a Waste Discharge Licence (WDL). Claire also noted that the Interference with a waterway guideline is not applicable in the context of the Harbour environment.

Claire confirmed that she had also consulted with and discussed the proposed bed levelling/sweeping activity with Mr Andrew Johnson, the Controller of Water Resources (authority for the Water Act) and Andrew's recommendation is that the Darwin Port ensures that appropriate environmental monitoring is in place. Darwin Port is committed to undertaking environmental monitoring program to quantify the environmental performance of Darwin Port's against its objectives and management strategies. Early detection of emerging issues will enable actions to be implemented and environmental impact to be avoided or minimised.

During the early consultation process with the NTG it was acknowledged that a referral is required for permitting to lawfully allow the actual dredging aspects in the DDMMP to occur. That is the subject of this Referral Report.

3 ENVIRONMENTAL FACTORS

The objective of the Referral is to inform the NT EPA and relevant stakeholders including the public about the potential environmental impacts of the proposed Project, and the measures proposed to avoid, mitigate and/or offset those impacts. The NT EPA will assess the information in this Referral to determine whether the Project requires assessment under the EP Act. The NT EPA's framework for the assessment of environmental impact uses 14 environmental factors divided in five themes to provide a systematic approach to organising environmental information and to establish environmental objectives against which proposals will be assessed. The NT EPA will conduct an environmental review on the Referral to determine whether the Project has the potential to have a significant impact on the environment. The potential for a significant impact is assessed by the context and intensity of the proposed activity's impact and the sensitivity value and quality of the environment proposed to be impacted (considering the duration, magnitude and geographic extent). **Table 2** provides the definition of the significance of an impact used to rate impacts in this Referral.

Table 2. Criteria for assessment of magnitude of impacts

Rank	Water Quality	Ecology
Negligible	Change from baseline conditions is immeasurable, undetectable or within the range of normal variation	Negligible effect on known population or range of species.
Small	Minor detectable change from baseline conditions over a limited distance (hundreds of metres) from source. Baseline conditions return within one month of cessation of activity.	Affects a specific group of localised individuals within a population over a short time period (one generation or less) but does not affect other trophic levels or the population itself.
Medium	Readily discernible change in quality beyond 1 km from source. Baseline conditions return within weeks of cessation of activity.	Affects a portion of a population and may bring about a change in abundance and/or distribution over more than one generation but does not threaten the integrity of that population or any population dependent on it.
Large	Readily discernible change in quality over a large area (>10 km ²) that persists over several months, with likely secondary impacts on marine ecology.	Affects a high portion of a population and may bring about a change in abundance and/or distribution over two or more generations, potentially threatening the integrity of that population or a population dependent on it.
Severe	Major alteration to baseline conditions over a large area (>10 km ²) that persists for more than 12 months, with probable secondary impacts on marine ecology.	Affects an entire population or species in sufficient magnitude to cause a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations

Pre-referral screening conducted for the Project determined that there were two Environmental Factors that have the potential to be impacted. A copy of the pre-referral screening is provided in **Appendix A**. A summary of the factors, risk levels and justifications are provided in **Table 3**.

Table 3. Summary of relevant Environmental Factors, risk level and justification.

Environmental Factor & Objective	Risk Level	Justification
Water 3) Aquatic ecosystems Objective: Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Negligible/Small	Dredging and disposal activities will not impact aquatic ecosystems, however small-scale intensity and extent turbid plumes will be generated. See Section 6.0 & 7.0 of the DDMMP for further detailed information on this aspect.
Sea 1) Coastal processes Objective: Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained.	Negligible/Small	The maintenance dredging proposed will not impact on coastal processes. The sediment is being removed from existing dredged areas of seabed and will be redistributed in adjacent areas of seabed. Volumes of sediment are small and are insignificant when compared to natural processes that redistribute sediment in Darwin Harbour. The areas of disturbance have been subject to dredging and disposal activities previously. See Section 6.0 & 7.0 of the DDMMP for further detailed information on this aspect.

Whilst the potential for impacts to environmental factors was assessed in the absence of mitigation measures, relevant mitigation measures are provided in the DDMMP. The proposed mitigation measures are readily available and proven to be effective in reducing the potential for impacts.

3.1 Cumulative Impacts

It is acknowledged that the MSB footprint is close to south shell island and might have a cumulative impact if the timing is similar to the adjacent ship lift. Dredging in the MSB during adjacent ship lift dredging will be avoided as much as practicable. It is also acknowledged that the conclusions drawn about the potential for significant impacts from the maintenance dredging and bed levelling activities is reviewed periodically, due to the potential for cumulative impacts. Port of Darwin will endeavour to work with local stakeholder to avoid dredging and bed levelling works when other dredging is active in the port's vicinity.

4 REFERENCES

AMA (2025) Darwin Port Maintenance Dredging Works – Dredging and Dredge Material Management Plan (DDMMP). Prepared for Port of Darwin.

AMA (2025b) Sediment Sampling and Analysis Implementation Report – Darwin Port Maintenance Dredging. Prepared for Darwin Port.

APPENDIX A - SCREENING TOOL

Part 2 – Answer checklist for Darwin Port Maintenance Dredging Campaign 2025

How to complete the answer checklist: Use questions 1-5 from Part 1 of the screening tool. Indicate answer to questions 1-5 in corresponding checkbox.

The table below gives an indication of possible *environmental values* and sensitivities for each environmental factor that should be addressed when considering each question. If the answer to a question is 'yes' or 'uncertain', it is possible that the proposal may have the potential to have a significant impact on the environment and the proposal should be referred to the NT EPA. If you answer 'no' to any question, provide a justification why there is no likely impact to that factor.

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Proponent's answer to screening questions 1-5				
				Q2	Q3	Q4	Q5
Is the industry type or activity proposed inherently hazardous with the potential to give rise to multiple or major impact sources and environmental stressors with the potential to impact on the environment? If so, does the nature of the industry preclude impact sources and stressors being substantively reduced?			No ☒ Yes ☐ No ☐ Yes ☐				
LAND	1) Landforms <u>Objective:</u> Conserve the variety and integrity of distinctive physical landforms.	• distinctive features in the landscape, either geological or anthropogenic • subterranean karstic terrain and faults • craters, gorges, ranges, caves, massifs, escarpments, plateaus • monuments • tourism related to landforms	Yes	☐	☐	☐	☐
			No	☐	☐	☐	X ☐
			Uncertain				
			Not Applicable	X	X	X	X
If you answered No to any screening questions for Landforms, provide justification here: Dredging and disposal activities do not involve any land-based works							
	2) Terrestrial environmental quality <u>Objective:</u> Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	• high quality soils, including chemical, physical, biological and aesthetic qualities that support life • the biological processes that depend on soil quality	Yes	☐	☐	☐	☐
			No	X	X	X	X
			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Proponent's answer to screening questions 1-5				
				Q2	Q3	Q4	Q5
	If you answered No to any screening questions for Terrestrial environmental quality, provide justification here: Dredging and disposal activities do not involve any land-based works						
	3) Terrestrial ecosystems <u>Objective:</u> Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	'sensitive or significant' vegetation or buffers (as defined in the NT Land Clearing Guidelines) - listed threatened species and their habitat (NT and Commonwealth) - listed migratory species and their habitat (Commonwealth) - listed threatened ecological communities (Commonwealth) - locally endemic or restricted species and their habitat - species that are data deficient with unknown protection status - protected area or reserve, including Indigenous Protected Area - biosecurity - high quality biological and functional diversity, integrity and services	Yes No Uncertain Not Applicable	☐ ☒ ☐ ☐	☐ ☒ ☐ ☐	☐ ☒ ☐ ☐	☐ ☒ ☐ ☐
	If you answered No to any screening questions for Terrestrial ecosystems, provide justification here: The highest value habitat for migratory shorebirds and waders is Pond D at the East Arm Wharf. Maintenance dredging would involve the disposal of some spoil into Pond E (north) and Pond K at East Arm Wharf. The Proposal does not involve any works in Pond D and the disposal of spoil and tail water in Pond K is unlikely to disturb or alter the quality of roosting habitat. The NT EPA acknowledges that East Arm Wharf is an operational port with existing industrial noise. The temporary increase in noise and activity during the proposed action is unlikely to have a significant impact.						
WATER	1) Hydrological processes <u>Objective:</u> Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	- the supply and quantity of water in surface water features including rivers, lakes, wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines - the supply and quantity of water in groundwater features including aquifers, aquitards, water tables and the ecosystems they support (stygo fauna, vegetation and groundwater dependent ecosystems) - declared beneficial uses - present and future uses, and users of water - current or potential water supplies, including regional scale aquifers - culturally important water features or other features affected by water level	Yes No Uncertain Not Applicable	☐ ☒ ☐ ☐	☐ ☒ ☐ ☐	☐ ☒ ☐ ☐	☐ ☒ ☐ ☐
	If you answered No to any screening questions for Hydrological processes, provide justification here: Dredging and disposal activities do not interact with groundwater or surface water						
			the quality of water in surface water features including rivers, lakes,	Yes	☐	☐	☐

Referring a proposal to the

	2) Inland water environmental quality	wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines	No	X	X	X	X
--	---------------------------------------	---	----	---	---	---	---

Referring a proposal to the

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Proponent's answer to screening questions 1-5				
				Q2	Q3	Q4	Q5
	<u>Objective:</u> Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	- the quality of water in groundwater features including aquifers and water tables - declared beneficial uses - present and future uses and users of water - current or potential water supplies, including regional scale aquifers - potability / drinkability - culturally important water features	Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Inland water environmental quality, provide justification here: Dredging and disposal activities will not interact with inland waters						
	3) Aquatic ecosystems	- threatened species - the health of the biota in inland waterways - the habitats that support the lifecycle of aquatic biota - groundwater dependent ecosystems - Ramsar wetlands - high quality biological and functional diversity, integrity and services	Yes No	☐	☐	☐	☐
	<u>Objective:</u> Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.		Uncertain	X	X	X	X
			Not Applicable	☐	☐	☐	☐
				☐	☐	☐	☐
If you answered No to any screening questions for Aquatic ecosystems, provide justification here: Dredging and disposal activities will not impact aquatic ecosystems, however small scale intensity and extent turbid plumes will be generated. The DDMMP specially addressing this aspect.							
SEA	1) Coastal processes	- processes that support marine ecosystems such as coral reefs and mangroves - processes that support coastal morphology such as beaches, rock bars, and sandbars - tidal creeks, deltas and river mouths - storm surge protection - unique coastal landforms	Yes No	☐	☐	☐	☐
	<u>Objective:</u> Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained.		Uncertain	X	X	X	X
			Not Applicable	☐	☐	☐	☐
				☐	☐	☐	☐
	If you answered No to any screening questions for Coastal processes, provide justification here: The maintenance dredging proposed will not impact on coastal processes. The sediment is being removed from existing dredged areas of seabed and will be redistributed in adjacent areas of seabed. Volumes of sediment are small and are insignificant when compared to natural processes that redistribute sediment in Darwin Harbour. The areas of disturbance have been subject to dredging and disposal activities previously.						

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Proponent's answer to screening questions 1-5				
				Q2	Q3	Q4	Q5
	2) Marine environmental quality <u>Objective:</u> Protect the quality and productivity of water, sediment and biota so that environmental values are maintained.	- quality of the water, sediment and biota - physical parameters that support fishing and aquaculture - physical parameters that support recreation and aesthetics - industrial water supply - cultural and spiritual values	Yes	☐	☐	☐	☐
			No	X	X	X	X
			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Marine environmental quality, provide justification here: The sediment is being removed from existing dredged areas of seabed and will be redistributed in adjacent areas of seabed. The sediment is not contaminated and will not impact the local marine environment. Volumes of sediment are small and are insignificant when compared to natural processes that redistribute sediment in Darwin Harbour. The increase in turbidity resulting from disposal activities will be transient and short lived with only minor measurable impacts on water quality. Where sediment is pumping into the ponds there is not PASS or contaminants release risks (AMA, 2025).						
	3) Marine ecosystems <u>Objective:</u> Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	- conservation significant marine and coastal fauna and critical habitat such as nesting, breeding or foraging habitat - conservation significant marine and coastal benthos (seagrass meadows, sponge gardens, coral reefs, mangrove communities and salt marshes) - groups of species (species richness and assemblages of species) - ecological functions and processes - high quality biological and functional diversity, integrity and services	Yes	☐	☐	☐	☐
			No	X	X	X	X
			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Marine ecosystems, provide justification here: The sediment is being removed from existing dredged areas of seabed and will be redistributed in adjacent areas of seabed. The sediment is not contaminated and will not impact the local marine environment. Volumes of sediment are small and are insignificant when compared to natural processes that redistribute sediment in Darwin Harbour. The areas of disturbance have been subject to dredging and disposal activities previously. The increase in turbidity resulting from disposal activities will be transient and short lived with only minor measurable impacts on water quality and negligible impacts to benthic primary producer habitat. It is also important to note that the NT EPA was previously satisfied that potential impacts and risks to benthic communities and habitats can be adequately managed through the implementation of the LTDMP and the Water Quality Environmental Management Framework that is consistent with the DDMMP. This was based on the previous referral assessment in 2018 and what is currently being proposed is of a similar scale and timeframe.						

Referring a proposal to the

AIR	1) Air quality	• ambient air quality in the local airshed • the chemical, physical and biological characteristics of quality air • the biological processes that depend on the air quality	Yes	☐	☐	☐	☐
	<u>Objective:</u> Protect air quality and minimise emissions and their impact so that environmental values are maintained.		No	X	X	X	X
			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Air quality, provide justification here: The dredging will be undertaken by a commercial vessel that is in good working order, that meets industry standard for emissions. The works are of a short duration with very limited air emissions. No impacts expected.						
2) Atmospheric processes	• a contribution to the NT's greenhouse gas emissions through nearing or reaching emission thresholds for: - o industrial projects of 100 000 tCO₂-e scope 1 emissions per year not counting emissions generated from land clearing	Yes	☐	☐	☐	☐	
<u>Objective:</u> Minimise greenhouse gas emissions so as to contribute to the		No	X	X	X	X	

Referring a proposal to the

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Proponent's answer to screening questions 1-5				
				Q2	Q3	Q4	Q5
	NT Government's goal of achieving net zero greenhouse gas emissions by 2050.	land use projects of 500 000 tCO₂-e scope 1 emissions from single or cumulative land clearing actions	Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Atmospheric processes, provide justification here: Any works will not be of a long duration, limiting any emissions. No impacts expected.						
PEOPLE	1) Community and economy <u>Objective:</u> Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.	- communities, towns and suburbs where people live - community aspirations for liveable environment and healthy lifestyles, - affordable access to food, water, electricity, transport and communication networks. - good amenity – air quality, noise, aesthetics - access to social infrastructure and services including transport and logistics - access to natural resources including bush food - recreational use of the natural or built environment (e.g. fishing, cycling, sports, picnics) - species of social, cultural, livelihood and or economic importance (terrestrial, aquatic and marine biota) - participation in jobs, businesses and education - existing industries such as agriculture, pastoralism, tourism, fisheries - vulnerable sectors of the community	Yes	☐	☐	☐	☐
			No	X	X	X	X
				Uncertain	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Community and economy, provide justification here: The maintenance dredging is required to maintain safe navigation into the Port of Darwin. Improved vessel access leads to better economic outcomes for the port and local community.						
	2) Culture and heritage <u>Objective:</u> Protect culture and heritage.	- Aboriginal cultural values - sacred sites - the Territory's natural and built heritage - declared heritage places and objects protected under the Heritage Act 2011 (NT) such as: - any Aboriginal or Macassan archaeological place or object (coastal mounds and middens, rock art, stone arrangements, quarries, artefacts, graves, burial sites and ancestral remains)	Yes	☐	☐	☐	☐
			No	X	X	X	X
			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐

Referring a proposal to the

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Proponent's answer to screening questions 1-5				
				Q2	Q3	Q4	Q5
		- o underwater cultural heritage (isolated objects, shipwrecks, plane wrecks, underwater cables and evidence of Aboriginal occupation prior to sea level rise) - o built heritage (colonial buildings and other historic buildings) - o defence structures (defensive positions and airfields) - o natural features (meteorite impact sites, palaeontological sites, springs, trees) - o world heritage • underwater cultural heritage protected under the Underwater Cultural Heritage Act 2018 (Cth) • Aboriginal rights and interests, including right of access					
	If you answered No to any screening questions for Culture and heritage, provide justification here: All dredging and disposal will occur within the existing channels, berths and areas of seabed that have been subject to disturbance previously, therefore no impacts on underwater cultural heritage will occur.						
	3) Human health <u>Objective:</u> Protect the health of the Northern Territory population.	• drinking water • air quality • bush tucker • radiological limits • biting insects	Yes No Uncertain Not Applicable	☐ ☐ ☐ X	☐ ☐ ☐ X	☐ ☐ ☐ X	☐ ☐ ☐ X
	If you answered No to any screening questions for Human health, provide justification here:						

Where the screening has been undertaken by a suitably qualified and experienced person and all responses in the checklist are 'no', a referral to the NT EPA is not likely required. The NT EPA and DEPWS does not require the completed checklist to be submitted in this case. However, the checklist and its justifications for no likely impact should be retained by the proponent to demonstrate the screening has been conducted. The proponent should also retain the scope of the proposal that was considered in conducting the screening, the name, qualifications and contact details of the suitably qualified and experienced person(s) who conducted the screening using the table below.

The NT EPA retains to power to "call-in" a proposal under section 53 of the EP Act.

Recommended record keeping: Where a proponent intends to retain this checklist to demonstrate it has given consideration to whether a referral is required, it is recommended that the following details are recorded.

	Details
Proponent name	Landbridge Darwin Port
Propose action name	Maintenance Dredging Campaign 2025
Description of proposed action	Maintenance dredging of East Arm Wharf, Marine Supply Base and Fort Hill Wharf

Pre-referral screening has been conducted by: names, qualifications and date of works by suitably qualified and experienced persons⁷ engaged by the proponent.

Environmental factor	Name	Qualification / Experience	Signature	Date
All	Dr Daniel Spooner	PhD Marine & Coastal Processes (Env Chem.)		25/06/2025

Proponent's declaration that the pre-referral screening has been conducted.

Screening declaration by proponent:

I, Dr Daniel Spooner, declare that I am authorised to verify the pre-referral screening of this proposed action/strategic proposal on behalf Of Landbridge Darwin Port name of legal entity organisation...Landbridge Darwin Port, and further declare that:

the attached environmental impact assessment documents (including attachments) are true; and

the attached environmental impact assessment documents do not provide false or misleading information and I know it is an offence to provide false and misleading information, noting the penalties under section 260 of the EP Act, and section 119 of the *Criminal Code Act 1983*.

⁷ Section 4 of the EP Act provides the meaning of a qualified person. Experience may be provided in years and/or a description of relevant experience.

APPENDIX B – DDMMP



DARWIN PORT MAINTENANCE DREDGING WORKS

DREDGING AND DREDGE MATERIAL MANAGEMENT PLAN (DMP)



Prepared for: Landbridge Darwin Port

Date: 24th April 2025

Dr Daniel Spooner & Dr Adam Cohen
Managing Directors & Principal Marine Scientists
Richard Mocke FIEAust CPEng, Senior Associate
Australasian Marine Associates Pty Ltd t/a AMA Maritime Consulting
41/35 Broadbeach Boulevard, Broadbeach Vic 4218.
Mobile 0404 834 164 or 0413 033 500
ABN: 47 602 913 762 ACN: 602 913 762

Cover Photo: Google Earth Pro Image, 2024. Under Licence.

© AMA Maritime Consulting. All rights reserved.

AMA has prepared this document for the client identified above. The sole purpose of this document is to enable the client to assess the proposal forwarded by AMA. No other party should rely or access this information without prior written consent of AMA. This document has been prepared based on confidential information provided from the client and its description of what is required. AMA may have also relied on other information provided by third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Document Control:

Document Version	Author/ Reviewer	Date	Comment	Approved (AMA Director)
Rev A	RM / AC / DS	20/12/24	Draft for Review	AC
Rev B	RM / AC	12/02/25	Updated for Submission	AC
Rev 0	AC/DS/ HH	24/4/25	Final	AC

Contents

1	Introduction	1
1.1	Darwin Harbour port facilities	1
1.1.1	Fort Hill Wharf (FHW).....	1
1.1.2	East Arm Wharf (EAW).....	2
1.1.3	Marine Supply Base (MSB)	3
1.2	Maintenance dredging requirements.....	3
1.3	Purpose of this plan.....	4
1.4	Proponent and dredging contractor	4
2	Legislative framework.....	5
2.1	Environmental Impact Assessment Guideline Screening	9
3	Environmental Project Management and Resourcing	11
3.1	Environmental Management System and Procedures	12
3.2	Key roles and responsibilities	12
3.3	Inductions and training requirements	12
3.3.1	Environmental general and work program specific inductions	12
3.3.2	Environmental awareness	13
3.3.3	Training	13
3.4	Environmental documents and records management	13
3.5	Performance management.....	13
3.5.1	Environmental objectives	14
3.5.2	Performance criteria.....	14
3.5.3	Environmental management KPIs	14
3.5.4	Environmental incident reporting.....	15
3.6	Management review.....	15
3.6.1	Inspections.....	15
3.6.2	Internal audits	15
3.6.3	Darwin Port audits.....	15
3.6.4	External audits.....	15
3.6.5	Project corrective actions register	15
3.6.6	Continuous improvement	16
4	Dredging and Dredge Spoil Placement Activities	17
4.1	Volumes	17
4.2	Schedule	17
4.3	Dredging Equipment.....	18
4.3.1	Bed Levelling.....	18
4.3.2	Cutter Suction Dredge (CSD).....	20
4.4	Summary of work method.....	22
4.5	Approach for Sediment Material Characterisation.....	22
4.6	Dredge spoil placement areas	23
4.7	Harbour disposal.....	24
4.8	Onshore disposal	24
4.8.1	Justification	24

4.8.2	<i>Dredge spoil placement and tailwater flow path</i>	25
4.8.3	<i>Available pond volumes</i>	27
4.8.4	<i>Pond water levels</i>	27
4.8.5	<i>Stormwater and landform</i>	27
5	Existing Environment and Relevant Studies	30
5.1	Regional Setting	30
5.2	Existing Physical Environment	30
5.2.1	<i>Meteorological conditions</i>	30
5.2.2	<i>Coastal geomorphology and bathymetry</i>	30
5.2.3	<i>Marine sediments</i>	31
5.2.4	<i>Metocean Conditions</i>	33
5.2.5	<i>Marine water quality</i>	34
5.2.6	<i>Water quality baseline data</i>	35
5.3	Environmental receptors	36
5.3.1	<i>Marine communities</i>	36
5.3.2	<i>Protected marine species</i>	37
5.3.3	<i>Other EPBC-listed marine species</i>	40
6	Sediment Transport Modelling and Impact Assessment	41
6.1	Synthesis of assessment approach	41
6.2	Hydrodynamic model	41
6.3	Sediment transport model	41
6.4	Modelling results	42
6.5	Tolerance limits for biological communities	45
6.6	Zones of Impact and Influence	45
6.7	Conclusions	47
6.7.1	<i>Suspended sediments</i>	47
6.7.2	<i>Sedimentation</i>	48
7	Environmental Risk Assessment	49
7.1	Purpose	49
7.2	Methodology	49
7.2.1	<i>Risk scoping</i>	49
7.2.2	<i>Risk assessment</i>	49
8	Environmental Monitoring and Management	62
8.1	Introduction	62
8.2	Darwin Harbour - water quality	62
8.2.1	<i>Potential impacts</i>	62
8.2.2	<i>Trigger values</i>	62
8.2.3	<i>Darwin harbour water quality monitoring program</i>	63
8.2.4	<i>Response to trigger exceedance</i>	67
8.2.5	<i>Management measures</i>	68
8.3	Dredge spoil decant ponds - water quality	70
8.3.1	<i>Potential impacts</i>	70
8.3.2	<i>Water quality criteria for disposal of tailwater</i>	71
8.3.3	<i>Decant ponds water quality monitoring program</i>	73

8.3.4	Outcomes	75
8.3.5	Response to trigger exceedance	75
8.3.6	Management measures	75
8.4	Protected marine species – physical interaction	77
8.4.1	Potential impacts.....	77
8.4.2	Protected marine species monitoring program	78
8.4.3	Response to sightings	78
8.4.4	Management measures	78
8.5	Protected marine species – underwater noise	82
8.6	Summary of monitoring programs	84
9	Reporting.....	88
9.1	Routine reporting	88
9.1.1	Daily reporting.....	88
9.1.2	Weekly monitoring report	88
9.1.3	Dredge operation records and reporting.....	88
9.1.4	End of dredge phase reporting	89
9.1.5	Compliance reporting	89
9.2	Exceedance notification and reporting.....	89
9.3	Environmental incident notification and reporting	89
9.4	Complaints reporting.....	90
9.5	Reporting and notification summary	90
10	References.....	93
Appendix A – Screening Tool for Bed Levelling Works.....		98
Appendix B – Dredging Volume Drawings		99

List of Figures

Figure 1-1: Darwin Port Facilities (source: Hatch, 2024)	1
Figure 1-2: Historic dredging at FHW (source: Table 2-1, Hatch 2024)	2
Figure 1-3: Historic Dredging at EAW (source: Table 2-2, Hatch 2024).....	3
Figure 1-4: Historic Dredging at MSB (source: Table 2-3, Hatch 2024)	3
Figure 1-5: Maintenance dredging locations (Source: Streten, Tsang & Harries (2017))	4
Figure 2-1 Referring a proposal to the NT EPA - Part 1 General Screening Questions.....	10
Figure 3-1: Darwin Port Environmental Policy	11
Figure 4-1: Tug bed levelling (Example only).	19
Figure 4-2: Close up of the type of bed levelling equipment (example only) to be used for the works.	19
Figure 4-3: CSD Everglade (Hall Contracting) (source: Hatch 2024).....	21
Figure 4-4: Typical cutter suction dredge (source: AECOM 2018)	21
Figure 4-5: Spoil disposal flowcharts (G/L = Commonwealth of Australia (2009) screening level).....	23
Figure 4-6: Dredge spoil disposal locations	24
Figure 4-7: East Arm Wharf Pond system	26
Figure 4-8: Stormwater flow paths through the East Arm Wharf Pond system.....	28

Figure 5-1: Dry season flushing zones in Darwin Harbour (Source: Fortune (2010)	34
Figure 6-1: 90 th percentile SSC	43
Figure 6-2: 95 th percentile SSC	43
Figure 6-3: SSC at South Shell Island during dredging.....	44
Figure 6-4: SSC at South Shell Island after dredging	44
Figure 6-5: Zone of Moderate Impact and Zone of Influence for Dry Season and Wet Season dredging operations	47
Figure 7-1: Risk matrix.....	51
Figure 8-1: Turbidity monitoring locations.....	64
Figure 8-2: Turbidity monitoring flowchart – Fort Hill Wharf	66
Figure 8-3: Turbidity monitoring flowchart – East Arm Wharf.....	66
Figure 8-4: Turbidity monitoring flowchart – MSB.....	67
Figure 8-5: Water quality monitoring locations	74
Figure 8-6: Vessel interaction management flowchart	81
Figure 8-7: Guidelines on approach distances for dolphins (Source: Natural Resource Management Ministerial Council (2005))	81
Figure 8-8: Marine fauna observations form	82

List of Tables

Table 2-1: Relevant Territory Legislation	5
Table 2-2: Relevant Commonwealth Legislation.....	8
Table 4-1: Estimated Dredge / Bed Levelling volumes (November 2024).....	17
Table 5-1: Diffuse annual pollutant loads	31
Table 5-2: Summary of water quality parameters at South Shell Island (Source: URS (2011)).....	35
Table 7-1: Criteria for assessment of magnitude of impacts	50
Table 7-2: Criteria for assessment of receptor sensitivity.....	50
Table 7-3: Risk categories.....	51
Table 7-4: Risk assessment outcomes.....	52
Table 8-1: Water quality EMF – Darwin Harbour	68
Table 8-2: South Shell Island monitoring – triggers and responses	70
Table 8-3: ANZECC Guidelines default effect size for varying levels of protection	71
Table 8-4: Toxicant trigger levels	72
Table 8-5: Water quality EMF - dredge spoil decant ponds	75
Table 8-6: Protected marine species EMF - physical interaction	79
Table 8-7: Protected marine species EMF - underwater noise	83
Table 8-8: Summary of monitoring program.....	85
Table 9-1: Reporting and notification summary	90

1 INTRODUCTION

1.1 Darwin Harbour port facilities

Darwin Port Operations Pty Ltd (Darwin Port) operates port facilities within Darwin Harbour, Northern Territory (NT); these include Fort Hill Wharf, East Arm Wharf and the Marine Supply Base (MSB). These areas are illustrated in **Figure 1-1** and a brief introduction to these facilities is presented further below.



Figure 1-1: Darwin Port Facilities (source: Hatch, 2024)

1.1.1 Fort Hill Wharf (FHW)

FHW is Darwin Port's cruise ship and defence vessel facility. The precinct includes a purpose-built cruise ship terminal which is capable of handling complete passenger changeovers for smaller cruise vessels whilst providing a transit lounge for more infrequent larger international cruise ships. Frequent naval ship visits to Darwin are catered for at the wharf, with secure and efficient port facilities and services provided. Berthage for tugs and pilot boats used within Darwin Harbour is also provided.

The wharf was originally constructed in during World War II, though bioerosion by *Teredo* worms led to the collapse of some two thirds of the structure. It was partially reconstructed with steel pipes and another two wharves (the Navy Boom Wharf and the Navy Repair Wharf) were added in 1941, the latter to facilitate repairs to Navy vessels.

Over the years the land abutting the wharf has been used for pre-export stockpiling of iron ore and zinc concentrate and a Navy refuelling facility has also operated across the wharf. The current Fort Hill Wharf was commissioned in 1981 (Darwin Port Corporation, undated). The old structure was removed, and some of the seabed in the vicinity of the wharf was dredged, as a part of the Darwin City Waterfront Redevelopment in 2006.

Historical dredging at FHW is as shown in **Figure 1-2**.

Year	Description	Volume removed (m ³)	Disposal site
1992	Fort Hill Wharf berth area dredged to -12 mCD	Unknown	Unknown
2006	Seabed in the vicinity of the wharf was dredged, as a part of the Darwin City Waterfront Redevelopment	550,000	Ponds within the Darwin Port lease
2008/09	Maintenance dredging of berth area	7,000	Seafloor approximately 300 m from the wharf.
2018/19	Maintenance dredging of berth area to -10 mCD	7,150	Sidecost per 2008/2009

Figure 1-2: Historic dredging at FHW (source: Table 2-1, Hatch 2024)

1.1.2 East Arm Wharf (EAW)

EAW was opened in 2000 and provides facilities for berthing vessels up to 80,000 tonnes. It comprises a:

- Bulk liquids berth which handles regular imports of fuel and is connected via pipeline to a fuel oil facility and a bio diesel refinery. Chemicals such as acids are also piped to adjoining areas.
- Common user facility which is heavily utilised by offshore oil rig tenders. The number of tenders permanently working out of Darwin is increasing as the offshore industry surrounding Darwin expands.
- Container facility served by mobile harbour cranes. This is also used as a common user berth to discharge or load break bulk cargo. Live cattle exports have increased significantly over the past few years with ongoing demand expected.
- Bulk materials handling facility which can cater for Panamax size vessels and is currently used to export iron ore and manganese.

The East Arm Wharf precinct has been progressively developed since 1994; the most recent expansion being the construction of the MSB in 2012-2013, the Multi User Barge Ramp Facility in 2015-2016 and the Darwin Shiplift project which is currently under construction. Spoil from the capital dredging campaigns undertaken to develop East Arm Wharf has been disposed within decant ponds within the Darwin Port lease. The ponds have also received spoil from other developments (e.g. the Darwin City Waterfront Redevelopment) and pond management measures have been developed over the years that have proven to be effective in mitigating impacts upon the environment outside of the pond system.

East Arm Wharf has a design depth of 15 m below CD (AECOM 2018) and historical maintenance dredging at FHW is as shown in **Figure 1-3**.

Year	Description	Volume removed (m3)	Disposal site
2008/09	Maintenance dredging at the berth removed accumulated sediments to a depth of -13 mCD.	1,000	Pond F at East Arm Wharf.
2018/19	Maintenance dredging to -12 mCD (Berth 1& BLB) and -13 mCD (Berth 2).	7,500	Seafloor approximately 500 m from the wharf.

Figure 1-3: Historic Dredging at EAW (source: Table 2-2, Hatch 2024)

1.1.3 Marine Supply Base (MSB)

The MSB was constructed over the period 2012 to 2016 and provides a common user facility utilised primarily by offshore oil rig tenders. The number of tenders permanently working out of Darwin is increasing as the offshore industry surrounding Darwin expands.

The MSB channel, turning basin and berths 2 and 3 have design depths of 7.7 m below CD and Berth 1 has a design depth of 8.7 m below CD. Historical dredging at MSB is as shown in **Figure 1-4**.

Year	Description	Volume removed (m3)	Disposal site
2012 to 2016	Capital dredging	650,000	Ponds within the Darwin Port lease
2018/19	Maintenance dredging to -8.7 mCD (Berth 1) and -7.7 mCD (Berth 2&3, turning area, and MSB Entrance)	7,500	Ponds within the Darwin Port lease

Figure 1-4: Historic Dredging at MSB (source: Table 2-3, Hatch 2024)

1.2 Maintenance dredging requirements

Darwin Port has a need to periodically undertake maintenance dredging and bed levelling to remove unconsolidated sediment (e.g. clay, silt, sand) that is naturally transported and deposited into existing berth pockets at East Arm Wharf and Fort Hill Wharf, and into the berth pockets, turning basin and channel of the MSB (**Figure 1-5**). This dredging and bed levelling is required to maintain the required depths to provide safe access at all tides for vessels using port facilities and maintain effective operational parameters at the facilities.

The frequency of maintenance dredging and bed levelling is dependent upon the rates of sediment accumulation at the three locations. In turn, this will be dependent upon factors such as the nature of the seafloor materials adjacent to the port facilities and the degree of their disturbance (e.g. by tidal currents and meteorological events) following the previous dredging campaigns. It is estimated that the berth pockets at East Arm Wharf and Fort Hill Wharf will require maintenance dredging at intervals of no less than six years, and that maintenance dredging at the MSB will be required no more frequently than every three years (Streten, Tsang & Harries 2017). Bed levelling will be used to maintain the declared depths between maintenance dredging events, where applicable.

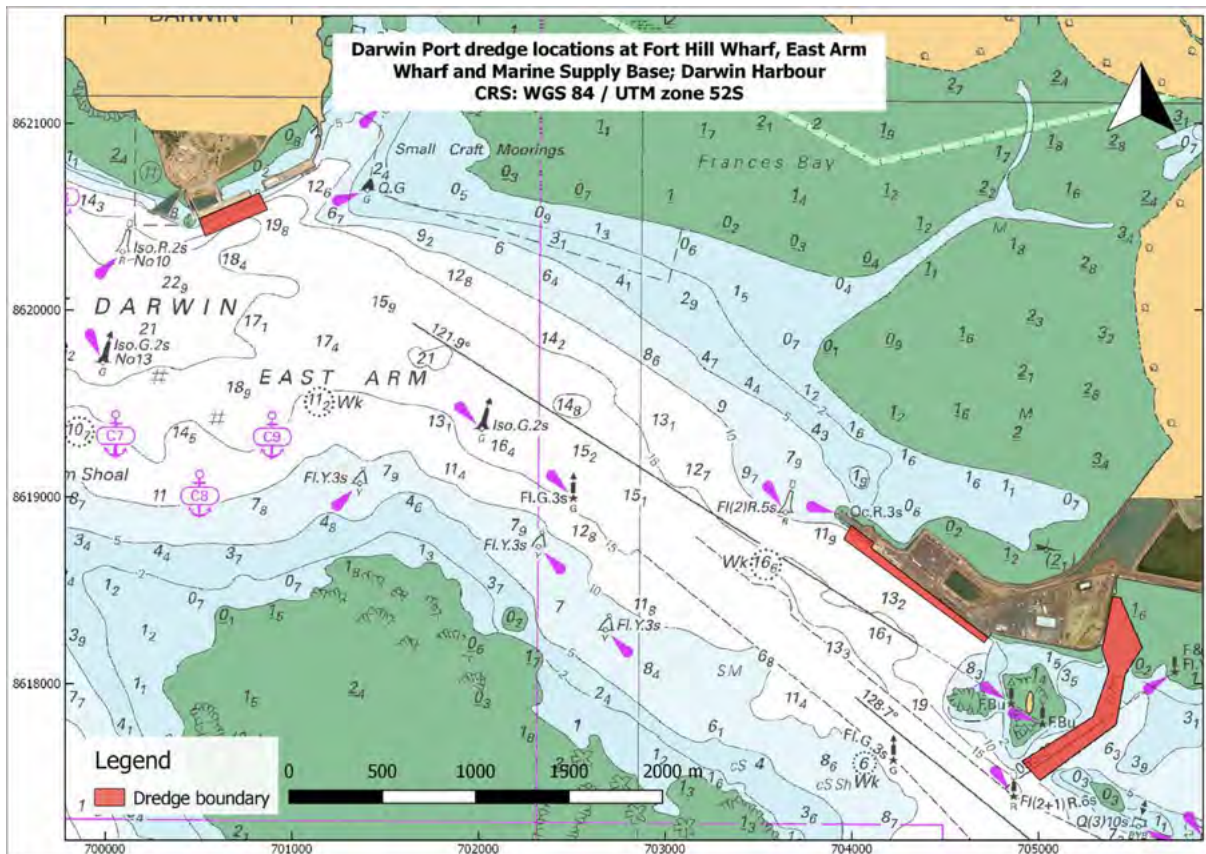


Figure 1-5: Maintenance dredging locations (Source: Streten, Tsang & Harries (2017))

1.3 Purpose of this plan

This document is the Dredging and Dredge Material Management Plan (hereafter simply abbreviated as the DMP) for the required periodic maintenance dredging and spoil disposal and bed levelling activities at East Arm Wharf, Fort Hill Wharf and the MSB. The purpose of the DMP addresses the short-term requirements of the port < 5 years and also provides guidance on the works required to maintain the channels and berths in the Port of Darwin.

The Plan will support the approvals processes for the dredging and bed levelling campaigns (e.g. variations to development permits, waste discharge licence applications). It will also form a part of the documentation released to prospective tenderers to undertake the maintenance dredging and bed levelling works.

1.4 Proponent and dredging contractor

The Proponent for the maintenance dredging works is Darwin Port. For each maintenance dredging campaign, a Dredging Contractor (hereafter 'Contractor') will be appointed; this entity will be required to comply with this DMP during execution of the dredging works.

For bed levelling activities, Darwin Port will fabricate its own bar and contract suitable vessels/ tug boats to bed level at targeted locations, as described in this DMP. These works will be completed outside of the formal dredge permit approvals process.

2 LEGISLATIVE FRAMEWORK

Darwin Port operates under the *Ports Management Act*, which was established to provide for the control, management and operation of ports, and for related purposes.

This DMP has been prepared to support Darwin Ports' planning applications for dredging works at Fort Hill Wharf, East Arm Wharf and the MSB and to also support bed levelling works at these sites.

Territory and Commonwealth legislation relevant to the project and this DMP is summarised in **Table 2-1** and **Table 2-2** respectively.

Table 2-1: Relevant Territory Legislation

Document	Purpose / Objectives	Agency
<i>Environment Protection Act 2019 (EP Act) and Regulations 2020 (EP Regulations)</i>	Protect the environment of the Territory; Promote ecologically sustainable development so that the wellbeing of the people of the Territory is maintained or improved without adverse impact on the environment of the Territory; Recognise the role of environmental impact assessment and environmental approval in promoting the protection and management of the environment of the Territory; Provide for broad community involvement during the process of environmental impact assessment and environmental approval; Recognise the role that Aboriginal people have as stewards of their country as conferred under their traditions and recognised in law, and the importance of participation by Aboriginal people and communities in environmental decision-making processes.	Department of Environment, Parks and Water Security
<i>Northern Territory Environment Protection Authority Act 2012 (NT EPA Act)</i>	Promote ecologically sustainable development; Protect the environment, having regard to the need to enable ecologically sustainable development; Promote effective waste management and waste minimisation strategies; and Enhance community and business confidence in the environmental protection regime of the Territory.	Department of Environment, Parks and Water Security
<i>Waste Management and Pollution Control Act 1998 and Regulations 1998</i>	Protect, and where practicable to restore and enhance the quality of, the Territory environment by: - Preventing pollution; - Reducing the likelihood of pollution occurring; - Effectively responding to pollution; - Avoiding and reducing the generation of waste; - Increasing the re-use and re-cycling of waste; and	Department of Environment, Parks and Water Security

Document	Purpose / Objectives	Agency
	- Effectively managing waste disposal; Encourage ecologically sustainable development; and To facilitate the implementation of national environment protection measures made under the National Environment Protection Council (Northern Territory) Act 1994 (described below).	
<i>Marine Pollution Act 1999 and Regulations 2003</i>	The overall purpose of this Act is to protect the Territory's marine and coastal environment by minimising intentional and negligent discharges of ship-sourced pollutants into coastal waters. This purpose is to be achieved primarily by giving effect to relevant provisions of the following annexes of MARPOL: - Annex I (which deals with pollution by oil); - Annex II (which deals with pollution by noxious liquid substances in bulk); - Annex III (which deals with pollution by harmful substances in packaged form); - Annex V (which deals with pollution by garbage). The purpose is also to be achieved by: - Providing an approach to protecting the Territory's marine and coastal environment from ship-sourced pollutants complementary to the approach of the Commonwealth and the States of the Commonwealth; - Making provision about the discharge of sewage from ships; - Enabling shipping casualties that are polluting, or threatening to pollute, coastal waters, to be dealt with; and - Imposing severe penalties on persons who pollute the Territory's marine and coastal environment in contravention of this Act.	Department of Environment, Parks and Water Security
<i>National Environment Protection Council (Northern Territory) Act 1994</i>	The object of this Act is to ensure that, by means of the establishment and operation of the National Environment Protection Council: People enjoy the benefit of equivalent protection from air, water or soil pollution and from noise, wherever they live in Australia; and Decisions of the business community are not distorted, and markets are not fragmented, by variations between participating jurisdictions in relation to the adoption or implementation of major environment protection measures.	Department of Environment, Parks and Water Security

Document	Purpose / Objectives	Agency
<i>Territory Parks and Wildlife Conservation Act 1976 (TPWC Act) and Regulations 2001</i>	Provides for the protection, conservation and sustainable utilisation of wildlife; and Provides protection of listed threatened species for which proponents must consider direct and indirect impacts on a listed threatened species or place covered under this Act.	Department of Environment, Parks and Water Security
<i>Water Act 1992 (Water Act) and Regulations 1992</i>	Provides for the investigation, allocation, use, control, protection, management and administration of water resources, including extraction of groundwater, wastewater management and water pollution; and Provides for water allocation plans, drilling licences, bore construction permits, water extraction licences, waste discharge licences, fees and charges, and penalties for offences against the Act.	Department of Environment, Parks and Water Security
<i>Ports Management Act 2015</i>	To provide for the control, management and operation of ports, and for related purposes.	Department of Infrastructure, Planning and Logistics
<i>Ports Management Regulations 2015</i>	Details regulations under the Ports Management Regulations 2015.	Department of Infrastructure, Planning and Logistics
<i>Heritage Act 2011 and Heritage Regulations 2012</i>	The object of this Act is to provide for the conservation of the Territory's cultural and natural heritage. The object is achieved by: - Declaring places and objects of heritage significance to be heritage places and objects; - Declaring classes of places and objects of heritage significance to be protected classes of heritage places and objects; - Establishing the Heritage Council; - Providing for heritage agreements to encourage the conservation, use and management of heritage places and objects; - Regulating work on heritage places and objects; and - Establishing enforcement and offence provisions.	Department of Territory Families, Housing and Communities
<i>Northern Territory Aboriginal Sacred Sites Act 1989 and Sacred Sites Regulations 2004</i>	Facilitates the protection and registration of sacred sites, through: - Providing entry onto sacred sites and the conditions to which such entry is subject; - Procedures for avoidance of sacred sites when developing and using land; - Establishing an Authority for the purposes of the Act; and - Procedures for the review of decisions of the Authority by the Minister.	Aboriginal Areas Protection Authority

Table 2-2: Relevant Commonwealth Legislation

Document	Purpose / Objectives	Agency
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	Provides for the protection of the environment and conservation of biodiversity, particularly species and places of national significance. Invoked only if a development is likely to have environmental impacts of national significance	Australian Government Department of Agriculture, Water and the Environment
<i>Environment Protection (Sea Dumping) Act 1981</i>	Regulates the loading and dumping of waste at sea and the placement of artificial reefs within Australian Waters. Australian Waters stretch from the low water mark of the Australian shoreline out to 200 nautical miles but does not include waters within the limits of a state or territory. The Act, therefore, does not need to be adhered to when disposing of dredge spoil within Darwin Harbour limits. However, the same assessment process and methods should generally be applied.	Australian Government Department of Agriculture, Water and the Environment
<i>National Environment Protection Measures (Implementation) Act 1998 and Regulations 1999</i>	The objects of this Act are: - To make provision for the implementation of national environment protection measures in respect of certain activities carried on by or on behalf of the Commonwealth and Commonwealth authorities; and - To protect, restore and enhance the quality of the environment in Australia, having regard to the need to maintain ecologically sustainable development; and - To ensure that the community has access to relevant and meaningful information about pollution.	Australian Government Department of Agriculture, Water and the Environment
<i>National Environment Protection (Assessment of Site Contamination) Measure 1999</i>	The purpose of the Measure is to establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry. The desired environmental outcome for this Measure is to provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination.	Australian Government Department of Agriculture, Water and the Environment

The DMP has also been prepared with reference to the following:

- Guidelines for the Environmental Assessment of Marine Dredging in the Northern Territory (NT EPA 2013).
- Guideline for the Preparation of a Notice of Intent (NT EPA 2015a).
- Guideline for the Preparation of an Environmental Management Plan (NT EPA 2015b).
- National Assessment Guidelines for Dredging (Commonwealth of Australia 2009).

- Technical Guidance: Environmental Impact Assessment of Marine Dredging Proposals (Western Australian Environmental Protection Authority [WA EPA] 2016).
- International best practice (e.g. PIANC 2006, 2008; CEDA 2011, 2015).
- Current recommendations for monitoring and impact assessments promulgated by the Dredging Node of the WA Marine Science Institution.
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (hereafter 'ANZG, 2018).
- Darwin Harbour Water Quality Protection Plan (WQPP) (DLRM 2014) under the National Water Quality Management Strategy.

2.1 Environmental Impact Assessment Guideline Screening

The NT EPA pre-referral screening tool from the Environmental Impact Assessment Guideline for Proponents; Referring a Proposal to the NT EPA (NT EPA, 2022), has been considered herein to identify whether a significant impact to the environment is posed specifically for the action of sweep bar / plough operations. An analysis of risks associated with this action is presented, with consideration for each aspect of the general screening questions is addressed (Figure 2-1 **Error! Reference source not found.**).

The relevant responses to the general screening questions are presented Appendix A. This assessment is only of relevance to the sweep bar / plough, and any actual dredging works will be referred to the NT government to seek Environmental approval. Some additional contexts for the proposed sweep bar / plough works includes:

- Short duration (maximum 2-week campaigns);
- Commonly small volumes (approx. < 1000 m³ per area); and
- Material will be assessed in accordance with the NADG screening levels to ensure it clean

Based on the outcomes of the screening questions (Appendix A) and the context for any proposed sweep bar / plough operations, there is considered to be no significant impact to the environment from sweep bar/plough operations.

Therefore, the action of sweep bar / plough works will not be included in the referral to the NT government as part of the dredging permit and this action will be undertaken on an as needs basis to improve vessel access in Darwin Port channels and berths. In addition, sweep bar /plough operations have been excluded from the risk assessment presented in this DMP (Section 7).

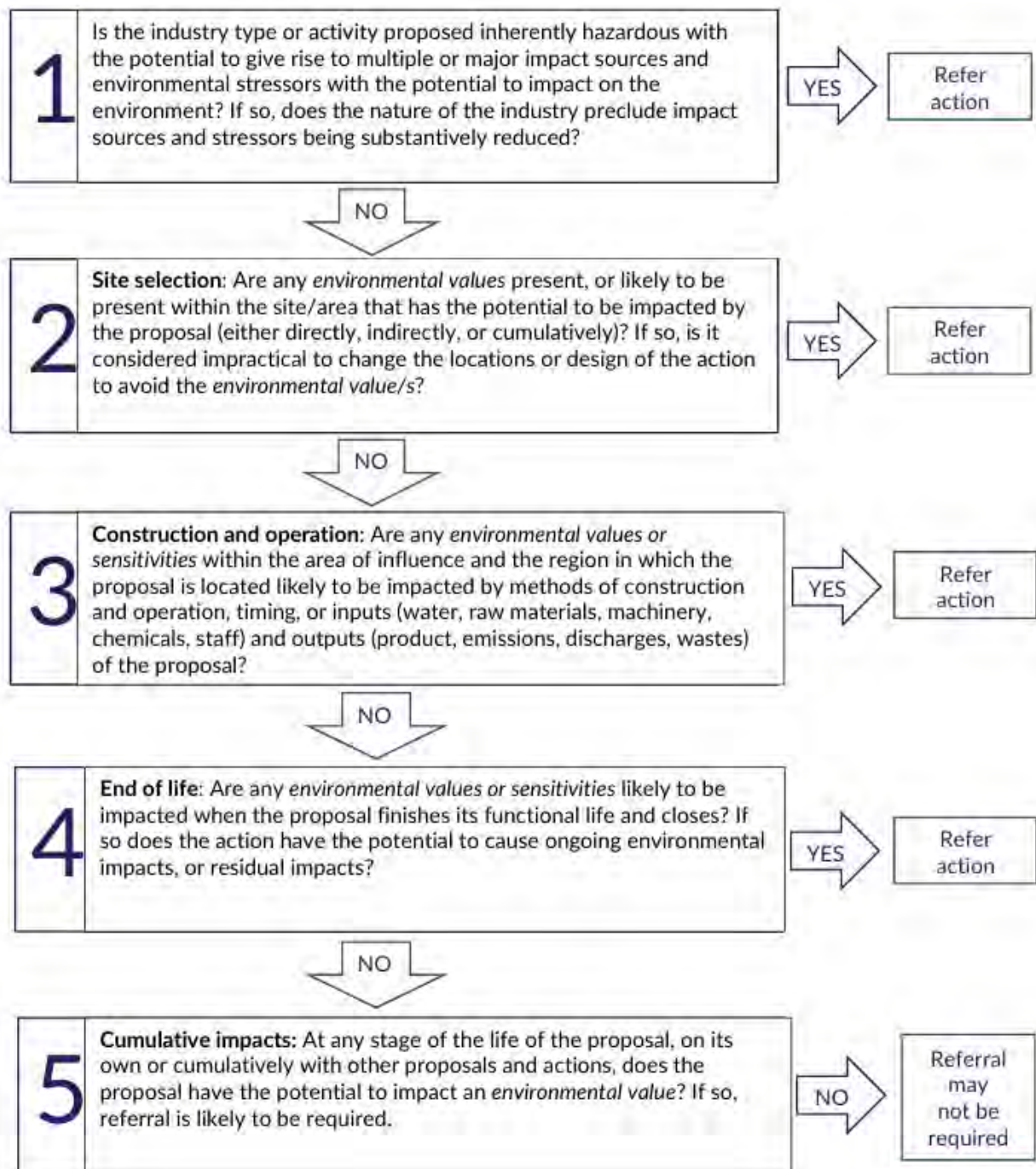


Figure 2-1 Referring a proposal to the NT EPA - Part 1 General Screening Questions.

3 ENVIRONMENTAL PROJECT MANAGEMENT AND RESOURCING

Maintenance dredging and bed levelling activities will be undertaken in accordance with the Darwin Port Environmental Policy (**Figure 3-1**); this requires that Darwin Port develops and maintains an Environmental Management System (EMS), provides sufficient resources to achieve its environmental targets and seeks to prevent pollution from its activities.



Figure 3-1: Darwin Port Environmental Policy

3.1 Environmental Management System and Procedures

The Darwin Port EMS is based on the requirements of ISO14001:2015 (International Standard for Environmental Management Systems) and provides a framework for the achievement of continual environmental improvement. The EMS is underpinned by 12 procedures (EMSPs) that explain the operation of the EMS.

The Darwin Port EMS and procedures will guide all maintenance dredging and bed levelling works. On appointment, the Contractor will develop an additional project-specific detailed dredge management plan or bed levelling management plan, required as bridging documents to the Darwin Port EMS and procedures. These plans will be approved by Darwin Port before dredging commences.

3.2 Key roles and responsibilities

Key roles and responsibilities will be identified by the Contractor on appointment and a project-specific organisational chart will be developed and maintained by the Contractor.

Site management responsibilities will be defined and documented by the Contractor before dredging and bed levelling commences; these will include reporting and communication pathways between the Contractor and Darwin Port personnel.

Key roles to be identified include (but are not limited to):

- Project Manager
- Health Safety Environment and Quality (HSEQ) Advisor
- Supervisors / engineers
- Employees and subcontractors

3.3 Inductions and training requirements

Inductions and training requirements will be determined by Darwin Port and the Contractor on appointment and will be in accordance with Darwin Port and the Contractor's policies and procedures. All relevant inductions will be completed by all personnel before they begin work on the project. A training and inductions register will be maintained by the Contractor.

3.3.1 Environmental general and work program specific inductions

The Darwin Port Environmental Policy commits to providing sufficient resources and training to achieve the targets defined in its EMS. Darwin Port will fulfil this commitment by:

- ensuring all persons involved with the maintenance dredging and/ or bed levelling complete the Darwin Port General Induction
- appointing Contractor(s) to perform the maintenance dredging and/ or bed levelling works with complementary environmental policies (through the Contractor prequalification process) and provision of advice to the Contractor on required work program specific environmental inductions.

Dredging work program and bed levelling program specific environmental inductions may include, but not be limited to, the following environmental topics:

- overview of key environmental issues and personnel responsibilities
- promoting awareness of significant environmental issues and personnel responsibilities
- reporting of environmental incidents - which will include how an event is reported and to whom the event is reported (all incidents are to be reported, including near misses)

- emergency procedures - which will cover the procedure for an emergency and for evacuation of the site in the event of a catastrophic situation arising
- contingency plans - e.g. for hydrocarbon or chemical spills.

3.3.2 Environmental awareness

Daily prestart / toolbox meetings will be conducted by the Contractor, with input from Darwin Port, and will be primarily aimed at operational staff. All Contractor and subcontractor personnel (if any) will be required to attend. Toolbox meetings will focus on environmental and safety items relevant for the project during that time and will be used as the main tool to further increase awareness of significant environmental and safety issues, and to communicate the relevant items contained in the Environmental and Safety Management Plans.

Typical items discussed in these toolbox meetings include environmental items such as new procedures or reinforcement of existing procedures relating to erosion control, handling of hazardous chemicals, management of waste/ recycling, need to report all incidents and hazards/near misses, etc.

3.3.3 Training

Only suitably qualified and experienced personnel will be engaged on the project. All personnel will have appropriate qualifications and experience for their role on the project. Training and qualifications are to be demonstrated to Darwin Port by the Contractor(s) prior to the commencement of the dredging work programs.

3.4 Environmental documents and records management

The Contractor appointed will have in place, or will develop before the start of dredging, a document management system that fulfils requirements to operate under the Darwin Port EMS.

Project records, including subcontractor project records, will be maintained to provide evidence of conformity to Darwin Port requirements and commitments in this DMP.

Such records include, but are not limited to:

- correspondence to/from the Darwin Port and interested parties
- permits, licenses and approvals
- induction training records
- inspection and test documentation (including calibration)
- non-conformance and corrective action / complaints
- environmental incidents
- audits and inspections
- monitoring records
- delivery / waste dockets.

3.5 Performance management

Performance management includes activities to ensure that goals are consistently being achieved in an effective and efficient manner. A key component of the environmental management process is the development and implementation of dredging work program specific measures to ensure that the environmental risks arising from the dredging and dredge spoil disposal activities are minimised. The success of these objectives is to be measured with key performance indicators (KPIs) defined for environmental management. Environmental performance measures are to be developed by Darwin Port and committed to by the Contractor(s) prior to the commencement of each specific dredging work program.

3.5.1 Environmental objectives

The environmental objectives of dredge operations management are to:

- Limit impacts of dredging and dredge spoil management operations and bed levelling activities on marine life and water quality.
- Ensure that protected marine species, including dolphins, dugongs, turtles and sawfish are not significantly adversely affected by dredging or bed levelling activities.
- Reduce the potential impacts from noise generated by dredging and bed levelling equipment.
- Limit sediment (turbid plume) mobilisation to an extent consistent with protecting the viability of specified communities.
- Ensure migratory bird species that use the dredge spoil deposition ponds are not directly adversely affected by dredge or bed levelling activities.
- Ensure that dredging and dredge spoil placement and bed levelling are undertaken in accordance with regulatory approvals, licenses, permits or authorisations.

3.5.2 Performance criteria

This DMP is the key reference document which identifies actions and commitments to be followed by the Contractor and subcontractor personnel throughout dredging operations. The broad performance criteria of the DMP are as follows:

- Compliance with the DMP by all project personnel and activities.
- Adherence to discharge water quality parameters as identified in the Water Quality Monitoring Plans (Sections 8.2.3 and 8.3.3 of this Plan).
- No net adverse impacts on corals, mangroves, dolphins, dugongs, turtles or sawfish.
- No injuries to protected marine species.
- No complaints received in relation to noise or vibration and no impacts on protected species from these sources.
- Response to all registered complaints and completion of Complaint Record and / or Incident Report; appropriate corrective actions taken within the timeframe stipulated by Darwin Port.

Where performance criteria are not met, this will form a trigger for review of the Plan, in addition to initiating corrective actions specific to the scenario.

3.5.3 Environmental management KPIs

In the environmental management frameworks detailed in Section 8 of this Plan, specific objectives and targets are set for each significant environmental aspect. KPIs related to the objectives and targets for each of the environmental management frameworks can be found in Section 8.

General objectives and targets are:

- all personnel working on site have undergone a work program specific environmental induction
- internal audit score of 100% compliance with the DMP (refer to Section 3.6)
- Darwin Port conducted audit score of 100% for compliance with the DMP (refer to Section 3.6)
- no activity in breach of the provisions of any environmental legislation
- 100% investigation and reporting of any environmental incident at the site
- 100% compliance required for management measures relating to dredging and dredge spoil management.

3.5.4 Environmental incident reporting

All Contractor and subcontractor site personnel will be required to report all environmental incidents immediately to the appropriate supervisor in accordance with their incident reporting procedures. The Contractor engaged will have (or will develop prior to the start of dredging) an Incident Reporting and Investigation Procedure.

Incidents shall be tracked through to close-out using an incident tracking system or register. Complaints will be investigated by the Project Manager and action taken to enable satisfactory closeout. Any incidents that have caused environmental harm, or that have the potential to cause environmental harm, will also be reported to the Darwin Port representative and to the NT EPA Pollution Hotline (1800-064-567) within 24 hours. When in any doubt as to the seriousness of the event, the Contractor will notify the authorities, in liaison with Darwin Port. Darwin Port will be notified of any notices received from authorities.

3.6 Management review

3.6.1 Inspections

Daily inspections of the work operations will be conducted by the Contractor's site supervisors. Any corrective actions resulting from inspections will be recorded and the progress tracked for completion.

3.6.2 Internal audits

Where dredging work programs are planned to be conducted over several days, internal audits of this DMP will be undertaken during the work program to assess the effectiveness of the Plan in the field, to ensure that the Contractor's monitoring and management regimes are aligned with those in the DMP, and to identify any opportunities for improvement.

3.6.3 Darwin Port audits

Darwin Port may audit the Contractor(s) implementation of this DMP at any time during the work program to assess the effectiveness of the Plan in the field, to ensure that the Contractor's monitoring and management regimes are aligned with those in the DMP, and to identify any opportunities for improvement.

3.6.4 External audits

External audits may be conducted by NTG departments if any given department considers there may be an issue in relation to environmental compliance. Darwin Port will assist with any external audit.

Results from any external audits will be reviewed by Darwin Port, with any necessary corrective actions assigned to Project personnel to ensure appropriate and timely closeout. Any corrective actions will be recorded and the progress tracked for completion.

3.6.5 Project corrective actions register

Any environmental non-conformance (e.g. incidents, audit-related non-conformance, complaints, NTG notices, etc.) will be recorded in a Project corrective actions register, or similar, to be developed by the Contractor. The corrective actions register will detail the non-conformance, the corrective action(s) required, the person(s) responsible for the action(s), timeframes within which each action is to be completed, and the actual completion date. Each non-conformance will be reviewed by Darwin Port and it will be established if there are any actions available to reduce the severity or likelihood of re-occurrence.

3.6.6 Continuous improvement

The Contractor will have in place mechanisms to review performance and to identify opportunities for improvement. Records will be kept, and reporting will be done according to Contractor procedures for managing documentation. Observations will be detailed in Project reporting to Darwin Port.

Mechanisms may include, but will not be limited to:

- prestart meetings
- toolbox meetings
- progress reports.

4 DREDGING AND DREDGE SPOIL PLACEMENT ACTIVITIES

4.1 Volumes

The estimated total volume of material requiring removal by maintenance dredging and bed levelling is approximately **30,000 m³** (based on the November 2024 hydrographic survey results, including 300mm over dredge allowance, see **Table 4-1** and the dredging volume drawings for each site in **Appendix B**). A total of four of the eight areas will be bed levelled, three will be dredged and a combination of bed levelling and dredging proposed at EAW Berth 2 (see **Table 4-1** footnotes for specific guidance).

Table 4-1: Estimated Dredge / Bed Levelling volumes (November 2024)

Site	Description	Base Level (m LAT)	Design Dredge Volume (m ³)	Dredge Volume Incl. Overdredge (m ³)
Marine Supply Base				
MSB Berth 1	Southern most berth on the MSB wharf	-8.7	578	1,655
MSB Berth 2 & 3	Two berths immediately to the north of berth 1	-7.7	848	1,938
MSB turning area	Area defined as the navigable area adjacent to both ends of the MSB wharf	-7.7	1,309	6,068
MSB entrance	Entrance to MSB channel near the East Arm sand bar	-7.7	961*	1,430
East Arm Wharf				
East Arm Wharf Berth 1	Berth at the south-east end of the wharf key line	-12.0	283*	865
East Arm Wharf Berth 2	In the centre area of East Arm Wharf	-13.5	8,137 [#]	12,438
East Arm Wharf bulk liquid berth	At the north-west end of East Arm Wharf	-12.0	413*	2,117
Fort Hill Wharf				
Fort Hill Wharf	Area adjacent to the face of, and extending to the northeast of the wharf	-10.0	2,765 [^]	4,237
TOTALS			15,295	30,748

* These areas will be subject to bed levelling; therefore the over-dredge volume is not of relevance. The works proposed will be in accordance with the sweep bar / plough work context presented in Section 2.1. [#]This area will also be subject to bed leveling to level out high spots, but the volume bed levelled will not exceed 1000m³. [^]This area is adjacent to deep water (See Appendix B) and bed levelling is proposed at this location to improve access and remove the 2,765m³.

4.2 Schedule

The schedule for each maintenance dredging and bed levelling campaign will depend upon the rates of accumulation of material within the areas to be dredged. These rates are expected to differ between areas; hence it is possible that not all sites will require dredging during each campaign.

Dredging of the volumes of material presented in **Table 4-1** is anticipated to require the dredge and/ or bed levelling plant to operate for approximately three days at each location. The dredging and/ or bed levelling campaign are each expected to be spread over a two-to-three-week period, depending upon the extent to which simultaneous operations occur (e.g. occupancy of wharf berths by ships). This takes account of:

- The need to dredge at reduced production rates when operating around wharf infrastructure (to avoid damage to structures);
- Time taken to relocate the dredge between the three dredging areas; and
- Supplementing the dredging works with bed levelling works.

If the dredging or bed levelling campaign is scheduled for execution during the Wet Season, then cyclonic or otherwise adverse weather conditions could necessitate the temporary cessation of dredging activities, thereby extending the period over which dredging would take place. The Contractor will make ongoing assessments regarding weather conditions to determine if a cessation in dredging was required. If Darwin Port goes into cyclone alert or shut down then, in accordance with the Darwin Port Cyclone Procedure (Darwin Port 2016), the Contractor will comply with all directions from the Darwin Port General Manager Operations.

4.3 Dredging Equipment

Dredging works will be carried out using bed levelling equipment and /or a cutter suction dredge (CSD) depending on the depth and composition of the accumulated materials.

4.3.1 Bed Levelling

4.3.1.1 General

Bed Levelling (also known as sweep bar works or ploughing) may be employed to redistribute sediment on the seabed (e.g. sweeping shallow areas into deeper areas or outside of navigation areas entirely) and does not involve the 'removal' of material.

Bed levelling is often relatively short in duration (i.e. <2 weeks). The bed levelling aims to relocate material from shallow to deep areas, to replicate the natural bed form migration and to help minimise the requirement for dredging works. The shallows areas of seabed material will be bed levelled by a purpose-built bed levelling plough (see **Figure 4-1** and **Figure 4-2**). A suitable tug will be commissioned for undertaking bed levelling operations.



Figure 4-1: Tug bed levelling (Example only).



Figure 4-2: Close up of the type of bed levelling equipment (example only) to be used for the works.

4.3.1.2 Disposal method and considerations

Material is redistributed on the seabed within the dredge areas or the adjacent channel and not removed.

4.3.1.3 Suitability for Darwin Port dredging works

Sweep bar works was considered by Hatch (2024) to be worthy of consideration at Darwin as follows:

- EAW and FHW appear well suited to sweeping works, with deep water near both wharfs. Alternatively, material may be able to be redistributed laterally into deeper areas along the wharf or pulled out of the berthing areas at either end.
- MSB may also be suitable for sweeping works, although this is likely to be less straightforward than at EAW and FHW. Deeper areas are available in the middle of the basin and in the channel.
- The MSB berth pockets may be more challenging to address via sweeping, particularly Berth 1 which is deeper than the other berths and adjacent basin. Material from Berth 1 could potentially be pulled into the deep end of Berth 2.
- Mobilisation/demob costs for sweeping are lower than many other dredging/intervention options. This may allow Darwin Ports to undertake these works on a trial basis to assess efficacy.
- The mobile nature of a sweep bar spread may be advantageous, allowing the dredge to shift locations as required (e.g. to avoid shipping movements).
- Approvals associated with sweep bar works will not be required, in contrast with the dredging works.

4.3.2 Cutter Suction Dredge (CSD)

4.3.2.1 General

Cutter Suction Dredges (CSD) are typically non-propelled barges equipped with a hydraulic cutterhead, suction pipe and pumps (see **Figure 4-3**). During dredging, the cutterhead is lowered to the seabed, rotating and disturbing the material to be dredged. The cut material together with water is drawn into the suction mouth. This slurry mixture is then transported by the dredge pump through the discharge pipeline to the designated discharge site.

To achieve the required pumping distances from the dredge footprint to the disposal sites, a booster pump may be required to supplement the pumping capacity of the CSD.

While operating, the CSD is considered stationary, with spud and anchor systems used for positioning the dredge within the dredging area. During the dredging works, a spud is lowered in the seabed to secure the vessel. Winches and anchors are used to swing the dredge from side to side allowing the cutterhead to remove material from the seabed (see **Figure 4-4**).



Figure 4-3: CSD Everglade (Hall Contracting) (source: Hatch 2024)

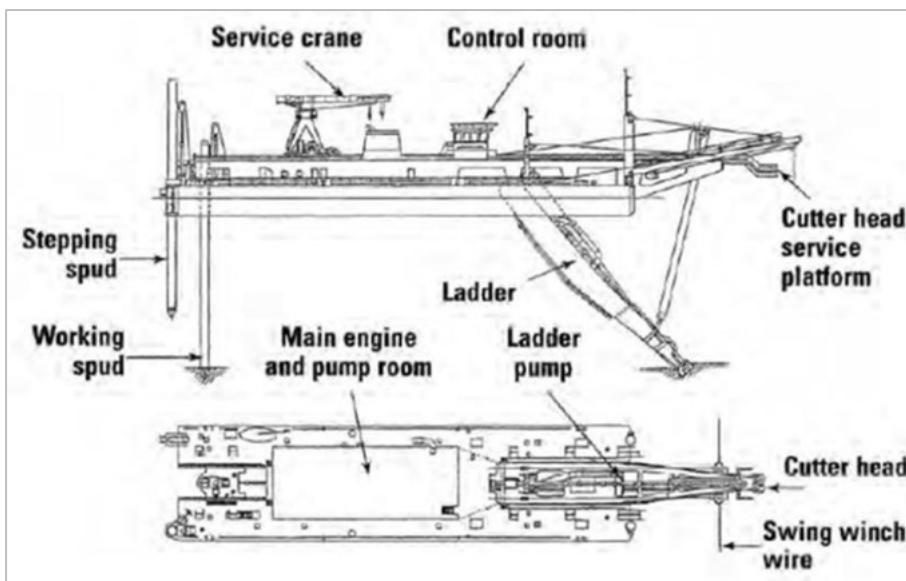


Figure 4-4: Typical cutter suction dredge (source: AECOM 2018)

4.3.2.2 Disposal method and considerations

Use of a CSD will allow pumped discharge disposal either to adjacent seabed disposal or to onshore ponds (in the case of the MSB dredging works).

4.3.2.3 Suitability for Darwin Port dredging works

Previous dredging works for Darwin Port have primarily been undertaken by CSD and was considered by Hatch (2024) to remain a viable option for future works.

Given the expected dredging volumes and disposal sites, a small to medium CSD is likely to be suitable for the works. A critical consideration for selecting a suitable CSD is the range of dredging depths, which may exceed 13.5 mCD (i.e. at EAW) plus allowance for tide. This likely means that a medium CSD will be most suitable, as smaller CSDs (with more limited max dredging depths) may be tidally restricted.

4.4 Summary of work method

Where the accumulated sediments are relatively thin (up to 1m deep) and/or where deeper water exists close to the berth locations, then sweep bar levelling will be employed to remove the accumulated materials to the maintenance dredge depths.

Where sweep bar levelling is not successful and/or not adjacent to deeper water, then CSD operations will be undertaken.

Where possible, dredging and/or bed levelling will be undertaken during the Wet Season; however, should the need arise, dredging and/or bed levelling during the Dry Season will also need to be permitted.

