Crowdy Head Harbour Upgrade

Review of Environmental Factors

Transport for NSW

Crowdy Head Harbour Upgrade

Review of Environmental Factors

Transport for NSW | June 2022

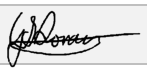
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Prepared by GHD Pty Ltd and Transport for NSW

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Document controls

Approval and authorisation

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Accepted on behalf of Transport for NSW by:	Gareth Doran Manager Programs | Infrastructure Programs (South)
Signed:	
Dated:	21/06/2022

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Executive summary

The proposal

Transport for NSW proposes to upgrade the Crowdy Head Harbour. Key features of the proposal include:

- Removal of the long central jetty (Jetty 2) and shorter eastern jetty (Jetty 1).
- Dredging of areas of the harbour to provide a safe clearance depth of between 2.6 and 3.0 metres.
- Construction of a new pontoon jetty about 10 metres south of Jetty 1.
- Disposal of dredge spoil on the southern side of Crowdy Head.

Construction is expected to commence in 2023 and would take around six months to complete.

Need for the proposal

The coastal harbour at Crowdy Head is situated on a natural harbour that was formed by a rocky reef on the north-eastern side of the headland. Due to the nature and location of the harbour, accumulation of marine sand occurs in the northern section of the harbour directly adjacent to the northern breakwater.

Works to repair Jetty 2 and dredging of the harbour was undertaken in 2010 by the NSW Land and Property Management Authority under the Department of Planning, Industry and Environment (now the Department of Planning and Environment, DPE) Coastal Infrastructure Program (2015-2019).

Since 2013, the Crowdy Head Harbour has not been able to sustain heavy boat use, with Jetty 2 closed since 2010. Furthermore, due to surging swells, the harbour has accumulated significant siltation that affects safe clearance depths. Infrastructure and services associated with the Crowdy Head Harbour have an estimated replacement value of about $18.5 million.

Proposal objectives

The objectives of the proposal are:

- Improved accessibility and safety for vessels using Crowdy Head Boat Harbour.
- Increased safety for users of the harbour by upgrading infrastructure to meet relevant modern design standards and requirements.
- Improved community access and use of the harbour.
- Increased lifespan of the infrastructure in use.

Options considered

There are few alternative options due to the deteriorated nature of the harbour infrastructure and the level of siltation. The following options were considered during the development of the proposal design:

- Do nothing – The do nothing option was not considered viable as it would not improve safety, amenity and use of the facility and would allow the infrastructure to fall into further disrepair.
- Repair not replace jetties – Repair of the jetties is not feasible due to the deterioration of their structural elements. In addition, all structures require removal to allow dredging.

- Alternative dredging methods - Side cast dredging or ocean going trailing suction hopper dredging is not considered feasible due to limited access and practicality. Other methods include bed sweeping/levelling, however this method would result in the infilling of the deep hole located at the harbour entrance.
- Spoil disposal - Beneficial placement of sand on areas within close proximity to the dredge area is limited. Nearby placement sites considered include renourishment of Crowdy and/or Harrington Beach or ocean placement. These options were discounted due to potential marine biodiversity impacts. Off-site disposal is not considered viable due to the volume of material to be removed and the cost of disposal.
- Preferred option - The removal of the long central jetty, replacement of the shorter eastern jetty with a pontoon jetty and dredging of the harbour to provide a safe clearance depth was identified as the most feasible option.

Statutory and planning framework

The proposed facility is a wharf or boating facility within the meaning of the State Environmental Planning Policy (Transport and Infrastructure) 2021 (Infrastructure SEPP), which came into effect on 1 March 2022 and repealed State Environmental Planning Policy (Infrastructure) 2007.

The proposal is to be carried Transport for NSW can therefore be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

Community and stakeholder consultation

The requirements for consultation for infrastructure projects are laid out in clause 2.10 to 2.17 of the Transport and Infrastructure SEPP. Review of these requirements have confirmed that consultation in accordance with Infrastructure SEPP is required for the proposal. Additional consualtion will include a “have your say” consultation process that has been devised to engage and involve the community during the REF display until 15 July. This includes two information sessions taking place in the local area on 22 and 23 June 2022.

Environment impacts

The main environmental impacts of the proposal are:

Water quality

Potential impacts to water quality during construction are associated predominantly with jetty demolition, dredging, construction and piling of the new jetty, potential spills from plant and equipment and land-based risks from ground disturbance, uncontrolled spills and dredge spoil management. Water quality impacts due to these activities could include:

- Sedimentation of harbour waters resulting in loss of visibility and smothering of aquatic habitat.
- Acidification of water due to disturbance of acid sulfate soils.
- Pollution of water due to disturbance of contaminated sediments or other pollutants entering the harbour.

Harbour sediments did not contain levels of contaminants of potential concern above the required criteria for human health, ecological heath or hydrocarbon management limits. It is important to note that the adopted assessment criteria are applicable for soil and not sediment but have been applied to assess potential risks to human and ecosystem health during spoil disposal activities. Elevated levels of copper and tributyltin were found near the slipway, however no disturbance of sediments is proposed in this area.

Harbour operational procedures will include ongoing measures for monitoring and managing water quality.

Waste management

The proposal will result in general building wastes from replacing the existing jetty. Where feasible, materials would be barged, including fuels, oils and other required liquids which would be stored in bunded containers. All waste removed from the proposal footprint would be transferred by a licenced contractor to a licenced receiving facility.

Dredge spoil does not pose a risk to human health or the environment. As such, the sediments are suitable for land-based reuse/placement, subject to appropriate management and handling measures. Dredge spoil is classified as General Solid Waste. Additional ASS testing has confirmed neutralisation without treatment.

A specific Resource Recovery Order and Resource Recovery Exemption under the Protection of the Environment Operations (Waste) Regulation 2014 will have to be sought to enable the proposed disposal of the dredged spoil to land.

Marine biodiversity

The Marine Biodiversity Assessment found that the proposed works could result in the following direct impacts:

- Biofouling and benthic community disturbance.
- Removal of seagrass and of habitat for threatened species.
- Decline in water quality.
- Artificial noise.

Indirect impacts could include:

- Increased shading of rocky reef and seagrass beds.
- Introduction of marine pest species.
- Collision with marine fauna.
- Accidental release of hydrocarbons or other chemicals.

The direct and indirect impacts that could potentially arise during proposal construction, are also applicable to the operational stage.

Assessments of significance of potential direct and indirect impacts as required under the *Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) found that with the implementation of the mitigation measures, there is unlikely to be a significant impact to threatened species listed as likely to occur, including marine turtles, White's Seahorse and the Black Rock Cod. Full justification is provided in the Marine Biodiversity Assessment (Appendix G).

Engagement with the NSW Department of Primary Industries (DPI) is required to confirm approval requirements and the adequacy of mitigation proposed for FM Act listed species.

Justification and conclusion

Transport for NSW has determined that the majority of the core infrastructure at the harbour is in a state of decline, and the harbour is affected by significant siltation. Use of the facility has declined in recent years as the asset condition has deteriorated. There is now little to no commercial activity at the harbour. Dredging of the harbour was last undertaken in 2010.

The proposed upgrade is intended to improve amenity of the maritime and land-side areas of the harbour, address maritime safety and safe use of the facilities, and to renew the lifespan of the infrastructure in use.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described herein best meets the project objectives but would still result in some impacts on marine habitat. Safeguards and management measures are provided to ameliorate or minimise these expected impacts. The proposal would also improve safety and provide improved access for all users including people with a disability. On balance the proposal is considered justified.

Display of the review of environmental factors

This REF is on display for comment until 15 July 2022. You can access the documents in the following ways:

Internet

The documents are available as pdf files on the Transport for NSW website at nswroads.work/crowdyhead and nsw.gov.au/have-your-say

Printed copies

The documents can be viewed at the following locations:

- Harrington Library, 1/7 Caledonia St, Harrington NSW 2427
- Crowdy Head Surf Club, 557 Crowdy Head Road, Crowdy Head 2427
- MidCoast Council Office, Yalawanyi Ganya 2 Biripi Way, Taree 2430

Copies by request

Printed and electronic copies are available by contacting the project team on 1800 973 343 (toll free) or email crowdyheadjetty@transport.nsw.gov.au noting that there may be a charge for hard copies, CD or USB.

Information session (staffed displays)

The project team has advertised the information sessions in the local paper and with local radio stations. They were also included in the June community update that was distributed to all Harrington and Crowdy Head residents from 10 June.

- Crowdy Head Surf Life Saving Club, 557 Crowdy Head Road, Crowdy Head

  Wednesday 22 June 2022 between 1 pm and 6 pm

- Harrington Memorial Hall, 2 Pilot Street, Harrington

  Thursday 23 June 2022, between 1 pm and 6 pm

How can I make a submission

To make a submission about this proposal, please send your written comments to:

- Visit: nsw.gov.au/have-your-say
- Email: **crowdyheadjetty@transport.nsw.gov.au**
- Phone: 1800 973 343 (toll free)
- Post: Crowdy Head Boat Harbour:

  Infrastructure Upgrade

  Maritime Branch

  Transport for NSW

  33 James Craig Road

  Rozelle NSW 2039

Submissions must be received by Friday 1 July 2022. Submissions will be managed in accordance with the Transport for NSW Privacy Statement which can be found here https://roads-waterways.transport.nsw.gov.au/about/access-to-information/my-privacy.html or by contacting 1800 973 343 for a copy.

What happens next

Transport for NSW will collate and consider the submissions received during public display of the REF.

After this consideration, Transport for NSW will determine whether or not the proposal should proceed as proposed and will inform the community and stakeholders of this decision.

If the proposal is determined to proceed, Transport for NSW will continue to consult with the community and stakeholders prior to and during construction.

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Appendix E Sediment Contamination and Waste Assessment

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1 Introduction

This chapter introduces the proposal and provides the context of the environmental assessment.

The proposal objectives and development history are outlined and the purpose of the report provided.

1.1 Proposal identification

Transport for NSW is proposing to upgrade the Crowdy Head Harbour (the proposal). The proposal includes:

- Removal of the long central jetty (Jetty 2) and shorter eastern jetty (Jetty 1).
- Dredging of areas of the harbour to provide a safe clearance depth of between 2.6 and 3.0 metres.
- Construction of a new pontoon jetty about 10 metres to the south of Jetty 1.
- Disposal of dredge spoil on the southern side of Crowdy Head.

Transport for NSW has determined that the majority of the core infrastructure at the harbour is in a state of decline, and the harbour is affected by significant siltation. Use of the facility has declined in recent years as the asset condition has deteriorated. There is now little to no commercial activity at the harbour. Dredging of the harbour was last undertaken in 2010.

The proposed upgrade is intended to improve amenity of the maritime and land-side areas of the harbour, address maritime safety and safe use of the facilities, and to renew the lifespan of the infrastructure in use. The proposal sits within a larger NSW maritime infrastructure program to upgrade ageing coastal infrastructure.

The proposal is located directly to the northwest of the village of Crowdy Head, which is approximately eight kilometres north of Harrington and 25 kilometres south of North Haven, in the MidCoast local government area (LGA). Crowdy Head is surrounded by the Crowdy Bay National Park, which conserves an area of approximately 7500 hectares of coastal land between Harrington and North Haven. A more detailed description of the location is provided in Section 6. The site locality is shown in Figure 1-1.

The proposed works would be staged, if possible, to allow continued access and use of the harbour, both on-water and land-side, outside nominated construction exclusion zones. Staging would allow a return to service and use of each jetty in sequence so that there is one available for use at all times.

A more detailed description of the proposal is provided in Section 3.

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by GHD Pty Ltd (GHD) on behalf of Transport for NSW, Maritime Infrastructure Delivery Office, Greater Sydney. For the purposes of these works, Transport for NSW is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail mitigation and management measures to be implemented.

The description of the proposed work and assessment of associated environmental impacts has been undertaken in the context of clause 171(2) of the Environmental Planning and Assessment Regulation 2021, the factors in *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (Is an EIS required? guidelines) (DUAP, 1995/1996), the Marinas and Related Facilities EIS Guideline (DUAP, 1996), the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In doing so, the REF helps to fulfil the requirements of section 5.5 of the EP&A Act including that Transport for NSW examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement (EIS) to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act.
- The significance of any impact on threatened species, as defined by the BC Act and/or FM Act, assessed under section 1.7 of the EP&A Act, and therefore the requirement for a species impact statement (SIS) or a biodiversity development assessment report (BDAR).
- The potential for the proposal to significantly impact any matter of national environmental significance (MNES) or Commonwealth land and the need to make a referral to the Australian Government Department of Agriculture, Water and Environment (DAWE) for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.



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Metres

Map Projection: Transverse Mercator
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Site location

Project No. **12554729**
Revision No. **1**
Date **25/05/2022**

FIGURE 1-1

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2 Need and options considered

This chapter describes the need for the proposal in terms of its strategic setting and operational need. It identifies the various options considered and the selection of the preferred option for the proposal.

2.1 Strategic need for the proposal

The coastal harbour at Crowdy Head is situated on a natural harbour that was formed by a rocky reef on the north-eastern side of the headland. Formation of the coastal harbour commenced in 1900 with construction of a breakwall using rock blasted from the nearby quarry. In the 1970s and 1980s the breakwater was extended, dredging was completed, and mooring jetties and an unloading wharf were built for the local fishing industry. Infrastructure and services associated with the Crowdy Head Harbour have an estimated replacement value of about $18.5 million.

Due to the nature and location of the harbour, marine sand transported from the south by coastal processes is 'pushed' through the northern breakwater by wave action and/or carried into the harbour through the entrance on flood tides. Furthermore, water circulation within the harbour results in an accumulation of marine sand in the northern section of the harbour directly adjacent to the northern breakwater.

Works to repair Jetty 1 and dredging of the harbour was undertaken in 2010 by the NSW Land and Property Management Authority under the Department of Planning, Industry and Environment (now the Department of Planning and Environment, DPE) Coastal Infrastructure Program (2015-2019).

Since 2013, the Crowdy Head Harbour has not been able to sustain heavy boat use, with Jetty 2 closed since 2010. Furthermore, due to surging swells, the harbour has accumulated significant siltation that affects safe clearance depths.

Under the Taree-Great Lakes Region Regional Boating Plan (Regional Plan; TfNSW, 2015), various complementary projects have been identified as priorities throughout the region. The Better Boating Program provided MidCoast Council with a grant in accordance with the Regional Plan to undertake maintenance dredging at the Crowdy Head boat ramp. This work was completed in early 2022.

From 1 July 2020 the former maritime-related functions of DPE, Crown Lands have been centrally coordinated and managed by the Maritime Infrastructure Delivery Office (MIDO) within Transport for NSW.

The proposed upgrade of Crowdy Head Harbour is needed to improve amenity of the maritime and land-side areas of the harbour, address maritime safety and safe use of the facilities, and to renew the lifespan of the infrastructure in use.

2.2 Existing infrastructure

The Crowdy Head Harbour has an approximate vessel capacity of 20, with harbour facilities that include a public wharf, boat ramp, commercial fishing unloading and berthing, and recreational and visitor berthing. There is one charter fishing boat business that operates out of the harbour.

Major existing structural features at the proposal site include:

- Rock breakwalls on the northern and southern boundary of the harbour.
- Jetty 1 with mooring bays, on the eastern side of the harbour.
- Formal, sealed parking area that serves Jetty 1.
- A T-shaped short jetty, between Jetty 1 and 2, that is used as a commercial loading and unloading area.
- The Crowdy Head Fishermen's Co-operative building, that is not currently in use, and associated sealed car parks.
- Slipway, not currently in use.
- Jetty 2, a long jetty in the centre of the harbour, closed to vessel use since 2010, now primarily used as an unofficial fishing or viewing platform by the community.
- Recently upgraded boat ramp.
- Formal, sealed parking area adjoining the upgraded boat ramp.

The harbour also provides bins and fishing signage at some locations. The harbour is accessed via Crowdy Head Road and Pacific Drive. Currently the harbour does not provide reduced mobility access along the breakwalls.

Transport for NSW has determined that the majority of the core infrastructure at the harbour is in a state of decline, and the harbour is affected by significant siltation. Use of the facility has declined in recent years as the asset condition has deteriorated. There is little to no commercial activity at the harbour.

The current layout of the harbour is shown in Figure 2-1.



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Review of Environmental Factors

Current layout of Crowdy Head Harbour

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Revision No. **1**
Date **25/05/2022**

FIGURE 2-1

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2.3 Proposal objectives

The objectives of the proposal are to:

- Improved accessibility and safety for vessels using Crowdy Head Boat Harbour.
- Increased safety for users of the harbour by upgrading infrastructure to meet relevant modern design standards and requirements.
- Improved community access and use of the harbour.
- Increased lifespan of the infrastructure in use.

2.4 Alternative options considered

There are few alternative options due to the deteriorated nature of the harbour infrastructure and the level of siltation. The following options were considered during the development of the proposal design:

- Do nothing – The do nothing option was not considered viable as it would not improve safety, amenity and use of the facility and would allow the infrastructure to fall into further disrepair.
- Repair not replace jetties – Repair of the jetties is not feasible due to the deterioration of their structural elements. In addition, all structures require removal to allow dredging.
- Alternative dredging methods - Side cast dredging or ocean going trailing suction hopper dredging is not considered feasible due to limited access and practicality. Other methods include bed sweeping/levelling, however this method would result in the infilling of the deep hole located at the harbour entrance.
- Spoil disposal - Beneficial placement of sand on areas within close proximity to the dredge area is limited. Nearby placement sites considered include renourishment of Crowdy and/or Harrington Beach or ocean placement (see Figure 2-1). These options were discounted due to potential marine biodiversity impacts. Off-site disposal is not considered viable due to the volume of material to be removed and the cost of disposal.



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Spoil disposal options

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FIGURE 2-2

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2.5 Preferred option

The preferred option for the proposal includes:

- Removal of the long central jetty (Jetty 2) and shorter eastern jetty (Jetty 1).
- Dredging of areas of the harbour to provide a safe clearance depth of between 2.6 and 3.0 metres.
- Construction of a new pontoon jetty about 10 metres to the south of Jetty 1.
- Disposal of dredge spoil on the southern side of Crowdy Head.

A more detailed description of the proposal is provided in Section 3.

3 Description of the proposal

This chapter describes the proposal and provides descriptions of existing conditions, the design parameters including major design features, the construction method and associated infrastructure and activities.

3.1 The proposal

The proposal includes:

- Removal of the long central jetty (Jetty 2) and shorter eastern jetty (Jetty 1).
- Dredging of areas of the harbour to provide a safe clearance depth of between 2.6 and 3.0 metres.
- Construction of a new pontoon jetty about 10 metres to the south of Jetty 1.
- Disposal of dredge spoil on the southern side of Crowdy Head.

An overview of the proposed infrastructure upgrades is shown in Figure 3-1 and the dredging areas are shown in Figure 3-2.



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Metres

Map Projection: Transverse Mercator
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Project No. **12554729**
Revision No. **1**
Date **25/05/2022**

Overview of infrastructure upgrades

FIGURE 3-1

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Print date: 26 May 2022 - 14:21

Data source: LPI: DCDB, DTDB, 2017. Metromap Tile Service: .
Created by: tmorton



Paper Size ISO A4

0 10 20 30 40 50 60

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Crowdy Head Harbour Upgrade
Review of Environmental Factors

Project No. **12554729**
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Dredge areas

FIGURE 3-2

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Print date: 26 May 2022 - 14:22

Data source: LPI: DCDB, DTDB, 2017. Metromap Tile Service: .
Created by: tmorton

3.2 Construction activities

3.2.1 Work methodology

The following work methodology has been developed for the purpose of the REF and would be confirmed by the construction contractor prior to any works commencing. Any departures from the scale, scope and location of the works described below may require additional assessment and approval.

Site establishment

Site establishment works would include:

- Establishment of ancillary facilities (discussed further in Section 3.3).
- Installation of exclusion fencing and signage to prevent access by the public to the works site.
- Installation of environmental controls before the mobilisation of the plant and equipment.
- Mobilisation of the barge and workboats. The barge will be transported to the site via truck and launched at the boat ramp. The contractor will liaise with MidCoast Council regarding any requirements for launching.

Jetty 1 and 2 removal

Jetty removal would include:

- Demolition of the existing deck of both jetties using powered hand tools and a hydraulic powered excavator mounted concrete breaker to remove the topping slab.
- Following removal of the deck, the beams and headstocks would be carefully removed using powered hand tools and hydraulic attachments mounted onto the excavator.
- Existing piles will be removed using the barge-mounted excavator.
- Removed jetty sections will be placed on the barge or a service punt and transported to shore.
- Removed sections will be loaded on the truck with a land-based excavator and taken offsite for disposal.

Dredging

A dewatering cofferdam will be established in the north-eastern corner of the harbour, where the material removed from the harbour will be dewatered and then excavated to the carpark. Water would be returned to the harbour through a sediment curtain (subject to testing and classification). Once sand is dewatered, it will be loaded onto a truck and moved to the disposal area.

The harbour will be dredged to a level of about 2.6 to 3.0 metres clearance depth. An estimated 12,700 cubic metres of insitu material will be removed. The proposed dredge area and levels are shown in Figure 3-2. The dredge material is proposed to be transported by heavy vehicle to a site directly south of Crowdy Head Cliffs. Dredge spoil would be placed here adjacent to an existing pile created during the 2010 dredging of the harbour. The location for stockpiling is shown as the preferred option in Figure 2-2. Options for the beneficial reuse of the clean marine sands removed from the harbour include rehabilitation of Crowdy Head quarry, renourishment of Crowdy Beach, fill material for the Harrington Waters development and/or general use by local quarry operators.

No vegetation would be removed to create the stockpile and it would be appropriately stabilised to prevent slippage and erosion. A Stockpile Management Plan would be prepared and implemented during works to outline transport routes, safety considerations, access arrangements, site preparation, stockpile management and site rehabilitation.

Pontoon wharf

Construction of the pontoon wharf will include:

- Following removal of Jetty 1, piles will be driven into the sea floor using an excavator mounted torque head. The piles will be screwed into the seabed using a water swivel.
- The excavator will hammer the piles to confirm they are seated correctly. Required testing of the piles will be completed.
- Pile caps will be concreted in place and the subframe connection will be secured.
- Sub-framing will be installed onto the piles. The subframe will be constructed offsite and installed by a crane or excavator.
- Pontoons would be installed on the subframe. Pontoons are constructed offsite and lifted into position using a crane sited in the car park.
- The pre-fabricated gangway is installed with the crane.
- Finishing items, such as power and water supply, are installed.

3.2.2 Construction hours and duration

Construction would be undertaken within the standard working hours as defined in the Interim Construction Noise Guideline (ICNG; DECC, 2009).

These hours include:

- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- No work on Sundays or public holidays.

Construction is expected to commence in 2023 and would take around six months to complete.

3.2.3 Plant and equipment

The following plant and equipment are anticipated to be required for construction of the proposal:

- Barge mounted excavator with piling and concrete breaking equipment
- Workboats to manoeuvre barges
- Sediment curtains
- Generators
- Powered hand tools
- Refuelling equipment “bunded”
- Site security fencing
- Site storage containers, accommodation and amenities blocks
- Land-based crane or excavator
- Dredging equipment

- Boaster pumps
- Dump trucks (road and off road)
- bulldozer
- Excavator

3.2.4 Traffic management and access

Access to Crowdy Head Harbour from the north and south is via Harington Road and Crowdy Head Road off the Pacific Highway (see Figure 1-1). Site access and parking is available within the harbour itself, along Crowdy Head Road, and on Pacific Drive.

The proposed transport route for dredge spoil is shown in Figure 3-3. Dredged material would be taken out through the harbour access road, Pacific Drive and Crowdy Head Road, to the unnamed quarry access road. The estimated total number of truck movements to transport the dredge spoil to the proposed disposal site is estimated at 900 to 1500 truckloads.



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Spoil transport route

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FIGURE 3-3

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Print date: 26 May 2022 - 15:05

Data source: LPI: DCDB, DTDB, 2017. .
Created by: tmorton

3.3 Ancillary facilities

Ancillary facilities installed at the proposal site during construction will include:

- Site storage container
- Security fencing
- Site toilets
- Spill kits
- Fire fighting equipment
- Emergency assembly point
- Barge and service punt

The locations of these are shown in Figure 3-4.



Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Site ancillary facilties

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FIGURE 3-4

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Print date: 26 May 2022 - 14:27

Data source: LPI: DCDB, DTDB, 2017. Metromap Tile Service: .
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3.4 Public utility adjustment

Power, water and sewer, and potentially telecommunications infrastructure is located within the harbour. All utility infrastructure will be physically located prior to any works commencing and the need for protection and/ or relocation confirmed with the asset owner.

3.5 Property acquisition

The works proposed are located within Lot 1, 2, 3, 4 and 5 DP1077643 and Lot 7306 DP1162930. These lots encompass several Crown Reserves, namely R1014609, R210107, R1012108 and R89406. Transport for NSW is the manager of these reserves, apart from R89406, which is managed by DPE Crown Lands.

Figure 3-5 shows the lots and Crown Reserves impacted by the proposal.



Paper Size ISO A4

0 50 100 150

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Crowdy Head Harbour Upgrade
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Crown land and cadastre

FIGURE 3-5

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Print date: 21 Jun 2022 - 13:37

Data source: LPI: DCDB, DTDB, 2017. Metromap Tile Service: .
Created by: eibbertson

4 Statutory planning framework

This chapter provides the statutory and planning framework for the proposal and considers the provisions of relevant state environmental planning policies, local environmental plans and other legislation.

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Transport and Infrastructure) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 (Infrastructure SEPP) came into effect on 1 March 2022 and repealed State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP). It aims to facilitate the effective delivery of infrastructure across the State. All relevant provisions of Infrastructure SEPP are carried over into the Infrastructure SEPP.

Clause 2.79(4) and (7) of the Infrastructure SEPP permits development for the purpose of wharf or boating facilities, including dredging, to be carried out on any land by or on behalf of a public authority without consent. However, such development may only be carried out on land reserved under the *National Parks and Wildlife Act 1974* (NPW Act) if the development is authorised by or under that Act.

As the proposal is for the purpose of wharf or boating facilities and is to be carried out by Transport for NSW, it can be assessed under Division 5.1 of the EP&A Act. Development consent from council is not required. The proposal is not located on land reserved under the NPW Act.

State Environmental Planning Policy (Planning Systems) 2021

State Environmental Planning Policy (Planning Systems) 2021 (Planning SEPP) repeals State Environmental Planning Policy (State and Regional Development) 2011 and identifies development that is State and regionally significant.

The proposal does not meet the definition of State significant infrastructure.

4.1.2 Greater Taree Local Environmental Plan 2010

The proposal site is zoned as follows under the Greater Taree Local Environmental Plan 2010 (LEP):

- W3 Working Waterways
- IN4 Working Waterfront
- E2 Environmental Conservation

As the proposal is development permissible without consent under Transport and Infrastructure SEPP, the development control provisions of the LEP do not apply.

4.1.3 Environmental Planning and Assessment Regulation 2021

The Environmental Planning and Assessment Regulation 2021 came into effect on 1 March 2022. The factors to be taken into account when considering the environmental impact of an activity are listed in Clause 171 of the EP&A Regulation. These are addressed in detail in Appendix A.

4.2 Other relevant NSW legislation

4.2.1 Fisheries Management Act 1994

The objectives of the FM Act are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It lists threatened species of fish and marine vegetation, including endangered populations, ecological communities and key threatening processes. One of the objectives of the FM Act is to 'conserve key fish habitats' which includes aquatic habitats that are important to the maintenance of fish populations generally and the survival and recovery of threatened aquatic species.

The FM Act applies to all waters that are within the limit of the State.

Section 220ZZ of the FM Act lists the factors to be considered to determine the impact of an activity on threatened species, populations, ecological communities of fish and marine vegetation. If the proposal is likely to significantly impact on the threatened species, populations or ecological communities, an SIS is required. The following permits are required:

- Section 37 Permit for the taking or possession of fish or marine vegetation that would otherwise be unlawful under the FM Act. This permit is required for the relocation works for the White's Seahorse.
- Section 205 Permit will also be required to harm marine animals and vegetation. Harm refers to the gathering, cutting, pulling up, destroying, poisoning digging up, removal, injury to, prevention of light or otherwise any harm to marine vegetation in whole, or part.

This issue is further discussed in Section 6.8.

Notification under the FM Act is required for works that constitute dredging and reclamation or harm to marine vegetation. Dredging is proposed and therefore notification will be required.

4.2.2 Biodiversity Conservation Act 2016

The BC Act lists threatened species, populations and ecological communities as well as critical habitat and key threatening processes. Section 7.3 of the BC Act provides the test for determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. If a significant impact is considered likely, an SIS or BDAR is required. Impacts to terrestrial biodiversity are addressed in detail in Section 6.7.

4.2.3 Crown Land Management Act 2016

The *Crown Lands Management Act 2016* (CLM Act) sets out the requirements for leases and licences to be obtained from the Crown land manager for the occupation and use of crown lands.

Where Transport for NSW is the manager of the Crown reserves impacted by the proposal, a lease or license under the CLM Act is not required. For Crown Reserve R89406, approval for proposed disposal of spoil will be required under the CLM Act. Transport for NSW will engage with DPE Crown Lands to acquire the required approval prior to any works commencing.

4.2.4 Aboriginal Land Rights Act 1983

The *Aboriginal Land Rights Act 1983* (ALR Act) establishes Aboriginal Land Councils (at State and local levels). These bodies have a statutory obligation to protect the culture and heritage of Aboriginal persons in the land council's area and promote awareness in the community of the culture and heritage of Aboriginal persons in the council's area. The process for land claim is defined under the ALR Act.

The proposal is located within the Purfleet/ Taree Local Aboriginal Land Council (LALC) area.

The works would directly impact on the following claims made under the ALR Act:

- Claim 36129 by the NSW LALC – under investigation
- Claim 36156 by the NSW LALC – under investigation

Transport for NSW would consult with the NSW LALC prior to any works commencing.

4.2.5 Water Management Act 2000

The *Water Management Act 2000* (WM Act) aims to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations.

Approval is required under the WM Act for development within 40 metres of a river, lake, estuary or the coastal waters of the State, including excavation of land or any works that would detrimentally affect the water flowing in a declared waterway.

However under Clause 41 of the Water Management (General) Regulation 2018, public authorities, such as Transport for NSW, are exempt from the requirement to acquire a controlled activity approval.

A water access licence (WAL) is required under the WM Act for dewatering of more than three megalitres in one year. If the proposal requires dewatering of greater than three megalitres, a WAL is required.

4.2.6 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) requires the issue of an environment protection licence (EPL) for scheduled activities (being activities listed in Schedule 1 of the Act), the issue of pollution offences, and generally the control of water, air and noise pollution and the management of wastes.

A specific Resource Recovery Order and Resource Recovery Exemption under the Protection of the Environment Operations (Waste) Regulation 2014 will have to be sought to enable the proposed disposal of the dredged spoil to land without it being considered a scheduled activity. Options for the beneficial reuse of the clean marine sands removed from the harbour include rehabilitation of Crowdy Head quarry, renourishment of Crowdy Beach, fill material for the Harrington Waters development and/or general use by local quarry operators.

4.2.8 National Parks and Wildlife Act 1974

The NPW Act aims to prevent the unnecessary or unwarranted destruction of relics and the active protection and conservation of relics of high cultural significance. The NPW Act also provides for the protection of native flora and fauna and the reservation of areas of natural and cultural significance. The Crowdy Bay National Park is approximately 800 metres to the southwest of the harbour and encompasses an area of approximately 7500 hectares of coastal land between Harrington and North Haven. It is not anticipated that the proposal would directly impact on the park.

Section 86 of the NPW Act lists offences relating to harming or desecrating Aboriginal objects. Under Section 87 of the NPW Act, a permit is required to disturb or move an Aboriginal object. Whilst under Section 90 of the NPW Act, consent is required to destroy, deface or damage an Aboriginal object or Aboriginal place. Aboriginal cultural heritage is discussed further in Section 6.10.

4.2.9 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) aims to ensure that the heritage of NSW is adequately identified and conserved. It provides protection to items, such as places, buildings, works, relics, moveable objects, precincts or land that have been identified, assessed and listed on the State Heritage Register (SHR).

The harbour and dredge material stockpile site are not listed on the SHR.

4.2.10 Coastal Management Act 2016

The *Coastal Management Act 2016* (CM Act) aims to manage the coastal environment of NSW in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State. It outlines the management objectives for coastal management areas, provisions for coastal management programs and the manual, and requirements for the establishment and operation of the Coastal Council.

The proposal site is mapped as within a Coastal Environment and Coastal Use area.

The management objectives for the Coastal Environment area are:

(a) to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity,

(b) to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change,

(c) to maintain and improve water quality and estuary health,

(d) to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons,

(e) to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place,

(f) to maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms.

The management objectives for the Coastal Use area are:

(a) to protect and enhance the scenic, social and cultural values of the coast by ensuring that—

(i) the type, bulk, scale and size of development is appropriate for the location and natural scenic quality of the coast, and

(ii) adverse impacts of development on cultural and built environment heritage are avoided or mitigated, and

(iii) urban design, including water sensitive urban design, is supported and incorporated into development activities, and

(iv) adequate public open space is provided, including for recreational activities and associated infrastructure, and

(v) the use of the surf zone is considered,

(b) to accommodate both urbanised and natural stretches of coastline.

The proposed works are broadly consistent with the above objectives.

4.2.11 Biosecurity Act 2015

The *Biosecurity Act 2015* provides for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. All private landowners, occupiers, public authorities and Councils are required to control weeds on their land under Schedule 1 of the *Biosecurity Act 2015*.

Any weeds encountered during works would be managed in accordance with the relevant requirements of this Act.

4.2.12 Contaminated Land Management Act 1997

The *Contaminated Land Management Act 1997* aims to establish a process for investigating and (where appropriate) remediating land that the Environment Protection Authority (EPA) considers to be contaminated significantly enough to require regulation under Division 2 of Part 3 of the Act.

Land contamination is discussed in detail in Section 6.1.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act, a referral is required to the Australian Government for proposed ‘actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land’. These are considered in detail in Appendix A.

Transport for NSW may also wish to submit a precautionary referral under the EPBC Act if they deem it necessary.

4.3.3 Native Title Act 1993

The *Native Title Act 1993* recognises and protects native title. The Act covers actions affecting native title and the processes for determining whether native title exists and compensation for actions affecting native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims, the Register of Indigenous Land Use Agreements, and the National Native Title Register. Under the Act, a future act includes proposed public infrastructure on land or waters that affects native title rights or interest.

There are no Native Title Claims identified within or near the site.

4.4 Confirmation of statutory position

The proposal is considered development permissible without consent. The proposal can be assessed under Division 5.1 of the EP&A Act and clause 171(2) of the EP&A Regulation in the form of this REF.

Transport for NSW is the determining authority for the REF. This REF will fulfil their obligation under Section 5.5 of the EP&A Act to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

The following additional approvals are required:

- Notification under the FM Act for dredging works.
- Permit under the FM Act for harm to marine vegetation.
- Permit under the FM Act for relocation of seahorses.
- An approval under the CLM Act for work within Crown Reserve R89406.
- Liaison agreement with land claimants as required under the ALR Act.
- A WAL under the WM Act if more than three megalitres is dewatered during works.
- A specific resource recovery order and resource recovery exemption under the Protection of the Environment Operations (Waste) Regulation 2014.

5 Consultation

This chapter discusses the consultation undertaken to date for the proposal and the consultation proposed for the future.

5.1 Consultation strategy

Consultation activities are programmed to align with key project milestones to keep the community updated and informed on the throughout the project.

A dedicated project web page has been developed to be a central location for all community information relating to the project. A project specific email inbox and 24 hour free call number has been established for the project so that the community has the ability to contact the project team for complaints and inquiries at any stage during the project.

Our consultation strategy is to engage and involve the community in a “have your say” process during the REF is display, for a period of three weeks. This strategy is common as it allows the community to not only review the concept plan but the full REF. The REF contains more extensive project details and outlines all identified potential impacts, giving the community the opportunity to provide more informed feedback.

For this project as it is not a legislative requirement to engage state agencies, as part of early consultation, these key stakeholders will be able to participate in the have your say process.

Once the “have your say” period is completed the project team will review all feedback received and provide a response as part of the submissions repoprt. Any changes as a result of the feedback will be made publicly available within the submissions report.

In addition to updating the project web page, the engagement tools and techniques outlined in Section 5.4 will be used.

5.2 Our values

Our values underpin our decisions and behaviours when working with customers, colleagues, stakeholders and partners.

Customer focus - We place the customer at the centre of everything we do

Collaboration - We value each other and create better outcomes by working together

Solutions - We deliver sustainable and innovative solutions to NSW’s transport needs

Integrity - We take responsibility and communicate openly

5.3 Our objectives

We will consult with the community and key stakeholders on the proposal to:

- Inform the community and stakeholders of the proposal of the upgrade of the Crowdy Head Harbour.

- Seek feedback on the concept design and Review of Environmental Factors. Giving the community the opportunity to raise issues of concern for consideration in developing the project. The feedback will inform the finalised proposal and design of the project.
- To better understand community values and desired outcomes for the Crowdy Head Harbour.

5.4 Engagement tools and techniques

- Media releases for local media to push the “reach” of notifications beyond a local level.
- Project notifications and project updates for nearby residents, businesses and stakeholders.
- Information sessions and face-to-face or online meetings with key stakeholders to brief the community on progress and updates.
- Site inductions, training and toolbox sessions.
- Letters, emails and targeted correspondence.
- Project updates on the TfNSW website: http://nswroads.work/crowdyhead
- A project phone number **1800 973 343** for inquiries, information and complaints.
- Database to record stakeholders and contacts.
- Signage around work area, announcing any upcoming closures or start of work. This signage should appear at least two weeks ahead of any interruption.

5.5 Stakeholder analysis

The following table identified key stakeholders and the required level of communication required.

Table 5-1: Identified stakeholders

Stakeholder group	Stakeholder	Recommended Communication level and activities.
Federal Government	Hon Dr David Gillespie MP	•Update
State Government	Hon Leslie Williams MP NSW Department of Planning and Environment (DPE) - Crown Lands Department of Primary Industries – Fisheries NSW EPA,	•Update •Inform
Local Government	Mid-Coast Council	•Update •Inform •Involve
Local Aboriginal Groups	Purfleet-Taree Aboriginal Land Council	•Update •Inform •Involve

Stakeholder group	Stakeholder	Recommended Communication level and activities.
Emergency services	Police, Fire and Rescue, MAC, Ambulance, Marine Rescue	•Update •Inform •Involve
Local residents	Approximately 100 residential properties at Crowdy Head. It is noted that a high number of homes are holiday homes.	Update and inform
Local Businesses	Commercial Fishers Commercial tourism operators Crowdy Bay Charters Crowdy Bay Eco Resort Beach Corner Crowdy Head Holiday House Hansens on the Headland Eagles Nest Cottage	•Update •Inform
Local Community	Crowdy Head SLSC Crowdy Head Residents Association	•Update •Inform
Maritime Stakeholder groups/ internal stakeholders	Australian Sailing Boating Industry Association Boat Owners Association Transport for NSW - Maritime Operations	•Update •Inform
Wider Community		•Update •Inform

5.6 Community involvement

We are committed to establishing genuine relationships with the community. This is underpinned by the belief that effective communication is a crucial element in the successful delivery of all our projects.

Table 5-2: Consultation to date and planned

Activity to date	Date
Initial announcement of the project by local members **https://www.lesliewilliams.com.au/crowdy-head-maritime-spending-boost**	December 2020
Meetings with MidCoast Council	Ongoing
Establish and regularly update **project website**	September 2021 – ongoing
Establish and monitor project specific information line	September 2021 – ongoing
Early investigation work Media Release	September 2021

Activity to date	Date
Notification of early investigation work delivered to 100 Crowdy Head residents **https://roads-waterways.transport.nsw.gov.au/documents/maritime/projects/crowdy-head-boat-harbour/crowdy-head-boat-harbour-start-of-investigations-notification-09-2021.pdf**	September 2021
Community Update of project overviewed – delivered to Crowdy Head and Harrington and uploaded to website. **https://roads-waterways.transport.nsw.gov.au/documents/maritime/projects/crowdy-head-boat-harbour/crowdy-head-boat-harbour-community-update-12-2021.pdf**	December 2021
Upcoming Activities (also refer to figure 5.1)	
Community update “have your say” concept design and REF display	July 2022
Advertise and conduct 2 x community information sessions	July 2022
Prepare and publish submissions report	TBA
Community update on outcome of consultation “have your say” process.	TBA
Community update prior to start of construction	TBA
Notifications during construction to inform the community of any local changes or impacts	TBA

Below is an example of the key issues that have been raised via the community. A more extensive list will be included in the submissions report following the have your say process.

Table 5-3: Summary of issues raised by the community to date

Group	Issue raised	Response
Residents	• Improved infrastructure in area will increase traffic and improving roads to Crowdy Head should be investigated • Jetty 2, is used as a popular fishing jetty and locals would like this to remain.	• Crowdy Head road is a local road and comes under the care and jurisdiction of Midcoast Council for any upgrade. • Jetty 2 was decommissioned as a working vessel jetty in 2010 for safety reasons. It has continued to deteriorate and is beyond repair and needs removal.

Group	Issue raised	Response
Local Business	• Concerns raised on Jetty 1 being replaced with floating pontoon. Concerns that it will not meet the conditions of the seiching waves experience in the harbour and may damage vessels.	The local conditions have been taken into consideration in the design development. A floating pontoon wharf will ride over these seiching waves with little surge or sway motions as they are constrained by the piles. Additionally, as the pontoon will rise and fall with the water level, it will make the mooring of vessels in the harbour safer as the mooring lines are not going to a cleat on a fixed wharf and will remain horizontal to the pontoon.
Marine Rescue	Access to both sides of boat for maintenance purposes via finger wharves.	The project team has updated the concept design to facilitate marine rescue needs.

6 Environmental assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of the factors specified in the guidelines *Is an EIS required?* (DUAP, 1995/1996) as required under clause 171(2) of the EP&A Regulation and the *Marinas and Related Facilities EIS Guideline* (DUAP, 1996). The factors specified in clause 171(2) of the EP&A Regulation are also considered in Appendix A.

Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

6.1 Land surface

6.1.1 Methodology

A Phase 1 Preliminary Site Investigation (PSI) has been completed for the proposal. The findings of the PSI are summarised below with the full report provided in Appendix C.

The methodology to prepare the PSI involved:

- Review of geology, soil, hydrology, hydrogeology and topography information for the site.
- Review of the site history including review of historical aerial photographs and any relevant available reports.
- Review of the EPA records under the CLM Act and licences under the POEO Act.
- Assessment and reporting in accordance with the Guidelines for Consultants Reporting on Contaminated Sites (EPA 2020) summarising the results of the desktop review, identification of areas of potential concern, potential chemicals of concern and preparation of a preliminary Conceptual Site Model.

6.1.2 Existing environment

Geology and soils

The proposal site is underlain by the Palaeozoic Cowangara Formation, which is characterised by cleaved, turbiditic, thinly to medium bedded grey to black laminated fine lithic sandstone, siltstone and slate with lenses of massive conglomerate. This is overlain by Quaternary marine sands and silts on the harbour floor.

Contamination

No records of contaminated land or contaminated sites notified to the EPA are listed within one kilometre of the proposal site.

The PSI found that the likelihood for significant chemical contamination to be present is considered to be medium to low. The main potential areas of concern were identified as:

- Marina facilities – use, storage and leaks of chemicals, disposal of wastes (medium potential).
- Storage and use of fuels on site (low potential).
- Spills of fuels and oils from vessels and machinery (low-medium potential).

- Potential use of herbicides or pesticides (low potential).
- Fill materials from unknown sources – historical use in construction of the break walls and marina foreshore (medium potential).

Acid sulfate soils

The proposal site and surrounds are mapped as Class 3 and Class 5 acid sulfate soils under the Greater Taree LEP (see Figure 6-1). Although not subject to the development control provisions of the LEP, the following requirements pertain to Class 3 and Class 5 land:

- Class 3 – development consent and an acid sulfate soil management plan are required for works more than 1 metre below the natural ground surface or works by which the watertable is likely to be lowered more than 1 metre below the natural ground surface.
- Class 5 - development consent and an acid sulfate soil management plan are required for works within 500 metres of adjacent Class 1, 2a, 2b, 3 or 4 land that is below 5 metres Australian Height Datum and by which the watertable is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2a, 2b, 3 or 4 land.

6.1.3 Potential impacts

Construction

Contamination

The proposed works on land would be very limited. There may be minor excavation of existing hard surfaces to access and connect to existing services. No ground preparation works are assumed to be required at the disposal site. It is unlikely that these works would disturb unknown contamination. Implementation of an unexpected finds procedures would ensure any potential contamination uncovered is appropriately managed.

Accidental spills from construction plant and improper storage of hazardous materials could lead to soil contamination. Contaminants may also enter and contaminate the harbour if not managed effectively. Potential impacts would be mitigated through the appropriate management of the storage of such materials, and the use of spill kits.

Acid sulfate soils

Excavation activities can result in the exposure of acid sulphate soils to oxygen with the potential to generate acidic leachate. Without appropriate mitigation, exposed acid sulphate soils could impact on water quality, soil health and groundwater. It is considered unlikely that works would expose acid sulfate soils.

Operation

The proposal would not alter existing land-based infrastructure, and no operational impacts to the land surface are anticipated.



Paper Size ISO A4

0 10 20 30 40 50 60

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Acid sulfate soils

FIGURE 6-1

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Data source: LPI: DCDB, DTDB, 2017. Metromap Tile Service: .
Created by: tmorton

6.1.4 Safeguards and management measures

Land surface safeguards and management measures are provided in Table 6-1.

Table 6-1: Land surface safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Erosion and sedimentation	An Erosion and Sediment Control Plan (ESCP) is to be prepared and implemented in accordance with the Landcom/Department of Housing *Managing Urban Stormwater, Soils and Construction Guidelines* (the Blue Book)) to: • Prevent sediment moving off-site and sediment laden water entering any the harbour • Reduce water velocity and capture sediment on site • Minimise the amount of material transported from site to surrounding waters and pavement surfaces • Divert clean water around the site • Monitor and maintain all controls.	Contractor	Pre-construction Construction	Standard safeguard
Spills	A spill kit is to be available on site and accessible at all times. The spill kit must be appropriately sized for the volume of substances at the work site.	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Contaminated land	Any unexpected finds of contamination are to be managed in accordance with an Unexpected Finds Procedure. If contaminated soils are encountered or suspected, works will cease until appropriate management is implemented and the site is cleared by Transport for NSW.	Contractor	Construction	Additional safeguard

6.2 Coastal processes

6.2.1 Methodology

A Coastal Processes Assessment has been completed for the proposal. The findings of the assessment are summarised below with the full report provided in Appendix D.

The methodology to prepare the assessment involved:

- Review of historical studies completed by MidCoast Council.
- Development of a conceptual model of the existing key sediment transport pathways of Crowdy Head.
- Assessment of the potential for the proposed dredge area to act as a sediment sink, which could intercept sediment transport in the vicinity of the boat harbour and deprive downdrift locations of sediment supply.
- Assessment of the potential for onshore placement of dredged material to remove sediment from the coastal system and deprive downdrift locations of sediment supply.
- Assessment of the potential for sediment placed updrift of the boat harbour to be deposited back into the boat harbour via coastal processes.
- Assessment of the potential for deposited material to smother any areas of rock reef type habitat.

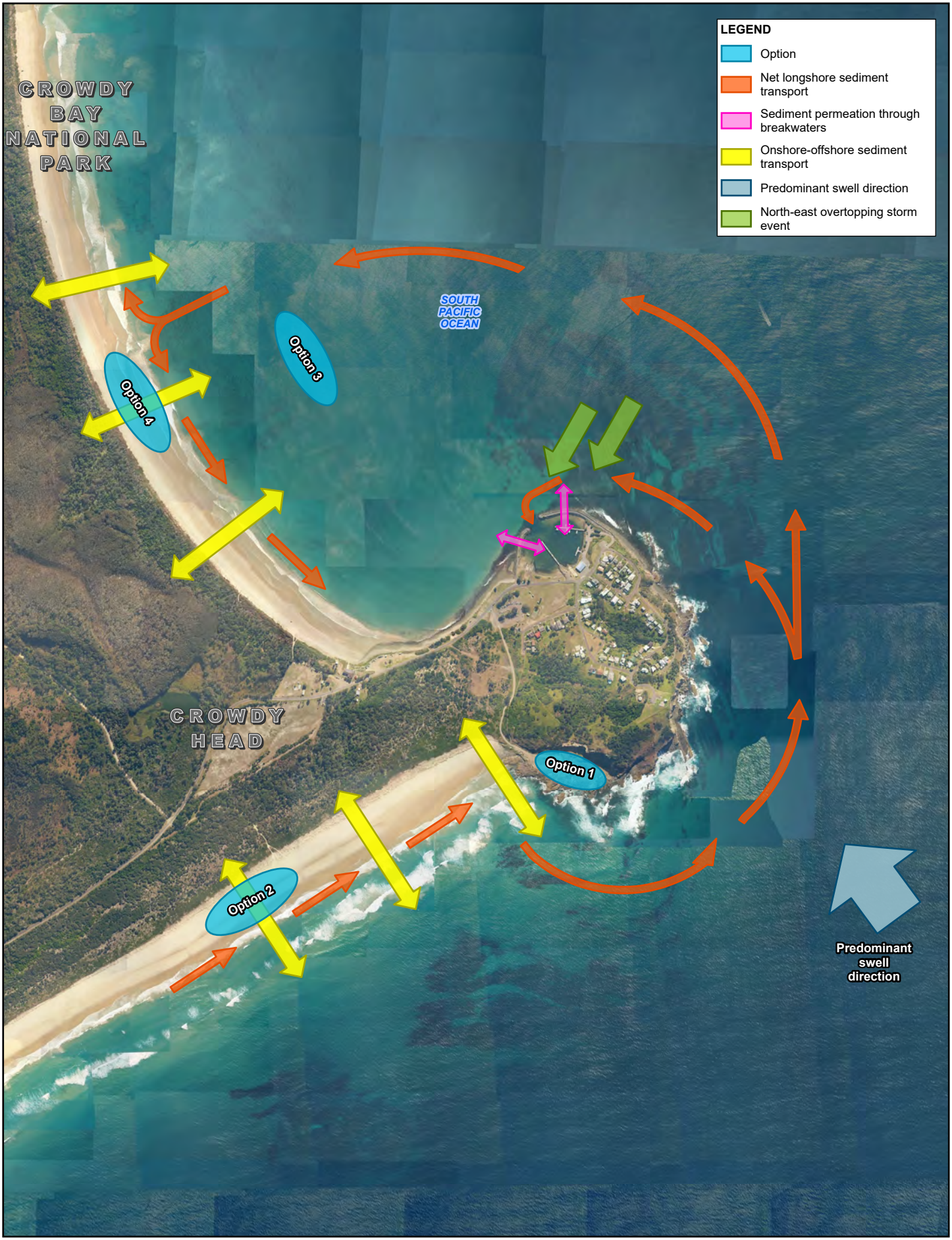
6.2.3 Existing environment

The coastal harbour at Crowdy Head is situated on a natural harbour that was formed by a rocky reef on the north-eastern side of the headland. The construction of a breakwall with rock blasted from the nearby quarry formed the coastal harbour.

Localised coastal processes in the vicinity of the proposal site are complex due to the presence of two river entrances, Crowdy Head and extensive inshore rocky reef areas. The transport of sediment into Crowdy Head Harbour is likely the result of three main modes; refraction and diffraction of waves around the eastern breakwater and into the harbour entrance, permeation of sediment through the breakwaters, and overtopping of waves over the breakwaters during major storm events.

The harbour acts as a sediment sink due to the comparatively lower energy environment. This means that the majority of sediment deposited within the harbour is effectively lost to the system until dredged or until sediment build up against the western most extent of the breakwaters reaches such a point that it may ‘spill over’ the structure back into the system.

The conceptual sediment transport model for the Crowdy Head Harbour is shown in Figure 6-2.



Paper Size ISO A4

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Conceptual sediment transport model

FIGURE 6-2

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Data source: LPI: DCDB, DTDB, 2017. Metromap Tile Service: .
Created by: tmorton

6.2.4 Potential impacts

Construction

Key impacts due to coastal processes during construction relate to safety risks for workers during periods of storm surge and very high tides. Potential impacts could also include damage to infrastructure, and construction plant and equipment due to extreme events.

Operation

There is potential for the proposed dredge area in the harbour to act as a sediment sink, which could intercept sediment transport in the vicinity of the harbour and deprive downdrift locations of sediment supply. This is due to the harbour's sheltered nature and the method in which sediment is transported behind the breakwaters, with the net movement of sediment always into the harbour.

Sediment that enters the harbour through overtopping during northeast storm events will not be able to exit the harbour by the same means. In a similar manner, whilst sediment transported into the harbour via permeation through the breakwaters or through the mouth may also return in the same way, the difference in ambient conditions inside and outside the harbour likely translates into a net movement of sediment into the harbour.

The dredging of the harbour is unlikely to affect any of these three modes for sediment movement into, and out of, the harbour and therefore the tendency for the harbour to act as a sediment sink may continue irrespective of the level of sediment build up within the harbour. This is however until such a point that sediment builds up within the harbour until it reaches capacity and then sediment may 'overflow' back into the system at the same rate that it enters the harbour. This scenario is however considered unrealistic in terms of an operational harbour and requires the manual removal of the material accumulated.

There is also potential for onshore placement of dredged material to remove sediment from the coastal system and deprive downdrift locations of sediment supply. As described above, the net buildup of sediment in the harbour has already been 'lost' to the system and so would already be affecting any downdrift locations. As such, onshore placement of material dredged from the harbour would likely not result in any additional adverse effects on downdrift locations over what may already be observed.

In summary, it is considered unlikely that the harbour dredging works and disposal activities at any of the potential placement locations will cause any significant impacts to coastal processes.

6.2.5 Safeguards and management measures

Coastal processes safeguards and management measures are provided in Table 6-2.