It is expected that CSD dredging would be undertaken up to 20 hours per day (24-hour operations with four hours down time per day) and bed levelling during daylight hours and would occur over of a period of approximately two to three weeks. Stoppages in dredging and bed levelling may occur for dredge or tug maintenance or to assist in the control of the quality of the water at the designated disposal sites within the harbour.

CSD dredge rates are anticipated to be between 1,400 m³ per hour at a water-to-sediment ratio of 19:1 (Streten, Tsang & Harries 2017) and 2,000 m³ per hour at a water-to-sediment ratio of 9:1 (Williams 2017). A sediment loss rate of 1% at the dredge head is typically applied to modelling of CSD operations. However, the cutter will only be engaged for limited time periods as most of the dredging will be undertaken in close proximity to wharf infrastructure and the loss rate will therefore be substantially less than this. To mitigate the risk of impact to the cutter head and the infrastructure, the dredge will operate in suction-only mode during these times.

4.5 Approach for Sediment Material Characterisation

Prior to each maintenance dredging and/or bed levelling campaign, the geochemical characteristics of representative samples of the material to be dredged will be determined through the implementation of a Sediment Sampling and Analysis Plan (SAP). The material will be unconsolidated sediments that have accumulated within areas in which capital dredging has been undertaken. The following characteristics of the sediments will be determined:

- Particle size distribution (PSD) to confirm that the sediment to be dredged is of comparable PSD to that used in plume dispersion modelling (Section 6.3).
- Concentrations of contaminants of potential concern (Section 5.2.3.2) to ascertain whether the 95% upper confidence limit of the mean (95% UCL) concentration of any contaminant exceeds the Commonwealth of Australia (2009) screening level for that contaminant.
- Acid sulfate soil potential (Section 5.2.3.3) to ascertain whether potential acid sulfate soils (PASS) are present in the areas to be dredged. This will only be required for sediments from the MSB berths

for which disposal into the decant ponds at East Arm Wharf is proposed (Section 4.8); the sediments to be disposed into harbour waters (Section 4.7) will not be exposed to air, hence there will be no potential for oxidation and acid generation.

The outcomes of the geochemical assessment will guide the selection of the location for the disposal of dredge spoil from each dredging site, as per **Figure 4-5**. [The results of the 2025 Sediment Sampling and Analysis Plan Implementation Report is presented in Section 5.](#)

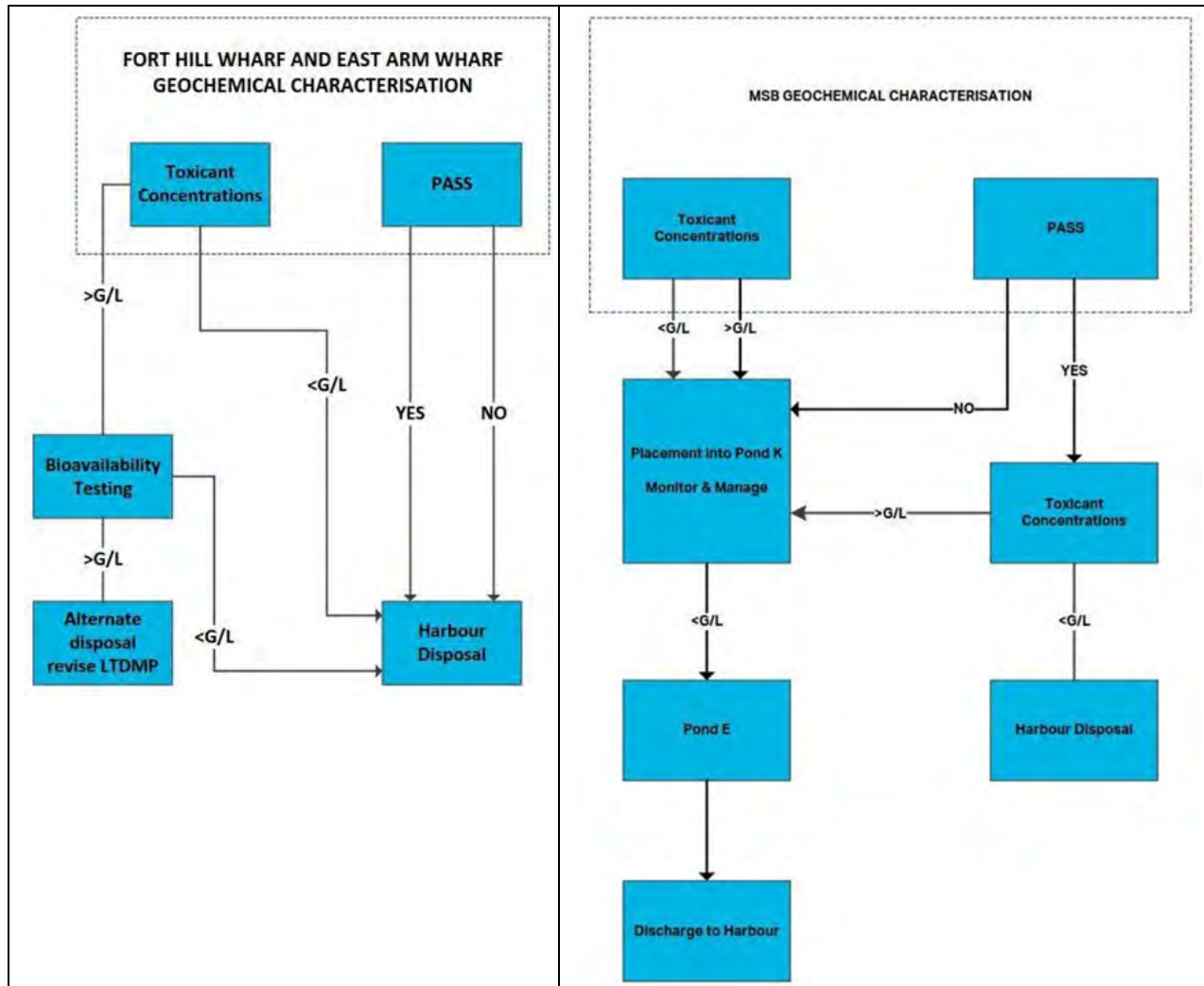


Figure 4-5: Spoil disposal flowcharts (G/L = Commonwealth of Australia (2009) screening level)

4.6 Dredge spoil placement areas

Dredge spoil placement will occur either onshore within the existing decant ponds in the East Arm Wharf area or in Darwin Harbour, nearby the dredge footprints. The proposed spoil disposal locations are shown in **Figure 4-6**.



Figure 4-6: Dredge spoil disposal locations

4.7 Harbour disposal

Dredge spoil from East Arm Wharf and Fort Hill Wharf will be disposed of into areas around 500 m from the wharves. Spoil will be relocated into deeper water adjacent to the berths using the sweep bar or pumped through a floating pipeline by the CSD to the disposal location where it will be discharged through the submerged end of the pipeline. To prevent mounding of the dredged material by the CSD method, the spoil will be disposed across areas that are 100 m wide and 800 m long, aligned along the tidal axes which are parallel to the wharf faces.

The spoil from maintenance dredging at the MSB Channel will also be will be disposed into deeper water offshore using the sweep bar or pumped through a floating pipeline by the CSD to the disposal location located around 300m from the end of the channel.

4.8 Onshore disposal

4.8.1 Justification

Placement into the existing decant ponds at East Arm Wharf is the preferred option for material dredged from the MSB wharf and turning basin areas due to the ready accessibility of the ponds without impacting upon shipping movements and other operations at East Arm Wharf. These ponds have been used to dispose of dredge spoil from several dredging programs in East Arm Wharf precinct, including the dredging associated with the construction of the MSB, the East Arm barge ramp and the Darwin Shiplift Project (DSL).

In the unlikely event that PASS is detected during the geochemical assessment of dredge material, dredge spoil will be placed at an alternative location approximately 600m east of the MSB to avoid exposure of

PASS to oxidising environments (provided the concentrations of all toxicants are below Commonwealth of Australia [2009] screening levels).

Maintenance material dredged from the East Arm Wharf berth pockets and MSB Channel cannot be safely, economically or practically disposed into the decant ponds as disposal pipelines would cross shipping channels and/or critical wharf operational areas.

4.8.2 Dredge spoil placement and tailwater flow path

If the geochemical assessment of the material to dredged from the MSB berths (Section 4.5) indicates that PASS is not present, then the spoil will be pumped into the East Arm Wharf decant ponds, with tailwater stored for sufficient time to allow for settling of fine suspended sediments (residence time) prior to discharge of the tailwater back into Darwin Harbour. Water quality management and monitoring is discussed in detail in **Section 8.3** of this plan.

Whenever possible, dredge spoil will be pumped ashore through a temporary pipeline from the dredge area into Pond K. Once the physico-chemical properties of the tailwater within Pond K are deemed acceptable for release (**Section 8.3.3**), it will flow into Pond E (North) via a reclamation box in the bund wall, through Pond E (South), then out of the permeable section of the railway bund wall (**Figure 4-7**).



Figure 4-7: East Arm Wharf Pond system

Transfer points from ponds K to E (North) and ponds E (North) to E (South) have reclamation boxes with adjustable height weirs. The weir boards are designed to be sufficiently watertight to contain sediment, thus managing turbidity levels within ponds K and E (North) and decreasing the likelihood of turbidity levels in Pond E (South) becoming unacceptably high. The reclamation boxes and associated weir boards are the same as those approved and used for previous dredging programs utilising the ponds for spoil disposal and tailwater management, including the capital dredging for construction of the MSB.

If it is necessary to place spoil directly into Pond E (North) (e.g. in the unlikely event that PASS is detected in the material to be dredged from the MSB and spoil cannot be placed at the designated harbour location [Section 4.7], or Pond K reaches capacity), then this would only occur when the chance of a large stormwater flow is low (i.e. during the Dry Season).

During dredging works, regardless of the initial dredge spoil deposition location (i.e. Pond K or Pond E [North]), the tailwater will be returned to the environment through the permeable section of the railway bund wall located in the south-west corner of Pond E (South).

4.8.3 Available pond volumes

The available pond capacities have been advised by Darwin Port (email R Akers 21/01/2025) as being:

- Pond K: 120,000 cubic meters
- Pond E North: 420,000 cubic meters RL9.0
- Pond E South: 180,000 Cubic meters RL9.0

Based on the above, the pond system has a storage capacity of 720,000 m³ for solids utilising all three ponds, hence it is apparent that there will be adequate capacity to receive the maintenance material from the MSB berth and turning basin dredging (estimated in situ volume of 9,661m³, refer **Table 4-1**).

It may also be possible to stockpile some dredge spoil within the ponds to achieve greater available volume should it be required (as was done during the MSB capital dredging campaign). The capacity of Pond K will be used as a priority.

4.8.4 Pond water levels

The maximum water height in Pond K will be 6.0 m AHD or a minimum of 0.5 m freeboard (whichever is higher). Pond E (North) will operate with a water level between 3.5 and 5.0 m AHD and be controlled by a reclamation box with an adjustable weir.

The water level in Pond E (South) will be controlled to ensure at least 0.5 m freeboard at all times; tailwater input can be managed such that, if necessary, the rate of flow out through the permeable section of the railway bund (at the south-west corner of Pond E [South]) matches or exceeds the rate of tailwater input.

At the reclamation boxes between ponds K and E (North), and between ponds E (North) and E (South), the flow can be stopped by adding drop boards and raising the height of the weir. In both instances flow can be stopped within an hour as a corrective action, if required (**Table 8-5**) and subject to the need to retain stormwater flows (**Section 4.8.5**).

4.8.5 Stormwater and landform

Stormwater from the pond network and adjacent Darwin Port land ultimately flows into Pond E (South) for return to the harbour via the permeable section of the railway bund wall (refer **Figure 4-8**). During MSB dredging operations, particularly if dredging is undertaken over the Wet Season, consideration will be given to possible storm events, and the Contractor will ensure that a flow path is always available for stormwater to find its way through the ponds.

Stormwater from the Pond K road bund and a catchment area near the gatehouse, estimated to be 20,000 m², is now diverted into a new stormwater channel in place along the boundary between

Pond K and the former Pond C area, instead of flowing into Pond K. Stormwater from the highpoint on the road to the south of Pond K now flows along a stormwater channel and through a culvert into Pond E (North).

The runoff from Darwin Port land to the north of the ponds passes through Pond D and into Pond E (North). Importantly, stormwater does not flow into Pond K, allowing greater control over water exiting from this primary spoil disposal pond.



Figure 4-8: Stormwater flow paths through the East Arm Wharf Pond system

If, during the Dry Season, it is necessary to dispose of sediment from the MSB berths into Pond E (North) (**Section 4.8.2**), then this will only be filled with solids to a level which will allow sufficient capacity for stormwater and tailwater management.

The pond network has the ongoing function of stormwater management beyond the duration of maintenance dredging operations and will be maintained during and after the completion of dredging activities. Therefore, the pipe connections between ponds will be retained for ongoing stormwater management.

When the dredging is complete a surface survey will be completed and a surface profile developed to minimise the risk of ponding against the access road causeway or in areas not forming part of the stormwater system, and the final landform will be effective in directing surface water through Pond E (North) before entering into Pond E (South), then returning to the receiving environment through the permeable portion of the railway bund wall.

5 EXISTING ENVIRONMENT AND RELEVANT STUDIES

5.1 Regional Setting

This section of the Plan provides a brief overview of those components of the existing environment that are pertinent to the consideration of impacts from dredging and spoil placement during maintenance dredging and/or bed levelling at Fort Hill Wharf, East Arm Wharf and the MSB. This information provides the context for determining the monitoring programs and management strategies detailed in [Section 8](#).

The Darwin Harbour region extends from Gunn Point in the east, to Charles Point in the west, covering an area of over 3200 km² comprising 65% terrestrial and 35% marine habitats (at high tide) (Fortune 2016). The Darwin Harbour region includes the catchments of the rivers and streams that flow into the harbour, including the Howard River, Elizabeth River and Blackmore River, as well as the large estuarine/marine water body that is Darwin Harbour. Within the harbour, shores are characterised by extensive intertidal mud flats and mangroves.

5.2 Existing Physical Environment

5.2.1 Meteorological conditions

Darwin Harbour lies in the monsoonal (wet–dry) tropics of northern Australia and experiences two distinct seasons; a hot Wet Season from November to March (when winds are predominantly westerly) and a warm Dry Season from May to September (when winds vary from south-easterly through to northerly). The months of April and October are transitional.

Maximum temperatures are defined as hot all year round, but November is the hottest month with a range of 25°C minimum to 33°C maximum, while the lowest average daily temperatures (19°C minimum to 31°C maximum) are normally experienced in July (Bureau of Meteorology [BoM] 2017). The mean annual rainfall for Darwin is 1723 mm, with rain falling on an average of 113 days, mainly from December to March (BoM 2017).

Cyclone activity occurs intermittently in the Darwin region, mainly between November and April, with cyclones typically causing the most damage within a distance of 50 km from the coast. Aside from the impacts of strong winds, storm surges can be of concern to vessels and coastal developments surrounding Darwin Harbour. Storm surges result from strong onshore winds and reduced atmospheric pressure and can cause flooding and damage through raised tidal levels and increased wave heights. The height of a storm surge is influenced by many factors, including the intensity and speed of winds within the associated cyclone, the angle at which the cyclone crosses the coast, the speed and direction of tidal flows and the bathymetry of the affected area (NT Emergency Service 2011).

5.2.2 Coastal geomorphology and bathymetry

Darwin Harbour is a large ria system, or drowned river valley, formed by post-glacial marine flooding of a dissected plateau. The harbour was formed by rising sea levels about 6000–8000 years ago. Since the formation of the harbour, surface erosion from the adjoining terrestrial environment has carried substantial quantities of sediment into the harbour. This sediment now forms much of the intertidal flats that which overlie bedrock around the harbour margins.

The harbour extends for more than 30 km along a north-west to south-east axis. The main channel of the harbour is around 15–25 m CD deep, with a maximum depth of some 36 m. The channel favours the eastern side of the harbour and continues into East Arm, at water depths of more than 10 m CD. The bathymetry in

this area has been modified by dredging for the development of East Arm Wharf and the INPEX LNG processing facilities located at Bladin Point.

5.2.3 Marine sediments

5.2.3.1 Darwin Harbour seafloor

Approximately 80% of the Darwin Harbour region's seafloor is estimated to be covered with soft surfaces consisting of mud and fine sand. Soft surfaces containing varying amounts of gravel and sand are found in the main channels around reefs, on beaches and on spits and shoals near the mouth of the harbour (Fortune 2006).

The typical geological profile of the Darwin Harbour seafloor comprises Quaternary age intertidal marine alluvium comprising mud, silt, sand and coral remnants, underlain by the Proterozoic metasediments of the Burrell Creek Formation, consisting of meta-siltstone, meta-sandstone and phyllite. The rocks strike close to north-south and are steeply dipping either to the east or west. Quartz veins are widespread within the Burrell Creek Formation.

Sediments in the river catchments are predominantly fine-grained, mainly clay and silt. Creeks and rivers may transport coarser material (e.g. sand) into the estuary during the wet season, though much is trapped by coastal vegetation, both riparian and mangrove (McKinnon et al. 2006). The fine sediment delivered to the upper arms of the harbour settles out of suspension and is then eroded and re-deposited mainly by tidal currents, especially at spring tides (Munksgaard 2013).

Hydrodynamic modelling of the fate of suspended sediment plumes has shown that substantial sediment fluxes are directed up-estuary where fine sediments are trapped; the sediment fraction exported to the ocean is relatively small (Williams, Wolanski & Spagnol 2006).

5.2.3.2 Contaminants of potential concern

Land uses in the Darwin Harbour catchment represent potential sources of contaminants that may accumulate in the berths to be dredged. Skinner, Townsend and Fortune (2009) estimated the diffuse annual contaminant loads contributed to the harbour during typical Wet Season rainfall (1,670 mm); the loads from catchments that may influence the maintenance dredging locations are presented in **Table 5-1**.

Table 5-1: Diffuse annual pollutant loads

Catchment	Susp	Nitro	Phos	Alum	Arse	Cad	Chro	Copp	Nicke	Lead	Zinc
	tonnes				kg						
EEA	3100	72	3.56	142	54.2	18.6	202	576	98.8	428	2300
Mi	737	14.2	0.9	40	11.7	3.49	44.8	169	19.3	156	616
PS	339	5.36	0.43	20.9	4.9	1.23	19.3	90.6	7.18	93.7	312
My	116	1.76	0.15	7.28	1.64	0.4	6.51	31.6	2.35	33.2	108
Hu	1010	14.4	1.32	65.8	14	3.17	55.9	287	19.2	308	969
Bl	473	6.82	0.61	30.5	6.56	1.51	26.2	133	9.08	143	451

Re	310	4.42	0.4	20.2	4.29	0.97	17.1	88.1	5.88	94.6	297
Sa	342	5.14	0.44	21.6	4.83	1.16	19.2	94	6.87	99.1	321
CBD	446	5.87	0.59	30	5.96	1.25	24.1	132	7.77	145	438
Total	6873	130	8.4	378	108	31.8	415	1601	176	1501	5812
Catchment codes: EEA=Elizabeth East Arm; Mi=Mitchell; PS=Palmerston South; My=Myrmidon; Hu=Hudson; Bl=Bleesers; Re=Reichardt; Sa=Sadgroves; CBD=Darwin Central Business District											

Approximately 6 km upstream of East Arm Wharf, the Palmerston Wastewater Treatment Plant discharges treated effluent into Myrmidon Creek, which enters the lower reaches of the Elizabeth River where it enters East Arm. The mass loadings of the release from the Plant in 2005/06 (the most recent data available) were 181 tonnes of suspended sediment, 40 tonnes of ammonia, 69 tonnes of nitrogen and 18 tonnes of phosphorus (Power and Water Corporation [PWC] 2006).

Potential contaminants in the three dredging areas pertaining to port operations over the years include metals (e.g. arsenic, cadmium, chromium, copper, iron, mercury, manganese, nickel, lead, uranium, zinc), hydrocarbons, nutrients (from fertilisers) and organotins (i.e. tributyltin from ship anti-foulant coatings). Whilst the latter substance is no longer permitted to be applied to ships that would enter Darwin Harbour (as per the International Convention on the Control of Harmful Anti-fouling Systems on Ships) it is a persistent contaminant that may remain within sediments for many years (Okoro et al 2011), often associated with paint flakes (Commonwealth of Australia 2009).

As indicated in Section 4.5, the geochemical characteristics of the material to be dredged in each campaign will be ascertained through analysis of representative samples during the planning phase.

5.2.3.3 Potential acid sulfate soil

In the Darwin region, PASS has been identified in association with mangrove sediments (e.g. Hill & Edmeades 2008). As PASS is formed under anaerobic conditions, it is considered unlikely that it will occur in the sediments that accumulate at the maintenance dredging locations, which will be deposited under aerobic conditions (i.e. in the presence of dissolved oxygen within the water column).

Nonetheless, the presence of PASS in the material to be dredged in each campaign will be ascertained through analysis of representative samples during the planning phase (Section 4.5).

5.2.3.4 2025 Sediment Sampling and Analysis Plan Implementation Report Results

Darwin Port has a need to periodically undertake maintenance bed levelling and dredging to remove unconsolidated sediment (e.g. clay, silt, sand) that is naturally transported and deposited into existing berth pockets at East Arm Wharf and Fort Hill Wharf and into the berth pockets, turning basin and channel of the MSB. This bed levelling and dredging is required to maintain the required depths, to provide safe access at all tides for vessels using port facilities and maintain effective operational parameters at the facilities.

The Darwin Port Maintenance Dredging SAP was prepared consistent with the requirements of the National Assessment Guidelines for Dredging and involved targeted sampling at the following port locations:

- Marine Supply Base (MSB);

- East Arm Wharf (EAW);
- Fort Hill Wharf (FHW); and
- MSB Entrance Channel (MEC).

Sediment sampling was conducted in March 2025 using a combination of surface grabs and diver coring. Sediments generally consisted of fine unconsolidated silts with small proportions of sand. Sediments from MEC were geologically distinct from the other locations and were primarily sand with a small proportion of shell.

Contaminant concentrations in sediments were consistently low for all analytes tested, with nearly all results returning 95% UCLs that were well below their respective screening levels. The exception was at MEC, where elevated levels of arsenic were recorded in all samples tested. The elevated levels were found to be related to naturally occurring arsenic that is present in particular geological strata. Elevated arsenic concentrations have been documented in previous sediment investigations of Darwin Harbour and have been determined to be of a localised geological origin.

No organotins were recorded above the limits of detection. TPH was recorded in all samples but at very low concentrations, whilst PAHs were less than their respective limits of reporting in most of the samples tested. Sediments were also confirmed as having low risk PASS properties.

Considering the results of the sediment sampling and analysis program, the sediments from the port locations tested would be considered suitable for open water disposal including bed levelling and sweeping related activities.

5.2.4 Metocean Conditions

Darwin Harbour has semidiurnal macro-tides (two highs and two lows per day) with a strong diurnal inequality. The highest astronomical tide is 8 m CD. The mean spring tidal range is 5.5 m, and the mean neap tidal range is 1.9 m, with a maximum range of 7.8 m. It is a well-mixed system with large volumes of water moving within the harbour with tidal fluctuations.

The large tidal ranges in the harbour produce strong currents that peak at speeds of up to 2–2.5 m/s. Tidal flows are also large; peak spring-tide flows have been measured along a line from East Point to Mandorah and are in the order of 120 000 m³/s. Over a spring tide up to 1000 GL/s can pass through this area (Williams & Wolanski 2003).

Modelling by Li et al (2014) indicated that total sediment transport in the harbour was predicted to be seaward in the main harbour channel, and landward at the entrance to East Arm. The model also suggested that mangroves and tidal flats played key roles in redistributing suspended sediments and affected total sediment transport by modulating tides and tidal asymmetry.

Williams, Wolanski and Spagnol (2006) investigated the link between hydrodynamics, sediment and nutrient dynamics in the harbour to assist in the management of infrastructure developments. Near headlands and embayments, a complex circulation occurs that includes jets, eddies, separation points and stagnation zones. These currents are different at flood and ebb tides, and the asymmetric dispersion of particles results in trapping at headlands and embayments. Sediment is delivered to the upper arms by runoff. Despite being macrotidal the harbour was found to be poorly flushed, with much of the riverine fine sediment remaining trapped in mud flats and mangroves with little escaping to the sea. The residence time of pollutants in the upper reaches of the harbour was found to be in the order of 20 days (Williams, Wolanski & Spagnol 2006).

The East Arm Wharf and MSB sites are located in an area where the Dry Season flushing is estimated to be around 40 days (**Figure 5-1**), hence it is defined as being in the Upper Estuary Zone. The flushing time at Fort Hill Wharf is estimated to be around 25 days; hence it is defined as being in the Middle Estuary zone (Fortune 2010).

5.2.5 Marine water quality

Water quality in Darwin Harbour is generally high, although naturally turbid most of the time. Water quality parameters vary greatly with the tide phase (spring versus neap; flood versus ebb), location (inner versus outer harbour), and with the season (Wet Season versus Dry Season). Duggan (2006) conducted research on the water quality of Darwin Harbour from 2002 to 2004. Seasonal aspects, rather than spatial or tidal aspects, were found to be the most important determinant of water quality within the harbour in general, with rainfall considered to have the greatest impact on water quality (increasing nutrients, suspended solids and chlorophyll a).

Tidal movement can play an important role in re-suspending material from the harbour floor into the water column and water quality in the dredging areas is predominantly impacted by suspended sediments resulting from fast moving currents.

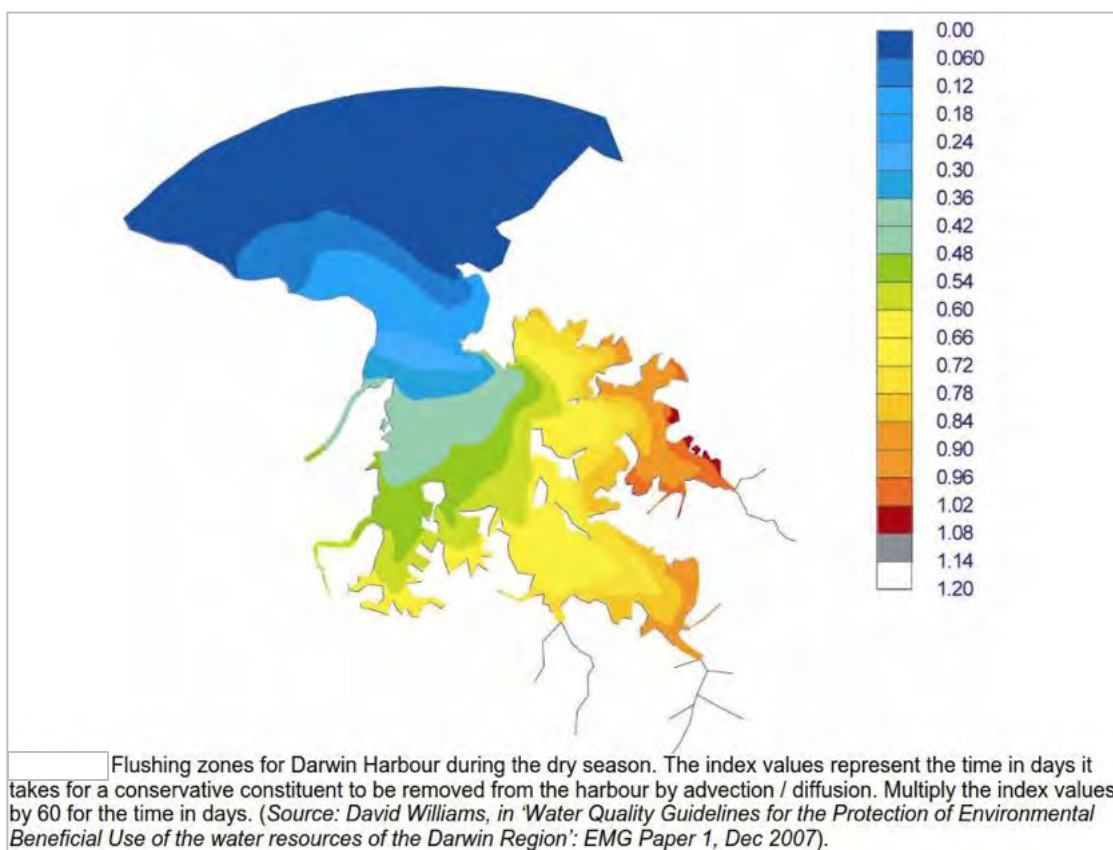


Figure 5-1: Dry season flushing zones in Darwin Harbour (Source: Fortune (2010))

Water quality is typically higher in outer harbour waters than within the inner harbour, though turbidity at the harbour mouth can be elevated in shallow areas due to re-suspension of sediments from intertidal flats, especially during spring tides.

A typical Darwin Wet Season extends from November to April and is characterised by warm air temperatures, convective storms and monsoonal weather which brings heavy rain and strong north-westerly winds and, in some years, cyclonic weather (Fortune 2016). These Wet Season conditions affect harbour water quality due to high surface runoff from the land (URS 2011).

There is no evidence of widespread water or sediment pollution in the Harbour (DENR 2016, Fortune 2016), although there some localised pollution has been identified in the past (e.g. Padovan 2003, Water Monitoring Branch 2005, Drewry et al 2011). Anthropogenic influences to Harbour water quality include the East Arm Wharf port operations, historic industrial activities at Darwin Waterfront, Sadgroves Creek and wastewater outfalls (URS 2004); however, there has been no evidence of widespread or persistent hydrocarbon or pesticide pollution in the harbour (Darwin Harbour Advisory Committee 2007).

The harbour may be subject to occasional pollution events such as hydrocarbon spills, from potential sources such as:

- seasonal stormwater inflow from Darwin and Palmerston stormwater drainage networks
- creeks with industrial developments in their catchments (e.g. Hudson Creek, Sadgroves Creek)
- bulk hydrocarbon storage (e.g. at East Arm Peninsula, Darwin LNG plant and Channel Island Power Station)
- inventories in recreational vessels and commercial ships
- refuelling locations (e.g. HMAS Coonawarra, Cullen Bay, Fishermans Wharf).

5.2.6 Water quality baseline data

Between 2008 and 2011, several water quality investigations were undertaken by URS on behalf of INPEX to characterise the existing conditions in East Arm (URS 2009, 2011). **Table 5-2** presents summary statistics for Dry and Wet Season water quality, as recorded at a site off the southern tip of South Shell Island (URS 2011).

These data were collected every 15 minutes over a year-long program. Data were grouped and averaged based on tidal cycle and seasonal variation, allowing seasonal means, medians and percentiles to be calculated. This gives a robust body of data to compare background levels of turbidity with potential increases associated with various natural and artificial turbidity-generating events in the harbour.

Water quality data from South Shell Island are relevant to the maintenance dredging locations as this site has the nearest sensitive receptors (coral communities) to them, although modelling does not predict that the communities are at risk of irreversible impacts from the dredging works (refer to Section 7).

Table 5-2: Summary of water quality parameters at South Shell Island (Source: URS (2011))

Parameter	Dry Season			Wet Season		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Temperature (°C)	28.1	25.3	32.1	30.4	28.1	32.0
Conductivity (mS/cm)	48.7	40.2	52.9	46.2	36.7	49.8
Depth (m)	6.3	2.4	11.0	6.7	2.5	11.3
pH	8.0	7.7	8.5	8.0	7.6	8.2

DO (%)	93.5	73.4	121.1	88.5	67.3	106.4
Turbidity (NTU)	4.4	0.1	46.4	8.3	0.2	68.0
Suspended sediment concentration (SSC) (mg/L)*	10.8	7.1	46.4	14.1	7.2	64.7

* Calculated from NTU using relationship in URS (2011): $SSC = 0.848 * NTU + 7.0477$

5.3 Environmental receptors

5.3.1 Marine communities

Darwin Harbour has a complex assemblage of marine ecological communities, including rocky shore biota, hard corals, filter feeders (primarily soft corals and sponges), macroalgae, seagrasses, soft sediment biota, mangroves and fish communities. Smit, Penny and Griffiths (2012), in their summary of previous benthic habitat mapping of Darwin Harbour, suggest that the benthic habitats present in the inner and outer harbour differ significantly and are typically characterised as follows:

- Outer harbour:
 - extensive seagrass communities occur in shallow waters
 - corals and algae dominate on hard substrates in shallow waters.
 - deeper waters are characterised by filter-feeder communities (e.g. sponges, soft corals).
- Inner harbour:
 - hard substrates in shallow and deeper waters consist of mixed communities or are dominated by sponge communities
 - no seagrass communities are present.

The environmental receptors that will be exposed to potential impacts from the maintenance dredging works are those within the inner harbour, hence seagrass communities are not considered within this Plan.

DENR is the custodian for comprehensive habitat mapping datasets accrued over surveys for many projects within Darwin Harbour (e.g. Geo Oceans 2011, 2012a, b; Siwabessy et al 2015). Habitats that are relevant to this Plan (i.e. those that could potentially be impacted by maintenance dredging) are shown in **Figure 6-5**.

5.3.1.1 Hard coral communities

Hard coral communities occur in Darwin Harbour where the substrate is rocky in the lower intertidal and shallow subtidal zones and where hydrodynamic conditions permit. A total of 123 species of corals have been recorded in Darwin Harbour (Wolstenholme, Dinesen & Alderslade 1997). Hard coral communities are typically dominated by colonies with massive (e.g. Faviidae, *Porites* spp.), foliose (e.g. *Turbinaria* spp.) or encrusting (e.g. Faviidae) growth forms (INPEX 2010).

Hard corals are dominant within some of the benthic communities around South Shell Island, mainly on the western side of the island. A reduction in hard coral cover was recorded at South Shell Island monitoring sites during the INPEX capital dredging campaign conducted between 2012 and 2014; this was concluded to be as a result of a combination of elevated turbidity and increased sedimentation (Cardno 2014). Reductions in hard coral cover at South Shell Island monitoring sites were also detected during the MSB capital dredging campaign that was undertaken within the same period as the much larger INPEX campaign (Macmahon 2013, Department of Infrastructure [DoI] 2014).

Sediment plume modelling for the maintenance dredging works covered in this Plan (Section 6.4) predicts that the South Shell Island coral community is sufficiently distant from the works to not be at risk of irreversible impact.

Other well-known hard coral communities in Darwin Harbour include the following:

- Off the north-east shore of Wickham Point.
- Weed Reef, Plater Rock and Kurumba Shoal, on the western side of the harbour, and Dudley Point at the northern end of Fannie Bay.
- Channel Island coral community in Middle Arm, on the intertidal platform between Channel Island and the mainland. This is listed on the Register of the National Estate and is a declared Heritage Place under the NT *Heritage Conservation Act 1991*.

All of these communities are sufficiently remote from the dredging and proposed spoil disposal locations that there is no credible risk of impact to them.

5.3.1.2 Filter-feeder communities

Filter-feeder communities are those that primarily comprise sponges, gorgonians (sea fans and sea whips) and other soft corals. They primarily occur on intertidal or subtidal hard substrates and may co- occur with hard corals, giving rise to “mixed species” communities. However, they also occur at depths shallower than, and deeper than, those at which hard corals thrive and can be the dominant component of the benthic community in some areas.

It is recognised that filter-feeder communities around South Shell Island and Old Man Rock may contain species that could be of importance to bio-prospecting. However, it is also recognised that large areas of filter-feeder communities are present both within East Arm and across the broader harbour (Geo Oceans 2011, 2012a, b; Siwabessy et al 2015).

Benthic habitat monitoring during the MSB capital dredging campaign (undertaken in 2012 and 2013) found no statistically significant changes in filter-feeder communities across the three surveys (Macmahon 2013, DoI 2014). This is somewhat unsurprising as these communities are generally less sensitive than corals to the physiological pressures of reduced benthic light availability and sedimentation associated with dredging activities or natural environmental conditions. Filter-feeder communities were not monitored as part of the INPEX dredging campaign that was conducted within the same period as the MSB dredging (INPEX 2013).

5.3.2 Protected marine species

5.3.2.1 Cetaceans

Three species of coastal dolphin inhabit the Darwin Harbour region: the Australian humpback (*Sousa sahulensis*; formerly known as the Indo-Pacific humpback), Indo-Pacific bottlenose (*Tursiops aduncus*) and Australian snubfin (*Orcaella heinsohni*) dolphins. All three species are listed under the EPBC Act as marine migratory species and are therefore designated as Matters of National Environmental Significance.

Brooks and Pollock (2014) undertook the most extensive and recent study of the abundance, movements and habitat use of coastal dolphins in the Darwin region (Darwin Harbour, Bynoe Harbour and Shoal Bay) between 2011 and 2014, a program initiated as part of the environmental approvals for the Ichthys LNG project. Their study revealed that together, these three species are more commonly observed in Shoal Bay, while in Darwin Harbour, dolphins are more commonly seen in East Arm and West Arm than other parts of Darwin Harbour.

Brooks and Pollock (2014) analysed the results of the first six primary samples from dolphin surveys undertaken between October 2011 and March 2014, concluding:

- Australian humpback dolphins were the most abundant at all three sites monitored with the number estimated across the six surveys in Darwin Harbour remaining relatively consistent at between 37 and 49 individuals.
- Bottlenose dolphin numbers in Darwin Harbour were more abundant than at Bynoe Harbour and Shoal Bay with numbers varying between 13 and 30 across the surveys. Temporary emigration between sites is thought to account for higher variation in numbers of bottlenose dolphins.
- Snubfin dolphins were the least observed species in the Darwin Harbour region with highly irregular numbers observed between surveys. Only one snubfin dolphin was detected in the vicinity of Darwin Harbour East Arm during the surveys.
- While significant changes in detection rates in East Arm were evident through this study, these differences occurred prior to any construction activity associated with the Ichthys project. Significant changes were also observed at Bynoe Harbour, a site distant from any potential construction impact.

The EPBC protected matters database also lists the following as “species or species habitat [that] may occur within area”, though the species are not known to occur within Darwin Harbour:

- Blue whale (*Balaenoptera musculus*).
- Bryde's Whale (*Balaenoptera edeni*).
- Humpback Whale (*Megaptera novaeangliae*).
- Killer Whale (*Orcinus orca*).

5.3.2.2 Dugongs

Dugongs are known to occur in Darwin Harbour waters, although in relatively low numbers. Dugongs have been recorded in higher densities at Gunn Point and the Vernon Islands, some 30–50 km to the north-east of the mouth of the harbour. Dugongs have also been observed in relatively high numbers at Bare Sand Island and Dundee Beach in Fog Bay, 60 km south-west of Darwin Harbour, and are known to travel long distances (Whiting 2008).

Cardno (2014) compared the results of baseline surveys with four surveys undertaken throughout the dredging phases of the Turtle and Dugong Monitoring Program associated with the INPEX Ichthys project. This study revealed that dugongs were observed in varying numbers between surveys however no trends (including seasonal trends) were evident. There was a higher number of dugong observed in shallower waters (6 – 10 m), generally in foraging areas where seagrass was present. It was concluded that variation in dugong numbers observed at each site between surveys was most likely to be a result of short-term movement to visit optimum foraging areas of seagrass.

During baseline surveys (June to October 2012) most sightings in Darwin Harbour were around Weed Reef, West Arm and near Bladin Point, as well as in the shallow regions of Shoal Bay. During later baseline surveys, most dugong sightings were around outer Darwin Harbour, with aggregations around mapped seagrass near Casuarina Beach.

During the first of the Dredging Phase surveys (May 2013), dugongs were predominantly sighted in outer Darwin Harbour, with only one dugong sighted near Weed Reef and another in the shallow areas in West Arm. During the Dredging Phase surveys in July/August and October 2013, no dugongs were sighted in the

inner Darwin Harbour, while during the end of dredging survey (May 2014) three dugongs were sighted near Weed Reef.

During the two surveys undertaken in October 2013, sightings were concentrated around Casuarina Beach and were associated with areas of seagrass (*Halodule* sp.). Lower numbers were observed in this area in Wet Season surveys, and it was considered that the reduced seagrass coverage in this season was likely to have been a contributing factor (Cardno 2014).

In general, it is considered that dugongs could occur anywhere in the harbour that could support seagrasses or algae. The closest benthic community to East Arm Wharf and the MSB that has been found to support a notable amount of macroalgae is the mixed sand and rocky reef habitat around Old Man Rock (Geo Oceans 2012a, b), some 2 km to the east of the dredging and spoil disposal locations. The nearest known area of substantial macroalgal communities to Fort Hill Wharf are those on the intertidal platform extending to the north-west from Wickham Point (Geo Oceans 2012a); these are some 2 km from the dredging and spoil disposal locations. Substantially greater areas of potential foraging habitat for dugong exist elsewhere in the harbour (INPEX 2011).

5.3.2.3 Turtles

Six species of marine turtles are known to occur in NT waters. Of these, four (green [*Chelonia mydas*], hawksbill [*Eretmochelys imbricata*], olive Ridley [*Lepidochelys olivacea*] and flatback [*Natator depressus*]) are considered to occur in the Darwin region, though olive Ridelies are thought to occur only occasionally within the harbour (Cardno 2014). Loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) turtles are considered unlikely to occur in Darwin Harbour (Whiting 2003).

Turtles recorded during surveys associated with the Ichthys Turtle and Dugong Monitoring Program (Cardno 2014) showed a general trend of decreasing numbers with depth (62% observed in water 0–5 m deep) with the majority of turtles observed in the Darwin Harbour region over sand, gravel or reef habitats. There were only a few turtles sighted in association with mangroves and mud habitats (0.5% and 3%, respectively).

The shoreline throughout Darwin Harbour, and particularly in East Arm, consists largely of mangrove forests and mudflats and does not provide suitable nesting habitat for any species of turtle. The nearest nesting beach (used by the flatback turtle) is located in the Casuarina Coastal Reserve near Lee Point on the north-eastern shore of the harbour. Turtles visiting the harbour are more likely to be foraging for food. Flatback and hawksbill turtles forage on the filter-feeder communities which are extensive in the harbour. The hawksbill turtle also forages on seagrass and macroalgal communities in addition to filter-feeders. Green turtles forage amongst seagrass and macroalgal communities (INPEX 2011).

5.3.2.4 Sawfish

The EPBC protected matters database indicates that four species of sawfish may potentially occur within the search area:

- Three threatened species, all designated as vulnerable - dwarf sawfish (*Pristis clavata*), green sawfish (*Pristis zijsron*) and largetooth sawfish (*Pristis pristis*).
- One migratory species - narrow sawfish (*Anoxypristis cuspidata*).

Although the database indicates that the “species or species habitat [is] known occur within [the] area”, the Atlas of Living Australia (biocache.ala.org.au) indicates that:

- The only two records of dwarf sawfish in the Darwin Harbour region are:

- Buffalo Creek, which discharges into Shoal Bay, outside of the main harbour (Museums and Art Galleries of the Northern Territory record).
- An Australian Museum record with an imprecise location, possibly from Rapid Creek which is more than 10 km from the dredging and spoil disposal locations.
- Two green sawfish have been recorded from Buffalo Creek.
- There are no records of largetooth sawfish within the harbour.
- The only record of narrow sawfish in the Darwin region is also from Buffalo Creek.

Buffalo and Rapid creeks are tidal creeks; quite a different environmental setting from the dredging and spoil disposal locations.

5.3.3 Other EPBC-listed marine species

The EPBC protected matters database indicates that the following threatened “species or species habitat may occur within [the] area”, though there are no records (in the Atlas of Living Australia) of these species occurring within Darwin Harbour:

- Great White Shark (*Carcharodon carcharias*)
- Northern River Shark (*Glyphis garricki*)
- Whale Shark (*Rhincodon typus*).

The database also indicates that the following migratory marine “species or species habitat may occur within [the] area”:

- Estuarine Crocodile (*Crocodylus porosus*) – this is known to occur within Darwin Harbour but is likely to typically avoid areas of high vessel activity, such as the dredging and spoil disposal locations.
- Coastal Manta Ray (*Manta alfredi*) and Oceanic Manta Ray (*Manta birostris*) – manta rays are known (from anecdotal accounts) to occur in the harbour, though there are no records (in the Atlas of Living Australia) from which to determine which particular species have been present.

6 SEDIMENT TRANSPORT MODELLING AND IMPACT ASSESSMENT

6.1 Synthesis of assessment approach

Darwin Port commissioned AIMS to undertake sediment transport modelling to assess the potential impacts of the proposed maintenance dredging operations on local water quality, and potential sedimentation impacts in the local area. The assessment of potential environmental impacts from the dredging works was informed by:

- A two-dimensional hydrodynamic model that incorporated water levels, currents and waves.
- A sediment transport model that determined suspended sediment dispersion and sediment accumulation.
- GIS analyses to quantify and depict potential impacts on habitats on the basis of tolerance limits.
- Preliminary sediment geochemical analysis undertaken on sediment samples collected to inform the modelling process.

6.2 Hydrodynamic model

The hydrodynamic model used by Williams (2017) was the 'Darwin Harbour hydrodynamic model', which has been used for previous dredging assessments for Darwin Port in the vicinity of East Arm and Fort Hill wharves. This model was developed for the original East Arm Wharf development and, over a period of 16 years, has been applied to many of the dredging campaigns within Darwin Harbour.

Over the past five years the model has been refined by AIMS to assist in understanding the general movement of cohesive and non-cohesive sediments and nutrients in the harbour. It has been enhanced with data from Multibeam Echo Sounder (MBES) surveys conducted in 2011 and 2015-16 and from Acoustic Doppler Current Profiler (ADCP) measurements in 2015 (Williams 2016).

The model was also refined around the wharf infrastructure and friction in the model elements was increased to emulate the effect of the wharf piles and braces at Fort Hill Wharf and the berthing fenders at East Arm Wharf (Williams 2017).

Boundary conditions for the model were taken from observations recorded at Buoy 5 at the entrance to Darwin Harbour. Buoy 5 is a Darwin Port channel marker that is equipped with instrumentation to measure wind speed and direction; tidal depth, current and direction; and waves. This model was applied to the dredging and spoil disposal management method proposed for the dredging works.

6.3 Sediment transport model

Williams (2017) modelled the sequential dredging of Fort Hill Wharf, East Arm berth 1, East Arm berth 2, East Arm berth 3 and the MSB berth, in that order, with a two-day break in between sites. Parameters adopted for the model were:

- Dredge rate of 2,000 m³/hr (as indicated in Section 4.4 this rate may be as low as 1,400 m³/hr, in which case the quantity of sediment released into suspension at the dredge head, and the rate of deposition at the harbour disposal locations, would be lower than those modelled)
- 9:1 water to sediment ratio (as indicated in Section 4.4 this may be as high as 19:1, in which case the sediment concentrations released at the harbour disposal locations would be only 50% of those modelled)
- 1% of total flow disturbance factor at dredge head (as indicated in Section 4.4 this is also conservative as the dredge will operate in suction-only mode for the majority of dredging works)
- Critical shear stress for erosion - 0.06 N/m²

- Critical shear stress for deposition - 0.08 N/m²
- Sediment fall velocity - 0.0006 m/s
- Sediment bulk density (assuming ~50% moisture) - 1400 kg/m³.

Sediment characteristics were determined from samples collected in 2016 and 2017 (Streten, Tsang & Harries 2017).

The model was run to represent the dredging and spoil disposal operations carried out using a small CSD for:

- Alternative spoil disposal locations 200 m and 500 m from Fort Hill Wharf and East Arm Wharf. As the 500 m locations showed improved dilution of turbid plumes from spoil disposal, these are the locations that have been carried forward for the purposes of impact assessment in this DMP.
- 12-hour and 24-hour dredging operations (the latter modelled assuming 20 hours of productive dredging per day, allowing four hours per day for dredge repositioning and maintenance). 24-hour dredging and spoil disposal operations have been carried forward in this DMP to provide for a conservatively high assessment of the risk of impact from the works.

6.4 Modelling results

Model outputs (from Williams 2017) presented here are:

- 90th percentile plot of modelled SSC (**Figure 6-1**)
- 95th percentile plot of modelled SSC (**Figure 6-2**)
- Time series chart of SSC at South Shell Island, the closest location with substantial areas of communities that could potentially be affected by plumes, during dredging (**Figure 6-3**) and after completion of dredging (**Figure 6-4**).

It is important to note that these figures show total SSCs; i.e. a 5 mg/L Dry Season background SSC plus dredging-related SSC. Hence the 5 mg/L contours in **Figure 6-1** and **Figure 6-2** show the lateral extent of SSC elevation due to dredging and spoil disposal activities.

No sediment deposition in excess of 2.5 mm was predicted within the harbour at the end of dredging, or two weeks after completion of dredging. Peak sediment deposition at South Shell Island was predicted to be approximately 0.55 mm (Williams 2017).

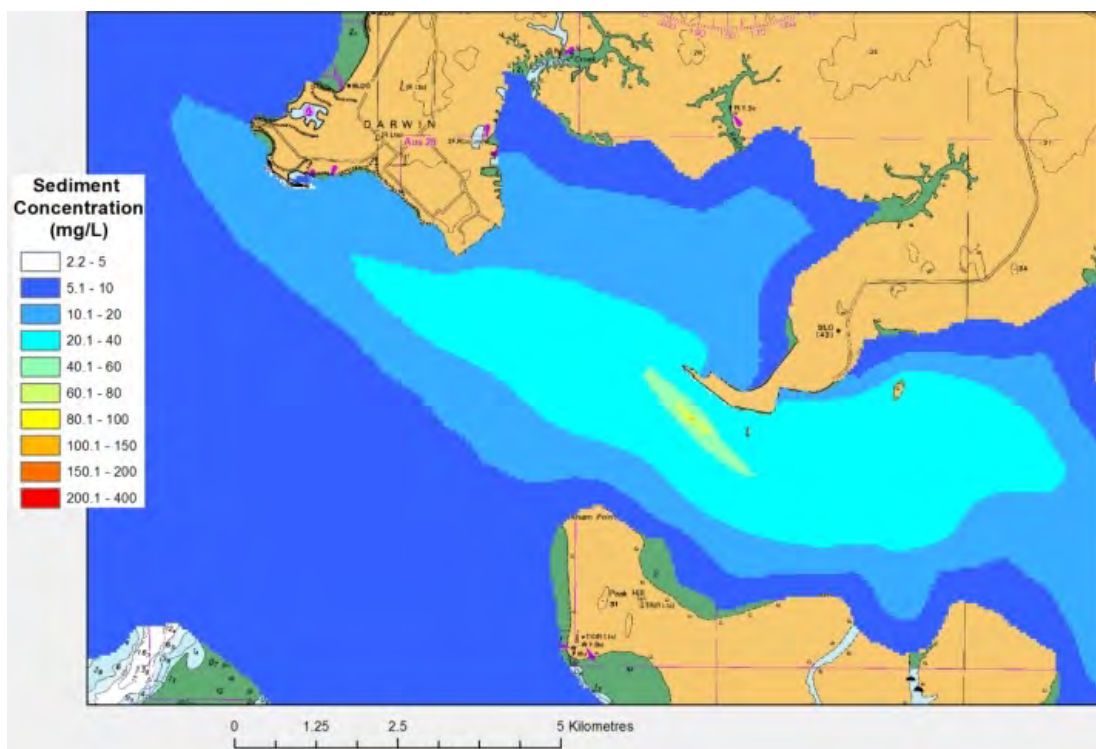


Figure 6-1: 90th percentile SSC

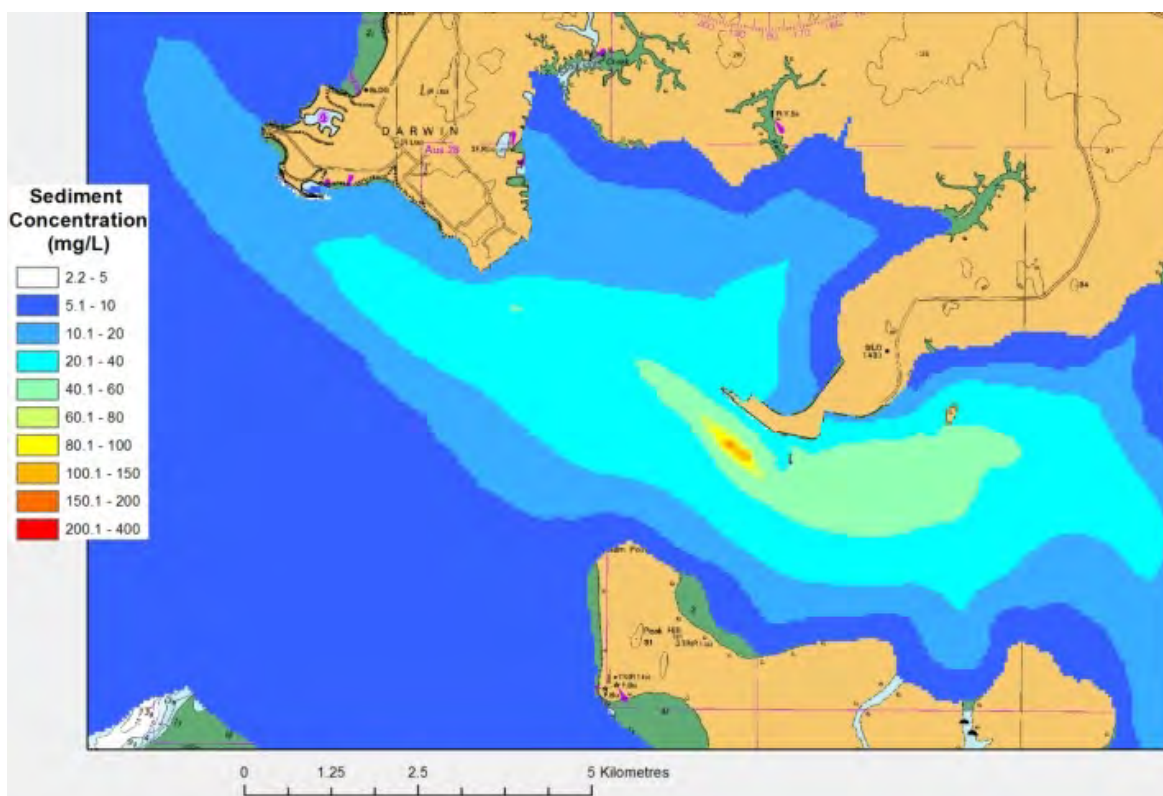


Figure 6-2: 95th percentile SSC

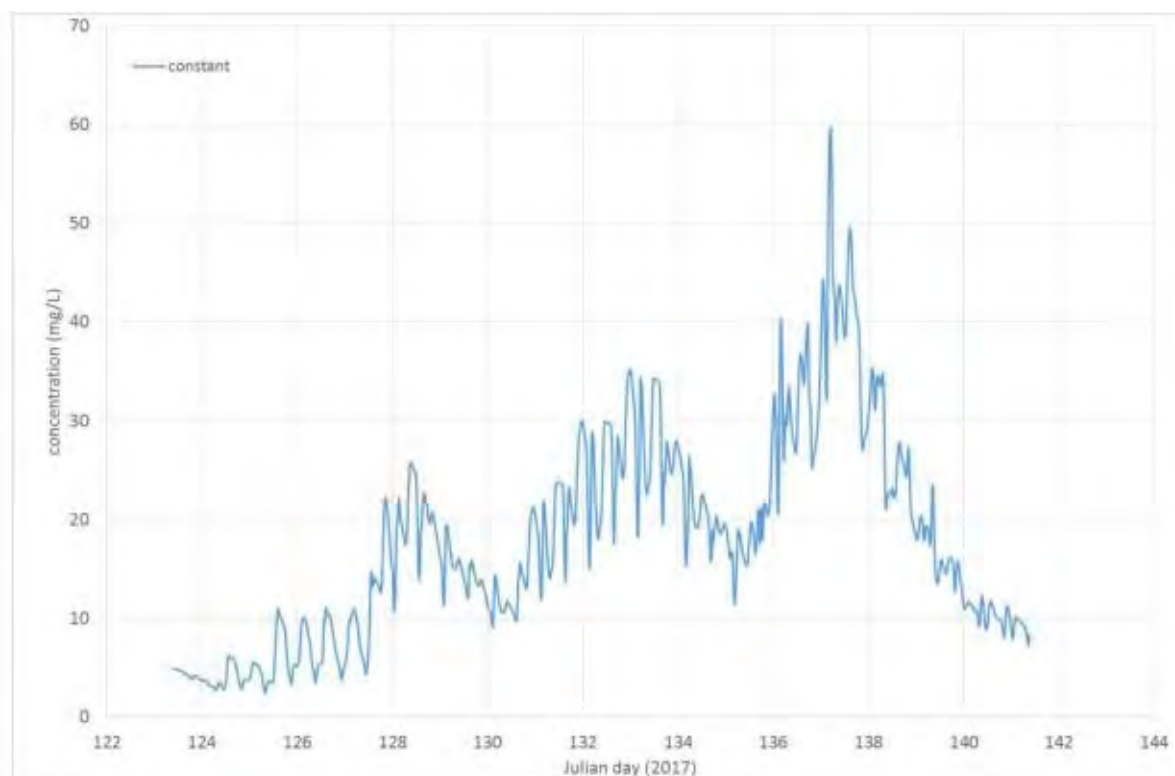


Figure 6-3: SSC at South Shell Island during dredging

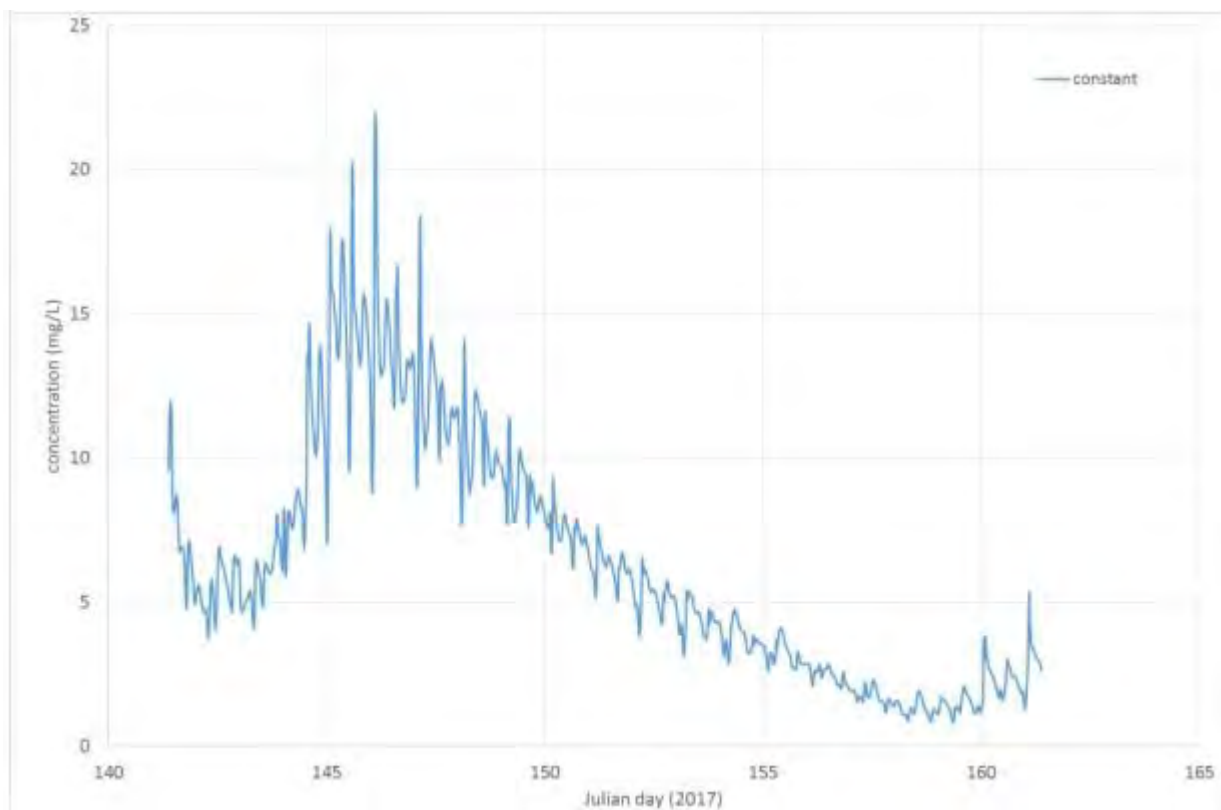


Figure 6-4: SSC at South Shell Island after dredging

6.5 Tolerance limits for biological communities

Tolerance limits used for the previous dredging around East Arm Wharf will be adopted for future maintenance dredging. These are considered to be appropriate as the only sensitive receptors likely to be impacted upon are in this region and it would be expected that they would have developed a tolerance to the naturally higher background SSC concentrations in the upper estuary in East Arm.

Given that the schedule for future maintenance dredging will be variable (depending on factors such as siltation rates and dredge availability) the tolerance limits applicable to the dredging will be dependent on whether dredging takes place in the Dry or Wet Season.

Tolerance limits were calculated from the appropriate (Dry or Wet Season) subset of a one-year baseline dataset of water quality (URS 2011), on the presumption that biological communities in East Arm are adapted to local conditions but will be stressed if exposed to conditions that regularly exceed the 95th percentile of normally prevailing background concentrations (calculated from URS 2011).

As the sediment transport model calculates excess (above background) SSC caused by the dredging and spoil disposal, the median of the background concentrations was subtracted from the 95th percentile of the background concentrations to provide a comparable tolerance limit. This yielded a tolerance limit for Dry Season dredging of 10 mg/L SSC and a Wet Season SSC tolerance limit of 25 mg/L.

Tolerance limits for sediment deposition on mangroves were derived by INPEX (2010, 2011) from a review of the outcomes of habitat-specific dose-response experiments and field observations reported in the scientific literature. These tolerance limits will be applied to the maintenance dredging campaigns – i.e. 50 mm accretion may lead to reduced health or mortality; at above 100 mm accretion, mortality of trees is considered “likely”.

For corals and filter-feeder communities, INPEX (2011) contended that a meaningful sedimentation threshold could not be derived from the literature due to factors such as wide variations in tolerances between species, and between morphologies within species. Subsequent laboratory research has been undertaken into sedimentation effects on corals and filter-feeders (e.g. Duckworth, Giofre & Jones 2017, Pineda et al 2017). Whilst these provide data that are indicative of sedimentation tolerance limits under laboratory conditions, they are of limited applicability in field conditions, especially conditions as dynamic as those within Darwin Harbour where strong tidal currents enhance the removal of sediments that settle on benthic biota.

6.6 Zones of Impact and Influence

For the assessment of potential dredging-related impacts upon benthic communities due to suspended sediment, definitions of Zones of Impact and Influence have been adopted in line with WA EPA Technical Guidance (WA EPA 2016), which is consistent with the NT EPA Guidelines (NT EPA 2013):

- **Zone of High Impact:** this zone constitutes the direct footprint of the dredged area and a 20 m wide annulus around the footprints to account for smothering from coarse sediments liberated from the cutter head during dredging. Impacts in these areas are predicted to be severe and often irreversible.
- **Zone of Moderate Impact:** within this zone, damage to benthic habitats and mortality of benthic biota may occur, primarily as a result of the indirect impacts from increased turbidity that may occur at times over areas within the zone. Impacts within this zone are predicted to occur, but the disturbed areas may recover (after completion of the dredging and disposal operations). It is

expected that there will be no long-term modification of the benthic habitats in this zone. The outer edge of the Zone of Moderate Impact is delineated by the 90th percentile contour plot for SSC, as defined by dredge plume modelling. This delineates the areas where, for 90% of the time, the predicted SSC is below the calculated tolerance for benthic communities (dredging- related SSC of 10 mg/L for East Arm communities during the Dry Season, 25 mg/L during the Wet Season, refer Section 6.5). The 10% of time during which the SSC threshold is predicted to be met or exceeded is likely to represent periods of mid-flow tidal states (particularly during spring tides) and any one exceedance event is not likely to exceed two hours.

- **Zone of Influence:** this zone includes the areas in which, at some time during the dredging works, benthic communities may experience (detectable) changes in sediment-related environmental quality outside the natural ranges that are normally expected. However, the intensity, duration and frequency of these changes is such that any damage to benthic habitats is likely to be reversible, and no mortality of benthic biota is expected to occur. The outer boundary of this zone is delineated by the 95th percentile contour plot for SSC, as defined by dredge plume modelling. This reflects the area where, for 95% of the time, excess SSC from the dredging will be below the calculated tolerance for benthic communities (10 mg/L in the Dry Season, 25 mg/L in the Wet Season, refer Section 6.5).

The predicted Zone of Moderate Impact and Zone of Influence for Dry Season and Wet Season dredging operations (at all three sites) are shown in **Figure 6-5**. These are based upon SSC, not upon sedimentation, as the predicted sedimentation rates are insufficiently high for equivalent zones to be determined (Section 6.4). The locations of recorded hard coral and filter-feeder communities are also shown.

The predicted impact zones have been determined on the basis of the MSB berth material being deposited onshore. For a scenario in which this material is deposited at the harbour disposal site (Section 4.7), the Zones of Moderate Impact and Influence are predicted to generally be encompassed within the corresponding zones shown in **Figure 6-5**. The only exception is the Wet Season Zone of Moderate Impact, which extends 35 m further to the north than the boundary shown in **Figure 6-5**.

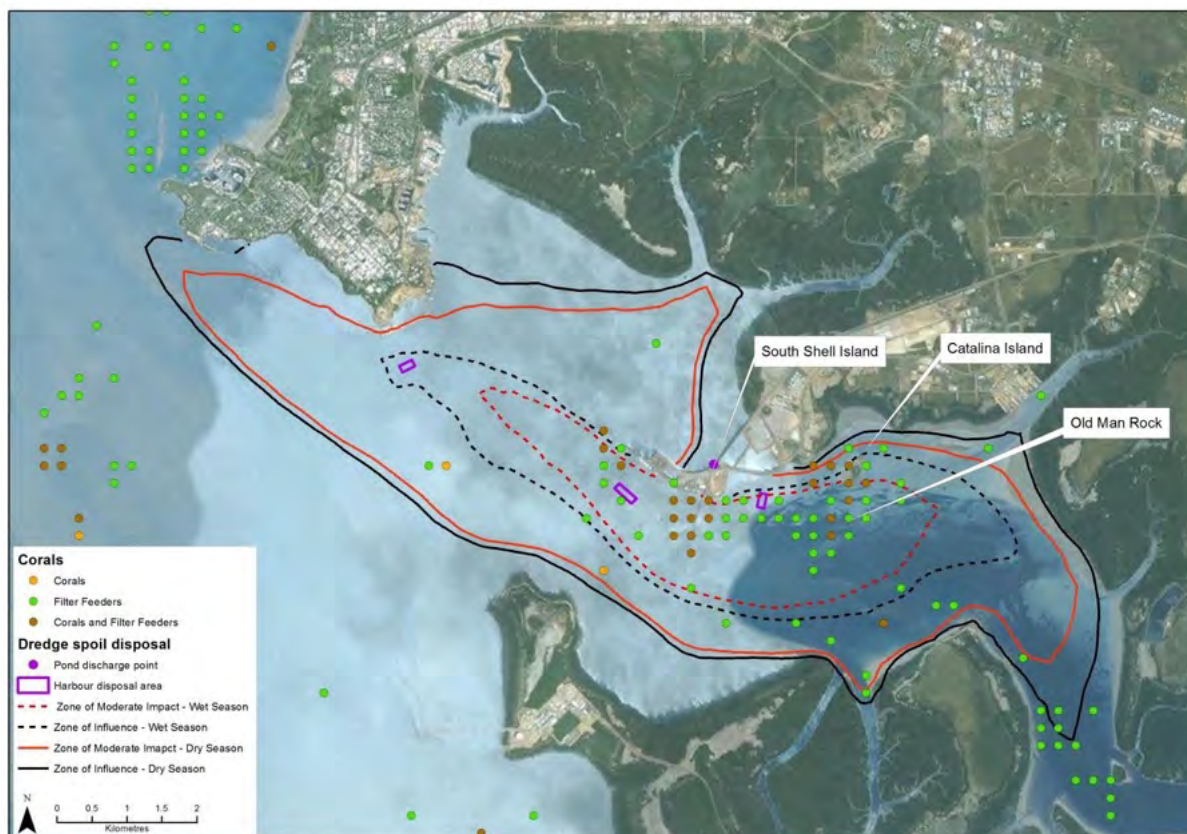


Figure 6-5: Zone of Moderate Impact and Zone of Influence for Dry Season and Wet Season dredging operations

6.7 Conclusions

6.7.1 Suspended sediments

From **Figure 6-5** it is evident that the hard coral and filter-feeder communities around South Shell Island are predicted to lie within the Zone of Moderate Impact during dredging operations in either the Dry Season or the Wet Season. Following the definition within WA EPA (2016), this would indicate that mortality of benthic biota could occur, but that the disturbed areas may recover and there would be no long-term modification of the benthic habitats. However, in considering the SSC time series at South Shell Island presented in **Figure 6-3** and **Figure 6-4** it is evident that:

- During the Dry Season, the 10 mg/L SSC tolerance limit for benthic communities is predicted to be exceeded on eight days during dredging and two days following dredging (the latter due to continued resuspension and dispersion of sediments deposited during the dredging campaign). It is emphasised that the 10 mg/L tolerance limit is for dredging-related SSC, whereas **Figure 6-3** and **Figure 6-4** show total SSC (background of 5 mg/L plus dredging-related SSC).
- During the Wet Season, the 25 mg/L SSC tolerance limit for benthic communities is predicted to only be exceeded on three days during dredging.

This indicates that, provided the SSCs generated during dredging and spoil disposal are not significantly greater than those upon which the modelling of Williams (2017) was based, then:

- In the Dry Season, it is considered highly unlikely that such short-term elevations in SSC would result in mortality within the hard coral and filter-feeder communities of South Shell Island. It is

reasonable to conclude that elevations of SSCs over longer time periods would be necessary for detectable impacts to occur.

- The risk of turbidity impacts during the Wet Season can be considered negligible. It could be expected that similar SSCs would regularly occur in the waters around South Shell Island on each spring tide cycle during the Wet Season.

Hence, it can be concluded that the implementation of robust monitoring of SSCs at South Shell Island and around the dredging and spoil disposal locations (as presented in Section 8.2.3) will be key to the protection of the benthic communities around South Shell Island.

6.7.2 Sedimentation

The sediment dispersion modelling predicts that the accumulation of dredging-derived sediment is not predicted to approach the 50 mm tolerance limit in any of the mangrove communities that are potentially reached by the turbid plumes generated by the dredging and spoil disposal. Hence sediment accumulation is not expected to impact on mangrove communities in areas such as Bleesers Creek and Charles Darwin National Park. It would be reasonably expected that Wet Season wave activity under normal conditions would have a greater impact in these areas than sedimentation associated with the dredging and spoil disposal.

The sediment dispersion modelling also predicts that there will be no net sedimentation of >2.5 mm within the hard coral and filter-feeder communities in East Arm. Hence it is concluded that the dredging and spoil disposal activities will pose a negligible risk of significant sedimentation impacts upon these communities.

It is concluded that potential sedimentation effects need not be given further detailed consideration in this Plan and that monitoring and management of suspended sediment levels within the pond system, and around the spoil disposal locations, will provide an appropriate level of mitigation against the risk of sedimentation impacts upon the receiving environment.

7 ENVIRONMENTAL RISK ASSESSMENT

7.1 Purpose

A systematic environmental risk assessment process has been applied to address the potential risks associated with maintenance dredging by Darwin Port. It takes into account guidance within the draft *Guideline for the Preparation of an Environmental Management Plan* (NT EPA 2015b) and is aligned with the standard *AS/NZS ISO 31000: 2009 Risk Management* and with Environment Institute of Australia and New Zealand guidelines (EIANZ 2015).

The purpose of the risk assessment process was to identify the activities, and the environmental aspects associated with those activities, that have the potential to result in environmental impacts; and to guide the development of management measures and controls to avoid or reduce those potential impacts. The assessment of environmental risk is an essential component of Darwin Port's approach to the environmental impact assessment process. It forms that basis for ongoing management and review of significant environmental risks that may arise over the course of maintenance dredging activities. Management controls identified through the risk assessment process are included in the Environmental Management Frameworks (EMFs) presented in Section 8 of this Plan.

7.2 Methodology

The risk assessment methodology ensured that a systematic approach was applied to the assessment and management of environmental risk; it comprised two main steps – risk scoping and risk assessment.

7.2.1 Risk scoping

The risk scoping step comprised the identification of:

- Environmental aspects - features or characteristics of a project activity that have the potential to affect the environment.
- Potential environmental impacts - any potential change to the environment, whether adverse or beneficial, wholly or partly resulting from a project's environmental aspects.

Each environmental aspect was considered in turn against each sensitive receptor in the surrounding environment for a potential pathway or interaction. Where pathways existed, each potential environmental impact was considered.

7.2.2 Risk assessment

The risk assessment process considered two factors:

- The magnitude of direct or indirect impacts on environmental receptors from project activities (**Table 7-1**).
- The sensitivity of these receptors to direct or indirect impacts (**Table 7-2**).

Following the matrix in **Figure 7-1** the predicted magnitude of impact, and receptor sensitivity, were used to produce a risk ranking (**Table 7-3**) for each impact. The outcomes of the risk assessment process are presented in **Table 7-4**.

It should be noted that the risk assessment encompasses activities that are directly related to operation of the dredge and to disposal of spoil. General vessel-related environmental aspects (e.g. unplanned hydrocarbon releases, waste disposal, marine pest introduction) are managed under other auspices (e.g. Oil Spill Response Plan, Port Environmental Management Plan, biosecurity regulations).

Table 7-1: Criteria for assessment of magnitude of impacts

Rank	Water Quality	Ecology
Negligible	Change from baseline conditions is immeasurable, undetectable or within the range of normal variation.	Negligible effect on known population or range of species.
Small	Minor detectable change from baseline conditions over a limited distance (hundreds of metres) from source. Baseline conditions return within one month of cessation of activity.	Affects a specific group of localised individuals within a population over a short time period (one generation or less) but does not affect other trophic levels or the population itself.
Medium	Readily discernible change in quality beyond 1 km from source. Baseline conditions return within weeks of cessation of activity.	Affects a portion of a population and may bring about a change in abundance and/or distribution over more than one generation but does not threaten the integrity of that population or any population dependent on it.
Large	Readily discernible change in quality over a large area (>10 km ²) that persists over several months, with likely secondary impacts on marine ecology.	Affects a high portion of a population and may bring about a change in abundance and/or distribution over two or more generations, potentially threatening the integrity of that population or a population dependent on it.
Severe	Major alteration to baseline conditions over a large area (>10 km ²) that persists for more than 12 months, with probable secondary impacts on marine ecology.	Affects an entire population or species in sufficient magnitude to cause a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations.

Table 7-2: Criteria for assessment of receptor sensitivity

Rank	Water Quality	Ecology
Low	Existing water quality is good and the ecological resources that it supports are not sensitive to a change in water quality.	The ecological features are abundant, common or widely distributed and are generally adaptable to changing environments. Species are not endangered or protected.
Moderate	Existing water quality already shows some signs of stress and/or supports	Some ecological features have low abundance, restricted ranges, are currently under pressure or are slow to adapt to changing environments. Species

	ecological resources that could be sensitive to change in water quality.	are valued locally/regionally and may be endemic, endangered or protected.
High	Existing water quality is already under stress and/or the ecological resources it supports are very sensitive to change (secondary ecological impacts are likely).	Some ecological features in the area are rare or endemic, under significant pressure and / or highly sensitive to changing environments. Species are valued nationally /globally and are listed as endangered or protected.

		Sensitivity		
		Low	Moderate	High
Magnitude	Negligible	Minor	Minor	Minor
	Small	Minor	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major
	Severe	Major	Major	Major

Figure 7-1: Risk matrix

Table 7-3: Risk categories

Risk	Description
Minor	Negligible risk of persistent changes to receptors. No management measures beyond those routinely applied to operations are required for the risk to be considered as low as reasonably practicable (ALARP).
Moderate	Reversible changes to receptors may occur. Corrective actions (i.e. management measures that are additional to those routinely applied to operations) are likely to be required to reduce risk to ALARP.
Major	Unacceptable risks to receptors. Project modifications or additional management measures are required to reduce risk to ALARP.

Table 7-4: Risk assessment outcomes

Aspect	Activity	Impact	Magnitude	Sensitivity	Risk	Comments
Fort Hill Wharf						
Seabed disturbance	Dredging of unconsolidated material from berths	Mortality of biota entrained within dredged sediments.	Medium	Low	Minor	Biota will be those that have colonised the sediments subsequent to the previous dredging campaign. Hence they are likely to be pioneer species that will recolonise the dredged seabed once the activities are complete. They are unlikely to represent a significant component of the harbour food web as similar habitats are widespread within the harbour.
	Spoil disposal in harbour	Smothering of biota in, and on, the seabed at disposal location, potentially leading to mortality.	Medium	Low	Minor	Colonisation of the deposited dredge spoil is likely to occur in the short term, most likely by species present in unconsolidated sediment habitats nearby. Biota at the disposal location are unlikely to represent a significant component of the harbour food web as similar habitats are widespread within the harbour.
Sediment plumes	Dredging and spoil disposal	Increased SSC in water column.	Small	Low	Minor	SSC increases will be orders of magnitude greater at the spoil disposal location than at the dredging site. However, it is predicted from modelling (Section 6.4) that tidal currents will rapidly disperse the suspended sediments.
		Increased toxicant concentrations in water column.	Small	Low	Minor	The 2025 SAP sediment geochemistry investigation did not detect elevated toxicants in samples from the Fort Hill Wharf berths.
		Reduced growth or to mortality.	Small	Low	Minor	

Aspect	Activity	Impact	Magnitude	Sensitivity	Risk	Comments
		Clogging of fauna feeding or respiratory structures, potentially leading to reduced growth or to mortality.	Small	Low	Minor	No benthic communities of conservation significance are known to occur in the vicinity of the dredging and spoil disposal activities.
		Reduction in food availability or foraging habitat for protected marine species, potentially leading to displacement.	Small	Moderate	Minor	The habitats for biota which may come into contact with suspended sediments from the dredging and spoil disposal activities are well represented within the harbour.
		Smothering of biota distant from activity, potentially leading to reduced growth or to mortality.	Negligible	Low	Minor	No benthic communities of critical importance to protected marine species are known to occur in the vicinity of the dredging and spoil disposal activities. Some individuals may temporarily forage in alternative harbour areas for the duration of the activities.
Indirect sedimentation	Dredging and spoil disposal	Displacement of protected marine species.	Small	Moderate	Minor	It is predicted from modelling that net sedimentation in mangroves, and on benthic biota, in the vicinity of Fort Hill Wharf will be imperceptible from that which occurs in the absence of dredging (Section 6.7).
Underwater noise and vibration	Dredging	Vessel collision with protected marine species.	Small	Moderate	Minor	Some individuals of protected marine species may temporarily relocate to alternative locations in the harbour for the duration of the dredging activities. There are no known areas within the vicinity of Fort Hill Wharf that are of critical importance to feeding or breeding for protected marine species. The area in which dredging will take place is currently

Aspect	Activity	Impact	Magnitude	Sensitivity	Risk	Comments
						subjected to underwater noise and vibration from vessel activity.
Vessel movements	Dredging	Vessel collision with protected marine species.	Small	Moderate	Minor	The area in which dredging will take place is currently subjected to substantial vessel activity, including small, fast-moving craft that pose a greater risk of impact to marine fauna than slow-moving work vessels associated with dredging operations. The dredge itself will be essentially stationary whilst operational. A marine fauna observer (MFO) will be on board the dredge and operators of project vessels will have been notified of marine fauna risks during project inductions.
East Arm Wharf						
Seabed disturbance	Dredging of unconsolidated material from berths	Smothering of biota in, and on, the seabed at disposal location, potentially leading to mortality.	Medium	Low	Minor	Biota will be those that have colonised the sediments subsequent to the previous dredging campaign. Hence, they are likely to be pioneer species that will recolonise the dredged seabed once the activities are complete. They are unlikely to represent a significant component of the harbour food web as similar habitats are widespread within the harbour.
	Spoil disposal in harbour	Increased SSC in water column.	Small	Low	Minor	Colonisation of the deposited dredge spoil is likely to occur in the short term, most likely by species present in unconsolidated sediment habitats nearby. Biota at the disposal location are unlikely to

Aspect	Activity	Impact	Magnitude	Sensitivity	Risk	Comments
						represent a significant component of the harbour food web as similar habitats are widespread within the harbour.
Sediment plumes	Dredging and spoil disposal	Increased SSC in water column.	Small	Low	Minor	SSC increases will be orders of magnitude greater at the spoil disposal location than at the dredging site. However, it is predicted from modelling (Section 6.4) that tidal currents will rapidly disperse the suspended sediments.
		Increased toxicant concentrations in water column.	Small	Low	Minor	The 2025 SAP sediment geochemistry investigation did not detect elevated toxicants or nutrients in samples from the East Arm Wharf berths.
		Clogging of fauna feeding or respiratory structures, potentially leading to reduced growth or to mortality.	Small	Low	Minor	
		Reduction in food availability or foraging habitat for protected marine species, potentially leading to displacement.	Small	Moderate	Minor	The habitats for biota which may come into contact with suspended sediments from the dredging and spoil disposal activities are well represented within the harbour.
		Smothering of benthic biota distant from activity, potentially leading to reduced growth or to mortality.	Negligible	Low	Minor	The habitats for biota which may come into contact with suspended sediments from the dredging and spoil disposal activities are well represented within the harbour.
		Displacement of protected marine species.	Small	Moderate	Minor	No benthic communities of critical importance to protected marine species are known to occur in the vicinity of the dredging and spoil disposal activities.

Aspect	Activity	Impact	Magnitude	Sensitivity	Risk	Comments
						Some individuals may temporarily forage in alternative harbour areas for the duration of the activities.
Indirect sedimentation	Dredging and spoil disposal	Vessel collision with protected marine species.	Small	Moderate	Minor	It is predicted from modelling that net sedimentation in mangroves, and on benthic biota, in the vicinity of East Arm will be imperceptible from that which occurs in the absence of dredging (Section 6.7).
Underwater noise and vibration	Dredging	Vessel collision with protected marine species.	Small	Moderate	Minor	Some individuals of protected marine species may temporarily relocate to alternative locations in the harbour for the duration of the dredging activities. There are no known areas within the vicinity of East Arm Wharf that are of critical importance to feeding or breeding for protected marine species. The area in which dredging will take place is currently subjected to underwater noise and vibration from vessel activity
Vessel movements	Dredging	Mortality of biota entrained within dredged sediments.	Medium	Low	Minor	The area in which dredging will take place is currently subjected to substantial vessel activity, including small, fast-moving craft that pose a greater risk of impact to marine fauna than slow-moving work vessels associated with dredging operations. The dredge itself will be essentially stationary whilst operational.

Aspect	Activity	Impact	Magnitude	Sensitivity	Risk	Comments
						An MFO will be on board the dredge and operators of project vessels will have been notified of marine fauna risks during project inductions.
MSB						
Seabed disturbance	Dredging of unconsolidated material from berths	Increased toxicant concentrations in water column.	Small	Low	Minor	Biota will be those that have colonised the sediments subsequent to the previous dredging campaign. Hence they are likely to be pioneer species that will recolonise the dredged seabed once the activities are complete. They are unlikely to represent a significant component of the harbour food web as similar habitats are widespread within the harbour.
Sediment plumes	Dredging	Increased SSC in water column.	Small	Low	Minor	SSC increases will be orders of magnitude greater at the spoil disposal location than at the dredging site. However, it is predicted from modelling (Section 6.4) that tidal currents will rapidly disperse the suspended sediments.
		Increased toxicant concentrations in water column.	Small	Low	Minor	The 2025 SAP sediment geochemistry investigation did not detect elevated toxicants or nutrients in samples from the MSB.
		Clogging of fauna feeding or respiratory structures, potentially leading to reduced growth or to mortality.	Small	Low	Minor	
		Reduction in food availability or foraging habitat for protected	Small	Moderate	Minor	The habitats for biota which may come into contact with suspended sediments from the dredging and

Aspect	Activity	Impact	Magnitude	Sensitivity	Risk	Comments
		marine species, potentially leading to displacement.				spoil disposal activities are well represented within the harbour.
		Smothering of biota, potentially leading to reduced growth or to mortality.	Negligible	Low	Minor	The habitats for biota which may come into contact with suspended sediments from the dredging and spoil disposal activities are well represented within the harbour.
		Displacement of protected marine species.	Small	Moderate	Minor	No benthic communities of critical importance to protected marine species are known to occur in the vicinity of the dredging and spoil disposal activities. Some individuals may temporarily forage in alternative harbour areas for the duration of the activities.
Indirect sedimentation	Dredging	Vessel collision with protected marine species.	Small	Moderate	Minor	It is predicted from modelling that net sedimentation in mangroves, and on benthic biota, in the vicinity of East Arm will be imperceptible from that which occurs in the absence of dredging (Section 6.7).
Underwater noise and vibration	Dredging	Increased SSC in receiving waters.	Negligible	Low	Minor	Some individuals of protected marine species may temporarily relocate to alternative locations in the harbour for the duration of the dredging activities. There are no known areas within the vicinity of the MSB that are of critical importance to feeding or breeding for protected marine species. The area in which dredging will take place is currently subjected to underwater noise and vibration from vessel activity.

Aspect	Activity	Impact	Magnitude	Sensitivity	Risk	Comments
Vessel movements	Dredging	Increased acidity or alkalinity in receiving waters.	Negligible	Low	Minor	The area in which dredging will take place is currently subjected to vessel activity. The dredge itself will be essentially stationary whilst operational. An MFO will be on board the dredge and operators of project vessels will have been notified of marine fauna risks during project inductions.
Tailwater release	Spoil disposal into decant ponds	Increased toxicant concentrations in receiving waters.	Negligible	Low	Minor	During previous dredging campaigns, in which far greater volumes of dredge spoil were disposed within the decant ponds, tailwater clarity has typically been higher (i.e. SSC has been lower) than in the receiving waters of Frances Bay.
		Increased nutrient concentrations in receiving waters.	Negligible	Low	Minor	Prior to its release, tailwater will be tested to ensure the pH is within a range over which adverse impacts to biota are unlikely.
		Reduction in incident light levels to benthic biota, potentially leading to reduced growth or to mortality.	Negligible	Low	Minor	Prior to its release, tailwater will be tested to ensure toxicant concentrations are below levels at which adverse impacts to biota may occur
		Clogging of fauna feeding or respiratory structures, potentially leading to reduced growth or to mortality.	Negligible	Low	Minor	Any nutrients within the tailwater will be rapidly dispersed once they enter the Frances Bay environment and are likely to be imperceptible from background concentrations within a short distance from the bund wall.

Aspect	Activity	Impact	Magnitude	Sensitivity	Risk	Comments
		Smothering of biota, potentially leading to reduced growth or to mortality.	Negligible	Low	Minor	During previous dredging campaigns, tailwater clarity has typically been higher than in the receiving waters of Frances Bay; hence incident light levels may increase, rather than decrease.
		Reduction in food availability or foraging habitat for protected marine species, potentially leading to displacement.	Negligible	Moderate	Minor	During previous dredging campaigns, tailwater clarity has typically been higher than in the receiving waters of Frances Bay; hence there is reduced risk of clogging of fauna feeding and
		Disturbance to migratory birds at roost sites in Pond K and Pond D.	Negligible	Moderate	Minor	respiratory structures, and a reduced risk of smothering.
						The tailwater will not have any characteristics that may cause a reduction in food availability for protected marine species.
Tailwater flow	Spoil disposal into decant ponds					Pond D is a protected habitat used by shorebirds at East Arm Wharf. This pond will not be used for direct placement of dredge spoil or tailwater storage and the dredge contractor will ensure that there is no direct disturbance to the pond. Adding further dredge spoil to Pond K is not expected to create any significant disturbance to migratory shorebirds roosting on Pond D. Birds have continued to roost in the vicinity during similar activities undertaken previously and there is a long history of vehicular movements in the general

Aspect	Activity	Impact	Magnitude	Sensitivity	Risk	Comments
						vicinity of Pond and Pond D. (Dr Stephen Garnett, pers. comm., 20 November 2017)

8 ENVIRONMENTAL MONITORING AND MANAGEMENT

8.1 Introduction

This section describes the EMFs, and associated monitoring programs, that have been developed for the key risks associated with the dredging works. The EMFs are instrumental to effectively manage and mitigate environmental risks to sensitive receptors identified in Section 5.

EMFs have been developed for the following aspects:

- Darwin Harbour - water quality
- Dredge spoil decant ponds - water quality
- Protected marine species – physical interaction
- Protected marine species – underwater noise

Each EMF states the relevant project commitments made and objectives to be met, and contains specific, measurable targets to achieve the objectives. It also summarises the management actions required to meet these targets, the relevant KPIs and the monitoring activities to be employed to measure success in meeting the requirements and identify the need for corrective actions.

It should be noted that:

- Management actions are routine tasks that will be undertaken to meet the objectives of each EMF.
- Corrective actions are those tasks that are possible to be undertaken if monitoring indicates that trigger values have been exceeded.

Where trigger values are proposed, it should be noted that these are triggers for further investigation and are set well below levels at which significant adverse ecological effects could be anticipated, thus protecting the declared beneficial uses of Darwin Harbour (Section 2). Each EMF also indicates the relevant reporting requirements (detailed further in Section 9) and the responsibilities of project personnel.

8.2 Darwin Harbour - water quality

8.2.1 Potential impacts

The cutter head of the dredge and the discharge of dredge spoil will generate plumes of turbid water containing elevated levels of suspended sediments. The magnitude of the impacts due to dredge related suspended sediment plumes will be proportionate to the duration of dredging and the volume of sediment to be dredged, both of which are relatively minor for the maintenance dredging proposed. The tailwater discharge from the dredge spoil decant ponds will also contribute suspended sediments to the receiving environment in vicinity of the permeable railway bund wall at East Arm Port, though on occasions (e.g. during spring tides) the concentrations of suspended sediments in the tailwater may be less than those in the receiving environment.

Plumes of suspended sediments may impact upon marine organisms through clogging of feeding or respiratory structures or through a reduction in light penetration through the water column.

8.2.2 Trigger values

Reactive turbidity trigger values have been set for the monitoring sites at South Shell Island and at sites 200 m down-current from the dredging and spoil disposal sites (Section 8.2.3.2); these are based on turbidity data collected by URS (2011) in a long-term water quality study conducted in Darwin Harbour. The URS data were collected every 15 minutes at two sites in East Arm (South Shell Island and North-east

Wickham Point) over a year-long program. Data were grouped and averaged based on tidal cycle and seasonal variation, allowing seasonal means, medians, and percentiles to be calculated. This gives a robust body of data to compare background levels of turbidity with potential increases associated with various natural and artificial turbidity-generating events in the harbour.

Different trigger values will apply between the Wet Season and the Dry Season due to differences in background SSC concentrations:

- If dredging is undertaken during the Wet Season (November to April), then dredging-related SSC at the monitoring sites will need to be maintained below 25 mg/L (the predicted Wet Season tolerance limit of benthic communities to excess SSC [refer Section 6.5]). As SSC cannot be directly monitored in the field, a dredging-related turbidity trigger value of 21.2 NTU will be applied; calculated as per the URS (2011) relationship between NTU and SSC for East Arm; $NTU = (SSC - 7.0477)/0.848$.
- If dredging is undertaken during the Dry Season (May to October), then dredging-related SSC at the monitoring sites will need to be maintained below 10 mg/L (the predicted Dry Season tolerance limit of benthic communities to excess SSC [refer Section 6.5]) and a dredging-related turbidity trigger value of 3.5 NTU will be applied (as per URS [2011]). Depending upon background levels, this may maintain turbidity outside of the 'mixing zone' to below the neap tide, Dry Season benchmark level of 4 NTU for Darwin Harbour (Cassilles-Southgate 2016, Fortune 2016).

8.2.3 Darwin harbour water quality monitoring program

8.2.3.1 Objective

The objective of this monitoring program is to ascertain turbidity levels over the duration of dredging and spoil disposal activities. This will enable assessments to be made of the potential for impacts on marine communities to occur from these activities. The approach is aligned with guidance provided in publications such as those of the Central Dredging Association (CEDA 2015) and the International Association of Dredging Companies (IADC 2016).

The program will:

- Utilise existing water quality data as a pre-dredging baseline (refer Section 8.2.2).
- Monitor turbidity levels in the water at South Shell Island, and near the dredging footprints and spoil disposal locations, during dredging.
- Trigger the implementation of dredge management measures (refer Section 8.2.5) if water quality data indicate that turbidity levels from dredging and spoil disposal are greater than those predicted from modelling (refer Section 6.4).

8.2.3.2 Monitoring locations

Turbidity monitoring within Darwin Harbour will be undertaken at the following locations (**Figure 8-1**):

- South Shell Island locations. These are putative impact sites due to their proximity to the dredging and spoil disposal locations, the model outcomes (Section 6.4) and the known presence of benthic communities that may be adversely affected by increased turbidity levels from dredging at East Arm Wharf and the MSB. Hard coral communities are present at the location of site SSI- West, while site SSI-E is located within filter-feeder communities. Site SSI-West is the closer of the two to the dredging activities at East Arm Wharf and, due to the passage of ebb tide currents to the north of South Shell Island, there may also be a greater potential for turbid plumes from the MSB

dredging to impinge upon this site than upon site SSI-East. For this reason, site SSI-West is treated as the 'primary' potential impact site, with data from site SI-East used to inform the attributability assessment that would be conducted in the event of a trigger value exceedance at site SSI-West (see Section 8.2.4).

- Locations 200 m up-current and down-current from the dredging and spoil disposal locations for the Fort Hill Wharf dredging operations. While modelling indicates that these operations are sufficiently distant from benthic communities that may be sensitive to increased turbidity levels, this monitoring will be used to verify the veracity of the turbidity levels predicted by the modelling.
- Locations 200 m up-current and down-current from the dredging and spoil disposal locations for the East Arm Wharf dredging operations. Monitoring will be undertaken on flood tides, as these are the times when the chance of plumes from the dredging operation reaching the benthic communities around South Shell Island is highest.
- Locations 200 m up-current and down-current from the dredging activity at the MSB. Monitoring will be undertaken on ebb tides, as these are the times when the chance of plumes from the dredging operation reaching the benthic communities around South Shell Island is highest.
- A reference location distant from the dredging and spoil disposal operations. Data from a reference location are required in the event that it is necessary to assess whether changes in water quality at the South Shell Island sites are due to the dredging and spoil disposal activities, or to the influence of harbour-wide changes in water quality (e.g. due to a period of high rainfall or elevated wave action).

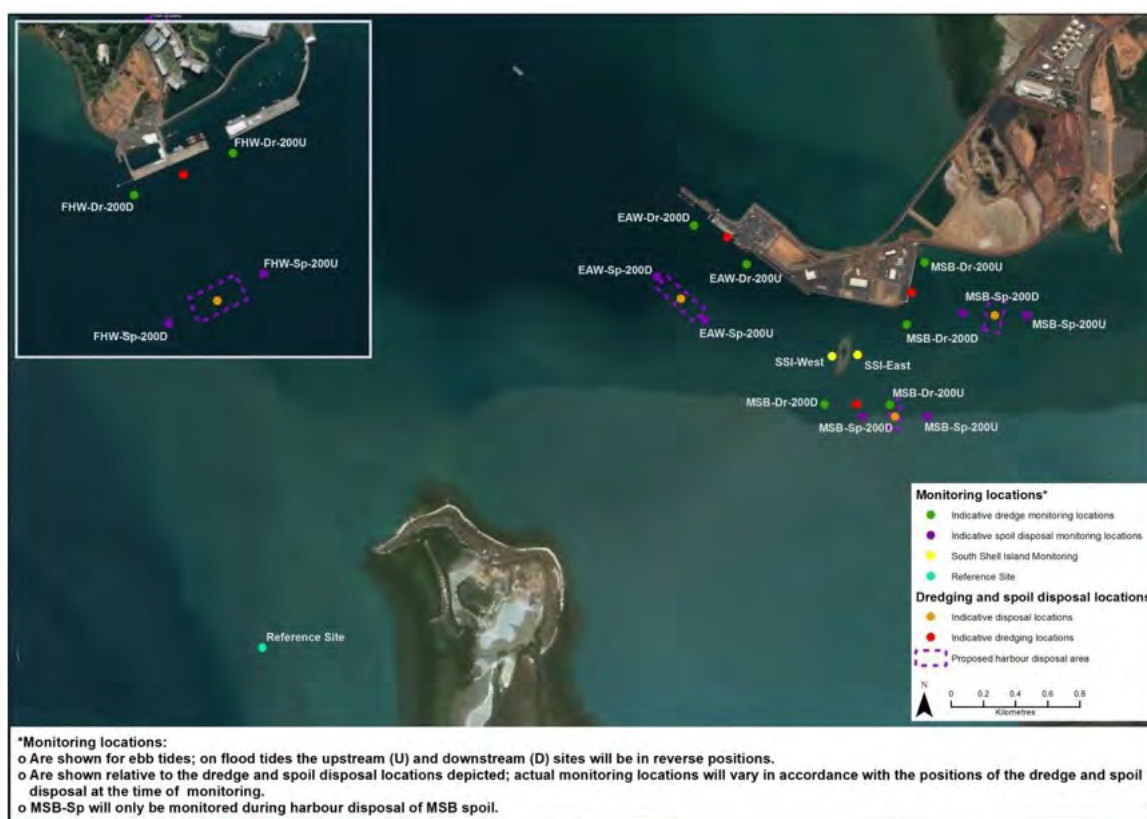


Figure 8-1: Turbidity monitoring locations

It should be noted that the '200 m up-current and down-current' sites shown in **Figure 8-1** are relative to the dredging and spoil disposal locations depicted in the figure; these monitoring sites will vary slightly according to the actual locations of dredging and spoil disposal at the time of monitoring. They are also depicted for an ebb tide scenario; on flood tides the up-current and down-current sites will be in the reverse positions.

The 200 m radius 'mixing zones' extending from the dredging and spoil disposal locations are considered appropriate as the model outputs represent probability plots for plume distribution; they do not represent 'snapshots' of plume distribution. Hence maintaining SSCs below the tolerance limits for turbidity-sensitive benthic communities at distances of 200 m or less from the turbidity-generating activities will provide assurance that the tolerance limits will not be exceeded at the nearest sensitive receptors (for East Arm Wharf and the MSB these are the coral and filter-feeder communities around South Shell Island).

8.2.3.3 Methodology

Monitoring will be undertaken daily for the duration of dredging and spoil disposal (into the harbour). The timing of the monitoring will be:

- Fort Hill Wharf – on flood tides, to ascertain the turbidity levels entering Frances Bay.
- East Arm Wharf - on flood tides, to ascertain the turbidity levels approaching the benthic communities on the western side of South Shell Island.
- MSB - on ebb tides, to ascertain the turbidity levels approaching the benthic communities of South Shell Island.

Turbidity will be measured, using a calibrated turbidity sensor, through the entire water column at each site and the mean (i.e. depth-averaged) turbidity calculated.

8.2.3.4 Data analysis

Turbidity data from the South Shell Island monitoring sites will be compared against the appropriate seasonal trigger value (21.2 NTU in the Wet Season or 3.5 NTU in the Dry Season).

For each monitoring location that is down-current from a dredging or spoil disposal location, the mean turbidity (in NTU) measured will be 'corrected' to account for non-dredging-related turbidity by subtracting the mean turbidity measured at the corresponding up-current site. The resultant mean turbidity value will then be compared against the appropriate seasonal trigger value.

8.2.3.5 Outcomes

The data outputs from the monitoring will enable ongoing assessments to be made of the need to implement management measures within the dredging and spoil disposal operations to maintain turbidity levels at the South Shell Island monitoring sites to below the predicted tolerance thresholds for the coral and filter-feeder communities around the island. **Figure 8-2**, **Figure 8-3** and **Figure 8-4** summarise the approaches for assessing the need to implement management measures for each of the three dredging and spoil disposal locations.

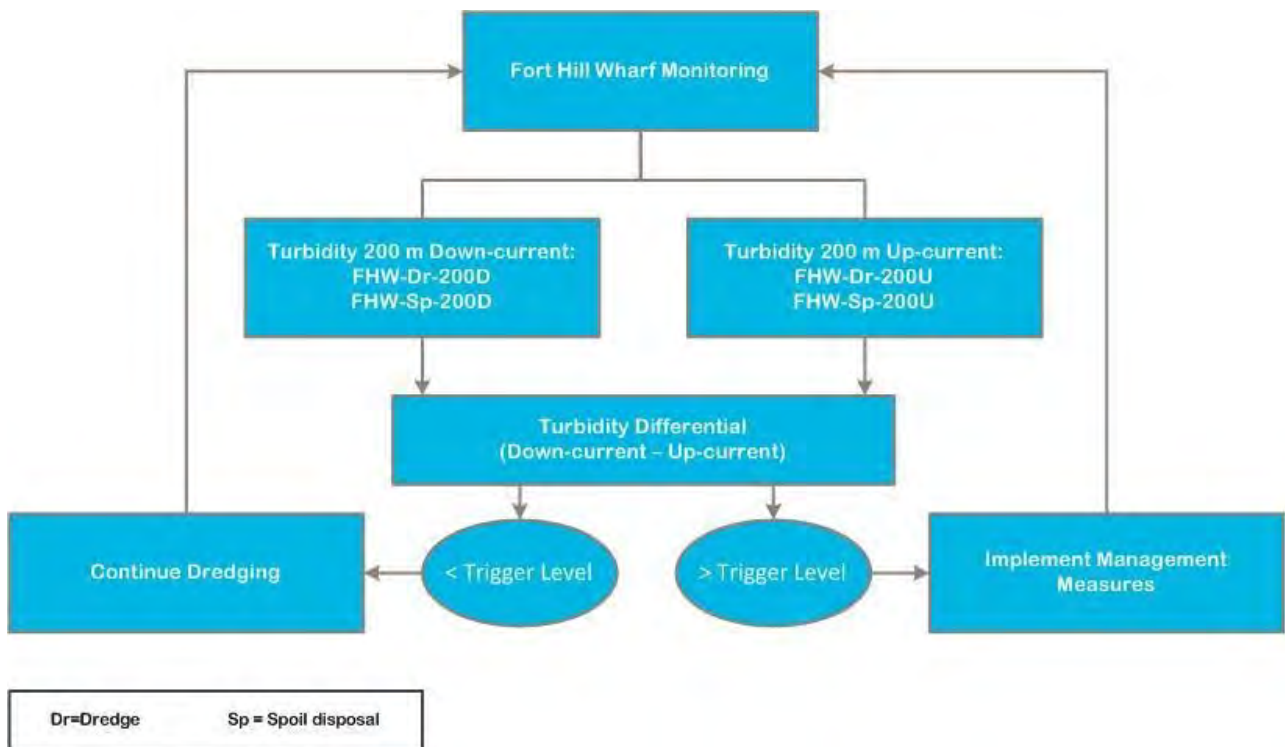


Figure 8-2: Turbidity monitoring flowchart – Fort Hill Wharf

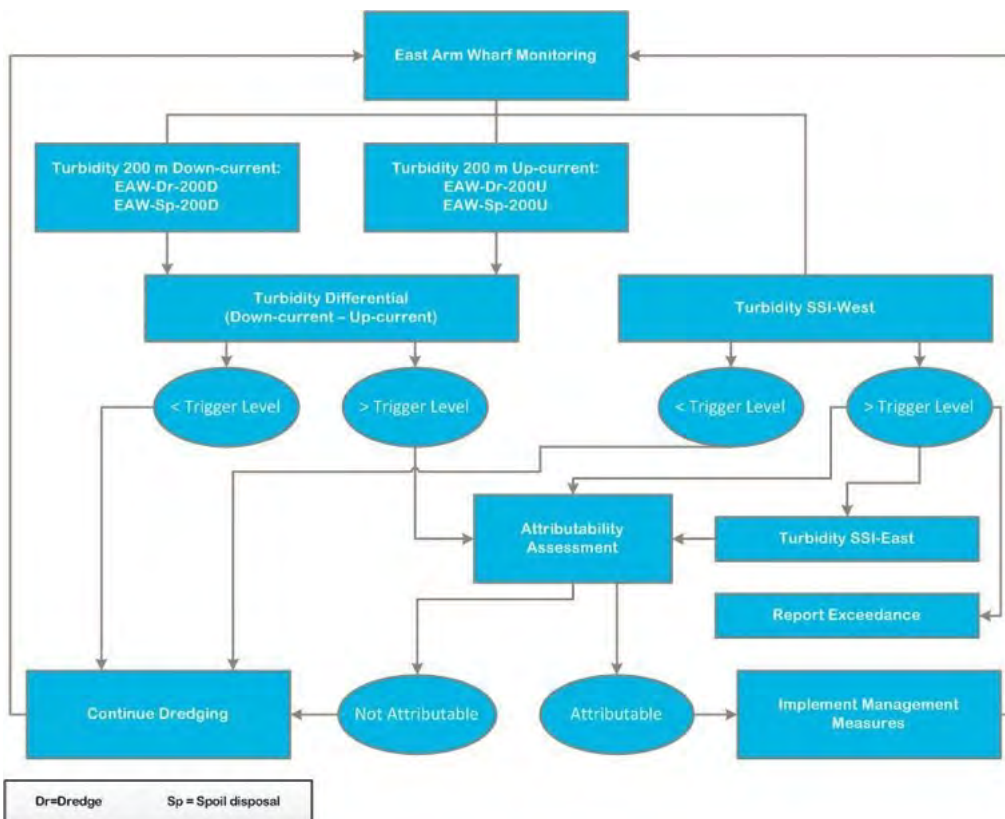


Figure 8-3: Turbidity monitoring flowchart – East Arm Wharf

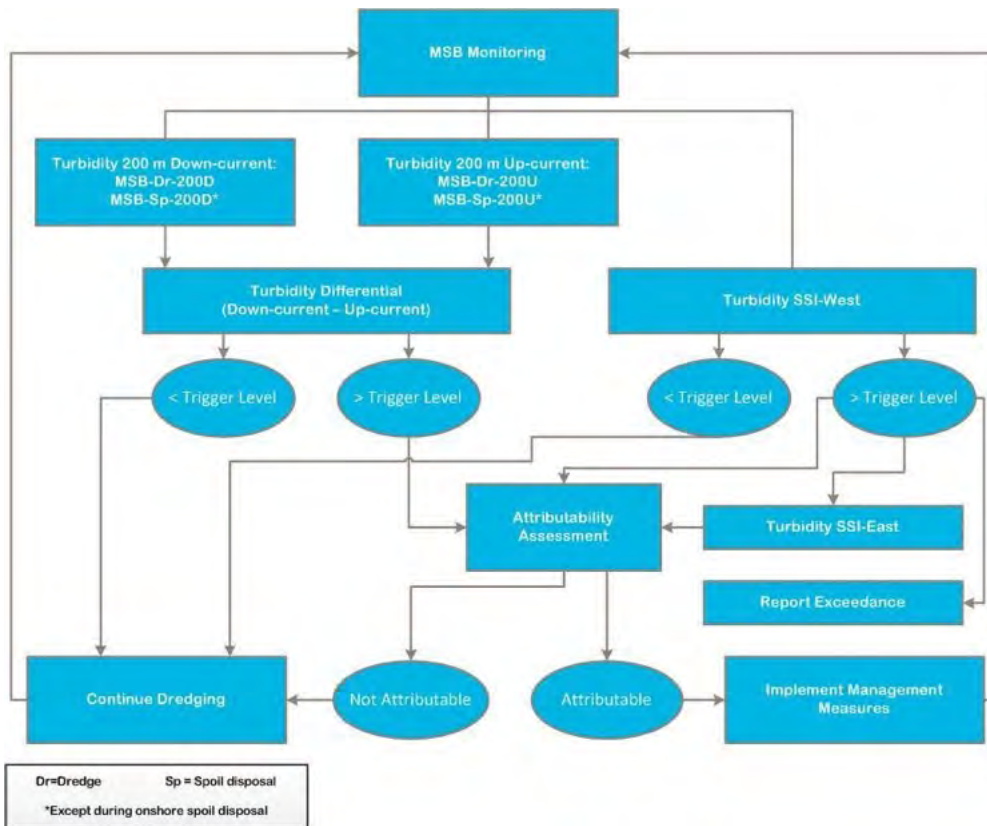


Figure 8-4: Turbidity monitoring flowchart – MSB

8.2.4 Response to trigger exceedance

Trigger exceedances will only apply to data from the SSI-West monitoring site. The data from the monitoring locations that are down-current from the dredging and spoil disposal locations (refer Section 8.2.3.2) will be used as ‘early warning’ indicators that corrective actions may need to be applied to the dredging operations to minimise the potential for trigger exceedances to occur at the SSI-West site.

If a seasonal turbidity trigger value (21.2 NTU in the Wet Season or 3.5 NTU in the Dry Season) is exceeded at the SSI-West monitoring site, then this will be reported by the Contractor to Darwin Port within 24 hours of the exceedance occurring. Also within 24 hours, additional monitoring and corrective actions (see Section 8.2.5, **Table 8-1** and **Table 8-2**) will be implemented in a manner aimed at determining which have the greatest potential to reduce the dispersion of plumes from the dredging and spoil disposal operations towards South Shell Island.

Concurrently, an attributability assessment will be initiated by the Contractor and submitted to Darwin Port to determine whether or not the exceedance was likely to have been caused by dredging or spoil disposal activities. This assessment will be completed within three business days of the exceedance occurring and will include consideration of information such as:

- Changes in water quality at the reference location (which would indicate whether there were regional increases in turbidity due to natural factors such as storm activity) and at site SSI-East.
- Observations of turbid plumes emanating from other sources within East Arm.
- Wind, wave, current direction and tidal data.

If it is deemed that the exceedance is potentially due to the maintenance dredging or spoil disposal operations, then those corrective actions (**Table 8-1**) that are most effective in adequately reducing turbidity emanating from these activities will continue to be implemented until such time as the turbidity levels fall to below the trigger value.

8.2.5 Management measures

The following inherent characteristics of the dredging operation are anticipated to minimise the generation of turbid plumes:

- The maintenance dredging operations are situated close to shore, at locations which are afforded some protection from the effects of tidal currents.
- The dredge operations will involve a single, static CSD with the suction pipe directly behind the cutter head. This maximises feed to the suction pipe and minimise the release of sediment into the water column surrounding the dredge.
- Cutter speed will be as low as possible, and the cutter will be disengaged for much of the time given the unconsolidated nature of the sediment to be dredged and its close proximity to infrastructure, while dredge pumps will operate at the maximum speed possible.

Consideration of trends in the water quality data collected during the monitoring program (Section 8.2.3) will be used to adaptively manage the maintenance dredging and spoil disposal operations to minimise the potential for water quality trigger values to be exceeded. The monitoring will provide advanced warning of any impending trigger value exceedance, allowing precautionary corrective actions (refer **Table 8-1**; these take account of contemporary guidance, such as that in Mills & Kemps [2016]) to be implemented before the trigger value is exceeded. For example, observations during monitoring will indicate the times within the tidal cycle when the migration of dredge and spoil disposal plumes towards South Shell Island is highest; maintenance or relocation of the dredge can then be scheduled to coincide with those times. The trigger and response procedures for monitoring at South Shell Island are summarised in **Table 8-2**.

Table 8-1: Water quality EMF – Darwin Harbour

Darwin Harbour Water Quality Management Framework	
Element	Maintenance of water quality within Darwin Harbour.
Commitments	Waste Discharge Licence conditions.
Objective	To minimise impacts upon the hard coral and filter-feeder communities at South Shell Island from turbid plumes emanating from dredging and spoil disposal operations.
Target	No instances of exceedance of turbidity trigger values at the South Shell Island monitoring sites.
Key Performance Indicator(s)	• Number of instances of exceedance of turbidity trigger value at South Shell Island monitoring site SSI-West that require corrective actions to be implemented to return turbidity to an acceptable level.

Darwin Harbour Water Quality Management Framework	
	Number of hours before turbidity at site SSI-West reduces to below the trigger value.
Management	Dredge cutter head and pump speeds managed to minimise dispersion of fine sediments from the cutter head.
Monitoring	- Reactive water quality monitoring at sites around South Shell Island, the dredging and spoil disposal locations, and a reference site. - Visual observation of plume dispersion from spoil disposal locations.
Reporting	- Daily reporting of data by Contractor to Darwin Port. - Monitoring report to NT EPA at conclusion of dredging. - Trigger value exceedances at South Shell Island monitoring site SSI-West will be reported by Contractor to Darwin Port within 24 hours of the exceedance occurring. - A report on corrective actions implemented to address the cause of the exceedance will be submitted by Contractor to Darwin Port within two business days of the notification. - Contractor will notify Darwin Port of the outcome of their investigation into attributability of the exceedance to dredging within three business days of the notification
Corrective Action(s)	- Slowing the cutter head or slew speed on the dredge to reduce sediment loss into the water column. - Increasing the water content of the discharged spoil (i.e. increasing the water-to-sediment ratio). - Reducing or temporarily suspending dredging and spoil disposal activity during tidal periods when the migration of dredge plumes towards South Shell Island is greatest.
Term	For the duration of dredging and spoil disposal operations.
Responsibility	- Contractor to ensure documents are compliant with the DMP. - Contractor project manager to ensure monitoring program and water quality management measures are implemented. - Contractor is required to take direction from the Darwin Port project manager.

Table 8-2: South Shell Island monitoring – triggers and responses

Components	Water Quality Trigger
Trigger value	Depth-averaged mean NTU at South Shell Island monitoring site SSI-West exceeds: - Wet Season – 21.2 NTU - Dry Season – 3.5 NTU
Trigger Description	An exceedance will be deemed to have occurred if the appropriate seasonal trigger listed above is exceeded. Trigger value exceedances will be reported to Darwin Port within 24 hours of the exceedance occurring.
Attributability Assessment	If a trigger value is exceeded, then an assessment will be undertaken to determine whether or not the exceedance is attributable to dredging. This assessment will be completed within three business days of the exceedance occurring. The assessment will include consideration of information such as: - Changes in water quality at the reference site and at site SSI-East. - Observations of turbid plumes emanating from other sources within East Arm. - Climatic and tidal conditions.
Monitoring Response	Hourly monitoring of turbidity at site SSI-West until such time as the turbidity levels fall to below the trigger value.
Management Response	Within 24 hours of exceedance of the water quality trigger, implement corrective action(s) (Table 8-1) to reduce turbidity attributable to dredging and spoil disposal that impinges upon the South Shell Island benthic communities.
Reporting	Reports detailing the monitoring data collected and corrective action(s) implemented will be submitted to Darwin Port within two business days of exceedance.

8.3 Dredge spoil decant ponds - water quality

8.3.1 Potential impacts

There are two primary sources of impact upon the receiving environment in Frances Bay from tailwater discharge from the decant ponds:

- Elevated concentrations of suspended sediments; these are addressed in Section 8.2.1.
- Increased acidity (i.e. reduced pH) and/or elevated toxicant concentrations. These could result in acute or chronic adverse impacts upon biota in the vicinity of the permeable section of the railway bund wall.

8.3.2 Water quality criteria for disposal of tailwater

The key water quality guidelines that are relevant to the management of the dredging and spoil disposal works are the ANZECC Guidelines (ANZECC & ARMCANZ 2000) and the Darwin Harbour Region WQOs (Fortune 2016). The Darwin Harbour Region Report Cards (e.g. Fortune 2016) are also relevant as they contain data from ongoing NTG water quality monitoring in Darwin Harbour.

The National Water Quality Management Strategy recommends that “the guidelines for each indicator should be based on locally derived data to reflect local (ambient) conditions. Where derivation of guidelines based on local monitoring is not possible, it is recommended that the national ANZECC Guidelines are used instead (for tropical Australia)”. Therefore, the most applicable guidelines for this project are Darwin Harbour Region WQOs, and in the absence of guidelines for certain parameters, reference will be made to the national ANZECC Guidelines.

The most stringent water quality criterion for Darwin Harbour was considered by NRETAS (2010) to be the environmental beneficial use category. This was because the intent of the environmental beneficial use was to maintain the health of aquatic ecosystems, and a water body that meets an environmental beneficial use will in almost all circumstances also meet the requirements for all other beneficial uses.

NRETAS (2010) adopted the ANZECC Guidelines approach for physico-chemical indicators for ‘slightly to moderately disturbed’ systems. The ANZECC guidelines have defined acceptable effect sizes for each level of protection for different indicator types (**Table 8-3**).

Table 8-3: ANZECC Guidelines default effect size for varying levels of protection

Indicator Class	Effect Size or Departure from Reference		
	High Conservation Value Systems	Slightly to Moderately Disturbed Systems	Highly Disturbed Systems
Toxicants in water	No change to natural values	95% of species protected	80-90% spp. protected
Toxicants in sediments	No change to natural values	>90% individuals protected	
Physico-chemical*	No change to natural values	Median lies within 20 th /80 th percentile of reference range*	Locally determined (10 th /90 th percentile of range)
Biological	No change to natural values	Median lies within 20 th /80 th percentile of reference range	Locally determined (10 th /90 th percentile of range)

*Applicable to the approach taken with WQOs for the Darwin Harbour Region

NRETAS (2010) states that the Darwin Harbour Region WQOs can be used as a tool for monitoring water quality and supporting decision making on the management of activities affecting coastal marine waters in the Darwin Harbour catchment. They apply to ambient waters (i.e. the receiving waters) and should not be regarded as individual discharge criteria. The values include protection of aquatic ecosystems and

recreational activities associated with the use of marine waters such as swimming, boating and fishing. Where the values are not being met, planning and management of these areas should move towards achieving the objectives over time.

The Darwin Harbour Region WQOs and the ANZECC Guidelines can be used to provide guidance to those undertaking water quality monitoring programs by providing key water quality indicators that can be monitored over time. Measured water quality can be compared with the criteria to determine whether management goals are being achieved or where management action is required.

The Darwin Harbour Region WQOs and ANZECC Guidelines apply to the receiving environment, rather than to the tailwater within the decant ponds. However, if the tailwater meets the following criteria then it will be considered suitable for continued disposal:

- The daily mean pH of the three water samples tested during monitoring at the discharge point from Pond E (South) (see Section 8.3.3.2) is >6.0 and <8.5. This will meet the WQO for an Upper Estuary setting (Fortune 2016).
- For toxicants the Darwin Harbour Region WQOs defer to the ANZECC Guidelines. Hence concentrations of toxicants will be compared against the ANZECC Guidelines for 'slightly to moderately disturbed' ecosystems (i.e. for 95% species protection) (ANZECC & ARMCANZ 2000). For some toxicants the ANZECC Guidelines have no criteria levels for marine waters as there are considered to be insufficient data to derive reliable trigger values. In these instances, it is proposed to adopt the criteria levels for fresh water. The list of metallic toxicants to be tested (**Table 8-4**) is based on the potential presence and toxicity of these metals in Darwin Harbour.
- The target SSC for the tailwater will be 100 mg/L (140 NTU). As SSC cannot be monitored directly in the environment, turbidity (in NTU) is used as a surrogate measure. A mathematical relationship between NTU and SSC was derived from water samples collected within the pond system and analysed for both SSC and turbidity as part of the MSB capital dredging monitoring program (DoI 2014). This relationship (100 mg/L = 140 NTU) will be applied during interpretation of water quality monitoring undertaken during the maintenance dredging campaigns. As the relationship was based upon the finer sediment fraction of the capital material that had migrated through the pond system, it is considered equally applicable to the finer sediment fraction of maintenance dredge material.

Table 8-4: Toxicant trigger levels

Toxicant	Trigger Level
Arsenic (AsIII)	24 µg/l (freshwater)
Arsenic (AsV)	13 µg/l (freshwater)
Cadmium	5.5 µg/l
Chromium (CrIII)	27.4 µg/l
Chromium (CrVI)	4.4 µg/l
Copper	1.3 µg/l
Lead	4.4 µg/l

Mercury (inorganic)	0.4 µg/l
Nickel	70 µg/l
Selenium (total)	5 µg/l (freshwater)
Zinc	15 µg/l

8.3.3 Decant ponds water quality monitoring program

8.3.3.1 Objective

The objective of monitoring water quality within the decant ponds is to confirm the physico-chemical properties (SSC, pH and toxicant concentrations) of the tailwater are suitable for release from the ponds to the harbour waters. That is, the quality of water discharging through the permeable section of the railway bund wall is within the criteria discussed in **Section 8.3.2**.

8.3.3.2 Monitoring locations

The water quality monitoring sites are shown in **Figure 8-5**. The pH and toxicant concentrations of the tailwater within Pond K (i.e. at Site 1) will be ascertained before discharge into Pond E (North) is permitted to commence. When tailwater is flowing through the pond system, turbidity will be monitored at the reclamation boxes (Sites 1 and 2) and within Pond E (South), close to the permeable section of the railway bund wall (Site 3). Pond E (South) is effectively considered to be the 'receiving environment', with the railway bund wall providing an additional buffer against impacts upon the environment of Frances Bay.

8.3.3.3 Methodology

During disposal of dredged material into Pond K, the weir to Pond E (North) will be closed such that all tailwater is retained within Pond K. At the completion of spoil disposal into Pond K, three water samples will be collected from the tailwater in the immediate proximity of the reclamation box leading to Pond E (North); i.e. at Site 1 in **Figure 8-5**. The samples will be sent to a National Association of Testing Authorities (NATA) accredited laboratory for analysis of toxicant concentrations. Prior to analysis, the samples will be filtered to remove particles >45 µm in diameter; this will reduce the potential for sediment-bound toxicants to be included in the analyses and will provide a measure of the bioavailable concentrations of any toxicants that are present. Based on potential toxicity and presence within Darwin Harbour sediments, the toxicants to be monitored through collection of water samples are shown in **Table 8-4**. Speciated toxicants (arsenic and chromium) will be analysed for total values, and if any total exceeds the trigger level of one of the species, then the samples will be reanalysed for the individual species.

The pH of the tailwater at Site 1 will also be tested, using a hand-held pH meter, to ascertain whether there are any causes for concern with respect to pH (i.e. pH <6.0 or >8.5) that may need to be addressed whilst the samples are being analysed for toxicants.

If the laboratory analytical results indicate that the mean concentrations of all toxicants are below ANZECC Guideline criteria levels (**Table 8-4**), the pH levels in three samples of tailwater from Site 1 will be ascertained. If the mean pH is within the range 6.0-8.5, then tailwater release into Pond E (North) will commence.

Commencing at the time of first tailwater flow through the reclamation box between Pond K and Pond E (North), and continuing until tailwater ceases to flow through the reclamation box between Pond E (North) and Pond E (South), tailwater turbidity will be monitored (using a hand-held probe) at

Sites 1, 2 and 3 (**Figure 8-5**) three times daily. The turbidity level at Site 3 will be compared against the turbidity trigger value (140 NTU) to ascertain whether or not contingency measures (as per **Table 8-5**) need to be implemented. The turbidity levels at Sites 1 and 2 will assist in determining whether any elevations in turbidity at Site 3 are due to tailwater from the spoil disposal operation or from other factors (such as stormwater inputs or the resuspension of settled sediments within Pond E [South] due to meteorological or tidal effects).

Over the duration of tailwater flow through the reclamation box between Pond E (North) and Pond E (South), daily visual inspections of the water outside of the permeable section of the railway bund wall will be conducted to confirm that the tailwater discharge is not giving rise to any of the adverse impacts listed in **Table 8-5**.



Figure 8-5: Water quality monitoring locations

8.3.4 Outcomes

The data outputs from the monitoring will enable assessments to be made of the need to implement corrective actions to:

- Render the tailwater suitable for release from Pond K (on the basis of pH level and toxicant concentrations).
- Maintain turbidity levels within Pond E (South) below the trigger level in order to render the water suitable for continued disposal.

8.3.5 Response to trigger exceedance

Prior to the release of tailwater from Pond K, if the laboratory analytical results indicate that the mean concentrations of any (dissolved) toxicants exceed ANZECC Guideline criteria levels, or if the pH lies outside of the range 6.0-8.5, then further investigations and contingency measures (e.g. dilution of tailwater with seawater, refer **Table 8-5**) will be instigated and tailwater will be retained within Pond K.

During tailwater discharge, if the mean turbidity level in Pond E (South) exceeds the trigger level (140 NTU) then (subject to the need to keep the weir open under high stormwater flow conditions), the reclamation box between Pond E (North) and Pond E (South) will be closed until turbidity levels have fallen to below 140 NTU.

8.3.6 Management measures

8.3.6.1 Tailwater

Tailwater release into Pond E (North) will not commence until such time as the quality of the tailwater (pH level and toxicant concentrations) at Site 1 is deemed acceptable (as per criteria listed in **Table 8-5**). Once the mean concentrations of all toxicants are below the trigger levels listed in **Table 8-4**, and the pH is confirmed to be within the acceptable range (6.0-8.5), the upper weir boards will be progressively removed such that the clearest surface layers of tailwater begin to flow into Pond E (North), thence into Pond E (South) and eventually through the permeable section of the bund wall and into Frances Bay.

In the event that the reclamation box between Pond E (North) and Pond E (South) is closed during tailwater discharge (due to exceedance of the turbidity trigger level), then corrective actions (**Table 8-5**) will be implemented and confirmed as successful by monitoring before recommencing discharge.

8.3.6.2 Potential Acid Sulfate Soil

Should PASS be detected in the pre-dredging geochemical assessment of the material to be dredged from the MSB (in volumes likely to have a noticeable impact on water quality), then dredge spoil will be disposed of at the harbour location to the east of the MSB (Section 4.7), provided all toxicant concentrations are below ANZECC Guideline criteria levels. This will remove the risk of spoil coming into contact with the atmosphere and the potential acidification of the sediments.

Table 8-5: Water quality EMF - dredge spoil decant ponds

Water Quality Management Framework - dredge spoil decant ponds	
Element	Maintenance of water quality within dredge spoil decant ponds.
Commitments	Waste Discharge Licence conditions.

Water Quality Management Framework - dredge spoil decant ponds	
Objectives	To protect receiving waters from dredging-related impacts.
Target	1. No increase in tailwater acidity within Pond K to the extent that it is unacceptable for discharge due to low pH (<6.0). 2. No increase in tailwater alkalinity within Pond K to the extent that it is unacceptable for discharge due to high pH (>8.5). 3. No exceedances of ANZECC Guideline criteria for toxicants (refer Table 8-4) in tailwater within Pond K prior to the commencement of transfer into Pond E (North). 4. 100% of tailwater discharging from Pond E (South) has SSC less than 100 mg/L (measured as turbidity [140 NTU], refer Section 8.3.2). 5. No occasions when tailwater discharging from Pond E (South): a. Contains floating oil or grease or petroleum hydrocarbon sheen or scum, or litter or other objectionable matter. b. Causes or generates odours which would adversely affect the use of surrounding waters. c. Causes algal blooms. d. Causes adverse impacts on plants.
Key Performance Indicator(s)	• Number of instances when SSC in Pond E (South) is >100 mg/L (measured as turbidity, refer Section 8.3.2). • Number of instances when target criteria 5 (a)-(d) are not met.
Management	• Dredge spoil will be directly deposited only into Pond K or, if required for PASS management, to the harbour disposal site to the east of the MSB. • The reclamation box between Pond K and Pond E (North) will remain closed during deposition of spoil into Pond K. • Once deposition of spoil has been completed, tailwater will be tested to ascertain the pH and the concentrations of all toxicants. • Once it is confirmed that pH is in the range 6.0-8.5 and the mean concentrations of all toxicants are below the ANZECC Guideline criteria (refer Table 8-4), the upper weir boards will be progressively removed such that the clearest surface layers of tailwater begin to flow into Pond E (North).
Monitoring	• Water quality monitoring within ponds – turbidity, pH and toxicants. • Visual monitoring of target criteria 5 (a)-(d) outside the permeable section of railway bund. • Water level monitoring to ensure no overflow from ponds and to control residence times.
Reporting	• Weekly reporting of data by Contractor to Darwin Port. • Trigger level exceedances at any monitoring location will be reported by Contractor to Darwin Port within 24 hours of the exceedance being detected. • A report on corrective actions implemented to address the cause of the exceedance will be provided by Contractor to Darwin Port within one business day of the notification.

Water Quality Management Framework - dredge spoil decant ponds	
	Monitoring report to NT EPA at conclusion of dredging.
Corrective Action(s)	- If deemed by the Contractor to be potentially effective in increasing the pH of the water in Pond K to >6.0 (but not above 8.5), high carbonate-content soil may be used to cover pond sediments that are exposed to air if it is apparent they are a source of acidification of the water. - Harbour water may be pumped into Pond K to return the pH of the tailwater to between 6.0 and 8.5. The mean recorded pH of seawater in the vicinity of South Shell Island is 8.0 (Table 5-2). - If pH is >8.5 in Pond K, then the water will not be discharged into Pond E (North) until such time as the pH decreases to below 8.5 (but not below 6.0). - If toxicant concentrations exceed ANZECC Guideline levels Table 8-4) in Pond K and the bioavailable component is deemed to pose a risk, then tailwater will not be released into Pond E (North) until such time as they fall below the trigger levels (e.g. through dilution with harbour water). - If SSC exceeds 100 mg/L in Pond E (South) at the railway bund wall then (subject to the need to keep the weir open under high stormwater flow conditions) tailwater flows out of Pond E (North) will be blocked at the reclamation box until SSC levels at the transfer point between Pond E (North) and Pond E (South) have fallen to below 100 mg/L.
Term	From the completion of spoil disposal into the ponds, until tailwater ceases flowing from Pond E (North) into Pond E (South).
Responsibility	- Contractor to ensure documents are compliant with the DMP. - Contractor project manager to ensure monitoring program and water quality management measures are implemented. - Contractor is required to take direction from the Darwin Port project manager.

8.4 Protected marine species – physical interaction

8.4.1 Potential impacts

The main risk of physical interaction with protected marine species will be in relation to the movement of dredge support vessels (e.g. crew transfer vessel, tender vessel). The risk of direct impact to protected marine species from the operating dredge is considered to be very low; the dredge will be stationary during most of the works and the cutter head will not often be engaged (due to the nature of the sediment to be dredged and its proximity to infrastructure).

When moving between or within the dredging footprint, the dredge will transit at low speeds (<5 kn) and only over small distances (tens of metres). In these circumstances, the dredge and support vessels will be replacing regular vessel traffic in what is usually an operational environment, meaning the risk of vessel strike is not greater than that posed during usual port operations.

It should be noted that physical interactions between dredging vessels and marine species are a higher risk when mobile dredges such as trailer suction hopper dredges are used and when dredged material is disposed offshore by barges. Neither of these scenarios is applicable to the maintenance dredging works.

8.4.2 Protected marine species monitoring program

8.4.2.1 Objective

The objective of the monitoring program is to minimise the risk of injury to, or mortality of, protected marine species.

8.4.2.2 Methodology

At all times that the dredge is operational, the crew will include at least one member that is trained (by a recognised training provider) as an MFO. The MFO will be responsible for undertaking visual assessments (for protected marine species) of the 150 m radius Observation Zone around the dredge (Figure 8-6) for a period of 10 minutes prior to the commencement of each period of dredging (i.e. on each occasion that the dredge has been non-operational for a period exceeding 30 minutes). The assessment of the Observation Zone will be made from an elevated position on the dredge, where a clear line of sight is achievable to the edge of the zone. The MFO will not be engaged in any other activities during the dedicated assessment periods.

During dredging, at 30 minute intervals the designated MFO will check, over a period of five minutes, the Exclusion Zone (Figure 8-6) for the presence of protected marine species.

8.4.3 Response to sightings

Sightings of protected marine species will be recorded (including details of the time and results of observation) if they are present within the:

- 150 m radius Observation Zone prior to the commencement of a period of dredging.
- Exclusion Zone during dredging.

If warranted, the corrective actions described in Table 8-6 will be implemented.

8.4.4 Management measures

The Contractor will provide awareness training to selected crew members to inform them about the protected marine species which may occur within Darwin Harbour; to provide a description of the record form to be used for recording protected marine species sightings; and to explain how to apply appropriate avoidance mitigation measures to minimise potential impacts or collisions with marine fauna. The purpose of the training is to raise awareness; to encourage recording and reporting of protected marine species sightings, and to emphasise the requirement to report stranded, injured or dead marine species regardless of what caused the injuries or deaths.

The Contractor will undertake observations for protected marine species and will report all positive sightings by the MFO to their Project Manager, who will ensure that sightings are logged and information is provided to Darwin Port. All sightings of protected marine species are recorded by the MFO on marine fauna observation forms similar to that presented in Figure 8-8; these will be available on all Project vessels. These records will then be logged into the Project marine fauna sighting register and will be used to identify potential fauna interaction areas which will be incorporated by the Contractor into pre-starts, toolboxes, marine fauna awareness training, and other general awareness sessions. The Contractor will report any incidents of injury or mortality to a listed threatened or migratory species (that may be attributable to the dredging activity) to Darwin Port within 24 hours.

Table 8-6: Protected marine species EMF - physical interaction

Protected Marine Species Management Framework – physical interaction	
Element	Vessel interaction with protected marine species.
Objectives	- Minimise the risk of injury to, or mortality of, protected marine species. - Develop and maintain awareness of the need to protect marine species.
Target	- No incidents of vessel interaction with protected marine species. - All dredging personnel to complete an HSE induction, including protected marine species awareness and management requirements. - All vessel masters competent in protected marine species interaction procedures. - At all times that the dredge is operational, at least one crew member is a trained MFO.
Key Performance Indicator(s)	- Number of incident reports. - Number of reported sightings of live, injured or dead marine fauna. - Number of personnel completing an HSE site induction. - Availability of MFO trained dredge operator
Management	- Training of Vessel Masters in interaction procedures and specified crew as MFOs. - A trained MFO must be on duty, above deck with good visibility, during all dredging operations. - On each occasion that the dredge has been non-operational for a period exceeding 30 minutes, a visual assessment shall be undertaken of the 150 m radius Observation Zone by the MFO for a period of 10 minutes. Dredging will not recommence until no protected marine species have been sighted within the 150 m radius Observation Zone for a period of 10 minutes. - The assessment of the Observation Zone will be made from an elevated position on the dredge, where a clear line of sight is achievable to the edge of the zone. - The MFO will not be engaged in any other activities during the 10 minute assessment period. - Every 30 minutes whilst the dredge is operating, the MFO will dedicate a period of five minutes for scanning (from an elevated position) for protected marine fauna within the Exclusion Zone. - If protected marine species are sighted within the Observation or Exclusion Zone, then a response in accordance with vessel interaction procedures (Figure 8-6) will be implemented. Dredging will be temporarily suspended if turtles, dugongs or dolphins enter within 50 m of the cutter head, or dolphins with calves enter within 150 m of the cutter head (i.e. the Exclusion Zone). - Dredging that commences prior to sunset, or prior to a period of low visibility, will continue unless, within the preceding 12 hours, there have been three or more suspensions of dredging due to protected species encroaching within the Exclusion Zone

Protected Marine Species Management Framework – physical interaction	
	- On the few occasions when the dredge cutter head is used, it will only start when it is positioned near the seafloor, and rotation will be stopped before the cutter is raised through the water column. - Guidelines on approach distances for protected marine species (Figure 8-7) will be followed. - Support vessels will adhere to Darwin Port speed restrictions. - Support vessels will not approach, circle or wait in front of wildlife for the purposes of casual viewing. - Watch will be maintained for stranded, injured or dead protected marine fauna; if observed, the NT Government Marine Wildwatch line (1800-453-941) will be contacted for retrieval, treatment or post-mortem of the fauna.
Monitoring	- Regular monitoring for the presence of stranded, injured or dead marine fauna - Marine fauna observations (refer to management section)
Reporting	- Daily submission to Darwin Port of marine fauna observations sheets (Figure 8-8). - Weekly summary reporting to Darwin Port of number of sightings, incidents and corrective actions. - Monitoring report to NT EPA at conclusion of dredging. - Any vessel interaction incidents and protected species injury or mortality will be reported to Darwin Port, and to NT EPA, within 24 hours of the incident occurring.
Corrective Action(s)	- In the event that an incident or near miss occurs between vessels and protected marine species, the incident will be investigated in order to identify opportunities to further improve awareness, and/or to develop procedures to reduce risk of collision. - For mobile vessels, a 5 kn vessel speed limit will be applied in areas where frequent sightings (an average of >1 per day in any one week) are made of protected marine species. - If protected marine species approach within the Caution Zone (Figure 8-7), vessels that are under way will proceed at a “no wash” speed.
Term	For the duration of dredging activities.
Responsibility	- Contractor to ensure their documents are compliant with the DMP. - Contractor to ensure protected marine species management and monitoring program is implemented. - Contractor project manager to liaise with NTG (via Marine Wildwatch [1800-453-941]) on response to stranded, injured or dead marine fauna and potential recovery, treatment or post-mortem.

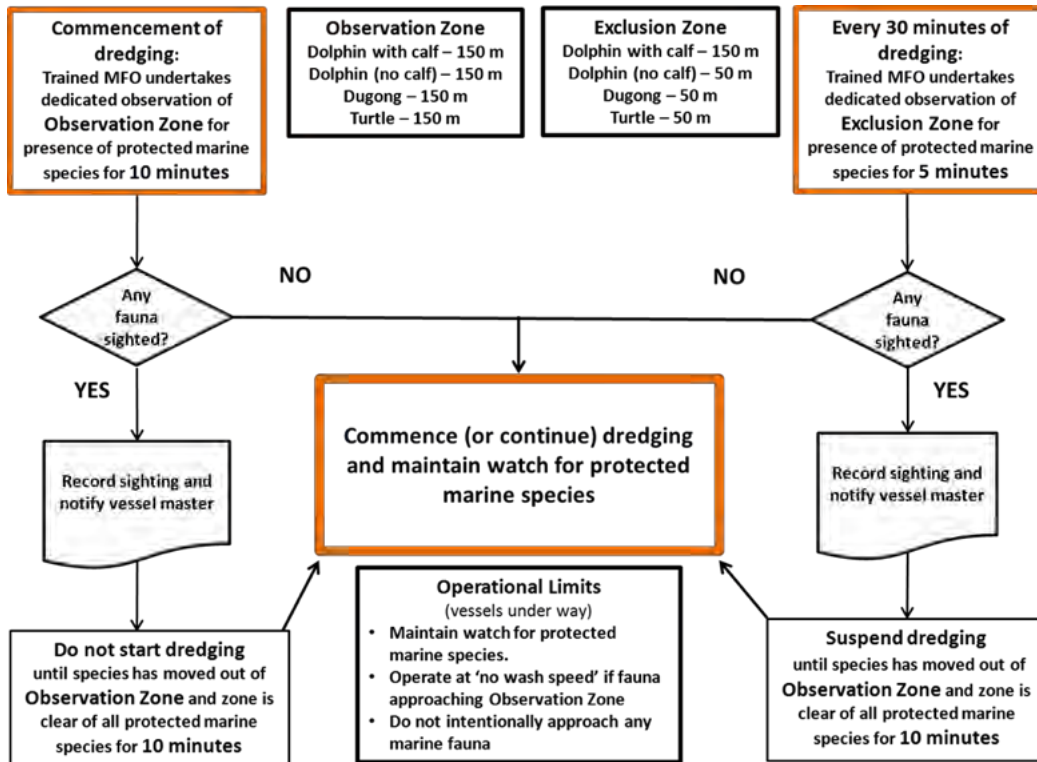


Figure 8-6: Vessel interaction management flowchart

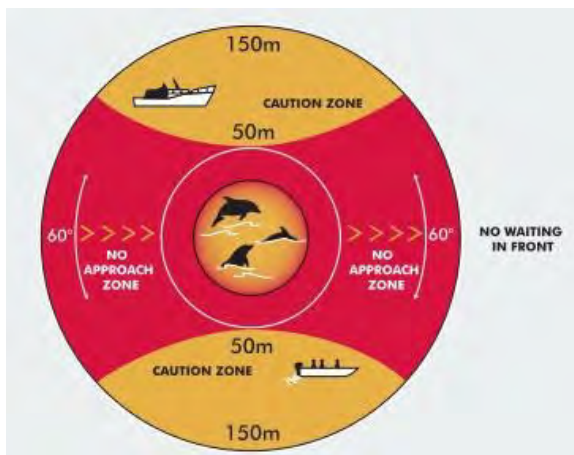


Figure 8-7: Guidelines on approach distances for dolphins (Source: Natural Resource Management Ministerial Council (2005))

Figure 8-8: Marine fauna observations form

Maintenance dredging will temporarily create additional underwater noise in various forms and intensity above current ambient levels in Darwin Harbour. However, noise levels at the dredging locations may be lower during dredging than during wharf operations due to the exclusion of shipping operations from these locations. Given the short duration of each maintenance dredging campaign, it is considered there is negligible risk of significant impacts upon protected marine species from underwater noise.

Turtle auditory morphology is adapted for hearing in water. They hear largely in the low frequency range (<1000 Hz), though the bandwidth and peak sensitivity varies between species. The use of sound by turtles is little understood. Experimentally, turtles have initially shown avoidance behaviour, then eventually habituating to the noise (Moein Bartol & Musick 2003). Observation of dredge activities around Australia is that turtles largely avoid coming in close proximity to the dredge. In part this is attributed to the sound of the dredge.