Table 6-2: Coastal processes safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Safety risk due to extreme events	An Emergency Management Plan (EMP) will be prepared and implemented to include procedures to maintain worker safety and prevent damage to infrastructure, plant and machinery. The EMP will include: • Evacuation procedures • Protocols for securing and removing water-based and land-based equipment and machinery during evacuation • Appropriate safe locations for stockpiles and storage areas etc.	Contractor	Construction	Additional safeguard

6.3 Water quality

6.3.1 Methodology

A Sediment Contamination and Waste Assessment (Sediment Assessment) has been completed for the proposal. The findings of the Sediment Assessment are summarised below with the full report provided in Appendix E.

The methodology to prepare the Sediment Assessment involved:

- Review of the existing available data (from previous dredging undertaken in 2010).
- Sampling of sediment at eight locations.
- Half-metre subsampling of the sediment core samples collected.
- Quality control sampling including field triplicate sampling at one location and split (triplicate) sampling at one location.
- Logging the profile of the sediment.
- Laboratory analysis of the primary subsamples (18 in total), field triplicate subsamples, and split (triplicate) subsamples for contaminants of potential concern (CoPC). Based on Table 2 of the National Assessment Guidelines for Dredging (NAGD) (DEWHA 2009), and GHD's general knowledge of the site and experience with similar harbours, CoPC are considered to include:
    - Tributyltin (TBT)
    - Heavy metals (including antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc)
    - Polycyclic aromatic hydrocarbons (PAH)
    - Total recoverable hydrocarbons (TRH)
    - Benzene, toluene, ethylbenzene and xylene (BTEX)

    - Organochlorine pesticides (OCP) – 55% of primary sediment samples (10 in total)
    - Polychlorinated biphenyls (PCB) – 55% of primary sediment samples (10 in total).
- Laboratory analysis of all sediment samples for total organic carbon (TOC) – used to normalise the results of organic contaminants in accordance with the NAGD (DEWHA 2009).
- Laboratory analysis of seven selected sediment samples for bulk density and 12 for particle size distribution (PSD) by sieve and hydrometer.
- Acid sulfate soil (ASS) screening on all 18 primary sediment samples, and laboratory analysis of 10 selected samples for the ASS chrome-reducible sulfur (CRS) suite.
- Preparation of report (including tabulated logs and a sampling location figure) summarising the findings of the investigation and assessment of the proposed dredge material in accordance with the relevant guidelines.

6.3.2 Existing environment

Harbour sediments were found to predominantly consist of sand with small quantities of silt and clay. The Sediment Assessment also found:

- Reported concentrations of CoPC in sediment samples were below the adopted health-based (soil) assessment criteria for public open space land use for potential exposure pathways including vapour inhalation and/or direct contact.
- Reported concentrations of CoPC in sediment samples were below the adopted ecological (soil) assessment criteria for public open space land use, with the exception of elevated levels of copper found near the slipway.
- None of the analytical results for the sediment samples contained CoPC at concentrations that exceed the management limits for hydrocarbons.
- Reported concentrations of CoPC in sediment samples were below the sediment toxicant guideline values, with the exception of elevated copper and TBT.
- ASS screening identified that samples exceed the actions criteria triggering the requirement for an ASS Management Plan (ASSMP) for dredging and disposal activities.

6.3.3 Potential impacts

Construction

Potential impacts to water quality during construction are associated predominantly with the activities of:

- Jetty demolition
- Dredging
- Constructing the new jetty, including piling
- Liquid spills or leaks from plant and equipment operating in the water, such as hydrocarbons and drilling fluid
- Movement and anchoring of plant and equipment

There are also land-based risks from ground disturbance, uncontrolled spills and dredge spoil management associated with:

- Loading and transport of sediment.
- Disturbed contaminated sediments being transported or dispersed into nearby areas.
- Liquid spills or leaks from plant and equipment, such as hydrocarbons and drilling fluid.

Water quality impacts due to the above could include:

- Sedimentation of harbour waters resulting in loss of visibility and smothering of aquatic habitat.
- Acidification of water due to disturbance of ASS.
- Pollution of water due to disturbance of contaminated sediments or other pollutants entering the harbour.
- The Sediment Assessment identified that harbour sediments did not contain levels of CoPC above the relevant criteria for human health, ecological heath or hydrocarbon management limits. It is important to note that the adopted assessment criteria are applicable for soil and not sediment but have been applied to assess potential risks to human and ecosystem health during spoil disposal activities.

Elevated levels of copper and TBT were found near the slipway. No disturbance of sediments is proposed in this area.

The potential impacts on aquatic flora and fauna from water quality are discussed in detail in Section 6.8.

Operation

Ongoing operational risks to water quality are not anticipated to be greater than those existing for an operational harbour. Harbour operational procedures will include ongoing measures for monitoring and managing water quality.

6.3.4 Safeguards and management measures

Water quality safeguards and management measures are provided in Table 6-3.

Table 6-3: Water quality safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Dredging	A detailed Dredging Management Plan (DMP) would be prepared to outline requirements to control sediments and potential pollutants during dredging activities. The DMP would include the following at a minimum):	Contractor	Construction	Additional safeguard
	Silt curtain/s are to be installed prior to and around the area of works that may disturb the seabed. Silt curtains are to be installed, monitored and maintained as needed to contain any sediment.			

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Dredging to take place at low tide only and during stable weather and wave conditions.			
	Positioning of barges, drilling and pile driving should occur during standard construction hours and calm conditions to prevent excessive scouring and minimise any safety risks.			
	Visual monitoring of local water quality (i.e. turbidity, hydrocarbon spills/slicks) on a regular basis to identify any potential spills or deficient erosion and sediment controls.			
	Vessels (including barges) are only to be used at suitable tides when no less than 600 mm clearance is available between the underside of the vessel and the bed of the waterway.			
	Prior to entry into the waterway, machinery should be appropriately cleaned, degreased and serviced.			
	Capture and store any waste drilling fluids for appropriate onshore disposal according to legislative requirements.			
	Ensure that all liquids including fuel and other liquids used on barges during construction are securely contained.			
	Vessel speeds will be limited to signposted speeds to minimise turbidity being generated from propellor wash.			
ASS	Potential or actual acid sulfate soils are to be managed in accordance with the Transport for NSW Guidelines for the Management of Acid Sulphate Materials 2005 and an ASSMP. The ASSMP is to include procedures for testing, material classification, treatment and disposal.	Contractor	Construction	Standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Water quality	Transport for NSW will continue to provide guidance for harbour users on correct procedures to avoid water quality impacts.	Transport for NSW	Operation	Additional safeguard

Other safeguards and management measures that would be implemented to minimise water quality impacts are included in Table 6-1.

6.4 Waste management

6.4.1 Methodology

A Sediment Assessment has been completed for the proposal. The findings of the Sediment Assessment are summarised below with the full report provided in Appendix E.

Sediments were classified using the Waste Classification Guidelines – Part 1: Classification of Waste (NSW EPA, 2014).

6.4.2 Existing environment

Public waste bins are provided at the existing harbour and are managed as part of the harbour operations. There is potential for litter to enter the harbour from existing jetty activities.

In terms of resource use, the harbour has required ongoing maintenance, repair and upgrade over time. This has required the use of small quantities of replacement materials such as timber, concrete and metal.

A preliminary waste classification, based on the limited sampling undertaken, was carried out using the analytical results from this assessment. The waste classification is indicative only and additional confirmation sampling would likely be required for offsite disposal to satisfy either state regulatory requirements or landfill acceptance criteria.

The spoil to be dredged for the proposal would likely be classified as General Solid Waste following required treatment for ASS.

The exception is the sediments in the vicinity of the slipway, which would likely be classified as Hazardous Waste. These sediments would not be disturbed by proposed works.

6.4.4 Potential impacts

Construction

Construction activities would generate potential waste streams including:

- Solid waste from the removal of the existing harbour elements
- Waste fuels, oils, liquids and chemicals
- Packaging wastes such as cardboard, timber, paper and plastic
- General garbage and sewage from the temporary compound
- Various building material wastes (including metals, timbers, plastics and concrete)
- Dredging spoil
- Asphalt and concrete
- General waste, including food, litter and other wastes generated by the construction workers

Land-side ancillary facilities would be contained within the site compound, and include a portable toilet, and small shipping container/shed. Minimal storage of materials is anticipated but may include precast materials and some plant and equipment. Where feasible, materials would be barged, including fuels, oils and other required liquids which would be stored in bunded containers. All waste removed from the proposal footprint would be transferred by a licenced contractor to a licenced receiving facility.

Results from the Sediment Assessment (Appendix E) indicate that the sediments to be dredged do not pose a risk to human health or the environment. As such, the sediments are suitable for land-based reuse/placement, subject to appropriate management and handling measures. Dredge spoil is classified as General Solid Waste. Additional ASS testing has confirmed neutralisation without treatment.

Other natural excavated material would be recovered and placed in the quarry in accordance with the Protection of the Environment Operations (Waste) Regulation 2005 – General Exemption Under Part 6, Clause 51 and 51A (the excavated natural material exemption 2008). Options for the beneficial reuse of the clean marine sands removed from the harbour include rehabilitation of Crowdy Head quarry, renourishment of Crowdy Beach, fill material for the Harrington Waters development and/or general use by local quarry operators.

It is not anticipated that the proposal would require the use of any scarce resources. Transport for NSW adopts a resource reduction strategy based on using:

- Alternative low-energy, high recycled content materials where they are cost and performance competitive and comparable in environmental performance.
- Locally sourced materials, noting that most of the materials needed to build the proposal are widely available and typically in abundant supply in the local market.
- Alternative forms of material sourcing to reduce the distances or methods travelled to supply materials.

Operation

One of the objectives of the proposal is to improve the accessibility and safety of the harbour for patrons. The proposal may lead to an increase in patronage as a result of improved access and generally improving the wharf. As a result, increased waste may be generated due to the increased use. Transport for NSW and MidCoast Council would continue to monitor and manage waste at the site.

6.4.5 Safeguards and management measures

Waste management safeguards and management measures are provided in Table 6-4.

Table 6-4: Waste management safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Waste	A Waste Management Plan (WMP) will be prepared in accordance with legislative requirements to include measures to minimise waste, outline methods of disposal, reuse and recycling and monitoring, as appropriate. The WMP would include: • Appropriate measures to avoid and minimise waste associated with the proposal should be investigated and implemented where possible • Waste management, littering and general tidiness will be monitored during routine site inspections • Monitor waste and recycling quantities using Transport for NSW Waste Data Collection Workbook – DMS-FT-436 to support compulsory requirement 4 of the Transport for NSW Sustainable Design Guidelines version 4.0.	Contractor	Pre-construction / Construction	Standard safeguard
	Existing waste bins to be monitored to determine appropriate size/ emptying frequency due to potential patron increase.	Transport for NSW/ Council	Operation	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Resource use	Recycled, durable, and low embodied energy products will be considered to reduce primary resource demand in instances where the materials are cost and performance competitive and comparable in environmental performance (e.g. where quality control specifications allow)	Transport for NSW	Detailed design	Standard safeguard

6.5 Noise and vibration

6.5.1 Methodology

A semi-qualitative assessment has been undertaken to assess potential noise and vibration impacts on sensitive land uses surrounding the proposal site. The assessment was undertaken using the Construction and Maintenance Noise Estimator (TfNSW, 2017).

A distance-based assessment was undertaken assuming the noisiest plant is a microdrilling rig (Soilmec SM-5). The assessment also assumed a noise area category of R1 and residential receivers within a developed settlement. All works would be undertaken during standard construction hours only.

Road traffic noise is assessed assuming a developed settlement, DGA road surface, local road impacts and receivers within 60 metres.

6.5.2 Existing environment

The nearest sensitive receivers to the proposal are residential and commercial properties on Pacific Drive, about 60 metres southeast of the proposal site (see Figure 6-3). Muir Park is approximately 900 metres south of the proposal. No other sensitive receivers are within proximity of the proposed works.

The existing noise environment is expected to be similar to be a typical suburban environment with a rating background level (RBL) of about 40 dBA (day). As such, the daytime noise management level (NML) would be 50 dBA (RBL + 10 dBA).

6.5.3 Potential impacts

Construction

The Construction and Maintenance Noise Estimator (TfNSW, 2017) predicts daytime exceedances of the NML for dwellings within 145 metres of the proposal during the operation of the noisiest plant predicted to be used which is a micro drilling rig. As the closest receiver is 60 metres from the proposed works, no highly intrusive (> 30 dBA) or highly affected (75 dBA or greater) noise levels are anticipated. Twenty-one residentail receivers will be affected (see Figure 6-3). The assessment report is provided in Appendix F.

As an active and passive recreation area, Muir Park (see Figure 6-3) would also be subject to daytime exceedances of the NML as it is within 105 metres of the works (see Appendix F).

The Construction and Maintenance Noise Estimator (TfNSW, 2017) does not predict any road traffic noise impacts (see Appendix F). Despite the total number of truck movements proposed they would be spread across the entire project period and are not likely to be more than 10 per day or two per hour. The road noise calculator found this would not result in a change in noise levels above 2dBA

Minimum working distances to sensitive receivers for vibration intensive plant are given in Table 6-3. Assuming pile driving or hydraulic hammer is the most vibration intensive plant to be used, works would not impact on surrounding dwellings. Works are outside the minimum working distances nominated.

Ground vibration – minimum working distances from sensitive receivers

As a guide, minimum working distances from sensitive receivers for typical items of vibration intensive plant are listed in the table below. The minimum distances are quoted for both "cosmetic" damage (refer BS 7385). The minimum working distances for cosmetic damage must be complied with at all times, unless otherwise approved by Transport for NSW or under the environmental license as relevant. DIN 4150 has criteria of particular reference for heritage structures.

Table 6-5: Ground vibration minimum working distances

Plant item	Rating / Description	Minimum working distance
		Cosmetic damage (BS 7385)
Vibratory Roller	<50 kN (Typically 1-2 tonnes)	5 m
	<100 kN (Typically 2-4 tonnes)	6 m
	<200 kN (Typically 4-6 tonnes)	12 m
	<300 kN (Typically 7-13 tonnes)	15 m
	>300 kN (Typically 13-18 tonnes)	20 m
	>300 kN (> 18 tonnes)	25 m
Small Hydraulic Hammer	(300 kg – 5 to 12t excavator)	2 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m
Pile Boring	≤ 800 mm	2 m (nominal)
Jackhammer	Hand held	1 m (nominal)
Profiler	Wirtgen W210	4 m
Asphalt Paver	Vogele Super 1800-3	1 m
Steel Drum Roller	Hamm HD70 (Oscillating Mode)	2 m
Steel Drum Roller	Hamm HD70 (Static Mode)	1 m

Note: More stringent conditions may apply to heritage or other sensitive structures.

The minimum working distances are indicative and will vary depending on the particular item of plant and local geotechnical conditions. They apply to cosmetic damage of typical buildings under typical geotechnical conditions. Vibration monitoring is recommended to confirm the minimum working distances at specific sites.



Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Noise and vibration receivers

FIGURE 6-3

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Data source: LPI: DCDB, DTDB, 2017. Metromap Tile Service: .
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Operation

Noise generating activities of the harbour are not expected to substantially change as a result of the proposal, and as such no significant operational noise impacts are anticipated.

6.5.4 Safeguards and management measures

Safeguards and management measures prescribed by the Construction and Maintenance Noise Estimator (TfNSW, 2017) are provided in Table 6-6.

Table 6-6: Noise and vibration safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise	A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the Interim Construction Noise Guideline (ICNG; DECC, 2009) and Construction Noise and Vibration Guideline (CNVG; TfNSW, 2016) and identify: • All potential major noise and vibration generating activities associated with the activity • Feasible and reasonable standard measures to be implemented • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures. • Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.	Contractor	Construction	Standard safeguard
Notification	Advance warning of works and potential disruptions can assist in reducing the impact on the community. The notification may consist of using variable message sign, letterbox drop (or equivalent), web site / social media or a combination to distribute information detailing work activities, time periods over which these will occur, impacts and mitigation measures. Notification should be a minimum of 5 working days prior to the	Contractor / TfNSW	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	start of works. The approval conditions for projects may also specify requirements for notification to the community about works that may impact on them.			

6.6 Landscape character and visual impact

6.6.1 Existing environment

The proposal site is highly visible and situated immediately north northwest of the small village of Crowdy Head.

The surrounding area east, west, and south of the harbour is comprised of residential development including residential flat buildings, multilevel buildings, detached dwellings, and recreational land uses including Muir Park. There are a small number of accommodation providers within the village. Crowdy Head Lighthouse sits on the southwestern corner of the headland. Most of village has a direct line of sight to the harbour.

A view from the southern breakwall showing the village of Crowdy Head is provided in Figure 6-4.

The harbour is located at sea level and is located at the base of a headland with an elevation of about 10 metres above sea level.



Figure 6-4: Crowdy Head village

6.6.2 Potential impacts

Construction

Landscape character and visual impacts during construction are expected due to the following construction components:

- Presence of equipment, barges and piling equipment on the harbour and around the wharf.
- Temporary compound site to include site sheds, amenities shed and storage containers for tools and materials.
- Demolition of Jetty 1 and Jetty 2.
- Trucks transporting spoil to the disposal area.

The proposal would have a temporary visual impact on users of the harbour, public walkway, recreational areas and those driving past the wharf on Crowdy Head Road and Pacific Drive. The proposal would also have a temporary visual impact on residences south and south-east of the wharf. Vegetation at the site will provide some limited screening.

Overall, the potential visual impacts of construction activities are considered to be minor as the works would be temporary and short-term.

Operation

The proposal has been designed to be as similar to the existing wharf structure as possible and therefore is not expected to result in significant visual impacts to the surrounding area. The removal of the long Jetty 2 would be a permanent visual change. However given the landscape context of the existing harbour, this change is not expected to be significant.

6.6.3 Safeguards and management measures

Landscape and visual safeguards and management measures are provided in Table 6-7.

Table 6-7: Landscape and visual safeguards and management

Impact	Environmental safeguards	Responsibility	Timing	Reference
Visual amenity	Hoarding or screening will be erected around the construction compound where possible, to reduce visibility.	Contractor	Construction	Additional safeguard
	The construction area would be left clean and tidy at the end of each working day.			

6.7 Terrestrial biodiversity

6.7.1 Methodology

A desktop database search and literature review were completed to create a list of threatened flora and fauna species, populations and ecological communities (biota) listed under the BC Act and FM Act, and MNES listed under the EPBC Act, that could be expected to occur in the locality based on previous records, known distribution ranges, and habitats present.

A day-time inspection of the proposal site was also conducted by GHD staff to confirm vegetation and potential habitats present within the impact area. The site inspection involved confirmation of plant community types and flora species within the investigation area.

6.7.2 Existing environment

The terrestrial environment within the proposal area is highly modified and consists of a landscaped roadside and foreshore park area (Muir Park), with mown grass, planted shrubs and approximately 10 street trees.

The proposed disposal area is directly adjacent and below the Crowdy Head Cliffs. The previous spoil disposal area is visible at the site (see Figure 6-5). The proposed disposal area is east of the existing disposal area (see Figure 6-6).



Figure 6-5: Existing disposal area



Figure 6-6: Proposed disposal area, with existing disposal area in the background

As shown in Figure 6-6, the proposed disposal area in predominantly flat and consists of groundcover vegetation only. While no vegetation would be removed, groundcover underneath the disposal stockpile would be smothered. Groundcover in this location consists of exotic and native grasses and sedges.

6.7.3 Potential impacts

Construction

It is not anticipated that any native vegetation/ fauna habitat would be removed for the proposed harbour demolition and construction works. Construction activity (noise, traffic, dust etc.) would disturb fauna at or near the site during the works, but it is anticipated that any fauna in the area would disperse to nearby areas until works are complete.

Spoil would be disposed of to an area of land that is already cleared and adjacent to the previous spoil site from dredging in 2010. This area is adjacent to an unnamed park area and rocky platform. Trucks entering and leaving the area, and machinery moving the spoil, would create a nuisance for fauna using the area to forage or rest. As above, it is anticipated that any fauna in the area would disperse to nearby areas until works are complete. Disposal activities would also smother existing groundcover at the disposal site. However this is not expected to result in significant impacts to biodiversity.

Operation

The proposal is not likely to impact on any terrestrial biodiversity during operation.

6.7.4 Safeguards and management measures

Terrestrial biodiversity safeguards and management measures are provided in Table 6-8.

Table 6-8: Terrestrial biodiversity safeguards and management

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	The disposal area would be set out prior to any transport of spoil commencing (with flagging tape or temporary fencing etc.). Works would be contained within the delineated area to avoid impacts to adjacent areas.	Contractor	Construction	Additional safeguard

6.8 Marine biodiversity

6.8.1 Methodology

A Marine Biodiversity Assessment (Appendix G) was completed to assess the potential impacts of the proposal on marine biota. The methodology to complete the assessment included:

- Desktop review of existing information and publicly available databases. GHD reviewed the following data sources in December 2021 as part of the desktop assessment:
    - NSW Department of Primary Industries (DPI) Fish Communities and Threatened Species Distribution of NSW.
    - DPI Critical Habitat Register and Key Fish Habitat maps.
    - DPI maps of estuarine habitats of NSW.
    - Office of Environment and Heritage (OEH) BioNet Atlas for records of threatened species, populations and endangered ecological communities listed under the BC Act and FM Act that have been recorded within the study area and surrounding environment.
    - OEH Areas of Outstanding Biodiversity Value.
    - DAWE Protected Matters Search Tool (PMST) for MNES listed under the EPBC Act predicted to occur in the locality.
    - Any data available for use from MidCoast Council.
    - Aerial imagery from Nearmap to inform habitat features.

- Collection of underwater towed video footage across two separate field survey events along the jetty piles, the seabed within the harbour and at three locations in the open ocean nearby corresponding with the potential spoil disposal areas. During the first field survey a total of eight transects were completed, five of which were located within the harbour. The second field survey was concentrated in the harbour, where the entire perimeter of the harbour was mapped, in addition to a further three transects within the harbour. Two transects were undertaken over the reef south of the headland on either side of the reef.

6.8.2 Existing environment

The study area includes the harbour environment and the open ocean surrounding the harbour. The harbour has been created by the construction of the breakwater, which supports seagrass and rocky reef habitats. The open ocean surrounding the harbour is largely open expanses of medium grain sands with sporadic algae. Crowdy Head and surrounds are considered key fish habitat.

The benthic environment of the study area is comprised of medium grain loosely consolidated sands. In the open ocean transects, organic detritus and shell material was present in some areas, carried by tides and wave activity. Sporadically occurring stalking algae and ascidians were noted.

Aggregated patches of sea grass species *Zostera muelleri* were observed within the harbour, primarily concentrated at the mouth.

Macroalgae was observed sporadically occurring alongside the rocky reef within the harbour. The two dominant species of macroalgae observed were Sargassum (*Sargassum* spp.) and Common Kelp (*Ecklonia radiata*). Strap Weed *(Phyllospora comosa*) and Peacock Weed (*Lobophora variegata*) were also noted frequently during the survey.

The harbour is mostly bounded on the eastern and western extents by rock forming part of the breakwater. Subtidal rocky reefs and intertidal rocky shores form as a result of the in-situ structures and are frequently colonised by various limpets, rock oysters, encrusting algae and various ascidians.

A large reef outcrop was noted on the southern side of Crowdy Head running parallel to the headland. The reef measures approximately 430 metres long and 163 metres wide at its widest point. A number of species were identified on the largely algae dominated rocky reef outcrop, including Cunjevoi (*Pyura stolonifera*), various encrusting sponges, encrusting coralline algae (*Corallinaceae*) and a juvenile Giant Shovelnose Ray (*Glaucostegus typus*).

The existing jetty structures are supported by piles, which have formed small niche artificial reef environments, comprising of Cunjevoi (*Pyura stoloniferas*), Common Kelp (*Ecklonia radiata*), Flat Oyster (*Ostrea angasi*), Fanweed (*Zonaria sp*.), *Sargassum* spp. and various species within Cellana genus, such as various limpets and porifera (sponges).

The following species were incidentally encountered during field survey:

- Australian Mado (*Atyptichthys strigatu*)
- Dusky Flathead (*Platycephalus fuscus*)
- Australasian Snapper (*Chrysophrys auratus*)
- Giant Shovelnose Ray (*Glaucostegus typus*)
- Common Stingaree (*Trygonoptera testacea*).

Two Olive Ridley turtle (*Lepidochelys olivacea*), listed as endangered under the *Environment Protection Biodiversity Conservation Act 1999*, were also observed during the field assessment.

An assessment of the likelihood of the occurrence of threatened species identified in the desktop review found:

- Five threatened species under the EPBC/BC Act:
    - Red knot (Calidris canutus)
    - Curlew Sandpiper (*Calidris ferruginea*)
    - Beach Stone Curlew (*Esacus mannirostris*)
    - White Throated Needletail (*Hirundanus caudacutus*)
    - Bar-tailed Godwit (Limpsa lapponica baueri)
- One migratory marine bird under the EPBC Act:
    - Lesser Frigatebird (Fregata ariel)
- Two species listed marine fish that were mapped to occur within 10 kilometres of the study area:
    - Black Rock Cod (Epinephelus daemelii)
    - White's Seahorse (Hippocampus whitei)
- Five species of listed marine and migratory mammals that are mapped to occur within 10 kilometres of the study area. None of these are considered 'likely to occur'.
- Five species of listed marine reptiles that were mapped to occur within the 10 kilometres of the study area. Of these, four are considered 'likely to occur'. The four species determined as 'likely to occur' include:
    - Loggerhead turtle (*Caretta caretta*)
    - Green turtle (*Chelonia mydas*)
    - Leatherback turtle (*Dermocheyls coriacea*)
    - Hawksbull turtle (Eretmochelys imbricata)
- While not mapped to occur within the study area through the desk assessment, two Olive Ridley turtle (*Leipidochelys olivacea*) was observed during field assessment.
- Three species of listed marine sharks and rays that are mapped to occur within 10 kilometres of the study area. The two species determined as 'likely to occur' are:
    - Grey Nurse Shark (*Carcharias taurus*)
    - Great White Shark (*Carcharodon carcharias*)

Further details are provided in Appendix G.

6.8.3 Potential impacts

Construction

The Marine Biodiversity Assessment found that the proposed works could result in the following direct impacts:

- Biofouling and benthic community disturbance

  This disturbance may occur during the following planned activities:

  - Removal of existing jetty infrastructures
  - Dredging of harbour sediments
  - Placement of dredged material ex-situ
  - Pile driving
  - Placement and anchoring of construction vehicles.

- Removal of seagrass and of habitat for threatened species

  This removal may occur during the following planned activities:

  - Removal of Jetty 1 and Jetty 2 will take away the existing piles that are habitat forming.
  - Dredging of the harbour to a safe depth clearance (2.6-3.0 metres) may result in the removal of seagrass and macroalgae habitat. The potential area of macroalgae and seagrass to be removed has been minimised through design changes. This footprint is small and contains approximately 3-5 small patches ~3 m2. This represents a total area of disturbance of between 9 m2 and 15 m2. A number of piles (exact number to be provided to DPI at time of consultation) will also be removed. These piles represent artificial reef habitat, that are currently providing habitat to species within the harbour, such as the White's Seahorse. The total area of all piles to be removed will also require offsetting. Exact offset obligations will be determined through consultation with DPI. Both actions will result in reduced habitat substrate for the White's Seahorse and degrade the ecological function of the harbour i.e. the seagrass' role as a food source and shelter.

- Decline in water quality

  This decline may occur during the following planned activities:

  - Dredging and piling works.

- Artificial noise

  Artificial noise may occur during the following planned activities:

  - Removal of existing infrastructure.
  - Pile driving to install new piles.
  - Dredging.

Indirect impacts could include:

- Increased shading of rocky reef and seagrass beds.
- Introduction of marine pest species.
- Collision with marine fauna.
- Accidental release of hydrocarbons or other chemicals.

The assessment also identified the potential responses of the animals to the proposed works identified within and surrounding the proposal area:

Mammal animals

Animals are expected to avoid areas where artificial noise is being generated. Following the completion of works, animals are expected to return to the area, and such any displacement is expected to be temporary.

Marine turtles

Observations of marine turtles show that when exposed to artificial sound, they reportedly increase their swimming activity and start an erratic swimming behaviour. The proposed piling activities have the potential to result in behavioural changes for these species if they are present in proximity to the works.

Sharks and fish

Grey Nurse Shark (*Carcharias taurus*) and Great White Shark (*Carcharodon carcharias*) are known to transit the area.

Marine Birds

A variety of migratory birds are likely to occur in the study area, with populations and species being highly dependent during certain times of the year. Piling and other associated activities have the potential to disturb birds in residence due to artificial noise generated. This may cause a local reduction in shorebird use of the study area during construction.

An assessment of the significance of potential direct and indirect impacts as required under the FM Act and EPBC Act is provided in Appendix G.

Operation

The direct and indirect impacts that could potentially arise during proposal construction, are also applicable to the operational stage.

Conclusion on significance of impacts

With the implementation of the mitigation measures detailed in Section 6.7.4, there is unlikely to be a significant impact to threatened species listed as likely to occur, including marine turtles, White's Seahorse and the Black Rock Cod. With the use of relocation and seahorse hotels within the harbour, individuals will be safely relocated in accordance with a detailed plan to be approved by DPI. There will be a loss of some habitat in the harbour due to the removal of piles from Jetty 1 and Jetty 2. There will be partial reinstatement of piles with the re-build of Jetty 1. The seahorse hotels will create new habitat.

Engagement with DPI is required to confirm approval requirements and the adequacy of mitigation proposed for FM Act listed species. Through this engagement, the potential permanency of seahorse hotels will be explored.

The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the FM Act and therefore an SIS or BDAR is not required.

6.8.4 Safeguards and management measures

Marine biodiversity management safeguards and management measures are provided in Table 6-9.

Table 6-9: Marine biodiversity management safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
General	A Marine Ecology Management Plan (MEMP) would be prepared to include, but not be limited to, the following measures relating to potential direct and indirect impacts.	Contractor	Construction	Additional safeguard
Impacts to White's Seahorse	• Visual inspection (via diving) for White's Seahorse on piles and seagrass by suitably qualified marine scientists prior to removal of piles and seagrass, with the intent to capture and relocate any individuals found. This will require the development and approval of a Relocation Plan. • Consultation with DPI to include the use of seahorse hotels in the Relocation Plan. • Avoid works during the breeding season of the White's Seahorse (September to February).	Contractor	Construction	Additional safeguard
Water quality	• Dredging will be carried out using a method appropriate to the sediment characteristics within the harbour, with the method reducing environmental impacts as far as reasonably practicable. Use of a cutter suction dredge will result in less environment impact as it is less impactful to the seabed, resulting in less suspended solids.	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	• Disposal of dredged material will be strictly limited to the approved disposal area. • A silt curtain will be used to limit the extent of the turbidity plume generated during dredge activities. Silt curtains to be placed around the works, not around the sensitive areas. • Use tides to assist with entry of deep-draught vessels for dredging to avoid sediment resuspension from propeller wash as far as practicable. • Monitoring of turbidity during dredging to understand the generation and migration of turbid plumes from the works. Monitoring should be undertaken with reference to trigger levels that are linked to management actions such as adjustment of dredging works (e.g., movement of the dredge position, deployment of silt curtains, ceasing dredging to allow water quality to improve). It is recommended that monitoring comprise daily visual inspections during the active works. Observations should be made on a flood and ebb tide. Where it is evident that the water is becoming turbid as a result of active works,			

Impact	Environmental safeguards	Responsibility	Timing	Reference
	works are to stop and the deployment configuration of silt curtains reconsidered or time allowed for settlement of suspended solids.			
	A 'Maintenance Dredging Environmental Management Plan' will be developed that considers the long-term management of spoil in the harbour to include actions that minimise accretion in the harbour, justification for depth and width of dredging proposed, co-ordinates dredging proposed with beach renourishment proposals to make best use of material and establishes spoil disposal arrangements for maintenance dredging that minimises long term impacts. The Plan will also address approvals required, roles and responsibilities, environmental controls, risks and dredging operations proposed.	Transport for NSW	Operation	Additional safeguard
Seagrass removal	Clear delineation of dredge boundaries to preserve seagrass outside the footprint. This can be achieved by markers to delineate no-go zones and use of live GPS on dredge plant with reference to digital dredge boundaries.	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise	• Consideration should be given to the use of bubble curtains during pile driving. • Activities that generate underwater noise (such as piling) should be timed to occur outside of peak migration months to reduce overlap with migratory movements and therefore reduce the potential threat to migratory marine mammals, turtles and migratory marine birds. • Piling activities should implement mitigation measures outlined in the Government of South Australia's Underwater Noise Piling Guidelines (DPTI, 2012).	Contractor	Construction	Additional safeguard
Marine pests	• Where possible, vessels should be locally sourced to complete the proposed works. • Any internationally sourced vessels will empty ballast water in accordance with the latest version of the Australian Ballast Water Management Requirements (DAWE, 2020). • If an invasive marine pest species is identified or suspected, then the contractor will notify the NSW Department of Primary Industries hotline on 1800 675 888 (24 hour line) within 24 hours.	Transport for NSW/ Contractor	Construction/ Operation	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	• Proposal activities will adhere to the National Introduced Marine Pest Information System (NIMPIS) and NSW requirements for invasive marine pest species identification and management.			
Fauna collision	• Vessels will be operated in accordance with Part 8 of the EPBC Regulation (Interacting with Cetaceans and Whale Watching). • The Australian Guidelines for Whale and Dolphin Watching (DoEE, 2017) for seafaring activities will be implemented across the proposal site.	Transport for NSW/ Contractor	Construction/ Operation	Additional safeguard
Release of hydrocarbons and chemical	• Chemicals and hydrocarbons will be packaged, marked, labelled and stowed in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex I, II and III regulations. • A Material Safety Data Sheet (MSDS) will be available for all chemicals and hydrocarbons in locations near to where the chemicals/wastes are stored. • Where required by legislation vessel operators will have an up-to-date Shipboard Oil Pollution Emergency Plan (SOPEP) and Shipboard Marine	Transport for NSW/ Contractor	Construction/ Operation	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Pollution Emergency Plan (SMPEP). All shipboard chemical and hydrocarbon spills will be managed in accordance with these plans by trained and competent crew. • Any contaminated material collected will be contained on board for appropriate onshore disposal. • Spill clean-up equipment will be located where chemicals and hydrocarbons are stored and frequently handled (i.e. 'high risk' areas). The quantity of spill recovery materials will be appropriate to the quantity of stored chemicals. • Transfer deck run off discharges to the sea via the scuppers. • Any equipment or machinery with the potential to leak oil will be enclosed in continuous bunding or will have drip trays in place where appropriate. • Following rainfall events, bunded areas on open decks of the vessels will be cleared of rainwater. • All hoses for pumping and transfers will be maintained and checked. • On board oily water disposal will be managed in accordance			

Impact	Environmental safeguards	Responsibility	Timing	Reference
	with the Marine Pollution Regulation 2006. • If vessels are equipped with an oily water filter system, they may discharge oily water after treatment to 15 parts per million (ppm) in an oily water filter system (providing they have a current calibration certificate for the bilge alarm) as required by MARPOL Annex I Regulations (for the prevention of pollution by oil). • Refuelling operations will be a manned operation. In the event the refuelling pipe is ruptured, fuel bunkering will cease. • Refuelling of a vessel will only occur in suitable weather conditions and within the harbour. • Dry-break refuelling hose couplings and hose floats can be installed on the refuelling hose assembly.			

Other safeguards and management measures that would address biodiversity impacts are identified in Sections 6.3.4 and 6.4.5.

6.8.5 Biodiversity offsets

The proposal is likely to impact upon seagrass and macroalgae beds, particularly within the harbour environment itself. In accordance with the Policy and Guidelines for Fish Habitat Conservation and Management (2013), a permit to harm vegetation under Section 205 of the FM Act will be required.

As part of the ordinary permit conditions of consent, DPI enforces a no net loss habitat policy that may require proponents to conduct habitat rehabilitation and/or provide compensation. DPI calculates habitat compensation on a minimum 2:1 basis for all key fish habitat to capture the indirect impacts of the proposal. A greater compensation ratio may be required where opportunities for compensation are not available in the immediate vicinity, or the type of habitat that has been lost.

The potential area of macroalgae and seagrass to be removed has been minimised through design changes. This footprint is small and contains approximately 3-5 small patches ~3 m^2. This represents a total area of disturbance of between 9 m^2 and 15 m^2. A number of piles (exact number to be provided to DPI at time of consultation) will also be removed. These piles represent artificial reef habitat, that are currently providing habitat to species within the harbour, such as the White's Seahorse. The total area of all piles to be removed will also require offsetting. Exact offset obligations will be determined through consultation with DPI.

6.9 Traffic, transport and access

6.9.1 Existing environment

Land transport

Road network

The road network within the vicinity of the harbour is characterised by residential streets with on and off-street parking.

Crowdy Head Harbour is accessed from Crowdy Head Road and Pacific Drive (see Figure 6-5). Both are local roads managed by MidCoast Council. Crowdy Head Road connects to the Pacific Highway (A1) to the east, with other local roads including Deborah Street, Leopold Street and Stewart Close, within the village to the west.

Crowdy Head Road/ Pacific Drive has one lane in each direction, and a signposted speed of 50 kilometres per hour. There is street lighting along parts of the road around the harbour area.

The road to the disposal site is unsealed and two way from the end of Muir Park to the car park at Crowdy Head Cliffs (see Figure 6-7 and Figure 6-8).



Figure 6-7: Crowdy Head Road in the background, from the harbour car park



Figure 6-8: Start of the road to Crowdy Head Cliffs at Muir Park



Figure 6-9: Crowdy Head Cliffs car park

Parking

Street parking is available on Crowdy Head Road and Pacific Drive. Designated parking lots (one north and one south) are available adjacent to the harbour with no time restrictions

In addition to this, there is further public parking available off Crowdy Head Road at Muir Park around 110 metres southwest of the proposal site.

There are a number of parking spaces and picnic shelters at Crowdy Head Cliffs.

Water transport

As described in Section 1.1, the harbour has an approximate vessel capacity of 20, with harbour facilities that include a public wharf, boat ramp, commercial fishing unloading and berthing, and recreational and visitor berthing. There is one charter fishing boat business that operates out of the harbour. Services will remain similar following construction of the proposal.

As already discussed, use of the harbour is now much reduced due to the deterioration of the assets.

The closest alternative harbour facilities are in Harrington, approximately 10 kilometres to the southwest.

6.9.2 Potential impacts

Construction

Road network

Construction vehicles would access the proposal site via Crowdy Head Drive and Pacific Drive. It is anticipated that most materials and equipment required for construction of the proposal would be delivered by road. Construction vehicle movements and access arrangements would interrupt traffic flow on the local road network during delivery and removal of materials and plant. It is estimated that between 900 and 1500 truck movements will be required to transport the dredged material to the disposal site depending on the final amount of material. Over the 6 month construction period this may result in up to 10 movements per day or two per hour. The capacity of the network and the harbour foreshore is sufficient to accommodate these additional vehicles during the construction period. The immediate disposal area would be blocked form public access during the work however this would not prevent the public being able to move to or from other publicly accessible areas.

Parking

The site compound and loading/unloading area is proposed for the car park at the harbour. The location of these is shown in Figure 3-4. This would require the temporary loss of the carparks, in addition to those required for construction workers.

These activities would reduce the availability of parking spaces close to the harbour. However, there are several other carparks within 200 metres of the site that could accommodate other vehicles. With the closure or partial closure of the harbour during construction and the already reduced use of the site, the minor, temporary loss of about five formal parking spaces is not expected to have a significant impact on local or visitors to the harbour.

Water transport

The harbour will be partially closed during works, depending on construction scheduling. As the current use of the harbour is much reduced, it is not expected that this would have a major impact on users. Key stakeholders, such as Marine Rescue, commercial fishers and the community, would be consulted with to reduce the potential for impacts and ensure functional elements of the harbour remain available where necessary.

Operation

Road network

Operation of the proposal would have negligible impact on the surrounding road network, parking or public transport.

Water transport

The size and capacity of the design would accommodate a similar type and volume of vessels as the existing harbour. Therefore, there would not be a significant change in water transport resulting from the proposal.

6.9.3 Safeguards and management measures

Traffic management safeguards and management measures are provided in Figure 6-9.

Table 6-10: Traffic management safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Property access	Property access would be maintained during the works.	Contractor	Construction	Standard safeguard
Traffic	A Traffic Control Plan (TCP) will be prepared and implemented in accordance with the '*Traffic control at work sites manual*' (RTA, 2010a) and Australian Standard 1742.3 *Manual of uniform control devices*	Contractor	Pre-construction /construction	Standard safeguard
Pedestrian access	Safe pedestrian access to the seawall and park area is to be maintained with consideration to temporary security fencing and wayfinding being implemented for each construction stage.	Contractor	Construction	Standard safeguard
Water traffic	A Marine Traffic Control Plan (MTCP) will be prepared and implemented. The MTCP will identify: • Navigational safety requirements for all construction vessels and water-based equipment • A response plan for implementation including 24-hour contact details, management and communication protocols for enquiries, complaints and emergencies.	Contractor	Construction	Standard safeguard
	Where possible, current vessel movements and public access to the waterway and foreshore area are to be maintained during works. Any disturbance is to be minimised as much as practicable.	Contractor	Construction	Standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Commercial, recreational operators, private services and the community that use the existing wharf will be advised of: • The commencement of construction, well in advance of work starting, including the location of the compound site and temporary loss of car parking bays • Any changes to pedestrian routes to safely access the harbour • The partial harbour closure at least two weeks prior to closure	Transport for NSW	Pre-construction	Additional safeguard
	A navigation exclusion zone will be established during construction to prevent unauthorised vessels entering the area. This zone will be clearly defined to communicate access for other water users.	Contractor	Pre-construction /construction	Additional safeguard

6.10 Aboriginal cultural heritage

6.10.1 Methodology

A Stage 1 Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) assessment has been carried out and is provided in Appendix G.

6.10.2 Existing environment

The proposal site falls within the boundaries of the Purfleet/Taree Local Aboriginal Land Council and within the boundaries of the Biripi and Worimi Aboriginal people.

A search of the Aboriginal heritage Information Management System (AHIMS) database identified no known sites within the proposal site. The AHIMS search did indicate one valid object or place 30-6-0006 over 100 m outside of the project area in Muir Park, and will not be impact by the proposed works.

Site 30-06-0019 is located approximately 900 metres south of the site.

If land Claim ALC36156 and ALC36129 are going to be impacted, the NSW Aboriginal Land Council will need to provide written approval.

6.10.3 Potential impacts

Construction

The Stage 1 PACHCI assessment found the proposal is unlikely to harm known Aboriginal objects or places as follows:

- The AHIMS search indicated one valid site 30-6-0006 of an Aboriginal object or place. The site is over 100 metres outside of the proposal site in Muir Park and will not be impacted by the works.
- The site was inspected by foot on 13 May 2021 with no new findings.
- The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage's Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW.
- Works are within previously disturbed road works and marine reserve.
- The cultural heritage potential of the study area appears to be reduced due to past disturbance, industrial area and previous road works.
- There is an absence of sandstone rock outcrops likely to contain Aboriginal art.

If Land Claim ALC36156 and ALC36129 are going to be impacted , the NSW Aboriginal Land Council will need to provide written approval.

Operation

No changes in the carpark use or surrounding area are expected. The proposal is not likely to impact on Aboriginal cultural heritage or sites during operation.

6.10.4 Safeguards and management measures

Aboriginal heritage management safeguards and management measures are provided in Table 6-11.

Table 6-11: Aboriginal heritage safeguards and mitigation measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Unexpected finds	If Aboriginal heritage items are uncovered during the works, all works in the vicinity of the find must cease and the Transport for NSW Aboriginal cultural heritage officer and regional environment manager contacted immediately. Steps in the Transport for NSW Standard Management Procedure: Unexpected Heritage Items must be followed.	Contractor	Construction	Standard safeguard

6.11 Other impacts

6.11.1 Existing environment and potential impacts

Environmental factor	Existing environment	Potential impacts
Air quality	The existing air quality is primarily influenced by emissions from motor vehicles, residential activities and the costal environment. Air quality is also influenced by the prevailing weather and climatic conditions, bushfires and other natural factors such as pollen.	During the construction of the proposal, temporary impacts on air quality may arise from: • Minor generation of particles and dust from general construction work (e.g. concrete cutting and breaking) • Minor emissions (primarily diesel exhaust) from plant and machinery • Minor emissions from construction traffic and vessels. These impacts are expected to be short-term, low intensity and be able to be managed through identified safeguard and management measures. The proposal is not anticipated to change the volume of water vessels or land vehicles accessing the site, and maintenance activities would be similar to the existing wharf operations. Therefore, no additional impacts to the air quality expected from the operation of the proposal.
Non-Aboriginal heritage	A search of the following databases was conducted to identify heritage items in proximity to the proposal: • Australian Heritage Database • State Heritage Register and Inventory • Greater Taree LEP	The proposal would not impact on any known non-Aboriginal heritage sites during construction. There is always the potential, albeit small in this location, for disturbance of unknown sites or objects of heritage value. There will be no impacts to non-Aboriginal heritage places during operation.

Environmental factor	Existing environment	Potential impacts
	The nearest heritage item listed under the Greater Taree LEP is the Crowdy Head Lighthouse located approximately 470 metres southeast of the proposal site. There are 13 state heritage items listed in the MidCoast LGA. None are within Crowdy Head. There are 19 heritage items listed under the Australian Heritage Database in the Greater Taree LGA. The nearest items to the proposal are: • The Crowdy Head Lighthouse located approximately 470 metres southeast of the proposal site. • Crowdy Bay National Park, located approximately two kilometres northwest of the proposal site.	
Hazards	The existing wharf is a fixed structure that is subject to tidal influence and depth changes due to siltation. This affects safe access for vessels and limits the harbour's utilisation.	The following hazards and risks would be associated with the proposal during construction: • Construction materials, wastes and/or other objects have the potential to fall from the land based construction area into the water causing water pollution and risk to human health • Construction materials, waste and/or objects have the potential to fall from the construction barge or other construction vessels into the water causing water pollution and risk to human health • Physical injury to public due to various hazards and risks associated with the construction activities (e.g. construction vehicle movements)

Environmental factor	Existing environment	Potential impacts
		• Physical injury to workers due to various hazards and risks associated with the construction activities. The proposal includes the replacement of the existing Jetty 1 with a pontoon jetty with mooring pens about 10 metres to the south of the existing Jetty 1 and the dredging of areas of the harbour to provide a safe clearance depth.
Socio-economic	The wharf is currently used by commercial fishing operators, as well as the local community and tourists. The parking lot and kerbside parking are located along the southern side of the proposal site. The harbour currently does not provide reduced mobility access along the break walls.	There would be some disruption to local community during construction from the additional traffic movements and restrictions to part of the wharf, parking and the pedestrian footpath. These disruptions would be managed by standard safeguard measures and would be short term. During operation of the proposal similar facilities would be available to the community with the benefit of improved access and utility connections. The proposal would result in significant positive socio-economic benefits for the community.
Climate change and greenhouse gas	In October 2009 the NSW government released its NSW Sea Level Rise Policy. The policy provided sea level rise planning benchmarks as follows: • 40 centimetres by 2050 • 90 centimetres by 2100 On 8 September 2012, the State government withdrew these benchmarks in order to provide more flexibility in considering local conditions when determining future hazards. Responsibility for adopting sea level rise projections for use in planning was transferred back to local government.	Climatic factors would not constrain construction of the proposal except during adverse weather conditions such as prolonged heavy rain or high winds. These may delay the completion of construction. Construction would contribute to climate change through the generation of greenhouses gases from construction activities. A temporary increase in greenhouse gas emissions, primarily carbon dioxide, would be expected during construction of the proposal due to exhaust emissions from construction machinery and vehicles transporting materials and personnel to and from the site. These impacts are anticipated to be minor however given the small scale and temporary nature of construction.

Environmental factor	Existing environment	Potential impacts
		The proposal is not anticipated to change the volume of water vessels or land vehicles accessing the site, and maintenance activities would be similar to the existing wharf operations. Therefore, no additional impacts to climate change or greenhouse gas emissions are expected from the operation of the proposal. The proposal has minimised its exposure to climate change risks by including improving clearances while also considering projected sea level rise over the next 50 years. The design for the proposal will consider projections of sea level rise.

6.11.2 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Air quality	• Manage work during strong winds or other adverse weather conditions as required • Cover all loaded trucks and vessels • Machinery to be turned off rather than left to idle when not in use • Maintain all vehicles, including trucks and vessels entering and leaving the site, in accordance with the manufacturers specifications to comply with all relevant legislation • Maintain the work site in a condition that minimises fugitive emissions such as minor dust • Install appropriate sediment and erosion controls for any exposed earth or stockpiled waste.	Contractor	Construction	Standard safeguard
Non-Aboriginal cultural heritage	If unknown or potential heritage object/s are found during construction, work would stop, the area would be protected and advice would be sought from Transport for NSW. Work will only re-commence once advised accordingly.	Contractor	Construction	Standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Hazards	Refuelling of plant and equipment is to occur in impervious bunded areas located a minimum of 50 metres from drainage lines or waterways.	Contractor	Construction	Standard safeguard
	Refuelling of plant and equipment and storage of hazardous materials on barges is to occur within a double-bunded area.	Contractor	Construction	Standard safeguard
	An emergency spill kit is to be kept on site at all times and maintained throughout the construction work. The spill kit must be appropriately sized for the volume of substances at the work site.	Contractor	Construction	Standard safeguard
	If an incident (e.g. spill) occurs, the Transport for NSW Environmental Incident Classification and Reporting Procedure is to be followed and the Transport for NSW Contract Manager notified as soon as practicable.	Contractor	Construction	Standard safeguard
	Emergency contacts will be kept in an easily accessible location on vehicles, vessels, plant and site office. All workers will be advised of these contact details and procedures.	Contractor	Construction	Standard safeguard
	Spill kits for construction barges must be specific for working within the marine environment.	Contractor	Construction	Standard safeguard
	All workers will be advised of the location of the spill kit and trained in its use.	Contractor	Construction	Standard safeguard
	Vehicles, vessels and plant must be properly maintained and regularly inspected for fluid leaks.	Contractor	Construction	Standard safeguard
	In the event of a maritime spill, the incident emergency plan would be implemented in accordance with Sydney Ports Corporation's response to shipping incidents and emergencies outlined in the *'NSW State Waters Marine Oil and Chemical Spill Contingency Plan'* (Maritime, 2012).	Contractor	Construction	Standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Socio-economic	A Communications and Stakeholder Engagement Plan will be prepared to provide timely and accurate information to wharf users, surrounding sensitive receivers, businesses, stakeholders and the local community of: • Construction activities well in advance of construction starting. • Project updates to the progress in construction including the stage construction program. Wharf users will be notified and informed on which sections of the wharf will be opened or closed for public use. • Any disruptions to local road traffic. • Contact name and telephone number for enquiries or for making a complaint. A webpage and free-call number will be established for enquiries and will remain active for the duration of construction. All enquiries and complaints will be tracked and acknowledged within 24 hours of being received.	Transport for NSW and Construction Contractor	Construction	Standard safeguard
Climate change and greenhouse gases	The proposal design would consider and reflect, as far as practical, climate change and sea level rise projection.	Transport for NSW	Detailed design	Additional safeguard
	Recycled materials to be used during design, construction and operation of the proposal wherever possible.	Transport for NSW and Construction Contractor	Detailed design/ construction/ operation	Additional safeguard

6.12 Cumulative impacts

6.12.1 Study area

Crowdy Head Harbour is located within the village of Crowdy Head, in the Greater Taree LGA. A search of the following databases was completed to identify any projects which might result in cumulative impacts with the proposal:

- Department of Planning, Industry and Environment – Major projects
- Midcoast Council development application register.

Projects identified on the above registers that may impact on the proposal have been identified in Table 6-12.

6.12.2 Other projects and developments

Potential impacts from the construction and operation of identified past, present and future projects are summarised in Table 6-12.

In addition, other minor residential alterations and development applications have been identified. No significant construction related traffic would be generated for these projects outside of light vehicles travelling to the site and minor deliveries of equipment and materials.

Table 6-12: Past, present and future projects

Project	Construction impacts	Operational impacts
8 Leopold Street, Crowdy Head, NSW, 2427. Construction of an inground concrete swimming pool.	Construction timeframe unknown. Potential impacts to traffic with a minor increase in construction and light vehicles for the construction activities. Potential noise impacts for the surrounding area.	No operational impacts are anticipated.
551 Crowdy Head Road, Crowdy Head, NSW, 2427. Crowdy Bay Eco Resort 20 ‘glamping sites’ all with an ensuite, a deck and a parking space. Also a covered double-storey dining deck with outdoor dining, a cafe and bar, an inground pool, a cultural learning area, yoga pavilion, covered kids-play area, community garden and a reception and manager's accommodation.	Construction commenced. Impacts to traffic due to an increase in construction and light vehicles during the construction stage. Vehicles will use the same (only) access from the highway. Potential noise impacts for the surrounding area.	Positive impacts due to the increased tourism from the Eco Resort, who would also visit the harbour.

6.12.3 Potential impacts

Potential cumulative impacts are summarised in Table 6-13.

Table 6-13: Potential impacts

Environmental factor	Construction	Operation
Traffic and transport	Increase in construction vehicles and light traffic.	No significant operational impacts are anticipated.
Traffic and transport	Minor decrease in availability of parking during construction.	No significant operational impacts are anticipated.
Noise	Minor increase in noise for residential dwellings within the immediate vicinity of the proposal and other development sites.	No operational impacts are anticipated.

6.12.4 Safeguards and management measures

Cumulative impact management safeguards and management measures are provided in Table 6-14.

Table 6-14: Cumulative impact safeguards and mitigation measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative construction impacts	Community will be notified prior to the start of the works. Updates on any delays or changes to the construction period will also be communicated. Developers of the Eco Resort will be consulted prior to undertaking the proposal to avoid potential traffic and other issues.	Transport for NSW	Pre-construction / Construction	Additional safeguard

7 Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are also listed.