Little information is available on the auditory systems of dugongs and little research has been undertaken to investigate the sensitivity of dugongs to noise. There are only anecdotal reports of dugongs avoiding areas with high boat traffic.

Monitoring of protected marine species is described in Section 8.4.2. Management measures implemented to reduce the risk of disturbance of protected marine species by underwater noise generated by the dredging works are listed in **Table 8-7**.

Table 8-7: Protected marine species EMF - underwater noise

Protected Marine Species Management Framework – underwater noise	
Element	Impact of underwater noise on protected marine species.
Objectives	- Minimise the risk of disturbance to protected marine species from underwater noise. - Establish and maintain awareness of the importance of protecting marine species.
Target	- No avoidable disturbance to protected marine species as a result of noise generated during dredging activities. - All dredging personnel to complete an HSE induction. - At all times that dredge is operational, at least one crew member is trained MFO.
Key Performance Indicator(s)	- Number of audits and incident reports. - Number of reported sightings of live, injured or dead protected marine species. - Number of personnel completing an HSE site induction. - Availability of MFO trained crew member.
Management	- Ensure that all equipment is maintained in good operating condition (balancing, greasing, etc.) and have proper noise control systems in place. - Ensure all noise minimisation measures such as mufflers, special enclosures and sound- insulation mounts are fitted and working. - Ensure revolving equipment such as propellers and drive shafts are balanced to reduce vibration. - Minimise the noise generation of equipment (thrusters and auxiliary plant) by switching them off when not used (i.e. avoid running on standby mode).
Monitoring	- Marine fauna observations. - Regular monitoring for stranded, injured or dead marine fauna.
Reporting	- Daily submission of marine fauna observations sheets (Figure 8-8). - Weekly summary reporting to Darwin Port of number of sightings of protected marine species. - Monitoring report to NT EPA at the conclusion of dredging. - Any suspected noise related incidents will be reported by Contractor to Darwin Port within 24 hours of the incident occurring. Incidents will also be reported by Contractor direct to NT EPA within 24 hours of the incident occurring.

Protected Marine Species Management Framework – underwater noise	
	Any corrective actions implemented in response to suspected noise-related incidents will be detailed in the weekly report to Darwin Port. This report will also be provided to NT EPA.
Corrective Action(s)	In the event that noise-related impact is suspected, the cause of any excessive noise will be investigated to identify the most appropriate action(s) to reduce the noise.
Term	For the duration of dredging activities.
Responsibility	- Contractor to ensure their documents are compliant with the DMP. - Contractor to implement noise management measures aboard vessels.

8.6 Summary of monitoring programs

Key aspects of each of the monitoring programs are summarised in **Table 8-8** (commencing on the following page).

Table 8-8: Summary of monitoring program

Locations	Parameter	Methods	Frequency	Triggers	EMF
DREDGE AND SPOIL DISPOSAL PLUMES (refer Figure 8-1)					
Section 8.2.3.2 Water column at locations 200 m up- current and down- current from Fort Hill Wharf, East Arm Wharf and MSB dredge and spoil disposal locations.	Turbidity	Visual / Hand-held probe	Daily on ebb tide for MSB dredging and flood tide for Fort Hill Wharf and East Arm Wharf dredging.	Differential in depth-averaged turbidity (NTU, measured through the water column) between the relevant pairs of up-current and down-current sites: - Wet Season: 21.2 NTU - Dry Season: 3.5 NTU Continue to monitor. Modify dredging and spoil disposal operations (Table 8-1) to reduce turbidity levels below the trigger value at a distance of 200 m from the dredge or spoil disposal location.	Water Quality Management - Darwin Harbour
Section 8.2.3.2 Water column at South Shell Island monitoring site SSI-West and a reference location.			Daily on ebb tide for MSB dredging and flood tide for East Arm Wharf dredging.	Average turbidity (NTU, measured through the water column) at site SSI-West: - Wet Season: 21.2 NTU - Dry Season: 3.5 NTU Increase frequency of monitoring at site SSI-West (Table 8-2), monitor site SSI-East and implement corrective actions (Table 8-1) to reduce turbidity levels to below trigger value.	
DREDGE SPOIL PLACEMENT PONDS (Corresponding relevant monitoring locations from Figure 8-5 are shown as 22 in the text)					

Locations	Parameter	Methods	Frequency	Triggers	EMF
Section 8.3.3.2 At all pond outlets where tailwater is flowing and in Pond E (South) prior to discharge through the bund wall.	pH	Hand-held probe	Pond K, near the weir box leading to Pond E (North): - Once when water samples for toxicant analysis are collected. - Once prior to release of tailwater into Pond E (North).	pH<6.0 or pH>8.5 Refer to Table 8-5 for corrective actions to be considered by the Contractor in the event of a trigger exceedance. Relevant monitoring location: ②	Water Quality Management - Dredge Spoil Placement Ponds
	Toxicants	Laboratory	Pond K, near the weir box leading to Pond E (North): Prior to release of tailwater to Pond E (North) being permitted to commence. Three samples collected on one occasion for laboratory analysis.	Exceedance of any ANZECC Guidelines 95% level of protection levels (Section 8.3.2; trigger levels detailed in Table 8-4). Refer to Table 8-5 for corrective actions to be considered by the Contractor in the event of a trigger exceedance. Relevant monitoring location: ②	
	Turbidity (NTU)	Hand-held probe	Three times daily from the commencement of tailwater flow from Pond K into Pond E (North) until the cessation of tailwater flow from Pond E (North) into Pond E (South).	Trigger level: 100 mg/L SSC = 140 NTU Continue to monitor and consider pre-emptive management actions to prevent exceedance in Pond E (North) at the weir into Pond E (South) or in Pond E (South) if trigger exceeded. Relevant monitoring locations: ②②②②②	
DREDGING AREA					

Locations	Parameter	Methods	Frequency	Triggers	EMF
Section 8.4.2 Observation Zone and Exclusion Zone around dredge	Protected Marine Species presence	Observation by trained -observers (MFOs)	On each occasion that the dredge has been non-operational for a period exceeding 30 minutes, a visual assessment will be undertaken of the 150 m radius Observation Zone by the MFO, for a period of 10 minutes prior to the recommencement of dredging. Every 30 minutes, the Exclusion Zone will be assessed by the MFO for a period of five minutes.	Trigger – presence of protected marine species within the 150 m Observation Zone. Dredging shall not commence until no protected marine species have been sighted within the Observation Zone for a period of 10 minutes. Trigger – entry of protected marine species into the Exclusion Zone: • 150 m for dolphin with calf • 50 m for all other protected marine species, including dolphin without calf. Dredging will be temporarily suspended until such time as there has been no protected marine species sighted within the 150 m Observation Zone for a period of 10 minutes.	Protected Marine Species Management – physical interaction and underwater noise

9 REPORTING

9.1 Routine reporting

9.1.1 Daily reporting

Brief daily reports will be provided by the Contractor to Darwin Port and will include:

- a summary of the dredging completed on that day and status of dredging operations
- turbidity (NTU) data from monitoring at sites up-current and down-current from the active dredge and spoil disposal locations and (during East Arm Wharf and MSB dredging) at South Shell Island monitoring site SSI-West and the reference site (Section 8.2.3)
- turbidity (NTU) data within Pond E (South), over the duration of tailwater flow from Pond K to Pond E (South) (Section 8.3.3.3)
- information relating to any exceedances detected through monitoring
- proposed schedule for dealing with exceedances reported and next steps to be followed
- records of sightings of protected marine species (Section 8.4.2)
- daily dredge logs showing work area and availability.

9.1.2 Weekly monitoring report

Each week during the dredging and tailwater discharge activities, a weekly summary report of monitoring data will be submitted by the Contractor to Darwin Port. The report will include:

- pH data for Pond K water at the time of collection of samples for toxicant analysis, and prior to tailwater release into Pond E (North) (Section 8.3.3)
- toxicant data for Pond K water, once available from the laboratory (Section 8.3.3.3)
- summary of daily data reports (Section 9.1.1)
- discussion of any trigger level exceedances (Section 9.2)
- corrective actions taken to address exceedances (Section 8)
- details of any injuries to, or mortalities of, turtles, dugongs or dolphins as a result of dredging activities (Section 9.3)
- a summary of environmentally significant equipment failures or events and an outline of corrective actions taken, or proposed, to reduce environmental harm arising therefrom (Section 9.3).

9.1.3 Dredge operation records and reporting

The Contractor will maintain daily records of areas dredged, the volumes of material removed and dredge availability. These records will be provided to Darwin Port weekly, and the findings from hydrographic surveys confirming dredge volumes and locations will be included in the Contractor report to the Darwin Port on completion of the dredging (see Section 9.1.4). Copies of the daily environmental inspection checklists and other relevant environmental records will be provided by the

Contractor to Darwin Port. All records will be provided in a format that allows auditing by environmental regulators if required.

9.1.4 End of dredge phase reporting

Within one month of the conclusion of dredging, the Contractor will submit a monitoring report to Darwin Port which includes the outcomes of all monitoring activities, exceedances, management actions and any relevant trend analysis and interpretation of analytical data collected in accordance with environmental conditions.

9.1.5 Compliance reporting

Darwin Port will hold Waste Discharge Licences for the spoil disposal activities. As the licensee, Darwin Port will submit to NT EPA any reports, data and information in accordance with any timeframes required under the licenses. During dredging, the licensee will notify NT EPA of any non-compliance with the Waste Discharge Licences, as required by those licences.

9.2 Exceedance notification and reporting

The following notifications of exceedances will be made to Darwin Port within 24 hours of the exceedances occurring:

- The depth-averaged mean NTU at South Shell Island monitoring site SSI-West exceeding the relevant seasonal turbidity trigger value (Section 8.2.2).
- Exceedance of SSC (measured as NTU) trigger level within Pond E (South) during tailwater disposal from the MSB maintenance dredging (as per Section 8.3.2).

For any of these exceedances, the Contractor will provide Darwin Port with a report on the corrective actions implemented to address the cause of the exceedance and an assessment of attributability of the exceedance. These reports will be submitted in accordance with the timeframe stipulated in **Table 8-1** and **Table 8-5**.

9.3 Environmental incident notification and reporting

In the event of the following environmental incidents, the Contractor will notify Darwin Port within 24 hours of the incident occurring:

- vessel interaction with protected marine species, including details of injury to, or mortality of, individuals (Section 8.4)
- suspected disturbance of protected marine species related to noise generated by dredging activities (Section 8.5).

Other environmental incidents (spills, etc.) will also be recorded and reported in environment monitoring reports to Darwin Port. If the incident is a notifiable incident under the *Waste Management and Pollution Control Act*, then Darwin Port will notify the NT EPA within 24 hours.

All incidents will be investigated and recorded on a Contractor 'Incident Report Form', 'Environmental Incident Details Form' or similar in accordance with Contractor's accident investigation and reporting procedures. Preventative and corrective actions will be established and these will be recorded on the

Contractor's 'Non-conformance and Corrective Action Register', and the progress tracked for completion.

9.4 Complaints reporting

In the event of a complaint received as a result of dredging or spoil disposal activities, they will be entered and tracked using the Contractor's incident management system. Details to be recorded include:

- date, time and method of complaints
- description of complaint
- complainant details
- cause, action and proposed action, including allocation of a person to action the complaint and an action date
- follow-up and close-out.

Corrective action in response to valid complaints is to occur within 48 hours following receipt of the complaint. Records will be made available to the Darwin Port and authorities upon request, taking into account any privacy issues of the complainant as appropriate.

9.5 Reporting and notification summary

The reporting and notification requirements for the Project are summarised in **Table 9-1**.

Table 9-1: Reporting and notification summary

Reporting Type	Time	Reporting to	Content/Comments
Routine Reporting			
Daily reporting (Section 9.1.1)	Dredging contractor to report daily during dredging and tailwater discharge activities.	Darwin Port	Brief work summary including the items identified in Section 9.1.1.
Weekly monitoring report (Section 9.1.2)	Weekly during dredging and tailwater discharge activities.	Darwin Port	Weekly summary report of monitoring data including the items identified in Section 9.1.2.
Dredge operations reporting (Section 9.1.3)	Dredging contractor to record daily, report weekly.	Darwin Port	Records of areas dredged, the volumes of material removed and dredge availability. Daily environmental inspection checklists and other relevant environmental records as outlined in Section 9.1.3.

Reporting Type	Time	Reporting to	Content/Comments
End of dredging phase reporting (Section 9.1.4)	Dredging contractor to report within one month of conclusion of dredging.	Darwin Port	Outcomes of all monitoring activities, exceedances, management actions and any relevant interpretation of analytical data collected in accordance with environmental conditions.
Compliance reporting (Section 9.1.5)	Darwin Port to report as specified in the relevant Waste Discharge Licences.	NT EPA	Any reports, data and information will be submitted in accordance with any timeframes required under the licenses. During dredging, the licensee will notify NT EPA of any non-compliance with the Waste Discharge Licences, as required by those licences
Exceedance notification and reporting			
Water quality exceedance (Section 9.2)	Contractor to report any exceedance within 24 hours of occurrence.	Darwin Port	Location and value of exceedance.
Water quality corrective actions report (Section 9.2)	Contractor to report within two business days of exceedance.	Darwin Port	Corrective actions implemented to address the cause of the exceedance.
Water Quality attributability notification (Section 9.2)	Contractor to notify within three business days of exceedance.		Outcome of contractor's investigation into attributability of the exceedance to dredging including any data analysis undertaken.
Environmental incident notifications and reporting			
Injury to, mortality of, or disturbance of, a protected species (Section 9.3)	Contractor to report within 24 hours.	Darwin Port	Time, location and photos.

Reporting Type	Time	Reporting to	Content/Comments
Other environmental incidents (Section 9.3)	Contractor to report within 24 hours.	Darwin Port	Report generated from Contractor incident management system
Complaints reporting			
Complaints (Section 9.4)	Contractor to report within 48 hours following receipt of the complaint.	Darwin Port	Date, time and method of complaints, description of complaint, complainant details, cause, action and proposed action, including allocation of a person to action the complaint and an action date.

10 REFERENCES

- AECOM 2018, Darwin Port Long Term Dredging Management Plan. Prepared for Darwin Port Operations, Dated: 22-Jan-2018, Doc No. R1855\M&C4101
- AIMS 2016, Sediment Transport Marine Supply Base, East Arm Darwin Harbour, Report Prepared for Darwin Port, August 2016.
- AIMS 2017, Sediment Plume Modelling for Darwin Port, Report Prepared for Darwin Port, July 2017.
- AIMS 2018, Survey of accumulated sediment in the berth pockets of East Arm Wharf, Fort Hill Wharf, Marine Supply Base, MSB swing basin and channel – July 2018, Report Prepared for Darwin Port, 2018.
- ANZG 2018, Australian and New Zealand Guidelines for Fresh and Marine Water Quality. 2018.
- BoM 2017, Climate averages for Darwin. Bureau of Meteorology website, viewed 27 September 2017 at http://www.bom.gov.au/climate/averages/tables/cw_014015.shtml.
- Brooks, L and Pollock, K 2014, Abundance, movements and habitat use of coastal dolphins in the Darwin region: Analysis of the first six primary samples (October 2011 to March 2014). Final report to the Northern Territory Government Department of Land Resource Management.
- Cardno 2014, Turtle and Dugong Monitoring End of Dredging Report Ichthys Nearshore Environmental Monitoring Program. Prepared for INPEX September 2014.
- Cassilles-Southgate N 2016, *Interim Darwin Harbour Turbidity Water Quality Objectives for Neap Tide Conditions*. Report Number 14/2016D. Aquatic Health Unit, Water Resources Division. Department of Land Resource Management. NT.
- CEDA 2011, *Environmental Control on Dredging Projects*. Central Dredging Association Information Paper, June 2011.
- CEDA 2015, *Integrating Adaptive Environmental Management into Dredging Projects*. Central Dredging Association Position Paper, March 2015.
- Commonwealth of Australia 2009, *National Assessment Guidelines for Dredging*. Commonwealth of Australia, Canberra.
- Darwin Harbour Advisory Committee 2007, Status on the implementation of the Darwin Harbour Regional Plan of Management 2005–2006.
- Darwin Port 2016, *Cyclone Procedure 2016-2017*. Standard Operating Procedure SOP_OPS/40.
- Darwin Port Corporation, undated, *Port of Darwin History*. Darwin Port Corporation Fact Sheet 7.
- DENR 2016, *Darwin Harbour Region Report Card 2016*. Department of Environment and Natural Resources.
- DLP 2011. *Draft Environmental Impact Statement: East Arm Wharf Expansion Project*. Northern Territory Department of Lands and Planning, Darwin, Northern Territory.
- DLRM 2014. *Darwin Harbour Water Quality Protection Plan*, Northern Territory Department of Land Resource Management, Darwin, NT, Australia.
- DoI 2014, Annual Monitoring Report for the Darwin Marine Supply Base Dredging and Dredge Spoil Placement Activities 2013 Reporting Period. Prepared by Department of Infrastructure,

Northern Territory Government on behalf of Department of Lands, Planning and Environment, March 2014.

- Drewry, J, Fortune, J, Majid, M, Schult, J, Lamche, G, Townsend, S and Cusack, S 2011, *Darwin Harbour Region Report Cards 2011*. Aquatic Health Unit, Department of Natural Resources, Environment, The Arts and Sport. Report No 17/2011D. Palmerston, NT, Australia.
- Duckworth, A, Giofre, N and Jones, R 2017, Coral morphology and sedimentation. *Marine Pollution Bulletin*, 125(1-2): 289-300.
- Duggan, S 2006, *The water quality of Darwin Harbour: December 2002 - December 2004*. AIMS Report No. 37, Australian Institute of Marine Science.
- EIANZ 2015, Ecological Impact Assessment (Ecia) - EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. Environment Institute of Australia and New Zealand Inc., March 2015.
- Fortune, J 2006, *The grain size and heavy metal content of sediment in Darwin Harbour*. Environmental Protection Agency, Department of Natural Resources, Environmental and the Arts. Report No. 14/2006D.
- Fortune, J 2010, *Water Quality Objectives for the Darwin Harbour Region – Background Document*. Aquatic Health Unit, Department of Natural Resources, Environment, The Arts and Sport.
- Fortune, J 2016. *Darwin Harbour Region 2016 Report Card Water Quality Supplement*. Report No. 22/2016D. Aquatic Health Unit, Department of Environment and Natural Resources. Palmerston, NT.
- Geo Oceans 2011, Ichthys Gas Field Development Project: Benthic Habitat Mapping of the Darwin region – Methods of Data Collection, Collation, and Map Production. Technical Appendix S6 to INPEX (2011).
- Geo Oceans 2012a, NT Department of Lands and Planning – East Arm Wharf Expansion Project. Marine Habitat Mapping Survey. Report to URS Australia Pty Ltd, Document code DLPEAWMAP.406, August 2012.
- Geo Oceans 2012b, NT Department of Lands and Planning – East Arm Wharf Expansion Project. Baseline Marine Habitat Monitoring Survey. Report to URS Australia Pty Ltd, Document code DLPEAWMON.401, October 2012.
- Hall 2018, Maintenance Dredging Works Project - Darwin Port Operations - Final Report, dated 18/12/18.
- Hall 2019, Environmental Report: Turbidity Monitoring - Maintenance Dredging Works Project. Report no: WDL210-02, Fort Hill Wharf, East Arm Wharf Berth Pockets and Marine Supply Base Berth Pocket, November 2018 – December 2019
- Hatch 2024, Sedimentation Assessment and Intervention Options Study, Ref H372944-0000-225-066-0001, Rev0, prepared for Darwin Port Operations Pty Ltd
- Hill, JV and Edmeades, BFJ 2008, *Acid Sulfate Soils of the Darwin Region*. Technical Report No.09/2008D. Land and Water Division, Department of Natural Resources, Environment the Arts and Sport, NT, November 2008.
- IADC 2016, Facts about: Adaptive Management. International Association of Dredging Companies. INPEX 2010, Ichthys Gas Field Development Project: Draft Environmental Impact Statement.
- INPEX 2011, Ichthys Gas Field Development Project: Supplement to the Draft Environmental Impact Statement.

- INPEX 2013, *Dredging and Spoil Disposal Management Plan – East Arm*. Document No C075-AH- PLN-0028, Rev. 4, 16 December 2013.
- Jensen, FH, Bejder L, Wahlberg, M, Aguiar Soto, N, Johnson, M and Madsen, PT 2009, Vessel noise effects on delphinid communication. *Marine Ecology Progress Series*, 395: 161-175.
- Li, L, Wang, XH, Andutta, F and Williams, D 2014, Effects of mangroves and tidal flats on suspended- sediment dynamics: Observational and numerical study of Darwin Harbour, Australia. *Journal of Geophysical Research: Oceans*, 119: 5854–5873.
- Macmahon 2013, *Dredging and Dredge Spoil Placement Management Plan (DDSPMP) End of Phase 1 Environmental Monitoring Report – Revision 0*.
- McKinnon, AD, Smit, N, Townsend, S and Duggan, S 2006, *Darwin Harbour: water quality and ecosystem structure in a tropical harbour in the early stages of development*. In: ‘The Environment in Asia Pacific Harbours’ (Ed: Wolanski, E). Springer, Dordrecht, the Netherlands.
- Mills, D and Kemps, H 2016, *Generation and release of sediments by hydraulic dredging: a review*. Report of Theme 2 - Project 2.1 prepared for the Dredging Science Node, Western Australian Marine Science Institution, Perth, Western Australia.
- Moein Bartol, S and Musick, JA 2003, *Sensory biology of sea turtles*. In: Lutz PL, Musick JA and Wyneken J (eds) *The Biology of Sea Turtles*, Vol 2. CRC Press, Boca Raton, FL, pp 79–102.
- Munksgaard, NC 2013, *Recommendations for sampling and analysis of Darwin Harbour sediment*. Environmental Chemistry and Microbiology Unit (ECMU), Research Institute for the Environment and Livelihoods, Charles Darwin University, November 2013.
- Natural Resource Management Ministerial Council 2005, *Australian National Guidelines for Whale and Dolphin Watching*.
- NRETAS 2010, *Water Quality Objectives for the Darwin Harbour Region at a Glance*. Northern Territory Government, Darwin Harbour Advisory Committee.
- NT Emergency Service 2011, *Darwin Storm Surge*. NT Emergency Service brochure.
- NT EPA 2013. *Guidelines for the Environmental Assessment of Marine Dredging in the Northern Territory*. Northern Territory Environment Protection Authority. Version 2.0, November 2013.
- NT EPA 2015a, *Guideline for the Preparation of a Notice of Intent*. Northern Territory Environment Protection Authority. Version 1.0, November 2015.
- NT EPA 2015b, *Guideline for the Preparation of an Environmental Management Plan*. Northern Territory Environment Protection Authority. Version 1.0, May 2015.
- NT Environment Protection Authority (NT EPA), 2022. Referring a Proposal to the NT EPA: Environmental impact assessment, Guidance for proponents (version 2.0). Darwin, Northern Territory, Australia.
- Okoro, HK, Fatoki, OS, Adekola, FA, Ximba, BJ, Synam, RG and Opeolu, B 2011, Human exposure, biomarkers, and fate of organotins in the environment. In Whitacre D (ed.) *Reviews of Environmental Contamination and Toxicology*, 213, 27-54.
- Padovan, AV 2003, *Darwin Harbour water and sediment quality*. Marine and Estuarine Environments of Darwin Harbour. Proceedings of the Darwin Harbour Public Presentations, February 2003.
- PIANC 2006, *Environmental Risk Assessment of Dredging and Disposal Operations*. World Association for Waterborne Transport Infrastructure (PIANC) Environmental Commission report of WG 10, October 2006.

- PIANC 2008, *Dredging Management Practices for the Environment: a Structured Selection Approach*. World Association for Waterborne Transport Infrastructure (PIANC) Environmental Commission Report No 100, 2008.
- Pineda, MC, Strehlow, B, Sternel, M, Duckworth, A, den Haan, J, Jones, R and Webster, NS 2017, Effect of sediment smothering on the sponge holobiont with implications for dredging management. *Scientific Reports*. doi:10.1038/s41598-017-05243-x.
- PWC 2006, Wastewater Treatment, Reuse and Discharge Report 2006. Power and Water Corporation.
- Siwabessy, PJW, Tran, M, Huang, Z, Nichol, S and Atkinson, I 2015, *Mapping and Classification of Darwin Harbour Seabed*. Record 2015/18. Geoscience Australia, Canberra.
- Skinner, L, Townsend, SA, and Fortune, J 2009, *The impact of urban land-use on total pollutant loads entering Darwin Harbour*. Department of Natural Resources Environment the Arts and Sport, Darwin.
- Smit, N, Penny, SS and Griffiths, AD 2012, *Assessment of marine biodiversity and habitat mapping in the Weddell region, Darwin Harbour*. Report to the Department of Lands, Planning and Environment. Department of Land Resource Management, Palmerston.
- Streten, C, Tsang, JJ and Harries, S 2017, *Sediment Sampling and Analysis Plan*. Report prepared for Darwin Port. Australian Institute of Marine Science, Darwin.
- URS 2004, *Darwin City Waterfront Redevelopment Project: Draft Environmental Impact Assessment*. Prepared for Department of Infrastructure, Planning and Environment, May 2004.
- URS 2009, *Ichthys Gas Field Development Project: Nearshore Marine Water Quality and Sediment Study*. Report prepared for INPEX Browse, Ltd, R1382, August 2009. Appendix 9 to INPEX (2010).
- URS 2011, *Ichthys Gas Field Development Project: summary of the long-term water-quality and program for Darwin Harbour*. Report prepared for INPEX Browse, Ltd, R1589, March 2011. Technical appendix S9 to INPEX (2011).
- WA EPA 2016, *Technical Guidance: Environmental Impact Assessment of Marine Dredging Proposals*. Western Australian Environmental Protection Authority, December 2016.
- Water Monitoring Branch 2005, *The Health of the Aquatic Environment in the Darwin Harbour Region, 2004*. Report 5/2005D. Natural Resource Management Division. Department of Natural Resources, Environment and the Arts. Darwin.
- Whiting, SD 2003. *Marine mammals and marine reptiles of Darwin Harbour*. In: Darwin Harbour Region: current knowledge and future needs. Proceedings of public presentations hosted by the Darwin Harbour Advisory Committee at the Northern Territory University, Darwin, on 11, 19 and 26 February 2003. Department of Infrastructure, Planning and Environment, Darwin, Northern Territory.
- Whiting, SD 2008, Movements and distribution of dugongs (*Dugong dugon*) in a macro tidal environment in northern Australia. *Australian Journal of Zoology* 56: 215–222.
- Williams, D, Wolanski, E and Spagnol, S 2006, *Hydrodynamics of Darwin Harbour*. In 'The environment in Asia Pacific Harbours' (Ed: E. Wolanski) pp 461-476. Springer, Dordrecht, the Netherlands.
- Williams, D 2016, *Sediment Transport, Marine Supply Base, East Arm, Darwin Harbour*. Report prepared for Darwin Port. Australian Institute of Marine Science, ATRF Darwin, October 2016.

- Williams, D 2017, *Sediment Plume Modelling for Darwin Port*. Report prepared for Darwin Port by Australian Institute of Marine Science, September 2017.
- Wolstenholme, J, Dinesen, ZD and Alderslade, P 1997, *Hard Corals of the Darwin region, Northern Territory, Australia*. In Hanley, JR, Caswell, G, Megirian, D and Larson HK (eds) *Proceedings of the Sixth International Marine Biological Workshop* ("The marine flora and fauna of Darwin Harbour, Northern Territory, Australia"). Museums and Art Galleries of the Northern Territory and the Australian Marine Sciences Association, Darwin, Northern Territory.

APPENDIX A – SCREENING TOOL FOR BED LEVELLING WORKS

Part 2 – Answer checklist for Sweep Bar / Plough Works

How to complete the answer checklist: Use questions 1-5 from Part 1 of the screening tool. Indicate answer to questions 1-5 in corresponding checkbox.

The table below gives an indication of possible *environmental values* and sensitivities for each environmental factor that should be addressed when considering each question. If the answer to a question is 'yes' or 'uncertain', it is possible that the proposal may have the potential to have a significant impact on the environment and the proposal should be referred to the NT EPA. If you answer 'no' to any question, provide a justification why there is no likely impact to that factor.

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Proponent's answer to screening questions 1-5				
				Q2	Q3	Q4	Q5
	Is the industry type or activity proposed inherently hazardous with the potential to give rise to multiple or major impact sources and environmental stressors with the potential to impact on the environment? If so, does the nature of the industry preclude impact sources and stressors being substantively reduced?		No ☒ Yes ☐				
LAND	1) Landforms <u>Objective:</u> Conserve the variety and integrity of distinctive physical landforms.	- distinctive features in the landscape, either geological or anthropogenic - subterranean karstic terrain and faults - craters, gorges, ranges, caves, massifs, escarpments, plateaus - monuments - tourism related to landforms	Yes No Uncertain Not Applicable	☐ X ☐ ☐	☐ X ☐ ☐	☐ X ☐ ☐	☐ X ☐ ☐
	If you answered No to any screening questions for Landforms, provide justification here: The sweep bar / plough works do not involve any land-based works						
	2) Terrestrial environmental quality <u>Objective:</u> Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	- high quality soils, including chemical, physical, biological and aesthetic qualities that support life - the biological processes that depend on soil quality	Yes No Uncertain Not Applicable	☐ X ☐ ☐	☐ X ☐ ☐	☐ X ☐ ☐	☐ X ☐ ☐

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Proponent's answer to screening questions 1-5				
				Q2	Q3	Q4	Q5
	If you answered No to any screening questions for Terrestrial environmental quality, provide justification here: The sweep bar / plough works do not involve any land based works						
	3) Terrestrial ecosystems <u>Objective:</u> Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	'sensitive or significant' vegetation or buffers (as defined in the NT Land Clearing Guidelines) - listed threatened species and their habitat (NT and Commonwealth) - listed migratory species and their habitat (Commonwealth) - listed threatened ecological communities (Commonwealth) - locally endemic or restricted species and their habitat - species that are data deficient with unknown protection status - protected area or reserve, including Indigenous Protected Area - biosecurity - high quality biological and functional diversity, integrity and services	Yes	☐	☐	☐	☐
		No	☒	☒	☒	☒	
			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Terrestrial ecosystems, provide justification here: The sweep bar / plough works do not involve any land based works						
WATER	1) Hydrological processes <u>Objective:</u> Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	- the supply and quantity of water in surface water features including rivers, lakes, wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines - the supply and quantity of water in groundwater features including aquifers, aquitards, water tables and the ecosystems they support (stygo fauna, vegetation and groundwater dependent ecosystems) - declared beneficial uses - present and future uses, and users of water - current or potential water supplies, including regional scale aquifers - culturally important water features or other features affected by water level	Yes	☐	☐	☐	☐
		No	☒	☒	☒	☒	
		Uncertain	☐	☐	☐	☐	
		Not Applicable	☐	☐	☐	☐	
	If you answered No to any screening questions for Hydrological processes, provide justification here: The sweep bar / plough works do not interact with groundwater or surface water						
	2) Inland water environmental quality	the quality of water in surface water features including rivers, lakes, wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines	Yes	☐	☐	☐	☐
			No	☒	☒	☒	☒

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Proponent's answer to screening questions 1-5				
				Q2	Q3	Q4	Q5
	Objective: Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	- the quality of water in groundwater features including aquifers and water tables - declared beneficial uses - present and future uses and users of water - current or potential water supplies, including regional scale aquifers - potability / drinkability - culturally important water features	Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Inland water environmental quality, provide justification here: The sweep bar / plough works interact with inland waters						
	3) Aquatic ecosystems	- threatened species - the health of the biota in inland waterways - the habitats that support the lifecycle of aquatic biota - groundwater dependent ecosystems - Ramsar wetlands - high quality biological and functional diversity, integrity and services	Yes	☐	☐	☐	☐
	Objective: Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.		No	X	X	X	X
			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
If you answered No to any screening questions for Aquatic ecosystems, provide justification here: The sweep bar / plough works will not create plume of high intensity and extent. The material will be redistributed in the immediate area and not impact sensitive receivers. The sediment sampling and analysis confirmed that the material is not contaminated.							
SEA	1) Coastal processes	- processes that support marine ecosystems such as coral reefs and mangroves - processes that support coastal morphology such as beaches, rock bars, and sandbars - tidal creeks, deltas and river mouths - storm surge protection - unique coastal landforms	Yes	☐	☐	☐	☐
	Objective: Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained.		No	X	X	X	X
			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
If you answered No to any screening questions for Coastal processes, provide justification here: The sweep bar / plough works do not impact on coastal processes. The material will be redistributed in the immediate area and not impact coastal processes. No cumulative impacts are anticipated, the material deposited on the seabed is part of natural processes and any movement of this material aids in its natural migration pathways along the coastline.							
	2) Marine environmental quality	- quality of the water, sediment and biota - physical parameters that support fishing and aquaculture	Yes	☐	☐	☐	☐

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Proponent's answer to screening questions 1-5				
				Q2	Q3	Q4	Q5
	Objective: Protect the quality and productivity of water, sediment and biota so that environmental values are maintained.	- physical parameters that support recreation and aesthetics - industrial water supply - cultural and spiritual values	No	X	X	X	X
			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Marine environmental quality, provide justification here: The material will be redistributed in the immediate area and not impact sensitive receivers. The sediment is not contaminated and will not impact the local marine environment. Any Plumes generated by the						
	3) Marine ecosystems <u>Objective:</u> Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	- conservation significant marine and coastal fauna and critical habitat such as nesting, breeding or foraging habitat - conservation significant marine and coastal benthos (seagrass meadows, sponge gardens, coral reefs, mangrove communities and salt marshes) - groups of species (species richness and assemblages of species) - ecological functions and processes - high quality biological and functional diversity, integrity and services	Yes	☐	☐	☐	☐
AIR			No	X	X	X	X
			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Marine ecosystems, provide justification here: The material will be redistributed in the immediate area and not impact sensitive. Receivers. Sweep bar works will not be of long duration (i.e. days or weeks, no greater than 2 weeks for each campaign)						
	1) Air quality <u>Objective:</u> Protect air quality and minimise emissions and their impact so that environmental values are maintained.	- ambient air quality in the local airshed - the chemical, physical and biological characteristics of quality air - the biological processes that depend on the air quality	Yes	☐	☐	☐	☐
			No	X	X	X	X
			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Air quality, provide justification here: The Sweep bar works will be undertaken by a commercial vessel in good working order, that meets industry standard for emissions. Any works will not be of a long duration, limiting any emissions. No impacts expected.						
	2) Atmospheric processes <u>Objective:</u> Minimise greenhouse gas emissions so as to contribute to the	- a contribution to the NT's greenhouse gas emissions through nearing or reaching emission thresholds for: - industrial projects of 100 000 tCO₂-e scope 1 emissions per year not counting emissions generated from land clearing	Yes	☐	☐	☐	☐
			No	X	X	X	X

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Proponent's answer to screening questions 1-5				
				Q2	Q3	Q4	Q5
PEOPLE	NT Government's goal of achieving net zero greenhouse gas emissions by 2050.	land use projects of 500 000 tCO₂-e scope 1 emissions from single or cumulative land clearing actions	Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Atmospheric processes, provide justification here: Any works will not be of a long duration, limiting any emissions. No impacts expected.						
	1) Community and economy <u>Objective:</u> Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.	- communities, towns and suburbs where people live - community aspirations for liveable environment and healthy lifestyles, - affordable access to food, water, electricity, transport and communication networks. - good amenity – air quality, noise, aesthetics - access to social infrastructure and services including transport and logistics - access to natural resources including bush food - recreational use of the natural or built environment (e.g. fishing, cycling, sports, picnics) - species of social, cultural, livelihood and or economic importance (terrestrial, aquatic and marine biota) - participation in jobs, businesses and education - existing industries such as agriculture, pastoralism, tourism, fisheries - vulnerable sectors of the community	Yes	☐	☐	☐	☐
			No	X	X	X	X
PEOPLE			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐
	If you answered No to any screening questions for Community and economy, provide justification here: The sweep bar operations provide a rapid and useful method for maximizing vessel access to Darwin Ports. Improved vessel access leads to better economic outcomes for the port and local community.						
	2) Culture and heritage <u>Objective:</u> Protect culture and heritage.	- Aboriginal cultural values - sacred sites - the Territory's natural and built heritage - declared heritage places and objects protected under the Heritage Act 2011 (NT) such as: - any Aboriginal or Macassan archaeological place or object (coastal mounds and middens, rock art, stone arrangements, quarries, artefacts, graves, burial sites and ancestral remains)	Yes	☐	☐	☐	☐
			No	X	X	X	X
PEOPLE			Uncertain	☐	☐	☐	☐
			Not Applicable	☐	☐	☐	☐

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Proponent's answer to screening questions 1-5				
				Q2	Q3	Q4	Q5
		- o underwater cultural heritage (isolated objects, shipwrecks, plane wrecks, underwater cables and evidence of Aboriginal occupation prior to sea level rise) - o built heritage (colonial buildings and other historic buildings) - o defence structures (defensive positions and airfields) - o natural features (meteorite impact sites, palaeontological sites, springs, trees) - o world heritage • underwater cultural heritage protected under the Underwater Cultural Heritage Act 2018 (Cth) • Aboriginal rights and interests, including right of access					
	If you answered No to any screening questions for Culture and heritage, provide justification here: All works will occur within the existing channels and berths, no impacts on cultural heritage will occur.						
	3) Human health <u>Objective:</u> Protect the health of the Northern Territory population.	• drinking water • air quality • bush tucker • radiological limits • biting insects	Yes No Uncertain Not Applicable	☐ X ☐ ☐	☐ X ☐ ☐	☐ X ☐ ☐	☐ X ☐ ☐
	If you answered No to any screening questions for Human health, provide justification here: The action of levelling off high spots in the Port of Darwin channels and berths will not impact on human health in any way.						

Where the screening has been undertaken by a suitably qualified and experienced person and all responses in the checklist are 'no', a referral to the NT EPA is not likely required. The NT EPA and DEPWS does not require the completed checklist to be submitted in this case. However, the checklist and its justifications for no likely impact should be retained by the proponent to demonstrate the screening has been conducted. The proponent should also retain the scope of the proposal that was considered in conducting the screening, the name, qualifications and contact details of the suitably qualified and experienced person(s) who conducted the screening using the table below.

The NT EPA retains to power to "call-in" a proposal under section 53 of the EP Act.

Recommended record keeping: Where a proponent intends to retain this checklist to demonstrate it has given consideration to whether a referral is required, it is recommended that the following details are recorded.

	Details
Proponent name	Landbridge Darwin Port
Propose action name	Sweep Bar / Plough
Description of proposed action	Levelling out high spots in the existing/approved channel and berth areas

Pre-referral screening has been conducted by: names, qualifications and date of works by suitably qualified and experienced persons⁷ engaged by the proponent.

Environmental factor	Name	Qualification / Experience	Signature	Date
All	Dr Daniel Spooner	PhD Marine & Costal Processes (Env Chem.)		13/12/24

Proponent's declaration that the pre-referral screening has been conducted.

Screening declaration by proponent:

I, Dr Daniel Spooner, declare that I am authorised to verify the pre-referral screening of this proposed action/strategic proposal on behalf Of Landbridge Darwin Port name of legal entity organisation...Landbridge Darwin Port, and further declare that:

- the attached environmental impact assessment documents (including attachments) are true; and
- the attached environmental impact assessment documents do not provide false or misleading information and I know it is an offence to provide false and misleading information, noting the penalties under section 260 of the EP Act, and section 119 of the *Criminal Code Act 1983*.

⁷ Section 4 of the EP Act provides the meaning of a qualified person. Experience may be provided in years and/or a description of relevant experience.

APPENDIX B – DREDGING VOLUME DRAWINGS

Earthwork Volume Report
Unclassified surface compared to Unclassified surface
Surfaces
Existing Surface Classification: Unclassified
-10 LAT Bench Classification: Unclassified

Bank Volumes Based on Surface Geometry Alone
Cut material 2,764.83 m3
Fill material 40,771.14 m3
Deficit 38,006.31 m3

Bank Areas Based on Surface Geometry Alone
Cut area 4,538.8m2
Fill area 14,514.4m2
Zero volume area 0.0m2
Total 19,053.2m2

Depth summary
Maximum depth of cut material 1.861m
Maximum depth of fill material 6.063m

Note: 'Cut Material' is defined as material where [-10 LAT Bench] is lower than [Existing Surface].
'Fill Material' is defined as the volume of material where [-10 LAT Bench] is higher than [Existing Surface].

Note: The above volumes are calculated solely from the geometries of the selected surfaces.
No material properties are applied to the above numbers.

Earthwork Volume Report
Unclassified surface compared to Unclassified surface
Surfaces
Existing Surface Classification: Unclassified
-300mm Over Dredge Classification: Unclassified

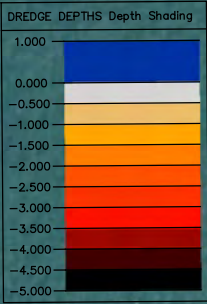
Bank Volumes Based on Surface Geometry Alone
Cut material 4,237.30 m3
Fill material 36,473.25 m3
Deficit 32,235.95 m3

Bank Areas Based on Surface Geometry Alone
Cut area 5,222.7m2
Fill area 14,153.0m2
Zero volume area 0.0m2
Total 19,377.7m2

Depth summary
Maximum depth of cut material 2.161m
Maximum depth of fill material 5.763m

Note: 'Cut Material' is defined as material where [-300mm Over Dredge] is lower than [Existing Surface].
'Fill Material' is defined as the volume of material where [-300mm Over Dredge] is higher than [Existing Surface].

Note: The above volumes are calculated solely from the geometries of the selected surfaces.
No material properties are applied to the above numbers.



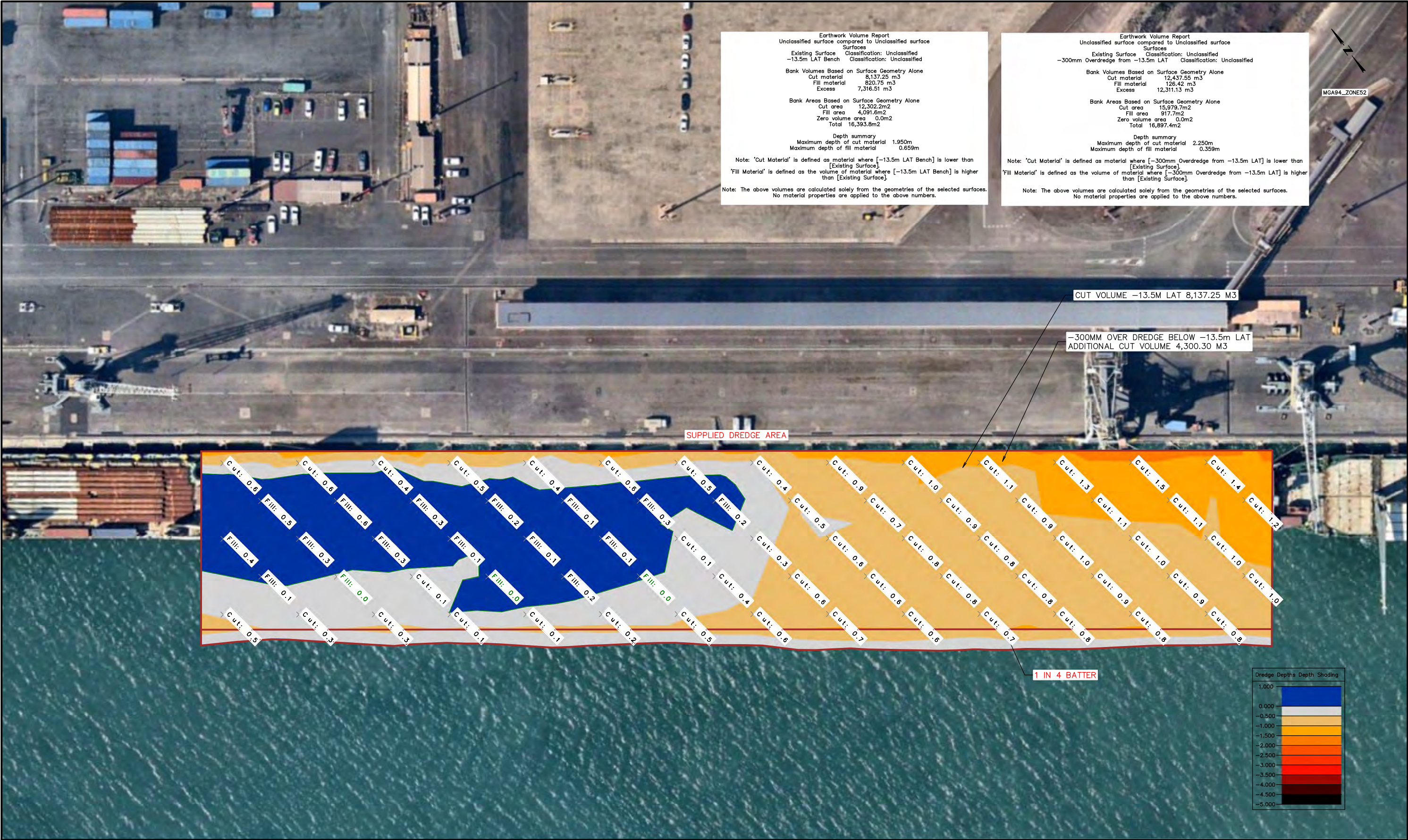
			 R.E & L.M. GERTZEL PTY. LTD ABN 28 005 396 985 ABN 28 005 396 985 7 FIR STREET DINGLEY VILLAGE, VICTORIA info@gertzel.com.au www.gertzel.com.au	Survey – Gertzel		DARWIN PORT BERTH POCKETS FORT HILL WHARF DREDGING VOLUMES		
				Original Size – A3				
1	21/01/2025	For Information Only		Drawn – DG				
Ref. No.	Date	Notes		Scale – 1:1500				
Document History				Form S114	Revision 4	26/06/2017	File: C:\Gertzel1 Dropbox\David Gladman\Data\AMA\8193 Darwin Port Volumes\819304 Volume reports\81930401 Fort Hill Wharf.vce	Sheet No: 1

Earthwork Volume Report
Unclassified surface compared to Unclassified surface
Surfaces
Existing Surface Classification: Unclassified
-12.0m LAT Bench Classification: Unclassified
Bank Volumes Based on Surface Geometry Alone
Cut material 283.42 m3
Fill material 5,719.11 m3
Deficit 5,435.69 m3
Bank Areas Based on Surface Geometry Alone
Cut area 1,004.8m2
Fill area 6,843.7m2
Zero volume area 0.0m2
Total 7,848.5m2
Depth summary
Maximum depth of cut material 1.229m
Maximum depth of fill material 1.676m
Note: 'Cut Material' is defined as material where [-12.0m LAT Bench] is lower than [Existing Surface].
'Fill Material' is defined as the volume of material where [-12.0m LAT Bench] is higher than [Existing Surface].
Note: The above volumes are calculated solely from the geometries of the selected surfaces.
No material properties are applied to the above numbers.

Earthwork Volume Report
Unclassified surface compared to Unclassified surface
Surfaces
Existing Surface Classification: Unclassified
-300mm Over Dredge Classification: Unclassified
Bank Volumes Based on Surface Geometry Alone
Cut material 865.17 m3
Fill material 3,946.30 m3
Deficit 3,081.13 m3
Bank Areas Based on Surface Geometry Alone
Cut area 2,843.7m2
Fill area 5,004.8m2
Zero volume area 0.0m2
Total 7,848.5m2
Depth summary
Maximum depth of cut material 1.529m
Maximum depth of fill material 1.376m
Note: 'Cut Material' is defined as material where [-300mm Over Dredge] is lower than [Existing Surface].
'Fill Material' is defined as the volume of material where [-300mm Over Dredge] is higher than [Existing Surface].
Note: The above volumes are calculated solely from the geometries of the selected surfaces.
No material properties are applied to the above numbers.



			Gertzel ENGINEERING SURVEYORS R.E & L.M. GERTZEL PTY. LTD ABN 28 005 396 985 7 FIR STREET DINGLEY VILLAGE, VICTORIA info@gertzel.com.au ABN 28 005 396 985 www.gertzel.com.au	Survey – Gertzel	AMA MARITIME CONSULTING	DARWIN PORT BERTH POCKETS EAST ARM WHARF BERTH 1 DREDGING VOLUMES	
				Original Size – A3			
1	21/01/2025	For Information Only		Drawn – DG			
Ref. No.	Date	Notes		Scale – 1:1000			
Document History				Form S114	Revision 4	26/06/2017	File: C:\Gertzel1 Dropbox\David Gladman\Data\AMA\8193 Darwin Port Volumes\819304 Volume reports\81930402 East Arm Wharf Berth 1



			 R.E & L.M. GERTZEL PTY. LTD ABN 28 005 396 985 7 FIR STREET DINGLEY VILLAGE, VICTORIA info@gertzel.com.au www.gertzel.com.au	Survey – Gertzel		DARWIN PORT BERTH POCKETS EAST ARM WHARF BERTH 2 DREDGING VOLUMES		
				Original Size – A3				
1	21/01/2025	For Information Only		Drawn – DG				
Ref. No.	Date	Notes		Scale – 1:1000				
Document History				Form S114	Revision 4	26/06/2017	File: C:\Gertzel1 Dropbox\David Gladman\Data\AMA\8193 Darwin Port Volumes\819304 Volume reports\81930403 East Arm Wharf Berth 2.vce	Sheet No: 2

Earthwork Volume Report
Unclassified surface compared to Unclassified surface
Surfaces
Existing Surface Classification: Unclassified
-12.0m LAT Bench Classification: Unclassified

Bank Volumes Based on Surface Geometry Alone
Cut material 413.31 m3
Fill material 14,689.34m3
Deficit 14,276.03 m3

Bank Areas Based on Surface Geometry Alone
Cut area 3,243.5m2
Fill area 14,046.7m2
Zero volume area 0.0m2
Total 17,290.1m2

Depth summary
Maximum depth of cut material 0.598m
Maximum depth of fill material 2.329m

Note: 'Cut Material' is defined as material where [-12.0m LAT Bench] is lower than [Existing Surface].
'Fill Material' is defined as the volume of material where [-12.0m LAT Bench] is higher than [Existing Surface].

Note: The above volumes are calculated solely from the geometries of the selected surfaces.
No material properties are applied to the above numbers.

Earthwork Volume Report
Unclassified surface compared to Unclassified surface
Surfaces
Existing Surface Classification: Unclassified
-300mm Over dredge Classification: Unclassified

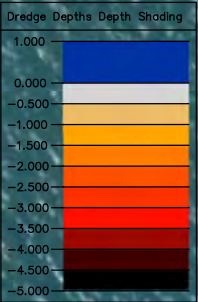
Bank Volumes Based on Surface Geometry Alone
Cut material 2,121.14 m3
Fill material 11,156.57 m3
Deficit 9,035.44 m3

Bank Areas Based on Surface Geometry Alone
Cut area 7,170.6m2
Fill area 10,237.0m2
Zero volume area 0.0m2
Total 17,407.6m2

Depth summary
Maximum depth of cut material 0.893m
Maximum depth of fill material 2.029m

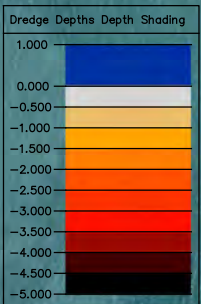
Note: 'Cut Material' is defined as material where [-300mm Over dredge] is lower than [Existing Surface].
'Fill Material' is defined as the volume of material where [-300mm Over dredge] is higher than [Existing Surface].

Note: The above volumes are calculated solely from the geometries of the selected surfaces.
No material properties are applied to the above numbers.



			 R.E & L.M. GERTZEL PTY. LTD ABN 28 005 396 985 ABN 28 005 396 985 7 FIR STREET DINGLEY VILLAGE, VICTORIA info@gertzel.com.au www.gertzel.com.au	Survey – Gertzel		DARWIN PORT BERTH POCKETS EAST ARM WHARF BULK LIQUIDS DREDGE VOLUMES		
				Original Size – A3				
				Drawn – DG				
				Scale – 1:1000				
1	21/01/2025	For Information Only		Form S114	Revision 4	26/06/2017	File: C:\Gertzel\Dropbox\David Gladman\Data\AMA\8193 Darwin Port Volumes\819304 Volume reports\81930404 East Arm Wharf Bulk Liquids.vce	Sheet No: 1
Ref. No.	Date	Notes						
Document History								

Earthwork Volume Report	
Unclassified surface compared to Unclassified surface	
Existing Surface	Surfaces
—300mm Over Dredge	Classification: Unclassified Classification: Unclassified
Bank Volumes Based on Surface Geometry Alone	
Cut material	11,536.77 m ³
Fill material	83,475.40 m ³
Deficit	71,938.62 m ³
Bank Areas Based on Surface Geometry Alone	
Cut area	41,634.1m ²
Fill area	99,906.5m ²
Zero volume area	0.0m ²
Total	141,540.6m ²
Depth summary	
Maximum depth of cut material	2.631m
Maximum depth of fill material	3.937m



			 Gertzel ENGINEERING SURVEYORS	Survey – Gertzel		DARWIN PORT BERTH POCKETS MARINE SUPPLY BASE TOTAL DREDGING VOLUME
				Original Size – A3		
1	21/01/2025	For Information Only		Drawn – DG		
Ref. No.	Date	Notes		Scale – 1:4000		
Document History			R.E & L.M. GERTZEL PTY. LTD ABN 28 005 396 985 ABN 28 005 396 985 7 FIR STREET DINGLEY VILLAGE, VICTORIA info@gertzel.com.au www.gertzel.com.au	Form S114 Revision 4 26/06/2017	File: C:\Gertzel1 Dropbox\David Gladman\Data\AMA\8193 Darwin Port Volumes\819304 Volume reports\81930405 Marine Supply Base Total	Sheet No: 1

Earthwork Volume Report
Unclassified surface compared to Unclassified surface
Surfaces
Existing Surface Classification: Unclassified
-7.7 LAT Bench Classification: Unclassified

Bank Volumes Based on Surface Geometry Alone
Cut material 847.58 m3
Fill material 305.70 m3
Excess 541.88 m3

Bank Areas Based on Surface Geometry Alone
Cut area 3,097.3m2
Fill area 1,258.2m2
Zero volume area 0.0m2
Total 4,355.5m2

Depth summary
Maximum depth of cut material 5.110m
Maximum depth of fill material 0.284m

Note: 'Cut Material' is defined as material where [-7.7 LAT Bench] is lower than [Existing Surface].
'Fill Material' is defined as the volume of material where [-7.7 LAT Bench] is higher than [Existing Surface].

Note: The above volumes are calculated solely from the geometries of the selected surfaces.
No material properties are applied to the above numbers.

Earthwork Volume Report
Unclassified surface compared to Unclassified surface
Surfaces
Existing Surface Classification: Unclassified
-300mm Over Dredge Classification: Unclassified

Bank Volumes Based on Surface Geometry Alone
Cut material 1,937.76 m3
Fill material 71.23 m3
Excess 1,866.53 m3

Bank Areas Based on Surface Geometry Alone
Cut area 4,028.6m2
Fill area 452.6m2
Zero volume area 0.0m2
Total 4,481.2m2

Depth summary
Maximum depth of cut material 5.290m
Maximum depth of fill material 0.127m

Note: 'Cut Material' is defined as material where [-300mm Over Dredge] is lower than [Existing Surface].
'Fill Material' is defined as the volume of material where [-300mm Over Dredge] is higher than [Existing Surface].

Note: The above volumes are calculated solely from the geometries of the selected surfaces.
No material properties are applied to the above numbers.



			Gertzel ENGINEERING SURVEYORS R.E & L.M. GERTZEL PTY. LTD ABN 28 005 396 985 7 FIR STREET DINGLEY VILLAGE, VICTORIA info@gertzel.com.au www.gertzel.com.au	Survey – Gertzel	AMA MARITIME CONSULTING	DARWIN PORT BERTH POCKETS MARINE SUPPLY BASE BERTH 2 DREDGING VOLUMES		
				Original Size – A3				
1	23/01/2025	For Information Only		Drawn – DG				
Ref. No.	Date	Notes		Scale – 1:1000				
Document History				Form S114	Revision 4	26/06/2017	File: C:\Gertzel\ Dropbox\David Gladman\Data\AMA\8193 Darwin Port Volumes\819304 Volume reports\81930407 Marine Supply Base B2.vce	Sheet No: 1

Earthwork Volume Report
Unclassified surface compared to Unclassified surface
Surfaces
Existing Surface Classification: Unclassified
-7.7m LAT Bench Classification: Unclassified
Bank Volumes Based on Surface Geometry Alone
Cut material 1,309.14 m3
Fill material 6,558.73 m3
Excess 5,249.59 m3
Bank Areas Based on Surface Geometry Alone
Cut area 8,694.2m2
Fill area 22,892.0m2
Zero volume area 0.0m2
Total 31,586.3m2
Depth summary
Maximum depth of cut material 0.964m
Maximum depth of fill material 1.105m
Note: 'Cut Material' is defined as material where [-7.7m LAT Bench] is lower than [Existing Surface].
'Fill Material' is defined as the volume of material where [-7.7m LAT Bench] is higher than [Existing Surface].
Note: The above volumes are calculated solely from the geometries of the selected surfaces.
No material properties are applied to the above numbers.

Earthwork Volume Report
Unclassified surface compared to Unclassified surface
Surfaces
Existing Surface Classification: Unclassified
-300mm Over Dredge Classification: Unclassified
Bank Volumes Based on Surface Geometry Alone
Cut material 6,068.32 m3
Fill material 1,842.04 m3
Excess 4,226.28 m3
Bank Areas Based on Surface Geometry Alone
Cut area 21,564.5m2
Fill area 9,921.8m2
Zero volume area 0.0m2
Total 31,586.3m2
Depth summary
Maximum depth of cut material 1.264m
Maximum depth of fill material 0.805m
Note: 'Cut Material' is defined as material where [-300mm Over Dredge] is lower than [Existing Surface].
'Fill Material' is defined as the volume of material where [-300mm Over Dredge] is higher than [Existing Surface].
Note: The above volumes are calculated solely from the geometries of the selected surfaces.
No material properties are applied to the above numbers.



			Gertzel ENGINEERING SURVEYORS R.E & L.M. GERTZEL PTY. LTD ABN 28 005 396 985 7 FIR STREET DINGLEY VILLAGE, VICTORIA info@gertzel.com.au ABN 28 005 396 985 www.gertzel.com.au	Survey – Gertzel	AMA MARITIME CONSULTING	DARWIN PORT BERTH POCKETS MARINE SUPPLY BASE SWING BASIN DREDGING VOLUMES		
				Original Size – A3				
1	23/01/2025	For Information Only		Drawn – DG				
Ref. No.	Date	Notes		Scale – 1:1500				
Document History				Form S114	Revision 4	26/06/2017	File: C:\Gertzel1 Dropbox\David Gladman\Data\AMA\8193 Darwin Port Volumes\819304 Volume reports\81930408 MSB Swing Basin.vce	Sheet No: 1

Earthwork Volume Report
Unclassified surface compared to Unclassified surface
Surfaces
Existing Surface Classification: Unclassified
-7.7m LAT Bench Classification: Unclassified

Bank Volumes Based on Surface Geometry Alone
Cut material 961.11 m3
Fill material 44,631.84 m3
Deficit 43,670.73 m3

Bank Areas Based on Surface Geometry Alone
Cut area 1,361.5m2
Fill area 19,517.9m2
Zero volume area 0.0m2
Total 20,879.5m2

Depth summary
Maximum depth of cut material 2.288m
Maximum depth of fill material 4.233m

Note: 'Cut Material' is defined as material where [-7.7m LAT Bench] is lower than [Existing Surface].
'Fill Material' is defined as the volume of material where [-7.7m LAT Bench] is higher than [Existing Surface].

Note: The above volumes are calculated solely from the geometries of the selected surfaces.
No material properties are applied to the above numbers.

Earthwork Volume Report
Unclassified surface compared to Unclassified surface
Surfaces
Existing Surface Classification: Unclassified
-300mm Over Dredge Classification: Unclassified

Bank Volumes Based on Surface Geometry Alone
Cut material 1,429.85 m3
Fill material 38,733.95 m3
Deficit 37,304.10 m3

Bank Areas Based on Surface Geometry Alone
Cut area 1,800.3m2
Fill area 19,070.8m2
Zero volume area 0.0m2
Total 20,871.1m2

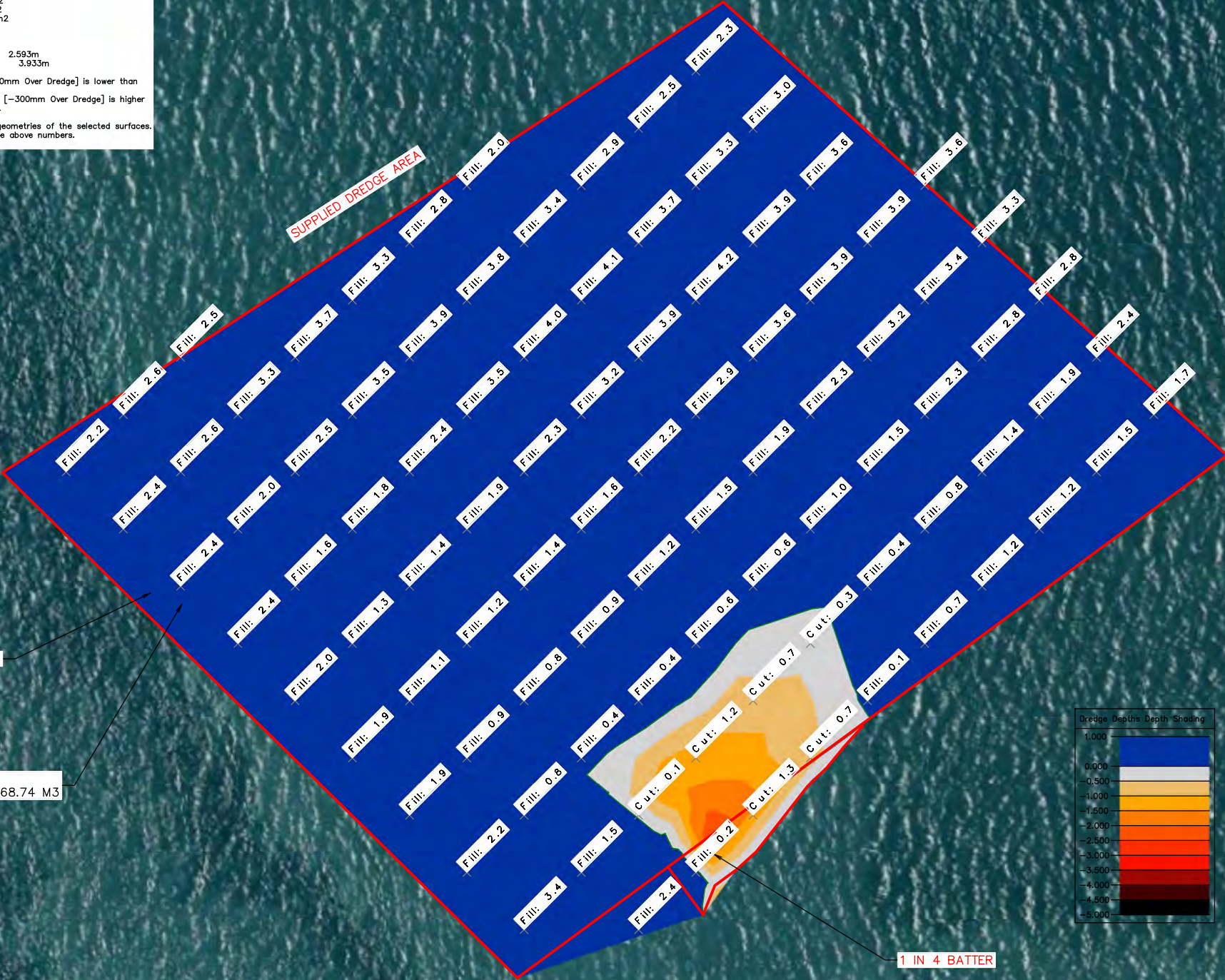
Depth summary
Maximum depth of cut material 2.593m
Maximum depth of fill material 3.933m

Note: 'Cut Material' is defined as material where [-300mm Over Dredge] is lower than [Existing Surface].
'Fill Material' is defined as the volume of material where [-300mm Over Dredge] is higher than [Existing Surface].

Note: The above volumes are calculated solely from the geometries of the selected surfaces.
No material properties are applied to the above numbers.

CUT VOLUME 961.11 M3

-300MM OVER DREDGE
ADDITIONAL CUT VOLUME 468.74 M3



			 R.E & L.M. GERTZEL PTY. LTD ABN 28 005 396 985 7 FIR STREET DINGLEY VILLAGE, VICTORIA info@gertzel.com.au www.gertzel.com.au	Survey – Gertzel			DARWIN PORT BERTH POCKETS MARINE SUPPLY BASE SANDBAR DREDGING VOLUMES	
				Original Size – A3				
1	21/01/2025	For Information Only		Drawn – DG				
Ref. No.	Date	Notes		Scale – 1:1000				
Document History				Form S114	Revision 4	26/06/2017	File: C:\Gertzel1 Dropbox\David Gladman\Data\AMA\8193 Darwin Port Volumes\819304 Volume reports\81930409 MSB Sandbar.vce	Sheet No: 1

APPENDIX C – 2025 SAP IMPLIMENTATION REPORT



SAP IMPLEMENTATION REPORT

Darwin Port Maintenance Dredging



Prepared for: Landbridge Darwin Port
Date: 17th April 2025

Dr Daniel Spooner & Dr Adam Cohen
Managing Directors & Principal Marine Scientists
Australasian Marine Associates Pty Ltd
42 Barkly Street, St Kilda, Victoria 3182.
Mobile 0404 834 164 or 0413 033 500
ABN: 47 602 913 762 ACN: 602 913 762

Cover Photo: East Am Wharf, Darwin, March 2025 (Image by AMA).

©Australasian Marine Associates. All rights reserved.

Australasian Marine Associates (AMA) has prepared this document for Darwin Port. The sole purpose of this document is to provide a SAP Implementation Report for characterising sediments in the four port locations to inform maintenance dredging. No other party should rely or access this information without prior written consent of Darwin Port. This document has been prepared based on confidential information provided from the client and its description of what is required. AMA may have also relied on other information provided by third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Document Control:

Document Version	Author/ Reviewer	Date	Comment	Approved (AMA Director)
Rev 0	HH/DS	17/04/2025	Final	HH

Contents

Executive Summary	1
1.0 Introduction	1
1.1 Fort Hill Wharf (FHW)	1
1.2 East Arm Wharf (EAW)	2
1.3 Marine Supply Base (MSB)	2
1.4 Maintenance Dredging Requirements	2
1.5 Sediment Sampling and Analysis Plan (SAP) Objectives	4
2.0 Sampling and Analysis Plan	6
2.1 Sampling Locations	6
2.2 Field Sampling	6
2.3 Sample Collection	11
2.4 Laboratory Analysis	11
2.5 Quality Control – Field Sampling	12
2.6 Sampling and Analytical Quality Control	13
2.7 Analysis and Interpretation	13
3.0 Results and Discussion	14
3.1 Physical Attributes	14
3.1.1 Total Organic Carbon	16
3.2 Phase II Testing - Contaminants	16
3.2.1 MSB	16
3.2.2 MEC	17
3.2.3 EAW	17
3.2.4 FHW	17
3.2.4 Elevated Arsenic Concentrations at MEC	18
3.3 Potential Acid Sulfate Soils (PASS)	18
4.0 Data Validation	21
4.1 Field Duplicates and Triplicates	21
5.0 Conclusions	22
6.0 References	23
APPENDIX A – SAMPLE LOCATIONS	24
APPENDIX B - FIELD LOGS	25
APPENDIX B – ANALYTICAL DATA	35
APPENDIX C – LABORATORY CERTIFICATES	40

Executive Summary

Darwin Port has a need to periodically undertake maintenance bed levelling and dredging to remove unconsolidated sediment (e.g. clay, silt, sand) that is naturally transported and deposited into existing berth pockets at East Arm Wharf and Fort Hill Wharf and into the berth pockets, turning basin and channel of the MSB. This bed levelling and dredging is required to maintain the required depths, to provide safe access at all tides for vessels using port facilities and maintain effective operational parameters at the facilities.

The Darwin Port Maintenance Dredging SAP was prepared consistent with the requirements of the National Assessment Guidelines for Dredging and involved targeted sampling at the following port locations:

- Marine Supply Base (MSB)
- East Arm Wharf (EAW)
- Fort Hill Wharf (FHW)
- MSB Entrance Channel (MEC)

Sediment sampling was conducted in March 2025 using a combination of surface grabs and diver coring. Sediments generally consisted of fine unconsolidated silts with small proportions of sand. Sediments from MEC were geologically distinct from the other locations and were primarily sand with a small proportion of shell.

Contaminant concentrations in sediments were consistently low for all analytes tested, with nearly all results returning 95% UCLs that were well below their respective screening levels. The exception was at MEC, where elevated levels of arsenic were recorded in all samples tested. The elevated levels were found to be related to naturally occurring arsenic that is present in particular geological strata. Elevated arsenic concentrations have been documented in previous sediment investigations of Darwin Harbour and have been determined to be of a localised geological origin.

No organotins were recorded above the limits of detection. TPH was recorded in all samples but at very low concentrations, whilst PAHs were less than their respective limits of reporting in most of the samples tested. Sediments were also confirmed as having low risk PASS properties.

Considering the results of the sediment sampling and analysis program, the sediments from the port locations tested would be considered suitable for open water disposal including bed levelling and sweeping related activities.

1.0 Introduction

Darwin Port Operations Pty Ltd (Darwin Port) operates port facilities within Darwin Harbour, Northern Territory (NT); these include Fort Hill Wharf, East Arm Wharf (EAW) and the Marine Supply Base (MSB). These areas are illustrated in **Figure 1** and a brief introduction to these facilities is presented further below.



Figure 1: Darwin Port Facilities (source: Hatch, 2024)

1.1 Fort Hill Wharf (FHW)

FHW is Darwin Port's cruise ship and defence vessel facility. The precinct includes a purpose-built cruise ship terminal, which is capable of handling complete passenger changeovers for smaller cruise vessels, whilst providing a transit lounge for more infrequent larger international cruise ships. Frequent naval ship visits to Darwin are catered for at the wharf, with secure and efficient port facilities and services provided. Berthage for tugs and pilot boats used within Darwin Harbour is also provided.