7.1 Environmental management plans

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe the safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Transport for NSW Environment Officer, prior to the commencement of any on-site works. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the QA Specification G36 – Environmental Protection (Management System), QA Specification G38 – Soil and Water Management (Soil and Water Plan), QA Specification G40 – Clearing and Grubbing and QA Specification G10 - Traffic Management.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed work on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

Table 7-1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN1	General - minimise environmental impacts during construction	A CEMP will be prepared and submitted for review and endorsement of the Transport for NSW Environment Manager prior to commencement of the activity. As a minimum, the CEMP will address the following: • Any requirements associated with statutory approvals • Details of how the project will implement the identified safeguards outlined in the REF • Issue-specific environmental management plans • Roles and responsibilities • Communication requirements • Induction and training requirements • Procedures for monitoring and evaluating environmental performance, and for corrective action • Reporting requirements and record-keeping	Contractor / Transport for NSW	Pre-construction / detailed design	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Procedures for emergency and incident management • Procedures for audit and review. The endorsed CEMP will be implemented during the undertaking of the activity.			
GEN2	General - notification	All businesses, residential properties and other key stakeholders (e.g. schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor / Transport for NSW project manager	Pre-construction	Standard safeguard
GEN3	General – environmental awareness	All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular "toolbox" style briefings. Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include [the following are examples only: • Areas of Aboriginal heritage sensitivity • Threatened species habitat • Adjoining residential areas requiring particular noise management measures.	Contractor / Transport for NSW project manager	Pre-construction/detailed design	Standard safeguard
LS1	Erosion and sedimentation	An Erosion and Sediment Control Plan (ESCP) is to be prepared and implemented in accordance with the Landcom/Department of Housing *Managing Urban Stormwater, Soils and Construction Guidelines* (the Blue Book)) to:	Contractor	Pre-construction Construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Prevent sediment moving off-site and sediment laden water entering any the harbour • Reduce water velocity and capture sediment on site • Minimise the amount of material transported from site to surrounding waters and pavement surfaces • Divert clean water around the site • Monitor and maintain all controls.			
LS2	Spills	A spill kit is to be available on site and accessible at all times. The spill kit must be appropriately sized for the volume of substances at the work site.	Contractor	Construction	Additional safeguard
LS3	Contaminated land	Any unexpected finds of contamination are to be managed in accordance with an Unexpected Finds Procedure. If contaminated soils are encountered or suspected, works will cease until appropriate management is implemented and the site is cleared by Transport for NSW.	Contractor	Construction	Additional safeguard
CP1	Safety risk due to extreme events	An Emergency Management Plan (EMP) will be prepared and implemented to include procedures to maintain worker safety and prevent damage to infrastructure, plant and machinery. The EMP will include: • Evacuation procedures	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Protocols for securing and removing water-based and land-based equipment and machinery during evacuation Appropriate safe locations for stockpiles and storage areas etc.			
WQ1	Dredging	A detailed Dredging Management Plan (DMP) would be prepared to outline requirements to control sediments and potential pollutants during dredging activities. The DMP would include the following at a minimum): Silt curtain/s are to be installed prior to and around the area of works that may disturb the seabed. Silt curtains are to be installed, monitored and maintained as needed to contain any sediment. Dredging to take place at low tide only and during stable weather and wave conditions. Positioning of barges, drilling and pile driving should occur during standard construction hours and calm conditions to prevent excessive scouring and minimise any safety risks. Visual monitoring of local water quality (i.e. turbidity, hydrocarbon spills/slicks) on a regular basis to identify any potential spills or deficient erosion and sediment controls. Vessels (including barges) are only to be used at suitable tides when no less than 600 mm clearance is available between the	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		underside of the vessel and the bed of the waterway. Prior to entry into the waterway, machinery should be appropriately cleaned, degreased and serviced. Capture and store any waste drilling fluids for appropriate onshore disposal according to legislative requirements. Ensure that all liquids including fuel and other liquids used on barges during construction are securely contained. Vessel speeds will be limited to signposted speeds to minimise turbidity being generated from propellor wash.			
WQ2	ASS	Potential or actual acid sulfate soils are to be managed in accordance with the Transport for NSW Guidelines for the Management of Acid Sulphate Materials 2005 and an ASSMP. The ASSMP is to include procedures for testing, material classification, treatment and disposal.	Contractor	Construction	Standard safeguard
WQ3	Water quality	Transport for NSW will continue to provide guidance for harbour users on correct procedures to avoid water quality impacts.	Transport for NSW	Operation	Additional safeguard
W1	Waste	A Waste Management Plan (WMP) will be prepared in accordance with legislative requirements to include measures to minimise waste, outline methods of disposal, reuse and recycling and monitoring, as appropriate. The WMP would include:	Contractor	Pre-construction / Construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Appropriate measures to avoid and minimise waste associated with the proposal should be investigated and implemented where possible • Waste management, littering and general tidiness will be monitored during routine site inspections Monitor waste and recycling quantities using Transport for NSW Waste Data Collection Workbook – DMS-FT-436 to support compulsory requirement 4 of the Transport for NSW Sustainable Design Guidelines version 4.0.			
W2	Waste	Existing waste bins to be monitored to determine appropriate size/ emptying frequency due to potential patron increase.	Transport for NSW/ Council	Operation	Additional safeguard
W2	Resource use	Recycled, durable, and low embodied energy products will be considered to reduce primary resource demand in instances where the materials are cost and performance competitive and comparable in environmental performance (e.g. where quality control specifications allow)	Transport for NSW	Detailed design	Standard safeguard
N1	Noise	A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the Interim Construction Noise Guideline (ICNG; DECC, 2009) and Construction Noise and Vibration Guideline (CNVG; TfNSW, 2016) and identify:	Contractor	Construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• All potential major noise and vibration generating activities associated with the activity • Feasible and reasonable standard measures to be implemented • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures. Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.			
N2	Notification	Advance warning of works and potential disruptions can assist in reducing the impact on the community. The notification may consist of using variable message sign, letterbox drop (or equivalent), web site / social media or a combination to distribute information detailing work activities, time periods over which these will occur, impacts and mitigation measures. Notification should be a minimum of 5 working days prior to the start of works. The approval conditions for projects may also specify requirements for notification to the community about works that may impact on them.	Contractor / TfNSW	Construction	Additional safeguard
VA1	Visual amenity	Hoarding or screening will be erected around the construction compound where possible, to reduce visibility.	Contractor	Construction	Additional safeguard
VA2	Visual amenity	The construction area would be left clean and tidy at the end of each working day.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
TB1	Biodiversity	The disposal area would be set out prior to any transport of spoil commencing (with flagging tape or temporary fencing etc.). Works would be contained within the delineated area to avoid impacts to adjacent areas.	Contractor	Construction	Additional safeguard
MB1	General	A Marine Ecology Management Plan (MEMP) would be prepared to include, but not be limited to, the following measures relating to potential direct and indirect impacts.	Contractor	Construction	Additional safeguard
MB2	Impacts to White's Seahorse	• Visual inspection (via diving) for White's Seahorse on piles and seagrass by suitably qualified marine scientists prior to removal of piles and seagrass, with the intent to capture and relocate any individuals found. This will require the development and approval of a Relocation Plan. • Consultation with DPI to include the use of seahorse hotels in the Relocation Plan. Avoid works during the breeding season of the White's Seahorse (September to February).	Contractor	Construction	Additional safeguard
MB3	Water quality	• Dredging will be carried out using a method appropriate to the sediment characteristics within the harbour, with the method reducing environmental impacts as far as reasonably practicable. Use of a cutter suction dredge will result	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		in less environment impact as it is less impactful to the seabed, resulting in less suspended solids. • Disposal of dredged material will be strictly limited to the approved disposal area. • A silt curtain will be used to limit the extent of the turbidity plume generated during dredge activities. Silt curtains to be placed around the works, not around the sensitive areas. • Use tides to assist with entry of deep-draught vessels for dredging to avoid sediment resuspension from propeller wash as far as practicable. Monitoring of turbidity during dredging to understand the generation and migration of turbid plumes from the works. Monitoring should be undertaken with reference to trigger levels that are linked to management actions such as adjustment of dredging works (e.g., movement of the dredge position, deployment of silt curtains, ceasing dredging to allow water quality to improve). It is recommended that monitoring comprise daily visual inspections during the active works. Observations should be made on a flood and ebb tide. Where it is evident that the water is becoming turbid as a result of active works, works are to stop and the deployment configuration of silt curtains			

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		reconsidered or time allowed for settlement of suspended solids.			
MB4	Water quality	A 'Maintenance Dredging Environmental Management Plan' will be developed that considers the long-term management of spoil in the harbour to include actions that minimise accretion in the harbour, justification for depth and width of dredging proposed, co-ordinates dredging proposed with beach renourishment proposals to make best use of material and establishes spoil disposal arrangements for maintenance dredging that minimises long term impacts. The Plan will also address approvals required, roles and responsibilities, environmental controls, risks and dredging operations proposed.	Transport for NSW	Operation	Additional safeguard
MB5	Seagrass removal	Clear delineation of dredge boundaries to preserve seagrass outside the footprint. This can be achieved by markers to delineate no-go zones and use of live GPS on dredge plant with reference to digital dredge boundaries.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
MB6	Noise	• Consideration should be given to the use of bubble curtains during pile driving. • Activities that generate underwater noise (such as piling) should be timed to occur outside of peak migration months to reduce overlap with migratory movements and therefore reduce the potential threat to migratory marine mammals, turtles and migratory marine birds. Piling activities should implement mitigation measures outlined in the Government of South Australia's Underwater Noise Piling Guidelines (DPTI, 2012).	Contractor	Construction	Additional safeguard
MB7	Marine pests	• Where possible, vessels should be locally sourced to complete the proposed works. • Any internationally sourced vessels will empty ballast water in accordance with the latest version of the Australian Ballast Water Management Requirements (DAWE, 2020). • If an invasive marine pest species is identified or suspected, then the contractor will notify the NSW Department of Primary Industries hotline on 1800 675 888 (24 hour line) within 24 hours. Proposal activities will adhere to the National Introduced Marine Pest Information System	Transport for NSW/ Contractor	Construction/ Operation	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		(NIMPIS) and NSW requirements for invasive marine pest species identification and management.			
MB8	Fauna collision	• Vessels will be operated in accordance with Part 8 of the EPBC Regulation (Interacting with Cetaceans and Whale Watching). The Australian Guidelines for Whale and Dolphin Watching (DoEE, 2017) for seafaring activities will be implemented across the proposal site.	Transport for NSW/ Contractor	Construction/ Operation	Additional safeguard
MB9	Release of hydrocarbons and chemical	• Chemicals and hydrocarbons will be packaged, marked, labelled and stowed in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex I, II and III regulations. • A Material Safety Data Sheet (MSDS) will be available for all chemicals and hydrocarbons in locations near to where the chemicals/wastes are stored. • Where required by legislation vessel operators will have an up-to-date Shipboard Oil Pollution Emergency Plan (SOPEP) and Shipboard Marine Pollution Emergency Plan (SMPEP). All shipboard chemical and hydrocarbon spills will be managed in accordance with these plans by trained and competent crew.	Transport for NSW/ Contractor	Construction/ Operation	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Any contaminated material collected will be contained on board for appropriate onshore disposal. • Spill clean-up equipment will be located where chemicals and hydrocarbons are stored and frequently handled (i.e. 'high risk' areas). The quantity of spill recovery materials will be appropriate to the quantity of stored chemicals. • Transfer deck run off discharges to the sea via the scuppers. • Any equipment or machinery with the potential to leak oil will be enclosed in continuous bunding or will have drip trays in place where appropriate. • Following rainfall events, bunded areas on open decks of the vessels will be cleared of rainwater. • All hoses for pumping and transfers will be maintained and checked. • On board oily water disposal will be managed in accordance with the Marine Pollution Regulation 2006. • If vessels are equipped with an oily water filter system, they may discharge oily water after treatment to 15 parts per million (ppm) in an oily water filter system (providing they have a current calibration certificate for the bilge alarm) as required			

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		by MARPOL Annex I Regulations (for the prevention of pollution by oil). • Refuelling operations will be a manned operation. In the event the refuelling pipe is ruptured, fuel bunkering will cease. • Refuelling of a vessel will only occur in suitable weather conditions and within the harbour. Dry-break refuelling hose couplings and hose floats can be installed on the refuelling hose assembly.			
TT1	Property access	Property access would be maintained during the works.	Contractor	Construction	Standard safeguard
TT2	Traffic	A Traffic Control Plan (TCP) will be prepared and implemented in accordance with the '*Traffic control at work sites manual'* (RTA, 2010a) and Australian Standard 1742.3 *Manual of uniform control devices*	Contractor	Pre-construction /construction	Standard safeguard
TT3	Pedestrian access	Safe pedestrian access to the seawall and park area is to be maintained with consideration to temporary security fencing and wayfinding being implemented for each construction stage.	Contractor	Construction	Standard safeguard
TT4	Water traffic	A Marine Traffic Control Plan (MTCP) will be prepared and implemented. The MTCP will identify: • Navigational safety requirements for all construction vessels and water-based equipment	Contractor	Construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		A response plan for implementation including 24-hour contact details, management and communication protocols for enquiries, complaints and emergencies.			
TT5	Water traffic	Where possible, current vessel movements and public access to the waterway and foreshore area are to be maintained during works. Any disturbance is to be minimised as much as practicable.	Contractor	Construction	Standard safeguard
TT6	Water traffic	Commercial, recreational operators, private services and the community that use the existing wharf will be advised of: • The commencement of construction, well in advance of work starting, including the location of the compound site and temporary loss of car parking bays • Any changes to pedestrian routes to safely access the harbour The partial harbour closure at least two weeks prior to closure	Transport for NSW	Pre-construction	Additional safeguard
TT7	Water traffic	A navigation exclusion zone will be established during construction to prevent unauthorised vessels entering the area. This zone will be clearly defined to communicate access for other water users.	Contractor	Pre-construction /construction	Additional safeguard
AH1	Unexpected finds	If Aboriginal heritage items are uncovered during the works, all works in the vicinity of the find must cease and the Transport for NSW Aboriginal cultural heritage officer and regional environment manager contacted	Contractor	Construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		immediately. Steps in the Transport for NSW Standard Management Procedure: Unexpected Heritage Items must be followed.			
AQ1	Air quality	• Manage work during strong winds or other adverse weather conditions as required • Cover all loaded trucks and vessels • Machinery to be turned off rather than left to idle when not in use • Maintain all vehicles, including trucks and vessels entering and leaving the site, in accordance with the manufacturers specifications to comply with all relevant legislation • Maintain the work site in a condition that minimises fugitive emissions such as minor dust Install appropriate sediment and erosion controls for any exposed earth or stockpiled waste.	Contractor	Construction	Standard safeguard
HH1	Non-Aboriginal cultural heritage	If unknown or potential heritage object/s are found during construction, work would stop, the area would be protected and advice would be sought from Transport for NSW. Work will only re-commence once advised accordingly.	Contractor	Construction	Standard safeguard
HR1	Hazards	Refuelling of plant and equipment is to occur in impervious bunded areas located a	Contractor	Construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		minimum of 50 metres from drainage lines or waterways.			
HR2	Hazards	Refuelling of plant and equipment and storage of hazardous materials on barges is to occur within a double-bunded area.	Contractor	Construction	Standard safeguard
HR3	Hazards	An emergency spill kit is to be kept on site at all times and maintained throughout the construction work. The spill kit must be appropriately sized for the volume of substances at the work site.	Contractor	Construction	Standard safeguard
HR4	Hazards	If an incident (e.g. spill) occurs, the Transport for NSW Environmental Incident Classification and Reporting Procedure is to be followed and the Transport for NSW Contract Manager notified as soon as practicable.	Contractor	Construction	Standard safeguard
HR5	Hazards	Emergency contacts will be kept in an easily accessible location on vehicles, vessels, plant and site office. All workers will be advised of these contact details and procedures.	Contractor	Construction	Standard safeguard
HR6	Hazards	Spill kits for construction barges must be specific for working within the marine environment.	Contractor	Construction	Standard safeguard
HR7	Hazards	All workers will be advised of the location of the spill kit and trained in its use.	Contractor	Construction	Standard safeguard
HR8	Hazards	Vehicles, vessels and plant must be properly maintained and regularly inspected for fluid leaks.	Contractor	Construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
HR9	Hazards	In the event of a maritime spill, the incident emergency plan would be implemented in accordance with Sydney Ports Corporation's response to shipping incidents and emergencies outlined in the *'NSW State Waters Marine Oil and Chemical Spill Contingency Plan'* (Maritime, 2012).	Contractor	Construction	Standard safeguard
SE1	Socio-economic	A Communications and Stakeholder Engagement Plan will be prepared to provide timely and accurate information to wharf users, surrounding sensitive receivers, businesses, stakeholders and the local community of: • Construction activities well in advance of construction starting. • Project updates to the progress in construction including the stage construction program. Wharf users will be notified and informed on which sections of the wharf will be opened or closed for public use. • Any disruptions to local road traffic. • Contact name and telephone number for enquiries or for making a complaint. A webpage and free-call number will be established for enquiries and will remain active for the duration of construction. All enquiries and complaints will be tracked and acknowledged within 24 hours of being received.	Transport for NSW and Construction Contractor	Construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
CC1	Climate change and greenhouse gas	The proposal design would consider and reflect, as far as practical, climate change and sea level rise projection.	Transport for NSW	Detailed design	Additional safeguard
CC2	Climate change and greenhouse gas	Recycled materials to be used during design, construction and operation of the proposal wherever possible.	Transport for NSW and Construction Contractor	Detailed design/ construction/ operation	Additional safeguard
CU1	Cumulative construction impacts	Community will be notified prior to the start of the works. Updates on any delays or changes to the construction period will also be communicated. Developers of the Eco Resort will be consulted prior to undertaking the proposal to avoid potential traffic and other issues.	Transport for NSW	Pre-construction / Construction	Additional safeguard

7.3 Licensing and approvals

A summary of the required license and approvals for the proposal is provided below.

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
Protection of the Environment Operations (Waste) Regulation 2014	Resource Recovery Order and Resource Recovery Exemption under the	Prior to start of the activity.
Fisheries Management Act 1994 (s199)	Notification to the Minister for Agriculture and Western NSW prior to any dredging or reclamation work.	A minimum of 28 days prior to the start of work.
Fisheries Management Act 1994 (s205)	Permit to harm marine vegetation from the Minister for Agriculture and Western NSW.	Prior to start of the activity.
Fisheries Management Act 1994 (s37)	Permit for the relocation of seahorses	Prior to start of the activity.
Water Management Act 2000 (s91F)	Aquifer interference approval from DPI (Water).	Prior to start of the activity, if more than three megalitres of dewatering required.
Crown Land Management Act 2016 (Division 3.4, 5.5 and 5.6)	Lease or licence to occupy areas of Crown land. Note: Work on Crown land triggers the requirement for a 24KA notice under the *Native Title Act 1993*. The notice is to be prepared by the legal team and send to NTSCORP. This is required whether there is a claim on the land or not.	Prior to start of the activity
Aboriginal Land Rights Act 1983	Engagement with the NSW LALC regarding impacts to Claim 36129 and Claim 36156.	Prior to start of the activity

8 Justification and conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the EP&A Regulation.

8.1 Justification

The proposal forms part of the delivery program for MIDO, whose objectives are to plan and deliver maritime infrastructure and dredging services including coastal and boating infrastructure programs. These objectives encompass the former maritime-related functions of DPE, Crown Lands.

Transport for NSW has determined that the majority of the core infrastructure at the harbour is in a state of decline, and the harbour is affected by significant siltation. Use of the facility has declined in recent years as the asset condition has deteriorated. There is now little to no commercial activity at the harbour. Dredging of the harbour was last undertaken in 2010.

The proposed upgrade is intended to improve amenity of the maritime and land-side areas of the harbour, address maritime safety and safe use of the facilities, and to renew the lifespan of the infrastructure in use.

A number of options and alternatives have been considered during design development. The preferred design best achieves the objectives outlined in Section 2.2, when compared to the option of doing nothing and the other options described in Section 2.4.

Potential environmental and social impacts resulting from construction and operation of the proposal have been assessed in Section 6 and minimised through the safeguards and management measures summarised in Section 7.2.

8.2 Objects of the EP&A Act

The objects of the EP&A Act and their relevance to the proposal are addressed in Table 8-1.

Table 8-1: Objects of the EP&A Act

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	Through the assessment in chapter 6, it has been identified that the proposal would not have a significant impact on any natural or artificial resources. The proposal will result in community benefits through facilitation of a safe and reliable public wharf in Crowdy Head.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	Ecologically sustainable development is considered in Section 8.3.
1.3(c) To promote the orderly and economic use and development of land.	The proposal facilitates continued and improved use of a public wharf.

Object	Comment
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the proposal.
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The assessment concluded that the proposal would not result in a significant impact on aquatic ecology. No terrestrial vegetation is proposed to be removed as part of the proposal.
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The proposal would not impact on Aboriginal or non-Aboriginal cultural heritage.
1.3(g) To promote good design and amenity of the built environment.	The proposal will be in keeping with the existing infrastructure to maintain design integrity. The proposal would be integrated within its local area, taking into consideration the nature of the site, local context and the surrounding biodiversity to create a high quality, secure and positive addition to the public domain.
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the proposal.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the proposal.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	This REF will be available to the community. Targeted consultation with the community and stakeholders would continue to occur throughout detailed design and construction.

8.3 Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

8.3.1 The precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

This principle was considered during route options development (refer to chapter 2). The precautionary principle has guided the assessment of environmental impacts for this REF and the development of mitigation measures (see Section 6).

The precautionary principle has shaped the proposal, assessment and mitigation measures as follows:

- Issues that may cause serious or irreversible environmental damage as a result of the proposed project and where there is scientific uncertainty as to the nature of the damage have been identified.
- Best available technical information, environmental standards and measures have been used to minimise environmental risks.
- Preferred design that minimises vegetation clearance, with particular consideration of sensitive areas, was selected.
- Preferred design to avoid or minimise potential damage to known items or areas of cultural significance was selected.
- Preferred design that minimises potential impacts on existing residential properties and other existing land uses, while also taking into consideration potential impacts on proposed future land use was selected.
- Conservative 'worst case' scenarios were considered while assessing environmental impact.
- Specialist studies were incorporated to gain a detailed understanding of the existing environment.

8.3.2 Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

Inter-generational equity concerns have shaped the proposal, assessment and mitigation measures as follows:

- The proposal minimises disturbance within sensitive ecological areas to ensure that such areas are conserved for future generations has been selected.
- Water quality, fauna connectivity and hydrological measures were included into the design to ensure that the impacts on the distribution of flora, fauna and ecological communities within sensitive ecological areas are minimised both for the short and long term.
- Possible compensatory habitat or offsets will be progressed with DPI.
- An Aboriginal cultural heritage assessment, including consultation with the local Aboriginal community, was carried out to avoid or minimise the potential for irreparable damage to occur to Aboriginal cultural heritage during the construction.
- The economic benefits in the form of access, safety and efficiency for surrounding areas for the current and future generation were identified.
- Issues that have potential long-term implications were minimised or avoided, for example consumption of non-renewable resources, waste disposal, greenhouse emissions, removal of vegetation and impacts on water quality, through application of management measures.

- Requirements to minimise the impact of climate change from greenhouse emissions were implemented, for example optimising fuel economy of all construction machinery, and use of recycled materials where feasible.
- Benefits that the proposal provides to current and future generations of local communities and the surrounding region that would maintain or enhance the health, diversity and productivity of the environment were identified.

8.3.3 Conservation of biological diversity and ecological integrity

Conservation of biological diversity and ecological integrity has shaped the proposal, assessment and mitigation measures as follows:

- Design features that would allow safe movement patterns for native fauna species were incorporated.
- Site selection criteria were established for construction phase facilities that include minimising disturbance.
- The cultural significance of the locality to the local Aboriginal community was considered.
- Biodiversity offset package for unavoidable residual impacts will be implemented.

8.3.4 Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by the carrying out of a project, including air, water, land and living things.

Valuation of environmental resources has shaped the proposal and mitigation measures by:

- Environmental issues were considered as key matters in the design development process for the proposal.
- The value of the proposal to the community in terms of improved safety was recognised.
- Mitigation measures for the avoidance, reuse, recycling and management of waste during construction and operation are to be implemented.

8.4 Conclusion

The proposed upgrade of Crowdy Head Harbour is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration impacts on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on marine habitat. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also improve safety, and provide improved access for all users including people with a disability. On balance the proposal is considered justified and the following conclusions are made.

Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore it is not necessary for an EIS to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. A BDAR or SIS is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

Engagement with DPI is required to confirm approval requirements and the adequacy of mitigation proposed for FM Act listed species.

Significance of impact under Australian legislation

With the implementation of the mitigation measures detailed in Sections 6.7.4 and 6.8.4, there is unlikely to be a significant impact to threatened species listed as likely to occur, including marine turtles, White's Seahorse and the Black Rock Cod.

Transport for NSW may wish to submit a precautionary referral under the EPBC Act if they deem it necessary.

9 Certification

This REF provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.



Simon Murphy

Technical Director – Environment & Community

GHD Pty Ltd

Date: 21 June 2022

I have examined this REF and accept it on behalf of Transport for NSW.



Gareth Doran

Manager Programs

Infrastructure Programs (South) Maritime Infrastructure Delivery Office

Maritime Greater Sydney Transport for NSW

Date: 21 June 2022

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Terms and acronyms used in this REF

Term/ Acronym	Description
AHIMS	Aboriginal Heritage Information Management System
AS	Australian Standard
Benthic	Relating to, or occurring at the bottom of a body of water
BC Act	*Biodiversity Conservation* Act *2016* (NSW).
CEMP	Construction environmental management plan
CM Act	Coastal Management Act 2016
DAWE	Australian Department of the Agriculture, Water and the Environment
DPI	Department of Primary Industries
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased
FM Act	*Fisheries Management Act 1994* (NSW)
Gangway	A landing used by passengers to board or exit ships/vessels
Heritage Act	*Heritage Act 1977* (NSW)
Infrastructure SEPP	State Environmental Planning Policy (Transport and Infrastructure) 202
Jetty	A structure extending into the harbour as part of a wharf
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local government area
MIDO	Maritime Infrastructure Delivery Office
MNES	Matters of national environmental significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
NML	Noise management level
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
Piles	Foundations used to support marine structures and offshore platforms
Pontoon	A floating structure serving as a dock
Proposal site	The area directly impacted by proposed works, including the installation and removal of structures.

Term/ Acronym	Description
RBL	Rating background level
REF	Review of environmental factors
Roads and Maritime	NSW Roads and Maritime Services now part of Transport for NSW
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
Soil and Water Plan	Soil and Water Management Plan
TfNSW	Transport for New South Wales
QA Specifications	Specifications developed by Transport for NSW for use with road work and bridge work contracts let by Transport for NSW.
Wharf	A landing place or pier where ships may tie up and load or unload.

Appendix A Consideration of clause 171 factors

Consideration of MNES and Commonwealth land

Clause 171 checklist

In addition to the requirements of the *Is an EIS required?* (DUAP 1995/1996) guideline and the *Marinas and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in clause 172(2) of the EP&A Regulation, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
a) Any environmental impact on a community? There would be some disruption to local community during construction from the additional traffic movements and restrictions to part of the wharf, parking and the pedestrian footpath. Minor increase in noise for residential dwellings within the immediate vicinity of the proposal site and residential flat development. During operation of the proposal similar facilities would be available to the community with the benefit of improved access and utility connections.	Minor. These disruptions would be managed by standard safeguard measures and would be short term.
b) Any transformation of a locality? Visual impacts of construction activities are considered to be minor as the works would be temporary and short-term. The proposal has been designed to be as similar to the existing wharf structure as possible and therefore is not expected to result in significant visual impacts to the surrounding area. The removal of the long Jetty 2 would be a permanent visual change. However given the landscape context of the existing harbour, this change is not expected to be significant.	Minor and temporary
c) Any environmental impact on the ecosystems of the locality? Removal of biofouling communities on piles and jetties will result in both permanent and temporary loss of biodiversity from the proposal footprint. While both existing jetties are to be removed, one will be re-instated. The piles from the jetty not re-instated represents a permanent loss of biodiversity. Removal of piles, seagrass or macroalgae habitat removes potential habitat for the threatened White's Seahorse. With the implementation of the mitigation measure detailed in the Marine Biodiversity Assessment (Appendix G), there is unlikely to be a significant impact to threatened species listed as likely to occur, including marine turtles, White's Seahorse and the Black Rock Cod	Minor loss of seagrass habitat
d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? During construction there will be reduced amenity and recreational activity due to partial harbour closure and physical presence of construction barges and equipment. The proposed works would be staged to allow continued access and use of the harbour, both on-water and land-side, outside nominated construction exclusion zones. Staging would allow a return to service and use of each jetty in sequence so that there is one available for use at all times.	Minor and temporary

Factor	Impact
e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? The proposal is to replace the existing infrastructure with a similar wharf facility. No significant heritage values will be impacted.	Nil
f) Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974)?* Removal of piles, seagrass or macroalgae habitat removes potential habitat for the threatened White's Seahorse. A permit will be required under Section 205 of the FM Act to harm marine vegetation.	Minor direct loss of seagrass habitat
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? Potential to impact on White's Seahorse, should they occur. Measures to avoid impacts to the White's Seahorse are provided in the Marine Biodiversity Assessment (Appendix G).	Minor direct loss of seagrass habitat
h) Any long-term effects on the environment? There is potential for long-term harm without strict adherence to mitigation controls to minimise the risk and extent of removal of seagrass and of habitat for threatened species. Mitigation controls are described in Section 6.8.4.	Nil
i) Any degradation of the quality of the environment? Construction activities, including dredging, has the potential to result in reduced water quality conditions. Proposed mitigation measures and implementation of a silt curtain will minimise sediment dispersion.	Temporary and minor
j) Any risk to the safety of the environment? The proposed upgrade is intended to improve amenity of the maritime and land-side areas of the harbour, address maritime safety and safe use of the facilities, and to renew the lifespan of the infrastructure in use.	Positive
k) Any reduction in the range of beneficial uses of the environment? The proposal improves the wharf facilities to replace an aging marine asset.	Positive
l) Any pollution of the environment? The REF describes several mitigation measures that will be implemented to avoid and minimise the potential for pollution of the environment. These will be implemented during construction and operation.	Minor

Factor	Impact
m) Any environmental problems associated with the disposal of waste? All waste removed from the proposal footprint would be transferred by a licenced contractor to a licenced receiving facility. Results from the Sediment Assessment (Appendix E) indicate that the sediments to be dredged do not pose a risk to human health or the environment. As such, the sediments are suitable for land-based reuse/placement, subject to appropriate management and handling measures.	Minor
n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The proposal is a small-scale proposal unlikely to result in increased demand or shortage of resources.	Nil
o) Any cumulative environmental effect with other existing or likely future activities? Refer to Section 6.1.2 of the REF.	Nil
p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? A Coastal Processes Assessment has been completed for the proposal. The findings of the assessment are summarised in Section 6.2 of the REF, with the full report provided in Appendix D.	Nil
q) Applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1 Applicable legislation, plans and strategies have been addressed in Section 2 and Section 4.	Nil
r) Other relevant environmental factors In considering the potential impacts of this proposal all relevant environmental factors have been considered, refer to Chapter 6 of this assessment.	Nil

Matters of national environmental significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act, the following MNES and impacts on the Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government DAWE.

Factor	Impact
a) Any impact on a World Heritage property?	Nil
b) Any impact on a National Heritage place?	Nil
c) Any impact on a wetland of international importance?	Nil
d) Any impact on a listed threatened species or communities? With the implementation of mitigation measures in Section 6.8.4, the proposed works will not impact individuals, populations or habitats of species listed under the EPBC Act such that the population survival will be compromised or result in any significant effect on the population structure and function.	Minor direct loss of seagrass habitat
e) Any impacts on listed migratory species? Refer to Section 6 of REF. Activities that generate underwater noise (such as piling) should be timed to occur outside of peak migration months to reduce overlap with migratory movements and therefore reduce the potential threat to migratory marine mammals, turtles and migratory marine birds.	Nil
f) Any impact on a Commonwealth marine area?	Nil
g) Does the proposal involve a nuclear action (including uranium mining)?	No
h) Additionally, any impact (direct or indirect) on the environment of Commonwealth land?	Nil

Appendix B Statutory consultation checklists

Infrastructure SEPP

Development within the coastal zone

Issue	Description	Yes/No/NA	If 'yes' consult with	Infrastructure SEPP clause
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No	Council	2.14

Note: See interactive map here: https://www.planning.nsw.gov.au/policy-and-legislation/coastal-management. Note the coastal vulnerability area has not yet been mapped.

Note: a certified coastal zone management plan is taken to be a certified coastal management program.

Council related infrastructure or services

Issue	Potential impact	Yes/No	If 'yes' consult with	Infrastructure SEPP clause
Stormwater	Is the work likely to have a *substantial* impact on the stormwater management services which are provided by council?	No	Council	2.10(a)
Traffic	Is the work likely to generate traffic to an extent that will *strain* the capacity of the existing road system in a local government area?	No	Council	2.10(b)
Sewerage system	Will the work involve connection to a council owned sewerage system? If so, will this connection have a *substantial* impact on the capacity of any part of the system?	No	Council	2.10(c)

Issue	Potential impact	Yes/No	If 'yes' consult with	Infrastructure SEPP clause
Water usage	Would the work involve connection to a council owned water supply system? If so, would this require the use of a *substantial* volume of water?	No	Council	2.10(d)
Temporary structures	Would the work involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, would this cause more than a *minor* or *inconsequential* disruption to pedestrian or vehicular flow?	No	Council	2.10(e)
Road & footpath excavation	Would the work involve more than *minor* or *inconsequential* excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No	Council	2.10(f)

Local heritage items

Issue	Potential impact	Yes/No	If 'yes' consult with	Infrastructure SEPP clause
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the work? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than *minor* or *inconsequential?*	No	Council	2.11

Flood liable land

Issue	Potential impact	Yes/No	If 'yes' consult with	Infrastructure SEPP clause
Flood liable land	Is the work located on flood liable land? If so, would the work change flood patterns to more than a *minor* extent?	No	Council	2.12
Flood liable land	Is the work located on flood liable land? (to any extent). If so, does the work comprise more than *minor* alterations or additions to, or the demolition of, a building, emergency work or routine maintenance?	No	State Emergency Service	2.13

Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled *Floodplain Development Manual: the management of flood liable* land published by the New South Wales Government.

Public authorities other than councils

Issue	Potential impact	Yes/No	If 'yes' consult with	Infrastructure SEPP clause
National parks and reserves	Is the work adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act?	No	Office of Environment and Heritage	2.15(a)
National parks and reserves	Is the work on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	Office of Environment and Heritage	2.15(b)
Navigable waters	Is the development comprising a fixed or floating structure in or over navigable waters?	No	Transport for NSW	2.15(c)
Artificial light	Would the work increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	Director of the Observatory	2.15(d)
Defence communications buffer land	Is the work on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in clause 5.15 of Lockhardt LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.	No	Department of Defence	2.15(e)

Issue	Potential impact	Yes/No	If 'yes' consult with	Infrastructure SEPP clause
Mine subsidence land	Is the work on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	No	Subsidence Advisory NSW	2.15(f)
Bush fire prone land	Has *Planning for Bush Fire Protection* been considered?	N/A	Rural Fire Service	2.16

Appendix C Preliminary Site Investigation

Crowdy Head Harbour Upgrade

Preliminary Site (Contamination) Investigation

Transport for NSW

26 April 2022

→ **The Power of Commitment**



GHD Pty Ltd | ABN 39 008 488 373
GHD Tower, Level 3, 24 Honeysuckle Drive
Newcastle, New South Wales 2300, Australia
T +61 2 4979 9999 | **F** +61 2 9475 0725 | **E** ntlmail@ghd.com | **ghd.com**

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			Name	Signature	Name	Signature	Date
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Executive summary

GHD Pty Ltd was engaged by Transport for NSW (TfNSW) to prepare a Review of Environmental Factors (REF), which includes a Preliminary Site (Contamination) Investigation (PSI), for the upgrade of the Crowdy Head Harbour (the Site). Crowdy Head is located on the NSW north coast. The harbour has an approximate vessel capacity of 20. The Site facilities include a public wharf, boat ramp, commercial fishing unloading and berthing, and recreational and visitors berthing. There is one charter fishing boat business that operates out of the harbour.

TfNSW is proposing to upgrade the harbour and requires an understanding of the potential contamination issues that may be present due to current or historical activities.

GHD completed a desktop review for Site including review of geology, soil, hydrology, hydrogeology, topography, historical aerial photographs, relevant reports and NSW government information.

Based on the desktop review, the Site was developed into a formal harbour (break walls, boat ramp and jetty) sometime prior to 1969. The Site was further developed over time with the addition of jetties, boat ramps, slipway and construction of formal access roads and parking.

Based on the available information on the historical use of the Site and subject to the scope of works in Section 1.3 and limitations presented in Section 1.4, the likelihood for significant chemical contamination to be present across the Site is considered to be medium to low. The main potential areas of concern identified were associated with the following:

– Marina facilities – use, storage and leaks of chemicals, disposal of wastes (medium potential)
– Storage and use of fuels on site (low potential)
– Spills of fuels and oils from vessels and machinery (low-medium potential)
– Potential use of herbicides or pesticides (low potential)
– Fill materials from unknown sources – historical use in construction of the break walls and marina foreshore (medium potential)

Based on the results of the desktop review, it is considered that risks from disturbance of any potential contaminated soils within the Site can be managed during any site works through the implementation of an unexpected finds protocol.

This PSI is to be read in conjunction with the Crowdy Heady Harbour Upgrade Review of Environmental Factors prepared by GHD (TfNSW 2022).

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1. Introduction

1.1 Background

GHD Pty Ltd was engaged by Transport for NSW (TfNSW) to prepare a Review of Environmental Factors (REF), which includes a Preliminary Site (Contamination) Investigation (PSI), for the proposed upgrade of Crowdy Head Harbour (the Site). Crowdy Head is located on the NSW north coast. The harbour has an approximate vessel capacity of 20. The Site facilities include a public wharf, boat ramp, commercial fishing unloading and berthing, and recreational and visitors berthing. There is one charter fishing boat business that operates out of the harbour. The site locality plan is presented in Appendix A.

TfNSW is proposing to upgrade the harbour and requires an understanding of the potential contamination issues that may be present due to current or historical activities.

This report presents the findings of the desktop review for the Site and surrounding terrestrial area. Marine sediment contamination is assessed within a separate report (GHD 2021).

1.2 Objective

The REF will assess the environmental impacts associated with the proposed upgrade of the Crowdy Head Harbour Facility (the Proposal). The purpose of this REF is to describe the Proposal, to document the likely impacts of the Proposal on the environment, and to detail mitigation and management measures to be implemented, including any potential issues with contaminated soils and/or sediments. The REF is required to fulfill the requirements of Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), and to take into account all matters affecting or likely to affect the environment as a result of the Proposal. This PSI forms part of the REF.

The objective of the PSI is to identify potential land contamination issues within the Site as a result of current or historical activities. It is intended to be read in conjunction with the REF.

1.3 Scope of work

The scope of work for this PSI is as follows:

– Review geology, soil, hydrology, hydrogeology and topography information for the Site.
– Site history review including review of historical aerial photographs and any relevant available reports.
– A review of NSW Environment Protection Authority (EPA) records under the *Contaminated Land Management Act 1997* (CLM Act) and licences under the *Protection of the Environment Operations Act 1997* (POEO Act).
– Reporting in accordance with the Guidelines for Consultants Reporting on Contaminated Sites (EPA 2020) summarising the results of the desktop review, identification of areas of potential concern, potential chemicals of concern and preparation of a preliminary Conceptual Site Model.

1.4 Limitations

This report has been prepared by GHD for TfNSW and may only be used and relied on by TfNSW for the purpose agreed between GHD and the TfNSW as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than TfNSW arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by TfNSW and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Except as otherwise expressly stated in this Report GHD makes no warranty or representation as to the presence or otherwise of asbestos and/or asbestos containing materials ("ACM") on the site. If fill material has been imported on to the site at any time, or if any buildings constructed prior to 1970 have been demolished on the site or material from such buildings disposed of on the site, the site may contain asbestos or ACM.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

Except as otherwise expressly stated in this Report, GHD makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site.

These Disclaimers should be read in conjunction with the entire Report and no excerpts are taken to be representative of the findings of this Report.

2. Site information

2.1 Site description and environmental setting

The harbour at Crowdy Head is situated on a natural harbour that was formed by a rocky reef on the north-eastern side of the headland. Formation of the coastal harbour commenced in 1900 with construction of a break wall from rock blasted from the nearby quarry. In the 1970s and 1980s, the break walls were extended, dredging of the harbour was completed, and mooring jetties and an unloading wharf were built for the local fishing industry.

Siltation of Crowdy Head Harbour has occurred over the past four decades as a result of marine sands transported from the south by coastal processes. Wave action and flood tides 'push' marine sands into the harbour. Furthermore, water circulation within the harbour also results in an accumulation of marine sand in the northern section of the harbour, directly adjacent to the northern break wall.

Site information is summarised in Table 2.1. This information was sourced from searches of publicly available databases as conducted by Lotsearch (Appendix B), and the REF (TfNSW 2022).

Table 2.1 Site description and environmental setting

Item	Detail
Location	The Site is located immediately to the northwest of the village of Crowdy Head and is approximately eight kilometres north of Harrington and 25 kilometres south of North Haven. A site locality plan is presented in Appendix A.
Street Address	562 Crowdy Head Road, Crowdy Head, NSW 2427
Lot and DP number	Lots 1, 2, 3, 4 and 5 DP1077643 and Lot 7306 DP1162930 These lots encompass several Crown Reserves: R1014609, R210107, R1012108 and R89406
Site owner	TfNSW is the manager for the Crown Reserves From 1 July 2020 the former maritime-related functions of the Department of Planning Industry and Environment (DPIE), Crown Lands, have been centrally coordinated and managed by the Maritime Infrastructure Delivery Office within TfNSW
Site area	53,200 m^2
Local Government Area	MidCoast Council
Land use zoning	Public recreation (RE1); Environmental Conservation (E2); Working Waterways (W3); Working Waterfront (IN4)
Site use	Coastal harbour with marina facilities, jetties and a boat ramp
Surrounding land use	Surrounding land uses are as follows: – **North** – Tasman Sea – **East** - Tasman Sea – **South** – Crowdy Head (residential) settlement – including sealed roads and houses and cleared land – and Muir Park (recreational area), within Crowdy Bay National Park – **West** – Crowdy Bay Beach within Crowdy Bay National Park
Topography	The Site has a maximum elevation of 10 m Australian height Datum (AHD).
Site drainage	Surface runoff from Site is expected to drain to the harbour
Hydrology	Rainfall is generally expected to infiltrate into sandy soils. Surface water runoff from the surrounding area is expected to flow into the harbour.
Hydrogeology	Groundwater is inferred to flow (generally) north (northwest) towards Crowdy Bay Harbour. The regional aquifer (southwest of the site) is described as porous, extensive and highly productive (Lotsearch LS023653, Aug 2021). There are no registered groundwater bores within 500 m of the Site – (refer to Hydrology & Groundwater section of Appendix B).

Item	Detail
Soils	The Site is within the A9 unit Rudosol, described as: Present beach system of dunes and estuaries; relatively unstable dunes of calcareous sands (Uc1.11) or siliceous sands (Uc1.21), passing inland to more stable dunes and flatter sandy areas of siliceous sands (Uc1.21) and/or leached sands (Uc2.2 and Uc2.3); some estuarine areas of plastic clays (Uf6.5 or Uf6.6) with sand D horizons; (areas of unit Ca7 may also be included); soil dominance varies locally between calcareous (Uc1.11) and siliceous (Uc1.21) sands.
Geology	The Site is underlain by the Palaeozoic Cowangara Formation – characterised by cleaved, turbiditic, thinly to medium bedded grey to black laminated fine lithic sandstone, siltstone and slate with lenses of massive conglomerate. This is overlain by Quaternary marine sands and silts on the harbour floor.
Acid Sulfate Soils	Under the *Environmental Planning Instrument - Acid Sulfate Soil* (ASS), the on-site ASS Plan Class that presents the largest environment risk is 3 – (indicates that works more than 1 metre below natural ground surface present an environmental risk, where the water table is likely to be lowered more than 1 metre below natural ground surface). The majority of the harbour (aquatic environment) is Class 5 – (works within 500 metres of an adjacent Class 3 that is below 5 metres AHD, and where the water table is likely to be lowered below 1 meter AHD on that adjacent Class 3 land). The Atlas of Australian ASS revealed that harbour foreshore is predominantly Class B – a low probability of ASS occurrence (6-70% chance); and minor areas of Class C – extremely low probability of occurrence (1-5% chance), with occurrences in small localised areas.
Sensitive receptors	Human health receptors: – Current and future occupants of the Site (e.g. workers and subcontractors) – Visitors to the Site (e.g. workers conducting maintenance, members of the public) – Current and future occupants of surrounding properties (e.g. residents, workers and visitors) Ecological receptors: – Flora and fauna within the Site and surrounding area – Groundwater beneath the Site – Surface water within the harbour

3. Site history

3.1 Site history review

Historical information was sourced from publicly available information by Lotsearch (Aug 2021) LS023653 (Appendix B), and the Crowdy Head Harbour Upgrade Review of Environmental Factors prepared by GHD (TfNSW, 2022).

Table 3.1 summarises the site history information.

Table 3.1 Site history

Item	Detail
Previous reports	Navigation Dredging and Repairs to Jetty No.1, Crowdy Head Boat Harbour, Land and Property Management Authority, Dec 2009. Works to repair the south-eastern jetty (Jetty 1) and dredging of the harbour was undertaken in 2010 by the then NSW Land and Property Management Authority. Jetty 1 was closed in 2010. Due to surging swells, the harbour has had significant siltation that affects safe clearance depths and has had not been able to sustain heavy boat use since 2013.
EPA [1]	No records of contaminated land listed within 1km of the Site were identified in the search. No records of contaminated sites notified to the EPA were identified within 1 km of the Site in the search. No records of gas works sites were identified within 1 km of the Site in the search.
POEO Act [2]	No licensed activities under the POEO Act were identified at the Site. The following Environment Protection Licence (EPL) is issued for land within 200m (south) of the Site: EPL 11346 – Mid-Coast Council; Waterways and Riparian Areas Within – other activities. No **former** licensed activities under the POEO Act were identified at the Site. The following **former** licensed (now surrendered) activities are within 200 m (south) of the Site: – 4653 – Luhrmann Environment Management Pty Ltd; Waterways throughout NSW – other activities/non-scheduled activity – application of herbicides (surrendered 06/09/2000). – 4838 – Robert Orchard; various waterways throughout NSW – other activities/non-scheduled activity - application of herbicides (surrendered 07/09/2000). – 6630 – Sydney Weed and Pest Management Pty Ltd; Waterways throughout NSW – Prospect NSW2148 – other activities/non-scheduled activity – application of herbicides (surrendered 09/11/2000). – 12461 – Greater Taree City Council; land or waterways within Greater Taree City Council LGA Taree – other activities (surrendered 21/03/2006).
Underground petroleum storage systems (UPSS) [3]	No UPSS were identified on-site or within 1 km of the Site.
Waste management facilities	No waste management or liquid fuel facilities were identified within 1 km of the Site.
PFAS investigation and management programs	No PFAS investigation or management programs were identified within 2 km of the Site.
Historical business directories	No historical business activities (including dry cleaners, motor garages and service stations) were identified within 500 .m of the Site.

[1] EPA public register, including contaminated land record of notices issued under the CLM Act, sites notified as contaminated to the EPA, and other EPA contamination issues e.g. former gasworks sties.
[2] POEO Act public register, including EPLs.
[3] Relating to the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2014 (UPSS Regulation).

3.2 Historical aerial photograph review

Observations from the review of historical aerial photographs in the Lotsearch report (Appendix B) are summarised in Table 3.2.

Table 3.2 Review of historical aerial photographs

Photograph	Observations
1940 Black and white	*Site* The Site appears as a natural sandy beach with a northward orientation. *Surrounding* The surrounding area is undeveloped with a dirt track leading into the area from the west - 50-80m from the shoreline. Approximately a dozen structures (shacks) are visible, and scrubby vegetation across the area – no formal residential settlement, boat ramp or other infrastructure.
1969 Black and white	*Site* Formalised harbour – construction started on the western and northern break walls. Two boat ramps in the southwest of the harbour and evidence of a small jetty and boats moored along wharf on the eastern shore within the harbour. *Surrounding* Formalised roads and residential settlement to the south of the harbour – approximately three dozen houses/structures in a new residential area to the southeast of the harbour.
1974 Black and white	*Site* Both break walls finished; boats anchored in the harbour; and two short jetties on the south-eastern shore. Boats no longer moored along south-eastern shore. *Surrounding* No significant changes to the residential area from the previous aerial photograph other than formalising the road coming in from the west and around the residential area.
1979 Black and white	*Site* Construction of two jetties extending from the southeast (Jetty 1) and eastern (Jetty 2) harbour foreshore. Only one boat ramp in use. Jetties accessed by formalised roads. *Surrounding* More residential development (west of initial development), and the beginning of a recreational area (tennis court and park area) at the entry to the area from the west (to the south of the harbour).
1989 Black and white	*Site* Sealed road to (single) formal boat ramp in southwest of harbour. The eastern jetty is well occupied, and boats area also along the south-eastern jetty. Additional jetty/facility built between the two jetties and a slipway next to the south-eastern jetty. *Surrounding* Further residential development to the southwest of the harbour, and parking provided to the recreational area (also possibly for the boat ramp).
1997 Colour	*Site* Sealed road and parking provided for the eastern jetty. No other significant changes from the previous aerial photograph. *Surrounding* No significant changes from the previous aerial photograph.
2002 Colour	*Site* No significant changes from the previous aerial photograph. *Surrounding* No significant changes from the previous aerial photograph.
2013 Colour	*Site* No significant changes from the previous aerial photograph, other than a structure built within the harbour area adjacent to the southeast jetty. *Surrounding* No significant changes from the previous aerial photograph.

Photograph	Observations
2019 Colour	*Site* No significant changes from the previous aerial photograph. *Surrounding* No significant changes from the previous aerial photograph.
2021 Colour	*Site* No significant changes from the previous aerial photograph. *Surrounding* No significant changes from the previous aerial photograph.
Summary of key points	*Site* The harbour was developed (break walls, boat ramp and jetty) sometime prior to 1969. Construction of the break walls commenced sometime prior to 1969 and were completed prior to 1974. The break walls have significantly changed the coastal geomorphology, from a sandy beach open to the ocean, to an enclosed harbour embayment. The Site was further developed over time with additional jetties (1 and 2) developed around 1979 and formalisation of the boat ramp, addition of a slipway and development of roads and parking. *Surrounding* Land to the southeast of the Site has been developed from open coastal scrubland to a small, low density residential community including open space recreational/park land use.

4. Preliminary conceptual site model

A conceptual site model (CSM) is a qualitative analysis tool, which identifies the contamination sources, transport mechanisms, exposure pathways and receptors. The CSM draws together historical data, specific and regional geological, hydrogeological, hydro-geochemical and contamination information to identify potential contamination sources, migration and exposure pathways and sensitive receptors.

4.1 Potential contamination sources

Table 4.1 summarises the potential areas of environmental concern based on the results of the desktop review.

Table 4.1 Potential areas of environmental concern

Description	Rationale/detail	Potential contaminants	Potential for contamination
Marina facilities	Use, storage and leaks of greases, antifouling agents, marine lubricants, fuels and general wastes Disposal and storage bilge water and sewage pump out	Heavy metals (copper oxides), total recoverable hydrocarbons (TRH), benzene, toluene, ethyl benzene, total xylene (BTEX), polycyclic aromatic hydrocarbon (PAH), polychlorinated biphenyls (PCB), tributyl tin (TBT)	Medium
Potential use of herbicides, pesticides	Use of pesticides or herbicides for weed or insect control	Arsenic, organochlorine pesticides (OCPs) and organophosphate pesticides (OPPs)	Low
Storage and use of fuels	Potential leaks and spills of fuels stored on site	TRH, BTEX, lead, PAHs	Low
Spillage of fuels and oils from vessels and machinery	Leaks and spills from vessels and machinery/equipment	TRH, BTEX, PAHs, heavy metals, TBT	Low - medium
Fill material	Historical use of fill – break walls & construction of foreshore foundations	Heavy metals, TRH, BTEX, PAHs, PCBs, OCPs, OPPs, PCBs, phenols and asbestos	Medium

4.2 Pathways

The following migration pathways were identified for the Site:

– Migration of surface soil impacts into subsurface soils. Contaminants may also be mobilised through windborne dust or material be transported via surface water flow.
– Surface water runoff from the surrounding area (to the south of the harbour) is expected to infiltrate into surface soils and/or flow overland towards the harbour.
– Leaching anti-fouling agents from boat (hull) and spillage from boats into harbour waters and sediments.
– Migration of soil impacts into groundwater aquifers beneath the Site.
– Migration of groundwater impacts from off-site sources.

4.3 Potential receptors

The following potential sensitive human and environmental receptors of possible contamination were identified for the Site and off-site disposal of dredged sediments.

4.3.1 Human health receptors

– Current and future occupants of the Site (e.g. workers and subcontractors)
– Visitors to the Site (e.g. workers conducting maintenance, members of the public)
– Current and future occupants of surrounding properties (e.g. residents, workers and visitors)

4.3.2 Environmental receptors

– Flora and fauna within the Site and surrounding area
– Surface water within the harbour
– Groundwater beneath the site

5. Conclusions and recommendations

5.1 Conclusions

Based on the available information on the historical use of the Site and the review completed herein, the likelihood for significant chemical contamination to be presence across the Site is considered to be medium to low. The main potential areas of concern identified were associated with the following:

– Marina facilities – use, storage and leaks of chemicals, disposal of wastes (medium potential)
– Storage and use of fuels on site (low potential)
– Spills of fuels and oils from vessels and machinery (low-medium potential)
– Potential use of herbicides or pesticides (low potential)
– Fill materials from unknown sources – historical use in construction of the break walls and marina foreshore (medium potential)

It is considered that risks from disturbance of any potential contaminated soils within the Site can be managed during any site works through the implementation of an unexpected finds protocol.