The wharf was originally constructed during World War II, though bioerosion by *Teredo* worms led to the collapse of some two thirds of the structure. It was partially reconstructed with steel pipes and another two wharves (the Navy Boom Wharf and the Navy Repair Wharf) were added in 1941, the latter to facilitate repairs to Navy vessels.

Over the years, the land abutting the wharf has been used for pre-export stockpiling of iron ore and zinc concentrate and a Navy refuelling facility has also operated across the wharf. The current Fort Hill Wharf was commissioned in 1981 (Darwin Port Corporation, undated). The old structure was removed, and some of the seabed in the vicinity of the wharf was dredged, as a part of the Darwin City Waterfront Redevelopment in 2006.

The most recent previous maintenance dredging at FHW was undertaken in 2018/19 where 7,150m³ of sediment was sidecast 300m from the wharf (Hatch 2024).

1.2 East Arm Wharf (EAW)

EAW was opened in 2000 and provides facilities for berthing vessels up to 80,000 tonnes. EAW comprises a:

- Bulk liquids berth, which handles regular imports of fuel and is connected via pipeline to a fuel oil facility and a bio diesel refinery. Chemicals such as acids are also piped to adjoining areas.
- Common user facility, which is heavily utilised by offshore oil rig tenders. The number of tenders permanently working out of Darwin is increasing as the offshore industry surrounding Darwin expands.
- Container facility served by mobile harbour cranes. This is also used as a common user berth to discharge or load break bulk cargo. Live cattle exports have increased significantly over the past few years with ongoing demand expected.
- Bulk materials handling facility which can cater for Panamax size vessels and is currently used to export iron ore and manganese.

The East Arm Wharf precinct has been progressively developed since 1994; the most recent expansion being the construction of the MSB in 2012-2013, the Multi User Barge Ramp Facility in 2015-2016 and the Darwin Shiplift project, which is currently under construction. Spoil from the capital dredging campaigns undertaken to develop East Arm Wharf has been disposed of within decant ponds within the Darwin Port lease. The ponds have also received spoil from other developments (e.g. the Darwin City Waterfront Redevelopment) and pond management measures have been developed over the years that have proven to be effective in mitigating impacts upon the environment outside of the pond system.

The most recent previous maintenance dredging at EAW was undertaken in 2018/19 where 7,500m³ of sediment was disposed to the seafloor ~500m from the wharf (Hatch 2024).

1.3 Marine Supply Base (MSB)

The MSB was constructed over the period 2012 to 2016 and provides a common user facility, utilised primarily by offshore oil rig tenders. The number of tenders permanently working out of Darwin is increasing as the offshore industry surrounding Darwin expands.

The most recent previous maintenance dredging at MSB was undertaken in 2018/19 where 7,500m³ of sediment was sidecast 300m from the wharf (Hatch 2024).

1.4 Maintenance Dredging Requirements

Darwin Port has a need to periodically undertake maintenance bed levelling and dredging to remove unconsolidated sediment (e.g. clay, silt, sand) that is naturally transported and deposited into existing berth pockets at East Arm Wharf and Fort Hill Wharf and into the berth pockets, turning basin and channel of the MSB (**Figure 2**). This bed levelling and dredging is required to maintain the required depths, to provide safe access at all tides for vessels using port facilities and maintain effective operational parameters at the facilities.

The frequency of maintenance dredging and bed levelling is dependent upon the rates of sediment accumulation at the three locations. In turn, this will be dependent upon factors such as the nature of the seafloor materials adjacent to the port facilities and the degree of their disturbance (e.g. by tidal currents and meteorological events) following the previous dredging campaigns. It is estimated that the berth pockets at East Arm Wharf and Fort Hill Wharf will require maintenance dredging at intervals of no less than six years and that maintenance dredging at the MSB will be required no more frequently than every three years (Streten, Tsang & Harries 2017). Bed levelling will be used to maintain the declared depths between maintenance dredging events, where required.

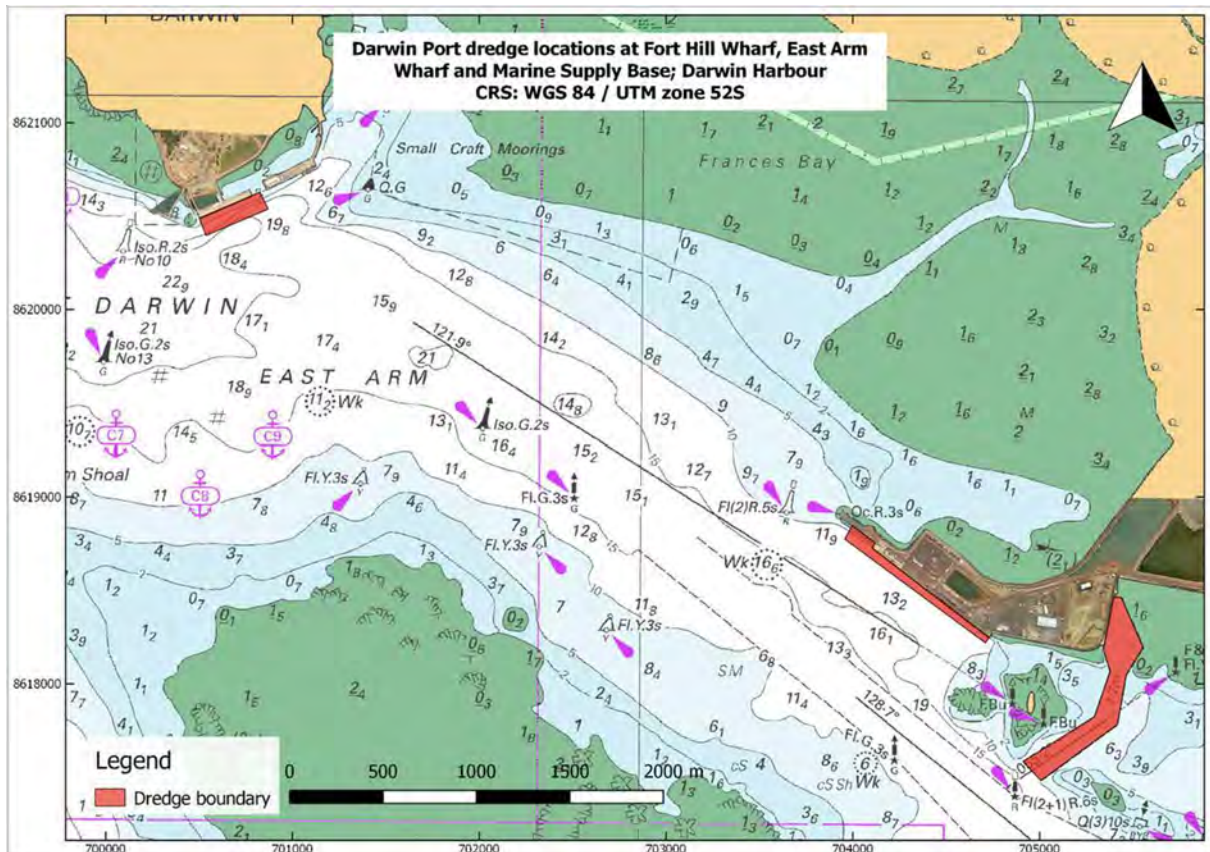


Figure 2: Maintenance dredging locations (Source: Streten, Tsang & Harries (2017))

The proposed maintenance dredging (and disposal) works required (as of the November 2024 bathymetric surveys) are described in greater detail in the Dredging and Dredge Material Management Plan (DMP, AMA (2025)).

The estimated total volume of material requiring removal by maintenance dredging is approximately **30,000 m³** (based on the November 2024 hydrographic survey results, including 300mm over dredge allowance), see **Table 1** overleaf.

These dredge locations and volumes were used to determine the Sediment Sampling and Analysis Plan (SAP) Objectives.

Table 1: Estimated Dredge / Bed Levelling Volumes and Surface Areas (November 2024)

Site	Description	Base Level (m LAT)	Design Dredge Volume (m ³)	Dredge Volume Inc. Overdredge (m ³)	Dredge Surface Area (m ²)
Marine Supply Base					
MSB Berth 1	Southern most berth on the MSB wharf	-8.7	578	1,655	4,037
MSB Berth 2 & 3	Two berths immediately to the north of berth 1	-7.7	848	1,938	4,029
MSB turning area	Area defined as the navigable area adjacent to both ends of the MSB wharf	-7.7	1,309	6,068	21,665
MSB entrance	Entrance to MSB channel near the East Arm sand bar	-7.7	961	1,430	1,800
East Arm Wharf					
East Arm Wharf Berth 1	Berth at the south-east end of the wharf key line	-12.0	283	865	2,844
East Arm Wharf Berth 2	In the centre area of East Arm Wharf	-13.5	8,137	12,438	15,980
East Arm Wharf bulk liquid berth	At the north-west end of East Arm Wharf	-12.0	413	2,117	7,171
Fort Hill Wharf					
Fort Hill Wharf	Area adjacent to the face of, and extending to the northeast of the wharf	-10.0	2,765	4,237	5,223
TOTALS			15,295	<u>30,748</u>	62,748

1.5 Sediment Sampling and Analysis Plan (SAP) Objectives

Consistent with the National Assessment Guidelines for Dredging (NAGD, 2009), (Commonwealth of Australia, 2009), AMA Maritime Consulting (AMA-MC) undertook a sediment characterisation study to inform the proposed bed levelling and dredging activities.

The objectives of the project were to:

- Implement a sediment sampling and analysis plan (SAP), which considers the sampling approach specified in the NAGD (2009);
- Test and analyse sediments for a range of contaminants of concern;

- Provide a comparison of contaminant concentrations against the NAGD (2009) Screening Levels; and
- Determine the suitability of sediments for unconfined sea disposal (or onshore disposal where sea disposal is not feasible or acceptable).

2.0 Sampling and Analysis Plan

This section provides details of the sampling and analysis protocols applied during the implementation of the SAP. All fieldwork was performed in accordance with the sampling and analysis plan (SAP) prepared for Darwin Port by AMA, dated 4th February 2025.

2.1 Sampling Locations

The Darwin Port Maintenance Dredging SAP was prepared consistent with the requirements of the NAGD (Commonwealth of Australia, 2009). Based on the respective dredge volumes, the following sampling program was implemented to meet the NADG (2009) requirements for sampling intensity:

- Marine Supply Base (MSB): sampling at 7 locations;
- East Arm Wharf (EAW): sampling at 7 locations;
- Fort Hill Wharf (FHW): sampling at 6 locations; and
- MSB Entrance Channel (MEC): sampling at 6 locations.

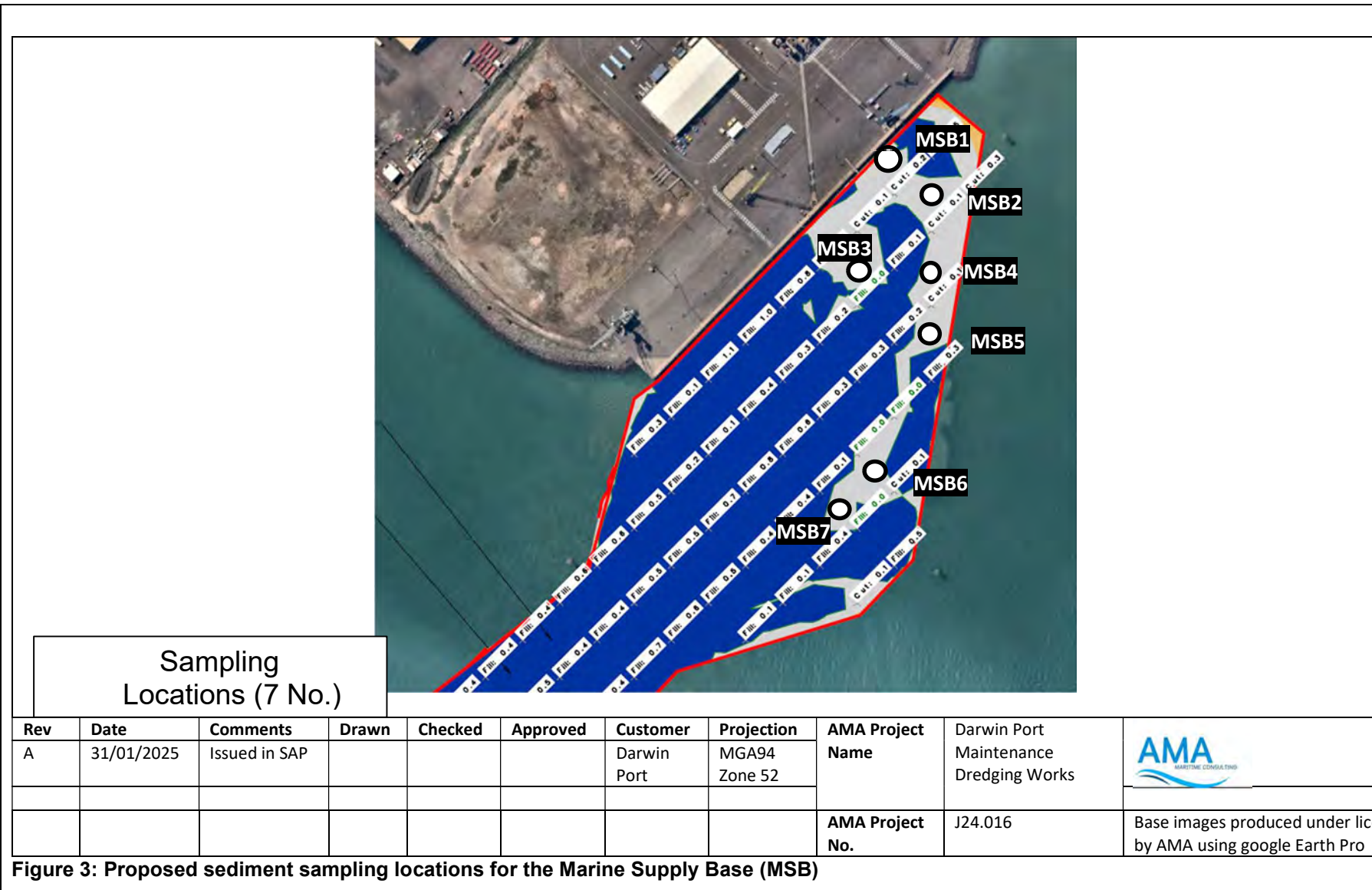
A complete list of sampling locations is shown in Figure 3, Figure 4, Figure 5 and Figure 6.

2.2 Field Sampling

Sampling was conducted on the 10th and 11th March 2025. Sediment samples were collected from the sampling locations shown in **Appendix A**. Samples were retrieved using either a grab for surface sampling or diver coring where samples were retrieved from a depth of one metre below the seabed (subject to refusal). Surface samples were retrieved using a Van Veen grab, whilst polycarbonate diver cores were used to retrieve samples at depth.

Once retrieved to the surface, sediment cores were carefully extruded into a glass vessel at the required intervals (i.e. 0-0.5 m and 0.5-1m).

Each core depth section was homogenised with sub samples collected and stored in clean pre-labelled sample containers, as provided by the laboratory. Samples collected beyond 0.5m were treated as separate samples for laboratory analysis.



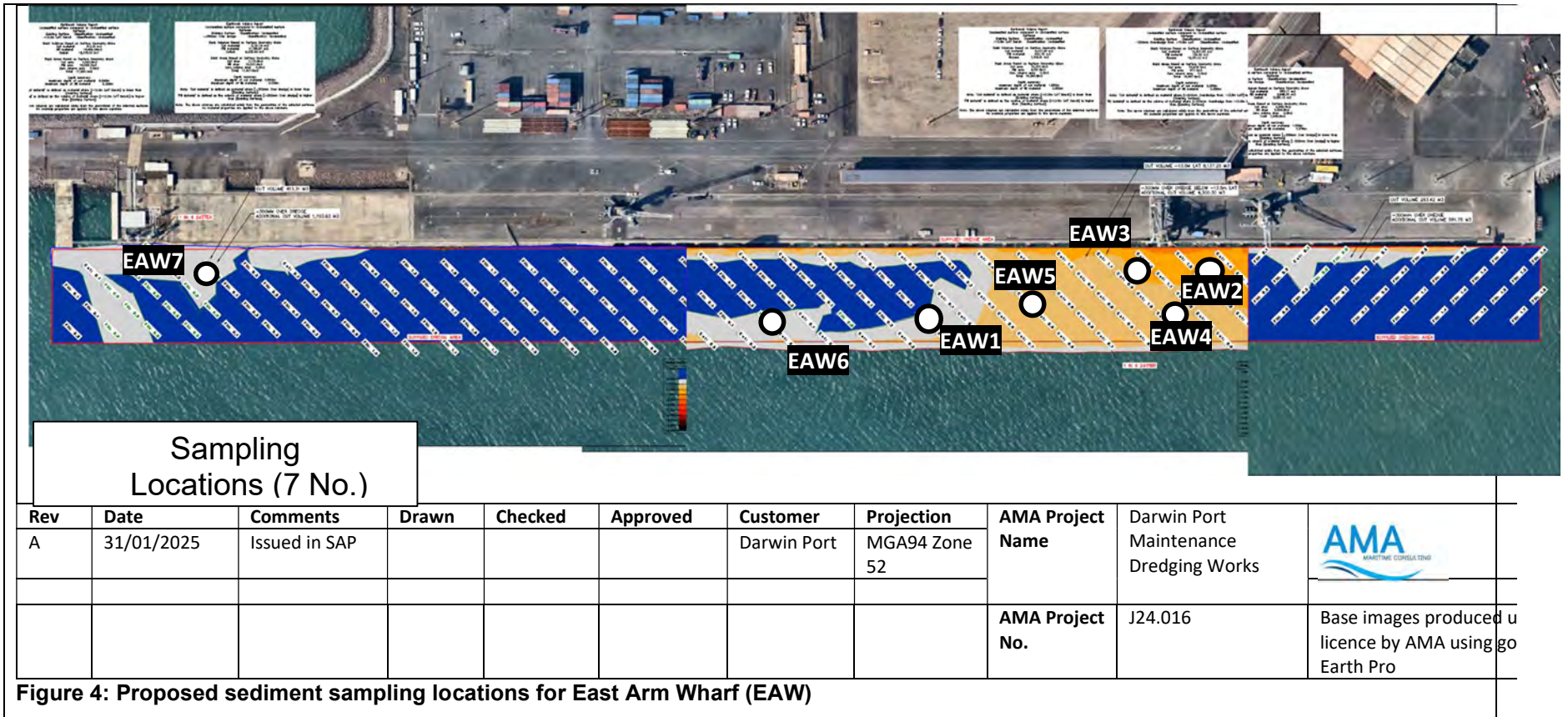


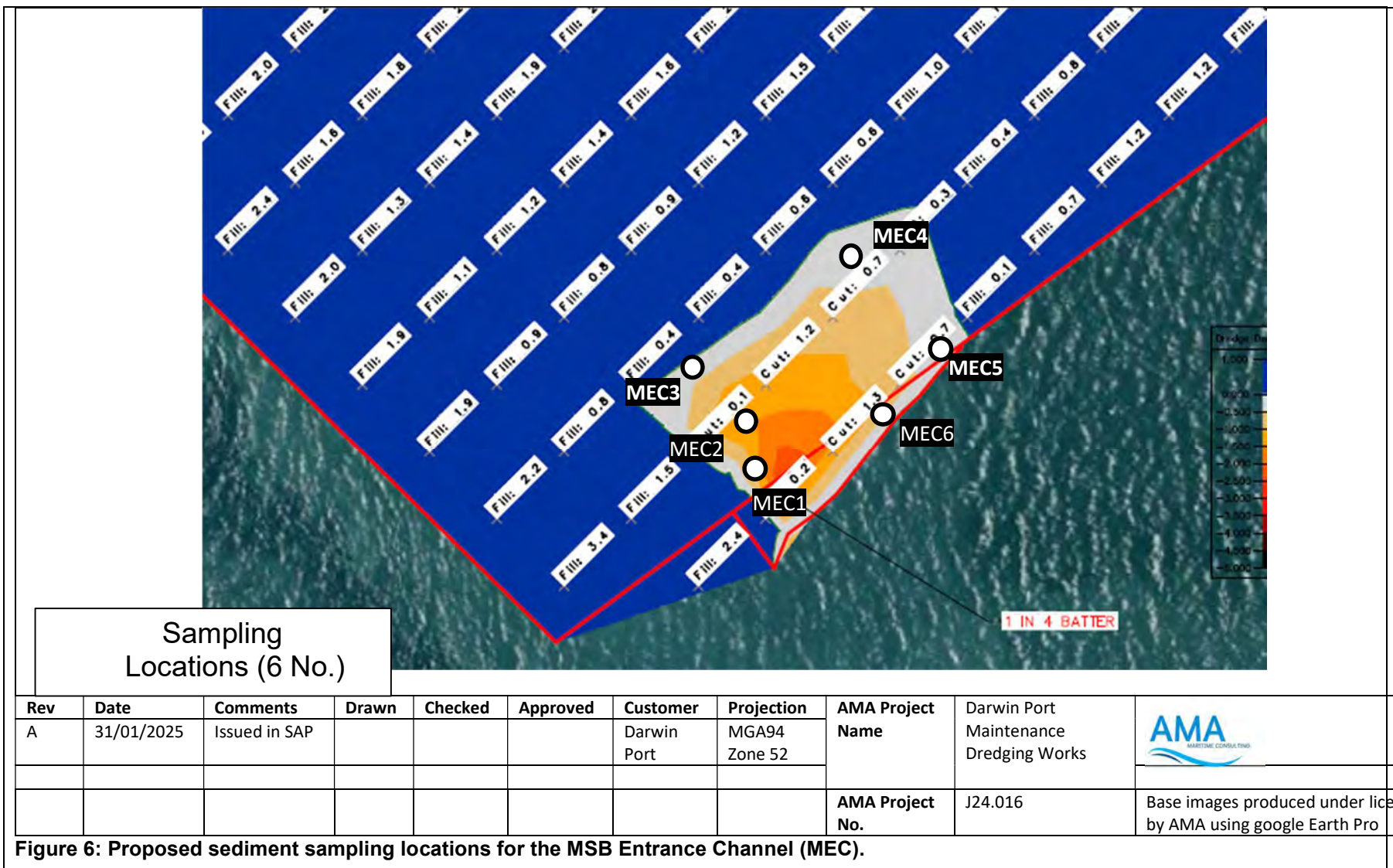
Figure 4: Proposed sediment sampling locations for East Arm Wharf (EAW)



Sampling
Locations (6 No.)

Rev	Date	Comments	Drawn	Checked	Approved	Customer	Projection	AMA Project Name	Darwin Port Maintenance Dredging Works	AMA
A	31/01/2025	Issued in SAP				Darwin Port	MGA94 Zone 52			
								AMA Project No.	J24.016	Base images produced under license by AMA using google Earth Pro

Figure 5: Proposed sediment sampling locations for Fort Hill Wharf (FHW)



2.3 Sample Collection

Triplicate and duplicate split samples were also collected and described further in the Quality Control section of the methods. **Table 2** provides details of the total number of samples including primary, duplicate splits and triplicate samples.

Table 2. Sediment Sampling and Analysis Program, Maintenance Dredging, Darwin Harbour

Sample Type	MSB1	MSB2	MSB3	MSB4	MSB5	MSB6	MSB7
0.0-0.5m	X	X	X	X	X	X	X
0.5-1.0m							
QA Sample			X				
Sample Type	EAW1	EAW2	EAW3	EAW4	EAW5	EAW6	EAW7
0.0-0.5m	X	X	X	X	X	X	X
0.5-1.0m		X	X	X	X		
QA Sample					X		X
Sample Type	FHW1	FHW2	FHW3	FHW4	FHW5	FHW6	
0.0-0.5m	X	X	X	X	X	X	
0.5-1.0m		X	X	X			
QA Sample			X				
Sample Type	MEC1	MEC2	MEC3	MEC4	MEC5	MEC6	
0.0-0.5m	X	X	X	X	X	X	
0.5-1.0m	X	X					
QA Sample							

At each location a field sheet was completed, which described the field conditions (i.e. weather, tides, currents), sample locations, field numbers, date, time and the identity of the sampler. A field sediment core log was also completed, which provided a field description of the sediment's characteristics, including the physical appearance and sediment properties, colour, odour, presence of foreign material, presence of shell fragments and/or biota and a digital image taken of each sample (see **Appendix B**).

Samples were collected using disposable nitrile gloves into laboratory supplied sample containers and kept chilled in the dark prior to transport to the NATA accredited analytical laboratory, under chain of custody procedures for a broad suite of analysis as described in the next section.

2.4 Laboratory Analysis

The sediment samples collected were analysed for a range of organic and inorganic analytes. The suite of analyses and additional tests required as stipulated in the proposal and SAP are presented in **Table 3**. ALS was engaged for undertaking the sediment sample analyses and is NATA accredited and experienced in the analysis of marine sediments. These methods considered the suite of analyses prescribed in NAGD (Commonwealth of Australia, 2009).

Table 3. Suite of Analyses for Sediments, All Sites.

ANALYTE	Limit of Reporting
METALS	mg/kg
Arsenic	1
Cadmium	0.1
Cobalt	0.1
Chromium	0.1
Copper	0.1
Lead	0.1
Mercury	0.01
Nickel	0.1
Zinc	0.5
Total Organic Carbon	0.02%
ORGANOTINS	ugSn/kg
Monobutyltin	1
Dibutyltin	1
Tributyl Tin (TBT)	0.5
ORGANICS	
Total petroleum hydrocarbons (TPH) (C10-C36)	3 – 5 mg/kg
Total recoverable hydrocarbons (TRH) (C10-C40) – NEPM (2013) fractions	3 – 5 mg/kg
Polynuclear Hydrocarbons (PAH)	4-5 µg/kg

2.5 Quality Control – Field Sampling

Quality control procedures adopted as part of the sediment sampling and analysis program included the following measures:

- Sample containers were provided by the laboratory and included glass containers for organics, plastic bags for PSD.
- Use of powder free nitrile gloves.
- Decontamination of equipment between samples.
- Population of a field log noting weather, tide, current, sampling methods, field sample numbers, date, time, and identity of sampler.
- Field descriptions of sediment collected, namely appearance, colour, constituents, biota, smell, texture.
- COC forms listing all samples collected and tests required were prepared for each batch and submitted to the laboratory.
- Samples were submitted to a NATA accredited laboratory, accredited for the analyses requested.
- Laboratory QA/QC Laboratory QA/QC procedures including laboratory blank, standard reference material analysis, matrix spike, surrogates, and replicate analysis were undertaken and reported.
- Sample holding times were within the prescribed limits as per Appendix 7 of the NAGD.

2.6 Sampling and Analytical Quality Control

Triplicate core samples and duplicate splits were collected at pre-determined sample location(s). **Table 4** provides details of the total number of samples, including primary, duplicate splits and triplicate samples for each area. A total of 35 primary samples and eight Quality Assurance / Quality Control (QA/QC) samples were collected from the dredge area during the execution of the sediment sampling and analysis program.

Table 4: Summary of Sediment Sampling and Analysis Program for Darwin Port

Sample Type	Darwin Port – All Locations
Primary Samples	35
Duplicate Splits Sample*	4
Field Triplicate Samples**	4

*A single core at two locations (that is, 5% of the total number of dredge sampling locations) will be homogenised, split into three containers, uniquely labelled and separately analysed in different lab batch.

** Triplicate core samples will be taken at two pre-determined locations (10% of the total number of sample locations). The triplicate core sample site will include a total of three cores (one primary, as well as a duplicate and triplicate core), all treated as separate samples.

2.7 Analysis and Interpretation

Sediment results were compared to Screening Levels and Sediment Quality High Values in NAGD (CoA, 2009). In the first instance, sediments were compared by sample depth to determine whether surface material has similar contaminant concentrations to those sampled from deeper layers. The upper 95th percentile confidence limit of the mean (95th percentile UCL) was then calculated using ProUCL Version 5 and used to determine compliance with the Screening Levels. Ninety fifth percentiles were only calculated for analytes that were present above the limits of reporting (or PQL). Where values were less than the PQL, the values were noted as half the PQL for the purpose of calculating the 95th percentile.

In the absence of an NT specific framework, an assessment of ASS risks was undertaken using action criteria detailed in the Queensland Acid Sulfate Soil Technical Manual (Dear et al, 2014).

3.0 Results and Discussion

This section presents the results obtained for the sediment quality assessment. Field logs completed during fieldwork are presented in **Appendix B**. Analytical summary data tables (**Appendix C**) and laboratory certificates, including quality control (**Appendix D**), are included in this report for future reference. Results of chemical and physical analysis are presented here, together with a quality assurance/ quality control section, which examines data quality and aids in the verification of the analytical data.

3.1 Physical Attributes

The physical composition of the sediment was consistent within locations but did vary between locations. The proportion of fines (<75 microns) was highest at MSB and were generally greater than 80%. The proportion of fines in EAW and FHW sediments was also high with an increasing proportion of sand was noted at FHW. Sediments from MEC had only a very minor component of fines and was dominated by sand and to a lesser extent shell.

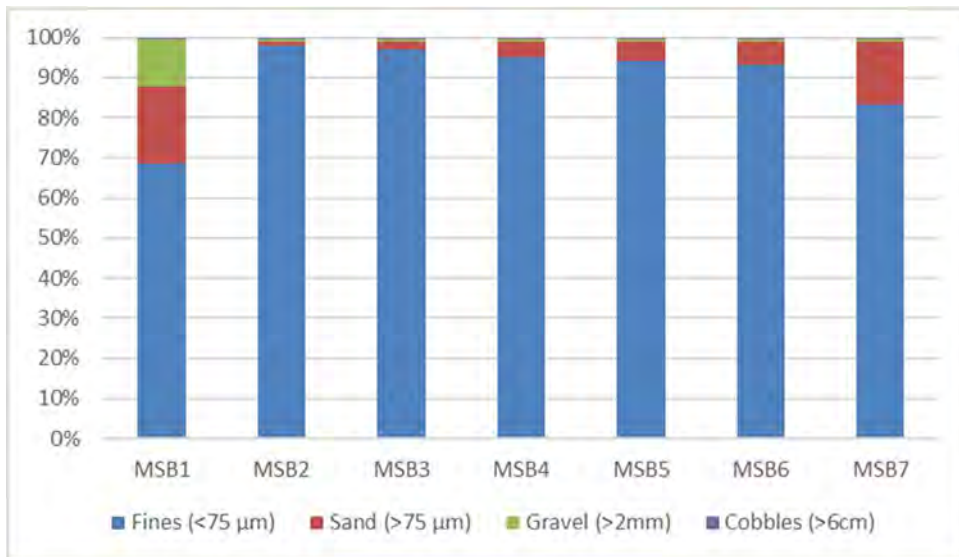


Figure 3 Particle size distribution from MSB Sediments

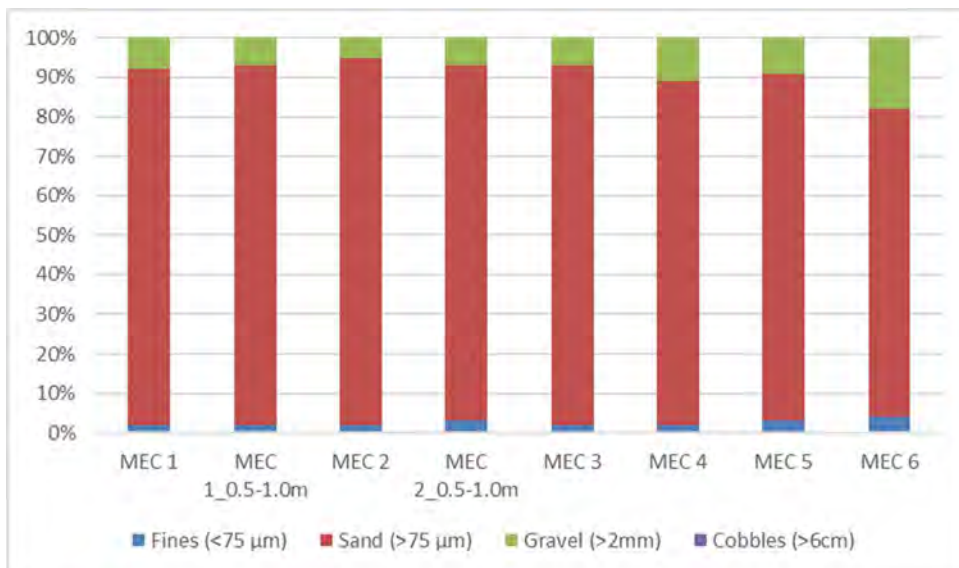


Figure 4 Particle size distribution from MEC Sediments

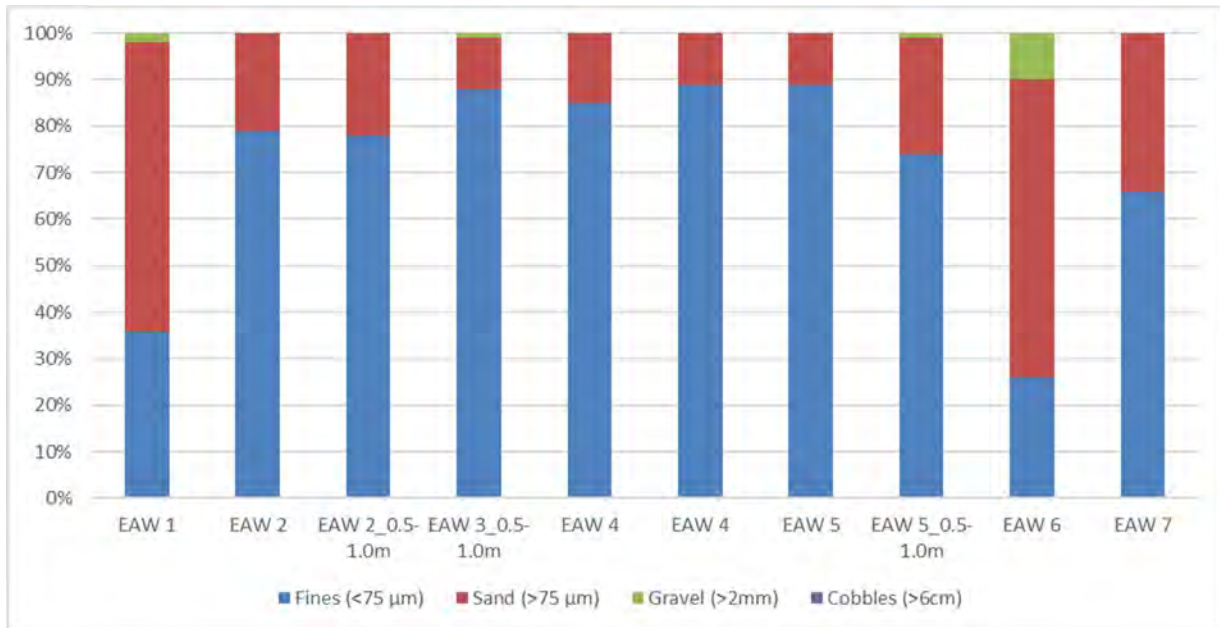


Figure 7 Particle size distribution from EAW Sediments

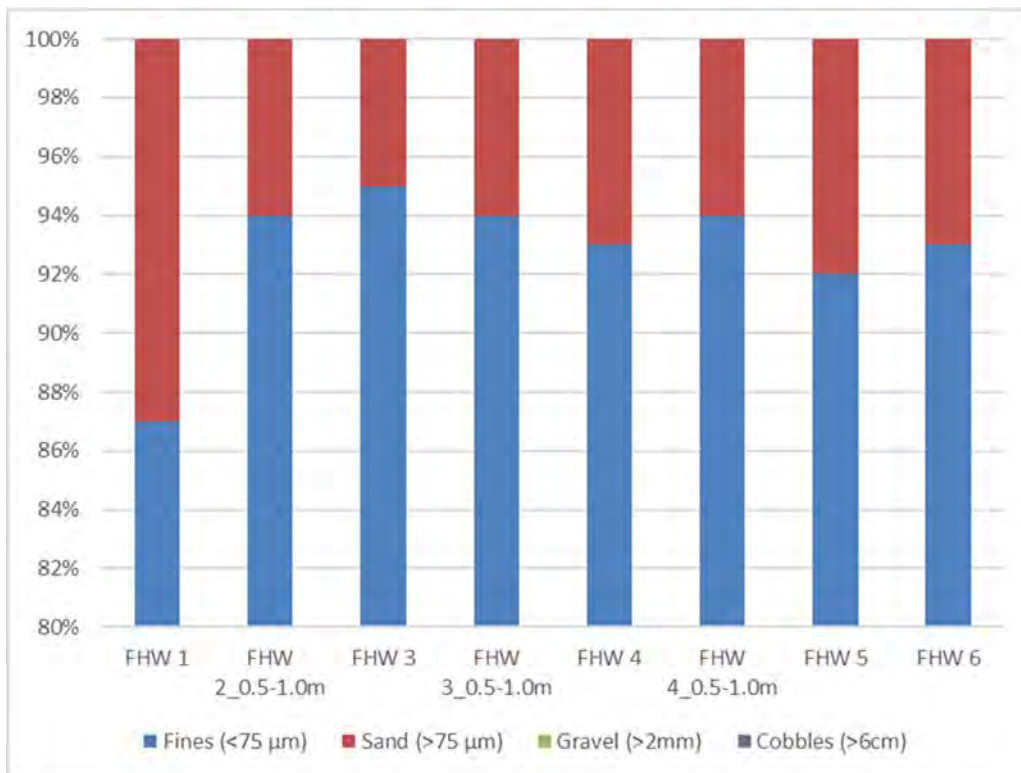


Figure 8 Particle size distribution from FHW Sediments

3.1.1 Total Organic Carbon

Percentage organic matter was highest in sediments with fine particle size and lowest in sediments dominated by sand and shell. For example, sediments from MEC were generally less than 0.2% as compared to MSB and FHW which were consistently above 1% (Table 0-1).

Table 5 Percentage Total Organic Carbon, All Locations

Location	Range of TOC (%)
MSB	1.23 - 1.51
MEC	0.1 - 1.1
EAW	0.58 – 1.2
FHW	1.1 – 1.33

3.2 Phase II Testing - Contaminants

Metal concentrations in sediments were consistently low for all analytes tested, with the majority returning 95%UCLs less than screening levels (**Table 5** and **Appendix B**). Organic contaminants were very low for all analytes tested with most near or below their respective limits of reporting.

Table 5. 95th UCL Values, All Areas, March 2025

Analytical Parameters	Units	Detection Limit	NAGD Screening Level	NAGD High Values	95% UCLs			
					MSB All Sites	MEC All Sites	EAW All Sites	FHW All Sites
Metals								
Arsenic	mg/kg	1	20	70	14.0	70.7	11.9	12.6
Cadmium	mg/kg	0.1	1.5	10	<0.2	<0.2	<0.2	<0.2
Chromium	mg/kg	1	80	370	51.2	25.1	42.9	43.7
Copper	mg/kg	1	65	270	13.2	2.2	12.3	9.4
Lead	mg/kg	1	50	220	14.3	5.2	10.7	12.3
Mercury	mg/kg	0.01	0.15	1	0.02	<0.01	<0.01	0.02
Nickel	mg/kg	1	21	52	12.6	12.4	4.1	13.4
Zinc	mg/kg	1	200	410	64.3	34.7	6.4	46.3
TPH								
Total TPH	mg/kg	3						
Normalised to 1% TOC			260	550	44.6	39.6	47.1	42.5
Organotins								
Tributyltin	µgSn/kg	0.5	-	-	<0.5	<0.5	<0.5	<0.5
Normalised to 1% TOC		0.5	9	70	<0.5	<0.5	<0.5	<0.5

3.2.1 MSB

Contaminant concentrations in sediments were consistently low for all analytes tested, with all samples returning 95% UCLs that were less than screening levels (**Table 5** and **Appendix B**).

In summary:

- Concentrations of cadmium were very low and less than the limits of reporting in all samples tested
- Concentrations of all other metals were very low and well below NAGD screening levels;
- Concentrations of all organotins (MBT, DBT and TBT) were less than the limits of reporting;
- Concentrations of total petroleum hydrocarbons (TPHs) were very low in all samples tested;
- Concentrations of BTEX organic contaminants were less than the limits of reporting;
- Concentrations of all polynuclear aromatic hydrocarbons (PAHs) were less than the limits of reporting.

Overall, all metal and organic contaminants were very low and well below screening levels.

3.2.2 MEC

Contaminant concentrations in sediments were consistently low for all analytes tested, with all samples returning 95% UCLs that were less than screening levels with the exception of arsenic (**Table 5** and **Appendix B**).

In summary:

- Concentrations of arsenic exceeded screening levels in six samples and exceeded High values in two samples
- Concentrations of cadmium and mercury were very low and less than the limits of reporting in all samples tested
- Concentrations of all other metals were very low and well below NAGD screening levels;
- Concentrations of all organotins (TBT) were less than the limits of reporting;
- Concentrations of total petroleum hydrocarbons (TPHs) were very low and close to the limits of reporting in all samples tested;
- Concentrations of BTEX organic contaminants were less than the limits of reporting;
- Concentrations of all polynuclear aromatic hydrocarbons (PAHs) were less than the limits of reporting.

Overall, all metal and organic contaminants (except for arsenic) were very low and well below screening levels.

3.2.3 EAW

Contaminant concentrations in sediments were consistently low for all analytes tested, with all samples returning 95% UCLs that were less than screening levels (**Table 5** and **Appendix B**).

In summary:

- Concentrations of cadmium were very low and less than the limits of reporting in all samples tested
- Concentrations of all other metals were very low and well below NAGD screening levels;
- Concentrations of all organotins (MBT, DBT and TBT) were less than the limits of reporting;
- Concentrations of total petroleum hydrocarbons (TPHs) were very low in all samples tested;
- Concentrations of BTEX organic contaminants were less than the limits of reporting;
- Concentrations of all polynuclear aromatic hydrocarbons (PAHs) were very low and close to the limits of reporting.

Overall, all metal and organic contaminants were very low and well below screening levels.

3.2.4 FHW

Contaminant concentrations in sediments were consistently low for all analytes tested, with all samples returning 95% UCLs that were either below the limits of reporting or returning 95%UCLs less than screening levels (**Table 5** and **Appendix B**).

In summary:

- Concentrations of all metals were very low and well below screening levels;
- Concentrations of total petroleum hydrocarbons (TPHs) were very low in all samples tested;

- Concentrations of all organotins (TBT) were less than the limits of reporting;
- Concentrations of BTEX organic contaminants were less than the limits of reporting;
- Concentrations of all polynuclear aromatic hydrocarbons (PAHs) were very low and close to the limits of reporting.

Overall, all metal and organic contaminants were very low and well below screening levels.

3.2.4 Elevated Arsenic Concentrations at MEC

The elevated arsenic concentrations recorded in all samples collected from MEC are consistent with previous findings as reported by AECOM (2020) as part of the sediment geochemical assessment undertaken for the Darwin Shiplift Project EIS where concentrations as high as 83.5 mg/kg were recorded.

As reported in AECOM (2020), elevated concentrations of arsenic in Darwin Harbour sediments have previously been attributed to local geological influence and are not thought to be attributable to anthropogenic sources (Fortune 2006). Interestingly, sediments sampled from MEC as part of the current study were physically distinct to samples collected from elsewhere in Darwin Harbour and are of a different geological origin. The sediments are also located the furthest away from any potential point source inputs, providing further evidence that the source is not related to anthropogenic inputs.

Bioavailability testing using 1M HCl digest on eight samples of Darwin Harbour sediments collected by URS (2009) found that only a very small proportion of arsenic was bioavailable. There is also reference to additional surveys conducted by URS at East Arm Wharf in 2012 and in 2014 where exceedances of the 95% UCL for arsenic were recorded. Radke et al. (2020) also reported two samples from East Arm with arsenic concentrations exceeding the SQG High Level of 70 mg/kg.

3.3 Potential Acid Sulfate Soils (PASS)

The Potential Acid Sulfate Soils (PASS) test results are summarised in Table 6 to Table 9 and the full screening laboratory certificates are in **Appendix C**. The SPOCAS chromium suite was adopted for testing of the acid sulfate soil assessment.

Table 6. Potential acid sulfate soil summary results for MSB sediments.

	pH KCl	pH OX	Net Acidity mole H ⁺	Net Acidity %S	Liming Rate kg CaCO ₃
MSB1	8.8	8.2	<10	<0.02	<1
MSB2	8.8	8.2	<10	<0.02	<1
MSB3	8.8	8.2	<10	<0.02	<1
MSB4	8.9	8.3	<10	<0.02	<1
MSB5	8.9	8.3	<10	<0.02	<1
MSB6	8.9	8.3	<10	<0.02	<1
MSB7	8.9	8.3	<10	<0.02	<1

Table 7. Potential acid sulfate soil summary results for MEC sediments

	pH KCl	pH OX	Net Acidity mole H ⁺	Net Acidity %S	Liming Rate kg CaCO ₃
MEC1	9.7	9.7	<10	<0.02	<1
MEC1s	9.6	9.5	<10	<0.02	<1
MEC2	9.7	9.6	<10	<0.02	<1

MEC2s	9.6	9.5	<10	<0.02	<1
MEC3	9.7	9.4	<10	<0.02	<1
MEC4	9.7	9.6	<10	<0.02	<1
MEC5	9.7	9.4	<10	<0.02	<1
MEC6	9.7	9.6	<10	<0.02	<1

Table 8. Potential acid sulfate soil summary results for EAW sediments

	pH KCl	pH OX	Net Acidity mole H ⁺	Net Acidity %S	Liming Rate kg CaCO ₃
EAW1	9.1	8.6	<10	<0.02	<1
EAW2s	9.0	8.3	<10	<0.02	<1
EAW3	8.9	8.2	<10	<0.02	<1
EAW3s	9.0	8.2	<10	<0.02	<1
EAW4	9.0	8.3	<10	<0.02	<1
EAW4s	9.1	8.3	<10	<0.02	<1
EAW5	9.0	8.2	<10	<0.02	<1
EAW5s	9.2	8.3	<10	<0.02	<1
EAW6	9.1	8.6	<10	<0.02	<1
EAW7	9.1	8.4	<10	<0.02	<1

Table9. Potential acid sulfate soil summary results for FHW sediments

	pH KCl	pH OX	Net Acidity mole H ⁺	Net Acidity %S	Liming Rate kg CaCO ₃
FHW1	9.1	8.3	<10	<0.02	<1
FHW2s	9.0	8.1	<10	<0.02	<1
FHW3	9.0	8.2	<10	<0.02	<1
FHW3s	9.0	8.1	<10	<0.02	<1
FHW4	8.4	8.2	<10	<0.02	<1
FHW4s	9.0	8.1	<10	<0.02	<1
FHW5	9.0	8.2	<10	<0.02	<1
FHW6	9.0	8.2	<10	<0.02	<1

An action criterion of 0.03 %S equivalent (18 mol H⁺/tonne) was adopted based on Dear et al. (2014).

Given the 0.03 %S criterion, SPOCAS sample analytical results indicated that:

- No actual acid sulfate soils (AASS) were identified in any of the samples tested with all TAA concentrations being less than the LoR (0.02 %S or 2 mole H⁺/tonne)
- peroxide oxidisable sulfur (POS) above the threshold of 0.03% was recorded in samples from MSB, EAW and FHW indicating potential acid sulphate soils
- peroxide oxidisable sulfur (POS) in sediments from MEC were mostly below the threshold and are unlikely to be PASS
- the titratable peroxide acidity (TPA) and pH (OX) values indicate absence of acid following oxidation suggesting that buffering capacity within sediments exceeds potential acidity arising from oxidation of sulphides.
- Disposal of sediments offshore presents minimal risk of oxidation or acidification and no further ASS management is required

- Disposal of sediments onshore may require additional consideration of ASS management.

4.0 Data Validation

The validity of the analytical data obtained in the study is described in this section of the report and presented in **Appendix C**, which provides the confidence in the results presented.

4.1 Field Duplicates and Triplicates

The NAGD stipulates the analysis of quality assurance field duplicate and triplicate samples to determine the precision of the analysis.

Field splits and triplicate samples were analysed to determine within location variation (by relative standard deviation (RSD) of primary, secondary and triplicate cores) where level of acceptability is $\pm 50\%$.

The RSD of field duplicate splits and triplicate samples were assessed against the respective acceptable RSD limits (**Appendix C**). As many of the values were less than the limits of reporting, RSD results were unable to be calculated, except for metals and TPH. In total, 51 results were calculated. RSDs for metals and TPH were generally less than 35%, which is well below the 50% level of acceptability. Only one value for chromium (52.2%) exceeded the level of acceptability. As all other values were less than the limits of reporting no RSD values were calculated.

Overall, data from the field and laboratory QA/QC testing confirm that the results are reliable and can be used for this sediment quality assessment.

5.0 Conclusions

Contaminant concentrations in sediments were consistently low for all analytes tested, with all results returning 95% UCLs that were well below their respective screening levels.

No TBT was recorded above the limits of detection. TPH was recorded from all samples but at very low concentrations, whilst PAHs were less than their respective limits of reporting in most of the samples tested. Sediments were also confirmed as having low risk PASS properties.

The elevated arsenic levels recorded at MEC did exceed screening levels, however these values were related to naturally occurring elevated concentrations of arsenic that have been documented in previous sediment investigations of Darwin Harbour. The arsenic is of a localised geological origin, as arsenic levels in sediments from the other port locations were relatively low.

Considering the results of the sediment sampling and analysis program, the sediments from the port locations tested would be considered suitable for open water disposal including bed levelling and sweeping related activities.

6.0 References

AECOM (2020). Marine Sediment Geochemical Assessment. Darwin Ship Lift Project. Report prepared for Department of the Chief Minister and Cabinet, Northern Territory Government.

AMA (2025). Dredging and Dredge Material Management Plan (DMP). Prepared for Darwin Port Maintenance Dredging Works.

ANZ (2018). Australian & New Zealand GUIDELINES FOR FRESH & MARINE WATER QUALITY. Commonwealth of Australia. <https://www.waterquality.gov.au/anz-guidelines>.

Commonwealth of Australia (2009). National Assessment Guideline for Dredging. Commonwealth of Australia, Canberra.

Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M., 2014. Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines. Brisbane: Department of Science, Information Technology, Innovation and the Arts, Queensland Government.

Fortune, J (2006). The grain size and heavy metal content of sediment in Darwin Harbour. Environmental Protection Agency, Department of Natural Resources, Environmental and the Arts. Report No. 14/2006D.

Hatch (2024). Sedimentation Assessment and Intervention Options Study, Ref H372944-0000-225-066-0001, Rev0, prepared for Darwin Port Operations Pty Ltd.

NAGD (2009). National Assessment Guidelines for Dredging, Commonwealth of Australia.

NEPM (1999). National Environment Protection (Assessment of Site Contamination) Measure 1999, and its individual Schedules B(1) – (10), <https://www.legislation.gov.au/Details/F2013C00288> website.

Radke, LC, Fortune, J, Majid, M & Mummery, A. (2020). Sediment quality assessment of East Arm, Darwin Harbour (2019): Survey record and data report. Technical Report No. 9/2020, Department of Environment and Natural Resources, Northern Territory Government, NT.

URS (2009). Nearshore Marine Water Quality and Sediment Study. In INPEX Browse Ltd 2009 Ichthys Gas Field Development Project INPEX Document Number C036-AH-REP-0026 Appendix 9.

URS (2014). Multiuser Barge Facility Sediment Geochemical Investigation, report prepared for Department of Lands and Planning, April 2014.

URS (2012). East Arm Wharf Expansion Project: Sediment Geochemical Investigation. Report prepared for Department of Lands and Planning, R1646 Rev 0, July 2012.

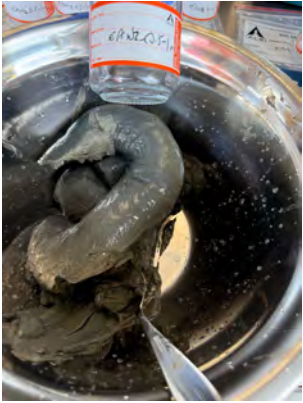
APPENDIX A – SAMPLE LOCATIONS

Marine Supply Base					
Point	E	N	RL	Lat	Long
MSB 1	705385.229	8618347.183	0.00	-12.49165	130.88989
MSB 2	705436.597	8618408.840	0.00	-12.49109	130.89036
MSB 3	705420.453	8618336.906	0.00	-12.49174	130.89021
MSB 4	705463.602	8618362.744	0.00	-12.4915	130.89061
MSB 5	705485.324	8618326.043	0.00	-12.49183	130.89081
MSB 6	705503.200	8618233.845	0.00	-12.49266	130.89098
MSB 7	705498.140	8618193.323	0.00	-12.49303	130.89094
East Arm Wharf					
Point	E	N	RL	Lat	Long
EAW 1	704664.088	8618287.028	0.00	-12.49224	130.88326
EAW 2	704587.750	8618337.750	0.00	-12.49178	130.88255
EAW 3	704554.430	8618362.271	0.00	-12.49156	130.88225
EAW 4	704555.193	8618330.319	0.00	-12.49185	130.88226
EAW 5	704502.154	8618377.388	0.00	-12.49143	130.88176
EAW 6	704383.517	8618460.607	0.00	-12.49069	130.88067
EAW 7	704156.612	8618664.485	0.00	-12.48886	130.87857
Fort Hill Wharf					
Point	E	N	RL	Lat	Long
FHW 1	700831.351	8620599.116	0.00	-12.47158	130.84786
FHW 2	700818.497	8620605.694	0.00	-12.47153	130.84774
FHW 3	700811.472	8620617.953	0.00	-12.47141	130.84767
FHW 4	700789.352	8620608.535	0.00	-12.4715	130.84747
FHW 5	700781.430	8620592.090	0.00	-12.47165	130.8474
FHW 6	700739.658	8620582.439	0.00	-12.47174	130.84701
MSB Entrance Channel					
Point	E	N	RL	Lat	Long
MEC 1	705041.103	8617510.364	0.00	-12.49923	130.88678
MEC 2	705038.883	8617518.628	0.00	-12.49916	130.88676
MEC 3	705030.170	8617526.830	0.00	-12.49908	130.88668
MEC 4	705056.657	8617544.250	0.00	-12.49893	130.88692
MEC 5	705070.034	8617529.958	0.00	-12.49905	130.88704
MEC 6	705060.812	8617519.140	0.00	-12.49915	130.88696

APPENDIX B - FIELD LOGS

Sample Name	Characteristics	Photo
MARINE SUPPLY BASE		
MSB1	Location: Marine Supply Base Depth: 0-0.5m Colour: grey, light brown Type: sandy silt Odour: nil	
MSB2	Location: Marine Supply Base Depth: 0-0.5m Colour: grey, light brown Type: silty sand Odour: nil	
MSB3	Location: Marine Supply Base Depth: 0-0.5m Colour: grey, light brown Type: silty sandy Odour: nil	

MSB4	Location: Marine Supply Base Depth: 0-0.5m Colour: grey, light brown Type: silty sand Odour: nil	
MSB5	Location: Marine Supply Base Depth: 0-0.5m Colour: grey, light brown Type: silty sand Odour: nil	
MSB6	Location: Marine Supply Base Depth: 0-0.5m Colour: grey, light brown Type: silty sand Odour: nil	

MSB7	Location: Marine Supply Base Depth: 0-0.5m Colour: grey, light brown Type: silty sand Odour: nil	
EAST ARM WHARF		
EAW1	Location: East Arm Wharf Depth: 0-0.5m Colour: grey, light brown Type: sandy silt, minor shell Odour: nil	
EAW2	Location: East Arm Wharf Depth: 0-0.5m Colour: grey, light brown Type: silty sand Odour: nil	
EAW2	Location: East Arm Wharf Depth: 0.5-1.0m Colour: grey, light brown Type: silty sand Odour: nil	

EAW3	Location: East Arm Wharf Depth: 0.0-0.5m Colour: grey, light brown Type: sandy silt Odour: nil	
EAW3	Location: East Arm Wharf Depth: 0.5-1.0m Colour: grey, light brown Type: silty sand Odour: nil	
EAW4	Location: East Arm Wharf Depth: 0.0-0.5m Colour: grey, Type: sandy silt Odour: nil	No image available
EAW4	Location: East Arm Wharf Depth: 0.5-1.0m Colour: grey, Type: silty clay Odour: nil	
EAW5	Location: East Arm Wharf Depth: 0.0-0.5m Colour: grey Type: sandy silt Odour: nil	

EAW5	Location: East Arm Wharf Depth: 0.5-1.0m Colour: light grey Type: sandy silt Odour: nil	
EAW6	Location: East Arm Wharf Depth: 0.0-0.5m Colour: light brown Type: sandy silt, some gravel Odour: nil	
EAW7	Location: East Arm Wharf Depth: 0.0-0.5m Colour: grey, light brown Type: sandy silt Odour: nil	
FORT HILL WHARF		

FHW1	Location: Fort Hill Wharf Depth: 0.0-0.5m Colour: grey, Type: sandy silt Odour: nil	
FHW2	Location: Fort Hill Wharf Depth: 0.0-0.5m Colour: grey, Type: sandy silt Odour: nil	
FHW2	Location: Fort Hill Wharf Depth: 0.5-1.0m Colour: grey, Type: sandy silt Odour: nil	

FHW3	Location: Fort Hill Wharf Depth: 0.0-0.5m Colour: grey, Type: sandy silt Odour: nil	
FHW4	Location: Fort Hill Wharf Depth: 0.0-0.5m Colour: grey, Type: sandy silt Odour: nil	
FHW4	Location: Fort Hill Wharf Depth: 0.5-1.0m Colour: grey, Type: sandy silt Odour: nil	
FHW5	Location: Fort Hill Wharf Depth: 0.0-0.5m Colour: grey, Type: sandy silt Odour: nil	

FHW6	Location: Fort Hill Wharf Depth: 0.0-0.5m Colour: grey, Type: sandy silt Odour: nil	
MSB ENTRANCE CHANNEL		
MEC1	Location: Entrance Channel Depth: 0.0-0.5m Colour: light brown, orange Type: sandy shell Odour: nil	
MEC1	Location: Entrance Channel Depth: 0.5-1.0m Colour: light brown, orange Type: sandy shell Odour: nil	
MEC2	Location: Entrance Channel Depth: 0.0-0.5m Colour: light brown, orange Type: sandy shell Odour: nil	

MEC2	Location: Entrance Channel Depth: 0.5-1.0m Colour: light brown, orange Type: sandy shell Odour: nil	
MEC3	Location: Entrance Channel Depth: 0.0-0.5m Colour: light brown, orange Type: sandy shell Odour: nil	
MEC4	Location: Entrance Channel Depth: 0.0-0.5m Colour: light brown, orange Type: sandy shell Odour: nil	
MEC4	Location: Entrance Channel Depth: 0.5-1.0m Colour: light brown, orange Type: sandy shell Odour: nil	

MEC5	Location: Entrance Channel Depth: 0.0-0.5m Colour: light brown, orange Type: sandy shell Odour: nil	
MEC6	Location: Entrance Channel Depth: 0.0-0.5m Colour: light brown, orange Type: sandy shell Odour: nil	

APPENDIX B – ANALYTICAL DATA

Marine Services Berth (MSB)

Analytical Parameters		Units	Detection Limit	Fill Material Criteria (EPA, 2009)	NAGD Screening Level	NAGD High Values	Surface Sediments						
							MSB1 0.0-0.5m	MSB2 0.0-0.5m	MSB3 0.0-0.5m	MSB4 0.0-0.5m	MSB5 0.0-0.5m	MSB6 0.0-0.5m	MSB7 0.0-0.5m
Metals													
	Arsenic	mg/kg	1	20	20	70	13.1	11.6	14.1	12.8	12.3	14.3	14.2
	Cadmium	mg/kg	0.1	3	1.5	10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Chromium	mg/kg	1	-	80	370	45.1	50.5	53.9	50.8	49.7	39.0	39.3
	Copper	mg/kg	1	100	65	270	14.6	11.5	13.0	12.4	12.2	12.0	11.7
	Lead	mg/kg	1	300	50	220	13.2	13.7	15.0	13.9	13.9	13.8	12.2
	Mercury	mg/kg	0.01	1	0.15	1	0.02	0.02	0.02	0.02	0.02	0.02	0.01
	Nickel	mg/kg	1	60	21	52	13.5	15.1	16.4	15.4	14.7	12.6	12.6
	Zinc	mg/kg	1	200	200	410	47.7	41.4	44.9	43.6	42.3	47.9	37.2
Organotins													
	Monobutyltin	µgSn/kg	1				<1	<1	<1	<1	<1	<1	<1
	Dibutyltin	µgSn/kg	1				<1	<1	<1	<1	<1	<1	<1
	Tributyltin	µgSn/kg	0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	<i>Normalised to 1% TOC</i>	µgSn/kg	0.5	-	9.00	70.00	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TRH													
	Total Recoverable Hydrocarbons												
	TRH C6-C10	mg/kg	3				<3	<3	<3	<3	<3	<3	<3
	TRH C10-C16	mg/kg	3				<5	<5	<5	<5	<5	<5	<5
	TRH C16-C34	mg/kg	3				26	35	40	53	56	35	35
	TRH C34-C40	mg/kg	3				12	12	14	22	18	13	12
	TRH C10-C40 (Sum)	mg/kg	3				38	47	54	75	74	48	47
TPH													
	TPH C6-C9	mg/kg	3				<3	<3	<3	<3	<3	<3	<3
	TPH C10 - C14	mg/kg	3	-	-	-	<3	<3	<3	<3	<3	<3	<3
	TPH C15 - C28	mg/kg	3	-	-	-	19	27	31	38	42	26	27
	TPH C29 - C36	mg/kg	5	-	-	-	15	18	20	34	30	20	18
	Sum of C10 - C36	mg/kg	3	-	-	-	34	45	51	72	72	46	45
	<i>Normalised to 1% TOC</i>	mg/kg	3	1000	280	550	24	30	35	51	50	36	37
PAHs													
	Naphthalene	µg/kg	5				<5	<5	<5	<5	<5	<5	<5
	2-Methylnaphthalene	µg/kg	5				<5	<5	<5	<5	<5	<5	<5
	Acenaphthylene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Acenaphthene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Fluorene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Phenanthrene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Anthracene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Fluoranthene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Pyrene	µg/kg	4				<5	<5	<5	5	<5	<5	<5
	Benz(a)anthracene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Chrysene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Benzo(b+j)fluoranthene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Benzo(k)fluoranthene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Benzo(e)pyrene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Benzo(a)pyrene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Perylene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Benzo(g,h,i)perylene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Dibenz(a,h)anthracene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Indeno(1,2,3,cd)pyrene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5
	Coronene	µg/kg	5				<5	<5	<5	<5	<5	<5	<5
	Sum of PAHs	µg/kg	4				<5	<5	<5	5	<5	<5	<5
	<i>Normalised PAH to 1% TOC</i>				10000	50000	<5	<5	<5	<5	<5	<5	<5
BTEXN													
	Benzene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Toluene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Ethylbenzene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	meta- & para-Xylene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	ortho-Xylene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Total Xylenes	mg/kg	0.5				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Sum of BTEX	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Naphthalene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Moist/TOC													
	Moisture content	%	0.1	-	-	-	60.3	67.6	68.1	64.5	65.1	65.7	63.7
	Total organic carbon	%	0.02	-	-	-	1.4	1.51	1.45	1.42	1.44	1.28	1.23

MSB Entrance Channel (MEC)

Analytical Parameters		Units	Detection Limit	Fill Material Criteria (EPA, 2009)	NAGD Screening Level	NAGD High Values	Surface Sediments							
							MEC 1 0.0-0.5m	MEC 1 0.5-1.0m	MEC2 0.0-0.5m	MEC 2 0.5-1.0m	MEC 3 0.0-0.5m	MEC 4 0.0-0.5m	MEC 5 0.0-0.5m	MEC 6 0.0-0.5m
Metals	Arsenic	mg/kg	1	20	20	70	77.7	71.3	69.4	68.1	49.5	48.8	62.4	63.4
	Cadmium	mg/kg	0.1	3	1.5	10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Chromium	mg/kg	1	-	80	370	27.7	19.6	24.8	17.5	11.5	11.8	16.8	31.8
	Copper	mg/kg	1	100	65	270	2.3	2.1	2	2	1.5	1.5	1.8	2.3
	Lead	mg/kg	1	300	50	220	5.2	4.9	4.9	4.8	3.6	3.5	4.6	5.9
	Mercury	mg/kg	0.01	1	0.15	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Nickel	mg/kg	1	60	21	52	4.3	4	4.4	3.8	2.8	3.2	3.6	3.9
	Zinc	mg/kg	1	200	200	410	6.7	5.7	6.8	6.2	5.5	6	5.9	6
Organotins														
	Monobutyltin	µgSn/kg	1				<1	<1	<1	<1	<1	<1	<1	<1
	Dibutyltin	µgSn/kg	1				<1	<1	<1	<1	<1	<1	<1	<1
	Tributyltin	µgSn/kg	0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Normalised to 1% TOC	µgSn/kg	0.5	-	9.00	70.00	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TRH	Total Recoverable Hydrocarbons													
	TRH C6-C10	mg/kg	3				<3	<3	<3	<3	<3	<3	<3	<3
	TRH C10-C16	mg/kg	3				<3	<3	<3	<3	<3	<3	<3	<3
	TRH C16-C34	mg/kg	3				5	4	4	4	6	5	4	3
	TRH C34-C40	mg/kg	3				<5	<5	<5	<5	<5	<5	<5	<5
	TRH C10-C40 (Sum)	mg/kg	3				5	4	4	4	6	5	4	3
TPH	TPH C6-C9	mg/kg	3				<3	<3	<3	<3	<3	<3	<3	<3
	TPH C10 - C14	mg/kg	3	-	-	-	<3	<3	<3	<3	<3	<3	<3	<3
	TPH C15 - C28	mg/kg	3	-	-	-	4	4	4	4	5	5	4	3
	TPH C29 - C36	mg/kg	5	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5
	Sum of C10 - C36	mg/kg	3	-	-	-	4	4	4	4	5	5	4	3
	Normalised to 1% TOC	mg/kg	3	1000	280	550	40	33	4	31	36	50	17	30
PAHs														
	Naphthalene	µg/kg	5				<5	<5	<5	<5	<5	<5	<5	<5
	2-Methylnaphthalene	µg/kg	5				<5	<5	<5	<5	<5	<5	<5	<5
	Acenaphthylene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Acenaphthene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Fluorene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Phenanthrene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Anthracene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Fluoranthene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Pyrene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Benz(a)anthracene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Chrysene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Benzo(b+)fluoranthene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Benzo(k)fluoranthene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Benzo(e)pyrene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Benzo(a)pyrene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Perylene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Benzo(g,h,i)perylene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Dibenz(a,h)anthracene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Indeno(1,2,3.cd)pyrene	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Coronene	µg/kg	5				<5	<5	<5	<5	<5	<5	<5	<5
	Sum of PAHs	µg/kg	4				<4	<4	<4	<4	<4	<4	<4	<4
	Normalised PAH to 1% TOC				10000	50000	<5	<5	<5	<5	<5	<5	<5	<5
BTEXN														
	Benzene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Toluene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Ethylbenzene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	meta- & para-Xylene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	ortho-Xylene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Total Xylenes	mg/kg	0.5				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Sum of BTEX	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Naphthalene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Moist/TOC														
	Moisture content	%	0.1	-	-	-	28.2	30.7	28.9	34.6	37.3	33.3	38	34.3
	Total organic carbon	%	0.02	-	-	-	0.10	0.12	1.10	0.13	0.14	0.10	0.23	0.10

East Arm Wharf (EAW)

Analytical Parameters		Units	Detection Limit	Fill Material Criteria (EPA, 2009)	NAGD Screening Level	NAGD High Values	Surface Sediments										
							EAW 1 0.0-0.5m	EAW 2 0.0-0.5m	EAW 2 0.5-1.0m	EAW 3 0.0-0.5m	EAW 3 0.5-1.0m	EAW 4 0.0-0.5m	EAW 4 0.5-1.0m	EAW 5 0.0-0.5m	EAW 5 0.5-1.0m	EAW 6 0.0-0.5m	EAW 7 0.0-0.5m
Metals	Arsenic	mg/kg	1	20	20	70	7.79	11	10.9	9.71	11.3	11.6	10.2	14.7	13.2	10.2	9.39
	Cadmium	mg/kg	0.1	3	1.5	10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Chromium	mg/kg	1	-	80	370	32.6	37.2	37.6	47.1	44.1	44.1	34.3	47.1	41.8	25	40.8
	Copper	mg/kg	1	100	65	270	6.5	8.0	9.0	11.2	12.5	8.3	10.8	10.4	20.8	5.4	7.8
	Lead	mg/kg	1	300	50	220	7.9	9.2	10	11.1	11.8	10.6	9.8	10.8	10.7	6	9.9
	Mercury	mg/kg	0.01	1	0.15	1	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02	<0.01	0.01
	Nickel	mg/kg	1	60	21	52	9.8	11	10.8	13.6	12.4	13.1	10.1	13.6	11.6	6.2	11.4
	Zinc	mg/kg	1	200	200	410	25.3	28.8	30	38.4	39.7	32.2	28.5	38.5	34	20	30.7
Organotins	Monobutyltin	µgSn/kg	1				<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Dibutyltin	µgSn/kg	1				<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Tributyltin	µgSn/kg	0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Normalised to 1% TOC	µgSn/kg	0.5	-	9.00	70.00	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TRH	Total Recoverable Hydrocarbons																
	TRH C6-C10	mg/kg	3				<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
	TRH C10-C16	mg/kg	3				<5	<5	<5	<5	<5	<5	<5	<5	<3	<3	<5
	TRH C16-C34	mg/kg	3				17	32	20	32	24	37	20	46	28	31	29
	TRH C34-C40	mg/kg	3				6	12	7	11	9	15	9	18	12	14	12
	TRH C10-C40 (Sum)	mg/kg	3				23	44	27	43	33	52	29	64	40	45	41
TPH	TPH C6-C9	mg/kg	3				<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
	TPH C10 - C14	mg/kg	3	-	-	-	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
	TPH C15 - C28	mg/kg	3	-	-	-	13	24	15	24	17	28	14	33	20	21	20
	TPH C29 - C36	mg/kg	5	-	-	-	8	18	11	17	14	20	13	27	16	21	18
	Sum of C10 - C36	mg/kg	3	-	-	-	21	42	26	41	31	48	27	60	36	42	38
	Normalised to 1% TOC	mg/kg	3	1000	280	550	32	35	27	34	30	44	27	52	45	72	40
PAHs	Naphthalene	µg/kg	5				<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	9
	2-Methylnaphthalene	µg/kg	5				<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	Acenaphthylene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Acenaphthene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Fluorene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Phenanthrene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Anthracene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Fluoranthene	µg/kg	4				<5	<5	7	<5	<5	<5	<5	<5	<4	<4	<5
	Pyrene	µg/kg	4				<5	<5	7	<5	<5	<5	<5	<5	<4	<4	5
	Benz(a)anthracene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Chrysene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Benzo(b+j)fluoranthene	µg/kg	4				<5	5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Benzo(k)fluoranthene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Benzo(e)pyrene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Benzo(a)pyrene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Perylene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Benzo(g,h,i)perylene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Dibenz(a,h)anthracene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Indeno(1.2.3.cd)pyrene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<4	<4	<5
	Coronene	µg/kg	5				<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	Sum of PAHs	µg/kg	4				<5	5	14	<5	<5	<5	<5	<5	<4	<4	14
	Normalised PAH to 1% TOC				10000	50000	<5	<5	14	<5	<5	<5	<5	<5	<5	<5	15
BTEXN																	
	Benzene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Toluene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Ethylbenzene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	meta- & para-Xylene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	ortho-Xylene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Total Xylenes	mg/kg	0.5				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Sum of BTEX	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Naphthalene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Moist/TOC																	
	Moisture content	%	0.1	-	-	-	51.6	59.4	52.2	63.8	54.1	59.3	51.7	59.9	48.7	35.3	57.1
	Total organic carbon	%	0.02	-	-	-	0.66	1.2	0.98	1.19	1.04	1.09	1.00	1.16	0.8	0.58	0.96

Fort Hill Wharf (FHW)

Analytical Parameters		Units	Detection Limit	Fill Material Criteria (EPA, 2009)	NAGD Screening Level	NAGD High Values	Surface Sediments								
							FHW 1 0.0-0.5m	FHW 2 0.0-0.5m	FHW 2 0.5-1.0m	FHW 3 0.0-0.5m	FHW 3 0.5-1.0m	FHW 4 0.0-0.5m	FHW 4 0.5-1.0m	FHW 5 0.0-0.5m	
Metals															
	Arsenic	mg/kg	1	20	20	70	13.4	6.66	5.87	8.7	13.2	13.6	12.2	10.8	12.5
	Cadmium	mg/kg	0.1	3	1.5	10	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Chromium	mg/kg	1	-	80	370	33.7	23.8	19.9	31.6	51.6	53.8	39.9	39.3	36.9
	Copper	mg/kg	1	100	65	270	7.4	6.1	4.9	7	10.3	10.7	9.4	8.6	8.6
	Lead	mg/kg	1	300	50	220	13.9	6.8	5.6	8.6	12.5	13.8	12.4	10.2	11
	Mercury	mg/kg	0.01	1	0.15	1	0.04	0.01	<0.01	0.01	0.02	0.02	0.02	0.02	0.02
	Nickel	mg/kg	1	60	21	52	9.9	6.8	5.7	9.4	14.8	15.6	11.2	10.7	11.4
	Zinc	mg/kg	1	200	200	410	133	21	16.6	27.6	37.4	43.4	36.9	31.3	36.3
Organotins															
	Monobutyltin	µgSn/kg	1				<1	<1	<1	<1	<1	<1	<1	<1	<1
	Dibutyltin	µgSn/kg	1				<1	<1	<1	<1	<1	<1	<1	<1	<1
	Tributyltin	µgSn/kg	0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Normalised to 1% TOC	µgSn/kg	0.5	-	9.00	70.00	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TRH	Total Recoverable Hydrocarbons														
	TRH C6-C10	mg/kg	3				<3	<3	<3	<3	<3	<3	<3	<3	<3
	TRH C10-C16	mg/kg	3				<5	<5	<5	<5	<5	<5	<5	<5	<3
	TRH C16-C34	mg/kg	3				41	36	26	40	28	41	36	34	40
	TRH C34-C40	mg/kg	3				15	15	11	17	11	15	15	13	15
	TRH C10-C40 (Sum)	mg/kg	3				56	51	37	57	39	56	51	47	55
TPH															
	TPH C6-C9	mg/kg	3				<3	<3	<3	<3	<3	<3	<3	<3	<3
	TPH C10 - C14	mg/kg	3	-	-	-	<3	<3	<3	<3	<3	<3	<3	<3	<3
	TPH C15 - C28	mg/kg	3	-	-	-	32	26	19	30	21	32	26	26	30
	TPH C29 - C36	mg/kg	5	-	-	-	20	20	14	23	14	20	21	18	21
	Sum of C10 - C36	mg/kg	3	-	-	-	52	46	33	53	35	52	47	44	51
	Normalised to 1% TOC	mg/kg	3	1000	280	550	46	38	28	48	30	42	39	37	38
PAHs															
	Naphthalene	µg/kg	5				<5	<5	6	<5	8	12	8	11	11
	2-Methylnaphthalene	µg/kg	5				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Acenaphthylene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Acenaphthene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Fluorene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Phenanthrene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Anthracene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Fluoranthene	µg/kg	4				<5	<5	<5	<5	<5	6	5	<5	<5
	Pyrene	µg/kg	4				<5	<5	<5	6	<5	7	6	<5	<5
	Benz(a)anthracene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Chrysene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Benzo(b+j)fluoranthene	µg/kg	4				<5	<5	<5	<5	<5	<5	5	<5	<5
	Benzo(k)fluoranthene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Benzo(e)pyrene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Benzo(a)pyrene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Perylene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Benzo(g,h,i)perylene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Dibenz(a,h)anthracene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Indeno(1,2,3.cd)pyrene	µg/kg	4				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Coronene	µg/kg	5				<5	<5	<5	<5	<5	<5	<5	<5	<5
	Sum of PAHs	µg/kg	4				<5	<5	6	6	8	25	24	11	11
	Normalised PAH to 1% TOC				10000	50000	<5	<5	5	5	7	20	20	9	8
BTEXN															
	Benzene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Toluene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Ethylbenzene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	meta- & para-Xylene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	ortho-Xylene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Total Xylenes	mg/kg	0.5				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Sum of BTEX	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Naphthalene	mg/kg	0.2				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Moist/TOC															
	Moisture content	%	0.1	-	-	-	62.8	63.2	59.9	65.9	62.4	65.8	56.1	64.7	64.2
	Total organic carbon	%	0.02	-	-	-	1.14	1.2	1.18	1.1	1.15	1.25	1.22	1.18	1.33

QA Samples

Analytical Parameters		Units	Detection Limit	Triplicate (FHW3 0.5-1.0m)						Triplicate (EAW5 0.5-1.0m)						Split Triplicate (MSB3 0-0.5m)						Split Triplicate (EAW7 0-0.5m)					
				FHW3	QA3	QA4	SD	Mean	RSD	EAW5	QA1	QA2	SD	Mean	RSD	MSB3	QA5	QA6	SD	Mean	RSD	EAW7	QA7	QA8	SD	Mean	RSD
Metals																											
	Arsenic	mg/kg	1	13.2	10.7	11.8	1.25	11.90	10.5	13.2	22.4	9.17	6.78	14.92	45.4	14.1	11.7	13.3	1.22	13.03	9.4	9.39	5.31	6.66	2.08	7.12	29.2
	Cadmium	mg/kg	0.1	<0.1	<0.1	<0.1	At LOR	At LOR	At LOR	<0.1	0.3	<0.1	At LOR	At LOR	At LOR	<0.1	<0.1	<0.1	At LOR	At LOR	At LOR	<0.1	<0.1	<0.1	At LOR	At LOR	At LOR
	Chromium	mg/kg	1	51.6	46.8	47.5	2.59	48.63	5.3	41.8	35.5	31.2	5.33	36.17	14.7	53.9	38.4	39.6	8.62	43.97	19.6	40.8	16.6	19.1	13.31	25.50	52.2
	Copper	mg/kg	1	10.3	10.3	10.3	0.00	10.30	0.0	20.8	9.7	19.1	5.98	16.53	36.2	13	10.8	11.2	1.17	11.67	10.0	7.8	4.6	4.6	1.85	5.67	32.6
	Lead	mg/kg	1	12.5	11.9	12	0.32	12.13	2.6	10.7	9.4	9.2	0.81	9.77	8.3	15	11.8	12.6	1.67	13.13	12.7	9.9	6.1	6.8	2.02	7.60	26.6
	Mercury	mg/kg	0.01	0.02	0.02	0.02	0.00	0.02	0.0	0.02	0.01	0.01	0.01	0.01	43.3	0.02	0.01	0.02	0.01	0.02	34.6	0.01	0.02	0.01	0.01	0.01	43.3
	Nickel	mg/kg	1	14.8	12.5	12.4	1.36	13.23	10.3	11.6	9.5	9.9	1.12	10.33	10.8	16.4	11.2	11.5	2.92	13.03	22.4	11.4	5.9	6.3	3.07	7.87	39.0
	Zinc	mg/kg	1	37.4	36.7	36.4	0.51	36.83	1.4	34	30.5	27.3	3.35	30.60	11.0	44.9	33.4	35.2	6.19	37.83	16.3	30.7	17.6	19.4	7.10	22.57	31.5
Organotins																											
	Monobutyltin	µgSn/kg		<1	<1	<1	At LOR	At LOR	At LOR	<1	<1	<1	At LOR	At LOR	At LOR	<1	<1	<1	At LOR	At LOR	At LOR	<1	<1	<1	At LOR	At LOR	At LOR
	Dibutyltin	µgSn/kg		<1	<1	<1	At LOR	At LOR	At LOR	<1	<1	<1	At LOR	At LOR	At LOR	<1	<1	<1	At LOR	At LOR	At LOR	<1	<1	<1	At LOR	At LOR	At LOR
	Tributyltin	µgSn/kg	0.5	<0.5	<0.5	<0.5	At LOR	At LOR	At LOR	<0.5	<0.5	<0.5	At LOR	At LOR	At LOR	<0.5	<0.5	<0.5	At LOR	At LOR	At LOR	<0.5	<0.5	<0.5	At LOR	At LOR	At LOR
TRH																											
	TRH C10-C16	mg/kg	3	<5	<5	<5	At LOR	At LOR	At LOR	<3	<5	<3	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<3	no data	no data			
	TRH C16-C34	mg/kg	3	28	30	30	1.2	29.3	3.9	28	34	25	4.6	29.0	15.8	40	<5	<5	At LOR	At LOR	At LOR	<3	no data	no data			
	TRH C34-C40	mg/kg	3	11	12	13	1.0	12.0	8.3	12	14	11	1.5	12.3	12.4	14	<5	<5	At LOR	At LOR	At LOR	<5	no data	no data			
	TRH C10-C40 (Sum)	mg/kg	3	39	42	43	2.1	41.3	5.0	40	48	36	6.1	41.3	14.8	54	<5	<5	At LOR	At LOR	At LOR	<3	no data	no data			
TPH																											
	C6 - C9 Fraction	mg/kg	3	<3	<3	<3	At LOR	At LOR	At LOR	<3	<3	<3	At LOR	At LOR	At LOR	<3	<3	<3	At LOR	At LOR	At LOR	<3	<3	<3			
	C10 - C14 Fraction	mg/kg	3	<3	<3	<3	At LOR	At LOR	At LOR	<3	<3	<3	At LOR	At LOR	At LOR	<3	<3	<3	At LOR	At LOR	At LOR	<3	<3	<3			
	C15 - C28 Fraction	mg/kg	5	21	22	21	0.6	21.3	2.7	20	24	17	3.5	20.3	17.3	31	<5	<5	At LOR	At LOR	At LOR	17	18	6	6.7	13.7	48.7
	C29 - C36 Fraction	mg/kg	3	14	16	17	1.5	15.7	9.8	16	20	16	2.3	17.3	13.3	20	<5	<5	At LOR	At LOR	At LOR	<5	<5	<5			
	C10 - C36 Fraction (sum)	mg/kg	3	35	38	38	1.7	37.0	4.7	36	44	33	5.7	37.7	15.1	51	<5	<5	At LOR	At LOR	At LOR	17	18	6	6.7	13.7	48.7
PAHs																											
	Naphthalene	µg/kg	5	8	8	7	1	8	7.5	<5	6	<5	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<5	no data	no data			
	2-Methylnaphthalene	µg/kg	5	<5	<5	<5	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<5	no data	no data			
	Acenaphthylene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Acenaphthene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Fluorene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Phenanthrene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Anthracene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Fluoranthene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Pyrene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Benz(a)anthracene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Chrysene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Benzo(b+)fluoranthene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Benzo(k)fluoranthene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Benzo(e)pyrene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Benzo(a)pyrene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Perylene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Benzo(g,h,i)perylene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Dibenz(a,h)anthracene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Indeno(1,2,3.cd)pyrene	µg/kg	4	<5	<5	<5	At LOR	At LOR	At LOR	<4	<4	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
	Coronene	µg/kg	5	<5	<5	<5	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<5	no data	no data			
	Sum of PAHs	µg/kg	4	8	8	7	1	8	7.5	<4	6	<4	At LOR	At LOR	At LOR	<5	<5	<5	At LOR	At LOR	At LOR	<4	no data	no data			
Moist/TOC																											
	Moisture content	%	0.1	62.4	61.2	61.8	0.6	61.8	1.0	48.7	55.2	47.6	4.1	50.5	8.1	68.1	66	66.6	1.1	66.9	1.6	57.1	53.6	55.0	1.8	55.2	3.2
	Total organic carbon	%	0.02	1.15	1.21	1.18	0.03	1.2	2.5	0.8	1.05	1.06	0.15	1.0	15.2	1.45	1.45	1.39	0.03	1.4	2.4	0.96	no data	no data			

APPENDIX C – LABORATORY CERTIFICATES



CERTIFICATE OF ANALYSIS

Work Order : **ES2506937**
Client : **AUSTRALASIAN MARINE ASSOCIATES PTY LTD**
Contact : DR ADAM COHEN
Address : 42 BARKLY STREET
ST KILDA 3182
Telephone : ----
Project : Darwin Ports Sediment Investigation
Order number : ----
C-O-C number : ----
Sampler : ADAM COHEN
Site : ----
Quote number : EM25AUSMARASS0002
No. of samples received : 43
No. of samples analysed : 43

Page : 1 of 45
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61-2-8784 8555
Date Samples Received : 13-Mar-2025 13:30
Date Analysis Commenced : 14-Mar-2025
Issue Date : 27-Mar-2025 14:36



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Edwandy Fadjjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Soil Preparation, Stafford, QLD
Kirsty Watson	Senior Chemist - Organics	Brisbane Organics, Stafford, QLD
Kirsty Watson	Senior Chemist - Organics	Brisbane Soil Preparation, Stafford, QLD



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- EP080-SD: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP132-B-SD : LOR is raised due to high amount of moistures is present.
- EP132B-SD : LOR is raised due to high amount of moistures is present.
- EP080-SD: Surrogate recovery bias low due to sample matrix interferences, confirmed by re-extraction and re-analysis.
- ASS: EA029 (SPOCAS): Retained Acidity not required because pH KCl greater than or equal to 4.5
- EP090 – Organotin Analysis: Sample 'EAW 7_0-0.5m' (ES2506937-026) shows poor matrix spike recovery due to matrix interference.
- EP090 – Organotin Analysis: Sample 'MSB 2_0-0.5m' (ES2506937-002) shows poor matrix spike recovery due to matrix interference.
- EP090 – Organotin Analysis: Sample 'EAW 3_0-0.5m' (ES2506937-019) shows poor matrix spike recovery due to matrix interference. Confirmed by re-extraction and re-analysis.
- EG020SD (Total Metals in Sediments by ICP-MS): EB2508871-001 shows poor duplicate results due to sample heterogeneity. This has been confirmed by visual inspection.
- ASS: EA029 (SPOCAS): Laboratory determinations of ANC needs to be corroborated by effectiveness of the measured ANC in relation to incubation ANC. Unless corroborated, the results of ANC testing should be discounted when determining Net Acidity for comparison with action criteria, or for the determination of the acidity hazard and required liming amounts.
- ASS: EA029 (SPOCAS): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO₃) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from kg/t dry weight to kg/m³ in-situ soil, multiply reported results x wet bulk density of soil in t/m³.



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MSB 1_0-0.5m	MSB 2_0-0.5m	MSB 3_0-0.5m	MSB 4_0-0.5m	MSB 5_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-001	ES2506937-002	ES2506937-003	ES2506937-004	ES2506937-005
				Result	Result	Result	Result	Result
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	8.8	8.8	8.8	8.9	8.9
pH OX (23B)	----	0.1	pH Unit	8.2	8.2	8.2	8.3	8.3
EA029-B: Acidity Trail								
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
Titrateable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	<2	<2	<2
Titrateable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
sulfidic - Titrateable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
sulfidic - Titrateable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	0.148	0.142	0.150	0.166	0.155
Peroxide Sulfur (23De)	----	0.020	% S	0.582	0.447	0.405	0.428	0.390
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	0.434	0.305	0.255	0.262	0.236
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	271	190	159	164	147
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	0.264	0.262	0.292	0.265	0.284
Peroxide Calcium (23Wh)	----	0.020	% Ca	5.79	4.16	5.15	4.68	5.57
Acid Reacted Calcium (23X)	----	0.020	% Ca	5.53	3.90	4.86	4.41	5.29
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	2760	1940	2420	2200	2640
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	4.42	3.12	3.89	3.53	4.23
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	0.221	0.249	0.243	0.276	0.248
Peroxide Magnesium (23Tm)	----	0.020	% Mg	0.572	0.602	0.632	0.628	0.659
Acid Reacted Magnesium (23U)	----	0.020	% Mg	0.350	0.353	0.388	0.353	0.411
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	288	290	320	290	338
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	0.462	0.465	0.512	0.465	0.542



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MSB 1_0-0.5m	MSB 2_0-0.5m	MSB 3_0-0.5m	MSB 4_0-0.5m	MSB 5_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-001	ES2506937-002	ES2506937-003	ES2506937-004	ES2506937-005
				Result	Result	Result	Result	Result
EA029-F: Excess Acid Neutralising Capacity								
Excess Acid Neutralising Capacity (23Q)	----	0.020	% CaCO ₃	13.9	11.6	13.8	12.7	13.9
acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H ⁺ / t	2780	2310	2760	2540	2780
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.020	% S	4.45	3.70	4.41	4.06	4.45
EA029-H: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H ⁺ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO ₃ /t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.43	0.30	0.26	0.26	0.24
Net Acidity excluding ANC (acidity units)	----	10	mole H ⁺ / t	271	190	159	164	147
Liming Rate excluding ANC	----	1	kg CaCO ₃ /t	20	14	12	12	11
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	60.3	67.6	68.1	64.5	65.1
EA150: Particle Sizing								
+75µm	----	1	%	31	1	2	4	5
+150µm	----	1	%	28	<1	<1	2	2
+300µm	----	1	%	26	<1	<1	1	<1
+425µm	----	1	%	24	<1	<1	<1	<1
+600µm	----	1	%	22	<1	<1	<1	<1
+1180µm	----	1	%	17	<1	<1	<1	<1
+2.36mm	----	1	%	10	<1	<1	<1	<1
+4.75mm	----	1	%	4	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MSB 1_0-0.5m	MSB 2_0-0.5m	MSB 3_0-0.5m	MSB 4_0-0.5m	MSB 5_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-001	ES2506937-002	ES2506937-003	ES2506937-004	ES2506937-005
				Result	Result	Result	Result	Result
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	69	99	98	96	95
Sand (>75 µm)	----	1	%	19	1	2	4	5
Gravel (>2mm)	----	1	%	12	<1	<1	<1	<1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	13.1	11.6	14.1	12.8	12.3
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	45.1	50.5	53.9	50.8	49.7
Copper	7440-50-8	1.0	mg/kg	14.6	11.5	13.0	12.4	12.2
Lead	7439-92-1	1.0	mg/kg	13.2	13.7	15.0	13.9	13.9
Nickel	7440-02-0	1.0	mg/kg	13.5	15.1	16.4	15.4	14.7
Zinc	7440-66-6	1.0	mg/kg	47.7	41.4	44.9	43.6	42.3
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.02	0.02	0.02	0.02	0.02
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.40	1.51	1.45	1.42	1.44
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg	19	27	31	38	42
C29 - C36 Fraction	----	5	mg/kg	15	18	20	34	30
[^] C10 - C36 Fraction (sum)	----	3	mg/kg	34	45	51	72	72
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	<3	<3	<3
>C10 - C16 Fraction	----	3	mg/kg	<5	<5	<5	<5	<5
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0
>C16 - C34 Fraction	----	3	mg/kg	26	35	40	53	56



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MSB 1_0-0.5m	MSB 2_0-0.5m	MSB 3_0-0.5m	MSB 4_0-0.5m	MSB 5_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-001	ES2506937-002	ES2506937-003	ES2506937-004	ES2506937-005
				Result	Result	Result	Result	Result
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons - Continued								
>C34 - C40 Fraction	----	5	mg/kg	12	12	14	22	18
^ >C10 - C40 Fraction (sum)	----	3	mg/kg	38	47	54	75	74
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	83-32-9	4	µg/kg	<5	<5	<5	<5	<5
Fluorene	86-73-7	4	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	85-01-8	4	µg/kg	<5	<5	<5	<5	<5
Anthracene	120-12-7	4	µg/kg	<5	<5	<5	<5	<5
Fluoranthene	206-44-0	4	µg/kg	<5	<5	<5	<5	<5
Pyrene	129-00-0	4	µg/kg	<5	<5	<5	5	<5
Benz(a)anthracene	56-55-3	4	µg/kg	<5	<5	<5	<5	<5
Chrysene	218-01-9	4	µg/kg	<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MSB 1_0-0.5m	MSB 2_0-0.5m	MSB 3_0-0.5m	MSB 4_0-0.5m	MSB 5_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-001	ES2506937-002	ES2506937-003	ES2506937-004	ES2506937-005
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<5	<5	<5	<5	<5
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<5	<5	<5	<5	<5
Benzo(e)pyrene	192-97-2	4	µg/kg	<5	<5	<5	<5	<5
Benzo(a)pyrene	50-32-8	4	µg/kg	<5	<5	<5	<5	<5
Perylene	198-55-0	4	µg/kg	<5	<5	<5	<5	<5
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<5	<5	<5	<5	<5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<5	<5	<5	<5	<5
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<5	<5	<5	<5	<5
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	<5	<5	<5	5	<5
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<5	<5	<5	<5	<5
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	<5	<5	<5	<5	<5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	10	10	10	10
EP080-SD: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.2	%	82.4	90.9	96.6	91.2	80.3
Toluene-D8	2037-26-5	0.2	%	81.0	96.1	100	88.4	81.1
4-Bromofluorobenzene	460-00-4	0.2	%	100	119	124	111	103
EP090S: Organotin Surrogate								
Tripopyltin	----	0.5	%	95.6	93.2	65.7	58.9	66.0
EP132T: Base/Neutral Extractable Surrogates - SD								
2-Fluorobiphenyl	321-60-8	10	%	77.3	102	77.8	81.7	89.6
Anthracene-d10	1719-06-8	10	%	112	119	99.9	112	125
4-Terphenyl-d14	1718-51-0	10	%	110	113	88.2	96.9	120



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MSB 6_0-0.5m	MSB 7_0-0.5m	MEC 1_0-0.5m	MEC 1_0.5-1.0m	MEC 2_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-006	ES2506937-007	ES2506937-008	ES2506937-009	ES2506937-010
				Result	Result	Result	Result	Result
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	8.9	8.9	9.7	9.6	9.7
pH OX (23B)	----	0.1	pH Unit	8.3	8.3	9.7	9.5	9.6
EA029-B: Acidity Trail								
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
Titrateable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	<2	<2	<2
Titrateable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
sulfidic - Titrateable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
sulfidic - Titrateable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	0.129	0.123	0.049	0.051	0.046
Peroxide Sulfur (23De)	----	0.020	% S	0.356	0.304	0.103	0.104	0.098
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	0.228	0.181	0.054	0.053	0.051
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	142	113	34	33	32
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	0.254	0.277	0.149	0.155	0.145
Peroxide Calcium (23Wh)	----	0.020	% Ca	5.24	5.02	11.3	12.0	11.0
Acid Reacted Calcium (23X)	----	0.020	% Ca	4.99	4.75	11.2	11.8	10.8
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	2490	2370	5580	5910	5410
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	3.99	3.80	8.94	9.48	8.67
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	0.223	0.197	0.056	0.060	0.057
Peroxide Magnesium (23Tm)	----	0.020	% Mg	0.548	0.519	0.318	0.334	0.312
Acid Reacted Magnesium (23U)	----	0.020	% Mg	0.325	0.322	0.262	0.274	0.255
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	267	265	215	225	210
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	0.429	0.425	0.345	0.361	0.336



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MSB 6_0-0.5m	MSB 7_0-0.5m	MEC 1_0-0.5m	MEC 1_0.5-1.0m	MEC 2_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-006	ES2506937-007	ES2506937-008	ES2506937-009	ES2506937-010
				Result	Result	Result	Result	Result
EA029-F: Excess Acid Neutralising Capacity								
Excess Acid Neutralising Capacity (23Q)	----	0.020	% CaCO ₃	13.4	13.2	38.0	45.1	45.0
acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	2680	2640	7590	9010	9000
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.020	% S	4.29	4.23	12.2	14.4	14.4
EA029-H: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO ₃ /t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.23	0.18	0.05	0.05	0.05
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	142	113	34	33	32
Liming Rate excluding ANC	----	1	kg CaCO ₃ /t	11	8	2	2	2
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	65.7	63.7	28.2	30.7	28.9
EA150: Particle Sizing								
+75µm	----	1	%	6	16	98	98	98
+150µm	----	1	%	3	11	98	97	97
+300µm	----	1	%	<1	7	91	89	82
+425µm	----	1	%	<1	5	66	64	55
+600µm	----	1	%	<1	3	45	41	35
+1180µm	----	1	%	<1	1	17	15	11
+2.36mm	----	1	%	<1	<1	4	4	2
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MSB 6_0-0.5m	MSB 7_0-0.5m	MEC 1_0-0.5m	MEC 1_0.5-1.0m	MEC 2_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-006	ES2506937-007	ES2506937-008	ES2506937-009	ES2506937-010
				Result	Result	Result	Result	Result
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	94	84	2	2	2
Sand (>75 µm)	----	1	%	6	16	90	91	93
Gravel (>2mm)	----	1	%	<1	<1	8	7	5
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	14.3	14.2	77.7	71.3	69.4
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	39.0	39.3	27.7	19.6	24.8
Copper	7440-50-8	1.0	mg/kg	12.0	11.7	2.3	2.1	2.0
Lead	7439-92-1	1.0	mg/kg	13.8	12.2	5.2	4.9	4.9
Nickel	7440-02-0	1.0	mg/kg	12.6	12.6	4.3	4.0	4.4
Zinc	7440-66-6	1.0	mg/kg	47.9	37.2	6.7	5.7	6.8
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.02	0.01	<0.01	<0.01	<0.01
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.28	1.23	0.10	0.12	1.10
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg	26	27	4	4	4
C29 - C36 Fraction	----	5	mg/kg	20	18	<5	<5	<5
[^] C10 - C36 Fraction (sum)	----	3	mg/kg	46	45	4	4	4
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	<3	<3	<3
>C10 - C16 Fraction	----	3	mg/kg	<5	<5	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0
>C16 - C34 Fraction	----	3	mg/kg	35	35	5	4	4



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MSB 6_0-0.5m	MSB 7_0-0.5m	MEC 1_0-0.5m	MEC 1_0.5-1.0m	MEC 2_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-006	ES2506937-007	ES2506937-008	ES2506937-009	ES2506937-010
				Result	Result	Result	Result	Result
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons - Continued								
>C34 - C40 Fraction	----	5	mg/kg	13	12	<5	<5	<5
^ >C10 - C40 Fraction (sum)	----	3	mg/kg	48	47	5	4	4
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<5	<5	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<5	<5	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<5	<5	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	<5	<5	<4	<4	<4
Anthracene	120-12-7	4	µg/kg	<5	<5	<4	<4	<4
Fluoranthene	206-44-0	4	µg/kg	<5	<5	<4	<4	<4
Pyrene	129-00-0	4	µg/kg	<5	<5	<4	<4	<4
Benz(a)anthracene	56-55-3	4	µg/kg	<5	<5	<4	<4	<4
Chrysene	218-01-9	4	µg/kg	<5	<5	<4	<4	<4



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MSB 6_0-0.5m	MSB 7_0-0.5m	MEC 1_0-0.5m	MEC 1_0.5-1.0m	MEC 2_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-006	ES2506937-007	ES2506937-008	ES2506937-009	ES2506937-010
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<5	<5	<4	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<5	<5	<4	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg	<5	<5	<4	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	<5	<5	<4	<4	<4
Perylene	198-55-0	4	µg/kg	<5	<5	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<5	<5	<4	<4	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<5	<5	<4	<4	<4
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<5	<5	<4	<4	<4
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	<5	<5	<4	<4	<4
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<5	<5	<4	<4	<4
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	<5	<5	5	5	5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	10	10	10	10
EP080-SD: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.2	%	98.7	70.9	78.7	89.5	82.6
Toluene-D8	2037-26-5	0.2	%	100	74.3	84.6	92.6	80.9
4-Bromofluorobenzene	460-00-4	0.2	%	120	90.2	98.2	110	118
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	96.2	104	78.9	103	96.8
EP132T: Base/Neutral Extractable Surrogates - SD								
2-Fluorobiphenyl	321-60-8	10	%	79.1	81.9	73.1	73.8	91.0
Anthracene-d10	1719-06-8	10	%	103	120	87.5	101	85.9
4-Terphenyl-d14	1718-51-0	10	%	98.3	116	90.9	103	90.1



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MEC 2_0.5-1.0m	MEC 3_0-0.5m	MEC 4_0-0.5m	MEC 5_0-0.5m	MEC 6_0-0.5m
Sampling date / time				10-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-011	ES2506937-012	ES2506937-013	ES2506937-014	ES2506937-015
				Result	Result	Result	Result	Result
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	9.6	9.6	9.6	9.6	9.6
pH OX (23B)	----	0.1	pH Unit	9.5	9.4	9.6	9.4	9.6
EA029-B: Acidity Trail								
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
Titrateable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	<2	<2	<2
Titrateable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
sulfidic - Titrateable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
sulfidic - Titrateable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	0.061	0.069	0.059	0.061	0.052
Peroxide Sulfur (23De)	----	0.020	% S	0.110	0.092	0.090	0.102	0.075
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	0.050	0.024	0.031	0.041	0.024
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	31	15	20	25	15
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	0.153	0.182	0.159	0.156	0.152
Peroxide Calcium (23Wh)	----	0.020	% Ca	11.3	9.49	10.2	9.84	8.44
Acid Reacted Calcium (23X)	----	0.020	% Ca	11.2	9.31	10.0	9.69	8.29
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	5570	4640	5000	4830	4140
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	8.93	7.45	8.02	7.75	6.63
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	0.074	0.084	0.070	0.074	0.063
Peroxide Magnesium (23Tm)	----	0.020	% Mg	0.342	0.295	0.280	0.243	0.227
Acid Reacted Magnesium (23U)	----	0.020	% Mg	0.268	0.211	0.210	0.170	0.164
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	220	173	172	139	135
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	0.354	0.278	0.277	0.224	0.217



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MEC 2_0.5-1.0m	MEC 3_0-0.5m	MEC 4_0-0.5m	MEC 5_0-0.5m	MEC 6_0-0.5m
Sampling date / time				10-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-011	ES2506937-012	ES2506937-013	ES2506937-014	ES2506937-015
				Result	Result	Result	Result	Result
EA029-F: Excess Acid Neutralising Capacity								
Excess Acid Neutralising Capacity (23Q)	----	0.020	% CaCO ₃	43.5	39.6	46.6	37.8	40.8
acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H ⁺ / t	8690	7910	9300	7540	8150
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.020	% S	13.9	12.7	14.9	12.1	13.1
EA029-H: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H ⁺ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO ₃ /t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.05	0.02	0.03	0.04	0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H ⁺ / t	31	15	20	25	15
Liming Rate excluding ANC	----	1	kg CaCO ₃ /t	2	1	1	2	1
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	34.6	37.3	33.3	38.0	34.3
EA150: Particle Sizing								
+75µm	----	1	%	97	98	98	97	96
+150µm	----	1	%	96	96	97	96	95
+300µm	----	1	%	83	82	92	84	87
+425µm	----	1	%	59	60	75	63	69
+600µm	----	1	%	41	42	54	46	53
+1180µm	----	1	%	15	16	22	19	30
+2.36mm	----	1	%	3	3	6	4	13
+4.75mm	----	1	%	1	<1	<1	<1	3
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				MEC 2_0.5-1.0m	MEC 3_0-0.5m	MEC 4_0-0.5m	MEC 5_0-0.5m	MEC 6_0-0.5m
Sampling date / time				10-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-011	ES2506937-012	ES2506937-013	ES2506937-014	ES2506937-015
				Result	Result	Result	Result	Result
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	3	2	2	3	4
Sand (>75 µm)	----	1	%	90	91	87	88	78
Gravel (>2mm)	----	1	%	7	7	11	9	18
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	68.1	49.5	48.8	62.4	63.4
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	17.5	11.5	11.8	16.8	31.8
Copper	7440-50-8	1.0	mg/kg	2.0	1.5	1.5	1.8	2.3
Lead	7439-92-1	1.0	mg/kg	4.8	3.6	3.5	4.6	5.9
Nickel	7440-02-0	1.0	mg/kg	3.8	2.8	3.2	3.6	3.9
Zinc	7440-66-6	1.0	mg/kg	6.2	5.5	6.0	5.9	6.0
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.13	0.14	0.10	0.23	0.10
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg	4	5	5	4	3
C29 - C36 Fraction	----	5	mg/kg	<5	<5	<5	<5	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg	4	5	5	4	3
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	<3	<3	<3
>C10 - C16 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0
>C16 - C34 Fraction	----	3	mg/kg	4	6	5	4	3



Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	MEC 2_0.5-1.0m	MEC 3_0-0.5m	MEC 4_0-0.5m	MEC 5_0-0.5m	MEC 6_0-0.5m
Sampling date / time					10-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit		ES2506937-011	ES2506937-012	ES2506937-013	ES2506937-014	ES2506937-015
					Result	Result	Result	Result	Result
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons - Continued									
>C34 - C40 Fraction	----	5	mg/kg		<5	<5	<5	<5	<5
[^] >C10 - C40 Fraction (sum)	----	3	mg/kg		4	6	5	4	3
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
[^] Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
[^] Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg		<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	<5	<5	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg		<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg		<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg		<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg		<4	<4	<4	<4	<4
Anthracene	120-12-7	4	µg/kg		<4	<4	<4	<4	<4
Fluoranthene	206-44-0	4	µg/kg		<4	<4	<4	<4	<4
Pyrene	129-00-0	4	µg/kg		<4	<4	<4	<4	<4
Benz(a)anthracene	56-55-3	4	µg/kg		<4	<4	<4	<4	<4
Chrysene	218-01-9	4	µg/kg		<4	<4	<4	<4	<4



Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	MEC 2_0.5-1.0m	MEC 3_0-0.5m	MEC 4_0-0.5m	MEC 5_0-0.5m	MEC 6_0-0.5m
Sampling date / time					10-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit		ES2506937-011	ES2506937-012	ES2506937-013	ES2506937-014	ES2506937-015
					Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		<4	<4	<4	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg		<4	<4	<4	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg		<4	<4	<4	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg		<4	<4	<4	<4	<4
Perylene	198-55-0	4	µg/kg		<4	<4	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg		<4	<4	<4	<4	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg		<4	<4	<4	<4	<4
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		<4	<4	<4	<4	<4
Coronene	191-07-1	5	µg/kg		<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg		<4	<4	<4	<4	<4
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg		<4	<4	<4	<4	<4
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg		5	5	5	5	5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg		10	10	10	10	10
EP080-SD: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		126	78.4	83.0	81.1	90.1
Toluene-D8	2037-26-5	0.2	%		103	86.8	87.9	85.5	114
4-Bromofluorobenzene	460-00-4	0.2	%		101	103	108	103	124
EP090S: Organotin Surrogate									
Tripopyltin	----	0.5	%		108	101	93.8	93.3	63.0
EP132T: Base/Neutral Extractable Surrogates - SD									
2-Fluorobiphenyl	321-60-8	10	%		90.3	70.6	70.9	91.4	83.4
Anthracene-d10	1719-06-8	10	%		81.3	81.8	84.6	78.6	91.7
4-Terphenyl-d14	1718-51-0	10	%		77.6	85.9	88.3	83.6	82.4



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 1_0-0.5m	EAW 2_0-0.5m	EAW 2_0.5-1.0m	EAW 3_0-0.5m	EAW 3_0.5-1.0m
Sampling date / time				11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-016	ES2506937-017	ES2506937-018	ES2506937-019	ES2506937-020
				Result	Result	Result	Result	Result
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	9.1	----	9.0	8.9	9.0
pH OX (23B)	----	0.1	pH Unit	8.6	----	8.3	8.2	8.2
EA029-B: Acidity Trail								
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	----	<2	<2	<2
Titrateable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	----	<2	<2	<2
Titrateable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	----	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	----	<0.020	<0.020	<0.020
sulfidic - Titrateable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	<0.020	----	<0.020	<0.020	<0.020
sulfidic - Titrateable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	<0.020	----	<0.020	<0.020	<0.020
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	0.094	----	0.109	0.137	0.107
Peroxide Sulfur (23De)	----	0.020	% S	0.228	----	0.474	0.334	0.357
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	0.133	----	0.366	0.196	0.250
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	83	----	228	122	156
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	0.221	----	0.259	0.295	0.245
Peroxide Calcium (23Wh)	----	0.020	% Ca	5.74	----	8.97	7.54	6.88
Acid Reacted Calcium (23X)	----	0.020	% Ca	5.52	----	8.71	7.24	6.64
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	2750	----	4350	3610	3310
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	4.42	----	6.97	5.80	5.31
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	0.124	----	0.164	0.210	0.174
Peroxide Magnesium (23Tm)	----	0.020	% Mg	0.398	----	0.617	0.595	0.547
Acid Reacted Magnesium (23U)	----	0.020	% Mg	0.275	----	0.453	0.385	0.373
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	226	----	373	317	307
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	0.362	----	0.598	0.508	0.492



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 1_0-0.5m	EAW 2_0-0.5m	EAW 2_0.5-1.0m	EAW 3_0-0.5m	EAW 3_0.5-1.0m
Sampling date / time				11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-016	ES2506937-017	ES2506937-018	ES2506937-019	ES2506937-020
				Result	Result	Result	Result	Result
EA029-F: Excess Acid Neutralising Capacity								
Excess Acid Neutralising Capacity (23Q)	----	0.020	% CaCO ₃	15.2	----	25.0	24.3	24.9
acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H ⁺ / t	3040	----	5000	4850	4980
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.020	% S	4.87	----	8.01	7.77	7.97
EA029-H: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	----	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H ⁺ / t	<10	----	<10	<10	<10
Liming Rate	----	1	kg CaCO ₃ /t	<1	----	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.13	----	0.36	0.20	0.25
Net Acidity excluding ANC (acidity units)	----	10	mole H ⁺ / t	83	----	228	122	156
Liming Rate excluding ANC	----	1	kg CaCO ₃ /t	6	----	17	9	12
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	51.6	59.4	52.2	63.8	54.1
EA150: Particle Sizing								
+75µm	----	1	%	64	21	22	----	12
+150µm	----	1	%	50	8	7	----	6
+300µm	----	1	%	14	2	2	----	2
+425µm	----	1	%	8	2	2	----	2
+600µm	----	1	%	6	1	1	----	2
+1180µm	----	1	%	4	<1	<1	----	1
+2.36mm	----	1	%	1	<1	<1	----	<1
+4.75mm	----	1	%	<1	<1	<1	----	<1
+9.5mm	----	1	%	<1	<1	<1	----	<1
+19.0mm	----	1	%	<1	<1	<1	----	<1
+37.5mm	----	1	%	<1	<1	<1	----	<1
+75.0mm	----	1	%	<1	<1	<1	----	<1



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 1_0-0.5m	EAW 2_0-0.5m	EAW 2_0.5-1.0m	EAW 3_0-0.5m	EAW 3_0.5-1.0m
Sampling date / time				11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-016	ES2506937-017	ES2506937-018	ES2506937-019	ES2506937-020
				Result	Result	Result	Result	Result
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	36	79	78	----	88
Sand (>75 µm)	----	1	%	62	21	22	----	11
Gravel (>2mm)	----	1	%	2	<1	<1	----	1
Cobbles (>6cm)	----	1	%	<1	<1	<1	----	<1
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	7.79	11.0	10.9	9.71	11.3
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	32.6	37.2	37.6	47.1	44.1
Copper	7440-50-8	1.0	mg/kg	6.5	8.0	9.0	11.2	12.5
Lead	7439-92-1	1.0	mg/kg	7.9	9.2	10.0	11.1	11.8
Nickel	7440-02-0	1.0	mg/kg	9.8	11.0	10.8	13.6	12.4
Zinc	7440-66-6	1.0	mg/kg	25.3	28.8	30.0	38.4	39.7
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.01	0.01	0.01	0.01	0.02
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.66	1.20	0.98	1.19	1.04
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg	13	24	15	24	17
C29 - C36 Fraction	----	5	mg/kg	8	18	11	17	14
^ C10 - C36 Fraction (sum)	----	3	mg/kg	21	42	26	41	31
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	<3	<3	<3
>C10 - C16 Fraction	----	3	mg/kg	<5	<5	<5	<5	<5
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0
>C16 - C34 Fraction	----	3	mg/kg	17	32	20	32	24



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 1_0-0.5m	EAW 2_0-0.5m	EAW 2_0.5-1.0m	EAW 3_0-0.5m	EAW 3_0.5-1.0m
Sampling date / time				11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-016	ES2506937-017	ES2506937-018	ES2506937-019	ES2506937-020
				Result	Result	Result	Result	Result
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons - Continued								
>C34 - C40 Fraction	----	5	mg/kg	6	12	7	11	9
[^] >C10 - C40 Fraction (sum)	----	3	mg/kg	23	44	27	43	33
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
[^] Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
[^] Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	83-32-9	4	µg/kg	<5	<5	<5	<5	<5
Fluorene	86-73-7	4	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	85-01-8	4	µg/kg	<5	<5	<5	<5	<5
Anthracene	120-12-7	4	µg/kg	<5	<5	<5	<5	<5
Fluoranthene	206-44-0	4	µg/kg	<5	<5	7	<5	<5
Pyrene	129-00-0	4	µg/kg	<5	<5	7	<5	<5
Benz(a)anthracene	56-55-3	4	µg/kg	<5	<5	<5	<5	<5
Chrysene	218-01-9	4	µg/kg	<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 1_0-0.5m	EAW 2_0-0.5m	EAW 2_0.5-1.0m	EAW 3_0-0.5m	EAW 3_0.5-1.0m
Sampling date / time				11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-016	ES2506937-017	ES2506937-018	ES2506937-019	ES2506937-020
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<5	5	<5	<5	<5
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<5	<5	<5	<5	<5
Benzo(e)pyrene	192-97-2	4	µg/kg	<5	<5	<5	<5	<5
Benzo(a)pyrene	50-32-8	4	µg/kg	<5	<5	<5	<5	<5
Perylene	198-55-0	4	µg/kg	<5	<5	<5	<5	<5
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<5	<5	<5	<5	<5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<5	<5	<5	<5	<5
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<5	<5	<5	<5	<5
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	<5	5	14	<5	<5
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<5	<5	<5	<5	<5
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	<5	5	<5	<5	<5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	10	10	10	10
EP080-SD: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.2	%	111	71.7	72.7	97.9	80.3
Toluene-D8	2037-26-5	0.2	%	84.6	83.0	80.2	88.2	96.1
4-Bromofluorobenzene	460-00-4	0.2	%	82.0	105	101	107	110
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	106	91.6	95.2	94.4	101
EP132T: Base/Neutral Extractable Surrogates - SD								
2-Fluorobiphenyl	321-60-8	10	%	89.8	101	82.0	77.9	86.9
Anthracene-d10	1719-06-8	10	%	109	109	96.5	89.0	93.9
4-Terphenyl-d14	1718-51-0	10	%	96.0	83.3	88.0	80.7	89.4



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 4_0-0.5m	EAW 4_0.5-1.0m	EAW 5_0-0.5m	EAW 5_0.5-1.0m	EAW 6_0-0.5m
Sampling date / time				10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-021	ES2506937-022	ES2506937-023	ES2506937-024	ES2506937-025
				Result	Result	Result	Result	Result
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	9.0	9.1	9.0	9.2	9.1
pH OX (23B)	----	0.1	pH Unit	8.3	8.3	8.2	8.3	8.6
EA029-B: Acidity Trail								
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
Titrateable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	<2	<2	<2
Titrateable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
sulfidic - Titrateable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
sulfidic - Titrateable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	0.143	0.116	0.165	0.104	0.066
Peroxide Sulfur (23De)	----	0.020	% S	0.462	0.426	0.390	0.500	0.172
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	0.319	0.309	0.225	0.396	0.105
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	199	193	140	247	66
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	0.247	0.251	0.327	0.229	0.233
Peroxide Calcium (23Wh)	----	0.020	% Ca	7.45	8.22	7.87	7.67	4.70
Acid Reacted Calcium (23X)	----	0.020	% Ca	7.20	7.97	7.54	7.44	4.47
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	3590	3980	3760	3710	2230
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	5.76	6.38	6.03	5.95	3.58
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	0.208	0.181	0.230	0.138	0.107
Peroxide Magnesium (23Tm)	----	0.020	% Mg	0.657	0.595	0.653	0.488	0.291
Acid Reacted Magnesium (23U)	----	0.020	% Mg	0.448	0.413	0.423	0.350	0.184
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	369	340	348	288	152
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	0.592	0.545	0.558	0.462	0.243



Analytical Results

Sub-Matrix: SEDIMENT
(Matrix: SOIL)

Sample ID

				EAW 4_0-0.5m	EAW 4_0.5-1.0m	EAW 5_0-0.5m	EAW 5_0.5-1.0m	EAW 6_0-0.5m
Sampling date / time				10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-021	ES2506937-022	ES2506937-023	ES2506937-024	ES2506937-025
				Result	Result	Result	Result	Result
EA029-F: Excess Acid Neutralising Capacity								
Excess Acid Neutralising Capacity (23Q)	----	0.020	% CaCO ₃	22.0	21.0	21.9	20.3	12.1
acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H ⁺ / t	4390	4200	4380	4060	2420
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.020	% S	7.03	6.73	7.02	6.50	3.88
EA029-H: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H ⁺ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO ₃ /t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.32	0.31	0.22	0.40	0.10
Net Acidity excluding ANC (acidity units)	----	10	mole H ⁺ / t	199	193	140	247	66
Liming Rate excluding ANC	----	1	kg CaCO ₃ /t	15	14	10	18	5
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	59.3	51.7	59.9	48.7	35.3
EA150: Particle Sizing								
+75µm	----	1	%	15	11	11	26	74
+150µm	----	1	%	8	3	6	8	64
+300µm	----	1	%	2	<1	1	2	23
+425µm	----	1	%	1	<1	<1	2	16
+600µm	----	1	%	<1	<1	<1	2	13
+1180µm	----	1	%	<1	<1	<1	1	11
+2.36mm	----	1	%	<1	<1	<1	<1	9
+4.75mm	----	1	%	<1	<1	<1	<1	8
+9.5mm	----	1	%	<1	<1	<1	<1	7
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 4_0-0.5m	EAW 4_0.5-1.0m	EAW 5_0-0.5m	EAW 5_0.5-1.0m	EAW 6_0-0.5m
Sampling date / time				10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-021	ES2506937-022	ES2506937-023	ES2506937-024	ES2506937-025
				Result	Result	Result	Result	Result
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	85	89	89	74	26
Sand (>75 µm)	----	1	%	15	11	11	25	64
Gravel (>2mm)	----	1	%	<1	<1	<1	1	10
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	11.6	10.2	14.7	13.2	10.2
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	44.1	34.3	47.1	41.8	25.0
Copper	7440-50-8	1.0	mg/kg	8.3	10.8	10.4	20.8	5.4
Lead	7439-92-1	1.0	mg/kg	10.6	9.8	10.8	10.7	6.0
Nickel	7440-02-0	1.0	mg/kg	13.1	10.1	13.6	11.6	6.2
Zinc	7440-66-6	1.0	mg/kg	32.2	28.5	38.5	34.0	20.0
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.01	0.01	0.01	0.02	<0.01
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.09	1.00	1.16	0.80	0.58
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg	28	14	33	20	21
C29 - C36 Fraction	----	5	mg/kg	20	13	27	16	21
^ C10 - C36 Fraction (sum)	----	3	mg/kg	48	27	60	36	42
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	<3	<3	<3
>C10 - C16 Fraction	----	3	mg/kg	<5	<5	<5	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0
>C16 - C34 Fraction	----	3	mg/kg	37	20	46	28	31



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 4_0-0.5m	EAW 4_0.5-1.0m	EAW 5_0-0.5m	EAW 5_0.5-1.0m	EAW 6_0-0.5m
Sampling date / time				10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-021	ES2506937-022	ES2506937-023	ES2506937-024	ES2506937-025
				Result	Result	Result	Result	Result
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons - Continued								
>C34 - C40 Fraction	----	5	mg/kg	15	9	18	12	14
[^] >C10 - C40 Fraction (sum)	----	3	mg/kg	52	29	64	40	45
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
[^] Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
[^] Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<5	<5	<5	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<5	<5	<5	<4	<4
Fluorene	86-73-7	4	µg/kg	<5	<5	<5	<4	<4
Phenanthrene	85-01-8	4	µg/kg	<5	<5	<5	<4	<4
Anthracene	120-12-7	4	µg/kg	<5	<5	<5	<4	<4
Fluoranthene	206-44-0	4	µg/kg	<5	<5	<5	<4	<4
Pyrene	129-00-0	4	µg/kg	<5	<5	<5	<4	<4
Benz(a)anthracene	56-55-3	4	µg/kg	<5	<5	<5	<4	<4
Chrysene	218-01-9	4	µg/kg	<5	<5	<5	<4	<4



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 4_0-0.5m	EAW 4_0.5-1.0m	EAW 5_0-0.5m	EAW 5_0.5-1.0m	EAW 6_0-0.5m
Sampling date / time				10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-021	ES2506937-022	ES2506937-023	ES2506937-024	ES2506937-025
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<5	<5	<5	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<5	<5	<5	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg	<5	<5	<5	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	<5	<5	<5	<4	<4
Perylene	198-55-0	4	µg/kg	<5	<5	<5	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<5	<5	<5	<4	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<5	<5	<5	<4	<4
Indeno(1,2,3,cd)pyrene	193-39-5	4	µg/kg	<5	<5	<5	<4	<4
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	<5	<5	<5	<4	<4
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<5	<5	<5	<4	<4
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	<5	<5	<5	5	5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	10	10	10	10
EP080-SD: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.2	%	69.4	124	57.4	73.4	64.9
Toluene-D8	2037-26-5	0.2	%	80.0	91.5	56.1	97.6	81.6
4-Bromofluorobenzene	460-00-4	0.2	%	60.1	98.8	51.2	110	93.3
EP090S: Organotin Surrogate								
Tripopyltin	----	0.5	%	81.6	39.5	37.3	87.4	77.5
EP132T: Base/Neutral Extractable Surrogates - SD								
2-Fluorobiphenyl	321-60-8	10	%	93.3	85.7	91.8	82.5	87.3
Anthracene-d10	1719-06-8	10	%	85.0	86.0	84.3	107	92.0
4-Terphenyl-d14	1718-51-0	10	%	86.0	87.9	86.2	104	81.8



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 7_0-0.5m	FHW 1_0-0.5m	FHW 2_0-0.5m	FHW 2_0.5-1.0m	FHW 3_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-026	ES2506937-027	ES2506937-028	ES2506937-029	ES2506937-030
				Result	Result	Result	Result	Result
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	9.1	9.1	----	9.0	9.0
pH OX (23B)	----	0.1	pH Unit	8.4	8.3	----	8.1	8.2
EA029-B: Acidity Trail								
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	----	<2	<2
Titrateable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	----	<2	<2
Titrateable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	----	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	----	<0.020	<0.020
sulfidic - Titrateable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	<0.020	<0.020	----	<0.020	<0.020
sulfidic - Titrateable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	<0.020	<0.020	----	<0.020	<0.020
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	0.127	0.154	----	0.128	0.172
Peroxide Sulfur (23De)	----	0.020	% S	0.298	0.397	----	0.487	0.394
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	0.170	0.243	----	0.359	0.222
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	106	151	----	224	138
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	0.283	0.332	----	0.313	0.363
Peroxide Calcium (23Wh)	----	0.020	% Ca	8.64	10.8	----	9.07	8.74
Acid Reacted Calcium (23X)	----	0.020	% Ca	8.36	10.4	----	8.76	8.38
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	4170	5210	----	4370	4180
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	6.69	8.35	----	7.01	6.70
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	0.183	0.212	----	0.215	0.226
Peroxide Magnesium (23Tm)	----	0.020	% Mg	0.640	0.740	----	0.761	0.730
Acid Reacted Magnesium (23U)	----	0.020	% Mg	0.457	0.528	----	0.546	0.504
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	376	434	----	449	414
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	0.602	0.696	----	0.720	0.664



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 7_0-0.5m	FHW 1_0-0.5m	FHW 2_0-0.5m	FHW 2_0.5-1.0m	FHW 3_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-026	ES2506937-027	ES2506937-028	ES2506937-029	ES2506937-030
				Result	Result	Result	Result	Result
EA029-F: Excess Acid Neutralising Capacity								
Excess Acid Neutralising Capacity (23Q)	----	0.020	% CaCO3	23.1	26.9	----	24.8	25.5
acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	4620	5370	----	4950	5100
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.020	% S	7.39	8.60	----	7.93	8.17
EA029-H: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	----	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	----	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	----	<10	<10
Liming Rate	----	1	kg CaCO3/t	<1	<1	----	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.17	0.24	----	0.36	0.22
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	106	151	----	224	138
Liming Rate excluding ANC	----	1	kg CaCO3/t	8	11	----	17	10
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	57.1	62.8	63.2	59.9	65.9
EA150: Particle Sizing								
+75µm	----	1	%	34	13	----	6	5
+150µm	----	1	%	21	1	----	<1	<1
+300µm	----	1	%	5	<1	----	<1	<1
+425µm	----	1	%	3	<1	----	<1	<1
+600µm	----	1	%	2	<1	----	<1	<1
+1180µm	----	1	%	<1	<1	----	<1	<1
+2.36mm	----	1	%	<1	<1	----	<1	<1
+4.75mm	----	1	%	<1	<1	----	<1	<1
+9.5mm	----	1	%	<1	<1	----	<1	<1
+19.0mm	----	1	%	<1	<1	----	<1	<1
+37.5mm	----	1	%	<1	<1	----	<1	<1
+75.0mm	----	1	%	<1	<1	----	<1	<1



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 7_0-0.5m	FHW 1_0-0.5m	FHW 2_0-0.5m	FHW 2_0.5-1.0m	FHW 3_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-026	ES2506937-027	ES2506937-028	ES2506937-029	ES2506937-030
				Result	Result	Result	Result	Result
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	66	87	----	94	95
Sand (>75 µm)	----	1	%	34	13	----	6	5
Gravel (>2mm)	----	1	%	<1	<1	----	<1	<1
Cobbles (>6cm)	----	1	%	<1	<1	----	<1	<1
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	9.39	13.4	6.66	5.87	8.70
Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	40.8	33.7	23.8	19.9	31.6
Copper	7440-50-8	1.0	mg/kg	7.8	7.4	6.1	4.9	7.0
Lead	7439-92-1	1.0	mg/kg	9.9	13.9	6.8	5.6	8.6
Nickel	7440-02-0	1.0	mg/kg	11.4	9.9	6.8	5.7	9.4
Zinc	7440-66-6	1.0	mg/kg	30.7	133	21.0	16.6	27.6
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.01	0.04	0.01	<0.01	0.01
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.96	1.14	1.20	1.18	1.10
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg	20	32	26	19	30
C29 - C36 Fraction	----	5	mg/kg	18	20	20	14	23
^ C10 - C36 Fraction (sum)	----	3	mg/kg	38	52	46	33	53
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	<3	<3	<3
>C10 - C16 Fraction	----	3	mg/kg	<5	<5	<5	<5	<5
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0
>C16 - C34 Fraction	----	3	mg/kg	29	41	36	26	40



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 7_0-0.5m	FHW 1_0-0.5m	FHW 2_0-0.5m	FHW 2_0.5-1.0m	FHW 3_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-026	ES2506937-027	ES2506937-028	ES2506937-029	ES2506937-030
				Result	Result	Result	Result	Result
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons - Continued								
>C34 - C40 Fraction	----	5	mg/kg	12	15	15	11	17
^ >C10 - C40 Fraction (sum)	----	3	mg/kg	41	56	51	37	57
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	9	<5	<5	6	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	83-32-9	4	µg/kg	<5	<5	<5	<5	<5
Fluorene	86-73-7	4	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	85-01-8	4	µg/kg	<5	<5	<5	<5	<5
Anthracene	120-12-7	4	µg/kg	<5	<5	<5	<5	<5
Fluoranthene	206-44-0	4	µg/kg	<5	<5	<5	<5	<5
Pyrene	129-00-0	4	µg/kg	5	<5	<5	<5	6
Benz(a)anthracene	56-55-3	4	µg/kg	<5	<5	<5	<5	<5
Chrysene	218-01-9	4	µg/kg	<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				EAW 7_0-0.5m	FHW 1_0-0.5m	FHW 2_0-0.5m	FHW 2_0.5-1.0m	FHW 3_0-0.5m
Sampling date / time				11-Mar-2025 00:00	11-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-026	ES2506937-027	ES2506937-028	ES2506937-029	ES2506937-030
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<5	<5	<5	<5	<5
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<5	<5	<5	<5	<5
Benzo(e)pyrene	192-97-2	4	µg/kg	<5	<5	<5	<5	<5
Benzo(a)pyrene	50-32-8	4	µg/kg	<5	<5	<5	<5	<5
Perylene	198-55-0	4	µg/kg	<5	<5	<5	<5	<5
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<5	<5	<5	<5	<5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<5	<5	<5	<5	<5
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<5	<5	<5	<5	<5
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	14	<5	<5	6	6
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<5	<5	<5	<5	<5
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	<5	<5	<5	<5	<5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	10	10	10	10
EP080-SD: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.2	%	69.4	68.9	66.3	77.5	86.2
Toluene-D8	2037-26-5	0.2	%	71.0	67.1	69.5	74.7	95.8
4-Bromofluorobenzene	460-00-4	0.2	%	55.9	54.4	54.5	56.4	76.1
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	77.4	86.7	92.8	106	90.3
EP132T: Base/Neutral Extractable Surrogates - SD								
2-Fluorobiphenyl	321-60-8	10	%	84.3	85.5	71.8	73.0	83.5
Anthracene-d10	1719-06-8	10	%	85.1	87.3	80.6	93.6	89.8
4-Terphenyl-d14	1718-51-0	10	%	86.9	82.0	77.4	85.8	81.3



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				FHW 3_0.5-1.0m	FHW 4_0-0.5m	FHW 4_0.5-1.0m	FHW 5_0-0.5m	FHW 6_0-0.5m
Sampling date / time				10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-031	ES2506937-032	ES2506937-033	ES2506937-034	ES2506937-035
				Result	Result	Result	Result	Result
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	9.0	8.4	9.0	9.0	9.0
pH OX (23B)	----	0.1	pH Unit	8.1	8.2	8.1	8.2	8.2
EA029-B: Acidity Trail								
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
Titrateable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	<2	<2	<2
Titrateable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
sulfidic - Titrateable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
sulfidic - Titrateable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	0.137	0.164	0.088	0.158	0.158
Peroxide Sulfur (23De)	----	0.020	% S	0.486	0.450	0.371	0.415	0.460
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	0.350	0.286	0.283	0.257	0.302
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	218	178	176	160	188
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	0.311	0.554	0.274	0.343	0.332
Peroxide Calcium (23Wh)	----	0.020	% Ca	9.51	9.64	9.99	9.58	8.92
Acid Reacted Calcium (23X)	----	0.020	% Ca	9.20	9.09	9.72	9.23	8.59
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	4590	4530	4850	4610	4280
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	7.36	7.27	7.77	7.39	6.87
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	0.205	0.240	0.188	0.219	0.224
Peroxide Magnesium (23Tm)	----	0.020	% Mg	0.770	0.758	0.786	0.735	0.718
Acid Reacted Magnesium (23U)	----	0.020	% Mg	0.565	0.518	0.598	0.516	0.494
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	465	426	492	424	406
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	0.745	0.683	0.789	0.680	0.651



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				FHW 3_0.5-1.0m	FHW 4_0-0.5m	FHW 4_0.5-1.0m	FHW 5_0-0.5m	FHW 6_0-0.5m
Sampling date / time				10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-031	ES2506937-032	ES2506937-033	ES2506937-034	ES2506937-035
				Result	Result	Result	Result	Result
EA029-F: Excess Acid Neutralising Capacity								
Excess Acid Neutralising Capacity (23Q)	----	0.020	% CaCO3	26.7	27.7	23.8	27.1	25.7
acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	5340	5530	4750	5420	5130
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.020	% S	8.55	8.85	7.61	8.68	8.22
EA029-H: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.35	0.28	0.28	0.26	0.30
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	218	178	176	160	188
Liming Rate excluding ANC	----	1	kg CaCO3/t	16	13	13	12	14
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	62.4	65.8	56.1	64.7	64.2
EA150: Particle Sizing								
+75µm	----	1	%	6	7	6	8	7
+150µm	----	1	%	<1	1	<1	1	<1
+300µm	----	1	%	<1	<1	<1	<1	<1
+425µm	----	1	%	<1	<1	<1	<1	<1
+600µm	----	1	%	<1	<1	<1	<1	<1
+1180µm	----	1	%	<1	<1	<1	<1	<1
+2.36mm	----	1	%	<1	<1	<1	<1	<1
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				FHW 3_0.5-1.0m	FHW 4_0-0.5m	FHW 4_0.5-1.0m	FHW 5_0-0.5m	FHW 6_0-0.5m
Sampling date / time				10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-031	ES2506937-032	ES2506937-033	ES2506937-034	ES2506937-035
				Result	Result	Result	Result	Result
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	94	93	94	92	93
Sand (>75 µm)	----	1	%	6	7	6	8	7
Gravel (>2mm)	----	1	%	<1	<1	<1	<1	<1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	13.2	13.6	12.2	10.8	12.5
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	51.6	53.8	39.9	39.3	36.9
Copper	7440-50-8	1.0	mg/kg	10.3	10.7	9.4	8.6	8.6
Lead	7439-92-1	1.0	mg/kg	12.5	13.8	12.4	10.2	11.0
Nickel	7440-02-0	1.0	mg/kg	14.8	15.6	11.2	10.7	11.4
Zinc	7440-66-6	1.0	mg/kg	37.4	43.4	36.9	31.3	36.3
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.02	0.02	0.02	0.02	0.02
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.15	1.25	1.22	1.18	1.33
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C10 - C14 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg	21	32	26	26	30
C29 - C36 Fraction	----	5	mg/kg	14	20	21	18	21
^ C10 - C36 Fraction (sum)	----	3	mg/kg	35	52	47	44	51
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	<3	<3	<3
>C10 - C16 Fraction	----	3	mg/kg	<5	<5	<5	<5	<5
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0
>C16 - C34 Fraction	----	3	mg/kg	28	41	36	34	40



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				FHW 3_0.5-1.0m	FHW 4_0-0.5m	FHW 4_0.5-1.0m	FHW 5_0-0.5m	FHW 6_0-0.5m
Sampling date / time				10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-031	ES2506937-032	ES2506937-033	ES2506937-034	ES2506937-035
				Result	Result	Result	Result	Result
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons - Continued								
>C34 - C40 Fraction	----	5	mg/kg	11	15	15	13	15
^ >C10 - C40 Fraction (sum)	----	3	mg/kg	39	56	51	47	55
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	8	12	8	11	11
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<5	<5	<5	<5	<5
Acenaphthene	83-32-9	4	µg/kg	<5	<5	<5	<5	<5
Fluorene	86-73-7	4	µg/kg	<5	<5	<5	<5	<5
Phenanthrene	85-01-8	4	µg/kg	<5	<5	<5	<5	<5
Anthracene	120-12-7	4	µg/kg	<5	<5	<5	<5	<5
Fluoranthene	206-44-0	4	µg/kg	<5	6	5	<5	<5
Pyrene	129-00-0	4	µg/kg	<5	7	6	<5	<5
Benz(a)anthracene	56-55-3	4	µg/kg	<5	<5	<5	<5	<5
Chrysene	218-01-9	4	µg/kg	<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	FHW 3_0.5-1.0m	FHW 4_0-0.5m	FHW 4_0.5-1.0m	FHW 5_0-0.5m	FHW 6_0-0.5m
Sampling date / time					10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00
Compound	CAS Number	LOR	Unit		ES2506937-031	ES2506937-032	ES2506937-033	ES2506937-034	ES2506937-035
					Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		<5	<5	5	<5	<5
Benzo(k)fluoranthene	207-08-9	4	µg/kg		<5	<5	<5	<5	<5
Benzo(e)pyrene	192-97-2	4	µg/kg		<5	<5	<5	<5	<5
Benzo(a)pyrene	50-32-8	4	µg/kg		<5	<5	<5	<5	<5
Perylene	198-55-0	4	µg/kg		<5	<5	<5	<5	<5
Benzo(g,h,i)perylene	191-24-2	4	µg/kg		<5	<5	<5	<5	<5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg		<5	<5	<5	<5	<5
Indeno(1,2,3,cd)pyrene	193-39-5	4	µg/kg		<5	<5	<5	<5	<5
Coronene	191-07-1	5	µg/kg		<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg		8	25	24	11	11
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg		<5	<5	<5	<5	<5
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg		<5	<5	5	<5	<5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg		10	10	10	10	10
EP080-SD: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		64.7	84.2	61.6	80.0	77.4
Toluene-D8	2037-26-5	0.2	%		84.8	95.7	65.2	84.0	81.3
4-Bromofluorobenzene	460-00-4	0.2	%		93.4	69.9	48.0	67.6	61.6
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		88.7	85.3	70.9	96.4	99.5
EP132T: Base/Neutral Extractable Surrogates - SD									
2-Fluorobiphenyl	321-60-8	10	%		88.2	107	73.0	78.3	81.0
Anthracene-d10	1719-06-8	10	%		105	107	88.7	77.6	85.8
4-Terphenyl-d14	1718-51-0	10	%		95.1	109	90.6	96.8	85.1



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				QA1	QA2	QA3	QA4	QA5
Sampling date / time				11-Mar-2025 00:00	10-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-036	ES2506937-037	ES2506937-038	ES2506937-039	ES2506937-040
				Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	-----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	-----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	<1	<1	<1
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	6	<5	8	7	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<5	<4	<5	<5	<5
Acenaphthene	83-32-9	4	µg/kg	<5	<4	<5	<5	<5
Fluorene	86-73-7	4	µg/kg	<5	<4	<5	<5	<5
Phenanthrene	85-01-8	4	µg/kg	<5	<4	<5	<5	<5
Anthracene	120-12-7	4	µg/kg	<5	<4	<5	<5	<5
Fluoranthene	206-44-0	4	µg/kg	<5	<4	<5	<5	<5
Pyrene	129-00-0	4	µg/kg	<5	<4	<5	<5	<5
Benz(a)anthracene	56-55-3	4	µg/kg	<5	<4	<5	<5	<5
Chrysene	218-01-9	4	µg/kg	<5	<4	<5	<5	<5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<5	<4	<5	<5	<5
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<5	<4	<5	<5	<5
Benzo(e)pyrene	192-97-2	4	µg/kg	<5	<4	<5	<5	<5



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				QA1	QA2	QA3	QA4	QA5
Sampling date / time				11-Mar-2025 00:00	10-Mar-2025 00:00	11-Mar-2025 00:00	11-Mar-2025 00:00	10-Mar-2025 00:00
Compound	CAS Number	LOR	Unit	ES2506937-036	ES2506937-037	ES2506937-038	ES2506937-039	ES2506937-040
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(a)pyrene	50-32-8	4	µg/kg	<5	<4	<5	<5	<5
Perylene	198-55-0	4	µg/kg	<5	<4	<5	<5	<5
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<5	<4	<5	<5	<5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<5	<4	<5	<5	<5
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<5	<4	<5	<5	<5
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	6	<4	8	7	<5
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<5	<4	<5	<5	<5
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	<5	5	<5	<5	<5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	10	10	10	10
EP080-SD: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.2	%	116	72.9	75.6	48.0	80.9
Toluene-D8	2037-26-5	0.2	%	86.8	94.8	102	44.7	85.2
4-Bromofluorobenzene	460-00-4	0.2	%	90.1	103	108	38.0	63.7
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	130	96.3	110	104	104
EP132T: Base/Neutral Extractable Surrogates - SD								
2-Fluorobiphenyl	321-60-8	10	%	77.2	73.0	79.6	79.8	81.1
Anthracene-d10	1719-06-8	10	%	102	88.2	84.0	89.2	81.4
4-Terphenyl-d14	1718-51-0	10	%	89.6	80.4	78.1	80.6	83.0



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				QA6	QA7	QA8	----	----
Sampling date / time				10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	----	----
Compound	CAS Number	LOR	Unit	ES2506937-041	ES2506937-042	ES2506937-043	-----	-----
				Result	Result	Result	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	----	53.6	55.0	----	----
Moisture Content	----	0.1	%	66.6	----	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	----	5.31	6.66	----	----
Arsenic	7440-38-2	1.00	mg/kg	13.3	----	----	----	----
Cadmium	7440-43-9	0.1	mg/kg	----	<0.1	<0.1	----	----
Cadmium	7440-43-9	0.1	mg/kg	<0.1	----	----	----	----
Chromium	7440-47-3	1.0	mg/kg	----	16.6	19.1	----	----
Chromium	7440-47-3	1.0	mg/kg	39.6	----	----	----	----
Copper	7440-50-8	1.0	mg/kg	----	4.6	4.6	----	----
Copper	7440-50-8	1.0	mg/kg	11.2	----	----	----	----
Lead	7439-92-1	1.0	mg/kg	----	6.1	6.8	----	----
Lead	7439-92-1	1.0	mg/kg	12.6	----	----	----	----
Nickel	7440-02-0	1.0	mg/kg	----	5.9	6.3	----	----
Nickel	7440-02-0	1.0	mg/kg	11.5	----	----	----	----
Zinc	7440-66-6	1.0	mg/kg	----	17.6	19.4	----	----
Zinc	7440-66-6	1.0	mg/kg	35.2	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	----	0.02	0.01	----	----
Mercury	7439-97-6	0.01	mg/kg	0.02	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.39	----	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	<3	----	----	----	----
C10 - C14 Fraction	----	3	mg/kg	<3	----	----	----	----
C15 - C28 Fraction	----	3	mg/kg	<5	----	----	----	----
C29 - C36 Fraction	----	5	mg/kg	<5	----	----	----	----



Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	QA6	QA7	QA8	----	----
Sampling date / time					10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	----	----
Compound	CAS Number	LOR	Unit		ES2506937-041	ES2506937-042	ES2506937-043	-----	-----
					Result	Result	Result	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons - Continued									
^ C10 - C36 Fraction (sum)	----	3	mg/kg		<5	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	----	----	----	----
>C10 - C16 Fraction	----	3	mg/kg		<5	----	----	----	----
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg		<3.0	----	----	----	----
>C16 - C34 Fraction	----	3	mg/kg		<5	----	----	----	----
>C34 - C40 Fraction	----	5	mg/kg		<5	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	3	mg/kg		<5	----	----	----	----
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	----	----	----
Toluene	108-88-3	0.2	mg/kg		<0.2	----	----	----	----
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.2	----	----	----	----
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	----	----	----	----
^ Total Xylenes	----	0.5	mg/kg		<0.5	----	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	----	----	----	----
Naphthalene	91-20-3	0.2	mg/kg		<0.2	----	----	----	----
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	<1	----	----
Dibutyltin	1002-53-5	1	µgSn/kg		<1	<1	<1	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	<0.5	----	----
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	----	----	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	----	----	----	----
Acenaphthylene	208-96-8	4	µg/kg		<5	----	----	----	----
Acenaphthene	83-32-9	4	µg/kg		<5	----	----	----	----
Fluorene	86-73-7	4	µg/kg		<5	----	----	----	----



Analytical Results

Sub-Matrix: SEDIMENT
 (Matrix: SOIL)

Sample ID

				QA6	QA7	QA8	----	----
Sampling date / time				10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	----	----
Compound	CAS Number	LOR	Unit	ES2506937-041	ES2506937-042	ES2506937-043	-----	-----
				Result	Result	Result	----	----
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Phenanthrene	85-01-8	4	µg/kg	<5	----	----	----	----
Anthracene	120-12-7	4	µg/kg	<5	----	----	----	----
Fluoranthene	206-44-0	4	µg/kg	<5	----	----	----	----
Pyrene	129-00-0	4	µg/kg	<5	----	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg	<5	----	----	----	----
Chrysene	218-01-9	4	µg/kg	<5	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<5	----	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<5	----	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg	<5	----	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg	<5	----	----	----	----
Perylene	198-55-0	4	µg/kg	<5	----	----	----	----
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<5	----	----	----	----
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<5	----	----	----	----
Coronene	191-07-1	5	µg/kg	<5	----	----	----	----
^ Sum of PAHs	----	4	µg/kg	<5	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<5	----	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	<5	----	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	10	----	----	----	----
EP080-SD: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.2	%	73.0	----	----	----	----
Toluene-D8	2037-26-5	0.2	%	77.3	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%	89.9	----	----	----	----
EP090S: Organotin Surrogate								
Tripopyltin	----	0.5	%	95.5	100	89.0	----	----
EP132T: Base/Neutral Extractable Surrogates - SD								
2-Fluorobiphenyl	321-60-8	10	%	70.1	----	----	----	----



Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	QA6	QA7	QA8	----	----
Sampling date / time					10-Mar-2025 00:00	10-Mar-2025 00:00	10-Mar-2025 00:00	----	----
Compound	CAS Number	LOR	Unit		ES2506937-041	ES2506937-042	ES2506937-043	-----	-----
					Result	Result	Result	----	----
EP132T: Base/Neutral Extractable Surrogates - SD - Continued									
Anthracene-d10	1719-06-8	10	%		79.5	----	----	----	----
4-Terphenyl-d14	1718-51-0	10	%		79.0	----	----	----	----



Surrogate Control Limits

Sub-Matrix: SEDIMENT		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080-SD: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	67	137
Toluene-D8	2037-26-5	74	134
4-Bromofluorobenzene	460-00-4	73	137
EP090S: Organotin Surrogate			
Tripopyltin	----	35	130
EP132T: Base/Neutral Extractable Surrogates - SD			
2-Fluorobiphenyl	321-60-8	55	135
Anthracene-d10	1719-06-8	70	136
4-Terphenyl-d14	1718-51-0	57	127

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry / Biology).