5.2 Recommendations

It is recommended that the Construction Environmental Management Plan (CEMP) prepared for the proposal include a detailed unexpected finds procedure to manage any potential impacts associated with the disturbance of potentially contaminated soils (if encountered) during works. It should include actions to cease work on discovery, test suspected contaminated material, and safely store, treat and dispose of the material as relevant. The procedure should also address any legislative requirements for reporting and/ or approval.

6. References

CRC Care (2011) Technical Report No. 10 – Health Screening Levels for Petroleum Hydrocarbons in soil and groundwater/ Summary

DEWHA (2009) Framework of the assessment of sediment quality – the NAGD

GHD (2021), Sediment Contamination and Waste Assessment, Crowdy Head Harbour Upgrade, 23 December 2021

NEPC (2013). National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended by the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1), National Environment Protection Council (NEPC), May 2013

NSW EPA (1997). Contaminated Land Management (CLM) Act 1997

NSW EPA (1997). Protection of the Environment Operations (POEO) Act 1997

NSW EPA (2014). Waste Classification Guidelines, Part 1; Classifying Waste, November 2014

NSW EPA (2020). Guidelines for Consultants Reporting on Contaminated Sites

NSW Land and Property Management Authority (2009). Navigation Dredging and Repairs to Jetty No.1, Crowdy Head Boat Harbour

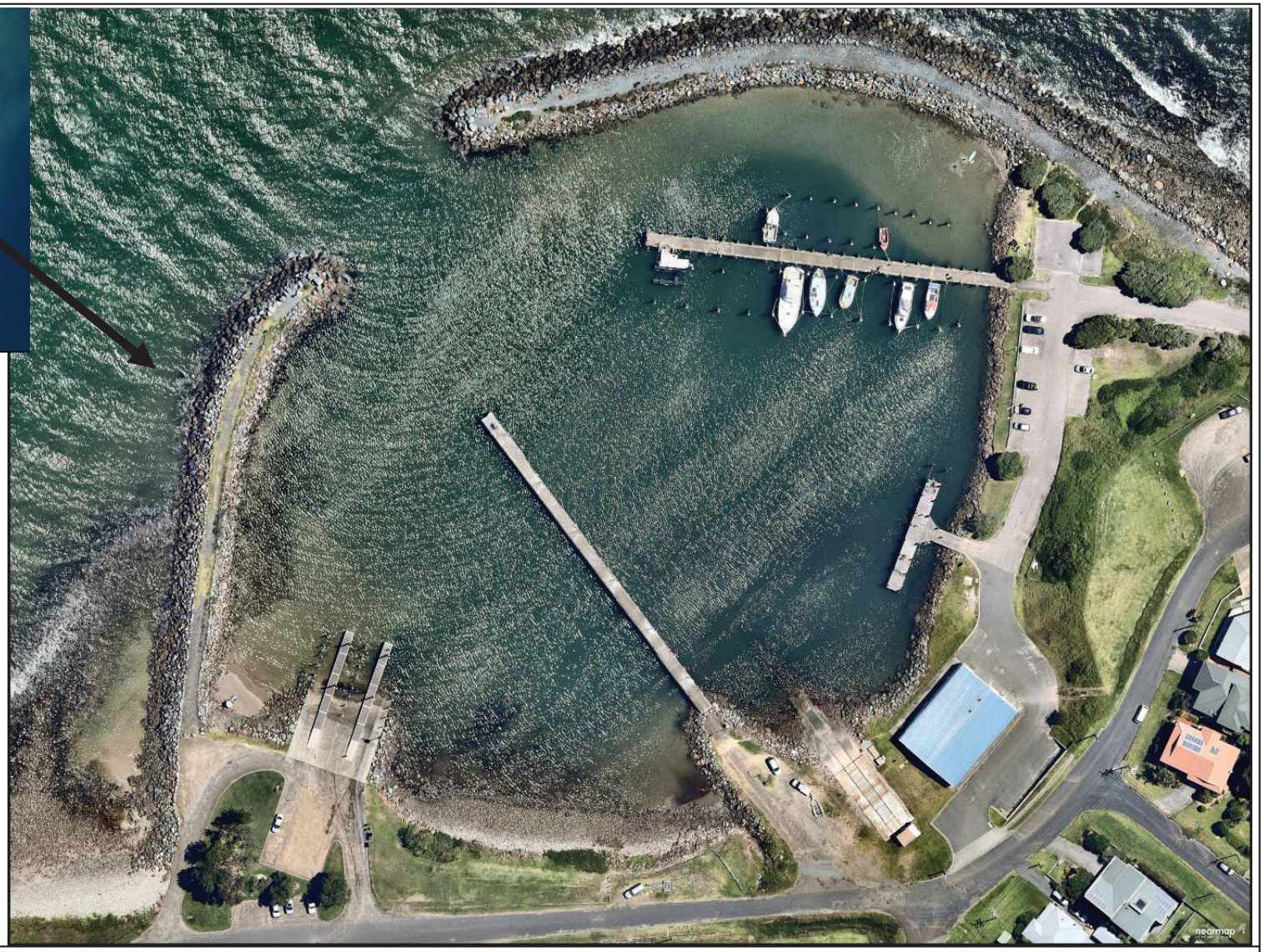
Transport for NSW (2022), Crowdy Head Harbour Upgrade, Review of Environmental Factors, Prepared by GHD February 2022

Appendices

Appendix A

Figures





Crowdy Head Harbour

562 Crowdy Head Rd, Crowdy Head NSW 2427

Appendix B

Lotsearch report

LOTSEARCH

LOTSEARCH ENVIRO PROFESSIONAL

Date: 30 Aug 2021 11:27:57

Reference: LS023653 EP

Address: 562 Crowdy Head Road, Crowdy Head, NSW 2427

Disclaimer:
The purpose of this report is to provide an overview of some of the site history, environmental risk and planning information available, affecting an individual address or geographical area in which the property is located. It is not a substitute for an on-site inspection or review of other available reports and records. It is not intended to be, and should not be taken to be, a rating or assessment of the desirability or market value of the property or its features.
You should obtain independent advice before you make any decision based on the information within the report.
The detailed terms applicable to use of this report are set out at the end of this report.

Dataset Listing

Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features On-site	No. Features within 100m	No. Features within Buffer
Cadastre Boundaries	NSW Department of Finance, Services & Innovation	20/08/2021	20/08/2021	Quarterly	-	-	-	-
Topographic Data	NSW Department of Finance, Services & Innovation	25/06/2019	25/06/2019	As required	-	-	-	-
List of NSW contaminated sites notified to EPA	Environment Protection Authority	16/08/2021	13/08/2021	Monthly	1000m	0	0	0
Contaminated Land Records of Notice	Environment Protection Authority	06/08/2021	06/08/2021	Monthly	1000m	0	0	0
Former Gasworks	Environment Protection Authority	11/08/2021	11/10/2017	Quarterly	1000m	0	0	0
National Waste Management Facilities Database	Geoscience Australia	12/05/2021	07/03/2017	Annually	1000m	0	0	0
National Liquid Fuel Facilities	Geoscience Australia	15/02/2021	13/07/2012	Annually	1000m	0	0	0
EPA PFAS Investigation Program	Environment Protection Authority	23/08/2021	28/04/2021	Monthly	2000m	0	0	0
Defence PFAS Investigation & Management Program - Investigation Sites	Department of Defence	02/08/2021	02/08/2021	Monthly	2000m	0	0	0
Defence PFAS Investigation & Management Program - Management Sites	Department of Defence	02/08/2021	02/08/2021	Monthly	2000m	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	05/08/2021	05/08/2021	Monthly	2000m	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	19/08/2021	19/08/2021	Quarterly	2000m	0	0	0
EPA Other Sites with Contamination Issues	Environment Protection Authority	02/02/2021	13/12/2018	Annually	1000m	0	0	0
Licensed Activities under the POEO Act 1997	Environment Protection Authority	16/08/2021	16/08/2021	Monthly	1000m	0	0	1
Delicensed POEO Activities still regulated by the EPA	Environment Protection Authority	16/08/2021	16/08/2021	Monthly	1000m	0	0	0
Former POEO Licensed Activities now revoked or surrendered	Environment Protection Authority	16/08/2021	16/08/2021	Monthly	1000m	0	0	4
UBD Business Directories (Premise & Intersection Matches)	Hardie Grant			Not required	150m	0	0	0
UBD Business Directories (Road & Area Matches)	Hardie Grant			Not required	150m	-	0	0
UBD Business Directory Dry Cleaners & Motor Garages/Service Stations (Premise & Intersection Matches)	Hardie Grant			Not required	500m	0	0	0
UBD Business Directory Dry Cleaners & Motor Garages/Service Stations (Road & Area Matches)	Hardie Grant			Not required	500m	-	0	0
Points of Interest	NSW Department of Finance, Services & Innovation	19/08/2021	19/08/2021	Quarterly	1000m	8	10	17
Tanks (Areas)	NSW Department of Customer Service - Spatial Services	19/08/2021	19/08/2021	Quarterly	1000m	0	0	0
Tanks (Points)	NSW Department of Customer Service - Spatial Services	19/08/2021	19/08/2021	Quarterly	1000m	0	0	1
Major Easements	NSW Department of Finance, Services & Innovation	19/08/2021	19/08/2021	Quarterly	1000m	0	0	1
State Forest	Forestry Corporation of NSW	25/02/2021	14/02/2021	Annually	1000m	0	0	0
NSW National Parks and Wildlife Service Reserves	NSW Office of Environment & Heritage	22/01/2021	11/12/2020	Annually	1000m	0	0	1
Hydrogeology Map of Australia	Commonwealth of Australia (Geoscience Australia)	08/10/2014	17/03/2000	As required	1000m	0	0	1
Temporary Water Restriction (Botany Sands Groundwater Source) Order 2018	NSW Department of Planning, Industry and Environment	26/10/2020	21/02/2018	Annually	1000m	0	0	0
Groundwater Boreholes	NSW Dept. of Primary Industries - Water NSW; Commonwealth of Australia (Bureau of Meteorology)	24/07/2018	23/07/2018	Annually	2000m	0	0	0

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features On-site	No. Features within 100m	No. Features within Buffer
Geological Units 1:250,000	NSW Department of Planning, Industry and Environment	20/08/2014		Annually	1000m	1	1	2
Geological Structures 1:250,000	NSW Department of Planning, Industry and Environment	20/08/2014		Annually	1000m	0	0	0
Naturally Occurring Asbestos Potential	NSW Dept. of Industry, Resources & Energy	04/12/2015	24/09/2015	Unknown	1000m	0	0	0
Atlas of Australian Soils	Australian Bureau of Agriculture and Resource Economics and Sciences (ABARES)	19/05/2017	17/02/2011	As required	1000m	1	1	3
Environmental Planning Instrument Acid Sulfate Soils	NSW Department of Planning, Industry and Environment	19/08/2021	28/06/2021	Monthly	500m	2	-	-
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000m	2	2	3
Dryland Salinity - National Assessment	National Land and Water Resources Audit	18/07/2014	12/05/2013	None planned	1000m	0	0	0
Mining Subsidence Districts	NSW Department of Customer Service - Subsidence Advisory NSW	19/08/2021	05/08/2021	Quarterly	1000m	0	0	0
Current Mining Titles	NSW Department of Industry	03/08/2021	03/08/2021	Monthly	1000m	0	0	0
Mining Title Applications	NSW Department of Industry	03/08/2021	03/08/2021	Monthly	1000m	0	0	0
Historic Mining Titles	NSW Department of Industry	03/08/2021	03/08/2021	Monthly	1000m	6	7	9
Environmental Planning Instrument SEPP State Significant Precincts	NSW Department of Planning, Industry and Environment	19/08/2021	07/12/2018	Monthly	1000m	0	0	0
Environmental Planning Instrument Land Zoning	NSW Department of Planning, Industry and Environment	19/08/2021	13/08/2021	Monthly	1000m	4	5	7
Commonwealth Heritage List	Australian Government Department of the Agriculture, Water and the Environment	18/05/2021	20/11/2019	Annually	1000m	0	0	1
National Heritage List	Australian Government Department of the Agriculture, Water and the Environment	18/05/2021	20/11/2019	Annually	1000m	0	0	0
State Heritage Register - Curtilages	NSW Department of Planning, Industry and Environment	19/08/2021	25/06/2021	Quarterly	1000m	0	0	0
Environmental Planning Instrument Local Heritage	NSW Department of Planning, Industry and Environment	19/08/2021	13/08/2021	Monthly	1000m	0	0	1
Bush Fire Prone Land	NSW Rural Fire Service	30/08/2021	23/08/2021	Weekly	1000m	0	0	2
Eastern Bushland Database (North Region)	NSW Office of Environment & Heritage	24/07/2016	01/01/1991	None planned	1000m	0	0	2
Ramsar Wetlands of Australia	Australian Government Department of Agriculture, Water and the Environment	24/02/2021	19/03/2020	Annually	1000m	0	0	0
Groundwater Dependent Ecosystems	Bureau of Meteorology	14/08/2017	15/05/2017	Annually	1000m	0	0	4
Inflow Dependent Ecosystems Likelihood	Bureau of Meteorology	14/08/2017	15/05/2017	Unknown	1000m	0	0	9
NSW BioNet Species Sightings	NSW Office of Environment & Heritage	23/08/2021	23/08/2021	Weekly	10000m	-	-	-

Site Diagram

562 Crowdy Head Road, Crowdy Head, NSW 2427



Legend

- Site Boundary
- Internal Parcel Boundaries

Total Area: 53201m²

Total Perimeter: 920m

Scale: 0 25 50 100 Meters

Data Source Aerial Imagery:
© Aerometrex Pty Ltd

Disclaimers:

Measurements are approximate only and may have been simplified or smaller lengths removed for readability.

Parcels that make up a small percentage of the total site area have not been labelled for increased legibility.

Coordinate System:
GDA 1994 MGA Zone 56

Date: 30 August 2021

Contaminated Land

562 Crowdy Head Road, Crowdy Head, NSW 2427

List of NSW contaminated sites notified to EPA

Records from the NSW EPA Contaminated Land list within the dataset buffer:

Map Id	Site	Address	Suburb	Activity	Management Class	Status	Location Confidence	Dist	Direction
N/A	No records in buffer								

The values within the EPA site management class in the table above, are given more detailed explanations in the table below:

EPA site management class	Explanation
Contamination being managed via the planning process (EP&A Act)	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. The contamination of this site is managed by the consent authority under the Environmental Planning and Assessment Act 1979 (EP&A Act) planning approval process, with EPA involvement as necessary to ensure significant contamination is adequately addressed. The consent authority is typically a local council or the Department of Planning and Environment.
Contamination currently regulated under CLM Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). Management of the contamination is regulated by the EPA under the CLM Act. Regulatory notices are available on the EPA's Contaminated Land Public Record of Notices.
Contamination currently regulated under POEO Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. Management of the contamination is regulated under the Protection of the Environment Operations Act 1997 (POEO Act). The EPA's regulatory actions under the POEO Act are available on the POEO public register.
Contamination formerly regulated under the CLM Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). The contamination was addressed under the CLM Act.
Contamination formerly regulated under the POEO Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed under the Protection of the Environment Operations Act 1997 (POEO Act).
Contamination was addressed via the planning process (EP&A Act)	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed by the appropriate consent authority via the planning process under the Environmental Planning and Assessment Act 1979 (EP&A Act).
Ongoing maintenance required to manage residual contamination (CLM Act)	The EPA has determined that ongoing maintenance, under the Contaminated Land Management Act 1997 (CLM Act), is required to manage the residual contamination. Regulatory notices under the CLM Act are available on the EPA's Contaminated Land Public Record of Notices.
Regulation being finalised	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997. A regulatory approach is being finalised.
Regulation under the CLM Act not required	The EPA has completed an assessment of the contamination and decided that regulation under the Contaminated Land Management Act 1997 is not required.
Under assessment	The contamination is being assessed by the EPA to determine whether regulation is required. The EPA may require further information to complete the assessment. For example, the completion of management actions regulated under the planning process or Protection of the Environment Operations Act 1997. Alternatively, the EPA may require information via a notice issued under s77 of the Contaminated Land Management Act 1997 or issue a Preliminary Investigation Order.

NSW EPA Contaminated Land List Data Source: Environment Protection Authority

© State of New South Wales through the Environment Protection Authority

Contaminated Land

562 Crowdy Head Road, Crowdy Head, NSW 2427

Contaminated Land: Records of Notice

Record of Notices within the dataset buffer:

Map Id	Name	Address	Suburb	Notices	Area No	Location Confidence	Distance	Direction
N/A	No records in buffer							

Contaminated Land Records of Notice Data Source: Environment Protection Authority
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Terms of use and disclaimer for Contaminated Land: Record of Notices, please visit http://www.epa.nsw.gov.au/clm/clmdisclaimer.htm

Former Gasworks

Former Gasworks within the dataset buffer:

Map Id	Location	Council	Further Info	Location Confidence	Distance	Direction
N/A	No records in buffer					

Former Gasworks Data Source: Environment Protection Authority
© State of New South Wales through the Environment Protection Authority

Waste Management & Liquid Fuel Facilities

562 Crowdy Head Road, Crowdy Head, NSW 2427

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site Id	Owner	Name	Address	Suburb	Class	Landfill	Reprocess	Transfer	Comments	Loc Conf	Dist	Direction
N/A	No records in buffer											

Waste Management Facilities Data Source: Geoscience Australia
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National Liquid Fuel Facilities

National Liquid Fuel Facilties within the dataset buffer:

Map Id	Owner	Name	Address	Suburb	Class	Operational Status	Operator	Revision Date	Loc Conf	Dist	Direction
N/A	No records in buffer										

National Liquid Fuel Facilities Data Source: Geoscience Australia
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PFAS Investigation & Management Programs

562 Crowdy Head Road, Crowdy Head, NSW 2427

EPA PFAS Investigation Program

Sites that are part of the EPA PFAS investigation program, within the dataset buffer:

Map ID	Site	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

EPA PFAS Investigation Program: Environment Protection Authority
© State of New South Wales through the Environment Protection Authority

Defence PFAS Investigation Program

Sites being investigated by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation Program Data Custodian: Department of Defence, Australian Government

Defence PFAS Management Program

Sites being managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Dist	Dir
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

562 Crowdy Head Road, Crowdy Head, NSW 2427

Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

EPA Other Sites with Contamination Issues

562 Crowdy Head Road, Crowdy Head, NSW 2427

EPA Other Sites with Contamination Issues

This dataset contains other sites identified on the EPA website as having contamination issues. This dataset currently includes:

- James Hardie asbestos manufacturing and waste disposal sites
- Radiological investigation sites in Hunter's Hill
- Pasminco Lead Abatement Strategy Area

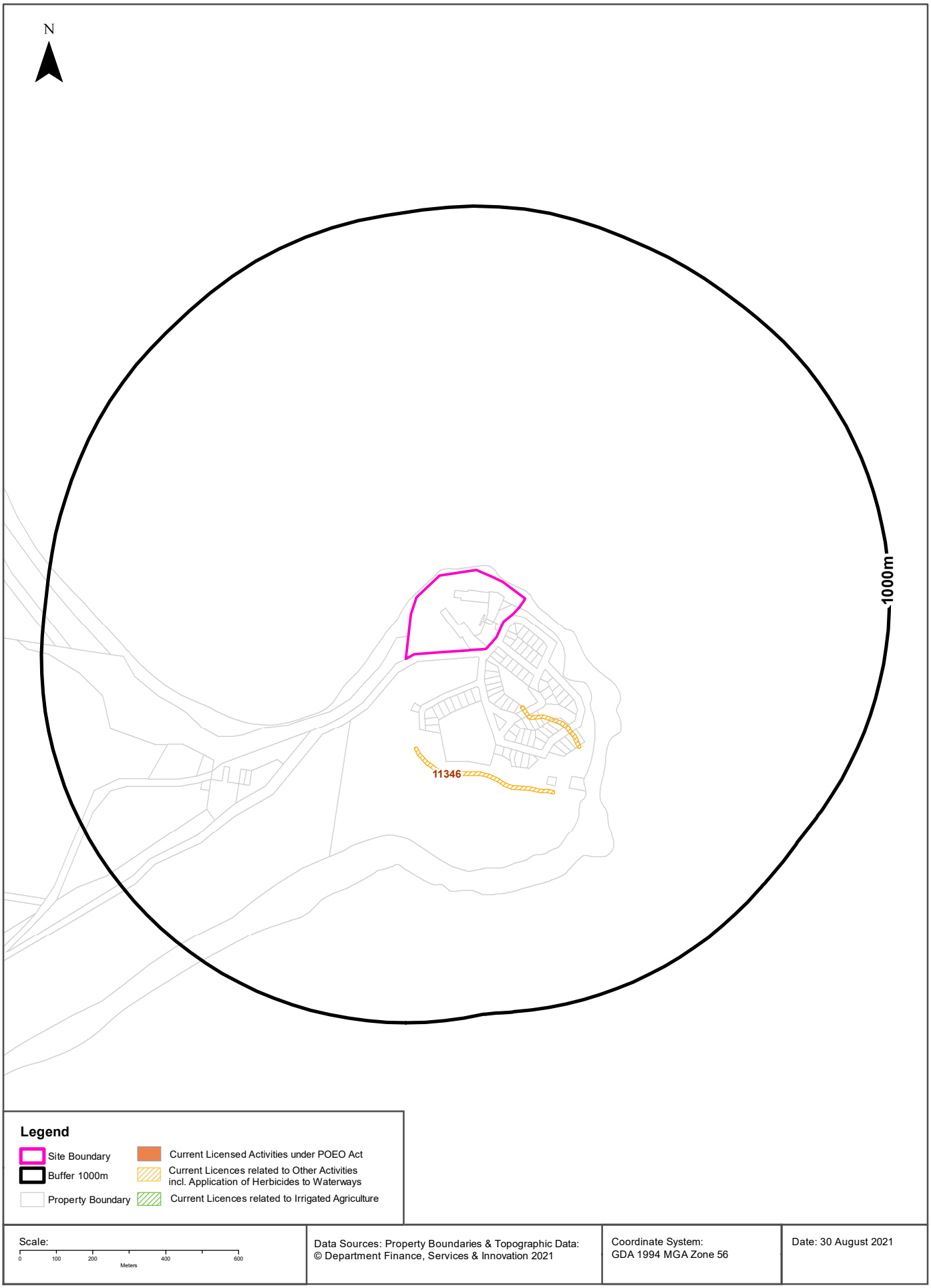
Sites within the dataset buffer:

Site Id	Site Name	Site Address	Dataset	Comments	Location Confidence	Distance	Direction
N/A	No records in buffer						

EPA Other Sites with Contamination Issues: Environment Protection Authority
© State of New South Wales through the Environment Protection Authority

Current EPA Licensed Activities

562 Crowdy Head Road, Crowdy Head, NSW 2427



EPA Activities

562 Crowdy Head Road, Crowdy Head, NSW 2427

Licensed Activities under the POEO Act 1997

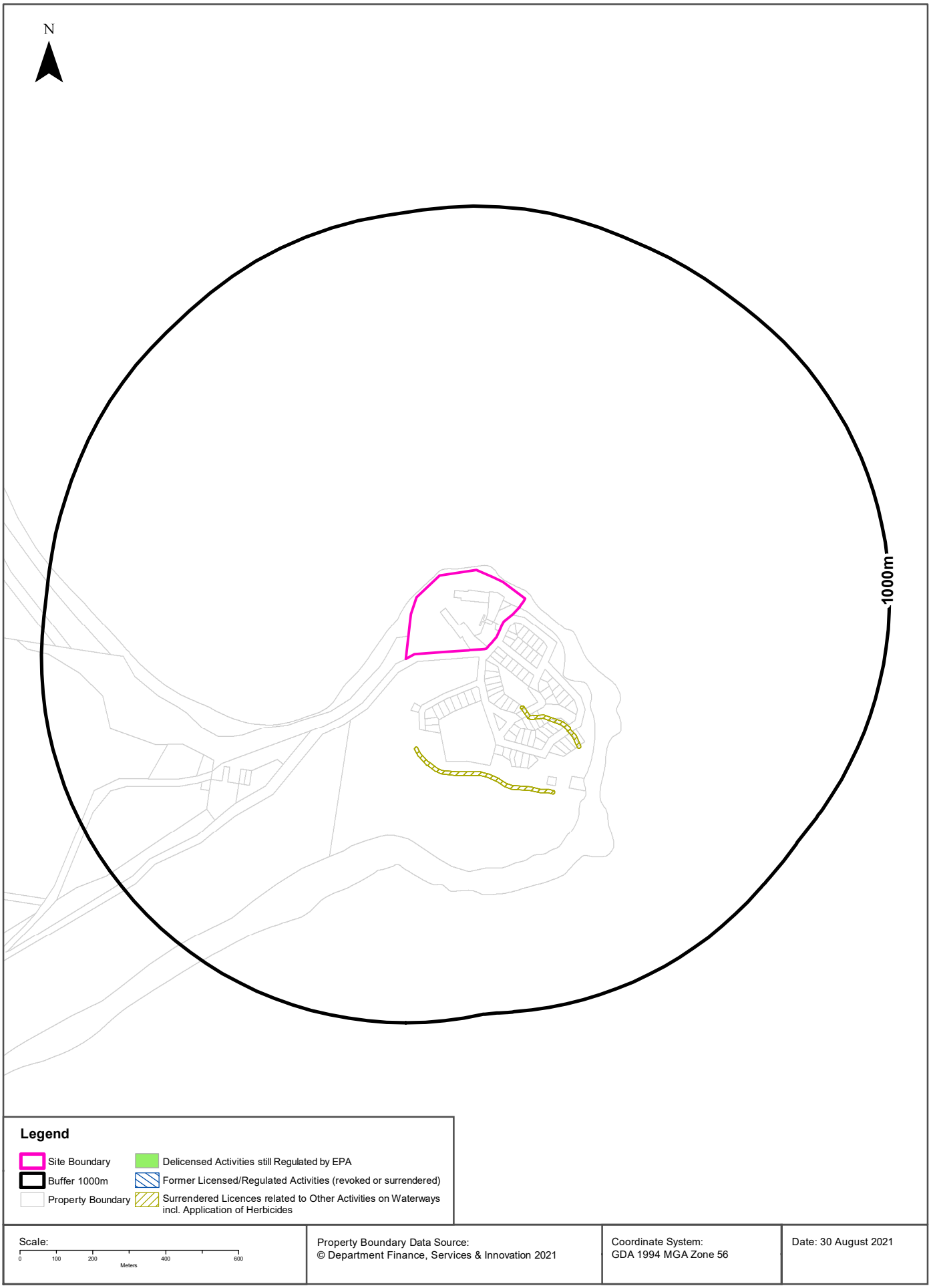
Licensed activities under the Protection of the Environment Operations Act 1997, within the dataset buffer:

EPL	Organisation	Name	Address	Suburb	Activity	Loc Conf	Distance	Direction
11346	MID-COAST COUNCIL	WATERWAYS AND RIPARIAN AREAS WITHIN	MID-COAST COUNCIL LOCAL GOVERNMENT AREA, FORSTER, NSW 2428	FORSTER	Other activities	Network of Features	184m	South

POEO Licence Data Source: Environment Protection Authority
© State of New South Wales through the Environment Protection Authority

Delicensed & Former Licensed EPA Activities

562 Crowdy Head Road, Crowdy Head, NSW 2427



EPA Activities

562 Crowdy Head Road, Crowdy Head, NSW 2427

Delicensed Activities still regulated by the EPA

Delicensed activities still regulated by the EPA, within the dataset buffer:

Licence No	Organisation	Name	Address	Suburb	Activity	Loc Conf	Distance	Direction
N/A	No records in buffer							

Delicensed Activities Data Source: Environment Protection Authority
© State of New South Wales through the Environment Protection Authority

Former Licensed Activities under the POEO Act 1997, now revoked or surrendered

Former Licensed activities under the Protection of the Environment Operations Act 1997, now revoked or surrendered, within the dataset buffer:

Licence No	Organisation	Location	Status	Issued Date	Activity	Loc Conf	Distance	Direction
4653	LUHRMANN ENVIRONMENT MANAGEMENT PTY LTD	WATERWAYS THROUGHOUT NSW	Surrendered	06/09/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	184m	South
4838	Robert Orchard	Various Waterways throughout New South Wales - SYDNEY NSW 2000	Surrendered	07/09/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	184m	South
6630	SYDNEY WEED & PEST MANAGEMENT PTY LTD	WATERWAYS THROUGHOUT NSW - PROSPECT, NSW, 2148	Surrendered	09/11/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	184m	South
12461	GREATER TAREE CITY COUNCIL	Land or Waterways within Greater Taree City Council LGA, Greater Taree Local Government Area, TAREE	Surrendered	21/03/2006	Other activities	Network of Features	184m	South

Former Licensed Activities Data Source: Environment Protection Authority
© State of New South Wales through the Environment Protection Authority

Historical Business Directories

562 Crowdy Head Road, Crowdy Head, NSW 2427

Business Directory Records 1950-1991
Premise or Road Intersection Matches

Universal Business Directory records from years 1991, 1982, 1970, 1961 & 1950, mapped to a premise or road intersection within the dataset buffer:

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
N/A	No records in buffer						

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Business Directory Records 1950-1991
Road or Area Matches

Universal Business Directory records from years 1991, 1982, 1970, 1961 & 1950, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published:

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
N/A	No records in buffer					

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Historical Business Directories

562 Crowdy Head Road, Crowdy Head, NSW 2427

Dry Cleaners, Motor Garages & Service Stations Premise or Road Intersection Matches

Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories, mapped to a premise or road intersection, within the dataset buffer.

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
N/A	No records in buffer						

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Dry Cleaners, Motor Garages & Service Stations Road or Area Matches

Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published.

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
N/A	No records in buffer					

Reproduced with permission of UBD and Hardie Grant Media Pty Ltd DD 01/08/2018

Aerial Imagery 2021

562 Crowdy Head Road, Crowdy Head, NSW 2427



Scale: 0 40 80 120 160 Meters	Data Source Aerial Imagery: © 2021 Google Inc, used with permission. Google and the Google logo are registered trademarks of Google Inc.	Coordinate System: GDA 1994 MGA Zone 56	Date: 27 August 2021

Aerial Imagery 2019

562 Crowdy Head Road, Crowdy Head, NSW 2427



Scale:	Data Source Aerial Imagery:	Coordinate System:	Date: 30 August 2021
0 40 80 120 160 Meters	© Aerometrex Pty Ltd	GDA 1994 MGA Zone 56	

Aerial Imagery 2013

562 Crowdy Head Road, Crowdy Head, NSW 2427



Data Source Aerial Imagery: © 2021 Google Inc, used with permission. Google and the Google logo are registered trademarks of Google Inc.

Coordinate System: GDA 1994 MGA Zone 56

Date: 27 August 2021

Aerial Imagery 2002

562 Crowdy Head Road, Crowdy Head, NSW 2427



Aerial Imagery 1997

562 Crowdy Head Road, Crowdy Head, NSW 2427



Aerial Imagery 1989

562 Crowdy Head Road, Crowdy Head, NSW 2427



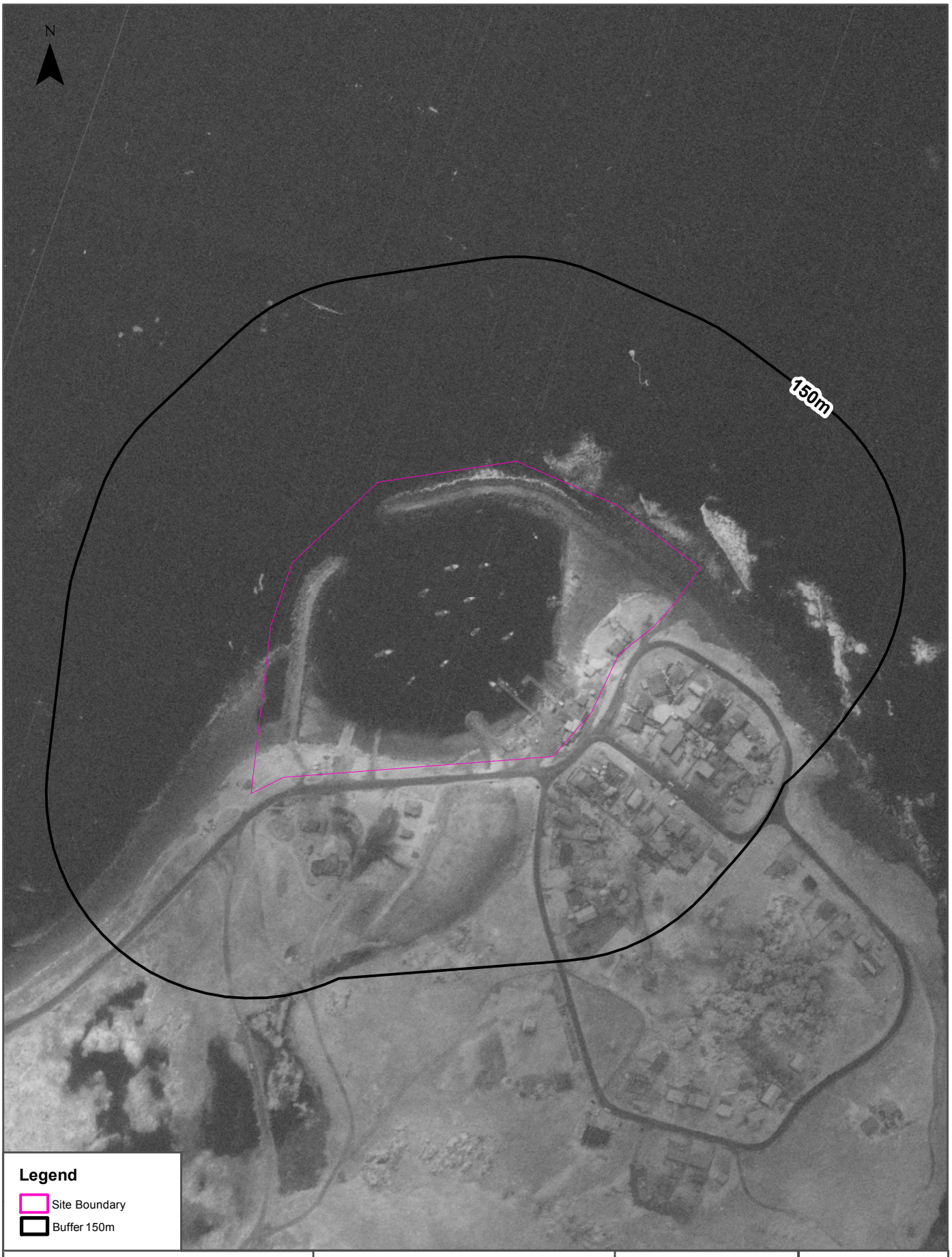
Aerial Imagery 1979

562 Crowdy Head Road, Crowdy Head, NSW 2427



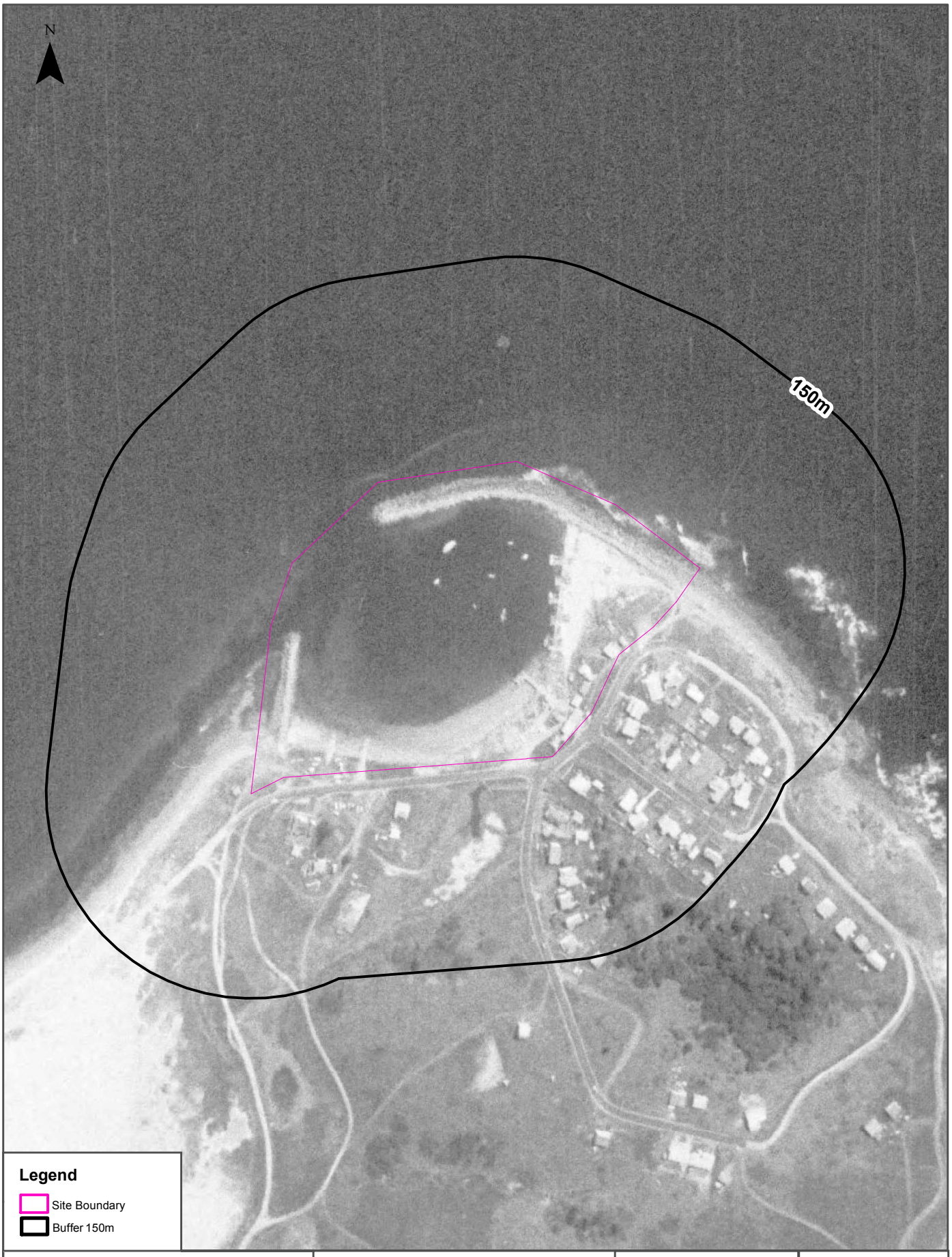
Aerial Imagery 1974

562 Crowdy Head Road, Crowdy Head, NSW 2427



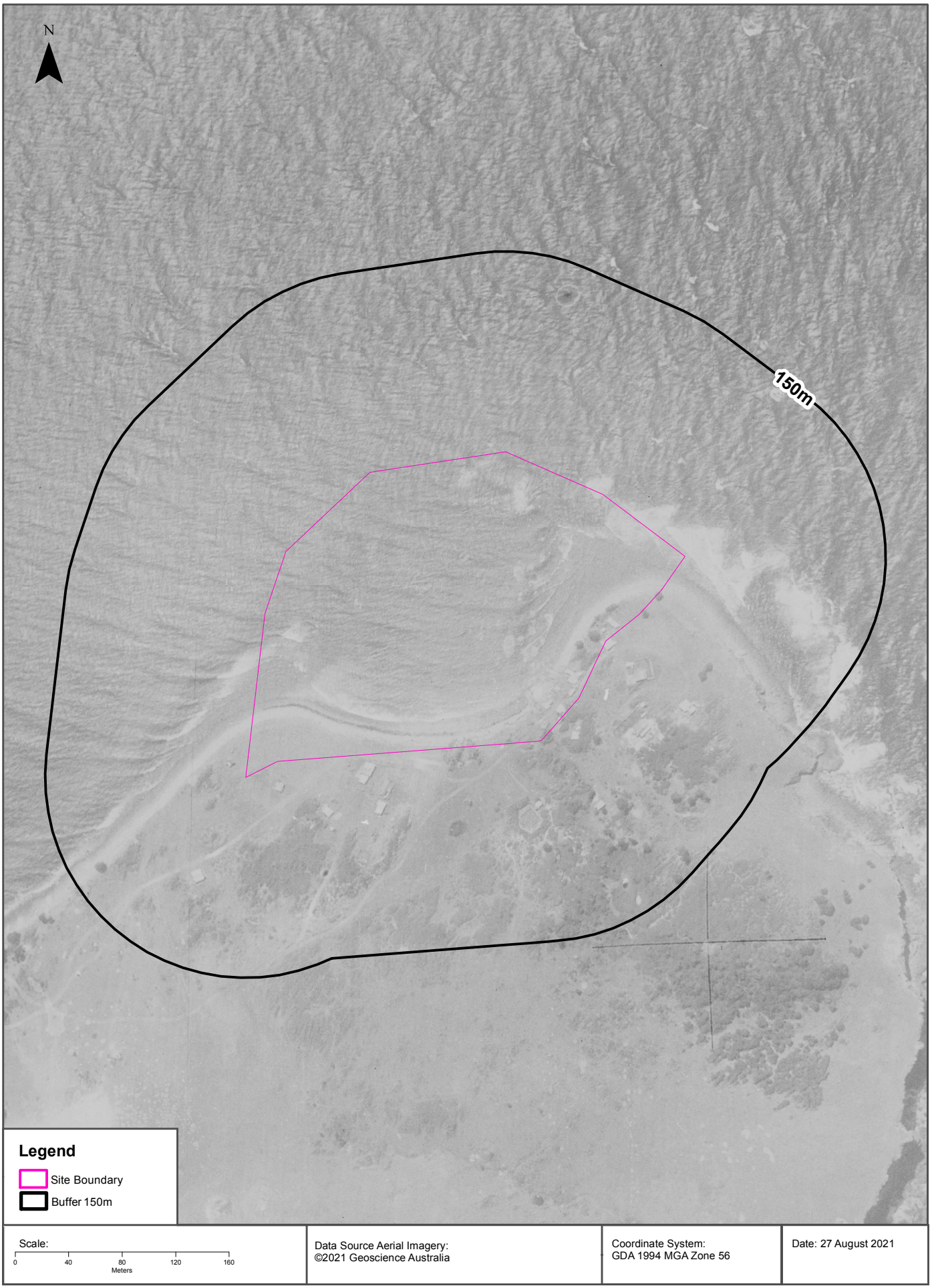
Aerial Imagery 1969

562 Crowdy Head Road, Crowdy Head, NSW 2427



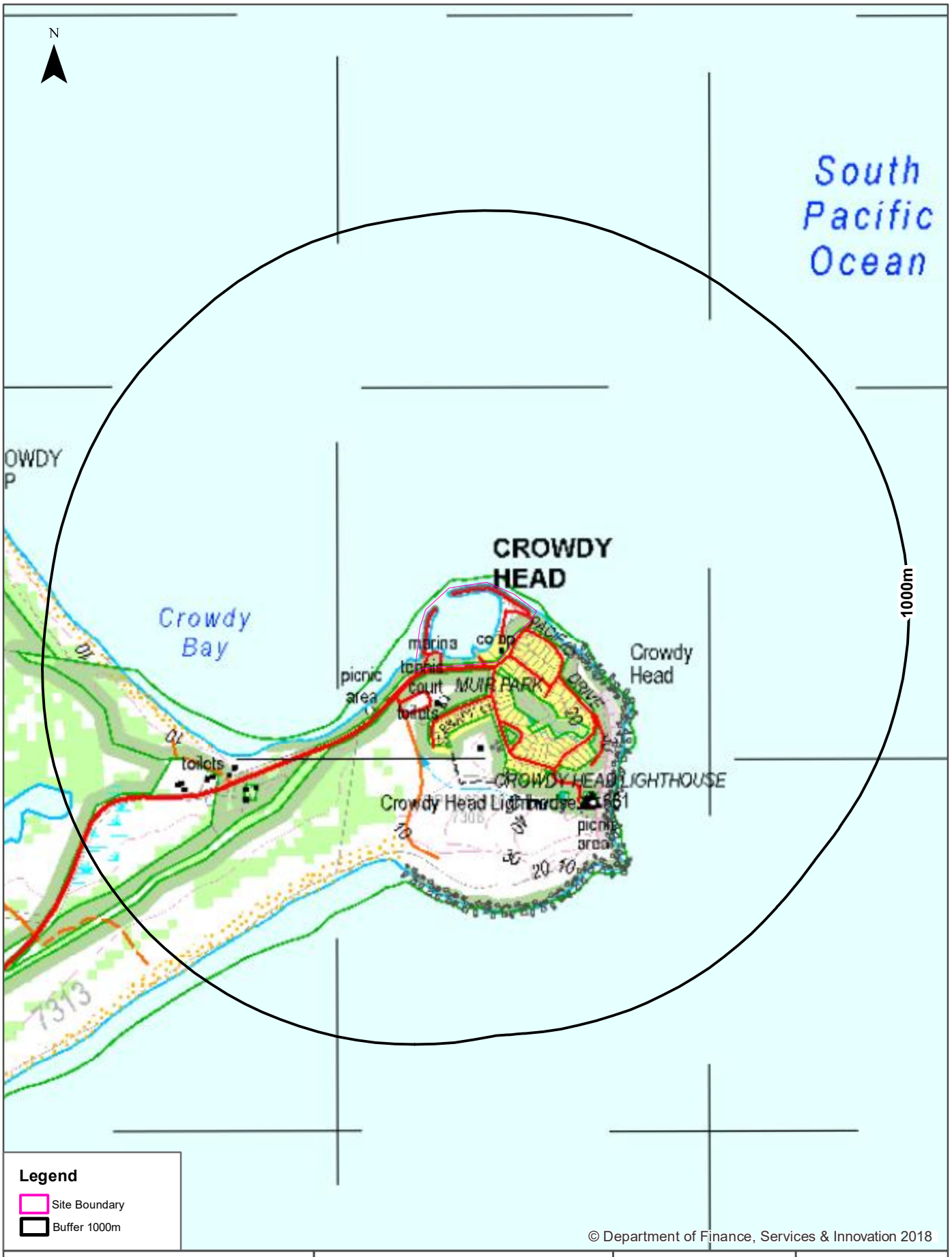
Aerial Imagery 1940

562 Crowdy Head Road, Crowdy Head, NSW 2427



Topographic Map 2015

562 Crowdy Head Road, Crowdy Head, NSW 2427



Scale: 0 160 320 480 640 Meters

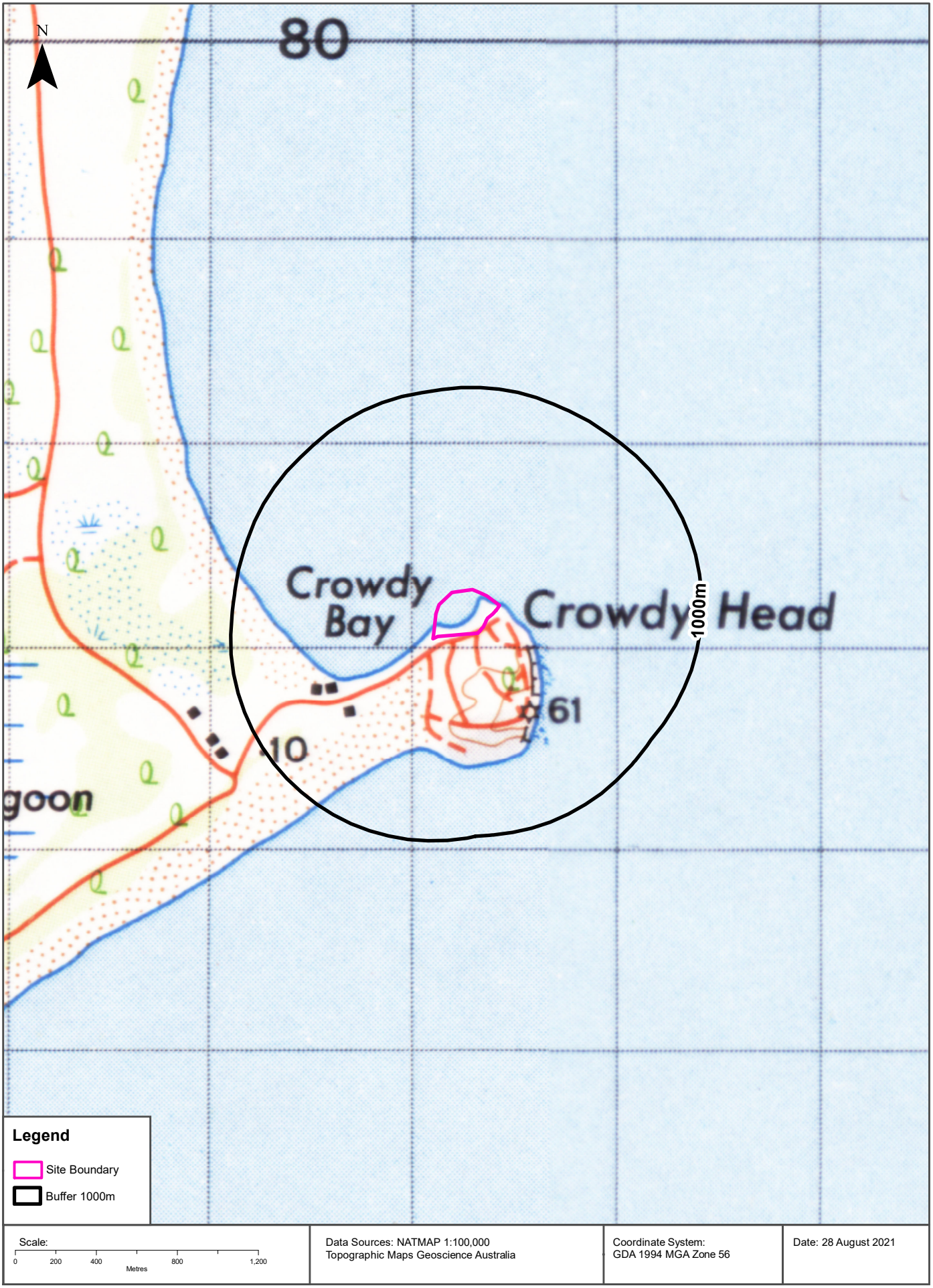
Data Sources: Topographic Map Data © NSW Land and Property Information

Coordinate System: GDA 1994 MGA Zone 56

Date: 30 August 2021

Historical Map 1972

562 Crowdy Head Road, Crowdy Head, NSW 2427



Historical Map c.1941

562 Crowdy Head Road, Crowdy Head, NSW 2427



Topographic Features

562 Crowdy Head Road, Crowdy Head, NSW 2427



Topographic Features

562 Crowdy Head Road, Crowdy Head, NSW 2427

Points of Interest

What Points of Interest exist within the dataset buffer?

Map Id	Feature Type	Label	Distance	Direction
75762	Co-operative	CROWDY HEAD FISH CO-OP	0m	On-site
74878	Boat Ramp	Boat Ramp	0m	On-site
74818	Wharf	Wharf	0m	On-site
75777	Wharf	Wharf	0m	On-site
75776	Wharf	Wharf	0m	On-site
74817	Wharf	Wharf	0m	On-site
75778	Wharf	Wharf	0m	On-site
73876	Marina	Marina	0m	On-site
75760	Park	MUIR PARK	59m	South
75761	Sports Court	TENNIS COURT	94m	South
74333	Village	CROWDY HEAD	106m	South
73518	Picnic Area	Picnic Area	159m	South West
74026	Headland	CROWDY HEAD	349m	South East
76222	Lighthouse	CROWDY HEAD LIGHTHOUSE	447m	South East
73519	Picnic Area	Picnic Area	457m	South East
2127	Bay Like	CROWDY BAY	501m	West
73861	Community Facility	CROWDY HEAD SLSC	552m	South West

Topographic Data Source: © Land and Property Information (2015)
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Topographic Features

562 Crowdy Head Road, Crowdy Head, NSW 2427

Tanks (Areas)

What are the Tank Areas located within the dataset buffer?
Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

Map Id	Tank Type	Status	Name	Feature Currency	Distance	Direction
N/A	No records in buffer					

Tanks (Points)

What are the Tank Points located within the dataset buffer?
Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

Map Id	Tank Type	Status	Name	Feature Currency	Distance	Direction
175722	Water	Operational		01/01/2005	405m	South East

Tanks Data Source: © Land and Property Information (2015)
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Major Easements

What Major Easements exist within the dataset buffer?
Note. Easements provided by LPI are not at the detail of local governments. They are limited to major easements such as Right of Carriageway, Electrical Lines (66kVa etc.), Easement to drain water & Significant subterranean pipelines (gas, water etc.).

Map Id	Easement Class	Easement Type	Easement Width	Distance	Direction
120112855	Primary	Undefined		332m	South East

Easements Data Source: © Land and Property Information (2015)
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Topographic Features

562 Crowdy Head Road, Crowdy Head, NSW 2427

State Forest

What State Forest exist within the dataset buffer?