- (SOIL) EA029-C: Sulfur Trail
- (SOIL) EA029-E: Magnesium Values
- (SOIL) EA029-D: Calcium Values
- (SOIL) EA029-B: Acidity Trail
- (SOIL) EA029-G: Retained Acidity
- (SOIL) EA029-H: Acid Base Accounting
- (SOIL) EP090: Organotin Compounds
- (SOIL) EP090S: Organotin Surrogate
- (SOIL) EP003: Total Organic Carbon (TOC) in Soil
- (SOIL) EA029-F: Excess Acid Neutralising Capacity
- (SOIL) EA029-A: pH Measurements

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry / Biology). Only applies to samples ES2506937 (042, 043).

- (SOIL) EG020-SD: Total Metals in Sediments by ICPMS
- (SOIL) EG035T: Total Recoverable Mercury by FIMS
- (SOIL) EA055: Moisture Content (Dried @ 105-110°C)

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry / Biology).

- (SOIL) EA150: Soil Classification based on Particle Size
- (SOIL) EA150: Particle Sizing



QUALITY CONTROL REPORT

Work Order	: ES2506937	Page	: 1 of 29
Client	: AUSTRALASIAN MARINE ASSOCIATES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: DR ADAM COHEN	Contact	: Customer Services ES
Address	: 42 BARKLY STREET ST KILDA 3182	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Darwin Ports Sediment Investigation	Date Samples Received	: 13-Mar-2025
Order number	: ----	Date Analysis Commenced	: 14-Mar-2025
C-O-C number	: ----	Issue Date	: 27-Mar-2025
Sampler	: ADAM COHEN		
Site	: ----		
Quote number	: EM25AUSMARASS0002		
No. of samples received	: 43		
No. of samples analysed	: 43		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Edwandy Fadjjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Soil Preparation, Stafford, QLD
Kirsty Watson	Senior Chemist - Organics	Brisbane Organics, Stafford, QLD
Kirsty Watson	Senior Chemist - Organics	Brisbane Soil Preparation, Stafford, QLD



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC
 * = The final LOR has been raised due to dilution or other sample specific cause; adjusted LOR is shown in brackets. The duplicate ranges for Acceptable RPD% are applied to the final LOR where applicable.

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 6440103)									
ES2506937-011	MEC 2_0.5-1.0m	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
ES2506793-041	Anonymous	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.03	0.02	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 6440106)									
ES2506937-021	EAW 4_0-0.5m	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.01	0.01	0.0	No Limit
ES2506937-031	FHW 3_0.5-1.0m	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.02	0.01	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 6443817)									
ES2506937-034	FHW 5_0-0.5m	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.02	0.02	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 6447542)									
ES2506937-042	QA7	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.02	<0.01	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 6452893)									
ES2506937-033	FHW 4_0.5-1.0m	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.02	0.02	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 6458489)									
ES2506937-035	FHW 6_0-0.5m	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.02	0.02	0.0	No Limit
EA029-A: pH Measurements (QC Lot: 6463147)									
ES2506937-001	MSB 1_0-0.5m	EA029: pH KCl (23A)	----	0.1	pH Unit	8.8	8.8	0.0	0% - 20%
		EA029: pH OX (23B)	----	0.1	pH Unit	8.2	8.1	0.0	0% - 20%
ES2506937-011	MEC 2_0.5-1.0m	EA029: pH KCl (23A)	----	0.1	pH Unit	9.6	9.6	0.0	0% - 20%
		EA029: pH OX (23B)	----	0.1	pH Unit	9.5	9.5	0.0	0% - 20%
EA029-A: pH Measurements (QC Lot: 6465391)									
EB2509518-001	Anonymous	EA029: pH KCl (23A)	----	0.1	pH Unit	5.7	5.6	2.7	0% - 20%



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA029-A: pH Measurements (QC Lot: 6465391) - continued									
EB2509518-001	Anonymous	EA029: pH OX (23B)	----	0.1	pH Unit	4.6	4.6	0.0	0% - 20%
ES2506937-025	EAW 6_0-0.5m	EA029: pH KCl (23A)	----	0.1	pH Unit	9.1	8.9	2.5	0% - 20%
		EA029: pH OX (23B)	----	0.1	pH Unit	8.6	8.6	0.0	0% - 20%
EA029-B: Acidity Trail (QC Lot: 6463147)									
ES2506937-001	MSB 1_0-0.5m	EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	<0.020	0.0	No Limit
		EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.020	<0.020	0.0	No Limit
		EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	<0.020	0.0	No Limit
		EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	0.0	No Limit
ES2506937-011	MEC 2_0.5-1.0m	EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	<0.020	0.0	No Limit
		EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.020	<0.020	0.0	No Limit
		EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	<0.020	0.0	No Limit
		EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	0.0	No Limit
EA029-B: Acidity Trail (QC Lot: 6465391)									
EB2509518-001	Anonymous	EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	<0.020	0.0	No Limit
		EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.020	<0.020	0.0	No Limit
		EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	<0.020	0.0	No Limit
		EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	4	5	0.0	No Limit
		EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	7	6	0.0	No Limit
		EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	2	<2	0.0	No Limit
ES2506937-025	EAW 6_0-0.5m	EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	<0.020	0.0	No Limit
		EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.020	<0.020	0.0	No Limit
		EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	<0.020	0.0	No Limit
		EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	0.0	No Limit
EA029-C: Sulfur Trail (QC Lot: 6463147)									
ES2506937-001	MSB 1_0-0.5m	EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	0.148	0.156	5.2	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA029-C: Sulfur Trail (QC Lot: 6463147) - continued									
ES2506937-001	MSB 1_0-0.5m	EA029: Peroxide Sulfur (23De)	----	0.02	% S	0.582	0.575	1.3	0% - 20%
		EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	0.434	0.419	3.6	0% - 20%
		EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	271	261	3.6	0% - 20%
ES2506937-011	MEC 2_0.5-1.0m	EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	0.061	0.061	0.0	No Limit
		EA029: Peroxide Sulfur (23De)	----	0.02	% S	0.110	0.117	6.1	No Limit
		EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	0.050	0.056	12.2	No Limit
		EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	31	35	12.2	No Limit
EA029-C: Sulfur Trail (QC Lot: 6465391)									
EB2509518-001	Anonymous	EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	<0.020	0.0	No Limit
		EA029: Peroxide Sulfur (23De)	----	0.02	% S	<0.020	<0.020	0.0	No Limit
		EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.020	<0.020	0.0	No Limit
		EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	0.0	No Limit
ES2506937-025	EAW 6_0-0.5m	EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	0.066	0.065	1.6	No Limit
		EA029: Peroxide Sulfur (23De)	----	0.02	% S	0.172	0.172	0.0	No Limit
		EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	0.105	0.106	1.1	No Limit
		EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	66	66	0.0	No Limit
EA029-D: Calcium Values (QC Lot: 6463147)									
ES2506937-001	MSB 1_0-0.5m	EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	0.264	0.276	4.5	0% - 50%
		EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	5.79	5.67	2.1	0% - 20%
		EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	5.53	5.39	2.4	0% - 20%
		EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	4.42	4.31	2.4	0% - 20%
		EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	2760	2690	2.4	0% - 20%
ES2506937-011	MEC 2_0.5-1.0m	EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	0.153	0.157	3.0	No Limit
		EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	11.3	11.3	0.2	0% - 20%
		EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	11.2	11.2	0.1	0% - 20%
		EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	8.93	8.94	0.1	0% - 20%
		EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	5570	5580	0.1	0% - 20%
EA029-D: Calcium Values (QC Lot: 6465391)									
EB2509518-001	Anonymous	EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	0.035	0.035	0.0	No Limit
		EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	0.057	0.061	6.8	No Limit
		EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	0.022	0.027	19.9	No Limit
		EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	0.021	7.1	No Limit
		EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	11	13	19.9	No Limit
ES2506937-025	EAW 6_0-0.5m	EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	0.233	0.251	7.5	0% - 50%



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA029-D: Calcium Values (QC Lot: 6465391) - continued									
ES2506937-025	EAW 6_0-0.5m	EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	4.70	4.85	3.0	0% - 20%
		EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	4.47	4.60	2.8	0% - 20%
		EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	3.58	3.68	2.8	0% - 20%
		EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	2230	2300	2.8	0% - 20%
EA029-E: Magnesium Values (QC Lot: 6463147)									
ES2506937-001	MSB 1_0-0.5m	EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	0.221	0.232	4.9	0% - 50%
		EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	0.572	0.609	6.3	0% - 20%
		EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	0.350	0.377	7.2	0% - 50%
		EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	0.462	0.497	7.2	0% - 20%
		EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	288	310	7.2	0% - 20%
ES2506937-011	MEC 2_0.5-1.0m	EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	0.074	0.075	1.8	No Limit
		EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	0.342	0.332	3.1	0% - 50%
		EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	0.268	0.256	4.5	0% - 50%
		EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	0.354	0.338	4.5	0% - 50%
		EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	220	211	4.5	0% - 20%
EA029-E: Magnesium Values (QC Lot: 6465391)									
EB2509518-001	Anonymous	EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.020	<0.020	0.0	No Limit
		EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.020	<0.020	0.0	No Limit
		EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	<0.020	0.0	No Limit
		EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	<0.020	0.0	No Limit
		EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	0.0	No Limit
ES2506937-025	EAW 6_0-0.5m	EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	0.107	0.118	10.4	No Limit
		EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	0.291	0.276	5.4	0% - 50%
		EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	0.184	0.158	15.8	No Limit
		EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	0.243	0.208	15.8	0% - 50%
		EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	152	130	15.8	0% - 50%
EA029-F: Excess Acid Neutralising Capacity (QC Lot: 6463147)									
ES2506937-001	MSB 1_0-0.5m	EA029: Excess Acid Neutralising Capacity (23Q)	----	0.02	% CaCO3	13.9	13.8	0.6	0% - 20%
		EA029: sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.02	% S	4.45	4.42	0.6	0% - 20%



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA029-F: Excess Acid Neutralising Capacity (QC Lot: 6463147) - continued									
ES2506937-001	MSB 1_0-0.5m	EA029: acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	2780	2760	0.6	0% - 20%
ES2506937-011	MEC 2_0.5-1.0m	EA029: Excess Acid Neutralising Capacity (23Q)	----	0.02	% CaCO3	43.5	43.4	0.1	0% - 20%
		EA029: sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.02	% S	13.9	13.9	0.1	0% - 20%
		EA029: acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	8690	8680	0.1	0% - 20%
EA029-F: Excess Acid Neutralising Capacity (QC Lot: 6465391)									
ES2506937-025	EAW 6_0-0.5m	EA029: Excess Acid Neutralising Capacity (23Q)	----	0.02	% CaCO3	12.1	12.2	0.7	0% - 20%
		EA029: sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.02	% S	3.88	3.90	0.7	0% - 20%
		EA029: acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	2420	2440	0.7	0% - 20%
EA029-H: Acid Base Accounting (QC Lot: 6463147)									
ES2506937-001	MSB 1_0-0.5m	EA029: ANC Fineness Factor	----	0.5	-	1.5	1.5	0.0	No Limit
		EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.43	0.42	3.6	0% - 20%
		EA029: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.0	No Limit
		EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	20	20	0.0	0% - 20%
		EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
		EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	271	261	3.6	0% - 20%
ES2506937-011	MEC 2_0.5-1.0m	EA029: ANC Fineness Factor	----	0.5	-	1.5	1.5	0.0	No Limit
		EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.05	0.06	0.0	No Limit
		EA029: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.0	No Limit
		EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	2	3	0.0	No Limit
		EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
		EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	31	35	12.2	No Limit
EA029-H: Acid Base Accounting (QC Lot: 6465391)									
EB2509518-001	Anonymous	EA029: ANC Fineness Factor	----	0.5	-	1.5	1.5	0.0	No Limit
		EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA029: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.0	No Limit
		EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	0.0	No Limit
		EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
		EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
ES2506937-025	EAW 6_0-0.5m	EA029: ANC Fineness Factor	----	0.5	-	1.5	1.5	0.0	No Limit
		EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA029-H: Acid Base Accounting (QC Lot: 6465391) - continued									
ES2506937-025	EAW 6_0-0.5m	EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.10	0.11	0.0	No Limit
		EA029: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.0	No Limit
		EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	5	5	0.0	No Limit
		EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.0	No Limit
		EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	66	66	0.0	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 6440108)									
ES2506793-041	Anonymous	EA055: Moisture Content	----	0.1	%	69.5	71.0	2.1	0% - 20%
ES2506937-004	MSB 4_0-0.5m	EA055: Moisture Content	----	0.1	%	64.5	65.3	1.2	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 6440109)									
ES2506937-016	EAW 1_0-0.5m	EA055: Moisture Content	----	0.1	%	51.6	49.3	4.4	0% - 20%
ES2506937-024	EAW 5_0.5-1.0m	EA055: Moisture Content	----	0.1	%	48.7	52.2	6.9	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 6443828)									
ES2506937-034	FHW 5_0-0.5m	EA055: Moisture Content	----	0.1	%	64.7	65.8	1.7	0% - 20%
ES2507213-001	Anonymous	EA055: Moisture Content	----	0.1 (1.0)*	%	3.5	3.4	3.6	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 6447544)									
EB2508981-001	Anonymous	EA055: Moisture Content	----	0.1	%	23.4	23.6	0.8	0% - 20%
ES2506937-042	QA7	EA055: Moisture Content	----	0.1	%	53.6	52.8	1.5	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 6452897)									
EN2504710-003	Anonymous	EA055: Moisture Content	----	0.1	%	14.0	14.1	0.0	0% - 20%
ES2507384-001	Anonymous	EA055: Moisture Content	----	0.1	%	4.5	4.6	2.6	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 6458494)									
ES2506937-035	FHW 6_0-0.5m	EA055: Moisture Content	----	0.1	%	64.2	63.6	1.0	0% - 20%
ES2508108-001	Anonymous	EA055: Moisture Content	----	0.1 (1.0)*	%	<1.0	<1.0	0.0	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 6465097)									
EB2509772-009	Anonymous	EA055: Moisture Content	----	0.1	%	5.2	5.1	0.0	0% - 20%
ES2506937-031	FHW 3_0.5-1.0m	EA055: Moisture Content	----	0.1	%	62.4	60.2	3.5	0% - 20%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 6440105)									
ES2506937-001	MSB 1_0-0.5m	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	13.1	12.0	8.6	0% - 50%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	45.1	43.6	3.3	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	14.6	13.6	7.0	0% - 50%
		EG020-SD: Lead	7439-92-1	1	mg/kg	13.2	12.4	5.9	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	13.5	13.0	3.4	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	47.7	43.0	10.2	0% - 20%
ES2506937-011	MEC 2_0.5-1.0m	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	68.1	59.6	13.2	0% - 20%

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 6440105) - continued									
ES2506937-011	MEC 2_0.5-1.0m	EG020-SD: Chromium	7440-47-3	1	mg/kg	17.5	18.2	4.0	0% - 50%
		EG020-SD: Copper	7440-50-8	1	mg/kg	2.0	1.8	10.0	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	4.8	4.9	3.2	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	3.8	3.8	0.0	No Limit
		EG020-SD: Zinc	7440-66-6	1	mg/kg	6.2	5.8	7.4	No Limit
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 6440107)									
ES2506937-021	EAW 4_0-0.5m	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	11.6	10.9	5.7	0% - 50%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	44.1	41.7	5.6	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	8.3	9.0	7.1	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	10.6	11.2	5.2	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	13.1	12.0	8.8	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	32.2	30.6	5.0	0% - 20%
ES2506937-031	FHW 3_0.5-1.0m	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	13.2	10.2	25.4	0% - 50%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	51.6	48.4	6.4	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	10.3	8.9	14.9	0% - 50%
		EG020-SD: Lead	7439-92-1	1	mg/kg	12.5	11.7	6.3	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	14.8	14.4	3.0	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	37.4	36.9	1.3	0% - 20%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 6443816)									
ES2506937-034	FHW 5_0-0.5m	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	10.8	10.8	0.0	0% - 50%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	39.3	40.4	2.8	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	8.6	9.1	6.0	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	10.2	10.5	2.6	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	10.7	10.8	1.4	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	31.3	34.4	9.5	0% - 20%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 6447543)									
ES2506937-042	QA7	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	5.31	5.71	7.3	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	16.6	17.3	3.8	0% - 50%
		EG020-SD: Copper	7440-50-8	1	mg/kg	4.6	5.5	16.7	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	6.1	6.5	5.8	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	5.9	6.3	6.1	No Limit
		EG020-SD: Zinc	7440-66-6	1	mg/kg	17.6	18.0	2.2	0% - 50%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 6452892)									



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 6452892) - continued									
ES2506937-033	FHW 4_0.5-1.0m	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	12.2	11.6	5.1	0% - 50%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	39.9	39.6	0.7	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	9.4	9.0	4.6	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	12.4	12.1	2.3	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	11.2	11.0	1.4	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	36.9	34.5	6.7	0% - 20%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 6458488)									
ES2506937-035	FHW 6_0-0.5m	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	12.5	13.8	9.5	0% - 50%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	36.9	38.4	4.2	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	8.6	8.6	0.0	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	11.0	11.4	4.0	0% - 50%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	11.4	12.1	6.2	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	36.3	37.1	2.0	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 6452580)									
ES2506937-001	MSB 1_0-0.5m	EP003: Total Organic Carbon	----	0.02	%	1.40	1.69	18.9	0% - 20%
ES2506937-011	MEC 2_0.5-1.0m	EP003: Total Organic Carbon	----	0.02	%	0.13	0.13	0.0	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 6452581)									
ES2506937-021	EAW 4_0-0.5m	EP003: Total Organic Carbon	----	0.02	%	1.09	1.07	1.5	0% - 20%
ES2506937-031	FHW 3_0.5-1.0m	EP003: Total Organic Carbon	----	0.02	%	1.15	1.11	3.7	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 6452582)									
ES2506937-041	QA6	EP003: Total Organic Carbon	----	0.02	%	1.39	1.35	2.9	0% - 20%
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 6438374)									
ES2506937-001	MSB 1_0-0.5m	EP071-SD-SV: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD-SV: C15 - C28 Fraction	----	3 (5)*	mg/kg	19	23	19.2	No Limit
		EP071-SD-SV: C10 - C36 Fraction (sum)	----	3 (5)*	mg/kg	34	41	18.7	No Limit
		EP071-SD-SV: C29 - C36 Fraction	----	5	mg/kg	15	18	16.0	No Limit
ES2506937-011	MEC 2_0.5-1.0m	EP071-SD-SV: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD-SV: C15 - C28 Fraction	----	3	mg/kg	4	5	0.0	No Limit
		EP071-SD-SV: C10 - C36 Fraction (sum)	----	3	mg/kg	4	5	22.2	No Limit
		EP071-SD-SV: C29 - C36 Fraction	----	5	mg/kg	<5	<5	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 6438376)									
ES2506937-021	EAW 4_0-0.5m	EP071-SD-SV: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD-SV: C15 - C28 Fraction	----	3 (5)*	mg/kg	28	31	9.6	No Limit
		EP071-SD-SV: C10 - C36 Fraction (sum)	----	3 (5)*	mg/kg	48	54	11.8	0% - 50%
		EP071-SD-SV: C29 - C36 Fraction	----	5	mg/kg	20	23	12.1	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 6438376) - continued									
ES2506937-031	FHW 3_0.5-1.0m	EP071-SD-SV: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD-SV: C15 - C28 Fraction	----	3 (5)*	mg/kg	21	19	11.4	No Limit
		EP071-SD-SV: C10 - C36 Fraction (sum)	----	3 (5)*	mg/kg	35	30	15.4	No Limit
		EP071-SD-SV: C29 - C36 Fraction	----	5	mg/kg	14	11	23.1	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 6438378)									
ES2506937-040	QA5	EP071-SD-SV: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD-SV: C15 - C28 Fraction	----	3 (5)*	mg/kg	<5	<5	0.0	No Limit
		EP071-SD-SV: C10 - C36 Fraction (sum)	----	3 (5)*	mg/kg	<5	<5	0.0	No Limit
		EP071-SD-SV: C29 - C36 Fraction	----	5	mg/kg	<5	<5	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 6439303)									
ES2506937-001	MSB 1_0-0.5m	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
ES2506937-011	MEC 2_0.5-1.0m	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 6439306)									
ES2506937-021	EAW 4_0-0.5m	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
ES2506937-031	FHW 3_0.5-1.0m	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 6442074)									
ES2507194-001	Anonymous	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 6438374)									
ES2506937-001	MSB 1_0-0.5m	EP071-SD-SV: >C10 - C16 Fraction	----	3 (5)*	mg/kg	<5	<5	0.0	No Limit
		EP071-SD-SV: >C16 - C34 Fraction	----	3 (5)*	mg/kg	26	31	20.2	No Limit
		EP071-SD-SV: >C10 - C40 Fraction (sum)	----	3 (5)*	mg/kg	38	43	12.3	No Limit
		EP071-SD-SV: >C34 - C40 Fraction	----	5	mg/kg	12	12	0.0	No Limit
ES2506937-011	MEC 2_0.5-1.0m	EP071-SD-SV: >C10 - C16 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD-SV: >C16 - C34 Fraction	----	3	mg/kg	4	6	0.0	No Limit
		EP071-SD-SV: >C10 - C40 Fraction (sum)	----	3	mg/kg	4	6	40.0	No Limit
		EP071-SD-SV: >C34 - C40 Fraction	----	5	mg/kg	<5	<5	0.0	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 6438376)									
ES2506937-021	EAW 4_0-0.5m	EP071-SD-SV: >C10 - C16 Fraction	----	3 (5)*	mg/kg	<5	<5	0.0	No Limit
		EP071-SD-SV: >C16 - C34 Fraction	----	3 (5)*	mg/kg	37	41	11.2	No Limit
		EP071-SD-SV: >C10 - C40 Fraction (sum)	----	3 (5)*	mg/kg	52	57	9.2	0% - 50%
		EP071-SD-SV: >C34 - C40 Fraction	----	5	mg/kg	15	16	9.0	No Limit
ES2506937-031	FHW 3_0.5-1.0m	EP071-SD-SV: >C10 - C16 Fraction	----	3 (5)*	mg/kg	<5	<5	0.0	No Limit
		EP071-SD-SV: >C16 - C34 Fraction	----	3 (5)*	mg/kg	28	24	15.5	No Limit
		EP071-SD-SV: >C10 - C40 Fraction (sum)	----	3 (5)*	mg/kg	39	33	16.7	No Limit
		EP071-SD-SV: >C34 - C40 Fraction	----	5	mg/kg	11	9	19.7	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 6438378)									
ES2506937-040	QA5	EP071-SD-SV: >C10 - C16 Fraction	----	3 (5)*	mg/kg	<5	<5	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 6438378) - continued									
ES2506937-040	QA5	EP071-SD-SV: >C16 - C34 Fraction	----	3 (5)*	mg/kg	<5	<5	0.0	No Limit
		EP071-SD-SV: >C10 - C40 Fraction (sum)	----	3 (5)*	mg/kg	<5	<5	0.0	No Limit
		EP071-SD-SV: >C34 - C40 Fraction	----	5	mg/kg	<5	<5	0.0	No Limit
EP080-SD: BTEXN (QC Lot: 6439303)									
ES2506937-001	MSB 1_0-0.5m	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
			106-42-3						
	EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit	
ES2506937-011	MEC 2_0.5-1.0m	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
			106-42-3						
	EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit	
EP080-SD: BTEXN (QC Lot: 6439306)									
ES2506937-021	EAW 4_0-0.5m	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
			106-42-3						
	EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit	
ES2506937-031	FHW 3_0.5-1.0m	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
			106-42-3						
	EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit	
EP080-SD: BTEXN (QC Lot: 6442074)									
ES2507194-001	Anonymous	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
			106-42-3						
	EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit	
EP090: Organotin Compounds (QC Lot: 6446524)									
ES2506937-025	EAW 6_0-0.5m	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit

Page : 12 of 29
 Work Order : ES2506937
 Client : AUSTRALASIAN MARINE ASSOCIATES PTY LTD
 Project : Darwin Ports Sediment Investigation



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP090: Organotin Compounds (QC Lot: 6446524) - continued									
ES2506937-025	EAW 6_0-0.5m	EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.0	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	0.0	No Limit
ES2506937-035	FHW 6_0-0.5m	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.0	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 6449572)									
ES2506937-001	MSB 1_0-0.5m	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.0	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	0.0	No Limit
ES2506937-011	MEC 2_0.5-1.0m	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.0	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 6449573)									
ES2506937-018	EAW 2_0.5-1.0m	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
		EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	0.0	No Limit
		EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	0.0	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 6438375)									
ES2506937-001	MSB 1_0-0.5m	EP132B-SD: Acenaphthylene	208-96-8	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Anthracene	120-12-7	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Pyrene	129-00-0	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Chrysene	218-01-9	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4 (5)*	µg/kg	<5	<5	0.0	No Limit
			205-82-3						
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Perylene	198-55-0	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 6438375) - continued									
ES2506937-001	MSB 1_0-0.5m	EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.0	No Limit
ES2506937-011	MEC 2_0.5-1.0m	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4	µg/kg	<4	<4	0.0	No Limit
		205-82-3							
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.0	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 6438380)									
ES2506937-021	EAW 4_0-0.5m	EP132B-SD: Acenaphthylene	208-96-8	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Anthracene	120-12-7	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Pyrene	129-00-0	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Chrysene	218-01-9	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		205-82-3							
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4 (5)*	µg/kg	<5	<5	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 6438380) - continued									
ES2506937-021	EAW 4_0-0.5m	EP132B-SD: Benzo(a)pyrene	50-32-8	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Perylene	198-55-0	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.0	No Limit
ES2506937-031	FHW 3_0.5-1.0m	EP132B-SD: Acenaphthylene	208-96-8	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Anthracene	120-12-7	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Pyrene	129-00-0	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Chrysene	218-01-9	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		205-82-3							
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Perylene	198-55-0	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4 (5)*	µg/kg	8	8	0.0	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	8	8	0.0	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.0	No Limit
		EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 6438381)							
ES2506937-040	QA5	EP132B-SD: Acenaphthylene	208-96-8	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Anthracene	120-12-7	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4 (5)*	µg/kg	<5	<5	0.0	No Limit

Page : 15 of 29
 Work Order : ES2506937
 Client : AUSTRALASIAN MARINE ASSOCIATES PTY LTD
 Project : Darwin Ports Sediment Investigation



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 6438381) - continued									
ES2506937-040	QA5	EP132B-SD: Pyrene	129-00-0	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Chrysene	218-01-9	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4 (5)*	µg/kg	<5	<5	0.0	No Limit
			205-82-3						
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Perylene	198-55-0	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Indeno(1,2,3,cd)pyrene	193-39-5	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4 (5)*	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.0	No Limit



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 6440103)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.087 mg/kg	107	72.0	116
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 6440106)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.087 mg/kg	101	72.0	116
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 6443817)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.087 mg/kg	94.2	72.0	116
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 6447542)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.087 mg/kg	125	70.0	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 6452893)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.087 mg/kg	77.0	72.0	116
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 6458489)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.087 mg/kg	98.3	72.0	116
EA029-A: pH Measurements (QCLot: 6463147)								
EA029: pH KCl (23A)	----	0.1	pH Unit	<0.1	4.7 pH Unit	97.8	70.0	130
EA029: pH OX (23B)	----	0.1	pH Unit	<0.1	4.5 pH Unit	94.4	70.0	130
EA029-A: pH Measurements (QCLot: 6465391)								
EA029: pH KCl (23A)	----	0.1	pH Unit	<0.1	4.7 pH Unit	96.8	70.0	130
EA029: pH OX (23B)	----	0.1	pH Unit	<0.1	4.5 pH Unit	97.8	70.0	130
EA029-B: Acidity Trail (QCLot: 6463147)								
EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	23.5 mole H+ / t	104	70.0	130
EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	46.5 mole H+ / t	110	70.0	130
EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	----	----	----	----
EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029-B: Acidity Trail (QCLot: 6465391)								
EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	23.5 mole H+ / t	109	70.0	130
EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	46.5 mole H+ / t	96.7	70.0	130
EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	----	----	----	----
EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.020	----	----	----	----



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit		Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Concentration	LCS	Low	High	
EA029-B: Acidity Trail (QCLot: 6465391) - continued								
EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029-C: Sulfur Trail (QCLot: 6463147)								
EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	0.056 % S	105	70.0	130
EA029: Peroxide Sulfur (23De)	----	0.02	% S	<0.020	0.165 % S	92.8	70.0	130
EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.020	----	----	----	----
EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	----	----	----	----
EA029-C: Sulfur Trail (QCLot: 6465391)								
EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	0.065 % S	90.8	70.0	130
EA029: Peroxide Sulfur (23De)	----	0.02	% S	<0.020	0.165 % S	80.4	70.0	130
EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.020	----	----	----	----
EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	----	----	----	----
EA029-D: Calcium Values (QCLot: 6463147)								
EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.020	0.188 % Ca	98.2	70.0	130
EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.020	0.185 % Ca	99.1	70.0	130
EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.020	----	----	----	----
EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	----	----	----	----
EA029-D: Calcium Values (QCLot: 6465391)								
EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.020	0.188 % Ca	86.1	70.0	130
EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.020	0.185 % Ca	88.5	70.0	130
EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.020	----	----	----	----
EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	----	----	----	----
EA029-E: Magnesium Values (QCLot: 6463147)								
EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.020	0.154 % Mg	100	70.0	130
EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.020	0.19 % Mg	94.4	70.0	130
EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	----	----	----	----
EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	----	----	----	----
EA029-E: Magnesium Values (QCLot: 6465391)								
EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.020	0.154 % Mg	112	70.0	130
EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.020	0.19 % Mg	84.1	70.0	130
EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	----	----	----	----
EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	----	----	----	----



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			Low	High
EA029-E: Magnesium Values (QCLot: 6465391) - continued								
EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	----	----	----	----
EA029-F: Excess Acid Neutralising Capacity (QCLot: 6463147)								
EA029: Excess Acid Neutralising Capacity (23Q)	----	0.02	% CaCO3	<0.020	----	----	----	----
EA029: acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.02	% S	<0.020	----	----	----	----
EA029-F: Excess Acid Neutralising Capacity (QCLot: 6465391)								
EA029: Excess Acid Neutralising Capacity (23Q)	----	0.02	% CaCO3	<0.020	----	----	----	----
EA029: acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.02	% S	<0.020	----	----	----	----
EA029-H: Acid Base Accounting (QCLot: 6463147)								
EA029: ANC Fineness Factor	----	0.5	-	<0.5	----	----	----	----
EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA029: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	----	----	----	----
EA029-H: Acid Base Accounting (QCLot: 6465391)								
EA029: ANC Fineness Factor	----	0.5	-	<0.5	----	----	----	----
EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA029: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	----	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6440105)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	110 mg/kg	114	80.0	139
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.8 mg/kg	104	83.0	127
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	20.3 mg/kg	110	73.0	130
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	49 mg/kg	101	76.0	130
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	57.4 mg/kg	110	74.0	130
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	14.7 mg/kg	105	83.0	130
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	125.8 mg/kg	114	82.0	137



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6440107)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	110 mg/kg	112	80.0	139
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.8 mg/kg	106	83.0	127
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	20.3 mg/kg	121	73.0	130
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	49 mg/kg	110	76.0	130
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	57.4 mg/kg	112	74.0	130
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	14.7 mg/kg	115	83.0	130
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	125.8 mg/kg	112	82.0	137
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6443816)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	110 mg/kg	103	80.0	139
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.8 mg/kg	99.0	83.0	127
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	20.3 mg/kg	111	73.0	130
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	49 mg/kg	106	76.0	130
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	57.4 mg/kg	97.7	74.0	130
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	14.7 mg/kg	94.8	83.0	130
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	125.8 mg/kg	98.3	82.0	137
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6447543)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	33.25 mg/kg	95.8	80.0	124
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.95 mg/kg	102	87.0	122
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	25.5 mg/kg	113	79.0	129
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	103.55 mg/kg	106	85.0	118
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	121 mg/kg	111	86.0	119
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	30.05 mg/kg	109	77.0	123
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	209 mg/kg	109	71.0	127
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6452892)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	110 mg/kg	87.9	80.0	139
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.8 mg/kg	95.1	83.0	127
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	20.3 mg/kg	96.1	73.0	130
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	49 mg/kg	87.8	76.0	130
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	57.4 mg/kg	102	74.0	130
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	14.7 mg/kg	86.0	83.0	130
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	125.8 mg/kg	91.8	82.0	137
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6458488)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	110 mg/kg	118	80.0	139
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.8 mg/kg	110	83.0	127

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6458488) - continued								
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	20.3 mg/kg	110	73.0	130
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	49 mg/kg	110	76.0	130
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	57.4 mg/kg	113	74.0	130
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	14.7 mg/kg	108	83.0	130
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	125.8 mg/kg	114	82.0	137
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 6452580)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.55 %	95.6	80.0	120
				<0.02	32.3 %	99.1	80.0	120
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 6452581)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.55 %	104	80.0	120
				<0.02	32.3 %	96.6	80.0	120
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 6452582)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.55 %	92.0	80.0	120
				<0.02	32.3 %	98.7	80.0	120
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6438374)								
EP071-SD-SV: C10 - C14 Fraction	----	3	mg/kg	<3	5 mg/kg	106	73.0	119
EP071-SD-SV: C15 - C28 Fraction	----	3	mg/kg	<3	7.5 mg/kg	108	70.0	130
EP071-SD-SV: C29 - C36 Fraction	----	5	mg/kg	<5	5 mg/kg	103	84.0	118
EP071-SD-SV: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6438376)								
EP071-SD-SV: C10 - C14 Fraction	----	3	mg/kg	<3	5 mg/kg	111	73.0	119
EP071-SD-SV: C15 - C28 Fraction	----	3	mg/kg	<3	7.5 mg/kg	107	70.0	130
EP071-SD-SV: C29 - C36 Fraction	----	5	mg/kg	<5	5 mg/kg	107	84.0	118
EP071-SD-SV: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6438378)								
EP071-SD-SV: C10 - C14 Fraction	----	3	mg/kg	<3	5 mg/kg	111	73.0	119
EP071-SD-SV: C15 - C28 Fraction	----	3	mg/kg	<3	7.5 mg/kg	102	70.0	130
EP071-SD-SV: C29 - C36 Fraction	----	5	mg/kg	<5	5 mg/kg	96.2	84.0	118
EP071-SD-SV: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6439303)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	6.2 mg/kg	72.4	61.0	133
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6439306)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	6.2 mg/kg	86.3	61.0	133
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6442074)								



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6442074) - continued								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	6.2 mg/kg	67.6	61.0	133
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 6438374)								
EP071-SD-SV: >C10 - C16 Fraction	----	3	mg/kg	<3	6.25 mg/kg	106	78.0	118
EP071-SD-SV: >C16 - C34 Fraction	----	3	mg/kg	<3	8.75 mg/kg	103	74.0	138
EP071-SD-SV: >C34 - C40 Fraction	----	5	mg/kg	<5	3.75 mg/kg	89.8	63.0	131
EP071-SD-SV: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 6438376)								
EP071-SD-SV: >C10 - C16 Fraction	----	3	mg/kg	<3	6.25 mg/kg	109	78.0	118
EP071-SD-SV: >C16 - C34 Fraction	----	3	mg/kg	<3	8.75 mg/kg	107	74.0	138
EP071-SD-SV: >C34 - C40 Fraction	----	5	mg/kg	<5	3.75 mg/kg	98.9	63.0	131
EP071-SD-SV: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 6438378)								
EP071-SD-SV: >C10 - C16 Fraction	----	3	mg/kg	<3	6.25 mg/kg	111	78.0	118
EP071-SD-SV: >C16 - C34 Fraction	----	3	mg/kg	<3	8.75 mg/kg	97.9	74.0	138
EP071-SD-SV: >C34 - C40 Fraction	----	5	mg/kg	<5	3.75 mg/kg	96.2	63.0	131
EP071-SD-SV: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD: BTEXN (QCLot: 6439303)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	0.2 mg/kg	101	66.0	122
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	0.2 mg/kg	117	70.0	130
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	0.2 mg/kg	117	66.0	126
EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	0.4 mg/kg	127	59.0	129
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	0.2 mg/kg	125	66.0	126
EP080-SD: BTEXN (QCLot: 6439306)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	0.2 mg/kg	99.6	66.0	122
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	0.2 mg/kg	116	70.0	130
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	0.2 mg/kg	108	66.0	126
EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	0.4 mg/kg	108	59.0	129
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	0.2 mg/kg	96.0	66.0	126
EP080-SD: BTEXN (QCLot: 6442074)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	0.2 mg/kg	91.6	66.0	122
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	0.2 mg/kg	92.3	70.0	130
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	0.2 mg/kg	98.0	66.0	126



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP080-SD: BTEXN (QCLot: 6442074) - continued								
EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	0.4 mg/kg	101	59.0	129
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	0.2 mg/kg	94.8	66.0	126
EP090: Organotin Compounds (QCLot: 6446524)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	47.5	36.0	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	64.8	42.0	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	109	52.0	139
EP090: Organotin Compounds (QCLot: 6449572)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	109	36.0	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	120	42.0	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	135	52.0	139
EP090: Organotin Compounds (QCLot: 6449573)								
EP090: Monobutyltin	78763-54-9	1	µgSn/kg	<1	1.25 µgSn/kg	114	36.0	128
EP090: Dibutyltin	1002-53-5	1	µgSn/kg	<1	1.25 µgSn/kg	115	42.0	132
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	112	52.0	139
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 6438375)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	118	63.0	129
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	112	64.0	128
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	110	65.0	129
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	112	68.0	132
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	119	68.0	124
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	116	64.0	134
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	102	65.0	131
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	110	64.0	130
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	109	67.0	133
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	102	62.0	130
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	105	65.0	133
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	25 µg/kg	113	68.0	120
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	113	61.0	133
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	111	63.0	127
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	112	66.0	118
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	106	69.0	119
EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	114	66.0	120
EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	110	64.0	122



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP132B: Polynuclear Aromatic Hydrocarbons (QCLOT: 6438375) - continued								
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	109	64.0	120
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	91.5	68.0	136
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLOT: 6438380)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	110	63.0	129
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	110	64.0	128
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	109	65.0	129
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	115	68.0	132
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	110	68.0	124
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	107	64.0	134
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	113	65.0	131
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	114	64.0	130
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	115	67.0	133
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	115	62.0	130
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	111	65.0	133
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	25 µg/kg	110	68.0	120
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	99.7	61.0	133
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	118	63.0	127
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	99.1	66.0	118
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	109	69.0	119
EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	107	66.0	120
EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	104	64.0	122
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	101	64.0	120
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	104	68.0	136
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLOT: 6438381)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	91.4	63.0	129
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	95.0	64.0	128
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	79.8	65.0	129
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	83.9	68.0	132
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	84.5	68.0	124
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	84.7	64.0	134
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	81.0	65.0	131



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 6438381) - continued								
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	76.8	64.0	130
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	78.8	67.0	133
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	83.5	62.0	130
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	88.4	65.0	133
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	4	µg/kg	<4	25 µg/kg	84.8	68.0	120
	205-82-3							
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	92.8	61.0	133
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	87.6	63.0	127
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	80.0	66.0	118
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	84.6	69.0	119
EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	80.8	66.0	120
EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	87.8	64.0	122
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	85.3	64.0	120
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	89.0	68.0	136
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	SpikeRecovery(%) MS	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number			Low	High
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 6440103)							
ES2506793-041	Anonymous	EG035T-LL: Mercury	7439-97-6	0.05 mg/kg	99.3	70.0	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 6440106)							
ES2506937-016	EAW 1_0-0.5m	EG035T-LL: Mercury	7439-97-6	0.05 mg/kg	106	70.0	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 6443817)							
ES2506937-034	FHW 5_0-0.5m	EG035T-LL: Mercury	7439-97-6	0.05 mg/kg	72.4	70.0	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 6447542)							
EM2503990-009	Anonymous	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	89.2	70.0	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 6452893)							
ES2506937-033	FHW 4_0.5-1.0m	EG035T-LL: Mercury	7439-97-6	0.05 mg/kg	90.1	70.0	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 6458489)							
ES2506937-035	FHW 6_0-0.5m	EG035T-LL: Mercury	7439-97-6	0.05 mg/kg	109	70.0	130



Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6440105)							
ES2506937-002	MSB 2_0-0.5m	EG020-SD: Arsenic	7440-38-2	50 mg/kg	103	70.0	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	102	70.0	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	107	70.0	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	102	70.0	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	95.6	70.0	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	103	70.0	130
		EG020-SD: Zinc	7440-66-6	250 mg/kg	102	70.0	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6440107)							
ES2506937-022	EAW 4_0.5-1.0m	EG020-SD: Arsenic	7440-38-2	50 mg/kg	107	70.0	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	104	70.0	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	111	70.0	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	101	70.0	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	95.2	70.0	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	105	70.0	130
		EG020-SD: Zinc	7440-66-6	250 mg/kg	102	70.0	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6443816)							
ES2506937-036	QA1	EG020-SD: Arsenic	7440-38-2	50 mg/kg	80.5	70.0	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	95.6	70.0	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	102	70.0	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	96.9	70.0	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	88.7	70.0	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	88.2	70.0	130
		EG020-SD: Zinc	7440-66-6	250 mg/kg	86.8	70.0	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6447543)							
ES2506937-043	QA8	EG020-SD: Arsenic	7440-38-2	50 mg/kg	83.6	70.0	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	85.0	70.0	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	86.0	70.0	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	84.8	70.0	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	84.6	70.0	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	85.3	70.0	130
		EG020-SD: Zinc	7440-66-6	250 mg/kg	84.4	70.0	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6452892)							
ES2506937-037	QA2	EG020-SD: Arsenic	7440-38-2	50 mg/kg	100	70.0	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	96.1	70.0	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	94.5	70.0	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	103	70.0	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	94.0	70.0	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	96.1	70.0	130



Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 6452892) - continued							
ES2506937-037	QA2	EG020-SD: Zinc	7440-66-6	250 mg/kg	94.6	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6438374)							
ES2506937-001	MSB 1_0-0.5m	EP071-SD-SV: C10 - C14 Fraction	----	14 mg/kg	79.4	70.0	130
		EP071-SD-SV: C15 - C28 Fraction	----	59 mg/kg	99.0	70.0	130
		EP071-SD-SV: C29 - C36 Fraction	----	42 mg/kg	94.9	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6438376)							
ES2506937-021	EAW 4_0-0.5m	EP071-SD-SV: C10 - C14 Fraction	----	14 mg/kg	90.6	70.0	130
		EP071-SD-SV: C15 - C28 Fraction	----	59 mg/kg	113	70.0	130
		EP071-SD-SV: C29 - C36 Fraction	----	42 mg/kg	112	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6438378)							
ES2506937-040	QA5	EP071-SD-SV: C10 - C14 Fraction	----	14 mg/kg	77.3	70.0	130
		EP071-SD-SV: C15 - C28 Fraction	----	59 mg/kg	106	70.0	130
		EP071-SD-SV: C29 - C36 Fraction	----	42 mg/kg	96.6	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6439303)							
ES2506937-001	MSB 1_0-0.5m	EP080-SD: C6 - C9 Fraction	----	6.5 mg/kg	71.2	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6439306)							
ES2506937-021	EAW 4_0-0.5m	EP080-SD: C6 - C9 Fraction	----	6.5 mg/kg	90.8	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 6442074)							
ES2507194-001	Anonymous	EP080-SD: C6 - C9 Fraction	----	6.5 mg/kg	83.2	70.0	130
EP080-SD: BTEXN (QCLot: 6439303)							
ES2506937-001	MSB 1_0-0.5m	EP080-SD: Benzene	71-43-2	0.5 mg/kg	75.9	70.0	130
		EP080-SD: Toluene	108-88-3	0.5 mg/kg	85.1	70.0	130
		EP080-SD: Ethylbenzene	100-41-4	0.5 mg/kg	90.9	70.0	130
		EP080-SD: meta- & para-Xylene	108-38-3	0.5 mg/kg	98.3	70.0	130
			106-42-3				
		EP080-SD: ortho-Xylene	95-47-6	0.5 mg/kg	99.4	70.0	130
EP080-SD: BTEXN (QCLot: 6439306)							
ES2506937-021	EAW 4_0-0.5m	EP080-SD: Benzene	71-43-2	0.5 mg/kg	# 69.0	70.0	130
		EP080-SD: Toluene	108-88-3	0.5 mg/kg	82.6	70.0	130
		EP080-SD: Ethylbenzene	100-41-4	0.5 mg/kg	81.5	70.0	130
		EP080-SD: meta- & para-Xylene	108-38-3	0.5 mg/kg	79.5	70.0	130
			106-42-3				
		EP080-SD: ortho-Xylene	95-47-6	0.5 mg/kg	74.2	70.0	130
EP080-SD: BTEXN (QCLot: 6442074)							
ES2507194-001	Anonymous	EP080-SD: Benzene	71-43-2	0.5 mg/kg	81.8	70.0	130
		EP080-SD: Toluene	108-88-3	0.5 mg/kg	87.8	70.0	130



Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080-SD: BTEXN (QCLot: 6442074) - continued							
ES2507194-001	Anonymous	EP080-SD: Ethylbenzene	100-41-4	0.5 mg/kg	83.6	70.0	130
		EP080-SD: meta- & para-Xylene	108-38-3	0.5 mg/kg	85.3	70.0	130
		106-42-3					
		EP080-SD: ortho-Xylene	95-47-6	0.5 mg/kg	81.9	70.0	130
EP090: Organotin Compounds (QCLot: 6446524)							
ES2506937-026	EAW 7_0-0.5m	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# 6.0	20.0	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	48.7	20.0	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	91.5	20.0	130
EP090: Organotin Compounds (QCLot: 6449572)							
ES2506937-002	MSB 2_0-0.5m	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# 8.0	20.0	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	59.2	20.0	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	112	20.0	130
EP090: Organotin Compounds (QCLot: 6449573)							
ES2506937-019	EAW 3_0-0.5m	EP090: Monobutyltin	78763-54-9	1.25 µgSn/kg	# 16.9	20.0	130
		EP090: Dibutyltin	1002-53-5	1.25 µgSn/kg	57.3	20.0	130
		EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	85.6	20.0	130
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 6438375)							
ES2506937-001	MSB 1_0-0.5m	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	115	70.0	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	106	70.0	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	120	70.0	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	110	70.0	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	104	70.0	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	112	70.0	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	104	70.0	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	108	70.0	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	107	70.0	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	109	70.0	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	108	70.0	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	25 µg/kg	105	70.0	130
		205-82-3					
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	112	70.0	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	106	70.0	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	120	70.0	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	109	70.0	130
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	25 µg/kg	113	70.0	130
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	25 µg/kg	108	70.0	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	108	70.0	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	90.5	70.0	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 6438380)							
ES2506937-021	EAW 4_0-0.5m	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	101	70.0	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	110	70.0	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	102	70.0	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	101	70.0	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	102	70.0	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	112	70.0	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	100	70.0	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	102	70.0	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	99.3	70.0	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	105	70.0	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	95.6	70.0	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	25 µg/kg	106	70.0	130
			205-82-3				
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	111	70.0	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	106	70.0	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	116	70.0	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	112	70.0	130
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	25 µg/kg	117	70.0	130
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	25 µg/kg	112	70.0	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	112	70.0	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	92.5	70.0	130
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 6438381)							
ES2506937-040	QA5	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	110	70.0	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	104	70.0	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	108	70.0	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	104	70.0	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	101	70.0	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	110	70.0	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	113	70.0	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	110	70.0	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	103	70.0	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	106	70.0	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	95.4	70.0	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2	25 µg/kg	100	70.0	130
			205-82-3				
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	106	70.0	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	101	70.0	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	110	70.0	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	106	70.0	130



Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 6438381) - continued							
ES2506937-040	QA5	EP132B-SD: Benzo(g,h,i)perylene	191-24-2	25 µg/kg	106	70.0	130
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	25 µg/kg	103	70.0	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	103	70.0	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	96.0	70.0	130



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES2506937	Page	: 1 of 27
Client	: AUSTRALASIAN MARINE ASSOCIATES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: DR ADAM COHEN	Telephone	: +61-2-8784 8555
Project	: Darwin Ports Sediment Investigation	Date Samples Received	: 13-Mar-2025
Site	: ----	Issue Date	: 27-Mar-2025
Sampler	: ADAM COHEN	No. of samples received	: 43
Order number	: ----	No. of samples analysed	: 43

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.

Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP080-SD: BTEXN	ES2506937--021	EAW 4_0-0.5m	Benzene	71-43-2	69.0 %	70.0-130%	Recovery less than lower data quality objective
EP090: Organotin Compounds	ES2506937--026	EAW 7_0-0.5m	Monobutyltin	78763-54-9	6.0 %	20.0-130%	Recovery less than lower data quality objective
EP090: Organotin Compounds	ES2506937--002	MSB 2_0-0.5m	Monobutyltin	78763-54-9	8.0 %	20.0-130%	Recovery less than lower data quality objective
EP090: Organotin Compounds	ES2506937--019	EAW 3_0-0.5m	Monobutyltin	78763-54-9	16.9 %	20.0-130%	Recovery less than lower data quality objective

Regular Sample Surrogates

Sub-Matrix: **SEDIMENT**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-023	EAW 5_0-0.5m	1,2-Dichloroethane-D4	17060-07-0	57.4 %	67.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-025	EAW 6_0-0.5m	1,2-Dichloroethane-D4	17060-07-0	64.9 %	67.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-028	FHW 2_0-0.5m	1,2-Dichloroethane-D4	17060-07-0	66.3 %	67.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-031	FHW 3_0.5-1.0m	1,2-Dichloroethane-D4	17060-07-0	64.7 %	67.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-033	FHW 4_0.5-1.0m	1,2-Dichloroethane-D4	17060-07-0	61.6 %	67.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-039	QA4	1,2-Dichloroethane-D4	17060-07-0	48.0 %	67.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-023	EAW 5_0-0.5m	Toluene-D8	2037-26-5	56.1 %	74.0-134 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-026	EAW 7_0-0.5m	Toluene-D8	2037-26-5	71.0 %	74.0-134 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-027	FHW 1_0-0.5m	Toluene-D8	2037-26-5	67.1 %	74.0-134 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-028	FHW 2_0-0.5m	Toluene-D8	2037-26-5	69.5 %	74.0-134 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-033	FHW 4_0.5-1.0m	Toluene-D8	2037-26-5	65.2 %	74.0-134 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-039	QA4	Toluene-D8	2037-26-5	44.7 %	74.0-134 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-021	EAW 4_0-0.5m	4-Bromofluorobenzene	460-00-4	60.1 %	73.0-137 %	Recovery less than lower data quality objective



Sub-Matrix: **SEDIMENT**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted - Continued							
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-023	EAW 5_0-0.5m	4-Bromofluorobenzene	460-00-4	51.2 %	73.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-026	EAW 7_0-0.5m	4-Bromofluorobenzene	460-00-4	55.9 %	73.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-027	FHW 1_0-0.5m	4-Bromofluorobenzene	460-00-4	54.4 %	73.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-028	FHW 2_0-0.5m	4-Bromofluorobenzene	460-00-4	54.5 %	73.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-029	FHW 2_0.5-1.0m	4-Bromofluorobenzene	460-00-4	56.4 %	73.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-032	FHW 4_0-0.5m	4-Bromofluorobenzene	460-00-4	69.9 %	73.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-033	FHW 4_0.5-1.0m	4-Bromofluorobenzene	460-00-4	48.0 %	73.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-034	FHW 5_0-0.5m	4-Bromofluorobenzene	460-00-4	67.6 %	73.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-035	FHW 6_0-0.5m	4-Bromofluorobenzene	460-00-4	61.6 %	73.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-039	QA4	4-Bromofluorobenzene	460-00-4	38.0 %	73.0-137 %	Recovery less than lower data quality objective
EP080-SD: TPH(V)/BTEX Surrogates	ES2506937-040	QA5	4-Bromofluorobenzene	460-00-4	63.7 %	73.0-137 %	Recovery less than lower data quality objective

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA055: Moisture Content (Dried @ 105-110°C)						
Soil Glass Jar - Unpreserved FHW 3_0.5-1.0m	----	----	----	26-Mar-2025	24-Mar-2025	2

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA029-A: pH Measurements								
Snap Lock Bag - frozen (EA029) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m,	MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 3_0-0.5m, EAW 4_0-0.5m	10-Mar-2025	26-Mar-2025	04-Dec-2027	✓	26-Mar-2025	24-Jun-2025	✓
Snap Lock Bag - frozen (EA029) EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 3_0-0.5m, FHW 4_0-0.5m,	EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, FHW 4_0.5-1.0m	10-Mar-2025	27-Mar-2025	04-Dec-2027	✓	27-Mar-2025	25-Jun-2025	✓
Snap Lock Bag - frozen (EA029) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m,	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m	11-Mar-2025	26-Mar-2025	05-Dec-2027	✓	26-Mar-2025	24-Jun-2025	✓
Snap Lock Bag - frozen (EA029) EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m	EAW 7_0-0.5m, FHW 5_0-0.5m,	11-Mar-2025	27-Mar-2025	05-Dec-2027	✓	27-Mar-2025	25-Jun-2025	✓

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA029-B: Acidity Trail									
Snap Lock Bag - frozen (EA029) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m,		MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 3_0-0.5m, EAW 4_0-0.5m	10-Mar-2025	26-Mar-2025	04-Dec-2027	✓	26-Mar-2025	24-Jun-2025	✓
Snap Lock Bag - frozen (EA029) EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 3_0-0.5m, FHW 4_0-0.5m,		EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, FHW 4_0.5-1.0m	10-Mar-2025	27-Mar-2025	04-Dec-2027	✓	27-Mar-2025	25-Jun-2025	✓
Snap Lock Bag - frozen (EA029) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m,		MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m	11-Mar-2025	26-Mar-2025	05-Dec-2027	✓	26-Mar-2025	24-Jun-2025	✓
Snap Lock Bag - frozen (EA029) EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m		EAW 7_0-0.5m, FHW 5_0-0.5m,	11-Mar-2025	27-Mar-2025	05-Dec-2027	✓	27-Mar-2025	25-Jun-2025	✓



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA029-C: Sulfur Trail								
Snap Lock Bag - frozen (EA029) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m,	MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 3_0-0.5m, EAW 4_0-0.5m	10-Mar-2025	26-Mar-2025	04-Dec-2027	✔	26-Mar-2025	24-Jun-2025	✔
Snap Lock Bag - frozen (EA029) EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 3_0-0.5m, FHW 4_0-0.5m,	EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, FHW 4_0.5-1.0m	10-Mar-2025	27-Mar-2025	04-Dec-2027	✔	27-Mar-2025	25-Jun-2025	✔
Snap Lock Bag - frozen (EA029) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m,	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m	11-Mar-2025	26-Mar-2025	05-Dec-2027	✔	26-Mar-2025	24-Jun-2025	✔
Snap Lock Bag - frozen (EA029) EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m	EAW 7_0-0.5m, FHW 5_0-0.5m,	11-Mar-2025	27-Mar-2025	05-Dec-2027	✔	27-Mar-2025	25-Jun-2025	✔

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA029-D: Calcium Values								
Snap Lock Bag - frozen (EA029) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m,	MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 3_0-0.5m, EAW 4_0-0.5m	10-Mar-2025	26-Mar-2025	04-Dec-2027	✓	26-Mar-2025	24-Jun-2025	✓
Snap Lock Bag - frozen (EA029) EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 3_0-0.5m, FHW 4_0-0.5m,	EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, FHW 4_0.5-1.0m	10-Mar-2025	27-Mar-2025	04-Dec-2027	✓	27-Mar-2025	25-Jun-2025	✓
Snap Lock Bag - frozen (EA029) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m,	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m	11-Mar-2025	26-Mar-2025	05-Dec-2027	✓	26-Mar-2025	24-Jun-2025	✓
Snap Lock Bag - frozen (EA029) EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m	EAW 7_0-0.5m, FHW 5_0-0.5m,	11-Mar-2025	27-Mar-2025	05-Dec-2027	✓	27-Mar-2025	25-Jun-2025	✓

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA029-E: Magnesium Values								
Snap Lock Bag - frozen (EA029) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m,	MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 3_0-0.5m, EAW 4_0-0.5m	10-Mar-2025	26-Mar-2025	04-Dec-2027	✓	26-Mar-2025	24-Jun-2025	✓
Snap Lock Bag - frozen (EA029) EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 3_0-0.5m, FHW 4_0-0.5m,	EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, FHW 4_0.5-1.0m	10-Mar-2025	27-Mar-2025	04-Dec-2027	✓	27-Mar-2025	25-Jun-2025	✓
Snap Lock Bag - frozen (EA029) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m,	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m	11-Mar-2025	26-Mar-2025	05-Dec-2027	✓	26-Mar-2025	24-Jun-2025	✓
Snap Lock Bag - frozen (EA029) EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m	EAW 7_0-0.5m, FHW 5_0-0.5m,	11-Mar-2025	27-Mar-2025	05-Dec-2027	✓	27-Mar-2025	25-Jun-2025	✓



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA029-F: Excess Acid Neutralising Capacity								
Snap Lock Bag - frozen (EA029) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m,	MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 3_0-0.5m, EAW 4_0-0.5m	10-Mar-2025	26-Mar-2025	04-Dec-2027	✔	26-Mar-2025	24-Jun-2025	✔
Snap Lock Bag - frozen (EA029) EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 3_0-0.5m, FHW 4_0-0.5m,	EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, FHW 4_0.5-1.0m	10-Mar-2025	27-Mar-2025	04-Dec-2027	✔	27-Mar-2025	25-Jun-2025	✔
Snap Lock Bag - frozen (EA029) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m,	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m	11-Mar-2025	26-Mar-2025	05-Dec-2027	✔	26-Mar-2025	24-Jun-2025	✔
Snap Lock Bag - frozen (EA029) EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m	EAW 7_0-0.5m, FHW 5_0-0.5m,	11-Mar-2025	27-Mar-2025	05-Dec-2027	✔	27-Mar-2025	25-Jun-2025	✔



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA029-G: Retained Acidity								
Snap Lock Bag - frozen (EA029) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m,	MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 3_0-0.5m, EAW 4_0-0.5m	10-Mar-2025	26-Mar-2025	04-Dec-2027	✔	26-Mar-2025	24-Jun-2025	✔
Snap Lock Bag - frozen (EA029) EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 3_0-0.5m, FHW 4_0-0.5m,	EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, FHW 4_0.5-1.0m	10-Mar-2025	27-Mar-2025	04-Dec-2027	✔	27-Mar-2025	25-Jun-2025	✔
Snap Lock Bag - frozen (EA029) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m,	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m	11-Mar-2025	26-Mar-2025	05-Dec-2027	✔	26-Mar-2025	24-Jun-2025	✔
Snap Lock Bag - frozen (EA029) EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m	EAW 7_0-0.5m, FHW 5_0-0.5m,	11-Mar-2025	27-Mar-2025	05-Dec-2027	✔	27-Mar-2025	25-Jun-2025	✔

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA029-H: Acid Base Accounting								
Snap Lock Bag - frozen (EA029) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m,	MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 3_0-0.5m, EAW 4_0-0.5m	10-Mar-2025	26-Mar-2025	04-Dec-2027	✓	26-Mar-2025	24-Jun-2025	✓
Snap Lock Bag - frozen (EA029) EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 3_0-0.5m, FHW 4_0-0.5m,	EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, FHW 4_0.5-1.0m	10-Mar-2025	27-Mar-2025	04-Dec-2027	✓	27-Mar-2025	25-Jun-2025	✓
Snap Lock Bag - frozen (EA029) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m,	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m	11-Mar-2025	26-Mar-2025	05-Dec-2027	✓	26-Mar-2025	24-Jun-2025	✓
Snap Lock Bag - frozen (EA029) EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m	EAW 7_0-0.5m, FHW 5_0-0.5m,	11-Mar-2025	27-Mar-2025	05-Dec-2027	✓	27-Mar-2025	25-Jun-2025	✓



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0-0.5m, EAW 3_0-0.5m, EAW 4_0-0.5m, EAW 5_0-0.5m, FHW 2_0-0.5m, FHW 3_0-0.5m	MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m, EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 2_0.5-1.0m,	10-Mar-2025	----	----	----	14-Mar-2025	24-Mar-2025	✓
Soil Glass Jar - Unpreserved (EA055) FHW 3_0.5-1.0m		10-Mar-2025	----	----	----	26-Mar-2025	24-Mar-2025	✗
Soil Glass Jar - Unpreserved (EA055) FHW 4_0-0.5m		10-Mar-2025	----	----	----	14-Mar-2025	24-Mar-2025	✓
Soil Glass Jar - Unpreserved (EA055) QA7,	QA8	10-Mar-2025	----	----	----	19-Mar-2025	24-Mar-2025	✓
Soil Glass Jar - Unpreserved (EA055) FHW 4_0.5-1.0m, QA5,	QA2, QA6	10-Mar-2025	----	----	----	20-Mar-2025	24-Mar-2025	✓
Soil Glass Jar - Unpreserved (EA055) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m, EAW 6_0-0.5m, FHW 1_0-0.5m	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m, EAW 7_0-0.5m,	11-Mar-2025	----	----	----	14-Mar-2025	25-Mar-2025	✓
Soil Glass Jar - Unpreserved (EA055) FHW 5_0-0.5m, QA3,	QA1, QA4	11-Mar-2025	----	----	----	17-Mar-2025	25-Mar-2025	✓
Soil Glass Jar - Unpreserved (EA055) FHW 6_0-0.5m		11-Mar-2025	----	----	----	24-Mar-2025	25-Mar-2025	✓

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0-0.5m, EAW 3_0.5-1.0m, EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 3_0-0.5m, FHW 4_0-0.5m, MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 2_0.5-1.0m, EAW 4_0-0.5m, EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, FHW 4_0.5-1.0m	10-Mar-2025	----	----	----	21-Mar-2025	06-Sep-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m, EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m, MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m, EAW 7_0-0.5m, FHW 5_0-0.5m	11-Mar-2025	----	----	----	21-Mar-2025	07-Sep-2025	✓
EA150: Soil Classification based on Particle Size							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0-0.5m, EAW 3_0.5-1.0m, EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 3_0-0.5m, FHW 4_0-0.5m, MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 2_0.5-1.0m, EAW 4_0-0.5m, EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, FHW 4_0.5-1.0m	10-Mar-2025	----	----	----	21-Mar-2025	06-Sep-2025	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m, EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m, MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m, EAW 7_0-0.5m, FHW 5_0-0.5m	11-Mar-2025	----	----	----	21-Mar-2025	07-Sep-2025	✓



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EG020-SD: Total Metals in Sediments by ICPMS								
Soil Glass Jar - Unpreserved (EG020-SD) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0-0.5m, EAW 3_0-0.5m, EAW 4_0-0.5m, EAW 5_0-0.5m, FHW 2_0-0.5m, FHW 3_0-0.5m, FHW 4_0-0.5m	MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m, EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m,	10-Mar-2025	17-Mar-2025	06-Sep-2025	✔	20-Mar-2025	06-Sep-2025	✔
Soil Glass Jar - Unpreserved (EG020-SD) QA7,	QA8	10-Mar-2025	19-Mar-2025	06-Sep-2025	✔	21-Mar-2025	06-Sep-2025	✔
Soil Glass Jar - Unpreserved (EG020-SD) FHW 4_0.5-1.0m, QA5,	QA2, QA6	10-Mar-2025	20-Mar-2025	06-Sep-2025	✔	21-Mar-2025	06-Sep-2025	✔
Soil Glass Jar - Unpreserved (EG020-SD) FHW 5_0-0.5m, QA3,	QA1, QA4	11-Mar-2025	17-Mar-2025	07-Sep-2025	✔	18-Mar-2025	07-Sep-2025	✔
Soil Glass Jar - Unpreserved (EG020-SD) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m, EAW 6_0-0.5m, FHW 1_0-0.5m	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m, EAW 7_0-0.5m,	11-Mar-2025	17-Mar-2025	07-Sep-2025	✔	20-Mar-2025	07-Sep-2025	✔
Soil Glass Jar - Unpreserved (EG020-SD) FHW 6_0-0.5m		11-Mar-2025	24-Mar-2025	07-Sep-2025	✔	25-Mar-2025	07-Sep-2025	✔



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EG035T: Total Recoverable Mercury by FIMS									
Soil Glass Jar - Unpreserved (EG035T-LL) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0-0.5m, EAW 3_0-0.5m, EAW 4_0-0.5m, EAW 5_0-0.5m, FHW 2_0-0.5m, FHW 3_0-0.5m, FHW 4_0-0.5m		MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m, EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m,	10-Mar-2025	17-Mar-2025	07-Apr-2025	✔	21-Mar-2025	07-Apr-2025	✔
Soil Glass Jar - Unpreserved (EG035T-LL) QA7,		QA8	10-Mar-2025	19-Mar-2025	07-Apr-2025	✔	22-Mar-2025	07-Apr-2025	✔
Soil Glass Jar - Unpreserved (EG035T-LL) FHW 4_0.5-1.0m, QA5,		QA2, QA6	10-Mar-2025	20-Mar-2025	07-Apr-2025	✔	24-Mar-2025	07-Apr-2025	✔
Soil Glass Jar - Unpreserved (EG035T-LL) FHW 5_0-0.5m, QA3,		QA1, QA4	11-Mar-2025	17-Mar-2025	08-Apr-2025	✔	19-Mar-2025	08-Apr-2025	✔
Soil Glass Jar - Unpreserved (EG035T-LL) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m, EAW 6_0-0.5m, FHW 1_0-0.5m		MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m, EAW 7_0-0.5m,	11-Mar-2025	17-Mar-2025	08-Apr-2025	✔	21-Mar-2025	08-Apr-2025	✔
Soil Glass Jar - Unpreserved (EG035T-LL) FHW 6_0-0.5m			11-Mar-2025	24-Mar-2025	08-Apr-2025	✔	27-Mar-2025	08-Apr-2025	✔