State Forest Number	State Forest Name	Distance	Direction
N/A	No records in buffer		

State Forest Data Source: © NSW Department of Finance, Services & Innovation (2018)
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National Parks and Wildlife Service Reserves

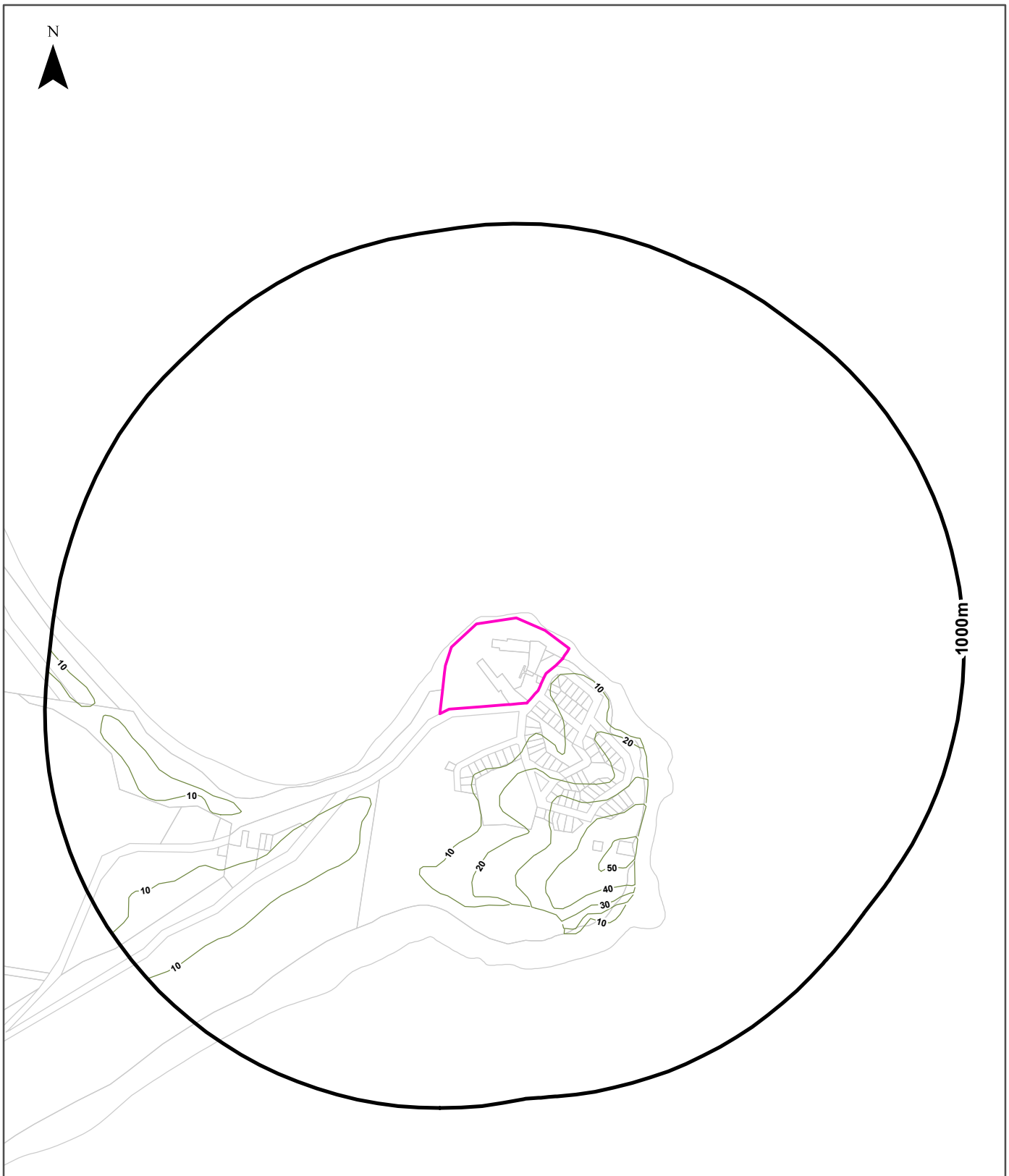
What NPWS Reserves exist within the dataset buffer?

Reserve Number	Reserve Type	Reserve Name	Gazetted Date	Distance	Direction
N0009	NATIONAL PARK	Crowdy Bay National Park	15/12/1972	695m	West

NPWS Data Source: © NSW Department of Finance, Services & Innovation (2018)
Creative Commons 3.0 © Commonwealth of Australia http://creativecommons.org/licenses/by/3.0/au/deed.en

Elevation Contours (m AHD)

562 Crowdy Head Road, Crowdy Head, NSW 2427



Legend

- Elevation Contour (m AHD)
- Site Boundary
- Buffer 1000m
- Property Boundary

Accuracy & Currency: This contour data can be up to 0.4 of the contour interval out in height and must therefore not be used for any design or engineering works, but only as a general guide to topography. Gaps may occur along contour lines due to vertical topography, obscured topography in the source photography such as buildings, dense vegetation or dead ground, or the fact that original buildings have been replaced in the intervening thirty years since the original contour capture.

Scale: 0 100 200 400 Meters	Data Sources: Property Boundaries & Topographic Data: © Department Finance, Services & Innovation 2021	Coordinate System: GDA 1994 MGA Zone 56	Date: 30 August 2021

Hydrogeology & Groundwater

562 Crowdy Head Road, Crowdy Head, NSW 2427

Hydrogeology

Description of aquifers within the dataset buffer:

Description	Distance	Direction
Porous, extensive highly productive aquifers	263m	South West

Hydrogeology Map of Australia : Commonwealth of Australia (Geoscience Australia)
Creative Commons 3.0 © Commonwealth of Australia http://creativecommons.org/licenses/by/3.0/au/deed.en

Temporary Water Restriction (Botany Sands Groundwater Source) Order 2018

Temporary water restrictions relating to the Botany Sands aquifer within the dataset buffer:

Prohibition Area No.	Prohibition	Distance	Direction
N/A	No records in buffer		

Temporary Water Restriction (Botany Sands Groundwater Source) Order 2018 Data Source : NSW Department of Primary Industries

Hydrogeology & Groundwater

562 Crowdy Head Road, Crowdy Head, NSW 2427

Groundwater Boreholes

Boreholes within the dataset buffer:

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m bgl)	Yield (L/s)	Elev (AHD)	Dist	Dir
N/A	No records in buffer														

Borehole Data Source : NSW Department of Primary Industries - Office of Water / Water Administration Ministerial Corporation for all bores prefixed with GW. All other bores © Commonwealth of Australia (Bureau of Meteorology) 2015. Creative Commons 3.0 © Commonwealth of Australia http://creativecommons.org/licenses/by/3.0/au/deed.en

Hydrogeology & Groundwater

562 Crowdy Head Road, Crowdy Head, NSW 2427

Driller's Logs

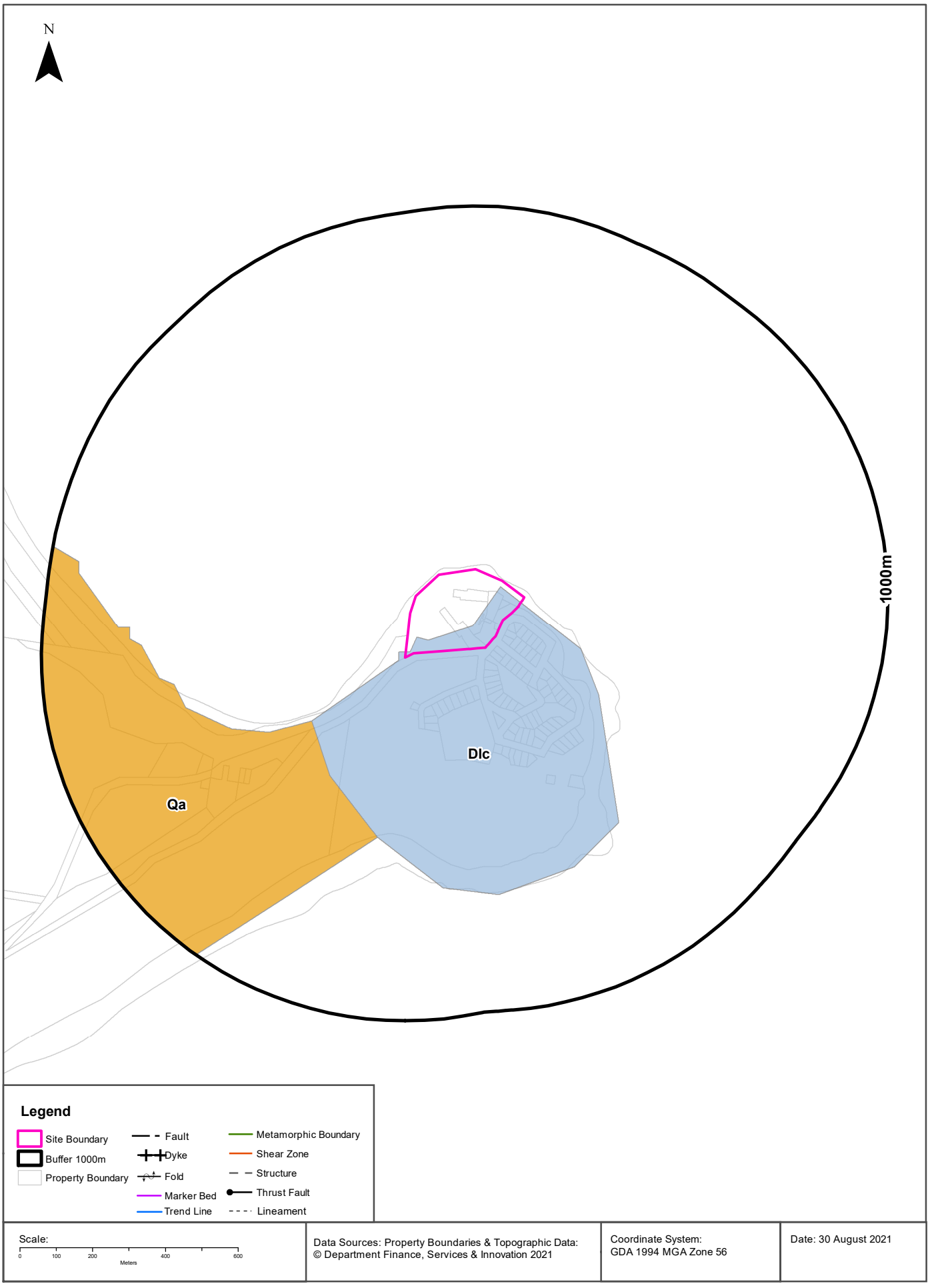
Drill log data relevant to the boreholes within the dataset buffer:

Groundwater No	Drillers Log	Distance	Direction
No related drill log data			

Drill Log Data Source: NSW Department of Primary Industries - Office of Water / Water Administration Ministerial Corp
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Geology

562 Crowdy Head Road, Crowdy Head, NSW 2427



Geology

562 Crowdy Head Road, Crowdy Head, NSW 2427

Geological Units 1:250,000

What are the Geological Units within the dataset buffer?

Symbol	Description	Unit Name	Group	Sub Group	Age	Dist	Dir
Dlc	Cleaved, turbiditic, thinly to medium bedded grey to black laminated fine lithic sandstone, siltstone and slate with lenses of massive conglomerate.	Cowangara Formation			Palaeozoic	0m	On-site
Qa	Undifferentiated alluvial plain; sand, silt, clay, gravel of alluvial/ fluvial deposits, some colluvium and residual soils	undifferentiated			Cainozoic	309m	South West

Geological Structures 1:250,000

What are the Geological Structures within the dataset buffer?

Feature	Name	Description	Map Sheet	Distance	Direction
N/A	No records in buffer				

Geological Data Source : NSW Department of Industry, Resources & Energy
© State of New South Wales through the NSW Department of Industry, Resources & Energy

Naturally Occurring Asbestos Potential

562 Crowdy Head Road, Crowdy Head, NSW 2427

Naturally Occurring Asbestos Potential

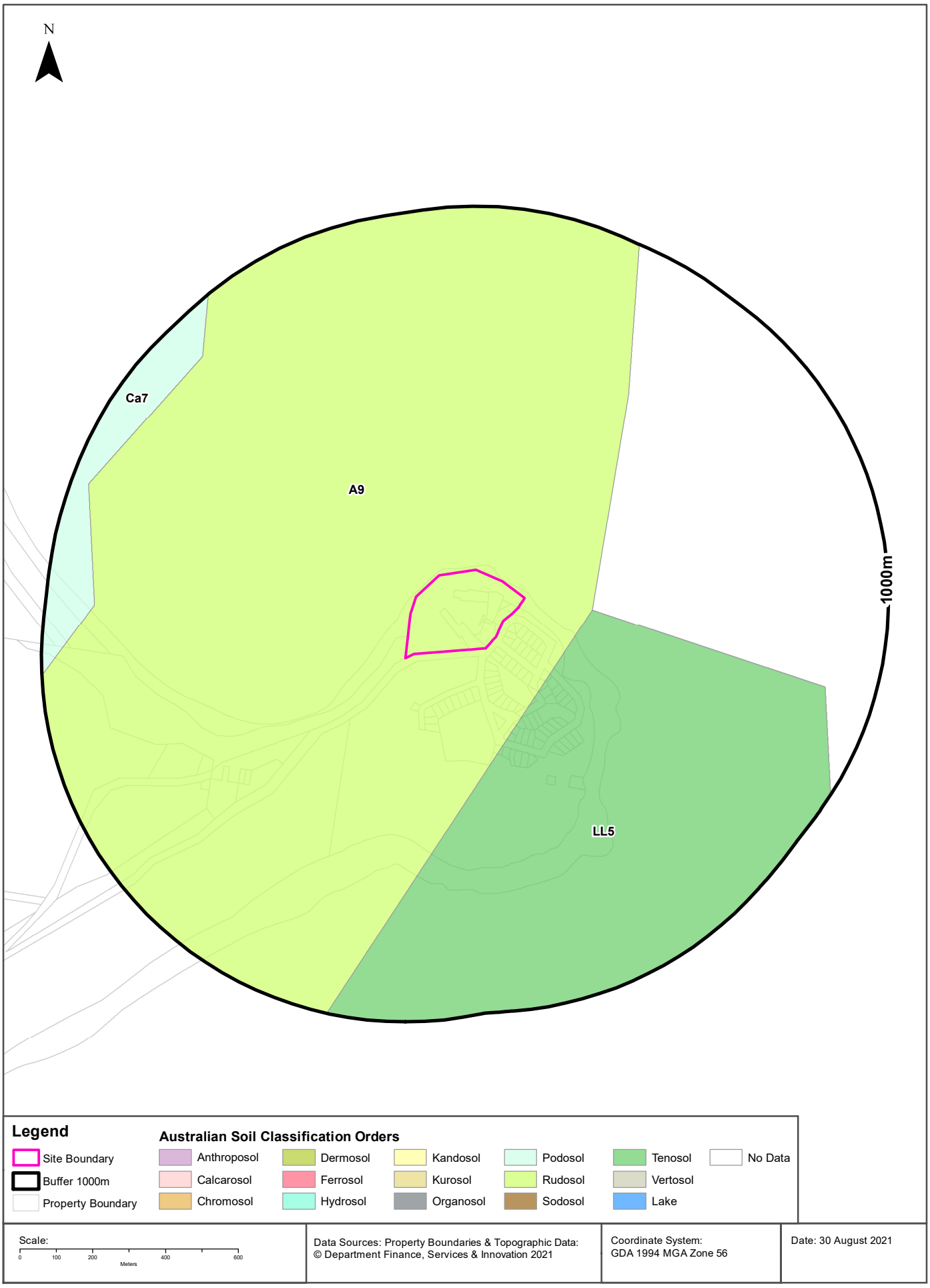
Naturally Occurring Asbestos Potential within the dataset buffer:

Potential	Sym	Strat Name	Group	Formation	Scale	Min Age	Max Age	Rock Type	Dom Lith	Description	Dist	Dir
No records in buffer												

Naturally Occurring Asbestos Potential Data Source: © State of New South Wales through NSW Department of Industry, Resources & Energy

Atlas of Australian Soils

562 Crowdy Head Road, Crowdy Head, NSW 2427



Soils

562 Crowdy Head Road, Crowdy Head, NSW 2427

Atlas of Australian Soils

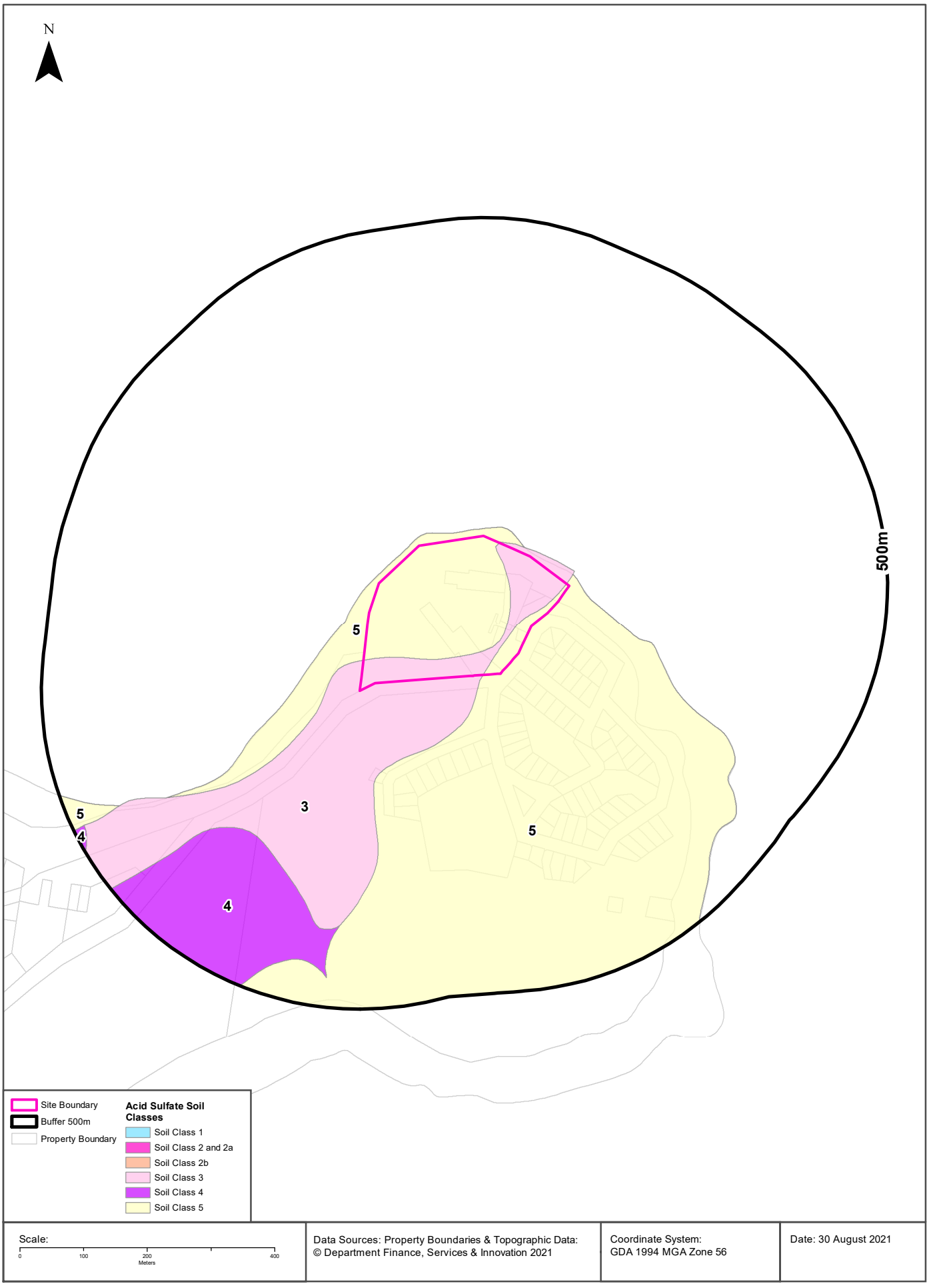
Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance	Direction
A9	Rudosol	Present beach system of dunes and estuaries: relatively unstable dunes of calcareous sands (Uc1.11) or siliceous sands (Uc1.21) passing inland to more stable dunes and flatter sandy areas of siliceous sands (Uc1.21) and/or leached sands (Uc2.2 and Uc2.3); some estuarine areas of plastic clays (Uf6.5 or Uf6.6) with sand D horizons. As mapped, areas of unit Ca7 are included. Soil dominance varies locally between (Uc1.11) and (Uc1.21) soils.	0m	On-site
LL5	Tenosol	Steep to very steep hill slopes: chief soils are loamy soils having an A2 horizon (Um4.2) and/or dark shallow porous loamy soils (Um6.21). Associated are various acid (Dy), (Db), and (Dr) soils and some deeply mantled colluvial slopes of various soils, including (Gn2.14). Data are limited.	172m	South East
Ca7	Podosol	Old sand dune and swamp system of gently undulating dune-swale succession: dunes of leached sands (Uc2.21 and Uc2.22) with extensive undulating areas of leached sands, such as (Uc2.2), (Uc3.2), and (Uc2.3). Associated are swamplands of (Uc2.2) sands with variable peaty and/or clayey layers on the surface, some acid peats (O) and plastic clays (Uf6.61) also with variable peaty surfaces in the lower-lying portions. As mapped, small areas of neighbouring units are included. Often this unit is separated from unit A9 by an elongate swamp.	866m	West

Atlas of Australian Soils Data Source: CSIRO
Creative Commons 4.0 © Commonwealth of Australia http://creativecommons.org/licenses/by/4.0/au/deed.en

Acid Sulfate Soils

562 Crowdy Head Road, Crowdy Head, NSW 2427



Acid Sulfate Soils

562 Crowdy Head Road, Crowdy Head, NSW 2427

Environmental Planning Instrument - Acid Sulfate Soils

What is the on-site Acid Sulfate Soil Plan Class that presents the largest environmental risk?

Soil Class	Description	EPI Name
3	Works more than 1 metre below natural ground surface present an environmental risk; Works by which the watertable is likely to be lowered more than 1 metre below natural ground surface, present an environmental risk	Greater Taree Local Environmental Plan 2010

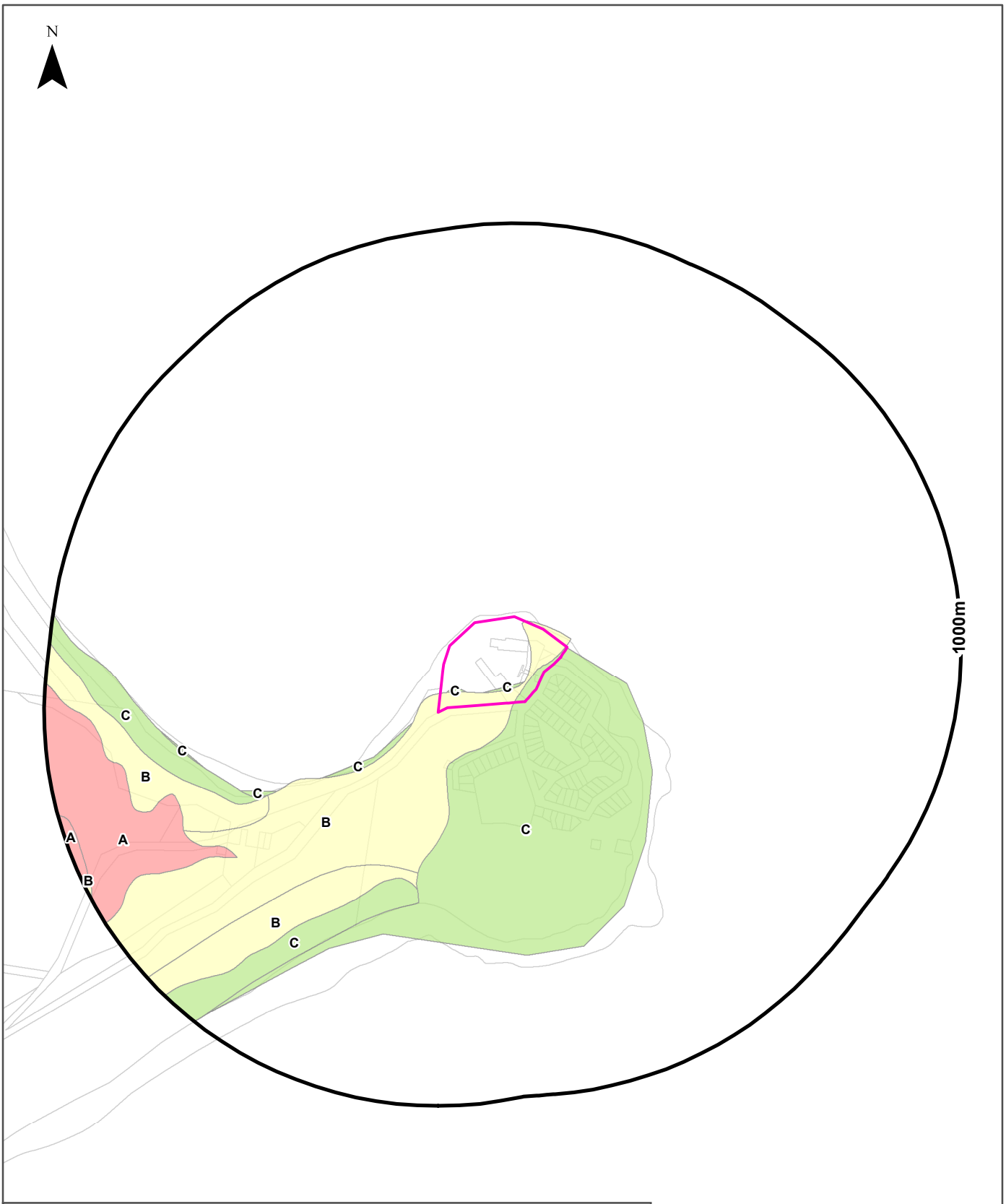
If the on-site Soil Class is 5, what other soil classes exist within 500m?

Soil Class	Description	EPI Name	Distance	Direction
N/A				

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Atlas of Australian Acid Sulfate Soils

562 Crowdy Head Road, Crowdy Head, NSW 2427



Legend

- Site Boundary
- Buffer 1000m
- Property Boundary

Probability of occurrence of Acid Sulfate Soils

- A. High (>70%)
- B. Low (6-70%)
- C. Extremely Low (1-5%)
- D. No Chance (0%)
- No Data

Scale: 0 100 200 400 600 Meters

Data Sources: Property Boundaries & Topographic Data: © Department Finance, Services & Innovation 2021

Coordinate System: GDA 1994 MGA Zone 56

Date: 30August 2021

Acid Sulfate Soils

562 Crowdy Head Road, Crowdy Head, NSW 2427

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance	Direction
B	Low Probability of occurrence. 6-70% chance of occurrence.	0m	On-site
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m	On-site
A	High Probability of occurrence. >70% chance of occurrence.	629m	West

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO
Creative Commons 3.0 © Commonwealth of Australia http://creativecommons.org/licenses/by/3.0/au/deed.en

Dryland Salinity

562 Crowdy Head Road, Crowdy Head, NSW 2427

Dryland Salinity - National Assessment

Is there Dryland Salinity - National Assessment data onsite?

No

Is there Dryland Salinity - National Assessment data within the dataset buffer?

No

What Dryland Salinity assessments are given?

Assessment 2000	Assessment 2020	Assessment 2050	Distance	Direction
N/A	N/A	N/A		

Dryland Salinity Data Source : National Land and Water Resources Audit
The Commonwealth and all suppliers of source data used to derive the maps of "Australia, Forecast Areas Containing Land of High Hazard or Risk of Dryland Salinity from 2000 to 2050" do not warrant the accuracy or completeness of information in this product. Any person using or relying upon such information does so on the basis that the Commonwealth and data suppliers shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information. Any persons using this information do so at their own risk.
In many cases where a high risk is indicated, less than 100% of the area will have a high hazard or risk.

Mining

562 Crowdy Head Road, Crowdy Head, NSW 2427

Mining Subsidence Districts

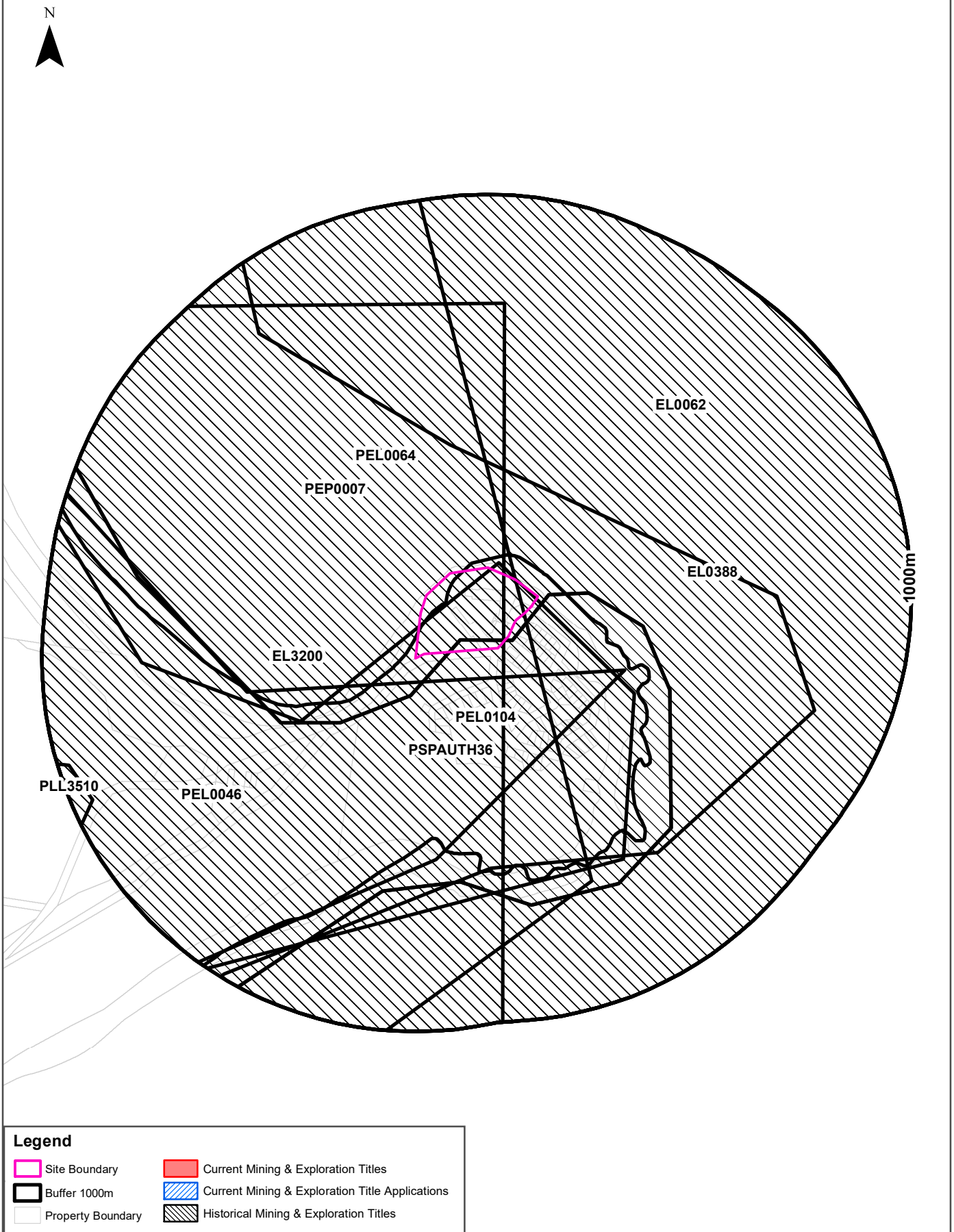
Mining Subsidence Districts within the dataset buffer:

District	Distance	Direction
There are no Mining Subsidence Districts within the report buffer		

Mining Subsidence District Data Source: © Land and Property Information (2016)
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Mining & Exploration Titles

562 Crowdy Head Road, Crowdy Head, NSW 2427



Mining

562 Crowdy Head Road, Crowdy Head, NSW 2427

Current Mining & Exploration Titles

Current Mining & Exploration Titles within the dataset buffer:

Title Ref	Holder	Grant Date	Expiry Date	Last Renewed	Operation	Resource	Minerals	Dist	Dir
N/A	No records in buffer								

Current Mining & Exploration Titles Data Source: © State of New South Wales through NSW Department of Industry

Current Mining & Exploration Title Applications

Current Mining & Exploration Title Applications within the dataset buffer:

Application Ref	Applicant	Application Date	Operation	Resource	Minerals	Dist	Dir
N/A	No records in buffer						

Current Mining & Exploration Title Applications Data Source: © State of New South Wales through NSW Department of Industry

Mining

562 Crowdy Head Road, Crowdy Head, NSW 2427

Historical Mining & Exploration Titles

Historical Mining & Exploration Titles within the dataset buffer:

Title Ref	Holder	Start Date	End Date	Resource	Minerals	Dist	Dir
PEL0104	AUSTRALIAN OIL AND GAS CORPORATION LTD			PETROLEUM	Petroleum	0m	On-site
EL0388	PLANET MINING COMPANY PTY LIMITED	01 Jan 1971	01 Jan 1975	MINERALS	Heavy mineral sands	0m	On-site
PEL0064	L H SMART OIL EXPLORATION CO. LTD			PETROLEUM	Petroleum	0m	On-site
PEP0007				PETROLEUM	Petroleum	0m	On-site
EL3200	BHP TITANIUM MINERALS PTY LTD	23 Sep 1988	22 Sep 1994	MINERALS	Heavy mineral sands	0m	On-site
PSPAUTH36	PANGAEA OIL & GAS PTY LIMITED	11/11/2009	11/11/2010	PETROLEUM	Petroleum	0m	On-site
PEL0046	AUSTRALIAN OIL AND GAS CORPORATION LTD, UNION OIL DEVELOPMENT CORP., KERN COUNTY LAND CO.			PETROLEUM	Petroleum	64m	South West
EL0062	PLANET MINING COMPANY PTY LIMITED	01 Sep 1966	01 Sep 1968	MINERALS	Heavy mineral sands	254m	North East
PLL3510	RUTILE & ZIRCON MINES (NEWCASTLE) LTD			MINERALS		943m	South West

Historical Mining & Exploration Titles Data Source: © State of New South Wales through NSW Department of Industry

State Environmental Planning Policy

562 Crowdy Head Road, Crowdy Head, NSW 2427

State Significant Precincts

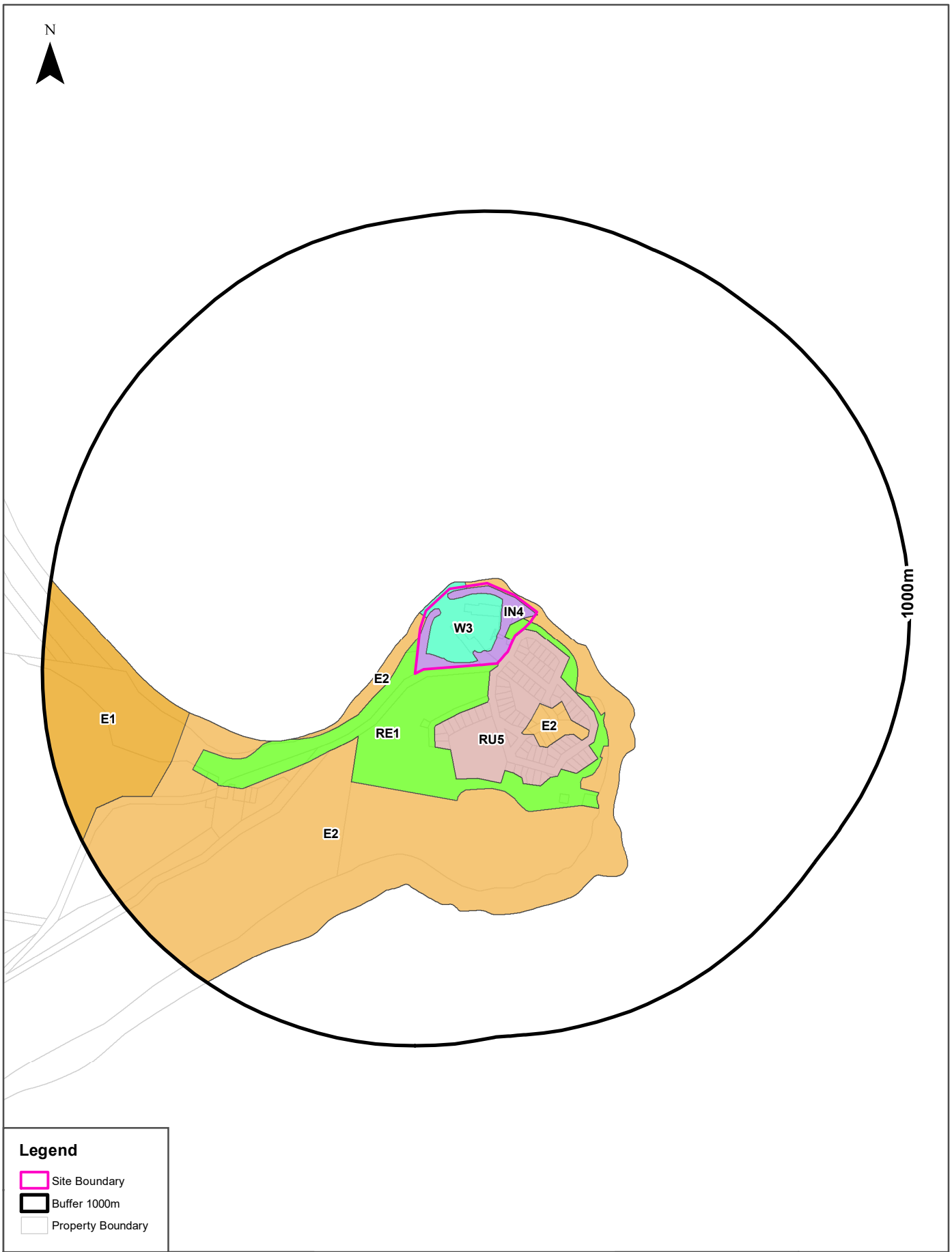
What SEPP State Significant Precincts exist within the dataset buffer?

Map Id	Precinct	EPI Name	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
N/A	No records in buffer							

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EPI Planning Zones

562 Crowdy Head Road, Crowdy Head, NSW 2427



Environmental Planning Instrument

562 Crowdy Head Road, Crowdy Head, NSW 2427

Land Zoning

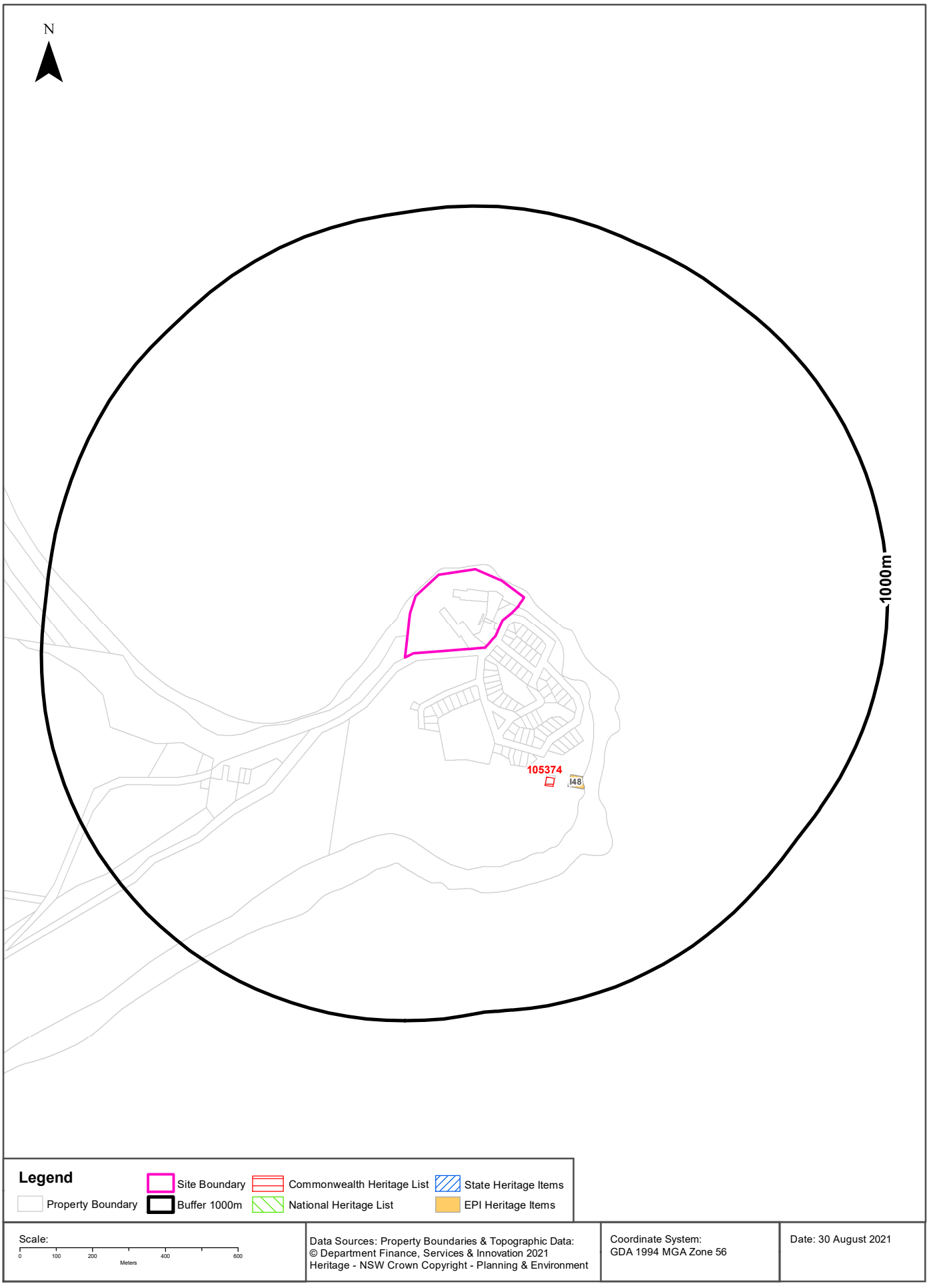
What EPI Land Zones exist within the dataset buffer?

Zone	Description	Purpose	EPI Name	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
RE1	Public Recreation		Greater Taree Local Environmental Plan 2010	25/06/2010	25/06/2010	30/04/2021		0m	On-site
E2	Environmental Conservation		Greater Taree Local Environmental Plan 2010	25/06/2010	25/06/2010	30/04/2021		0m	On-site
W3	Working Waterways		Greater Taree Local Environmental Plan 2010	25/06/2010	25/06/2010	30/04/2021		0m	On-site
IN4	Working Waterfront		Greater Taree Local Environmental Plan 2010	25/06/2010	25/06/2010	30/04/2021		0m	On-site
RU5	Village		Greater Taree Local Environmental Plan 2010	25/06/2010	25/06/2010	30/04/2021		0m	South East
E2	Environmental Conservation		Greater Taree Local Environmental Plan 2010	25/06/2010	25/06/2010	30/04/2021		157m	South East
E1	National Parks and Nature Reserves		Greater Taree Local Environmental Plan 2010	25/06/2010	25/06/2010	30/04/2021		614m	West

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Heritage Items

562 Crowdy Head Road, Crowdy Head, NSW 2427



Heritage

562 Crowdy Head Road, Crowdy Head, NSW 2427

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
105374	Crowdy Head Lighthouse	Crowdy Head NSW	1/18/143/0005	Historic	Ineligible Place		394m	South East

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?
Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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State Heritage Register - Curtilages

What are the State Heritage Register Items located within the dataset buffer?

Map Id	Name	Address	LGA	Listing Date	Listing No	Plan No	Distance	Direction
N/A	No records in buffer							

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Environmental Planning Instrument - Heritage

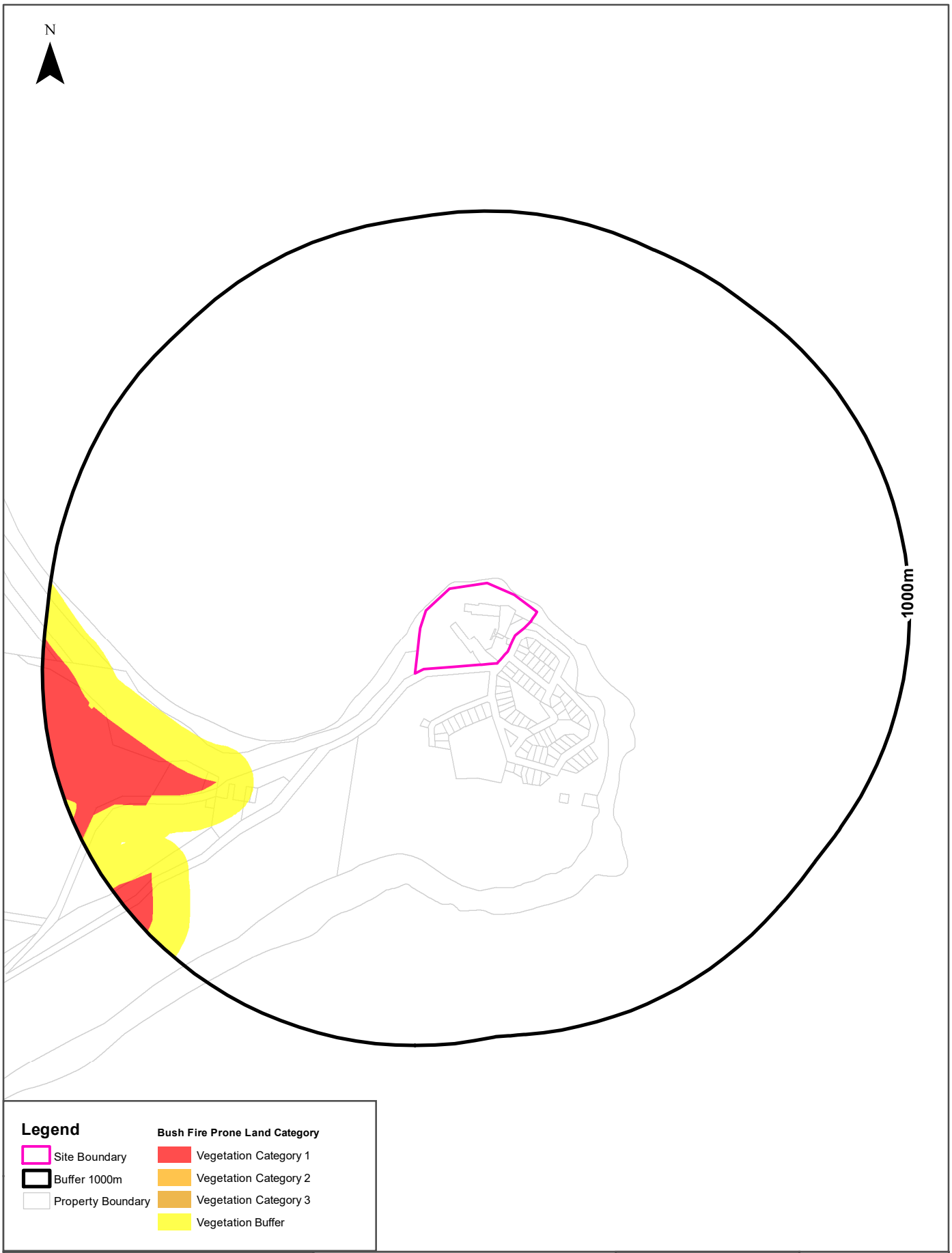
What are the EPI Heritage Items located within the dataset buffer?

Map Id	Name	Classification	Significance	EPI Name	Published Date	Commenced Date	Currency Date	Distance	Direction
I48	Crowdy Head Lighthouse	Item - General	Local	Greater Taree Local Environmental Plan 2010	25/06/2010	25/06/2010	03/03/2017	421m	South East

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Natural Hazards - Bush Fire Prone Land

562 Crowdy Head Road, Crowdy Head, NSW 2427



Data Sources: Bush Fire Prone Land: © NSW Rural Fire Service 2021. Property Boundaries: © Department Finance, Services & Innovation 2021

Coordinate System: GDA 1994 MGA Zone 56

Date: 30 August 2021

Natural Hazards

562 Crowdy Head Road, Crowdy Head, NSW 2427

Bush Fire Prone Land

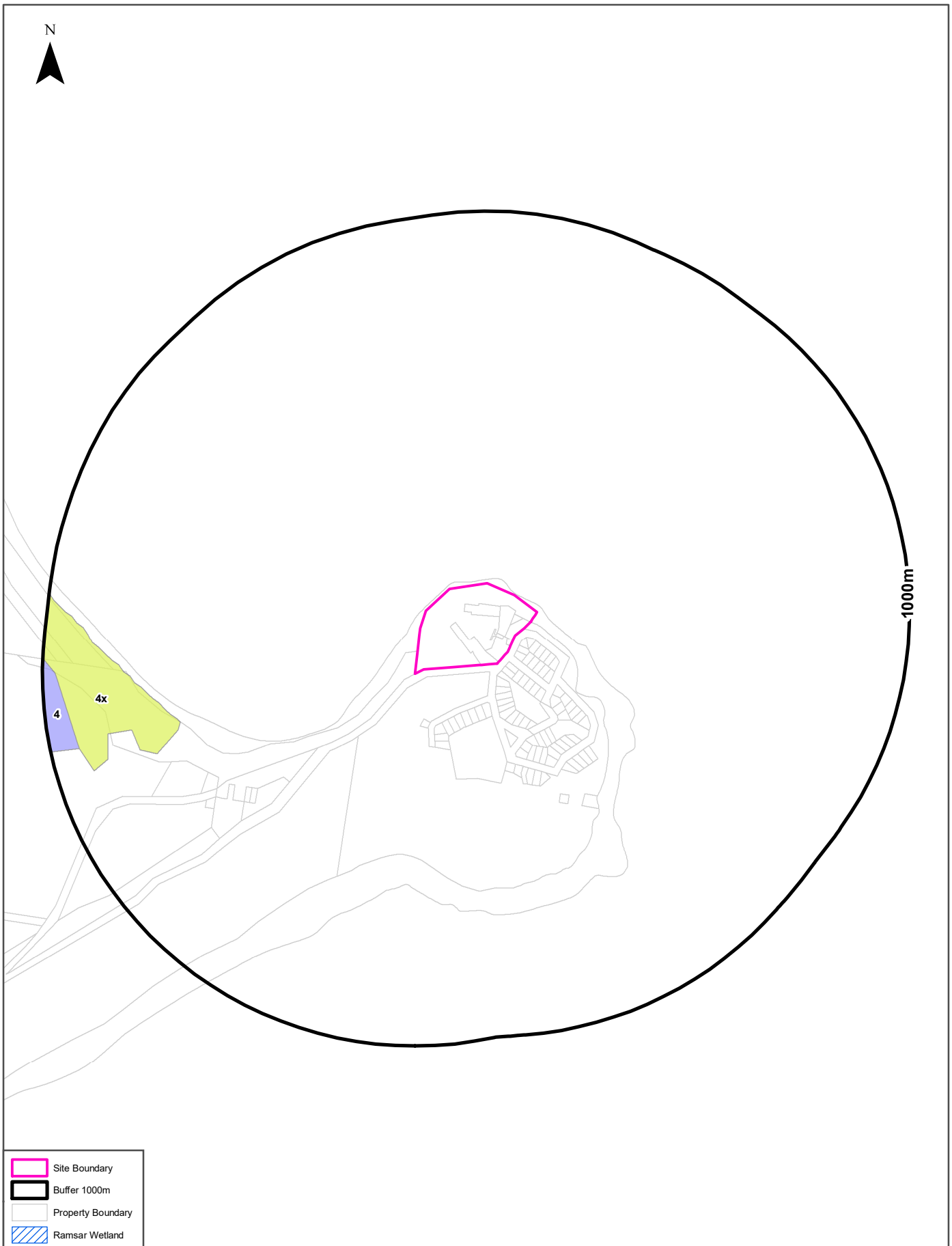
What are the nearest Bush Fire Prone Land Categories that exist within the dataset buffer?

Bush Fire Prone Land Category	Distance	Direction
Vegetation Buffer	507m	South West
Vegetation Category 1	607m	West

NSW Bush Fire Prone Land - © NSW Rural Fire Service under Creative Commons 4.0 International Licence

Ecological Constraints - Vegetation & Ramsar Wetlands

562 Crowdy Head Road, Crowdy Head, NSW 2427



Ecological Constraints

562 Crowdy Head Road, Crowdy Head, NSW 2427

Vegetation - Eastern Bushland Database (North Region)

What Vegetation exists within the dataset buffer?

Veg Code	Veg Desc	NVISCode	NVISDesc	Distance	Direction
4x	disturbed coastal complex	2	Coastal complex	643m	West
4	coastal complex	2	Coastal complex	923m	West

Vegetation Eastern Bushland Database Data Source: NSW Office of Environment and Heritage
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Ramsar Wetlands

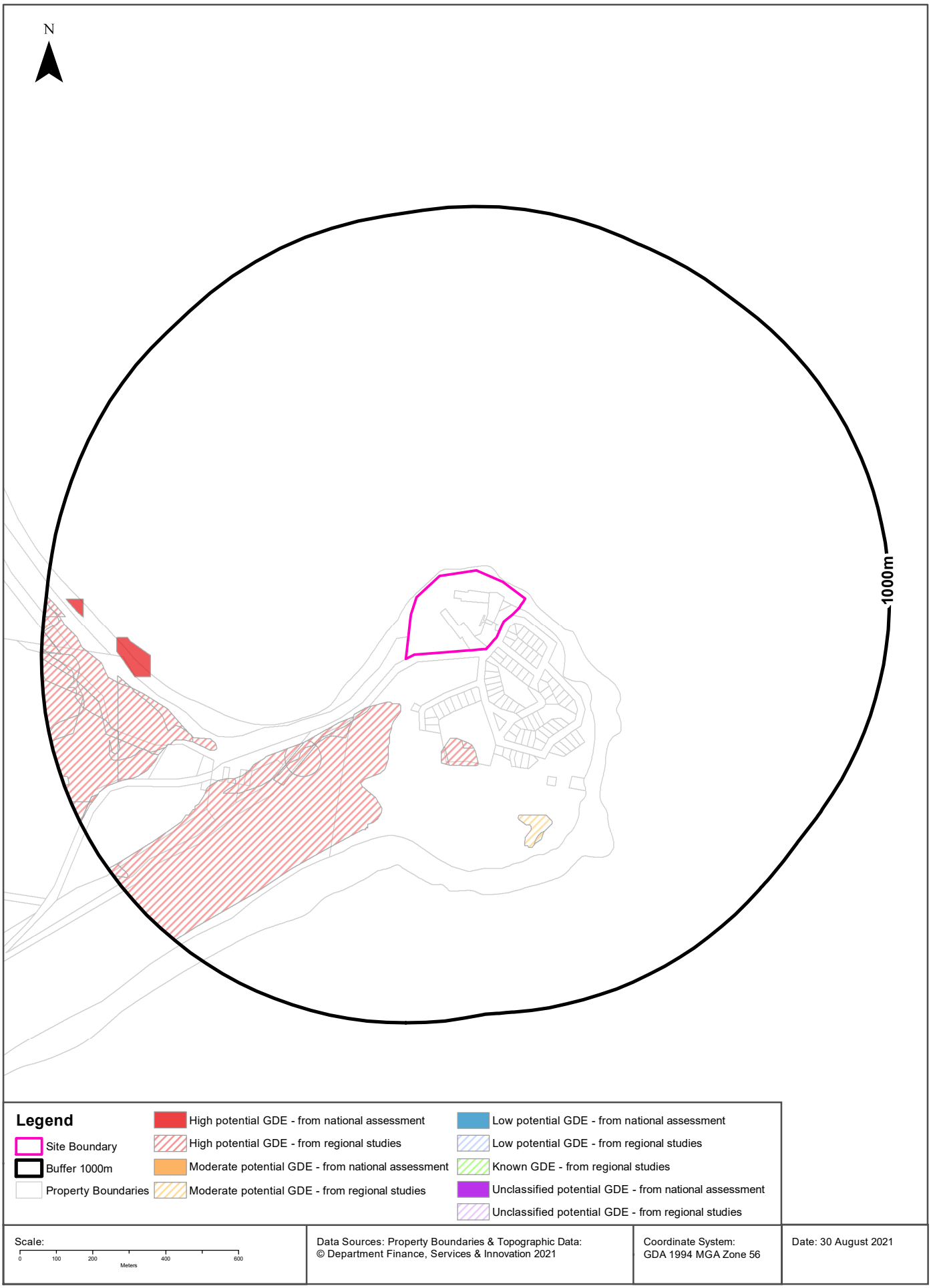
What Ramsar Wetland areas exist within the dataset buffer?

Map Id	Ramsar Name	Wetland Name	Designation Date	Source	Distance	Direction
N/A	No records in buffer					

Ramsar Wetlands Data Source: © Commonwealth of Australia - Department of Agriculture, Water and the Environment

Ecological Constraints - Groundwater Dependent Ecosystems Atlas

562 Crowdy Head Road, Crowdy Head, NSW 2427



Ecological Constraints

562 Crowdy Head Road, Crowdy Head, NSW 2427

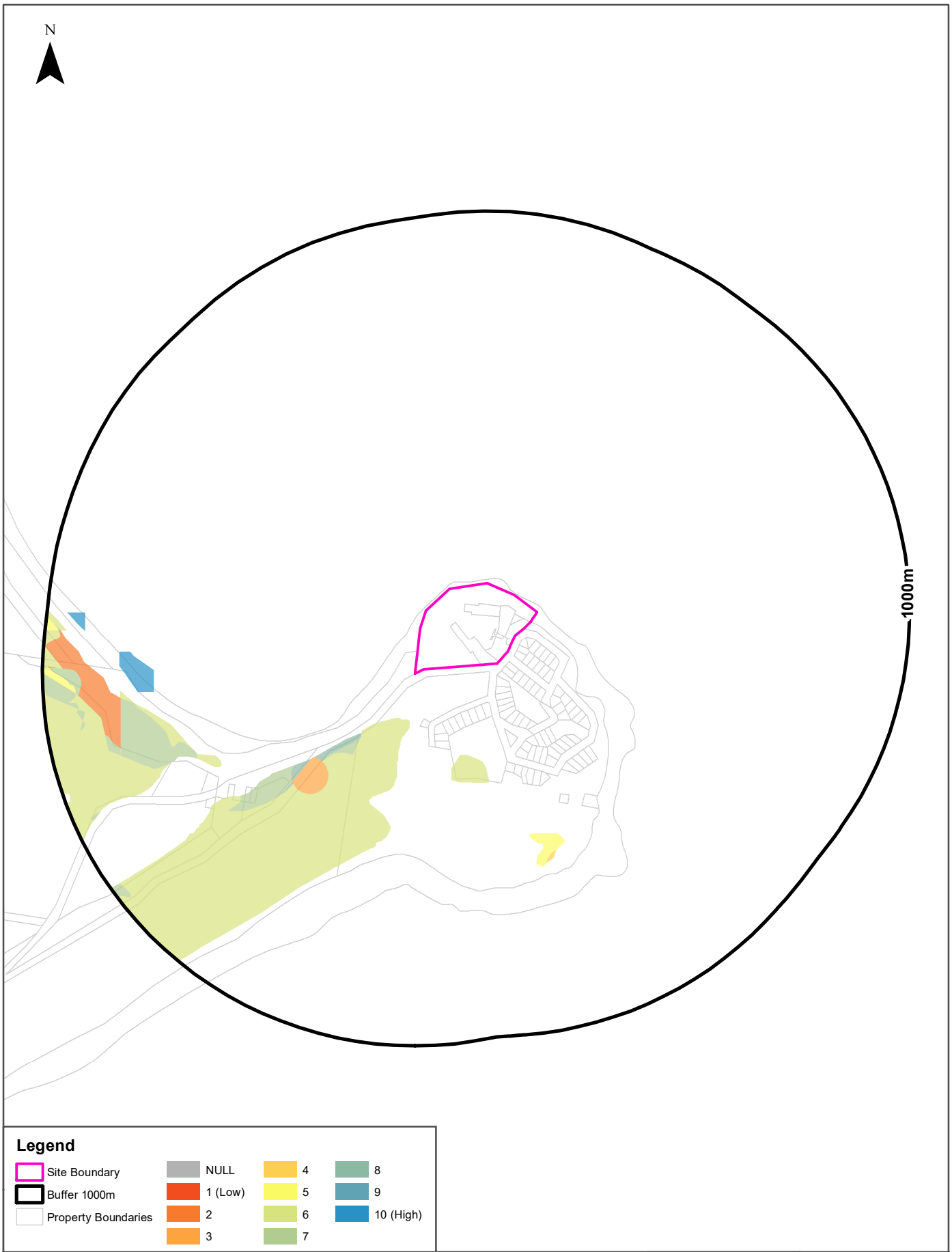
Groundwater Dependent Ecosystems Atlas

Type	GDE Potential	Geomorphology	Ecosystem Type	Aquifer Geology	Distance	Direction
Terrestrial	High potential GDE - from regional studies	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation		125m	South West
Terrestrial	Moderate potential GDE - from regional studies	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation		464m	South
Terrestrial	High potential GDE - from national assessment	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation		701m	West
Terrestrial	High potential GDE - from national assessment	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation	Unconsolidated sedimentary	893m	West

Groundwater Dependent Ecosystems Atlas Data Source: The Bureau of Meteorology
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Ecological Constraints - Inflow Dependent Ecosystems Likelihood

562 Crowdy Head Road, Crowdy Head, NSW 2427



Data Sources: Property Boundaries & Topographic Data:
© Department Finance, Services & Innovation 2021

Coordinate System:
GDA 1994 MGA Zone 56

Date: 30 August 2021

Ecological Constraints

562 Crowdy Head Road, Crowdy Head, NSW 2427

Inflow Dependent Ecosystems Likelihood

Type	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Distance	Direction
Terrestrial	6	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation		125m	South West
Terrestrial	8	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation		214m	South West
Terrestrial	7	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation		222m	South West
Terrestrial	3	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation		343m	South West
Terrestrial	5	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation		464m	South
Terrestrial	4	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation		524m	South
Terrestrial	10	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation		701m	West
Terrestrial	2	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation		793m	West
Terrestrial	10	Plateau flank dissected into narrow strike ridges and valleys.	Vegetation	Unconsolidated sedimentary	893m	West

Inflow Dependent Ecosystems Likelihood Data Source: The Bureau of Meteorology
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Ecological Constraints

562 Crowdy Head Road, Crowdy Head, NSW 2427

NSW BioNet Atlas

Species on the NSW BioNet Atlas that have a NSW or federal conservation status, a NSW sensitivity status, or are listed under a migratory species agreement, and are within 10km of the site?

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Amphibia	Crinia tinnula	Wallum Froglet	Vulnerable	Not Sensitive	Not Listed	
Animalia	Amphibia	Litoria olongburensis	Olongburra Frog	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Aves	Ardenna carneipes	Flesh-footed Shearwater	Vulnerable	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Ardenna pacifica	Wedge-tailed Shearwater	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Ardenna tenuirostris	Short-tailed Shearwater	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Artamus cyanopterus cyanopterus	Dusky Woodswallow	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Botaurus poiciloptilus	Australasian Bittern	Endangered	Not Sensitive	Endangered	
Animalia	Aves	Burhinus grallarius	Bush Stone-curlew	Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Calidris alba	Sanderling	Vulnerable	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Calidris canutus	Red Knot	Not Listed	Not Sensitive	Endangered	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Calidris ruficollis	Red-necked Stint	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Calidris tenuirostris	Great Knot	Vulnerable	Not Sensitive	Critically Endangered	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Calyptorhynchus lathami	Glossy Black-Cockatoo	Vulnerable	Category 2	Not Listed	
Animalia	Aves	Carterornis leucotis	White-eared Monarch	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Chlidonias leucopterus	White-winged Black Tern	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Daphoenositta chrysoptera	Varied Sittella	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Ephippiorhynchus asiaticus	Black-necked Stork	Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Epthianura albifrons	White-fronted Chat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Esacus magnirostris	Beach Stone-curlew	Critically Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Gallinago hardwickii	Latham's Snipe	Not Listed	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Glossopsitta pusilla	Little Lorikeet	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Haematopus fuliginosus	Sooty Oystercatcher	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Haematopus longirostris	Pied Oystercatcher	Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Hieraaetus morphnoides	Little Eagle	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Hirundapus caudacutus	White-throated Needletail	Not Listed	Not Sensitive	Vulnerable	ROKAMBA;CAMBA; JAMBA

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Aves	Hydroprogne caspia	Caspian Tern	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Ixobrychus flavicollis	Black Bittern	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Lathamus discolor	Swift Parrot	Endangered	Category 3	Critically Endangered	
Animalia	Aves	Limosa lapponica	Bar-tailed Godwit	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Lophoictinia isura	Square-tailed Kite	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Ninox connivens	Barking Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Ninox strenua	Powerful Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Numenius madagascariensis	Eastern Curlew	Not Listed	Not Sensitive	Critically Endangered	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Numenius minutus	Little Curlew	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Numenius phaeopus	Whimbrel	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Pandion cristatus	Eastern Osprey	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Petroica phoenicea	Flame Robin	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Pluvialis fulva	Pacific Golden Plover	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Pluvialis squatarola	Grey Plover	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Ptilinopus magnificus	Wompoo Fruit-Dove	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Ptilinopus regina	Rose-crowned Fruit-Dove	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Sterna hirundo	Common Tern	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Sternula albifrons	Little Tern	Endangered	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Thalassarche cauta	Shy Albatross	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Aves	Thalasseus bergii	Crested Tern	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Tringa brevipes	Grey-tailed Tattler	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Tringa nebularia	Common Greenshank	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Tyto longimembris	Eastern Grass Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Tyto novaehollandiae	Masked Owl	Vulnerable	Category 3	Not Listed	
Animalia	Mammalia	Arctocephalus forsteri	New Zealand Fur-seal	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Arctocephalus pusillus doriferus	Australian Fur-seal	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Cercartetus nanus	Eastern Pygmy-possum	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Megaptera novaeangliae	Humpback Whale	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Miniopterus australis	Little Bent-winged Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Miniopterus orianae oceanensis	Large Bent-winged Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Phascolarctos cinereus	Koala	Vulnerable	Not Sensitive	Vulnerable	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Mammalia	Pseudomys gracilicaudatus	Eastern Chestnut Mouse	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Syconycteris australis	Common Blossom-bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Chelonia mydas	Green Turtle	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Reptilia	Dermochelys coriacea	Leatherback Turtle	Endangered	Not Sensitive	Endangered	
Animalia	Reptilia	Eretmochelys imbricata	Hawksbill Turtle	Not Listed	Not Sensitive	Vulnerable	
Plantae	Flora	Allocasuarina defungens	Dwarf Heath Casuarina	Endangered	Not Sensitive	Endangered	
Plantae	Flora	Allocasuarina simulans	Nabiac Casuarina	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Cynanchum elegans	White-flowered Wax Plant	Endangered	Not Sensitive	Endangered	
Plantae	Flora	Lindernia alsinoides	Noah's False Chickweed	Endangered	Not Sensitive	Not Listed	
Plantae	Flora	Maundia triglochinoides		Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	Rhodomyrtus psidioides	Native Guava	Critically Endangered	Not Sensitive	Not Listed	

Data does not include NSW category 1 sensitive species.
NSW BioNet: © State of NSW and Office of Environment and Heritage

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Where Lotsearch has had to georeference features from supplied addresses, a location confidence has been assigned to the data record. This indicates a confidence to the positional accuracy of the feature. Where applicable, a code is given under the field heading “LC” or “LocConf”. These codes lookup to the following location confidences:

LC Code	Location Confidence
Premise Match	Georeferenced to the site location / premise or part of site
Area Match	Georeferenced to an approximate or general area
Road Match	Georeferenced to a road or rail corridor
Road Intersection	Georeferenced to a road intersection
Buffered Point	A point feature buffered to x metres
Adjacent Match	Land adjacent to a georeferenced feature
Network of Features	Georeferenced to a network of features
Suburb Match	Georeferenced to a suburb boundary
As Supplied	Spatial data supplied by provider

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Appendix D Coastal Processes Assessment

Coastal Processes Assessment

Crowdy Head Harbour Upgrade

Transport for NSW

26 April 2022

→ **The Power of Commitment**



GHD Pty Ltd | ABN 39 008 488 373
GHD Tower, Level 3, 24 Honeysuckle Drive
Newcastle, New South Wales 2300, Australia
T 61-2-4979 9999 | **F** 4979 9988 | **E** ntlmail@ghd.com | **ghd.com**

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Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
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1. Introduction

1.1 Background

GHD has been engaged by Transport for NSW (TfNSW) to prepare a Review of Environmental Factors (REF) and specialist studies for the upgrade of the Crowdy Head Harbour. The REF includes an assessment of the dredging works that are now required as part of the harbour upgrade.

It is proposed that the harbour is to be dredged down to either 3.0 or 2.6 metres depth to improve its functionality. These dredging works increase the potential for environmental impacts and interference with natural coastal processes. The proposed location and extent of dredging activities are shown in Figure 1.1.

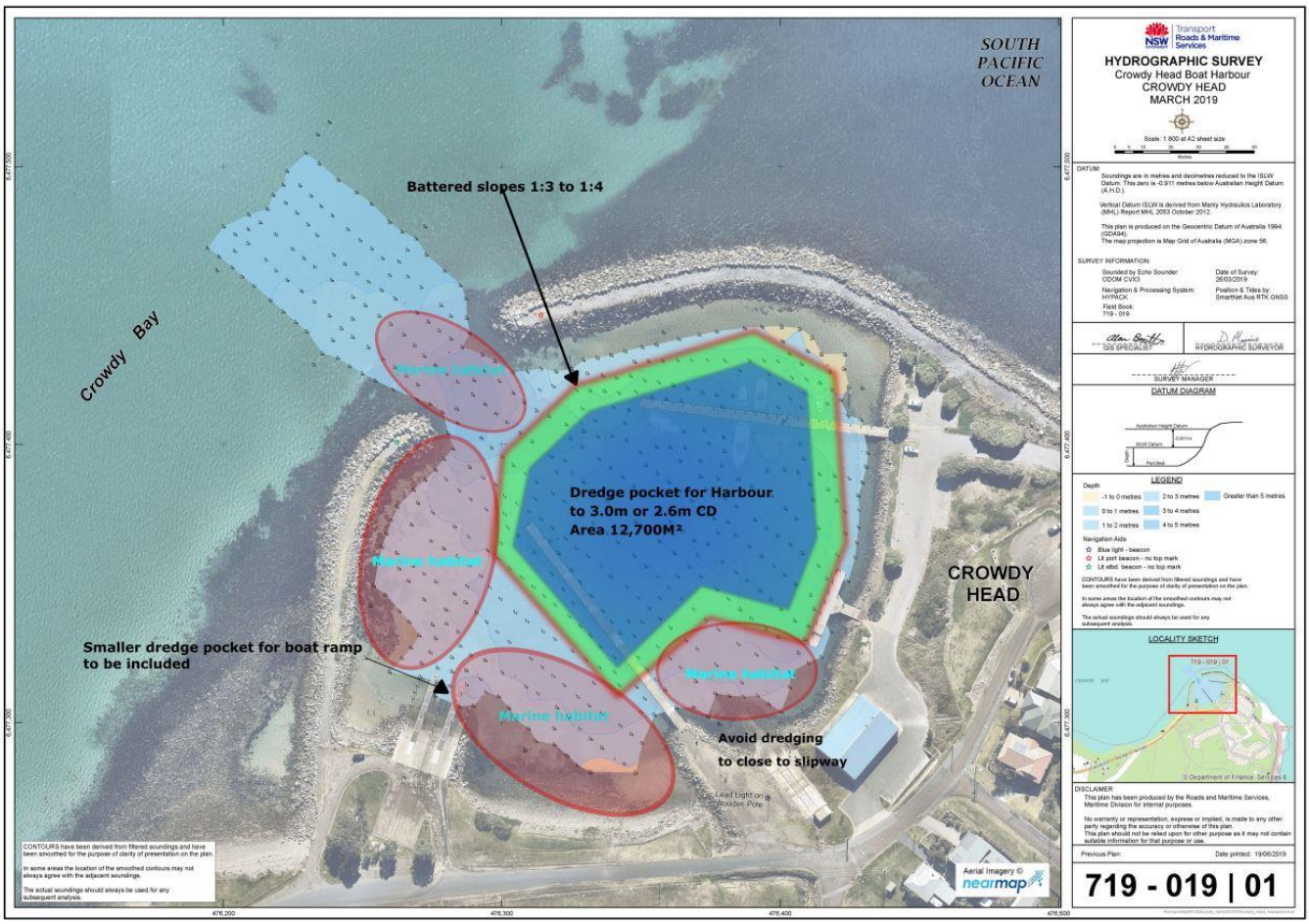


Figure 1.1 Proposed dredge area

1.2 Purpose of this report

The purpose of this report is to assess and summarise the potential impacts to coastal processes as a result of the proposed dredging of Crowdy Head Harbour and removal/deposition of dredged material.

1.3 Scope

The assessment of the existing coastal processes is based on the review of historical studies completed by MidCoast Council relating to coastal hazards and coastal management. From the findings of these studies, a conceptual model has been developed to describe the key sediment transport pathways. Using this conceptual model, a qualitative assessment of the potential impacts of the proposed dredging works has been completed.

On this basis, the scope of works for the assessment of potential impacts on coastal processes is limited to the following:

- Review historical studies completed by MidCoast Council.
- Develop a conceptual model of the existing key sediment transport pathways of Crowdy Head.
- Assess the potential for the proposed dredge area to act as a sediment sink, which could intercept sediment transport in the vicinity of the boat harbour and deprive downdrift locations of sediment supply.
- Assess the potential for onshore placement of dredged material to remove sediment from the coastal system and deprive downdrift locations of sediment supply.
- Assess the potential for sediment placed updrift of the boat harbour to be deposited back into the boat harbour via coastal processes.
- Assess the potential for deposited material to smother any areas of rock reef type habitat.

1.4 Limitations

This report: has been prepared by GHD for Transport for NSW and may only be used and relied on by Transport for NSW for the purpose agreed between GHD and Transport for NSW as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Transport for NSW arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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2. Coastal processes impact assessment

2.1 Existing coastal processes

Crowdy Head is located between Harrington Beach, to the south, and Crowdy Bay/Diamond Head, to the north (Figure 2.1). The existing coastal processes in the vicinity of the Crowdy Head Harbour can be largely extrapolated from past studies commissioned by the now MidCoast Council and the former Great Lakes, Greater Taree and Gloucester Shire Councils.



Figure 2.1 Crowdy Head location, image source: Google Earth

Generally, exposed beaches along the NSW coastline experience erosion during major storm events followed by periods of recovery or deposition during ambient conditions (Greater Taree City Council 2015). These storm driven cycles are typically overlain by a net northerly longshore transport of sediment due to the predominant south easterly wave climate.

Previous studies concluded that there is relatively little net longshore drift along this part of the NSW coastline and beaches are close to swash aligned (WorleyParsons 2013). Localised processes in the vicinity of the proposed upgrade are complex due to the presence of two river entrances, Crowdy Head and extensive inshore rocky reef areas. Further details relating to each beach is provided below.

2.1.1 Harrington Beach

The southern end of Harrington Beach abuts the training wall for the Harrington Inlet to the Manning River. Harrington Beach is a 5.6 kilometre long, south-east facing beach, which has been shown to be historically stable, with a net increase in sand deposition occurring between 1965 and 2006 (WorleyParsons 2010). Harrington Beach is supplied with sand from the Harrington entrance bar, with the southern geometry of the beach determined by wave refraction and diffraction patterns in the lee of the training wall and is hence stable (WorleyParsons 2013). As is typical of NSW beaches downdrift (north) of a trained river entrance, the southern portion of the beach has been observed to prograde whilst the mid to northern portion recedes. The recession tapers off toward the very northern end of Harrington Beach, at Crowdy Head, which is once again stable. This planform is in equilibrium with the long term altered wave climate and little change has been evident. Progradation of the entire beach compartment occurs relative to the net bypassing of the Harrington Inlet entrance (WorleyParsons 2010).

2.1.2 Crowdy Bay

Crowdy Bay is a 14.2 kilometre long, east to south-east facing beach that extends north from Crowdy Head Harbour to Diamond Head. The coastal processes and changes to the coastline of Crowdy Bay have not been analysed in previous studies as it is predominantly covered by the Crowdy Bay National Park and therefore managed by the NSW National Parks and Wildlife Service (MidCoast Council 2018). Crowdy Bay is not addressed in any of the completed Coastal Management Programs as there are unlikely to be any assets at immediate risk from coastal hazards north of Crowdy Head (Greater Taree City Council 2015).

It can be inferred from the planform of the northern end of the beach and the hard southern boundary that the coastal processes at play for sediment transport are generally similar to those for Harrington Beach. The geometry of the southern end of Crowdy Bay in front of the Surf Life Saving Club (SLSC) is largely driven by wave refraction and diffraction around Crowdy Head, which provides shelter from the predominant south-east wave climate. This end of Crowdy Bay though may be susceptible to large scale erosion under wave attack from the north-east.

2.1.3 Crowdy Head headland and harbour

Satellite imagery shows a rocky reef extending approximately 500 metres north of Crowdy Head, see Figure 2.2, and is observed to have remained uncovered by sediment through historical imagery from Google Earth over the last 15 years. Previous studies have indicated that northerly sediment transport around Crowdy Head is in the order of 10,000 cubic metres per year (m^3/year) and episodic in nature as shown in Figure 2.3.

Sediment bypassing the area of the harbour feeds Crowdy Bay with a directional null point in the southern portion of the bay. From this point, the sediment may continue north or may be transported south to feed the southern end of Crowdy Bay before being carried offshore by rip cells in a cyclical system, which is occasionally disrupted by large storm events from the north-east quadrant, such as the June 2016 storm.

A paper relating to the repair of breakwaters by I. Jayewardene (Jayewardene et al 2018) states that the Crowdy Head breakwater sustained extensive damage to the crest during the June 2016 storm event. During such events, sediment is eroded from the beach and deposited further offshore. Sediment is then naturally replenished to the beach area through onshore transport under ambient conditions.

The transport of sediment into the Crowdy Head Harbour is likely the result of three main modes: refraction and diffraction of waves around the eastern breakwater and into the harbour entrance, permeation of sediment through the breakwaters, and overtopping of waves over the breakwaters during major storm events.

The harbour acts as a sediment sink due to the comparatively lower energy environment. This means that the majority of sediment deposited within the harbour is effectively lost to the system until dredged or until sediment build up against the western most extent of the breakwaters reaches such a point that it may “spill over” the structure back into the system.



Figure 2.2 Rock reef north of Crowdy Head, image source: Google Earth

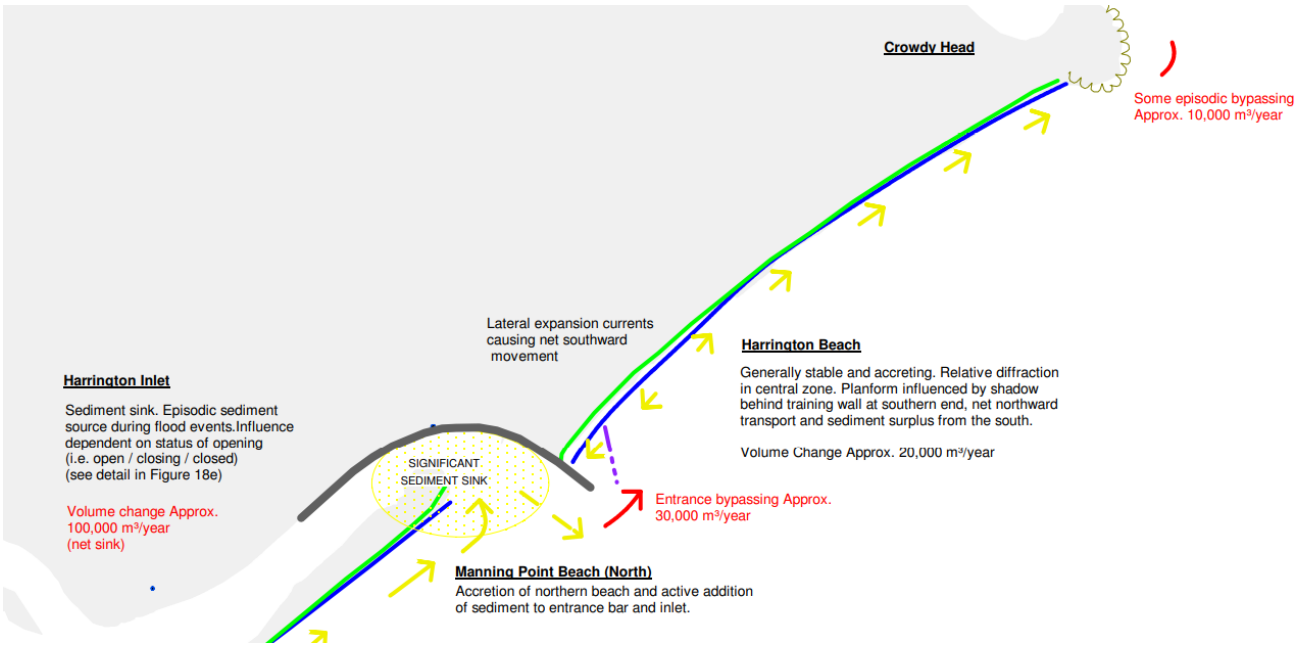


Figure 2.3 Conceptual model of sediment transport around Crowdy Head (extract from WorleyParsons, 2010)

2.2 Assessment methodology

From the coastal process identified for the study area, as per the previously conducted studies and first principles assessment, a conceptual model has been produced as shown in Figure 2.4. It is understood that TfNSW has nominated four potential areas for deposition of the dredged harbour material, and these have been included in the developed model for perspective on potential outcomes.

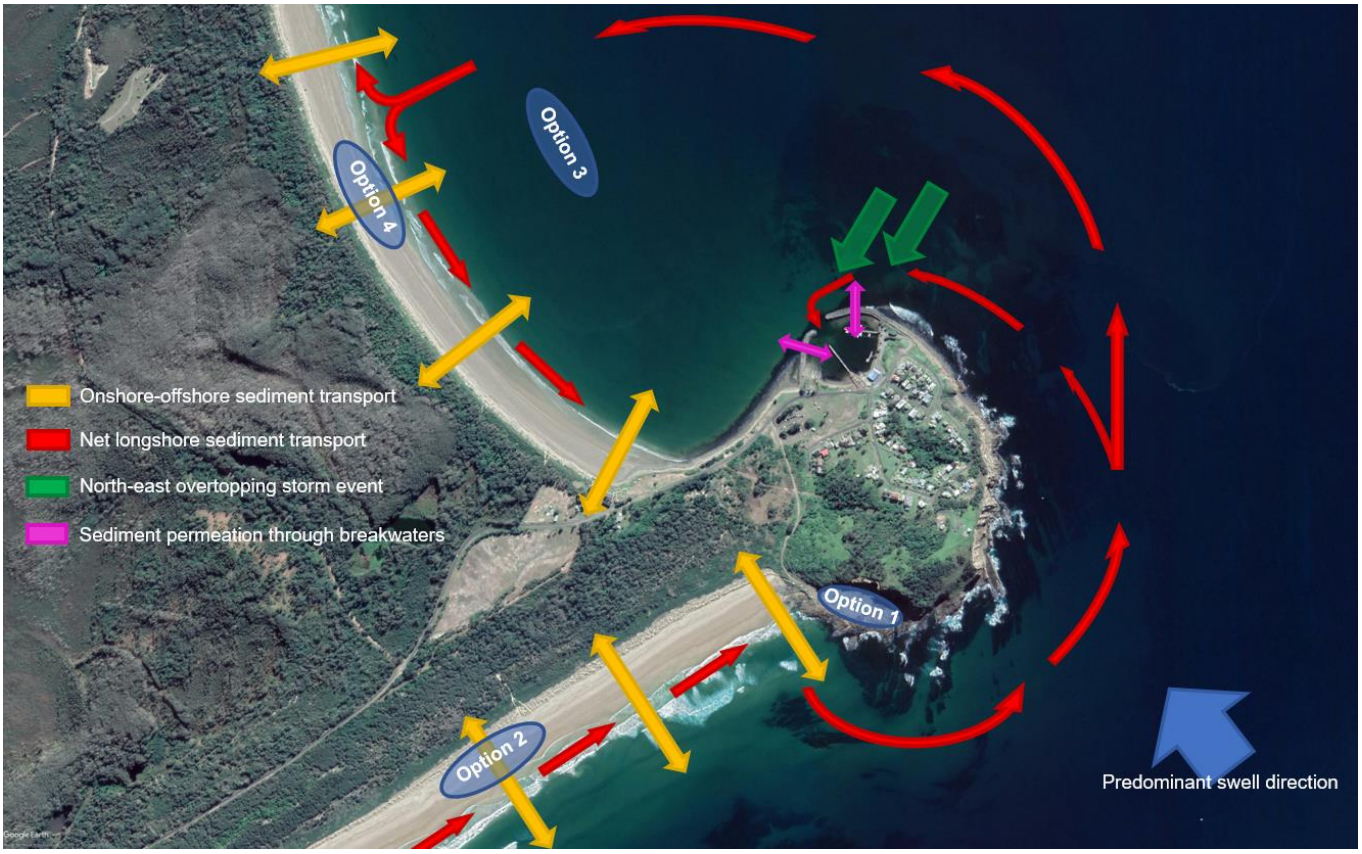


Figure 2.4 Conceptual sediment transport model at Crowdy Head

It should be noted that the above sediment transport model is only conceptual, inferred from historical studies (not conducted by GHD) as well as first-principle processes applicable to the mid to north NSW coastline. As such, the primary sediment transport routes as depicted in Figure 2.4 are only representative. In particular, the net longshore transport around the headland and its intersection with Crowdy Bay at the perceived null point north of the SLSC is shown for concept only and an accurate location for this potential null point can only be determined through a focussed study of the coastal process along the Crowdy Bay shoreline.

2.3 Coastal impact assessment

Potential impacts due to the proposed dredging works, the risks associated with them, and recommended mitigation is summarised in Table 2.1.

Table 2.1 Coastal impact assessment

Potential impact	Risk assessment	Mitigation measures
Potential for the proposed dredge area to act as a sediment sink, which could intercept sediment transport in the vicinity of the harbour and deprive downdrift locations of sediment supply.	By virtue of the harbour's sheltered nature and the methods in which sediment is transported behind the breakwaters, the net movement of sediment will always be into the harbour. Sediment that enters the harbour through overtopping during north-east storm events will not be able to exit the harbour by the same means. In a similar manner, whilst sediment transported into the harbour via permeation through the breakwaters or through the mouth may also return in the same way, the difference in ambient conditions inside and outside the harbour likely translates into a net movement of sediment into the harbour. The dredging of the harbour is unlikely to affect any of these three modes for sediment movement into, and out of, the harbour and therefore the tendency for the harbour to act as a sediment sink may continue irrespective of the level of sediment build up within the harbour. This is however until such a point that sediment builds up within the harbour until it reaches capacity and then sediment may "overflow" back into the system at the same rate that it enters the harbour. This scenario is however considered unrealistic in terms of an operational harbour.	No mitigation measures considered necessary.
Potential for onshore placement of dredged material to remove sediment from the coastal system and deprive downdrift locations of sediment supply.	In keeping with the above discussion on the harbour's tendency to act as a sediment sink (largely regardless of the levels of maintained dredging) the net build up of sediment in the harbour has already been "lost" to the system and so would already be affecting any downdrift locations. As such, onshore placement of material dredged from the harbour would likely not result in any additional adverse effects on downdrift locations over what may already be observed.	No mitigation measures considered necessary.
Potential for deposited material to smother any areas of rock reef type habitat.	The sediment that has been trapped in the harbour has previously left the natural system and so reintroduction to the system is unlikely to cause any smothering issues provided the placement location is sufficiently offset from existing areas of rock reef type habitat. Nevertheless is it important to consider potential impacts associated with suspended solids, light attenuation and potential for mobilisation of any contaminants present within the sediments as outlined in the main body of the REF.	Ensure any placement location is sufficiently offset from existing areas of rock reef type habitat.
Potential for sediment placed updrift of the harbour to be deposited back into the harbour via coastal processes.	As shown in the conceptual model illustrated in Figure 2.4 and discussed in Section 2.1.3, a relatively small annual quantity of sediment bypasses Crowdy Head. Given the quantity of material for disposal and distance to potential placement locations, infilling of the dredge area with previously dredged sand is not a significant issue.	No mitigation measures considered necessary.

3. Conclusion and recommendations

It is noted that placement of dredged material downdrift of the dredge area is generally preferrable to removal of dredged sand from the natural system of coastal processes. In this instance however it is important to note the following key points:

– Sediments proposed for removal are not currently available to the system of coastal processes since the boat harbour acts as a sediment sink.
– Sediments may contain elevated concentrations of contaminants, odours, discolouration and a higher concentration of fines than typical beach sediments, making them unsuitable for beach nourishment or placement within the marine environment.
– Placement of dredged sediment in the vicinity of rock reef habitat may result in impacts to water quality and marine ecology.
– Placement of dredged material on beaches will result in a greater construction phase impact to terrestrial ecology and beach users.

It is considered unlikely that the harbour dredging works and disposal activities at any of the potential placement locations will cause any significant impacts to coastal processes, as discussed in Section 2.3. It is on this basis that the works are considered suitable to proceed without a significant impact on existing coastal processes. It is not considered necessary to undertake any monitoring of coastal processes during or after the proposed works.

It is recommended that the preferred placement location be selected on the basis of an assessment which considers the above findings in relation to coastal processes as well as a broader range of evaluation criteria as outlined in the main body of the REF.

4. References

Greater Taree City Council (2015), *Greater Taree - Coastal Zone Management Plan.* Greater Taree City Council, September 2015

WorleyParsons (2013), *A Coastal Zone Management Plan for Greater Taree.* Prepared for Greater Taree City Council. March 2013

WorleyParsons (2010), *Greater Taree Coastline Management Study – Black Head to Crowdy Head.* Prepared for Greater Taree City Council. October 2010

Manning City Council (2018), *Manning Valley - Coastal Zone Management Plan.* MidCoast Council, January 2018

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Appendix E Sediment Contamination and Waste Assessment

Sediment Contamination and Waste Assessment

Crowdy Head Harbour Upgrade

Transport for NSW

26 April 2022

→ **The Power of Commitment**



GHD Pty Ltd | ABN 39 008 488 373

GHD Tower, Level 3, 24 Honeysuckle Drive

Newcastle, New South Wales 2300, Australia

T +61 2 4979 9999 | **F** +61 2 9475 0725 | **E** ntlmail@ghd.com | **ghd.com**

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			Name	Signature	Name	Signature	Date
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Acronyms and abbreviations

Acronym	Definition
ACL	Added Contaminant Limit
ANC	Acid neutralising capacity
ASS	Acid Sulfate Soil
ASSMP	Acid Sulfate Soil Management Plan
BaP	Benzo(a)pyrene
BTEX	Benzene, toluene, ethyl benzene, and xylenes
CEC	Cation Exchange Capacity
CLM Act	Contaminated Land Management Act 1997 (incorporating amendments made by the Contaminated Land Management Amendment Act 2003)
COC	Chain of Custody
COPC	Contaminant of Potential Concern
CRC CARE	Cooperative Research Centre for Contamination Assessment and Remediation of the Environment
CRS	Chromium Reducible Sulfur (ASS suite)
DGV	Default Guideline Value
DPIE	Department of Planning, Industry and Environment
EIL	Ecological Investigation Level
ENM	Excavated Natural Material
EPA	Environment Protection Authority
ESL	Ecological Screening Level
GV	Guideline Values
HIL	Health Investigation Level (relating to defined land use scenario)
HOC	Hydrophobic Organic Contaminants
HSL	Health Screening Level
ISLW	Indian Spring Low Water
LGA	Local Government Area
LNAPL	Light non-aqueous phase liquids
LOR	Limit of reporting
NAGD	National Assessment Guidelines for Dredging
NATA	National Association of Testing Authorities of Australia
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NEMP	National Environmental Management Plan
NSW EPA	NSW Environmental Protection Authority
OC	Organic Carbon
OCP	Organochlorine Pesticide
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated Biphenyl
PSD	Particle Size Distribution
QA	Quality Assurance
QC	Quality Control

Acronym	Definition
REF	Review of Environmental Factors
RPD	Relative percentage difference
SQG	Sediment Quality Guidelines
TBT	Tributyltin
TCLP	Toxicity Characteristics Leaching Procedure
TEQ	Toxicity equivalent quotient (in reference to BaP)
TfNSW	Transport for NSW
TOC	Total Organic Carbon
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
UCL	Upper Confidence Limit

1. Introduction

1.1 General

GHD Pty Ltd (GHD) was engaged by Transport for NSW (TfNSW) to prepare a Review of Environmental Factors (REF) and specialist studies for the upgrade of the Crowdy Head Harbour (the proposal), which includes dredging works to improve the harbour's functionality (see Figure 1 in Appendix A). At the time of the assessment, several disposal options were considered for the dredged spoil including on-land beach renourishment, offshore and wash zone beach renourishment, off-site 'reuse', and off-site disposal, as discussed in the REF (GHD 2021a). As part of the REF's specialist studies a contamination and waste assessment of the harbour sediment was undertaken. This report presents a summary of the findings of this sediment assessment.

1.2 Objective

The objective of the contamination and waste assessment was to identify the current contamination status of harbour sediment to inform spoil disposal requirements during upgrade works.

1.3 Scope of work

The scope of works for the assessment included the following:

- Review of existing available data (from previous dredging undertaken in 2010).
- Sampling of sediment at eight locations.
- Half-metre subsampling of the sediment core samples collected.
- Quality control sampling including:
  - Field triplicate sampling at one location
  - Split (triplicate) sampling at one location
- Logging the profile of the sediment.
- Laboratory analysis of the primary subsamples (18 in total), field triplicate subsamples, and split (triplicate) subsamples for contaminants of potential concern (COPC). Based on Table 2 of the National Assessment Guidelines for Dredging (NAGD) (DEWHA 2009), and GHD's general knowledge of the site and experience with similar harbours, COPC are considered to include:
  - Tributyltin (TBT)
  - Heavy metals (including antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc)
  - Polycyclic aromatic hydrocarbons (PAH)
  - Total recoverable hydrocarbons (TRH)
  - Benzene, toluene, ethylbenzene and xylene (BTEX)
  - Organochlorine pesticides (OCP) – 55% of primary sediment samples (10 in total)
  - Polychlorinated biphenyls (PCB) – 55% of primary sediment samples (10 in total)
- Laboratory analysis of all sediment samples for total organic carbon (TOC) – used to normalise the results of organic contaminants in accordance with the NAGD (DEWHA 2009).
- Laboratory analysis of seven selected sediment samples for bulk density and 12 for particle size distribution (PSD) by sieve and hydrometer.
- Acid sulfate soil (ASS) screening on all 18 primary sediment samples, and laboratory analysis of 10 selected samples for the ASS chrome-reducible sulfur (CRS) suite.
- Preparation of report (including tabulated logs and a sampling location figure) summarising the findings of the investigation and assessment of the proposed dredge material in accordance with the relevant guidelines.

2. Site information

Site information, including the site setting, is presented in the proposal's Preliminary Site (contamination) Investigation (PSI) (GHD 2021b) and has not been replicated here.

As discussed in the PSI (GHD 2021), siltation of the harbour has occurred over the past four decades as a result of marine sands transported from the south by coastal processes. Wave action and flood tides 'push' marine sands into the harbour. Furthermore, water circulation within the harbour also results in an accumulation of marine sand in the northern section of the harbour, directly adjacent to the northern break wall.

Works to repair the south-eastern jetty (Jetty 1; see Figure 1 in Appendix A) and dredging of the harbour was undertaken in 2010 by the NSW Land and Property Management Authority. Limited sediment testing (i.e. two samples analysed) based on characterisation of the sediment as Excavated Natural Material (ENM) was undertaken as part of these dredging works. Since 2013, Crowdy Head Harbour has not been able to sustain heavy boat use, with Jetty 1 closed since 2010 and significant siltation affecting safe clearance depths.

3. Basis of assessment

3.1 Relevant guidelines

The general framework on which the contamination status of harbour sediment was assessed is based on guidelines published or approved by the NSW Environment Protection Authority (EPA) under Section 105 of the *Contaminated Land Management Act 1997* (CLM Act) and the NAGD (DEWHA 2009), as well as other relevant technical publications.

The guidelines that were referenced include (but are not limited to) the following:

– Framework of the assessment of sediment quality – the NAGD (DEWHA 2009).
– Assessment of sediment contamination and offshore disposal – toxicant default guideline values for sediment quality (assessment criteria) presented in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018).
– Assessment of potential acid sulfate soils (ASS) – guidance and criteria presented in the National Acid Sulfate Soils Guidance (DAWR 2018) which supplements the NSW Acid Sulfate Soils Manual (ASSMAC 1998).
– Assessment of potential land-based reuse/placement (considered to be soil contamination) – ecological and human health investigation levels presented in the National Environmental Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (NEPC 2013).
– Assessment of potential off-site disposal to a facility licenced to accept the classified waste – thresholds presented in the Waste Classification Guidelines (NSW EPA 2014).
– NSW EPA (2020). Consultants Reporting on Contaminated Land: Contaminated Land Guidelines.

The adopted assessment criteria are discussed below and shown in the results summary tables in Appendix C.

A number of statistical tests were adopted for the assessment of contamination in accordance with guidance provided in the NEPM including:

– The 95% upper confidence limit (UCL) of the arithmetic mean concentration of the contaminant is less than the relevant assessment criteria.
– No individual sample concentration exceeds 250% of the assessment criteria.
– The standard deviation of the sample concentrations does not exceed 50% of the assessment criteria.

3.2 Sediment assessment criteria

The selection of the assessment criteria was based on the following considerations, some of which are specific to spoil disposal options being considered for the proposal:

– There is potential for direct contact within contaminated spoil for land-based disposal. The NEPM includes ecological and health investigation and screening levels for a range of contaminants and for a range of land use and exposure scenarios. The public open space land use scenario investigation/screening levels are considered applicable to the land-based disposal options.
– There is potential for aquatic organisms to come into contact within contaminated spoil for offshore disposal. ANZG includes sediment quality guidelines (SQGs) to assess sediment quality in aquatic environments. These SQGs are considered applicable to the offshore disposal option.

3.2.1 Health investigation and screening levels

Health investigation levels (HILs) have been developed for a broad range of metals and organic substances and are applicable for assessing human health risk via all relevant pathways of exposure. The HILs are generic to all soil types. Site specific conditions determine the depth to which HILs apply for land uses other than residential (generally to depth of 3 m).

Health screening levels (HSLs) for petroleum compounds, which comprise TRH including BTEX have been developed for assessing human health risk via the vapour exposure pathway. The HSLs apply to the same land use settings as HILs and include additional dimensions of soil type and depth.

Given the considerations outlined above, the following assessment criteria were adopted for this investigation:

– HIL/HSL C (public open space)
– Direct Contact for TRH Fractions in Soil – HSL C

3.2.2 Ecological investigation levels and ecological screening levels

Ecological investigation levels (EILs) have been developed for selected metals and organic substances and are applicable for assessing risk to terrestrial ecosystems. EILs depend on land use scenarios and generally apply to the top 2 m of soil. EILs have been developed for three generic land use settings including areas of ecological significance, urban residential areas and public open space, and commercial and industrial land uses. Added contaminant limit (ACL) based EILs have been derived for As, Cu, Cr III, DDT, naphthalene, Ni, Pb and Zn. ACL-based EILs are dependent on the site-specific soil pH and cation exchange capacity (CEC).

Although pH testing was undertaken there is some uncertainty on what the final pH of dredged spoil will be and no CEC analysis was performed, as such conservative EILs (which disregard the site-specific pH and CEC) were used in this assessment. Generic EILs have been derived for aged As, fresh DDT and fresh naphthalene.

Ecological Screening Levels (ESLs) have been developed for selected petroleum hydrocarbon compounds and TRH fractions and are applicable for assessing risk to terrestrial ecosystems. ESLs also depend on land use scenarios (identical to EILs) and broadly apply to coarse- and fine-grained soils and various land uses. They are generally applicable to the top 2 m of soil.

Given the proposed development of the site, the following assessment criteria were adopted:

– Soil Specific ACL-based EILs for public open space land use.
– Generic EILs (for arsenic and fresh DDT) for public open space land use.
– ESLs for public open space land use.

In regard to benzo(a)pyrene (BaP), revised, high reliability ESLs were derived from Technical Report No.39 Risk-based Management and Remediation Guidance for Benzo(a)pyrene (CRC CARE 2017). Use of this criterion is based on the justification provided by CRC CARE (2017) which states “The NEPM ESLs are based on an older set of Canadian soil quality guidelines, which have been subsequently revised. For this guidance document higher reliability screening levels have been developed using additional and more recent information following the NEPM methodology. The derived screening levels are more than an order of magnitude greater than the ESLs previously listed in the NEPM, and more generally accord with the revised Canadian guidelines levels.” The higher reliability B(a)P ESL for public open space land use is 33 mg/kg, which has been considered in this assessment.

3.2.3 Management limits

The NEPM includes “Management Limits” which are typically considered after application of the HSLs and ESLs, to address a number of policy considerations which reflect the nature and properties of petroleum hydrocarbons:

– Formation of observable light non-aqueous phase liquids (LNAPL).
– Fire and explosive hazards.
– Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services.

The management limits have been adopted in the NEPM as interim Tier 1 guidance to avoid or minimise these potential effects. The NEPM states that application of the management limits will require consideration of site-specific factors such as the depth of building basements and services and depth to groundwater, to determine the maximum depth to which the limits should apply, and that the management limits may have less relevance at operating industrial sites (including mine sites) which have no or limited sensitive receptors in the area of potential impact. As part of the Tier 1 screening, GHD will consider the management limits for public open space land use.

3.2.4 Sediment quality guidelines

ANZG 2018 provides sediment quality guidelines (SQG) which are designed to represent a generic starting point for assessing sediment quality in aquatic environments, as follows:

– Default guideline values (DGVs) indicate the concentrations below which there is a low risk of unacceptable effects occurring, and are recommended to be used, with other lines of evidence, to protect aquatic ecosystems.
– The 'upper' guideline values (GV-high) provide an indication of concentrations at which toxicity-related adverse effects may become apparent. As such, the GV-high value is recommended to be used as an indicator of potential high-level toxicity problems, not as a guideline value to ensure protection of ecosystems.

The application of sediment guideline values is influenced by local conditions and can be refined based on the organic carbon (OC) content present within the sediment (expressed as a percentage). For hydrophobic organic contaminants (HOCs), the DGVs are normalised to 1.0 % OC.

For sediments with 0.2 to 10.0 % OC (dry weight), normalising the measured HOC concentration to 1 % OC is undertaken by dividing the measured HOC concentration by the measured percent OC. If the sediment OC concentration is below or above this range, the measured HOC concentration should be normalised to (i.e. divided by) 0.2% and 10.0 %, respectively.

DGV for HOCs have been normalised at each sediment sampling location where a DGV has been specified for a toxicant of interest.

3.2.5 ASS assessment criteria

The ASSMAC (1998) action criteria for treatment of ASS have been adopted and used to assess the net acidity in each soil sample. The criteria are presented in Table 3.1.

When analytical results exceed the action criteria, a treatment regime and management plan for the materials is triggered. For disturbances of less than 1000 tonnes the action criteria vary according to the texture of the material, however if more than 1000 tonnes is to be disturbed all action criteria are the same: 0.03 for S% and 18 mol H+/tonne for acid. As spoil generated from dredging works will exceed 1000 tonnes these action criteria have been selected.

Table 3.1 Action criteria for ASS treatment

Soil texture	Clay content %	< 1000 tonnes disturbed		> 1000 tonnes disturbed	
		Sulfur Content %	Acid mol/Tonne	Sulfur content %	Acid mol/Tonne
Coarse (sands-gravels)	≤ 5	0.03	18		
Medium (sandy loam-light clay)	5 - 40	0.06	36	**0.03**	**18**
Fine (medium to heavy clays, silty clays)	≥ 40	0.10	62		

Note: Bold indicates selected criteria

3.3 Preliminary waste classification criteria

Materials that may require offsite disposal were classified using the Waste Classification Guidelines – Part 1: Classification of Waste (NSW EPA 2014).

With reference to NSW EPA 2014, the following six-step guide to the classification of waste and waste classification principles apply:

- **Step 1:** establish if the waste should be classified as a special waste.

  'Special waste' is a class of waste that has unique regulatory requirements. The potential environmental impacts of special waste need to be managed to minimise the risk of harm to the environment and human health. Special wastes are:

  - Clinical and related waste
  - Asbestos waste
  - Waste tyres

  Asbestos waste means any waste that contains asbestos. If asbestos is mixed with other waste to form asbestos waste, the waste must continue to be assessed in accordance with the guidelines to enable the disposal of the asbestos waste at an appropriate waste facility. Asbestos waste must be managed to meet the management and disposal requirements of both asbestos and the other class of waste with which it is mixed (if any).
- **Step 2:** If not a special waste, establish whether the waste should be classified as a liquid waste.
- **Step 3:** If not special waste or liquid waste, establish whether the waste is of a type that has already been pre classified. A number of commonly generated wastes have been pre-classified.
- **Step 4:** If the waste is not a special waste, liquid waste or is not suitable for pre classification, establish whether it has certain hazardous characteristics and should therefore be classified as hazardous.
- **Step 5:** If the waste does not possess hazardous characteristics, chemically assess to determine what class of waste.
- **Step 6:** The first test used to chemically assess waste is the Specific Contaminant Concentration (SCC) test, which determines the total concentration of each contaminant in the waste sample. The guidelines set different maximum levels for the total concentration of each contaminant in order for waste to be classified as either general solid waste or restricted solid waste.

  The toxicity characteristic leaching potential (TCLP) test estimates the potential for waste to release chemical contaminants into a leaching liquid. The guidelines set different maximum levels of the leachable concentration of each contaminant in order for waste to be classified as general solid waste, restricted solid waste or hazardous waste. TCLP testing was not undertaken during this assessment.

4. Field investigation methodology

4.1 General

Sediment sampling was undertaken by suitably qualified GHD Environmental Scientists / Engineers. Standard Operating Field Procedures were followed during the sampling to provide a consistent approach to sample collection and handling at each sampling location. The field investigation was conducted using carefully documented and supervised quality assurance (QA) procedures.

4.2 Field investigations

4.2.1 Sampling locations and rationale

The selection of GHD investigation test locations for contamination sampling was based on:

– The proposed dredging works.
– Consideration of site access and environmental constraints.

GHD considers that the number and location of the sampling points was sufficient to provide an indicative characterisation of the project area in regard to potential sediment contamination.

Sediment samples were collected from eight locations within the harbour (SD01 to SD08) in accordance with Table 6 of the NAGD (DEWHA 2009), based on a modelled dredge spoil volume of approximately 19,000 m³ for dredging to 3.0 m Indian Spring Low Water (ISLW) – across the area of the proposed dredging, to the proposed depth of dredging (maximum of approximately 2.2 m)) or practical refusal, using a hand operated push tube sampler, operated from a vessel. Sediment samples were collected every half metre of the sediment cores to the depth of refusal, which was reached at approximately one metre. The locations of samples are shown on Figure 1 in Appendix A.

All re-usable sampling equipment was decontaminated between each sampling point by rinsing with seawater. New disposable Nitrile gloves were used when collecting samples. Sediment samples were placed in laboratory supplied glass jars and stored in an ice-filled cooler box for transport to the laboratory for analysis.

4.3 Laboratory analysis

Selected samples were analysed by the primary laboratory ALS Environmental and the secondary laboratory Eurofins (for inter-laboratory duplicate analysis) both accredited by the National Association of Testing Authorities (NATA) for the required analyses. The analytical program for this assessment is summarised in Table 4.1

Table 4.1 Primary sample analytical program

Media	Analysis	Number of primary samples analysed
Sediment	Heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Zn)	18
	BTEX, TRH	18
	PAH	18
	OCP	10
	PCBs	10
	Bulk density	7
	PSD	12
	ASS indicator tests	18
	ASS CRS suite	10

The following quality control (QC) samples were collected and analysed as summarised in Table 4.2:

– Field triplicates – three separate samples collected at the same location to determine the variability of the sediment physical and chemical characteristics. One of the samples was also sent to the secondary laboratory for analysis, to assess laboratory variation.
– Split triplicates – samples thoroughly mixed then split into three containers to assess laboratory methodology variation. One of the three samples was also sent to the secondary laboratory for analysis, to assess laboratory variation.