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP003: Total Organic Carbon (TOC) in Soil									
Pulp Bag (EP003) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0-0.5m, EAW 3_0-0.5m, EAW 4_0-0.5m, EAW 5_0-0.5m, FHW 2_0-0.5m, FHW 3_0-0.5m, QA2, FHW 4_0-0.5m, QA6		MEC 1_0.5-1.0m, MEC 2_0.5-1.0m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m, EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, QA5, FHW 4_0.5-1.0m,	10-Mar-2025	20-Mar-2025	07-Apr-2025	✓	20-Mar-2025	07-Apr-2025	✓
Pulp Bag (EP003) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m, EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m, QA3,		MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m, EAW 7_0-0.5m, FHW 5_0-0.5m, QA1, QA4	11-Mar-2025	20-Mar-2025	08-Apr-2025	✓	20-Mar-2025	08-Apr-2025	✓



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
Soil Glass Jar - Unpreserved (EP071-SD-SV) FHW 3_0.5-1.0m, QA6	QA5,	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	14-Mar-2025	23-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m, EAW 4_0.5-1.0m, EAW 5_0-0.5m, FHW 2_0-0.5m, FHW 3_0-0.5m, FHW 4_0.5-1.0m,	MEC 1_0.5-1.0m, EAW 2_0-0.5m, EAW 3_0-0.5m, EAW 4_0-0.5m, EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 4_0-0.5m, QA5	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	15-Mar-2025	24-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) MEC 2_0.5-1.0m, QA2	EAW 5_0.5-1.0m,	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	18-Mar-2025	24-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP071-SD-SV) MEC 1_0-0.5m, MEC 2_0-0.5m,	MEC 1_0.5-1.0m, MEC 2_0.5-1.0m	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	19-Mar-2025	23-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP071-SD-SV) EAW 2_0-0.5m, EAW 3_0-0.5m, EAW 4_0-0.5m, EAW 5_0-0.5m, FHW 2_0-0.5m, FHW 3_0-0.5m, FHW 4_0-0.5m, QA2	EAW 2_0.5-1.0m, EAW 3_0.5-1.0m, EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, FHW 4_0.5-1.0m, QA2	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	20-Mar-2025	23-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) QA6		10-Mar-2025	17-Mar-2025	24-Mar-2025	✔	18-Mar-2025	24-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m,	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	14-Mar-2025	25-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) MEC 4_0-0.5m, MEC 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m,	MEC 5_0-0.5m, EAW 7_0-0.5m, FHW 5_0-0.5m, QA4	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	15-Mar-2025	25-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP071-SD-SV) EAW 1_0-0.5m, QA3,	EAW 6_0-0.5m, QA4	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	18-Mar-2025	23-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD)								



Matrix: SOIL

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons - Continued								
MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 6_0-0.5m,	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, QA1	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	19-Mar-2025	25-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP071-SD-SV) MEC 4_0-0.5m, EAW 1_0-0.5m, EAW 7_0-0.5m, FHW 5_0-0.5m, QA1	MEC 5_0-0.5m, EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m, QA1	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	20-Mar-2025	23-Apr-2025	✔



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
Soil Glass Jar - Unpreserved (EP071-SD-SV) FHW 3_0.5-1.0m, QA6	QA5,	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	14-Mar-2025	23-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m, EAW 4_0.5-1.0m, EAW 5_0-0.5m, FHW 2_0-0.5m, FHW 3_0-0.5m, FHW 4_0.5-1.0m,	MEC 1_0.5-1.0m, EAW 2_0-0.5m, EAW 3_0-0.5m, EAW 4_0-0.5m, EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 4_0-0.5m, QA5	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	15-Mar-2025	24-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) MEC 2_0.5-1.0m, QA2	EAW 5_0.5-1.0m,	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	18-Mar-2025	24-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP071-SD-SV) MEC 1_0-0.5m, MEC 2_0-0.5m,	MEC 1_0.5-1.0m, MEC 2_0.5-1.0m	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	19-Mar-2025	23-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP071-SD-SV) EAW 2_0-0.5m, EAW 3_0-0.5m, EAW 4_0-0.5m, EAW 5_0-0.5m, FHW 2_0-0.5m, FHW 3_0-0.5m, FHW 4_0-0.5m, QA2	EAW 2_0.5-1.0m, EAW 3_0.5-1.0m, EAW 4_0.5-1.0m, EAW 5_0.5-1.0m, FHW 2_0.5-1.0m, FHW 3_0.5-1.0m, FHW 4_0.5-1.0m,	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	20-Mar-2025	23-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) QA6		10-Mar-2025	17-Mar-2025	24-Mar-2025	✔	18-Mar-2025	24-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m,	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	14-Mar-2025	25-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) MEC 4_0-0.5m, MEC 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m,	MEC 5_0-0.5m, EAW 7_0-0.5m, FHW 5_0-0.5m, QA4	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	15-Mar-2025	25-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP071-SD-SV) EAW 1_0-0.5m, QA3,	EAW 6_0-0.5m, QA4	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	18-Mar-2025	23-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD)								



Matrix: SOIL

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons - Continued								
MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 6_0-0.5m,	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, QA1	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	19-Mar-2025	25-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP071-SD-SV) MEC 4_0-0.5m, EAW 1_0-0.5m, EAW 7_0-0.5m, FHW 5_0-0.5m, QA1	MEC 5_0-0.5m, EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m, QA1	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	20-Mar-2025	23-Apr-2025	✔



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080-SD: BTEXN							
Soil Glass Jar - Unpreserved (EP080-SD) FWH 3_0.5-1.0m	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	14-Mar-2025	24-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0.5-1.0m, EAW 3_0.5-1.0m, EAW 4_0.5-1.0m, FHW 2_0-0.5m, FHW 3_0-0.5m, FHW 4_0.5-1.0m, MEC 1_0.5-1.0m, EAW 2_0-0.5m, EAW 3_0-0.5m, EAW 4_0-0.5m, EAW 5_0-0.5m, FHW 2_0.5-1.0m, FHW 4_0-0.5m, QA5	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	15-Mar-2025	24-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) MEC 2_0.5-1.0m, QA2	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	18-Mar-2025	24-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) QA6	10-Mar-2025	17-Mar-2025	24-Mar-2025	✔	18-Mar-2025	24-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	14-Mar-2025	25-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) MEC 4_0-0.5m, MEC 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m, MEC 5_0-0.5m, EAW 7_0-0.5m, FHW 5_0-0.5m, QA4	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	15-Mar-2025	25-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) EAW 1_0-0.5m, QA3	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	18-Mar-2025	25-Mar-2025	✔
Soil Glass Jar - Unpreserved (EP080-SD) QA1	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	19-Mar-2025	25-Mar-2025	✔



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP090: Organotin Compounds								
Soil Glass Jar - Unpreserved (EP090) FWH 2_0-0.5m, FWH 3_0-0.5m, FWH 4_0-0.5m, QA2, QA6, QA8	FHW 2_0.5-1.0m, FWH 3_0.5-1.0m, FWH 4_0.5-1.0m, QA5, QA7,	10-Mar-2025	18-Mar-2025	24-Mar-2025	✔	20-Mar-2025	27-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP090) EAW 2_0.5-1.0m, EAW 3_0.5-1.0m, EAW 4_0.5-1.0m,	EAW 3_0-0.5m, EAW 4_0-0.5m, EAW 5_0-0.5m	10-Mar-2025	19-Mar-2025	24-Mar-2025	✔	24-Mar-2025	28-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP090) EAW 5_0.5-1.0m		10-Mar-2025	19-Mar-2025	24-Mar-2025	✔	25-Mar-2025	28-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP090) MEC 1_0-0.5m, MEC 2_0-0.5m, EAW 2_0-0.5m	MEC 1_0.5-1.0m, MEC 2_0.5-1.0m,	10-Mar-2025	21-Mar-2025	24-Mar-2025	✔	25-Mar-2025	30-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP090) EAW 6_0-0.5m, FWH 1_0-0.5m, FWH 6_0-0.5m, QA3,	EAW 7_0-0.5m, FWH 5_0-0.5m, QA1, QA4	11-Mar-2025	18-Mar-2025	25-Mar-2025	✔	20-Mar-2025	27-Apr-2025	✔
Soil Glass Jar - Unpreserved (EP090) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m, MEC 4_0-0.5m, MEC 6_0-0.5m,	MSB 2_0-0.5m, MSB 4_0-0.5m, MSB 6_0-0.5m, MEC 3_0-0.5m, MEC 5_0-0.5m, EAW 1_0-0.5m	11-Mar-2025	21-Mar-2025	25-Mar-2025	✔	25-Mar-2025	30-Apr-2025	✔



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP132B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP132B-SD) FHW 3_0.5-1.0m, FHW 4_0-0.5m	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	18-Mar-2025	23-Apr-2025	✔	
Soil Glass Jar - Unpreserved (EP132B-SD) MEC 1_0-0.5m, MEC 2_0-0.5m,	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	20-Mar-2025	23-Apr-2025	✔	
Soil Glass Jar - Unpreserved (EP132B-SD) EAW 2_0-0.5m, EAW 3_0-0.5m, EAW 4_0-0.5m, EAW 5_0-0.5m, FHW 2_0-0.5m, FHW 3_0-0.5m, QA2, QA6	10-Mar-2025	14-Mar-2025	24-Mar-2025	✔	22-Mar-2025	23-Apr-2025	✔	
Soil Glass Jar - Unpreserved (EP132B-SD) MEC 4_0-0.5m,	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	18-Mar-2025	23-Apr-2025	✔	
Soil Glass Jar - Unpreserved (EP132B-SD) MSB 1_0-0.5m, MSB 3_0-0.5m, MSB 5_0-0.5m, MSB 7_0-0.5m,	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	20-Mar-2025	23-Apr-2025	✔	
Soil Glass Jar - Unpreserved (EP132B-SD) MEC 6_0-0.5m, EAW 6_0-0.5m, FHW 1_0-0.5m, FHW 6_0-0.5m, QA3,	11-Mar-2025	14-Mar-2025	25-Mar-2025	✔	22-Mar-2025	23-Apr-2025	✔	



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: **✖** = Quality Control frequency not within specification ; **✔** = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification	
Analytical Methods	Method	QC	Regular	Actual	Expected		Evaluation
Laboratory Duplicates (DUP)							
Moisture Content	EA055	12	99	12.12	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	5	43	11.63	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	5	41	12.20	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspension Peroxide Oxidation-Combined Acidity and Sulphate	EA029	4	40	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	7	49	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	7	44	15.91	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	5	41	12.20	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fractions Only	EP071-SD-SV	5	41	12.20	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	5	47	10.64	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Organotin Analysis	EP090	3	43	6.98	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	3	41	7.32	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspension Peroxide Oxidation-Combined Acidity and Sulphate	EA029	2	40	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	5	49	10.20	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	5	44	11.36	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	6	41	14.63	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fractions Only	EP071-SD-SV	3	41	7.32	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	3	47	6.38	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Organotin Analysis	EP090	3	43	6.98	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	3	41	7.32	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspension Peroxide Oxidation-Combined Acidity and Sulphate	EA029	2	40	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	5	49	10.20	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	5	44	11.36	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	3	41	7.32	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fractions Only	EP071-SD-SV	3	41	7.32	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	3	47	6.38	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Organotin Analysis	EP090	3	43	6.98	5.00	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	3	41	7.32	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	5	49	10.20	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	4	44	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fractions Only	EP071-SD-SV	3	41	7.32	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification .

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Matrix Spikes (MS) - Continued							
TRH Volatiles/BTEX in Sediments	EP080-SD	3	47	6.38	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Suspension Peroxide Oxidation-Combined Acidity and Sulphate	EA029	SOIL	In house: Referenced to Ahern et al 2004 - a suspension peroxide oxidation method following the 'sulfur trail' by determining the level of 1M KCL extractable sulfur and the sulfur level after oxidation of soil sulphides. The 'acidity trail' is followed by measurement of TAA, TPA and TSA. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Particle Size Analysis (Sieving)	EA150	SOIL	In house: Referenced to AS1289.3.6.1. Particle Size Analysis by Sieving
Total Metals in Sediments by ICPMS	EG020-SD	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. Analyte list and LORs per NODG.
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO ₂) is automatically measured by infra-red detector.
TPH - Semivolatile Fractions Only	EP071-SD-SV	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX in Sediments	EP080-SD	SOIL	In house: Referenced to USEPA SW 846 - 8260 Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve.
Organotin Analysis	EP090	SOIL	In house: Referenced to USEPA SW 846 - 8270 Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quantified against an established calibration curve.
PAHs in Sediments by GCMS(SIM)	EP132B-SD	SOIL	In house: Referenced to USEPA 8270 GCMS Capillary column, SIM mode using large volume programmed temperature vaporisation injection.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Dry and Pulverise (up to 100g)	GEO30	SOIL	#



<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids (Option A - Concentrating)	ORG17A	SOIL	In house: Mechanical agitation (tumbler). 20g of sample, Na ₂ SO ₄ and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Tumbler Extraction of Solids for LVI (Non-concentrating)	ORG17D	SOIL	In house: 10g of sample, Na ₂ SO ₄ and surrogate are extracted with 50mL 1:1 DCM/Acetone by end over end tumbling. An aliquot is concentrated by nitrogen blowdown to a reduced volume for analysis if required.
Organotin Sample Preparation	ORG35	SOIL	In house: 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

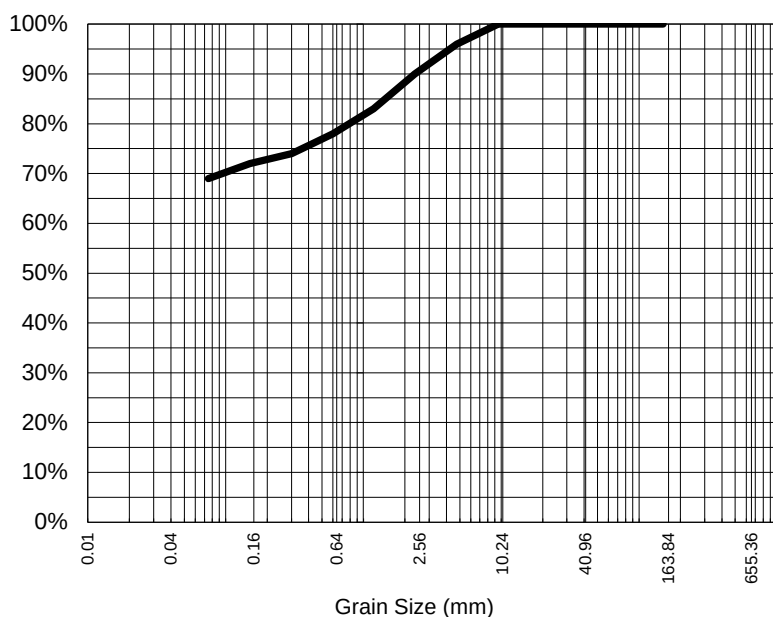
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-001 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MSB 1_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	96%
2.36	90%
1.18	83%
0.600	78%
0.425	76%
0.300	74%
0.150	72%
0.075	69%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND, GRAVEL

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

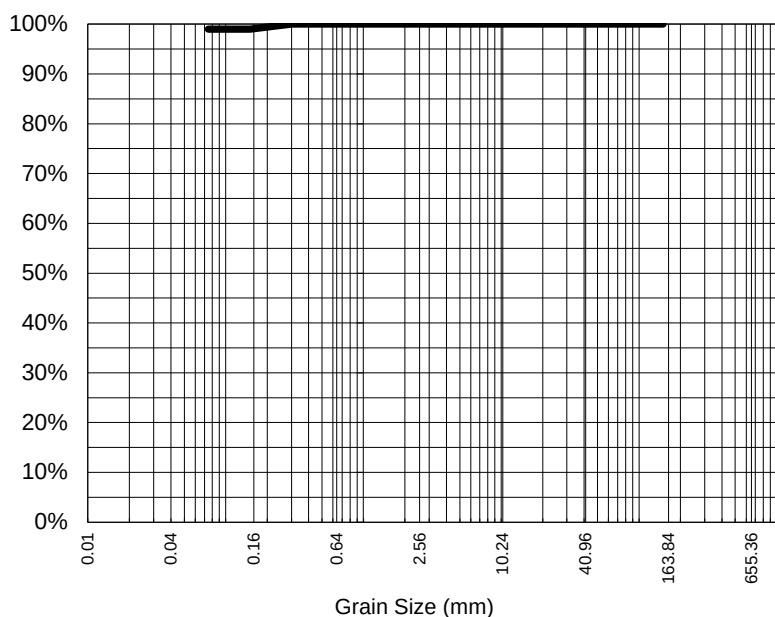
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-002 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MSB 2_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	99%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

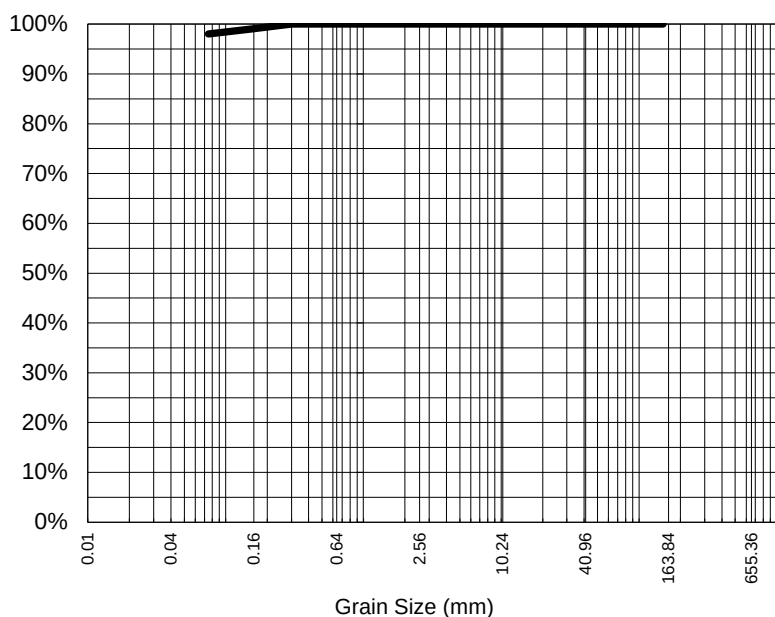
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-003 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MSB 3_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	98%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

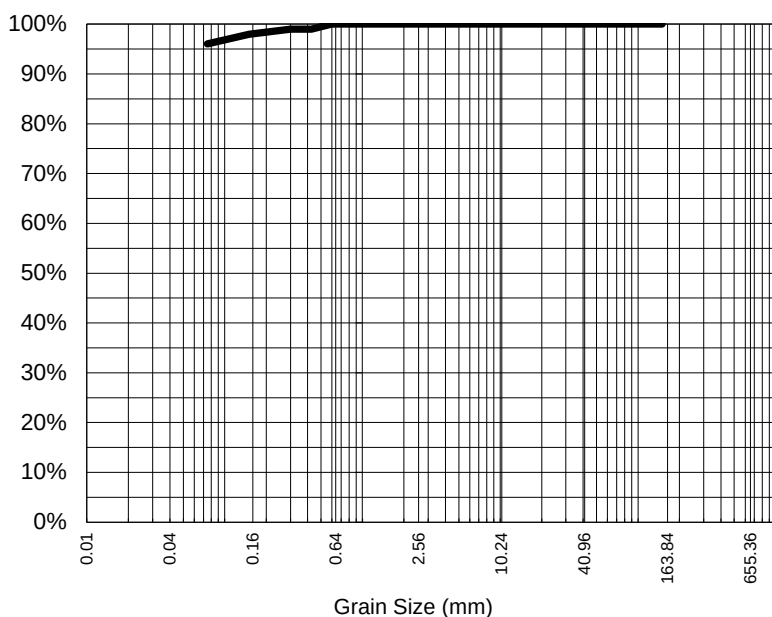
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-004 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MSB 4_0-0.5m

Particle Size Distribution



Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

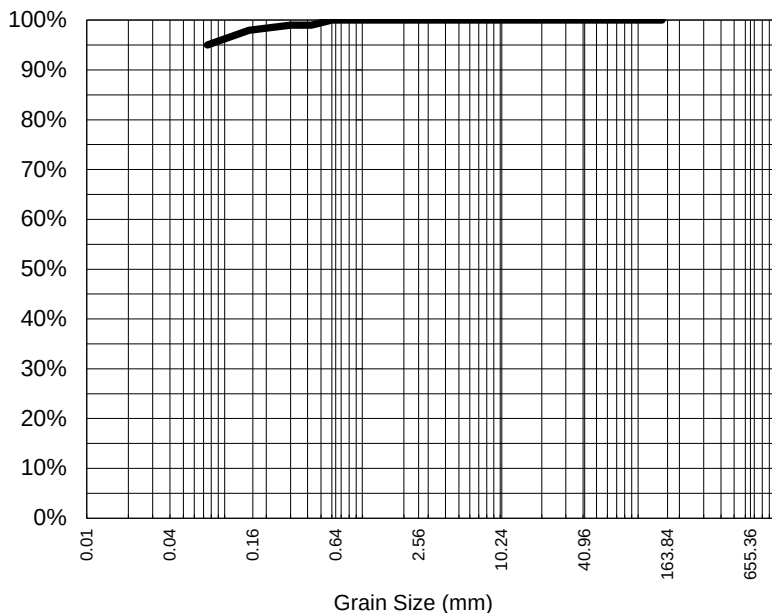
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-005 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MSB 5_0-0.5m

Particle Size Distribution



Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

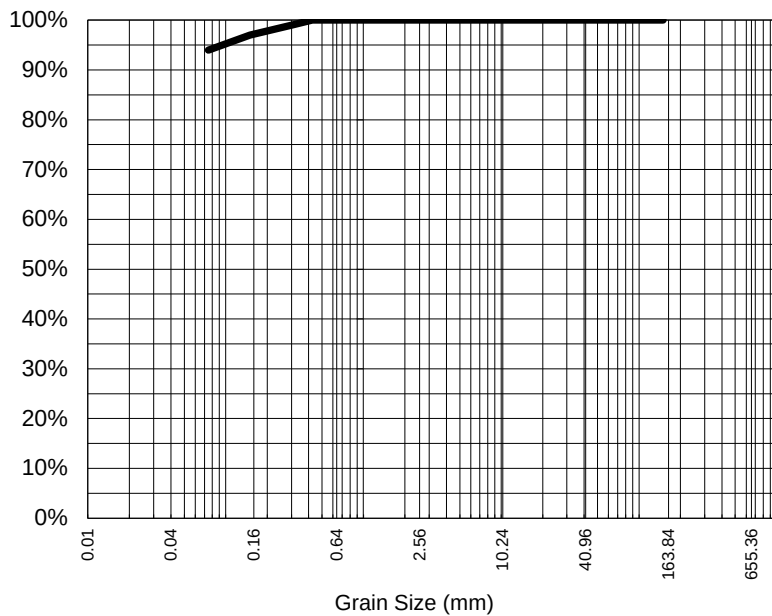
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-006 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MSB 6_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
0.075	94%
0.150	97%
0.300	99%
0.425	100%
0.600	100%
0.850	100%
1.180	100%
1.600	100%
2.000	100%
2.500	100%
3.150	100%
4.000	100%
5.000	100%
6.300	100%
8.000	100%
10.000	100%
12.500	100%
16.000	100%
20.000	100%
25.000	100%
31.500	100%
40.000	100%
50.000	100%
63.000	100%
80.000	100%
100.000	100%
125.000	100%
160.000	100%
200.000	100%
250.000	100%
315.000	100%
400.000	100%
500.000	100%
630.000	100%
800.000	100%
1000.000	100%
1250.000	100%
1600.000	100%
2000.000	100%
2500.000	100%
3150.000	100%
4000.000	100%
5000.000	100%
6300.000	100%
8000.000	100%
10000.000	100%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

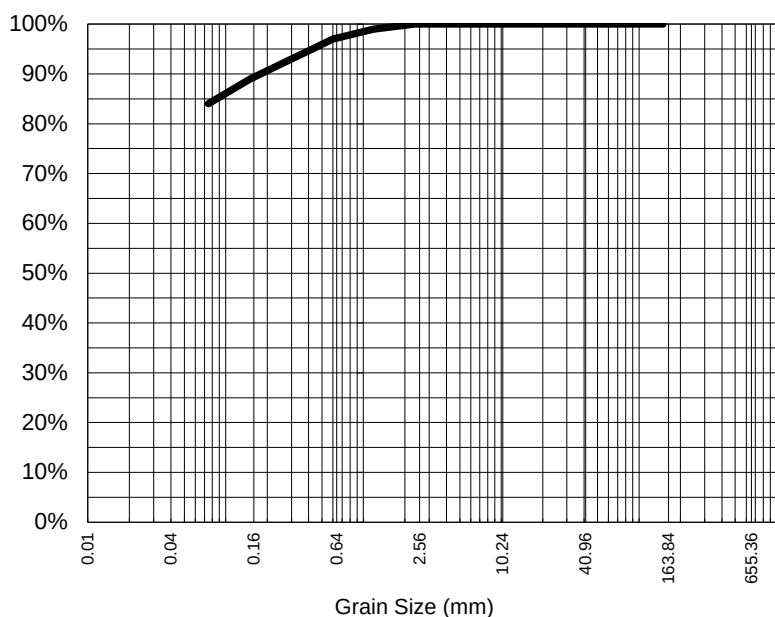
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-007 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MSB 7_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	97%
0.425	95%
0.300	93%
0.150	89%
0.075	84%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

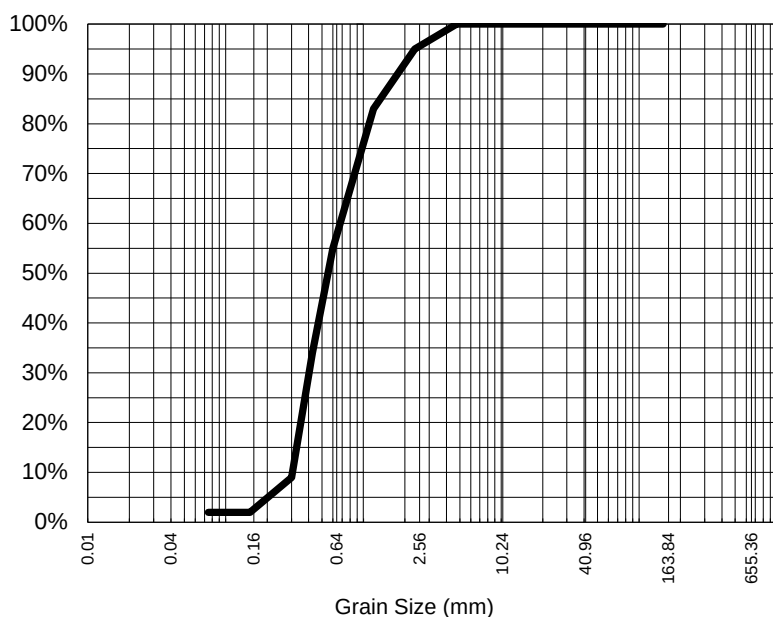
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-008 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MEC 1_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	95%
1.18	83%
0.600	55%
0.425	34%
0.300	9%
0.150	2%
0.075	2%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.558
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL, FINES

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

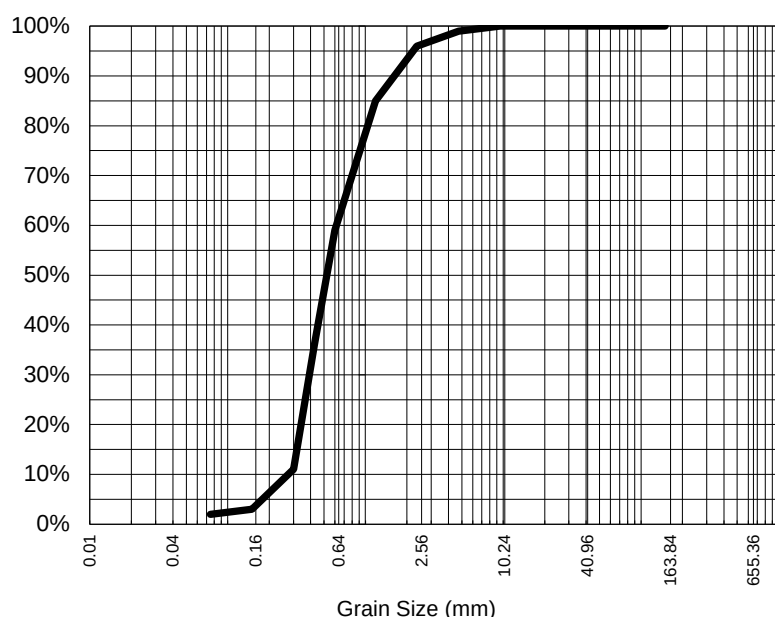
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-009 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MEC 1_0.5-1.0m

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	96%
1.18	85%
0.600	59%
0.425	36%
0.300	11%
0.150	3%
0.075	2%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.532
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL, FINES

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

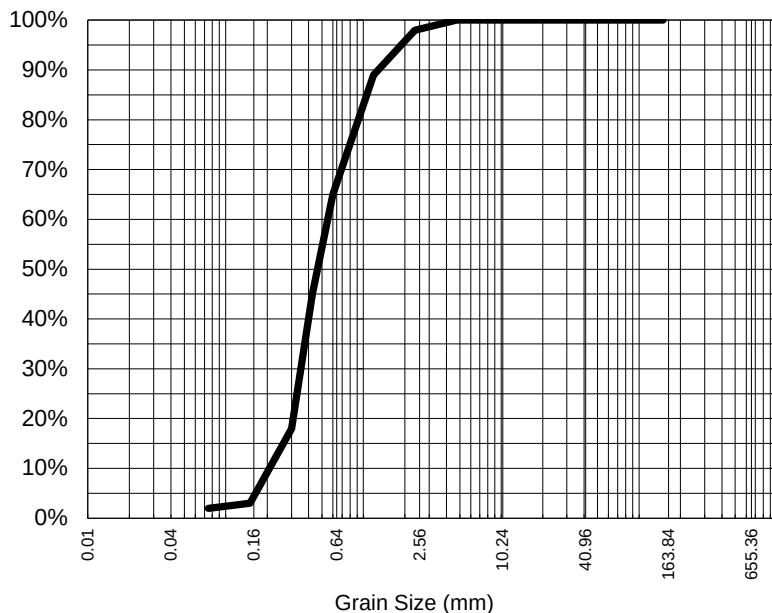
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-010 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MEC 2_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	98%
1.18	89%
0.600	65%
0.425	45%
0.300	18%
0.150	3%
0.075	2%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.469
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL, FINES

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

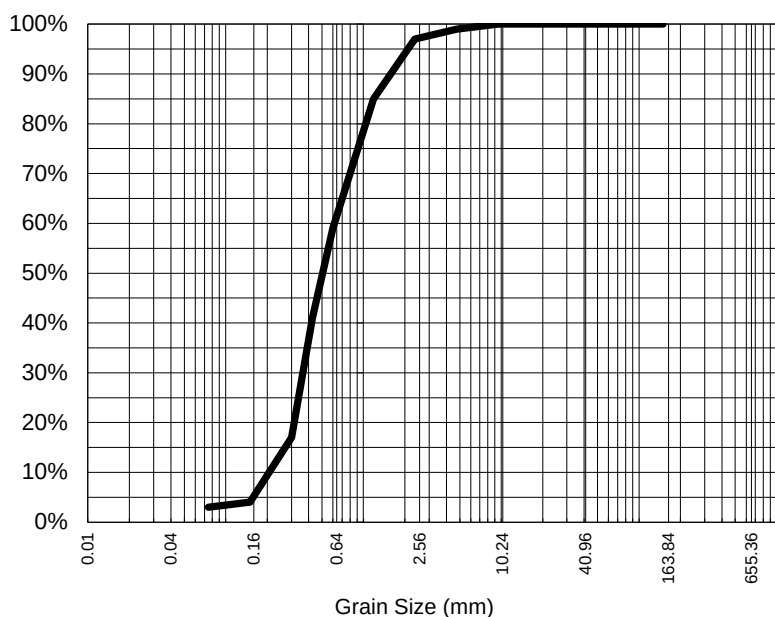
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-011 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MEC 2_0.5-1.0m

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	97%
1.18	85%
0.600	59%
0.425	41%
0.300	17%
0.150	4%
0.075	3%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.513
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL, FINES

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

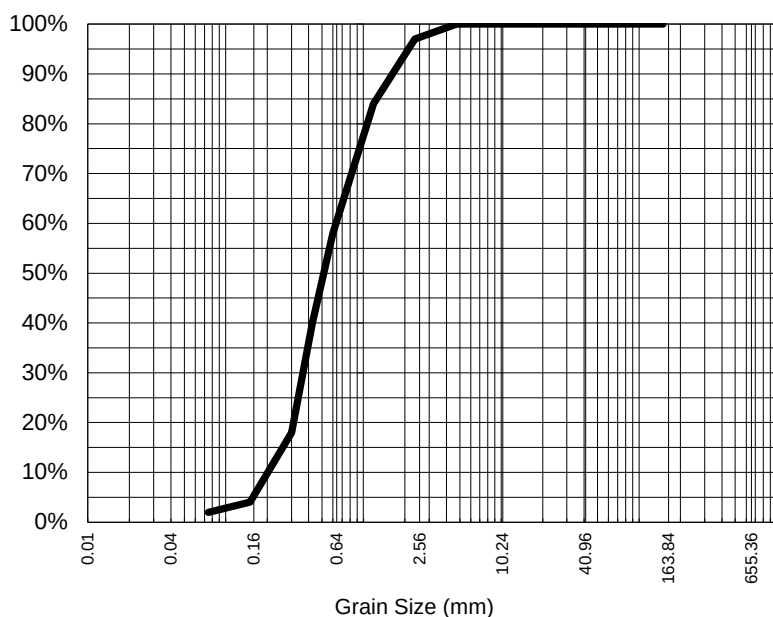
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-012 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MEC 3_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	97%
1.18	84%
0.600	58%
0.425	40%
0.300	18%
0.150	4%
0.075	2%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.522
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL, FINES

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

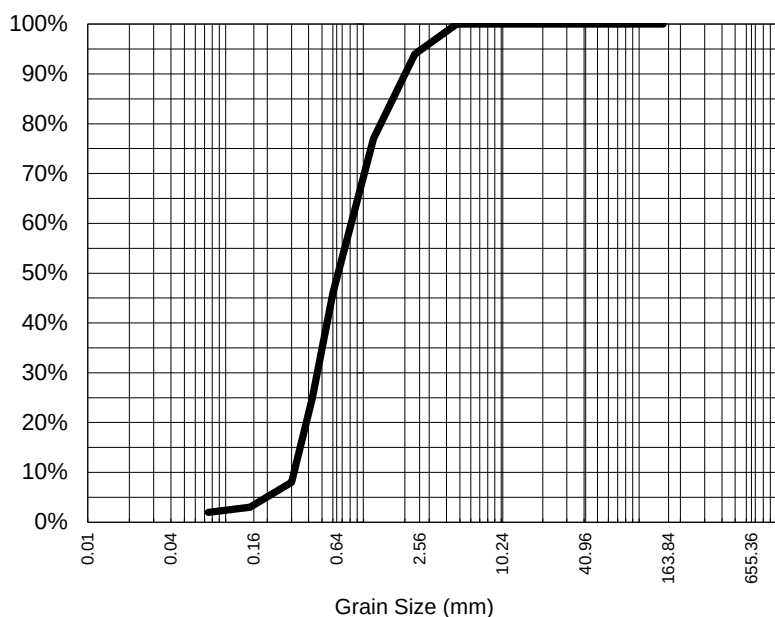
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-013 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MEC 4_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
0.075	2%
0.150	3%
0.300	8%
0.425	25%
0.600	46%
1.18	77%
2.36	94%
4.75	100%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.675
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL, FINES

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

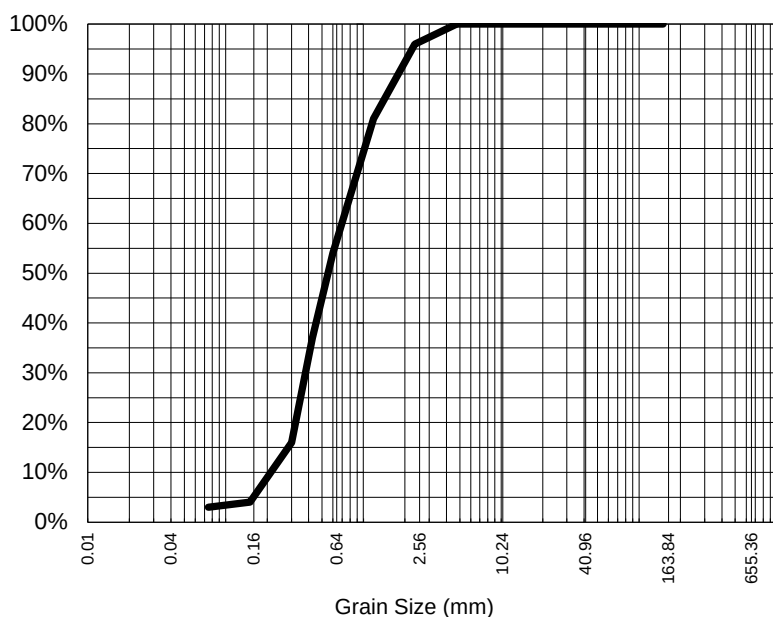
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-014 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MEC 5_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	96%
1.18	81%
0.600	54%
0.425	37%
0.300	16%
0.150	4%
0.075	3%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.559
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL, FINES

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

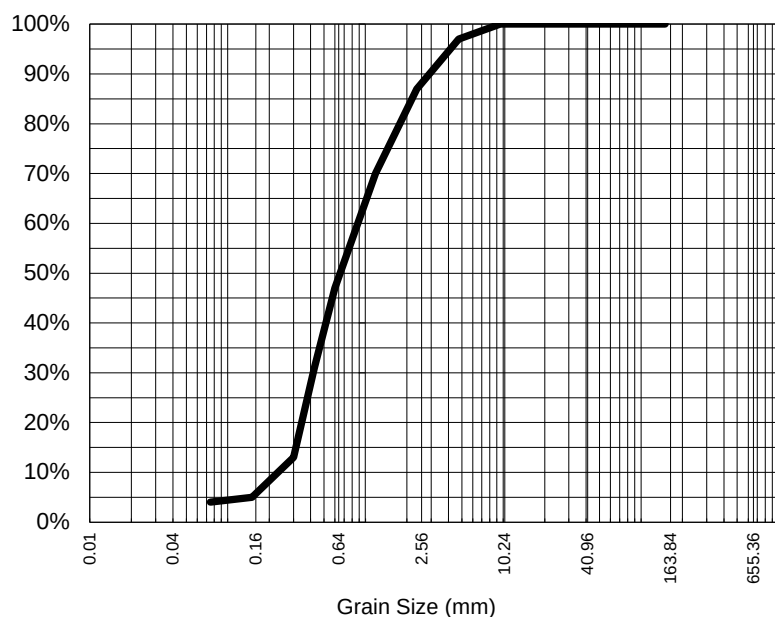
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-015 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: MEC 6_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	97%
2.36	87%
1.18	70%
0.600	47%
0.425	31%
0.300	13%
0.150	5%
0.075	4%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.676
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, GRAVEL, FINES

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

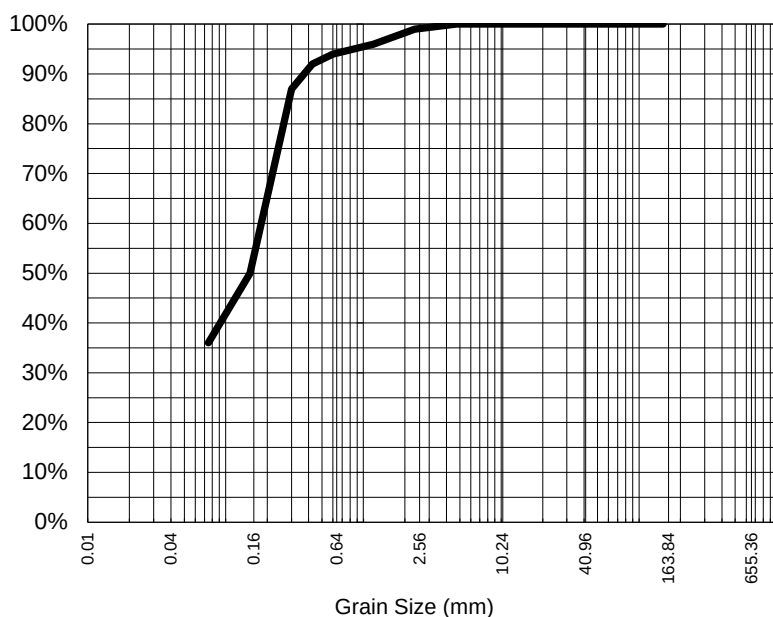
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-016 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: EAW 1_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	96%
0.600	94%
0.425	92%
0.300	87%
0.150	50%
0.075	36%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.150
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, FINES, GRAVEL

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

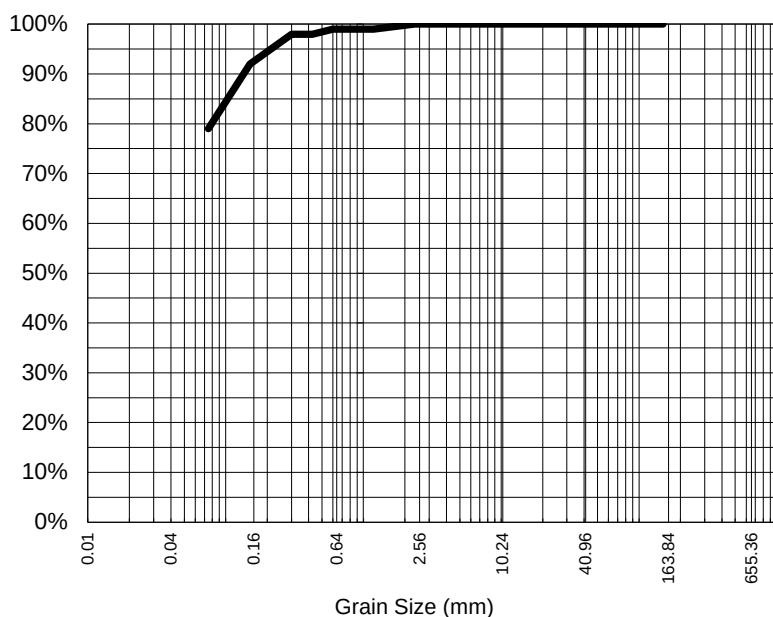
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-017 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: EAW 2_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	99%
0.425	98%
0.300	98%
0.150	92%
0.075	79%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

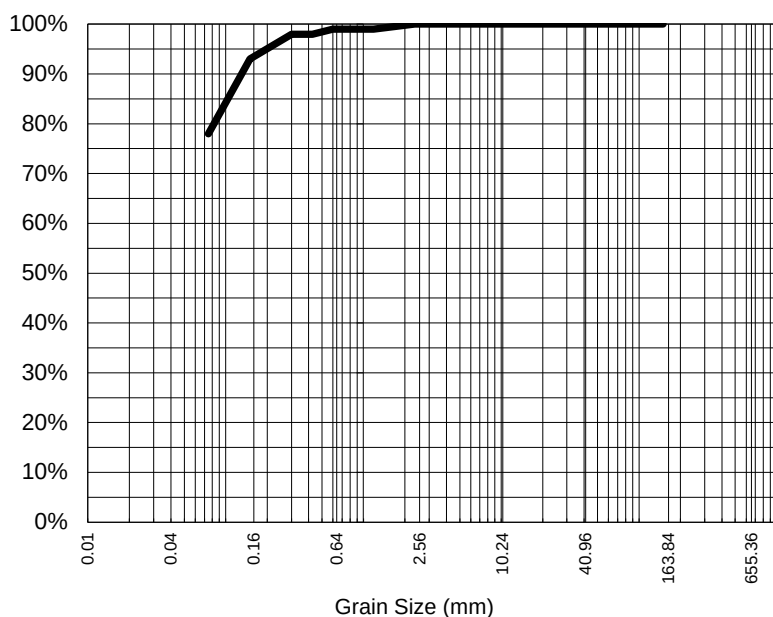
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-018 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: EAW 2_0.5-1.0m

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	99%
0.425	98%
0.300	98%
0.150	93%
0.075	78%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

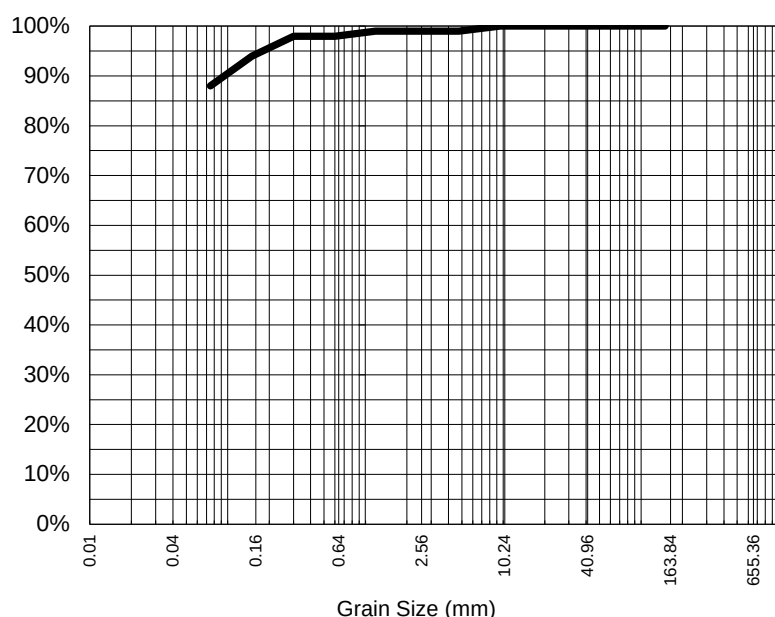
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-020 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: EAW 3_0.5-1.0m

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	99%
1.18	99%
0.600	98%
0.425	98%
0.300	98%
0.150	94%
0.075	88%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

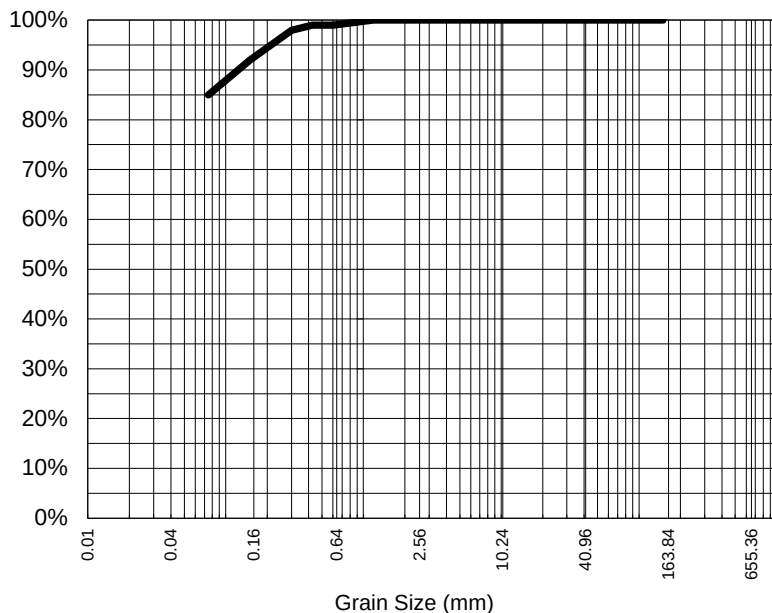
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-021 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: EAW 4_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	99%
0.300	98%
0.150	92%
0.075	85%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

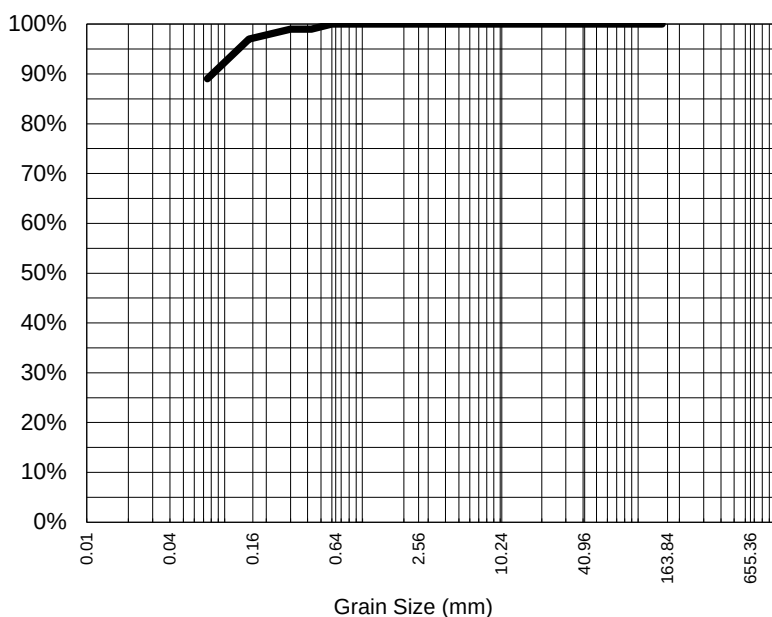
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-022 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: EAW 4_0.5-1.0m

Particle Size Distribution



Particle Size (mm)	% Passing
0.600	100%
0.425	99%
0.300	99%
0.150	97%
0.075	89%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

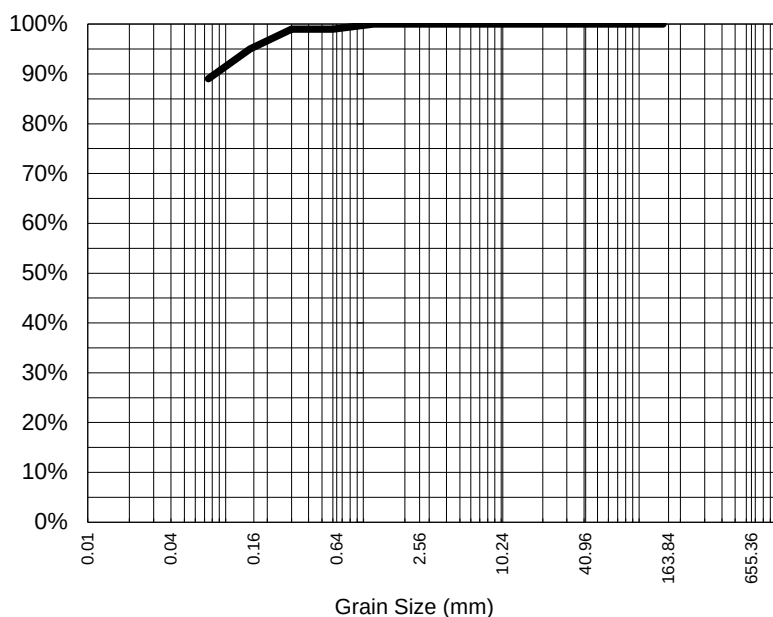
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-023 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: EAW 5_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
0.075	89%
0.150	95%
0.300	99%
0.425	99%
0.600	99%
1.18	100%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

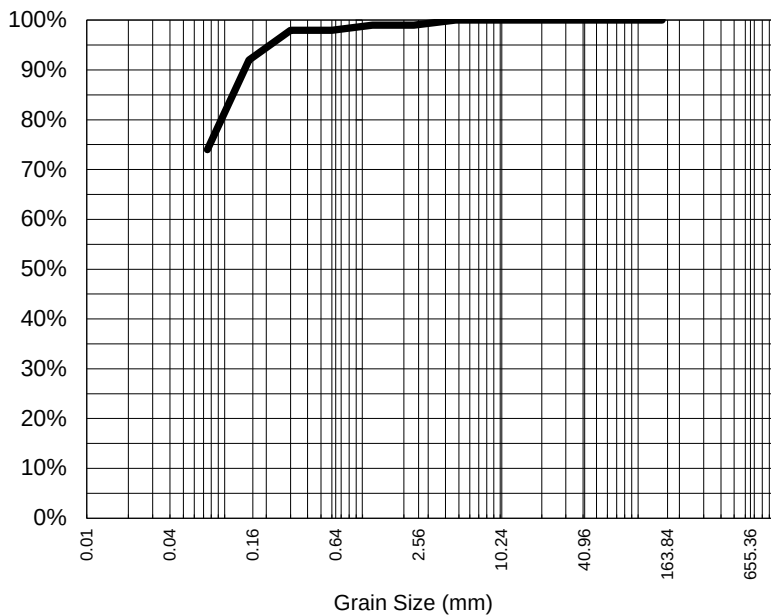
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-024 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: EAW 5_0.5-1.0m

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	99%
0.600	98%
0.425	98%
0.300	98%
0.150	92%
0.075	74%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

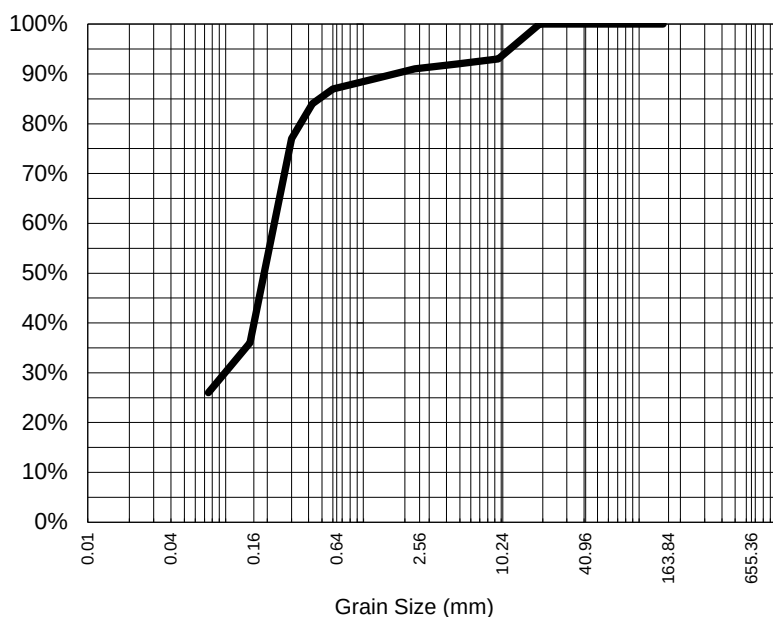
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-025 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: EAW 6_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
19.0	100%
9.50	93%
4.75	92%
2.36	91%
1.18	89%
0.600	87%
0.425	84%
0.300	77%
0.150	36%
0.075	26%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.201
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, FINES, GRAVEL

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

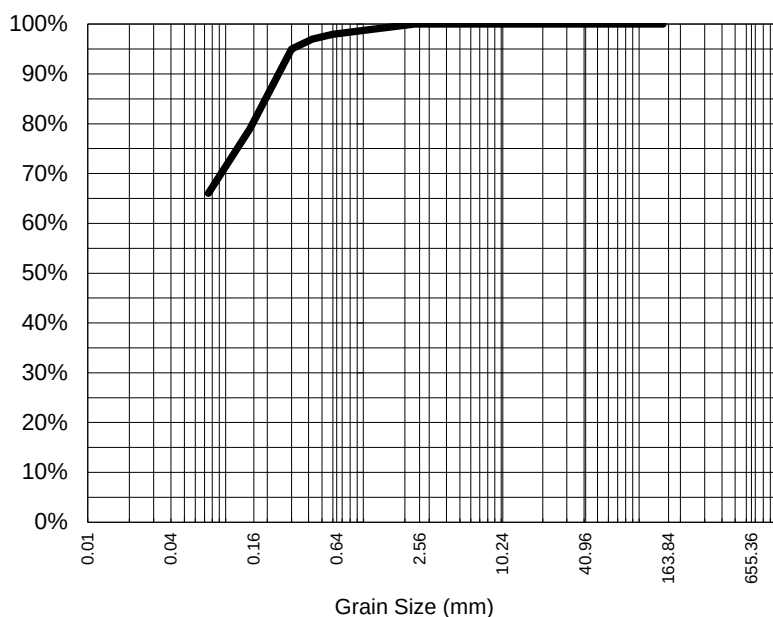
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-026 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: EAW 7_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	98%
0.425	97%
0.300	95%
0.150	79%
0.075	66%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

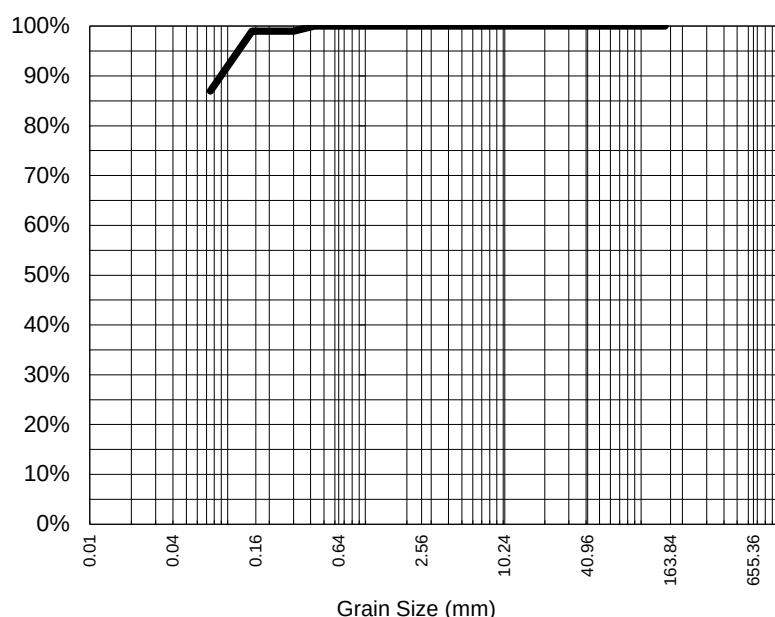
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-027 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: FHW 1_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
0.425	100%
0.300	99%
0.150	99%
0.075	87%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

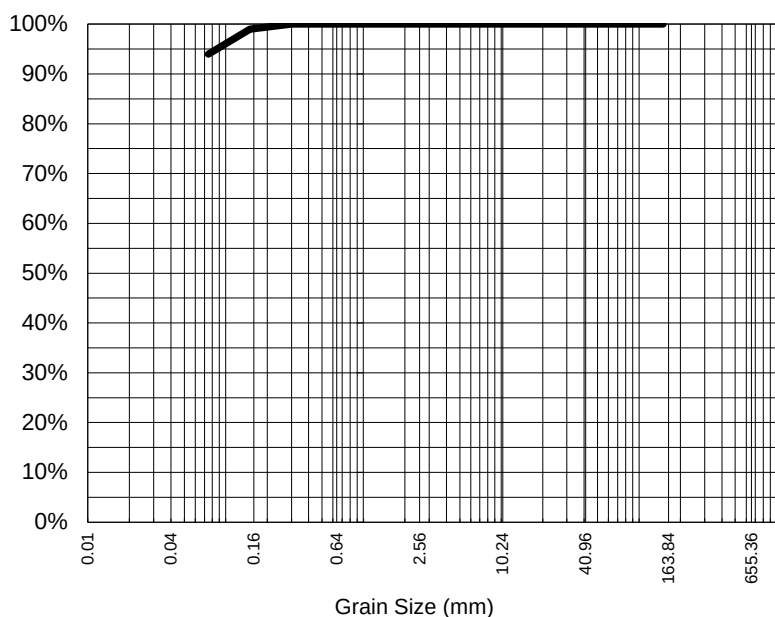
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-029 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: FHW 2_0.5-1.0m

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	94%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

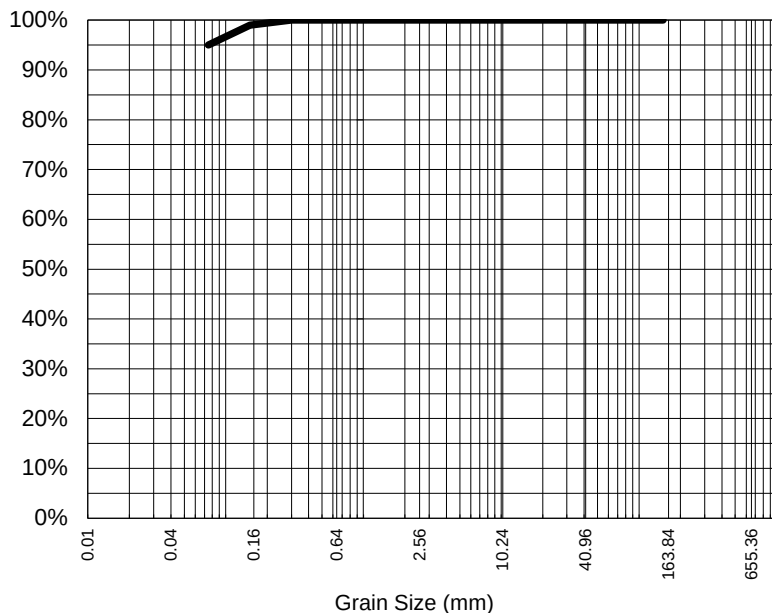
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-030 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: FHW 3_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	95%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

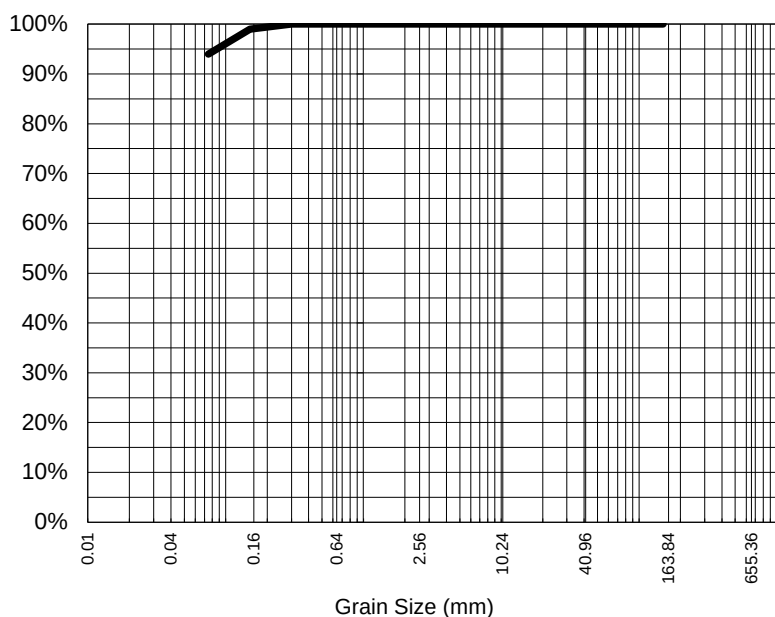
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-031 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: FHW 3_0.5-1.0m

Particle Size Distribution



Particle Size (mm)	% Passing
0.300	100%
0.150	99%
0.075	94%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

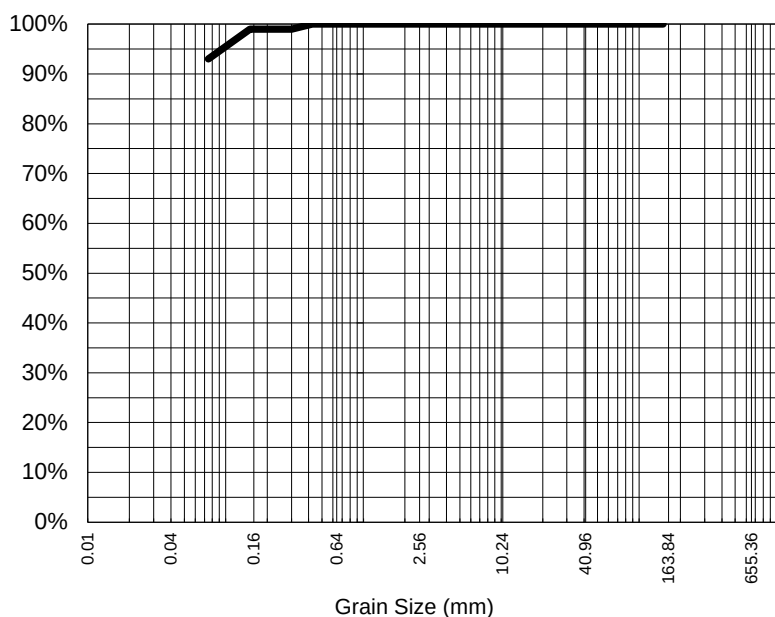
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-032 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: FHW 4_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
0.425	100%
0.300	99%
0.150	99%
0.075	93%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.

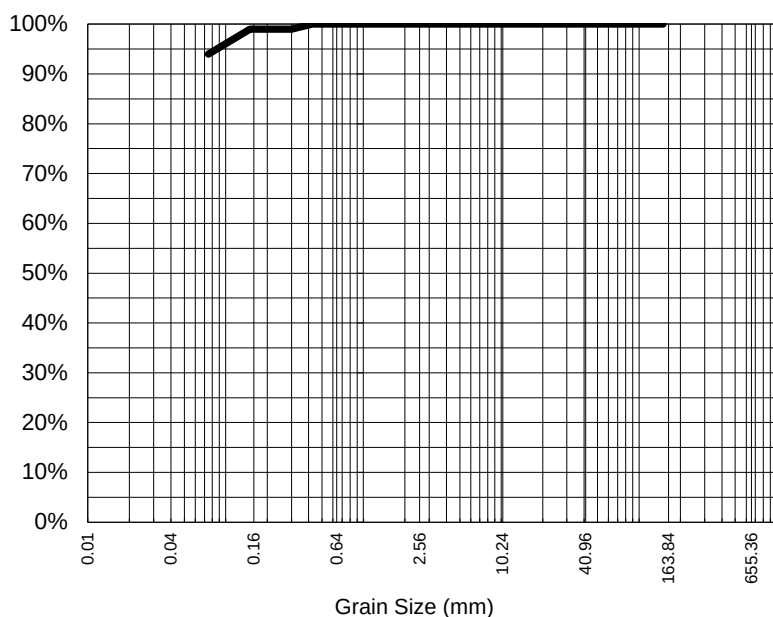


Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Newcastle, NSW

SAMPLE ID: FHW 4 0.5-1.0m

Particle Size (mm)	% Passing
0.425	100%
0.300	99%
0.150	99%
0.075	94%



Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Analysed: 18-Mar-25

Limit of Reporting: 1%

Test Method: AS1289.3.6.1




Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

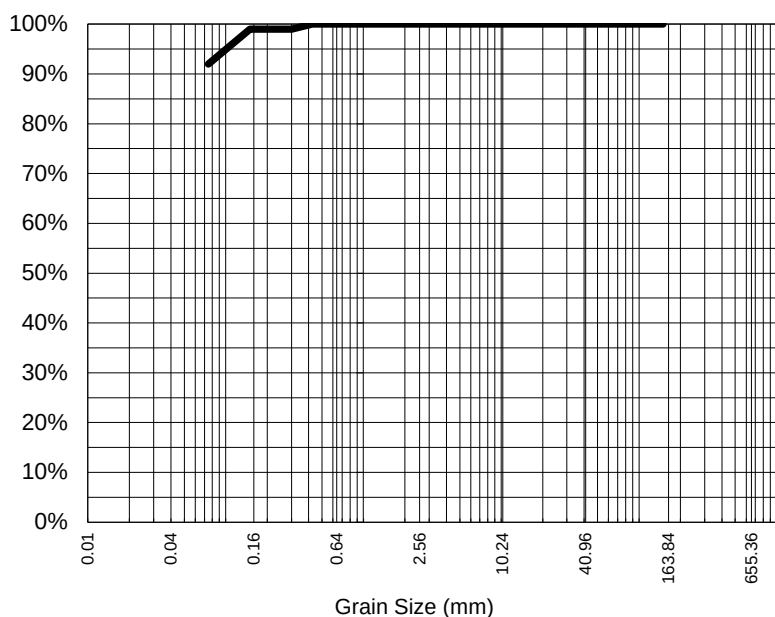
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-034 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: FHW 5_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
0.425	100%
0.300	99%
0.150	99%
0.075	92%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5/585 Maitland Road
Mayfield West, NSW 2304
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: ADAM COHEN

DATE REPORTED: 21-Mar-2025

COMPANY: AUSTRALASIAN MARINE
ASSOCIATES PTY LTD

DATE RECEIVED: 13-Mar-2025

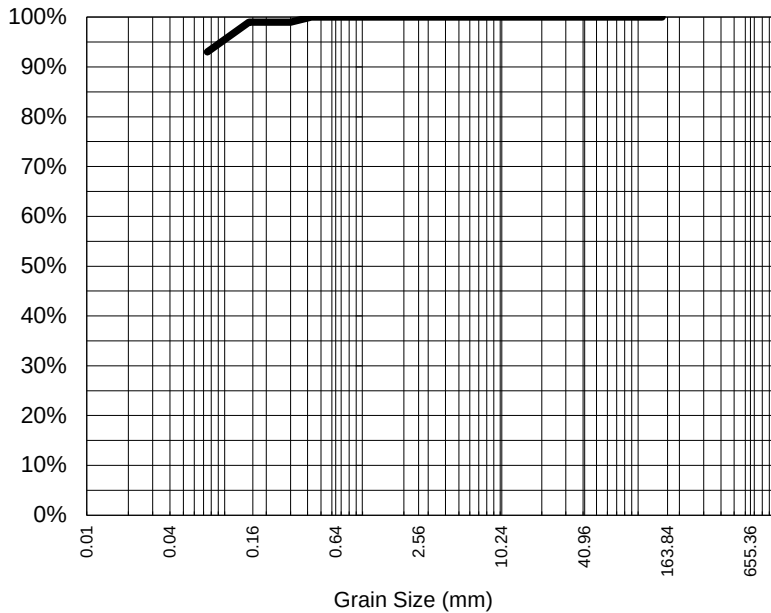
ADDRESS: 42 Barkly Street
St Kilda

REPORT NO: ES2506937-035 / PSD

PROJECT: Darwin Ports Sediment
Investigation

SAMPLE ID: FHW 6_0-0.5m

Particle Size Distribution



Particle Size (mm)	% Passing
0.075	93%
0.150	99%
0.300	99%
0.425	100%
0.600	100%
0.850	100%
1.180	100%
1.600	100%
2.000	100%
2.500	100%
3.000	100%
3.550	100%
4.750	100%
6.000	100%
7.500	100%
10.000	100%
12.500	100%
16.000	100%
20.000	100%
25.000	100%
31.500	100%
40.000	100%
50.000	100%
63.000	100%
80.000	100%
100.000	100%
125.000	100%
160.000	100%
200.000	100%
250.000	100%
315.000	100%
400.000	100%
500.000	100%
630.000	100%
800.000	100%
1000.000	100%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075
----------------------------	--------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Mar-25

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Test Method: AS1289.3.6.1

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. This document shall not be
reproduced, except in full.



Aleksandar Vujkovic
Laboratory Supervisor
Authorised Signatory