Table 4.2 QC sample analytical program

Sample type	Sample ID	Parent sample	Laboratory	Analysis
Field triplicate	FD04		ALS	TBT, heavy metals, PAH, TRH, BTEX, OCP, PCB, TOC
	FD05		ALS	
			Eurofins	TBT, heavy metals, PAH, TRH, OCP, PCB, TOC
	FD06		ALS	TBT, heavy metals, PAH, TRH, BTEX, OCP, PCB, TOC
	FD07		ALS	
			Eurofins	TBT, heavy metals, PAH, TRH, OCP, PCB, TOC
Split triplicate	FD08		ALS	TBT, heavy metals, PAH, TRH, BTEX, OCP, PCB, TOC
	FD09		ALS	
			Eurofins	TBT, heavy metals, PAH, TRH, OCP, PCB, TOC
	FD10		ALS	TBT, heavy metals, PAH, TRH, BTEX, OCP, PCB, TOC
	FD11		ALS	
			Eurofins	TBT, heavy metals, PAH, TRH, OCP, PCB, TOC

Field duplicates (two samples collected at the same location) (FD01 to FD03) were also collected at one location (SD01) but were not analysed.

4.4 Quality assurance and control

Details (including results and discussion) regarding quality assurance (QA) and quality control (QC) are presented in Appendix D.

5. Results and discussion

5.1 Field observations

Sediments collected from the harbour were relatively homogenous and can be described as dark grey sand to sandy gravel to approximately one metre depth where refusal occurred within more clayey sediment. Sediment from SD08 had more fines than at other locations sampled, which gave a “spongy” texture to this sediment. Some sulfur odours were noted at SD02. The locations of samples are shown on Figure 1 in Appendix A.

Field notes are provided in Appendix B.

5.2 Sediment analytical results

The sediment analytical results are presented in Tables 1 to 7 in Appendix C.

Laboratory documents are provided in Appendix E.

5.2.1 Physical parameters

Results from the bulk density and PSD testing indicated:

– The bulk density of sediment ranged from 1.02 to 1.65 g/cm^3.
– Sediments at SD01 to SD07 were 83% to 96% sand and 1% to 8% of both silt and clay.
– Sediment at SD08 was 72% to 75% sand, 17%-20% silt and the remaining 7% to 8% clay.

5.2.2 Human health assessment criteria

Reported concentrations of COPC in sediment samples were below the adopted health-based (soil) assessment criteria for public open space land use (e.g. HIL-C and HSL-C) for potential exposure pathways including vapour inhalation and/or direct contact, as presented in the NEPM (2013). Given these results it is unlikely that the dredged spoil would present a human health risk under the proposed land-based disposal options.

It is important to note that the adopted assessment criteria are applicable for soil and not sediment but have been applied to assess potential risks to human health during spoil disposal activities.

5.2.3 Ecological assessment criteria

Reported concentrations of COPC in sediment samples were below the adopted ecological (soil) assessment criteria for public open space land use (EIL-C and ESL-C) as presented in the NEPM (2013), with the exception of those summarised in Table 5.1.

Table 5.1 NEPM ecological assessment criteria exceedances

Field ID	Location	Analyte	Result	Assessment criteria source	Assessment criteria value
SD08_0.0-0.5	Near the slipway	Copper	102 mg/kg	NEPM (2013) EIL C	60 mg/kg
SD08_0.5-1.0			85.2 mg/kg		

The exceedances of copper are considered relatively marginal, given:

– The exceeding concentrations were less than 250% of the EIL.
– The calculated 95% UCL (Chebyshev method) of 36.1 mg/kg for copper, was less than the EIL.
– The standard deviation for copper results was calculated at 24.8 mg/kg which is less than 50% of the EIL.

Given these results it is unlikely that the dredged spoil would present an ecological risk under the proposed land-based disposal options.

It is important to note that the adopted assessment criteria are applicable for soil (and not sediment) but have been applied to assess potential risks to ecological health from spoil disposal activities. Note also, the NEPM does not provide an investigation level for TBT. However, elevated TBT could pose a risk for land-based disposal as it could migrate into aquatic habitats from the disposal site.

5.2.4 Management limits

None of the analytical results for the sediment samples contained COPC at concentrations that exceed the NEPM Management Limits. Given these results it is unlikely that the dredged spoil would present a hydrocarbon management risk under the proposed land-based disposal options.

5.2.5 ANZG assessment criteria

Reported concentrations of COPC in sediment samples were below the sediment toxicant guideline values presented in ANZG (2018), with the exception of those samples summarised in Table 5.2.

Table 5.2 ANZG assessment criteria exceedances

Field ID	Analyte	Result	Assessment criteria source	Assessment criteria value
SD08_0.0-0.5	Copper	102 mg/kg	ANZG (2018) DGV	65 mg/kg
SD08_0.5-1.0		85.2 mg/kg		
SD08_0.5-1.0	Tributyltin (TBT)	0.0362 mg/kg		0.009 mg/kg
SD08_0.5-1.0		0.0954 mg/kg	ANZG (2018) GV-high	0.07 mg/kg

The exceedances of copper are considered relatively marginal, given:

– The exceeding concentrations were less than 250% of the DGV.
– The calculated 95% UCL (Chebyshev method) of 36.1 mg/kg for copper was less than the DGV.
– The standard deviation for copper results was calculated at 24.8 mg/kg which is less than 50% of the DGV.

The TBT exceedances could present an unacceptable risk to aquatic ecosystems as:

– The exceeding concentrations exceeded 250% of the DGV or GV-high.
– The calculated 95% UCL (Chebyshev method) of 0.0234 mg/kg for TBT exceeded the DGV.
– The standard deviation for TBT results was calculated at 0.0194 mg/kg which exceeds 50% of the DGV.

SD08 is located in the vicinity of the slipway, hence elevated contaminant concentrations are not unexpected. As noted by TfNSW, this area was proposed to be excluded from the proposed dredging works. Further investigations (sampling) should be undertaken in order to delineate the extent of contamination (to be avoided), or else, a dredge exclusion zone adopted based on a radius centred at the slipway foreshore out to SD07 (approximately 45 m) assuming that the contamination is sourced from the slipway and would decrease in concentration with distance from the source.

5.2.6 ASS testing

Results from the ASS field screening showed:

– Values for pH_F were slightly alkaline ranging from 8.5 to 9.0.
– Values for pH_{Fox} were near neutral ranging from 6.6 to 6.8.
– The ΔpH, defined as pH_F minus pH_{Fox}, ranged from 1.90 to 2.20.

As a result of this change in pH, CRS ASS suite analysis was undertaken on 10 selected samples. With results as follows:

– Net acidity [excluding acid neutralising capacity (ANC)] for all 10 samples exceeded the action criteria of 18 mol H+/t or 0.03%S. However, the testing indicated that the sediment currently has sufficient ANC to neutralise all the acidity that could be produced from the oxidation of these sediments (i.e. the net acidity including ANC was reported below the LOR).

The ANC was corroborated by 'Chip Tray Incubation' carried out by ALS, with incubated pH values ranging between 7.0 and 7.2 at nine weeks. Therefore, the results for net acidity including ANC are considered representative of the sediment if exposed and subject to oxidation. As such, the applicable results are below the action criteria and an ASS Management Plan (ASSMP) is not required for dredging and disposal activities.

5.2.7 Preliminary waste classification

A preliminary waste classification, based on the limited sampling undertaken, was carried out using the analytical results from this assessment. It is important to note that the waste classification is indicative only and additional confirmation sampling may be required for off-site disposal to satisfy either state regulatory requirements or landfill acceptance criteria.

If it is necessary to dispose spoil to a waste facility, the reported concentrations indicate that the spoil would likely be classified as General Solid Waste (with the exception of sediments in the vicinity of SD08 / the slipway, which would likely be classified as Hazardous Waste).

6. Conclusions and recommendations

Based on the scope of work summarised in Section 1.3 and subject to the limitations set out in Section 8, and with consideration of the objectives of the assessment (as outlined in Section 1.2):

– Results from the assessment indicate that most of the sediments to be dredged do not pose a risk to human health or the environment from a contamination perspective (with the exception of TBT contamination identified at SD08). As such, they are likely to be suitable for land-based reuse/placement, offshore placement and off-site disposal, subject to appropriate management and handling measures. Further sampling and analysis would be required to assess the nature and extent of tributyltin contamination at SD08 to determine suitable disposal options for dredge spoil from this area (in the vicinity of the slipway).
– The sediment was found to contain ASS, however ANC incubation testing corroborated that the sediment contains the capacity to neutralise acidity produced through oxidation of this material.
– The reported concentrations indicate that the spoil would likely be classified as General Solid Waste (with the exception of sediments in the vicinity of SD08 / the slipway, which would likely be classified as Hazardous Waste). It is important to note that the waste classification is indicative only and additional confirmation sampling may be required for off- site disposal to satisfy either state regulatory requirements or landfill acceptance criteria.

7. References

ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia

ASSMAC (1998) NSW Acid Sulfate Soils Manual

CRC CARE (2017) Technical Report No. 39, Risk-based management and remediation guidance for benzo(a)pyrene. CRC for Contamination Assessment and Remediation of the Environment, January 2017.

DAWR (2018) National Acid Sulfate Soils Guidance

DEWHA (2009) National Assessment Guidelines for Dredging

Friebel, E and Nadebaum, P (2011). Health screening levels for petroleum hydrocarbons in soil and groundwater. CRC CARE Technical Report no. 10. CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia, 2011.

GHD (2021a) Review of Environmental Factors, Crowdy Head Harbour Upgrade. GHD Pty Ltd, December 2021 (DRAFT).

GHD (2021b) Preliminary Site (Contamination) Investigation, Crowdy Head Harbour Upgrade. GHD Pty Ltd, December 2021 (DRAFT).

NEPC (2013). National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999. National Environment Protection Council, as amended in May 2013.

NSW EPA (2014). Waste Classification Guidelines, Part 1: Classifying Waste. November 2014.

NSW EPA (2021). Guidelines for Consultants Reporting on Contaminated sites.

8. Limitations

This report has been prepared by GHD for the Transport for NSW (TfNSW) for the purpose as stated in Section 1 of this report.

GHD otherwise disclaims responsibility to any person other than TfNSW arising from or in connection with this report.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the Report are excluded unless they are expressly stated to apply in this Report.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking the services mentioned above and preparing the Report ("Assumptions"), as specified throughout this Report.

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The opinions, conclusions and any recommendations in this Report are based on information obtained from, and testing undertaken at or in connection with, specific sampling points and may not fully represent the conditions that may be encountered across the site at other than these locations. Site conditions at other parts of the site may be different from the site conditions found at the specific sampling points.

These Disclaimers should be read in conjunction with the entire Report and no excerpts are taken to be representative of the findings of this Report.

Appendices

Appendix A

Figure



Paper Size ISO A4

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Transport for NSW
Crowdy Head Harbour Upgrade
Sediment Contamination and Waste Assessment

Project No. **12554729**
Revision No. **0**
Date **26/04/2022**

Sampling locations

FIGURE 1

N:\AU\Sydney\Projects\21\12554729\GIS\Maps\ContamAssessment_0.aprx
Print date: 26 Apr 2022 - 12:56

Data source: LPI: DCDB, DTDB, 2017. MetroMap: Aerial imagery, 15/10/2021. .
Created by: tmorton

Appendix B

Field notes

GHD CLIENTS|PEOPLE|PERFORMANCE

CALCULATIONS

Client		Job no.	Sheet of
Project		Calcs by	Date
Subject		Checked by	Date

SD06, 8:00 — Practical refusal @ 1.2m, Thin grey/brown layer dark grey SAND, F-M grain ~~grading paler w/ depth~~. Samples 0.0-0.5, 0.5-1.0, Photo/samples wrong way - 0.0-0.5 = 0.5-1.0

SD01, 9:00 — Practical refusal @ 1.6, As above. Samples 0.0-0.5 (FD01), 0.5-1.0 (FD02), 1.0-1.5 (FD03)

SD03, ~~10:00~~ — DTB ~2.7m, Practical refusal @ 1.0m, grey brown ~0.2m Dark grey/black to extent. Samples 0.0-0.5, 0.5-1.0

SD04, 10:45 — DTB ~ 2.7m, Practical refusal @ 1.0m, as above. Triplicate individuals 0.0-0.5 (FD04+FD05) 1.0-1.5 (FD06 + FD07)

SD07, 11:45 — DTB ~ 2.4, Practical refusal @ 1.3m, 0.9 to Dark grey/black ~~as above~~ as ~~except~~ ~0.2m sandy GRAVEL (F) ~~instead of the~~ above ~~grey/brown sand~~ at bottom (no grey/brown) Samples 0.0-0.5, 0.5-1.0, 1.0-1.3 (0.8-1.0)

SD02, 13:00 — DTB ~~2.8~~ ~3.2, Practical refusal @ 0.8-1.0, Black ~~grading~~ to dark grey. SAND (F). Clay to 0.2m Sulfur odour. Clayey to extent.

SD08, 13:40 — DTB ~2.0m, Practical refusal @ 1.0m. CLAY, w/ some sand (F). High P, 'Spongy', dark grey [NO PHOTOS?]

~~SD09~~ SD05, 14:05 — DTB ~1.8m, Practical refusal @ 1.1m. Dark grey SAND as prev. 'Homogenised triplicate 0.0-0.5 (FD08 FD09) 0.5-1.0 (FD10 + FD11).

Appendix C

Analytical results summary tables

						Inorganics	Particle Size Analysis																Soil Bulk Density
						Moisture (%)	Cobbles (>6cm)	Gravel (>2mm)	Sand (0.06-2.00 mm)	Silt (2-60 µm)	Clay (<2 µm)	+75µm	+150µm	+300µm	+425µm	+600µm	+1180µm	+2.36mm	+4.75mm	+9.5mm	+19.0mm	+37.5mm	+75.0mm	Bulk density*
						%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	G/CM3
LOR						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.001
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																		
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	26.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	28.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	34.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	45.2	<1	1	83	8	8	82	39	4	2	2	1	<1	<1	<1	<1	<1	<1	1.02
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	32.1	<1	<1	85	9	6	84	43	4	2	1	<1	<1	<1	<1	<1	<1	<1	1.2
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	28.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	25.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	25.2	<1	<1	96	3	1	95	64	3	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.54
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	29.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	26.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	25.8	<1	<1	93	3	4	92	60	4	2	1	<1	<1	<1	<1	<1	<1	<1	1.43
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	29.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	28.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	25.4	<1	1	93	2	4	93	59	8	3	2	1	<1	<1	<1	<1	<1	<1	1.65
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	29.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	23.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	23.8	<1	2	91	3	4	92	64	11	6	4	3	2	<1	<1	<1	<1	<1	1.48
		FD10	0.5 - 1	Field_D	EB2130323	28.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD11	0.5 - 1	Field_D	EB2130323	27.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	24.8	<1	<1	95	3	2	94	61	4	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.38
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	26.2	<1	1	91	4	4	91	48	6	3	2	2	1	1	<1	<1	<1	<1	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	29.7	<1	1	85	8	6	85	42	11	6	4	1	<1	<1	<1	<1	<1	<1	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	29.3	<1	1	85	6	8	85	43	12	7	4	2	1	<1	<1	<1	<1	<1	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	20.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	35.4	<1	<1	75	17	8	73	31	6	3	2	<1	<1	<1	<1	<1	<1	<1	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	36.6	<1	1	72	20	7	71	34	8	3	2	2	<1	<1	<1	<1	<1	<1	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

						Organic Indicators	Metals										
						Total Organic Carbon	Aluminium	Antimony	Arsenic	Cadmium	Chromium (III+ VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury
						%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR						0.02	50	0.5	1	0.1	1	0.5	1	50	1	10	0.01
CRC CARE 2011 Soil Direct Contact Intrusive Works																	
CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to < 2m,Sand																	
NEPM 2013 Table 1A(1) HIL C Rec									300[#5]	90	300[#6]	300	17,000		600[#3]	19,000	80[#4]
NEPM 2013 Table 1A(3) HSL C Rec Soil for Vapour Intrusion, Sand																	
> = 0m, < 1m																	
> = 1m, < 2m																	
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**												
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	0.25	1,340	< 0.50	5.90	< 0.1	5.7	1.2	1.4	3,540	1.3	53	< 0.01
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	0.36	1,680	< 0.50	5.26	< 0.1	6.6	1.4	2.6	4,070	1.7	62	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	0.46	1,790	< 0.50	4.64	< 0.1	6.4	1.4	3.1	4,280	1.9	69	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	0.85	2,660	< 0.50	6.58	< 0.1	8.9	2.1	9.2	6,220	3.3	75	0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	0.70	2,130	< 0.50	5.30	< 0.1	7.2	1.6	7.4	5,020	2.6	59	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	0.27	1,110	< 0.50	5.14	< 0.1	4.1	1.0	1.8	3,120	1.1	40	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	0.16	1,080	< 0.50	4.69	< 0.1	3.9	0.9	2.0	2,860	1.1	34	< 0.01
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	0.24	1,380	< 0.50	5.10	< 0.1	5.8	1.1	3.3	3,540	1.5	44	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	0.32	1,460	< 0.50	5.01	< 0.1	4.7	1.2	3.9	3,720	1.8	44	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	0.26	1,360	< 0.50	4.90	< 0.1	4.6	1.1	3.2	3,580	1.6	42	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	0.23	1,260	< 0.50	4.59	< 0.1	4.2	1.0	3.4	3,250	1.6	40	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	0.22	1,450	< 0.50	4.80	< 0.1	5.2	1.1	4.6	3,500	2.0	47	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	0.27	1,150	< 0.50	3.47	< 0.1	3.6	0.8	3.3	2,910	1.4	32	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	0.31	1,470	< 0.50	4.34	< 0.1	5.0	1.1	6.4	3,550	2.4	38	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	0.33	1,530	< 0.50	4.99	< 0.1	5.4	1.2	6.3	3,750	2.5	41	0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	0.32	1,290	< 0.50	5.51	< 0.1	6.3	1.3	7.0	3,280	3.1	45	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	0.31	1,610	< 0.50	4.95	< 0.1	5.4	1.2	39.0	3,920	3.3	41	0.01
		FD10	0.5 - 1	Field_D	EB2130323	0.34	1,740	< 0.50	6.24	< 0.1	5.6	1.2	10.0	4,340	4.4	43	0.01
		FD11	0.5 - 1	Field_D	EB2130323	0.35	1,610	< 0.50	4.67	< 0.1	5.7	1.2	9.2	3,840	3.9	40	0.01
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	0.25	1,400	< 0.50	4.91	< 0.1	4.6	1.1	4.2	3,630	2.1	44	0.05
						-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	0.37	1,740	< 0.50	5.06	< 0.1	6.2	1.3	8.2	4,160	2.9	50	0.01
						-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	0.54	2,210	< 0.50	5.09	< 0.1	7.0	1.5	20.6	5,180	4.3	47	0.02
						-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	0.57	2,540	< 0.50	6.23	< 0.1	7.8	1.6	24.4	5,780	4.8	50	0.02
						-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	0.45	2,020	< 0.50	6.35	< 0.1	5.7	1.4	16.6	6,090	4.4	46	0.02
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	0.84	3,220	< 0.50	6.59	0.2	10.0	1.8	102	7,280	13.0	53	0.06
						-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	1.30	4,580	< 0.50	7.56	0.2	10.8	2.2	85.2	9,840	20.1	64	0.08
						-	-	-	-	-	-	-	-	-	-	-	-

Comments

#1 Not limiting: Derived soil HSL exceeds soil saturation concentration

#2 PCBs: HIL refers to non-dioxin like PCBs only. Where PCB source is known, or suspected at a site, a site-specific assessment of exposure to all PCBs (inc dioxin like PCBs) should be undertaken

#3 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be considered where appropriate.

#4 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be present.

#5 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Shedule B7).

#6 In the absence of a guideline value for total chromium, chromium VI value adopted

#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its BaP TEF (ref Table 1A(1)) & summing

#8 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) & naphthalene (should meet relevant HSL)

							Metals					Organo Metals	BTEXN								TRH - NEPM 2013						
							Nickel	Selenium	Silver	Vanadium	Zinc	Tributyltin	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX (Sum of Total) - Lab Calc	Naphthalene	F1 (C6-C10 minus BTEX)	C6-C10 Fraction	F2 (> C10-C16 minus Naphthalene)	> C10-C16 Fraction	F3 (> C16-C34 Fraction)	F4 (> C34-C40 Fraction)	
							mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
LOR							1	0.1	0.1	2	1	0.0005	0.2	0.2	0.2	0.2	0.2	0.5	0.2	0.005	3	3	3	3	3	5	
CRC CARE 2011 Soil Direct Contact Intrusive Works													1,100	120,000	85,000			130,000		29,000	82,000		62,000		85,000	120,000	
CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to < 2m,Sand													77	999,999#1	999,999#1			999,999#1		999,999#1	999,999#1		999,999#1				
NEPM 2013 Table 1A(1) HIL C Rec							1,200	700			30,000																
NEPM 2013 Table 1A(3) HSL C Rec Soil for Vapour Intrusion, Sand																											
> = 0m, < 1m													999,999#1	999,999#1	999,999#1			999,999#1		999,999#1	999,999#1		999,999#1				
> = 1m, < 2m													999,999#1	999,999#1	999,999#1			999,999#1		999,999#1	999,999#1		999,999#1				
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																						
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323		2.8	0.1	< 0.1	7.4	8.3	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	< 3	< 5	
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323		3.3	0.1	< 0.1	8.8	12.3	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	4	4	15	< 5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.018	-	-	-	-	-	-	
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323		3.0	0.4	< 0.1	8.7	12.6	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	12	< 5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.011	-	-	-	-	-	-	
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323		4.8	0.3	< 0.1	11.8	24.8	0.0012	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	7	7	58	16	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.019	-	-	-	-	-	-	
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323		3.8	0.3	< 0.1	9.4	19.4	0.0006	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	4	4	29	9	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.015	-	-	-	-	-	-	
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323		1.9	0.2	< 0.1	6.3	7.5	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	13	< 5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.009	-	-	-	-	-	-	
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323		1.9	< 0.1	< 0.1	5.4	7.8	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	3	< 5	
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323		2.8	0.1	< 0.1	7.0	12.2	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	14	< 5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	
		FD04	0 - 0.5	Field_D	EB2130323		2.3	0.1	< 0.1	7.2	12.9	0.0016	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	3	3	18	5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.013	-	-	-	-	-	-	
		FD05	0 - 0.5	Field_D	EB2130323		2.3	0.2	< 0.1	6.6	11.4	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	15	< 5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.008	-	-	-	-	-	-	
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323		1.9	0.1	< 0.1	6.7	11.6	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	10	< 5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.007	-	-	-	-	-	-	
		FD06	0.5 - 1	Field_D	EB2130323		2.4	0.2	< 0.1	7.3	14.9	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	8	< 5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	
		FD07	0.5 - 1	Field_D	EB2130323		1.8	0.1	< 0.1	5.4	10.6	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	< 3	< 5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.005	-	-	-	-	-	-	
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323		2.4	0.2	< 0.1	6.6	20.1	0.0008	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	9	< 5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.011	-	-	-	-	-	-	
		FD08	0 - 0.5	Field_D	EB2130323		2.7	0.2	< 0.1	6.8	20.2	0.0008	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	< 3	< 5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.009	-	-	-	-	-	-	
		FD09	0 - 0.5	Field_D	EB2130323		3.2	0.2	< 0.1	7.6	24.4	0.0008	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	11	< 5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.008	-	-	-	-	-	-	
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323		2.7	0.1	< 0.1	7.5	32.8	0.0006	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	18	< 5	
		FD10	0.5 - 1	Field_D	EB2130323		2.8	0.2	< 0.1	7.9	26.9	0.0017	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	17	< 5	
		FD11	0.5 - 1	Field_D	EB2130323		2.9	0.2	< 0.1	7.3	25.7	0.0012	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	16	< 5	
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323		2.2	0.1	< 0.1	6.9	20.0	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	3	3	22	6	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323		2.9	< 0.1	< 0.1	8.1	25.9	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	17	5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323		3.6	0.3	< 0.1	8.5	37.8	0.0036	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	3	3	22	6	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.013	-	-	-	-	-	-	
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323		3.9	0.3	< 0.1	9.4	43.1	0.0020	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	16	< 5	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323		3.2	0.2	< 0.1	8.5	36.2	0.0030	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	3	3	22	6	
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323		4.9	0.3	< 0.1	11.9	96.6	0.0304	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	5	5	45	10	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.018	-	-	-	-	-	-	
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323		5.6	0.4	< 0.1	15.7	108	0.124	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	13	13	85	20	
							-	-	-	-	-	-	-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	

Comments

#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 PCBs: HIL refers to non-dioxin like PCBs only. Where PCB source is known, or suspected at a site, a site-specific assessment of exposure to all
#3 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioava
#4 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, c
#5 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Shedule B7).
#6 In the absence of a guideline value for total chromium, chromium VI value adopted
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by it
#8 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL

						> C10-C40 (Sum of Total)
						mg/kg
LOR						3
CRC CARE 2011 Soil Direct Contact Intrusive Works						
CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to < 2m,Sand						
NEPM 2013 Table 1A(1) HIL C Rec						
NEPM 2013 Table 1A(3) HSL C Rec Soil for Vapour Intrusion, Sand						
> = 0m, < 1m						
> = 1m, < 2m						
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**	
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	19
						-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	12
						-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	81
						-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	42
						-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	13
						-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	3
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	14
						-
		FD04	0 - 0.5	Field_D	EB2130323	26
						-
		FD05	0 - 0.5	Field_D	EB2130323	15
						-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	10
						-
		FD06	0.5 - 1	Field_D	EB2130323	8
						-
		FD07	0.5 - 1	Field_D	EB2130323	< 3
						-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	9
						-
		FD08	0 - 0.5	Field_D	EB2130323	< 3
						-
		FD09	0 - 0.5	Field_D	EB2130323	11
						-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	18
		FD10	0.5 - 1	Field_D	EB2130323	17
		FD11	0.5 - 1	Field_D	EB2130323	16
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	31
						-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	22
						-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	31
						-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	16
						-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	31
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	60
						-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	118
						-

Comments

#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 PCBs: HIL refers to non-dioxin like PCBs only. Where PCB source is known, or suspected at a site, a site-specific assessment of exposure to all
#3 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioava
#4 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, c
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#6 In the absence of a guideline value for total chromium, chromium VI value adopted
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by it
#8 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL

						TRH - NEPM 1999					PAHs - standard 16															
						C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 (Sum of Total)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo[b+j]fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	PAHs (Sum of total) - Lab calc	Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ) (half LOR) - Lab Calc
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR						3	3	3	5	3	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
CRC CARE 2011 Soil Direct Contact Intrusive Works																												
CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to < 2m,Sand																												
NEPM 2013 Table 1A(1) HIL C Rec																										300[#8]	3[#7]	3[#7]
NEPM 2013 Table 1A(3) HSL C Rec Soil for Vapour Intrusion, Sand																												
> = 0m, < 1m																												
> = 1m, < 2m																												
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																							
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	< 3	< 3	< 5	< 3	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	3	11	7	21	< 0.004	< 0.004	< 0.004	0.012	0.012	0.011	0.01	0.008	0.015	< 0.004	0.022	< 0.004	0.007	0.014	0.021	0.164	0.016	0.018
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	< 3	< 3	9	5	14	< 0.004	< 0.004	< 0.004	0.01	0.01	0.011	0.008	0.007	0.013	< 0.004	0.02	< 0.004	0.006	0.012	0.019	0.139	0.014	0.016
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	6	33	34	73	< 0.004	< 0.004	0.006	0.018	0.013	0.015	0.011	0.008	0.043	< 0.004	0.035	0.005	0.008	0.019	0.03	0.245	0.019	0.021
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	3	19	15	37	0.006	0.008	0.019	0.052	0.048	0.048	0.032	0.032	0.051	0.009	0.117	0.009	0.027	0.068	0.096	0.694	0.074	0.074
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	< 3	9	6	15	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.009	< 0.004	0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	< 3	< 3	< 5	< 3	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	< 3	10	7	17	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.006	0.018	< 0.004	0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	< 3	3	13	8	24	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	0.007	< 0.004	< 0.004	< 0.004	0.007	0.032	< 0.004	0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	< 3	3	11	7	21	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.004	0.012	< 0.004	0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	< 3	7	< 5	7	< 0.004	< 0.004	< 0.004	0.005	0.005	0.005	< 0.004	< 0.004	0.005	< 0.004	0.008	< 0.004	< 0.004	0.005	0.008	0.048	0.006	0.008
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	< 3	< 3	6	< 5	6	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	< 0.004	0.004	0.006	0.021	< 0.004	0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	< 3	< 3	< 3	< 5	< 3	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	< 3	6	< 5	6	< 0.004	< 0.004	< 0.004	0.005	0.006	0.005	0.004	0.004	0.01	< 0.004	0.009	< 0.004	0.004	0.006	0.009	0.077	0.008	0.01
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	< 3	< 3	< 3	< 5	< 3	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.004	< 0.004	< 0.004	0.005	< 0.004	0.008	< 0.004	< 0.004	0.008	0.008	0.042	< 0.004	0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	< 3	< 3	7	6	13	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.006	< 0.004	< 0.004	0.005	0.005	0.024	< 0.004	0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	< 3	12	8	20	< 0.004	< 0.004	< 0.004	0.005	0.006	0.005	< 0.004	0.005	0.006	< 0.004	0.012	< 0.004	0.005	0.009	0.012	0.069	0.008	0.01
		FD10	0.5 - 1	Field_D	EB2130323	< 3	< 3	10	9	19	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	< 0.004	0.004	0.006	0.019	< 0.004	0.005
		FD11	0.5 - 1	Field_D	EB2130323	< 3	< 3	9	9	18	< 0.004	< 0.004	< 0.004	0.005	0.006	0.006	0.005	0.005	0.006	< 0.004	0.012	< 0.004	0.004	0.006	0.011	0.07	0.008	0.01
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	3	15	11	29	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.012	< 0.004	0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	< 3	11	9	20	< 0.004	< 0.004	< 0.004	0.007	0.007	0.007	0.005	0.006	0.013	< 0.004	0.013	< 0.004	0.005	0.007	0.014	0.096	0.01	0.012
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	3	15	11	29	0.005	< 0.004	0.004	0.013	0.014	0.025	0.013	0.011	0.024	0.005	0.028	0.005	0.012	0.015	0.027	0.234	0.026	0.026
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	< 3	11	8	19	< 0.004	0.004	< 0.004	0.008	0.009	0.008	0.007	0.008	0.009	< 0.004	0.015	< 0.004	0.007	0.012	0.016	0.119	0.012	0.014
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	< 3	< 3	15	12	27	< 0.004	< 0.004	< 0.004	0.009	0.011	0.012	0.007	0.008	0.012	< 0.004	0.016	< 0.004	0.007	0.011	0.014	0.115	0.015	0.017
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	4	34	18	56	0.022	0.013	0.013	0.063	0.079	0.072	0.054	0.052	0.105	0.027	0.116	0.019	0.057	0.069	0.103	0.976	0.132	0.132
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	6	67	35	108	0.007	0.021	0.02	0.031	0.054	0.05	0.03	0.04	0.032	0.018	0.058	0.014	0.04	0.033	0.065	0.595	0.088	0.088
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Comments

#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 PCBs: HIL refers to non-dioxin like PCBs only. Where PCB source is known, or suspected at a site, a site-specific assessment of exposure to all
#3 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioava
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#8 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL

							PAHs - extended			OC Pesticides																
						Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc	2-methylnaphthalene	Benzo(e)pyrene	Perylene	4,4'-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	Chlordane (cis)	Chlordane (trans)	d-BHC	4,4 DDD	4,4 DDT	DDT+ DDE+ DDD - Lab Calc	Dieldrin	Endosulfan	Endosulfan I (alpha)	Endosulfan II (beta)	Endosulfan Sulfate	Endrin	Endrin aldehyde
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR						0.004	0.005	0.004	0.004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.5	0.0005	0.0005	0.0005	0.0005	0.0005
CRC CARE 2011 Soil Direct Contact Intrusive Works																												
CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to < 2m,Sand																												
NEPM 2013 Table 1A(1) HIL C Rec						3[#7]							10		70						400		340,000				20	
NEPM 2013 Table 1A(3) HSL C Rec Soil for Vapour Intrusion, Sand																												
> = 0m, < 1m																												
> = 1m, < 2m																												
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																							
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	0.01	< 0.005	< 0.004	< 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	0.02	< 0.005	0.009	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	0.018	< 0.005	0.008	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	0.023	< 0.005	0.01	0.005	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	0.074	< 0.005	0.032	0.016	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	0.01	< 0.005	< 0.004	< 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	0.01	< 0.005	< 0.004	< 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	0.01	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	0.01	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	0.01	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	0.011	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	0.01	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	0.01	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	0.012	< 0.005	0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	0.01	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	0.01	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	0.012	< 0.005	0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
		FD10	0.5 - 1	Field_D	EB2130323	0.01	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
		FD11	0.5 - 1	Field_D	EB2130323	0.012	< 0.005	0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	0.01	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	0.014	< 0.005	0.006	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	0.026	< 0.005	0.015	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	0.016	< 0.005	0.006	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	0.019	< 0.005	0.008	< 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	0.132	< 0.005	0.05	0.023	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	0.088	< 0.005	0.033	0.019	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Comments

#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 PCBs: HIL refers to non-dioxin like PCBs only. Where PCB source is known, or suspected at a site, a site-specific assessment of exposure to all
#3 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioava
#4 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, c
#5 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Shedule B7).
#6 In the absence of a guideline value for total chromium, chromium VI value adopted
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by it
#8 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL

						Organic Indicators	Metals										
						Total Organic Carbon	Aluminium	Antimony	Arsenic	Cadmium	Chromium (III+ VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury
						%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR						0.02	50	0.5	1	0.1	1	0.5	1	50	1	10	0.01
NEPM 2013 EIL-Urban Residential- Public Open Space									100		190#1		60#1		1,100		
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil																	
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																	
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**												
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	0.25	1,340	< 0.50	5.90	< 0.1	5.7	1.2	1.4	3,540	1.3	53	< 0.01
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	0.36	1,680	< 0.50	5.26	< 0.1	6.6	1.4	2.6	4,070	1.7	62	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	0.46	1,790	< 0.50	4.64	< 0.1	6.4	1.4	3.1	4,280	1.9	69	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	0.85	2,660	< 0.50	6.58	< 0.1	8.9	2.1	9.2	6,220	3.3	75	0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	0.70	2,130	< 0.50	5.30	< 0.1	7.2	1.6	7.4	5,020	2.6	59	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	0.27	1,110	< 0.50	5.14	< 0.1	4.1	1.0	1.8	3,120	1.1	40	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	0.16	1,080	< 0.50	4.69	< 0.1	3.9	0.9	2.0	2,860	1.1	34	< 0.01
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	0.24	1,380	< 0.50	5.10	< 0.1	5.8	1.1	3.3	3,540	1.5	44	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	0.32	1,460	< 0.50	5.01	< 0.1	4.7	1.2	3.9	3,720	1.8	44	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	0.26	1,360	< 0.50	4.90	< 0.1	4.6	1.1	3.2	3,580	1.6	42	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	0.23	1,260	< 0.50	4.59	< 0.1	4.2	1.0	3.4	3,250	1.6	40	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	0.22	1,450	< 0.50	4.80	< 0.1	5.2	1.1	4.6	3,500	2.0	47	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	0.27	1,150	< 0.50	3.47	< 0.1	3.6	0.8	3.3	2,910	1.4	32	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	0.31	1,470	< 0.50	4.34	< 0.1	5.0	1.1	6.4	3,550	2.4	38	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	0.33	1,530	< 0.50	4.99	< 0.1	5.4	1.2	6.3	3,750	2.5	41	0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	0.32	1,290	< 0.50	5.51	< 0.1	6.3	1.3	7.0	3,280	3.1	45	< 0.01
						-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	0.31	1,610	< 0.50	4.95	< 0.1	5.4	1.2	39.0	3,920	3.3	41	0.01
		FD10	0.5 - 1	Field_D	EB2130323	0.34	1,740	< 0.50	6.24	< 0.1	5.6	1.2	10.0	4,340	4.4	43	0.01
		FD11	0.5 - 1	Field_D	EB2130323	0.35	1,610	< 0.50	4.67	< 0.1	5.7	1.2	9.2	3,840	3.9	40	0.01
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	0.25	1,400	< 0.50	4.91	< 0.1	4.6	1.1	4.2	3,630	2.1	44	0.05
						-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	0.37	1,740	< 0.50	5.06	< 0.1	6.2	1.3	8.2	4,160	2.9	50	0.01
						-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	0.54	2,210	< 0.50	5.09	< 0.1	7.0	1.5	20.6	5,180	4.3	47	0.02
						-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	0.57	2,540	< 0.50	6.23	< 0.1	7.8	1.6	24.4	5,780	4.8	50	0.02
						-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	0.45	2,020	< 0.50	6.35	< 0.1	5.7	1.4	16.6	6,090	4.4	46	0.02
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	0.84	3,220	< 0.50	6.59	0.2	10.0	1.8	102	7,280	13.0	53	0.06
						-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	1.30	4,580	< 0.50	7.56	0.2	10.8	2.2	85.2	9,840	20.1	64	0.08
						-	-	-	-	-	-	-	-	-	-	-	-

Comments
#1 Develop site specific based on CEC, pH, clay content, state and traffic volume
#2 Naphthalene should not be subtracted from >C10-C16 (as there is no separate ESL for naphthalene) (refer to Errata 30 April 2014)
#3 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#4 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2
#5 Benzo(a)pyrene value derived from CRC Care 2017

Appendix B Table 3 NEPM Ecological Assessment Criteria

	Metals					Organo Metals	BTEXN								TRH - NEPM 2013						
	Nickel	Selenium	Silver	Vanadium	Zinc	Tributyltin	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX (Sum of Total) - Lab Calc	Naphthalene	F1 (C6-C10 minus BTEX)	C6-C10 Fraction	F2 (> C10-C16 minus Naphthalene)	> C10-C16 Fraction	F3 (> C16-C34 Fraction)	F4 (> C34-C40 Fraction)	> C10-C40 (Sum of Total)
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR	1	0.1	0.1	2	1	0.0005	0.2	0.2	0.2	0.2	0.2	0.5	0.2	0.005	3	3	3	3	3	5	3
NEPM 2013 EIL-Urban Residential- Public Open Space	30[#1]				70[#1]									170							
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil							**50**	**85**	**70**			**105**			**180**[#3]			**120**[#2]	**300**	**2,800**	
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																700[#4]		1,000[#4]	2,500	10,000	

Location Code	Date	Field ID	Depth	Sample Type	Lab Report Number																	
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	2.8	0.1	< 0.1	7.4	8.3	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	< 3	< 5	< 3
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	3.3	0.1	< 0.1	8.8	12.3	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	4	4	15	< 5	19
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.018	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	3.0	0.4	< 0.1	8.7	12.6	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	12	< 5	12
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.011	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	4.8	0.3	< 0.1	11.8	24.8	0.0012	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	7	7	58	16	81
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.019	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	3.8	0.3	< 0.1	9.4	19.4	0.0006	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	4	4	29	9	42
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.015	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	1.9	0.2	< 0.1	6.3	7.5	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	13	< 5	13
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.009	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	1.9	< 0.1	< 0.1	5.4	7.8	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	3	< 5	3
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	2.8	0.1	< 0.1	7.0	12.2	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	14	< 5	14
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	2.3	0.1	< 0.1	7.2	12.9	0.0016	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	3	3	18	5	26
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.013	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	2.3	0.2	< 0.1	6.6	11.4	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	15	< 5	15
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.008	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	1.9	0.1	< 0.1	6.7	11.6	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	10	< 5	10
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.007	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	2.4	0.2	< 0.1	7.3	14.9	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	8	< 5	8
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	1.8	0.1	< 0.1	5.4	10.6	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	< 3	< 5	< 3
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.005	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	2.4	0.2	< 0.1	6.6	20.1	0.0008	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	9	< 5	9
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.011	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	2.7	0.2	< 0.1	6.8	20.2	0.0008	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	< 3	< 5	< 3
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.009	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	3.2	0.2	< 0.1	7.6	24.4	0.0008	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	11	< 5	11
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.008	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	2.7	0.1	< 0.1	7.5	32.8	0.0006	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	18	< 5	18
		FD10	0.5 - 1	Field_D	EB2130323	2.8	0.2	< 0.1	7.9	26.9	0.0017	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	17	< 5	17
		FD11	0.5 - 1	Field_D	EB2130323	2.9	0.2	< 0.1	7.3	25.7	0.0012	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	16	< 5	16
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	2.2	0.1	< 0.1	6.9	20.0	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	3	3	22	6	31
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	2.9	< 0.1	< 0.1	8.1	25.9	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	17	5	22
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	3.6	0.3	< 0.1	8.5	37.8	0.0036	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	3	3	22	6	31
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.013	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	3.9	0.3	< 0.1	9.4	43.1	0.0020	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	16	< 5	16
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	3.2	0.2	< 0.1	8.5	36.2	0.0030	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	3	3	22	6	31
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	4.9	0.3	< 0.1	11.9	96.6	0.0304	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	5	5	45	10	60
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.018	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	5.6	0.4	< 0.1	15.7	108	0.124	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	13	13	85	20	118
						-	-	-	-	-	-	-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	-

Comments
#1 Develop site specific based on CEC, pH, clay content, state and traffic volume
#2 Naphthalene should not be subtracted from >C10-C16 (as there is no separate ESL for naphthalene) (refer to Errata 30 April 2014)
#3 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#4 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F
#5 Benzo(a)pyrene value derived from CRC Care 2017

Appendix B Table 3 NEPM Ecological Assessment Criteria

	TRH - NEPM 1999					PAHs - standard 16																	
	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 (Sum of Total)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b+ j)fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	PAHs (Sum of total) - Lab calc	Total 8 PAHs (as BaP TEQ)zero LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ) (half LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR	3	3	3	5	3	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
NEPM 2013 EIL-Urban Residential- Public Open Space																								
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil										**33**[#5]														
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																								

Location Code	Date	Field ID	Depth	Sample Type	Lab Report Number																			
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	< 3	< 3	< 5	< 3	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	0.01
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	3	11	7	21	< 0.004	< 0.004	< 0.004	0.012	0.012	0.011	0.01	0.008	0.015	< 0.004	0.022	< 0.004	0.007	0.014	0.021	0.164	0.016	0.018	0.02
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	< 3	< 3	9	5	14	< 0.004	< 0.004	< 0.004	0.01	0.01	0.011	0.008	0.007	0.013	< 0.004	0.02	< 0.004	0.006	0.012	0.019	0.139	0.014	0.016	0.018
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	6	33	34	73	< 0.004	< 0.004	0.006	0.018	0.013	0.015	0.011	0.008	0.043	< 0.004	0.035	0.005	0.008	0.019	0.03	0.245	0.019	0.021	0.023
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	3	19	15	37	0.006	0.008	0.019	0.052	0.048	0.048	0.032	0.032	0.051	0.009	0.117	0.009	0.027	0.068	0.096	0.694	0.074	0.074	0.074
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	< 3	9	6	15	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.009	< 0.004	0.005	0.01
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	< 3	< 3	< 5	< 3	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	0.01
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	< 3	10	7	17	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.006	0.018	< 0.004	0.005	0.01
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	< 3	3	13	8	24	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	0.007	< 0.004	< 0.004	< 0.004	0.007	0.032	< 0.004	0.005	0.01
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	< 3	3	11	7	21	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.004	0.012	< 0.004	0.005	0.01
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	< 3	7	< 5	7	< 0.004	< 0.004	< 0.004	0.005	0.005	0.005	< 0.004	< 0.004	0.005	< 0.004	0.008	< 0.004	< 0.004	< 0.004	0.005	0.008	0.048	0.006	0.008	0.011
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	< 3	< 3	6	< 5	6	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	< 0.004	< 0.004	0.004	0.006	0.021	< 0.004	0.005	0.01
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	< 3	< 3	< 3	< 5	< 3	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	0.005	0.01
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	< 3	6	< 5	6	< 0.004	< 0.004	< 0.004	0.005	0.006	0.005	0.004	0.004	0.01	< 0.004	0.009	< 0.004	0.004	0.006	0.009	0.077	0.008	0.01	0.012
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	< 3	< 3	< 3	< 5	< 3	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.004	< 0.004	< 0.004	0.005	< 0.004	0.008	< 0.004	< 0.004	0.008	0.008	0.042	< 0.004	0.005	0.01
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	< 3	< 3	7	6	13	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.006	< 0.004	< 0.004	< 0.004	0.005	0.005	0.024	< 0.004	0.005	0.01
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	< 3	12	8	20	< 0.004	< 0.004	< 0.004	0.005	0.006	0.005	< 0.004	0.005	0.006	< 0.004	0.012	< 0.004	0.005	0.009	0.012	0.069	0.008	0.01	0.012
		FD10	0.5 - 1	Field_D	EB2130323	< 3	< 3	10	9	19	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	< 0.004	< 0.004	0.004	0.006	0.019	< 0.004	0.005	0.01
		FD11	0.5 - 1	Field_D	EB2130323	< 3	< 3	9	9	18	< 0.004	< 0.004	< 0.004	0.005	0.006	0.006	0.005	0.005	0.006	< 0.004	0.012	< 0.004	0.004	0.006	0.011	0.07	0.008	0.01	0.012
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	3	15	11	29	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.012	< 0.004	0.005	0.01
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	< 3	11	9	20	< 0.004	< 0.004	< 0.004	0.007	0.007	0.007	0.005	0.006	0.013	< 0.004	0.013	< 0.004	0.005	0.007	0.014	0.096	0.01	0.012	0.014
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	3	15	11	29	0.005	< 0.004	0.004	0.013	0.014	0.025	0.013	0.011	0.024	0.005	0.028	0.005	0.012	0.015	0.027	0.234	0.026	0.026	0.026
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	< 3	11	8	19	< 0.004	0.004	< 0.004	0.008	0.009	0.008	0.007	0.008	0.009	< 0.004	0.015	< 0.004	0.007	0.012	0.016	0.119	0.012	0.014	0.016
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	< 3	< 3	15	12	27	< 0.004	< 0.004	< 0.004	0.009	0.011	0.012	0.007	0.008	0.012	< 0.004	0.016	< 0.004	0.007	0.011	0.014	0.115	0.015	0.017	0.019
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	< 3	4	34	18	56	0.022	0.013	0.013	0.063	0.079	0.072	0.054	0.052	0.105	0.027	0.116	0.019	0.057	0.069	0.103	0.976	0.132	0.132	0.132
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	< 3	6	67	35	108	0.007	0.021	0.02	0.031	0.054	0.05	0.03	0.04	0.032	0.018	0.058	0.014	0.04	0.033	0.065	0.595	0.088	0.088	0.088
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Comments
#1 Develop site specific based on CEC, pH, clay content, state and traffic volume
#2 Naphthalene should not be subtracted from >C10-C16 (as there is no separate ESL for naphthalene) (refer to Errata 30 April 2014)
#3 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#4 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F
#5 Benzo(a)pyrene value derived from CRC Care 2017

						PAHs - extended			OC Pesticides																
						2-methylnaphthalene	Benzo(e)pyrene	Perylene	4,4'-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	Chlordane (cis)	Chlordane (trans)	d-BHC	4,4 DDD	4,4 DDT	DDT+ DDE+ DDD - Lab Calc	Dieldrin	Endosulfan	Endosulfan I (alpha)	Endosulfan II (beta)	Endosulfan Sulfate	Endrin	Endrin aldehyde
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR						0.005	0.004	0.004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.5	0.0005	0.0005	0.0005	0.0005	0.0005
NEPM 2013 EIL-Urban Residential- Public Open Space																			180	180							
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil																											
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																											
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																						
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.005	< 0.004	< 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.005	0.009	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	< 0.005	0.008	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.005	0.01	0.005	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.005	0.032	0.016	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.005	< 0.004	< 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.005	< 0.004	< 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.005	0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.005	0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
		FD10	0.5 - 1	Field_D	EB2130323	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
		FD11	0.5 - 1	Field_D	EB2130323	< 0.005	0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.005	< 0.004	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.005	0.006	< 0.004	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.005	0.015	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.005	0.006	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	< 0.005	0.008	< 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.005	0.05	0.023	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.005	0.033	0.019	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Comments
#1 Develop site specific based on CEC, pH, clay content, state and traffic volume
#2 Naphthalene should not be subtracted from >C10-C16 (as there is no separate ESL for naphthalene) (refer to Errata 30 April 2014)
#3 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#4 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F
#5 Benzo(a)pyrene value derived from CRC Care 2017

					OC Pesticides							PCBs								SVOCs
					Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Hexachlorobenzene	Methoxychlor	Oxychlordane	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	PCBs (Total)	Coronene
					mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg
LOR					0.0005	0.00025	0.0005	0.0005	0.5	0.0005	0.0005	5	5	5	5	5	5	5	5	0.005
NEPM 2013 EIL-Urban Residential- Public Open Space																				
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil																				
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																				
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**															
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	0.009
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
		FD10	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
		FD11	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	0.021
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	0.018
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Comments
#1 Develop site specific based on CEC, pH, clay content, state and traffic volume
#2 Naphthalene should not be subtracted from >C10-C16 (as there is no separate ESL for naphthalene) (refer to Errata 30 April 2014)
#3 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#4 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F
#5 Benzo(a)pyrene value derived from CRC Care 2017

						OC Pesticides							PCBs								SVOCs
						Endrin ketone	g-BHC (lindane)	Heptachlor	Heptachlor epoxide	Hexachlorobenzene	Methoxychlor	Oxychlordane	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	PCBs (Total)	Coronene
						mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg
LOR						0.0005	0.00025	0.0005	0.0005	0.5	0.0005	0.0005	5	5	5	5	5	5	5	5	0.005
CRC CARE 2011 Soil Direct Contact Intrusive Works																					
CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to < 2m,Sand																					
NEPM 2013 Table 1A(1) HIL C Rec								10		10,000	400									1,000[#2]	
NEPM 2013 Table 1A(3) HSL C Rec Soil for Vapour Intrusion, Sand																					
> = 0m, < 1m																					
> = 1m, < 2m																					
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	0.009
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
		FD10	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
		FD11	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.005
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	0.021
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	0.018
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Comments

#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 PCBs: HIL refers to non-dioxin like PCBs only. Where PCB source is known, or suspected at a site, a site-specific assessment of exposure to all
#3 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioava
#4 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, c
#5 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Shedule B7).
#6 In the absence of a guideline value for total chromium, chromium VI value adopted
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by it
#8 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL

Appendix B Table 4 ANZG Sediment Toxicant Values

						Organic Indicators	Metals															
						Total Organic Carbon	Aluminium	Antimony	Arsenic	Cadmium	Chromium (III+ VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
						%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR						0.02	50	0.5	1	0.1	1	0.5	1	50	1	10	0.01	1	0.1	0.1	2	1
ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV								2	20	1.5	80		65		50		0.15	21		1		200
ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high								25	70	10	370		270		220		1	52		4		410
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																	
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	0.25	1,340	< 0.50	5.90	< 0.1	5.7	1.2	1.4	3,540	1.3	53	< 0.01	2.8	0.1	< 0.1	7.4	8.3
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	0.36	1,680	< 0.50	5.26	< 0.1	6.6	1.4	2.6	4,070	1.7	62	< 0.01	3.3	0.1	< 0.1	8.8	12.3
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	0.46	1,790	< 0.50	4.64	< 0.1	6.4	1.4	3.1	4,280	1.9	69	< 0.01	3.0	0.4	< 0.1	8.7	12.6
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	0.85	2,660	< 0.50	6.58	< 0.1	8.9	2.1	9.2	6,220	3.3	75	0.01	4.8	0.3	< 0.1	11.8	24.8
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	0.70	2,130	< 0.50	5.30	< 0.1	7.2	1.6	7.4	5,020	2.6	59	< 0.01	3.8	0.3	< 0.1	9.4	19.4
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	0.27	1,110	< 0.50	5.14	< 0.1	4.1	1.0	1.8	3,120	1.1	40	< 0.01	1.9	0.2	< 0.1	6.3	7.5
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	0.16	1,080	< 0.50	4.69	< 0.1	3.9	0.9	2.0	2,860	1.1	34	< 0.01	1.9	< 0.1	< 0.1	5.4	7.8
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	0.24	1,380	< 0.50	5.10	< 0.1	5.8	1.1	3.3	3,540	1.5	44	< 0.01	2.8	0.1	< 0.1	7.0	12.2
		FD04	0 - 0.5	Field_D	EB2130323	0.32	1,460	< 0.50	5.01	< 0.1	4.7	1.2	3.9	3,720	1.8	44	< 0.01	2.3	0.1	< 0.1	7.2	12.9
		FD05	0 - 0.5	Field_D	EB2130323	0.26	1,360	< 0.50	4.90	< 0.1	4.6	1.1	3.2	3,580	1.6	42	< 0.01	2.3	0.2	< 0.1	6.6	11.4
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	0.23	1,260	< 0.50	4.59	< 0.1	4.2	1.0	3.4	3,250	1.6	40	< 0.01	1.9	0.1	< 0.1	6.7	11.6
		FD06	0.5 - 1	Field_D	EB2130323	0.22	1,450	< 0.50	4.80	< 0.1	5.2	1.1	4.6	3,500	2.0	47	< 0.01	2.4	0.2	< 0.1	7.3	14.9
		FD07	0.5 - 1	Field_D	EB2130323	0.27	1,150	< 0.50	3.47	< 0.1	3.6	0.8	3.3	2,810	1.4	32	< 0.01	1.8	0.1	< 0.1	5.4	10.6
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	0.31	1,470	< 0.50	4.34	< 0.1	5.0	1.1	6.4	3,550	2.4	38	< 0.01	2.4	0.2	< 0.1	6.6	20.1
		FD08	0 - 0.5	Field_D	EB2130323	0.33	1,530	< 0.50	4.99	< 0.1	5.4	1.2	6.3	3,750	2.5	41	0.01	2.7	0.2	< 0.1	6.8	20.2
		FD09	0 - 0.5	Field_D	EB2130323	0.32	1,290	< 0.50	5.51	< 0.1	6.3	1.3	7.0	3,280	3.1	45	< 0.01	3.2	0.2	< 0.1	7.6	24.4
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	0.31	1,610	< 0.50	4.95	< 0.1	5.4	1.2	39.0	3,920	3.3	41	0.01	2.7	0.1	< 0.1	7.5	32.8
		FD10	0.5 - 1	Field_D	EB2130323	0.34	1,740	< 0.50	6.24	< 0.1	5.6	1.2	10.0	4,340	4.4	43	0.01	2.8	0.2	< 0.1	7.9	26.9
		FD11	0.5 - 1	Field_D	EB2130323	0.35	1,610	< 0.50	4.67	< 0.1	5.7	1.2	9.2	3,840	3.9	40	0.01	2.9	0.2	< 0.1	7.3	25.7
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	0.25	1,400	< 0.50	4.91	< 0.1	4.6	1.1	4.2	3,630	2.1	44	0.05	2.2	0.1	< 0.1	6.9	20.0
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	0.37	1,740	< 0.50	5.06	< 0.1	6.2	1.3	8.2	4,160	2.9	50	0.01	2.9	< 0.1	< 0.1	8.1	25.9
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	0.54	2,210	< 0.50	5.09	< 0.1	7.0	1.5	20.6	5,180	4.3	47	0.02	3.6	0.3	< 0.1	8.5	37.8
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	0.57	2,540	< 0.50	6.23	< 0.1	7.8	1.6	24.4	5,780	4.8	50	0.02	3.9	0.3	< 0.1	9.4	43.1
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	0.45	2,020	< 0.50	6.35	< 0.1	5.7	1.4	16.6	6,090	4.4	46	0.02	3.2	0.2	< 0.1	8.5	36.2
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	0.84	3,220	< 0.50	6.59	0.2	10.0	1.8	102	7,280	13.0	53	0.06	4.9	0.3	< 0.1	11.9	96.6
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	1.30	4,580	< 0.50	7.56	0.2	10.8	2.2	85.2	9,840	20.1	64	0.08	5.6	0.4	< 0.1	15.7	108

Comments
#1 Normalised to 1% OC within the limits of 0.2-10%

Environmental Standards
Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV
Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high

						Organo Metals		BTEXN								TRH - NEPM 2013								TRH - NEPM 1999				
						Tributyltin	Tributyltin #1	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX (Sum of Total) - Lab Calc	Naphthalene	F1 (C6-C10 minus BTEX)	C6-C10 Fraction	F2 (> C10-C16 minus Naphthalene)	> C10-C16 Fraction	F3 (> C16-C34 Fraction)	F4 (> C34-C40 Fraction)	> C10-C40 (Sum of Total)	> C10-C40 (Sum of Total) #1	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 (Sum of Total)
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR						0.0005	0.0005	0.2	0.2	0.2	0.2	0.2	0.5	0.2	0.005	3	3	3	3	3	5	3	3	3	3	3	5	3
ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV							0.009															280	280					280
ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high							0.07															550	550					550
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																							
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.0005	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	< 3	< 5	< 3	< 3	< 3	< 3	< 3	< 5	< 3
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.0005	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	4	4	15	< 5	19	53	< 3	3	11	7	21
						-	-	-	-	-	-	-	-	-	0.018	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	< 0.0005	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	12	< 5	12	26	< 3	< 3	9	5	14
						-	-	-	-	-	-	-	-	-	0.011	-	-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	0.0012	0.0014	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	7	7	58	16	81	95	< 3	6	33	34	73
						-	-	-	-	-	-	-	-	-	0.019	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	0.0006	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	4	4	29	9	42	60	< 3	3	19	15	37
						-	-	-	-	-	-	-	-	-	0.015	-	-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.0005	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	13	< 5	13	48	< 3	< 3	9	6	15
						-	-	-	-	-	-	-	-	-	0.009	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.0005	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	3	< 5	3	19	< 3	< 3	< 3	< 5	< 3
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.0005	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	14	< 5	14	58	< 3	< 3	10	7	17
						-	-	-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	0.0016	0.005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	3	3	18	5	26	81	< 3	3	13	8	24
						-	-	-	-	-	-	-	-	-	0.013	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	< 0.0005	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	15	< 5	15	58	< 3	3	11	7	21
						-	-	-	-	-	-	-	-	-	0.008	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.0005	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	10	< 5	10	43	< 3	< 3	7	< 5	7
						-	-	-	-	-	-	-	-	-	0.007	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	< 0.0005	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	8	< 5	8	36	< 3	< 3	6	< 5	6
						-	-	-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	< 0.0005	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	< 3	< 5	< 3	< 3	< 3	< 3	< 3	< 5	< 3
						-	-	-	-	-	-	-	-	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	0.0008	0.0026	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	9	< 5	9	29	< 3	< 3	6	< 5	6
						-	-	-	-	-	-	-	-	-	0.011	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	0.0008	0.0024	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	< 3	< 5	< 3	< 3	< 3	< 3	< 3	< 5	< 3
						-	-	-	-	-	-	-	-	-	0.009	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	0.0008	0.0025	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	11	< 5	11	34	< 3	< 3	7	6	13
						-	-	-	-	-	-	-	-	-	0.008	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	0.0006	0.0019	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	18	< 5	18	58	< 3	< 3	12	8	20
		FD10	0.5 - 1	Field_D	EB2130323	0.0017	0.0050	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	17	< 5	17	50	< 3	< 3	10	9	19
		FD11	0.5 - 1	Field_D	EB2130323	0.0012	0.0034	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	16	< 5	16	46	< 3	< 3	9	9	18
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.0005	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	3	3	22	6	31	124	< 3	3	15	11	29
						-	-	-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.0005	< 0.0005	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	17	5	22	59	< 3	< 3	11	9	20
						-	-	-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	0.0036	0.0067	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	3	3	22	6	31	57	< 3	3	15	11	29
						-	-	-	-	-	-	-	-	-	0.013	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	0.0020	0.0035	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	16	< 5	16	28	< 3	< 3	11	8	19
						-	-	-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	0.0030	0.0067	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	3	3	22	6	31	69	< 3	< 3	15	12	27
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	0.0304	0.0362	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	5	5	45	10	60	71	< 3	4	34	18	56
						-	-	-	-	-	-	-	-	-	0.018	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	0.124	0.0954	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	13	13	85	20	118	91	< 3	6	67	35	108
						-	-	-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-

Comments
#1 Normalised to 1% OC within the limits of 0.2-10%

Environmental Standards
Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DG
Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV

Appendix B Table 4 ANZG Sediment Toxicant Values

						PAHs - standard 16																PAHs - extended		
						Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b+j)fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	PAHs (Sum of total) - Lab calc	PAHs (Sum of total) - Lab calc #1	Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ) (half LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc	2-methylnaphthalene	Benzo(e)pyrene	Perylene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR						0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.004	0.004
ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV																					10	10						
ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high																					50	50						
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																							
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.012	0.012	0.011	0.01	0.008	0.015	< 0.004	0.022	< 0.004	0.007	0.014	0.021	0.164	0.456	0.016	0.018	0.02	< 0.005	0.009	0.005
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.01	0.01	0.011	0.008	0.007	0.013	< 0.004	0.02	< 0.004	0.006	0.012	0.019	0.139	0.302	0.014	0.016	0.018	< 0.005	0.008	0.004
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.004	< 0.004	0.006	0.018	0.013	0.015	0.011	0.008	0.043	< 0.004	0.035	0.005	0.008	0.019	0.03	0.245	0.288	0.019	0.021	0.023	< 0.005	0.01	0.005
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	0.006	0.008	0.019	0.052	0.048	0.048	0.032	0.032	0.051	0.009	0.117	0.009	0.027	0.068	0.096	0.694	0.991	0.074	0.074	0.074	< 0.005	0.032	0.016
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.009	0.033	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.006	0.018	0.075	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		FD04	0 - 0.5	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	0.007	< 0.004	< 0.004	< 0.004	0.007	0.032	0.100	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		FD05	0 - 0.5	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.004	0.012	0.046	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.005	0.005	0.005	< 0.004	< 0.004	0.005	< 0.004	0.008	< 0.004	< 0.004	0.005	0.008	0.048	0.209	0.006	0.008	0.011	< 0.005	< 0.004	< 0.004
		FD06	0.5 - 1	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	< 0.004	0.004	0.006	0.021	0.095	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		FD07	0.5 - 1	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	0.019	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.005	0.006	0.005	0.004	0.004	0.01	< 0.004	0.009	< 0.004	0.004	0.006	0.009	0.077	0.248	0.008	0.01	0.012	< 0.005	0.004	< 0.004
		FD08	0 - 0.5	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.004	< 0.004	< 0.004	0.005	< 0.004	0.008	< 0.004	< 0.004	0.008	0.008	0.042	0.127	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		FD09	0 - 0.5	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.006	< 0.004	< 0.004	0.005	0.005	0.024	0.075	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.005	0.006	0.005	< 0.004	0.005	0.006	< 0.004	0.012	< 0.004	0.005	0.009	0.012	0.069	0.223	0.008	0.01	0.012	< 0.005	0.004	< 0.004
		FD10	0.5 - 1	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	< 0.004	0.004	0.006	0.019	0.056	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		FD11	0.5 - 1	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	0.005	0.006	0.006	0.005	0.005	0.006	< 0.004	0.012	< 0.004	0.004	0.006	0.011	0.07	0.200	0.008	0.01	0.012	< 0.005	0.004	< 0.004
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.012	0.048	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.007	0.007	0.007	0.005	0.006	0.013	< 0.004	0.013	< 0.004	0.005	0.007	0.014	0.096	0.259	0.01	0.012	0.014	< 0.005	0.006	< 0.004
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	0.005	< 0.004	0.004	0.013	0.014	0.025	0.013	0.011	0.024	0.005	0.028	0.005	0.012	0.015	0.027	0.234	0.433	0.026	0.026	0.026	< 0.005	0.015	0.005
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.004	0.004	< 0.004	0.008	0.009	0.008	0.007	0.008	0.009	< 0.004	0.015	< 0.004	0.007	0.012	0.016	0.119	0.209	0.012	0.014	0.016	< 0.005	0.006	0.004
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.009	0.011	0.012	0.007	0.008	0.012	< 0.004	0.016	< 0.004	0.007	0.011	0.014	0.115	0.256	0.015	0.017	0.019	< 0.005	0.008	< 0.004
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	0.022	0.013	0.013	0.063	0.079	0.072	0.054	0.052	0.105	0.027	0.116	0.019	0.057	0.069	0.103	0.976	1.162	0.132	0.132	0.132	< 0.005	0.05	0.023
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	0.007	0.021	0.02	0.031	0.054	0.05	0.03	0.04	0.032	0.018	0.058	0.014	0.04	0.033	0.065	0.595	0.458	0.088	0.088	0.088	< 0.005	0.033	0.019

Comments
#1 Normalised to 1% OC within the limits of 0.2-10%

Environmental Standards
Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DG
Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV

	OC Pesticides																										
	4,4'-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	Chlordane (cis)	Chlordane (trans)	d-BHC	4,4 DDD	4,4 DDT	DDT+ DDE+ DDD - Lab Calc	Dieldrin	Endosulfan	Endosulfan I (alpha)	Endosulfan II (beta)	Endosulfan Sulfate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Hexachlorobenzene	Methoxychlor	Oxychlordane
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	mg/kg	mg/kg
LOR	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.5	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00025	0.0005	0.0005	0.5	0.0005	0.0005
ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV	0.0014					0.0045				0.0035			0.0028					0.0027			0.0009					
ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high	0.007					0.009				0.009			0.007					0.06			0.0014					

Location Code	Date	Field ID	Depth	Sample Type	Lab Report Number																							
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		FD04	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		FD05	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		FD06	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		FD07	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		FD08	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		FD09	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		FD10	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		FD11	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050

Comments
#1 Normalised to 1% OC within the limits of 0.2-10%

Environmental Standards
Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DG
Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV

						PCBs								SVOCs
						Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	PCBs (Total)	Qronene
						µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg
LOR						5	5	5	5	5	5	5	5	0.005
ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV													34	
ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high														
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**									
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	0.009
						-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
		FD10	0.5 - 1	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
		FD11	0.5 - 1	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	0.021
						-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	0.018
						-	-	-	-	-	-	-	-	-

Comments
#1 Normalised to 1% OC within the limits of 0.2-10%

Environmental Standards
Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DG
Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV

Appendix B
Table 5 Acid Sulfate Soils Field Indicator Values

						ASS - Field			
						pHF	pHFox	pH - pHFox	Reaction Ratings*
						pH units	pH units	pH units	-
LOR						0.1	0.1	0.1	1
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**				
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	8.5	6.6	1.90	3
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	8.8	6.7	2.10	3
						-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	8.8	6.7	2.10	3
						-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	8.7	6.7	2.00	3
						-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	8.7	6.7	2.00	3
						-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	8.8	6.6	2.20	3
						-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	8.8	6.6	2.20	3
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	8.6	6.7	1.90	3
						-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	-	-	-	-
						-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	-	-	-	-
						-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	8.8	6.7	2.10	3
						-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	-	-	-	-
						-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	-	-	-	-
						-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	8.8	6.6	2.20	3
						-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	-	-	-	-
						-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	-	-	-	-
						-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	8.8	6.6	2.20	3
		FD10	0.5 - 1	Field_D	EB2130323	-	-	-	-
		FD11	0.5 - 1	Field_D	EB2130323	-	-	-	-
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	8.6	6.6	2.00	3
						-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	8.7	6.6	2.10	3
						-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	8.6	6.6	2.00	3
						-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	8.8	6.7	2.10	3
						-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	9.0	6.8	2.20	3
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	8.6	6.7	1.90	3
						-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	8.6	6.8	1.80	3
						-	-	-	-

						ASS - pH	ASS - Acidity Trail		ASS - Potential Acidity		ASS - ANC			ASS - Acid Base Accounting					ASS - Liming Rate	
						pHKCl	Titratable Actual Acidity	Titratable Actual Acidity (sulfur units)	Chromium Reducible Sulphur (acidity units)	Chromium Reducible Sulfur	Acid Neutralising Capacity (acidity units)	Acid Neutralising Capacity (sulfur units)	Acid Neutralising Capacity	Net Acidity (acidity units)	Net Acidity (Acidity Units) excluding ANC	Net Acidity (sulfur units)	Net Acidity (Sulfur Units) excluding ANC	ANC Fineness Factor	Liming Rate	Liming Rate excluding ANC
						pH units	mole H+ /t	% S	mole H+ /t	% S	mole H+ /t	% S	% CaCO3	mole H+ /t	mole H+ /t	% S	% S	-	kg CaCO3/t	kg CaCO3/t
LOR						0.1	2	0.02	10	0.005	10	0.01	0.01	10	10	0.02	0.02	0.5	1	1
ASSMAC (1998) Action criteria														18	18	0.03	0.03			
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**															
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2132548	9.7	< 2	< 0.02	34	0.055	3,480	5.58	17.4	< 10	34	< 0.02	0.06	1.5	< 1	2
		SD01_0.5-1.0	0.5 - 1	Normal	EB2132548	9.6	< 2	< 0.02	60	0.097	4,450	7.13	22.2	< 10	60	< 0.02	0.10	1.5	< 1	4
		SD01_1.0-1.5	1 - 1.5	Normal	EB2132548	9.6	< 2	< 0.02	82	0.131	4,620	7.40	23.1	< 10	82	< 0.02	0.13	1.5	< 1	6
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2132548	9.6	< 2	< 0.02	74	0.118	2,640	4.24	13.2	< 10	74	< 0.02	0.12	1.5	< 1	6
		SD05_0.5-1.0	0.5 - 1	Normal	EB2132548	9.6	< 2	< 0.02	78	0.125	2,780	4.45	13.9	< 10	78	< 0.02	0.12	1.5	< 1	6
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2132548	9.5	< 2	< 0.02	146	0.233	2,980	4.79	14.9	< 10	146	< 0.02	0.23	1.5	< 1	11
		SD07_0.5-1.0	0.5 - 1	Normal	EB2132548	9.4	< 2	< 0.02	192	0.308	3,150	5.05	15.8	< 10	192	< 0.02	0.31	1.5	< 1	14
		SD07_1.0-1.3	1 - 1.3	Normal	EB2132548	9.4	< 2	< 0.02	207	0.331	2,070	3.32	10.4	< 10	207	< 0.02	0.33	1.5	< 1	16
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2132548	9.3	< 2	< 0.02	250	0.401	3,050	4.88	15.2	< 10	250	< 0.02	0.40	1.5	< 1	19
		SD08_0.5-1.0	0.5 - 1	Normal	EB2132548	9.0	< 2	< 0.02	542	0.869	2,890	4.63	14.4	< 10	542	< 0.02	0.87	1.5	< 1	41

						Organic Indicators	Metals															Organo Metals
						Total Organic Carbon	Aluminium	Antimony	Arsenic	Cadmium	Chromium (III+ VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc	Tributyltin
						%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR						0.02	50	0.5	1	0.1	1	0.5	1	50	1	10	0.01	1	0.1	0.1	2	1	0.0005
NSW EPA (2014) General Solid Waste CT1 (No Leaching)									100	20	100				100		4	40	20	100			
NSW EPA (2014) General Solid Waste SCC1 (with TCLP)									**500**	**100**	**1,900**				**1,500**		**50**	**1,050**	**50**	**180**			
NSW EPA (2014) Restricted Solid Waste CT2 (No Leaching)									400	80	400				400		16	160	80	400			0.07
NSW EPA (2014) Restricted Solid Waste SCC2 (with TCLP)									**2,000**	**400**	**7,600**				**6,000**		**200**	**4,200**	**200**	**720**			
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																		
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	0.25	1,340	< 0.50	5.90	< 0.1	5.7	1.2	1.4	3,540	1.3	53	< 0.01	2.8	0.1	< 0.1	7.4	8.3	< 0.0005
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	0.36	1,680	< 0.50	5.26	< 0.1	6.6	1.4	2.6	4,070	1.7	62	< 0.01	3.3	0.1	< 0.1	8.8	12.3	< 0.0005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	0.46	1,790	< 0.50	4.64	< 0.1	6.4	1.4	3.1	4,280	1.9	69	< 0.01	3.0	0.4	< 0.1	8.7	12.6	< 0.0005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	0.85	2,660	< 0.50	6.58	< 0.1	8.9	2.1	9.2	6,220	3.3	75	0.01	4.8	0.3	< 0.1	11.8	24.8	0.0012
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	0.70	2,130	< 0.50	5.30	< 0.1	7.2	1.6	7.4	5,020	2.6	59	< 0.01	3.8	0.3	< 0.1	9.4	19.4	0.0006
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	0.27	1,110	< 0.50	5.14	< 0.1	4.1	1.0	1.8	3,120	1.1	40	< 0.01	1.9	0.2	< 0.1	6.3	7.5	< 0.0005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	0.16	1,080	< 0.50	4.69	< 0.1	3.9	0.9	2.0	2,860	1.1	34	< 0.01	1.9	< 0.1	< 0.1	5.4	7.8	< 0.0005
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	0.24	1,380	< 0.50	5.10	< 0.1	5.8	1.1	3.3	3,540	1.5	44	< 0.01	2.8	0.1	< 0.1	7.0	12.2	< 0.0005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	0.32	1,460	< 0.50	5.01	< 0.1	4.7	1.2	3.9	3,720	1.8	44	< 0.01	2.3	0.1	< 0.1	7.2	12.9	0.0016
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	0.26	1,360	< 0.50	4.90	< 0.1	4.6	1.1	3.2	3,580	1.6	42	< 0.01	2.3	0.2	< 0.1	6.6	11.4	< 0.0005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	0.23	1,260	< 0.50	4.59	< 0.1	4.2	1.0	3.4	3,250	1.6	40	< 0.01	1.9	0.1	< 0.1	6.7	11.6	< 0.0005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	0.22	1,450	< 0.50	4.80	< 0.1	5.2	1.1	4.6	3,500	2.0	47	< 0.01	2.4	0.2	< 0.1	7.3	14.9	< 0.0005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	0.27	1,150	< 0.50	3.47	< 0.1	3.6	0.8	3.3	2,910	1.4	32	< 0.01	1.8	0.1	< 0.1	5.4	10.6	< 0.0005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	0.31	1,470	< 0.50	4.34	< 0.1	5.0	1.1	6.4	3,550	2.4	38	< 0.01	2.4	0.2	< 0.1	6.6	20.1	0.0008
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	0.33	1,530	< 0.50	4.99	< 0.1	5.4	1.2	6.3	3,750	2.5	41	0.01	2.7	0.2	< 0.1	6.8	20.2	0.0008
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	0.32	1,290	< 0.50	5.51	< 0.1	6.3	1.3	7.0	3,280	3.1	45	< 0.01	3.2	0.2	< 0.1	7.6	24.4	0.0008
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	0.31	1,610	< 0.50	4.95	< 0.1	5.4	1.2	39.0	3,920	3.3	41	0.01	2.7	0.1	< 0.1	7.5	32.8	0.0006
		FD10	0.5 - 1	Field_D	EB2130323	0.34	1,740	< 0.50	6.24	< 0.1	5.6	1.2	10.0	4,340	4.4	43	0.01	2.8	0.2	< 0.1	7.9	26.9	0.0017
		FD11	0.5 - 1	Field_D	EB2130323	0.35	1,610	< 0.50	4.67	< 0.1	5.7	1.2	9.2	3,840	3.9	40	0.01	2.9	0.2	< 0.1	7.3	25.7	0.0012
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	0.25	1,400	< 0.50	4.91	< 0.1	4.6	1.1	4.2	3,630	2.1	44	0.05	2.2	0.1	< 0.1	6.9	20.0	< 0.0005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	0.37	1,740	< 0.50	5.06	< 0.1	6.2	1.3	8.2	4,160	2.9	50	0.01	2.9	< 0.1	< 0.1	8.1	25.9	< 0.0005
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	0.54	2,210	< 0.50	5.09	< 0.1	7.0	1.5	20.6	5,180	4.3	47	0.02	3.6	0.3	< 0.1	8.5	37.8	0.0036
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	0.57	2,540	< 0.50	6.23	< 0.1	7.8	1.6	24.4	5,780	4.8	50	0.02	3.9	0.3	< 0.1	9.4	43.1	0.0020
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	0.45	2,020	< 0.50	6.35	< 0.1	5.7	1.4	16.6	6,090	4.4	46	0.02	3.2	0.2	< 0.1	8.5	36.2	0.0030
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	0.84	3,220	< 0.50	6.59	0.2	10.0	1.8	102	7,280	13.0	53	0.06	4.9	0.3	< 0.1	11.9	96.6	0.0304
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	1.30	4,580	< 0.50	7.56	0.2	10.8	2.2	85.2	9,840	20.1	64	0.08	5.6	0.4	< 0.1	15.7	108	0.124
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

General Solid Waste - Less than CT1 or SCC1
Restricted Solid Waste - Exceeds General Solid Waste CT1 or SCC1
Hazardous Waste - Exceeds Restricted Solid Waste CT2 or SCC2

							BTEXN							TRH - NEPM 2013							TRH - NEPM 1999				
							Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX (Sum of Total) - Lab Calc	Naphthalene	F1 (C6-C10 minus BTEX)	C6-C10 Fraction	F2 (> C10-C16 minus Naphthalene)	> C10-C16 Fraction	F3 (> C16-C34 Fraction)	F4 (> C34-C40 Fraction)	> C10-C40 (Sum of Total)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 (Sum of Total)
							mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR							0.2	0.2	0.2	0.2	0.2	0.5	0.2	0.005	3	3	3	3	3	5	3	3	3	3	5	3
NSW EPA (2014) General Solid Waste CT1 (No Leaching)							10	288	600			1,000										650				10,000
NSW EPA (2014) General Solid Waste SCC1 (with TCLP)							**18**	**518**	**1,080**			**1,800**										**650**				**10,000**
NSW EPA (2014) Restricted Solid Waste CT2 (No Leaching)							40	1,152	2,400			4,000										2,600				40,000
NSW EPA (2014) Restricted Solid Waste SCC2 (with TCLP)							**72**	**2,073**	**4,320**			**7,200**										**2,600**				**40,000**
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																					
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	< 3	< 5	< 3	< 3	< 3	< 3	< 5	< 3
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	4	4	15	< 5	19	< 3	3	11	7	21
							-	-	-	-	-	-	-	0.018	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	12	< 5	12	< 3	< 3	9	5	14
							-	-	-	-	-	-	-	0.011	-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	7	7	58	16	81	< 3	6	33	34	73
							-	-	-	-	-	-	-	0.019	-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	4	4	29	9	42	< 3	3	19	15	37
							-	-	-	-	-	-	-	0.015	-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	13	< 5	13	< 3	< 3	9	6	15
							-	-	-	-	-	-	-	0.009	-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	3	< 5	3	< 3	< 3	< 3	< 5	< 3
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	14	< 5	14	< 3	< 3	10	7	17
							-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	3	3	18	5	26	< 3	3	13	8	24
							-	-	-	-	-	-	-	0.013	-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	15	< 5	15	< 3	3	11	7	21
							-	-	-	-	-	-	-	0.008	-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	10	< 5	10	< 3	< 3	7	< 5	7
							-	-	-	-	-	-	-	0.007	-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	8	< 5	8	< 3	< 3	6	< 5	6
							-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	< 3	< 5	< 3	< 3	< 3	< 3	< 5	< 3
							-	-	-	-	-	-	-	0.005	-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	9	< 5	9	< 3	< 3	6	< 5	6
							-	-	-	-	-	-	-	0.011	-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	< 3	< 5	< 3	< 3	< 3	< 3	< 5	< 3
							-	-	-	-	-	-	-	0.009	-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	11	< 5	11	< 3	< 3	7	6	13
							-	-	-	-	-	-	-	0.008	-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	18	< 5	18	< 3	< 3	12	8	20
		FD10	0.5 - 1	Field_D	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	17	< 5	17	< 3	< 3	10	9	19
		FD11	0.5 - 1	Field_D	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	< 3	< 3	16	< 5	16	< 3	< 3	9	9	18
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	3	3	22	6	31	< 3	3	15	11	29
							-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	17	5	22	< 3	< 3	11	9	20
							-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	3	3	22	6	31	< 3	3	15	11	29
							-	-	-	-	-	-	-	0.013	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	< 3	< 3	16	< 5	16	< 3	< 3	11	8	19
							-	-	-	-	-	-	-	0.006	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.005	< 3.0	< 3	3	3	22	6	31	< 3	< 3	15	12	27
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	5	5	45	10	60	< 3	4	34	18	56
							-	-	-	-	-	-	-	0.018	-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5	< 0.2	< 0.2	< 3.0	< 3	13	13	85	20	118	< 3	6	67	35	108
							-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	-	-	-	-	-	-

General Solid Waste - Less than CT1 or SCC1
Restricted Solid Waste - Exceeds General Solid Waste CT1 or SCC1
Hazardous Waste - Exceeds Restricted Solid Waste CT2 or SCC2

						PAHs - standard 16																PAHs - extended		
						Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b + j)fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	PAHs (Sum of total) - Lab Calc	Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ) (half LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc	2-methylnaphthalene	Benzo(e)pyrene	Perylene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR						0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.004	0.004
NSW EPA (2014) General Solid Waste CT1 (No Leaching)										0.8											200						
NSW EPA (2014) General Solid Waste SCC1 (with TCLP)										**10**											**200**						
NSW EPA (2014) Restricted Solid Waste CT2 (No Leaching)										3.2											800						
NSW EPA (2014) Restricted Solid Waste SCC2 (with TCLP)										**23**											**800**						
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																						
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.012	0.012	0.011	0.01	0.008	0.015	< 0.004	0.022	< 0.004	0.007	0.014	0.021	0.164	0.016	0.018	0.02	< 0.005	0.009	0.005
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.01	0.01	0.011	0.008	0.007	0.013	< 0.004	0.02	< 0.004	0.006	0.012	0.019	0.139	0.014	0.016	0.018	< 0.005	0.008	0.004
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.004	< 0.004	0.006	0.018	0.013	0.015	0.011	0.008	0.043	< 0.004	0.035	0.005	0.008	0.019	0.03	0.245	0.019	0.021	0.023	< 0.005	0.01	0.005
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	0.006	0.008	0.019	0.052	0.048	0.048	0.032	0.032	0.051	0.009	0.117	0.009	0.027	0.068	0.096	0.694	0.074	0.074	0.074	< 0.005	0.032	0.016
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.009	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.006	0.018	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		FD04	0 - 0.5	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	0.007	< 0.004	< 0.004	< 0.004	0.007	0.032	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		FD05	0 - 0.5	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.004	0.012	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.005	0.005	0.005	< 0.004	< 0.004	0.005	< 0.004	0.008	< 0.004	< 0.004	0.005	0.008	0.048	0.006	0.008	0.011	< 0.005	< 0.004	< 0.004
		FD06	0.5 - 1	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	< 0.004	0.004	0.006	0.021	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		FD07	0.5 - 1	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.005	0.006	0.005	0.004	0.004	0.01	< 0.004	0.009	< 0.004	0.004	0.006	0.009	0.077	0.008	0.01	0.012	< 0.005	0.004	< 0.004
		FD08	0 - 0.5	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.004	< 0.004	< 0.004	0.005	< 0.004	0.008	< 0.004	< 0.004	0.008	0.008	0.042	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		FD09	0 - 0.5	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.006	< 0.004	< 0.004	0.005	0.005	0.024	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.005	0.006	0.005	< 0.004	0.005	0.006	< 0.004	0.012	< 0.004	0.005	0.009	0.012	0.069	0.008	0.01	0.012	< 0.005	0.004	< 0.004
		FD10	0.5 - 1	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	< 0.004	< 0.004	0.004	0.006	0.019	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		FD11	0.5 - 1	Field_D	EB2130323	< 0.004	< 0.004	< 0.004	0.005	0.006	0.006	0.005	0.005	0.006	< 0.004	0.012	< 0.004	0.004	0.006	0.011	0.07	0.008	0.01	0.012	< 0.005	0.004	< 0.004
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.012	< 0.004	0.005	0.01	< 0.005	< 0.004	< 0.004
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.007	0.007	0.007	0.005	0.006	0.013	< 0.004	0.013	< 0.004	0.005	0.007	0.014	0.096	0.01	0.012	0.014	< 0.005	0.006	< 0.004
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	0.005	< 0.004	0.004	0.013	0.014	0.025	0.013	0.011	0.024	0.005	0.028	0.005	0.012	0.015	0.027	0.234	0.026	0.026	0.026	< 0.005	0.015	0.005
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.004	0.004	< 0.004	0.008	0.009	0.008	0.007	0.008	0.009	< 0.004	0.015	< 0.004	0.007	0.012	0.016	0.119	0.012	0.014	0.016	< 0.005	0.006	0.004
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	< 0.004	< 0.004	< 0.004	0.009	0.011	0.012	0.007	0.008	0.012	< 0.004	0.016	< 0.004	0.007	0.011	0.014	0.115	0.015	0.017	0.019	< 0.005	0.008	< 0.004
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	0.022	0.013	0.013	0.063	0.079	0.072	0.054	0.052	0.105	0.027	0.116	0.019	0.057	0.069	0.103	0.976	0.132	0.132	0.132	< 0.005	0.05	0.023
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	0.007	0.021	0.02	0.031	0.054	0.05	0.03	0.04	0.032	0.018	0.058	0.014	0.04	0.033	0.065	0.595	0.088	0.088	0.088	< 0.005	0.033	0.019

General Solid Waste - Less than CT1 or SCC1
Restricted Solid Waste - Exceeds General Solid Waste CT1 or SCC1
Hazardous Waste - Exceeds Restricted Solid Waste CT2 or SCC2

						OC Pesticides																						
						4,4'-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	Chlordane (cis)	Chlordane (trans)	d-BHC	4,4 DDD	4,4 DDT	DDT+ DDE+ DDD - Lab Calc	Dieldrin	Endosulfan	Endosulfan I (alpha)	Endosulfan II (beta)	Endosulfan Sulfate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Hexachlorobenzene	Methoxychlor	Oxychlordane
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	mg/kg	mg/kg
LOR						0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.5	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00025	0.0005	0.0005	0.5	0.0005	0.0005
NSW EPA (2014) General Solid Waste CT1 (No Leaching)																			60,000												
NSW EPA (2014) General Solid Waste SCC1 (with TCLP)																			**108,000**												
NSW EPA (2014) Restricted Solid Waste CT2 (No Leaching)																			240,000												
NSW EPA (2014) Restricted Solid Waste SCC2 (with TCLP)																			**432,000**												
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**																										
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		FD10	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
		FD11	0.5 - 1	Field_D	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00025	< 0.00050	< 0.00050	< 0.50	< 0.00050	< 0.00050
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

General Solid Waste - Less than CT1 or SCC1
Restricted Solid Waste - Exceeds General Solid Waste CT1 or SCC1
Hazardous Waste - Exceeds Restricted Solid Waste CT2 or SCC2

						PCBs								SVOCs
						Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	PCBs (Total)	Coronene
						µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg
LOR						5	5	5	5	5	5	5	5	0.005
NSW EPA (2014) General Solid Waste CT1 (No Leaching)													50,000	
NSW EPA (2014) General Solid Waste SCC1 (with TCLP)													**50,000**	
NSW EPA (2014) Restricted Solid Waste CT2 (No Leaching)													50,000	
NSW EPA (2014) Restricted Solid Waste SCC2 (with TCLP)													**50,000**	
Location Code	**Date**	**Field ID**	**Depth**	**Sample Type**	**Lab Report Number**									
SD01	19/10/2021	SD01_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
		SD01_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-
		SD01_1.0-1.5	1 - 1.5	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-
SD02	19/10/2021	SD02_0.0-0.5	0 - 0.5	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		SD02_0.5-1.0	0.5 - 1	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	0.009
						-	-	-	-	-	-	-	-	-
SD03	19/10/2021	SD03_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-
		SD03_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
SD04	19/10/2021	SD04_0.0-0.5	0 - 0.5	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		FD04	0 - 0.5	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		FD05	0 - 0.5	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		SD04_0.5-1.0	0.5 - 1	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		FD06	0.5 - 1	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		FD07	0.5 - 1	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
SD05	19/10/2021	SD05_0.0-0.5	0 - 0.5	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		FD08	0 - 0.5	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		FD09	0 - 0.5	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		SD05_0.5-1.0	0.5 - 1	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
		FD10	0.5 - 1	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
		FD11	0.5 - 1	Field_D	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
SD06	19/10/2021	SD06_0.0-0.5	0 - 0.5	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
		SD06_0.5-1.0	0.5 - 1	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.005
						-	-	-	-	-	-	-	-	-
SD07	19/10/2021	SD07_0.0-0.5	0 - 0.5	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-
		SD07_0.5-1.0	0.5 - 1	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
						-	-	-	-	-	-	-	-	-
		SD07_1.0-1.3	1 - 1.3	Normal	EB2130323	-	-	-	-	-	-	-	-	< 0.005
SD08	19/10/2021	SD08_0.0-0.5	0 - 0.5	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	0.021
						-	-	-	-	-	-	-	-	-
		SD08_0.5-1.0	0.5 - 1	Normal	EB2130323	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	0.018
						-	-	-	-	-	-	-	-	-

General Solid Waste - Less than CT1 or SCC1
Restricted Solid Waste - Exceeds General Solid Waste CT1 or SCC1
Hazardous Waste - Exceeds Restricted Solid Waste CT2 or SCC2

Date			19/10/2021			19/10/2021			19/10/2021			19/10/2021			19/10/2021		
Field ID			SD04_0.0-0.5	FD04		SD04_0.0-0.5	FD05		SD04_0.0-0.5	FD05		SD04_0.0-0.5	FD05		SD04_0.0-0.5	21-No.29601	
Lab Report Number			EB2130323	EB2130323		EB2130323	EB2130323		EB2130323	840516		EB2130323	846766		EB2130323	RN1335142	
Matrix Type			Soil	Soil	RPD	Soil	Soil	RPD	Soil	Soil	RPD	Soil	Soil	RPD	Soil	Soil	RPD
	Unit	LOR															
Metals																	
Aluminium	mg/kg	50	1,380	1,460	6	1,380	1,360	1	1,380	-	-	1,380	-	-	1,380	-	-
Antimony	mg/kg	0.5	< 0.50	< 0.50	0	< 0.50	< 0.50	0	< 0.50	-	-	< 0.50	< 0.5	0	< 0.50	-	-
Arsenic	mg/kg	1	5.10	5.01	2	5.10	4.90	4	5.10	-	-	5.10	5.4	6	5.10	-	-
Cadmium	mg/kg	0.1	< 0.1	< 0.1	0	< 0.1	< 0.1	0	< 0.1	-	-	< 0.1	< 0.1	0	< 0.1	-	-
Chromium (III+ VI)	mg/kg	1	5.8	4.7	21	5.8	4.6	23	5.8	-	-	5.8	5.4	7	5.8	-	-
Cobalt	mg/kg	0.5	1.1	1.2	9	1.1	1.1	0	1.1	-	-	1.1	-	-	1.1	-	-
Copper	mg/kg	1	3.3	3.9	17	3.3	3.2	3	3.3	-	-	3.3	3.4	3	3.3	-	-
Iron	mg/kg	50	3,540	3,720	5	3,540	3,580	1	3,540	-	-	3,540	-	-	3,540	-	-
Lead	mg/kg	1	1.5	1.8	18	1.5	1.6	6	1.5	-	-	1.5	1.9	24	1.5	-	-
Manganese	mg/kg	10	44	44	0	44	42	5	44	-	-	44	-	-	44	-	-
Mercury	mg/kg	0.01	< 0.01	< 0.01	0	< 0.01	< 0.01	0	< 0.01	-	-	< 0.01	0.03	100	< 0.01	-	-
Nickel	mg/kg	1	2.8	2.3	20	2.8	2.3	20	2.8	-	-	2.8	2.6	7	2.8	-	-
Selenium	mg/kg	0.1	0.1	0.1	0	0.1	0.2	67	0.1	-	-	0.1	-	-	0.1	-	-
Silver	mg/kg	0.1	< 0.1	< 0.1	0	< 0.1	< 0.1	0	< 0.1	-	-	< 0.1	-	-	< 0.1	-	-
Vanadium	mg/kg	2	7.0	7.2	3	7.0	6.6	6	7.0	-	-	7.0	-	-	7.0	-	-
Zinc	mg/kg	1	12.2	12.9	6	12.2	11.4	7	12.2	-	-	12.2	13	6	12.2	-	-
Organo Metals																	
Dibutyltin as Sn	mg/kg		-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.0005	-
Monobutyltin as Sn	mg/kg		-	-	-	-	-	-	-	-	-	-	-	-	-	0.0011	-
Tributyltin	mg/kg	0.0005	< 0.0005	0.0016	105	< 0.0005	< 0.0005	0	-	-	-	< 0.0005	-	-	< 0.0005	-	-
Tributyltin (as Sn)	mg/kg		-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.0005	-
BTEXN																	
Benzene	mg/kg	0.2	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Toluene	mg/kg	0.2	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Ethylbenzene	mg/kg	0.2	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Xylene (o)	mg/kg	0.2	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Xylene (m & p)	mg/kg	0.2	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Xylene Total	mg/kg	0.5	< 0.5	< 0.5	0	< 0.5	< 0.5	0	< 0.5	-	-	< 0.5	-	-	< 0.5	-	-
BTEX (Sum of Total) - Lab Calc	mg/kg	0.2	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Naphthalene (BTEXN suite)	mg/kg	0.2	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	< 0.5	0	< 0.2	-	-	< 0.2	-	-
TRH - NEPM 2013																	
F1 (C6-C10 minus BTEX)	mg/kg	3	< 3.0	< 3.0	0	< 3.0	< 3.0	0	< 3.0	< 20	0	< 3.0	-	-	< 3.0	-	-
C6-C10 Fraction	mg/kg	3	< 3	< 3	0	< 3	< 3	0	< 3	< 20	0	< 3	-	-	< 3	-	-
F2 (> C10-C16 minus	mg/kg	3	< 3	3	0	< 3	< 3	0	< 3	< 50	0	< 3	-	-	< 3	-	-
> C10-C16 Fraction	mg/kg	3	< 3	3	0	< 3	< 3	0	< 3	< 50	0	< 3	-	-	< 3	-	-
F3 (> C16-C34 Fraction)	mg/kg	3	14	18	25	14	15	7	14	< 100	0	14	-	-	14	-	-
F4 (> C34-C40 Fraction)	mg/kg	5	< 5	5	0	< 5	< 5	0	< 5	< 100	0	< 5	-	-	< 5	-	-
> C10-C40 (Sum of Total)	mg/kg	3	14	26	60	14	15	7	14	< 100	0	14	-	-	14	-	-
TRH - NEPM 1999																	
C6-C9 Fraction	mg/kg	3	< 3	< 3	0	< 3	< 3	0	< 3	< 20	0	< 3	-	-	< 3	-	-
C10-C14 Fraction	mg/kg	3	< 3	3	0	< 3	3	0	< 3	< 20	0	< 3	-	-	< 3	-	-
C15-C28 Fraction	mg/kg	3	10	13	26	10	11	10	10	< 50	0	10	-	-	10	-	-
C29-C36 Fraction	mg/kg	5	7	8	13	7	7	0	7	< 50	0	7	-	-	7	-	-
C10-C36 (Sum of Total)	mg/kg	3	17	24	34	17	21	21	17	< 50	0	17	-	-	17	-	-
PAHs - standard 16																	
Acenaphthene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Acenaphthylene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Anthracene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Benz(a)anthracene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Benzo(a)pyrene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Benzo(b+ j)fluoranthene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Benzo(k)fluoranthene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Benzo(g,h,i)perylene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Chrysene	mg/kg	0.004	< 0.004	0.005	22	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Dibenz(a,h)anthracene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Fluoranthene	mg/kg	0.004	< 0.004	0.007	55	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Fluorene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Naphthalene-PAH	mg/kg	0.005	0.012	0.013	8	0.012	0.008	40	0.012	< 0.005	82	0.012	-	-	0.012	-	-
Phenanthrene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Pyrene	mg/kg	0.004	0.006	0.007	15	0.006	0.004	40	0.006	< 0.005	18	0.006	-	-	0.006	-	-
PAHs (Sum of total) - Lab calc	mg/kg	0.004	0.018	0.032	56	0.018	0.012	40	0.018	< 0.005	113	0.018	-	-	0.018	-	-
Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	-	-	< 0.004	-	-	< 0.004	-	-
Total 8 PAHs (as BaP TEQ) (half LOR) - Lab Calc	mg/kg	0.004	0.005	0.005	0	0.005	0.005	0	0.005	-	-	0.005	-	-	0.005	-	-
Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc	mg/kg	0.004	0.01	0.01	0	0.01	0.01	0	0.01	-	-	0.01	-	-	0.01	-	-
PAHs - extended																	
2-methylnaphthalene	mg/kg	0.005	< 0.005	< 0.005	0	< 0.005	< 0.005	0	< 0.005	-	-	< 0.005	-	-	< 0.005	-	-
Benzo(e)pyrene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	-	-	< 0.004	-	-	< 0.004	-	-
Perylene	mg/kg	0.004	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	-	-	< 0.004	-	-	< 0.004	-	-
OC Pesticides																	
Organochlorine pesticides	mg/kg	0.01	-	-	-	-	-	-	-	< 0.01	-	-	-	-	-	-	-
Other organochlorine pesticides EPAVic	mg/kg	0.01	-	-	-	-	-	-	-	< 0.01	-	-	-	-	-	-	-
4,4'-DDE	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
a-BHC	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Aldrin	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Aldrin + Dieldrin	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
b-BHC	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Chlordane	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.01	0	< 0.00050	-	-	< 0.00050	-	-
Chlordane (cis)	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	-	-	< 0.00050	-	-	< 0.00050	-	-
Chlordane (trans)	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	-	-	< 0.00050	-	-	< 0.00050	-	-
d-BHC	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
4,4 DDD	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
4,4 DDT	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
DDT+ DDE+ DDD - Lab Calc	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Dieldrin	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endosulfan	µg/kg	0.5	< 0.50	< 0.50	0	< 0.50	< 0.50	0	< 0.50	-	-	< 0.50	-	-	< 0.50	-	-
Endosulfan I (alpha)	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endosulfan II (beta)	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endosulfan Sulfate	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endrin	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endrin aldehyde	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endrin ketone	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
g-BHC (Lindane)	mg/kg	0.00025	< 0.00025	< 0.00025	0	< 0.00025	< 0.00025	0	< 0.00025	< 0.005	0	< 0.00025	-	-	< 0.00025	-	-
Heptachlor	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Heptachlor epoxide	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Hexachlorobenzene	µg/kg	0.5	< 0.50	< 0.50	0	< 0.50	< 0.50	0	< 0.50	< 5	0	< 0.50	-	-	< 0.50	-	-
Methoxychlor	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Oxychlordane	mg/kg	0.0005	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	-	-	< 0.00050	-	-	< 0.00050	-	-
Toxaphene	mg/kg	0.1	-	-	-	-	-	-	-	< 0.1	-	-	-	-	-	-	-
PCBs																	
Arochlor 1016	µg/kg	5	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1221	µg/kg	5	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1232	µg/kg	5	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1242	µg/kg	5	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1248	µg/kg	5	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1254	µg/kg	5	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1260	µg/kg	5	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
PCBs (Total)	µg/kg	5	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
SVOCs																	
Coronene	mg/kg	0.005	< 0.005	< 0.005	0	< 0.005	< 0.005	0	< 0.005	-	-	< 0.005	-	-	< 0.005	-	-

***RPDs have only been considered where a concentration is greater than 1 times the EQL.**
****Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: 1000 (1 - 10 x EQL); 30 (10 - 30 x EQL); 30 (> 30 x EQL))**
*****Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory**

		19/10/2021			19/10/2021			19/10/2021			19/10/2021			19/10/2021		
		SD04_0.5-1.0	FD06		SD04_0.5-1.0	FD07		SD04_0.5-1.0	FD07		SD04_0.5-1.0	FD07		SD04_0.5-1.0	21-No29602	
		EB2130323	EB2130323		EB2130323	EB2130323		EB2130323	840516		EB2130323	846766		EB2130323	RN1335142	
	Unit	Soil	Soil	RPD	Soil	Soil	RPD	Soil	Soil	RPD	Soil	Soil	RPD	Soil	Soil	RPD
Metals																
Aluminium	mg/kg	1,260	1,450	14	1,260	1,150	9	1,260	-	-	1,260	-	-	1,260	-	-
Antimony	mg/kg	< 0.50	< 0.50	0	< 0.50	< 0.50	0	< 0.50	-	-	< 0.50	< 0.5	0	< 0.50	-	-
Arsenic	mg/kg	4.59	4.80	4	4.59	3.47	28	4.59	-	-	4.59	5.1	11	4.59	-	-
Cadmium	mg/kg	< 0.1	< 0.1	0	< 0.1	< 0.1	0	< 0.1	-	-	< 0.1	< 0.1	0	< 0.1	-	-
Chromium (III+ VI)	mg/kg	4.2	5.2	21	4.2	3.6	15	4.2	-	-	4.2	6.0	35	4.2	-	-
Cobalt	mg/kg	1.0	1.1	10	1.0	0.8	22	1.0	-	-	1.0	-	-	1.0	-	-
Copper	mg/kg	3.4	4.6	30	3.4	3.3	3	3.4	-	-	3.4	4.7	32	3.4	-	-
Iron	mg/kg	3,250	3,500	7	3,250	2,910	11	3,250	-	-	3,250	-	-	3,250	-	-
Lead	mg/kg	1.6	2.0	22	1.6	1.4	13	1.6	-	-	1.6	2.3	36	1.6	-	-
Manganese	mg/kg	40	47	16	40	32	22	40	-	-	40	-	-	40	-	-
Mercury	mg/kg	< 0.01	< 0.01	0	< 0.01	< 0.01	0	< 0.01	-	-	< 0.01	< 0.01	0	< 0.01	-	-
Nickel	mg/kg	1.9	2.4	23	1.9	1.8	5	1.9	-	-	1.9	2.8	38	1.9	-	-
Selenium	mg/kg	0.1	0.2	67	0.1	0.1	0	0.1	-	-	0.1	-	-	0.1	-	-
Silver	mg/kg	< 0.1	< 0.1	0	< 0.1	< 0.1	0	< 0.1	-	-	< 0.1	-	-	< 0.1	-	-
Vanadium	mg/kg	6.7	7.3	9	6.7	5.4	21	6.7	-	-	6.7	-	-	6.7	-	-
Zinc	mg/kg	11.6	14.9	25	11.6	10.6	9	11.6	-	-	11.6	17	38	11.6	-	-
Organo Metals																
Dibutyltin as Sn	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.0005	-
Monobutyltin as Sn	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00078	-
Tributyltin	mg/kg	< 0.0005	< 0.0005	0	< 0.0005	< 0.0005	0	-	-	-	< 0.0005	-	-	< 0.0005	-	-
Tributyltin (as Sn)	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.0005	-
BTEXN																
Benzene	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Toluene	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Ethylbenzene	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Xylene (o)	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Xylene (m & p)	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Xylene Total	mg/kg	< 0.5	< 0.5	0	< 0.5	< 0.5	0	< 0.5	-	-	< 0.5	-	-	< 0.5	-	-
BTEX (Sum of Total) - Lab Calc	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Naphthalene (BTEXN suite)	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	< 0.5	0	< 0.2	-	-	< 0.2	-	-
TRH - NEPM 2013																
F1 (C6-C10 minus BTEX)	mg/kg	< 3.0	< 3.0	0	< 3.0	< 3.0	0	< 3.0	< 20	0	< 3.0	-	-	< 3.0	-	-
C6-C10 Fraction	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 20	0	< 3	-	-	< 3	-	-
F2 (> C10-C16 minus	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 50	0	< 3	-	-	< 3	-	-
> C10-C16 Fraction	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 50	0	< 3	-	-	< 3	-	-
F3 (> C16-C34 Fraction)	mg/kg	10	8	22	10	< 3	108	10	< 100	0	10	-	-	10	-	-
F4 (> C34-C40 Fraction)	mg/kg	< 5	< 5	0	< 5	< 5	0	< 5	< 100	0	< 5	-	-	< 5	-	-
> C10-C40 (Sum of Total)	mg/kg	10	8	22	10	< 3	108	10	< 100	0	10	-	-	10	-	-
TRH - NEPM 1999																
C6-C9 Fraction	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 20	0	< 3	-	-	< 3	-	-
C10-C14 Fraction	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 20	0	< 3	-	-	< 3	-	-
C15-C28 Fraction	mg/kg	7	6	15	7	< 3	80	7	< 50	0	7	-	-	7	-	-
C29-C36 Fraction	mg/kg	< 5	< 5	0	< 5	< 5	0	< 5	< 50	0	< 5	-	-	< 5	-	-
C10-C36 (Sum of Total)	mg/kg	7	6	15	7	< 3	80	7	< 50	0	7	-	-	7	-	-
PAHs - standard 16																
Acenaphthene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Acenaphthylene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Anthracene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Benz(a)anthracene	mg/kg	0.005	< 0.004	22	0.005	< 0.004	22	0.005	< 0.005	0	0.005	-	-	0.005	-	-
Benzo(a)pyrene	mg/kg	0.005	< 0.004	22	0.005	< 0.004	22	0.005	< 0.005	0	0.005	-	-	0.005	-	-
Benzo(b+ j)fluoranthene	mg/kg	0.005	< 0.004	22	0.005	< 0.004	22	0.005	< 0.005	0	0.005	-	-	0.005	-	-
Benzo(k)fluoranthene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Benzo(g,h,i)perylene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Chrysene	mg/kg	0.005	< 0.004	22	0.005	< 0.004	22	0.005	< 0.005	0	0.005	-	-	0.005	-	-
Dibenz(a,h)anthracene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Fluoranthene	mg/kg	0.008	0.005	46	0.008	< 0.004	67	0.008	< 0.005	46	0.008	-	-	0.008	-	-
Fluorene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Naphthalene-PAH	mg/kg	0.007	0.006	15	0.007	0.005	33	0.007	< 0.005	33	0.007	-	-	0.007	-	-
Phenanthrene	mg/kg	0.005	0.004	22	0.005	< 0.004	22	0.005	< 0.005	0	0.005	-	-	0.005	-	-
Pyrene	mg/kg	0.008	0.006	29	0.008	< 0.004	67	0.008	< 0.005	46	0.008	-	-	0.008	-	-
PAHs (Sum of total) - Lab calc	mg/kg	0.048	0.021	78	0.048	0.005	162	0.048	< 0.005	162	0.048	-	-	0.048	-	-
Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc	mg/kg	0.006	< 0.004	40	0.006	< 0.004	40	0.006	-	-	0.006	-	-	0.006	-	-
Total 8 PAHs (as BaP TEQ) (half LOR) - Lab Calc	mg/kg	0.008	0.005	46	0.008	0.005	46	0.008	-	-	0.008	-	-	0.008	-	-
Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc	mg/kg	0.011	0.01	10	0.011	0.01	10	0.011	-	-	0.011	-	-	0.011	-	-
PAHs - extended																
2-methylnaphthalene	mg/kg	< 0.005	< 0.005	0	< 0.005	< 0.005	0	< 0.005	-	-	< 0.005	-	-	< 0.005	-	-
Benzo(e)pyrene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	-	-	< 0.004	-	-	< 0.004	-	-
Perylene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	-	-	< 0.004	-	-	< 0.004	-	-
OC Pesticides																
Organochlorine pesticides	mg/kg	-	-	-	-	-	-	-	< 0.01	-	-	-	-	-	-	-
Other organochlorine pesticides EPAVic	mg/kg	-	-	-	-	-	-	-	< 0.01	-	-	-	-	-	-	-
4,4'-DDE	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
a-BHC	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Aldrin	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Aldrin + Dieldrin	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
b-BHC	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Chlordane	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.01	0	< 0.00050	-	-	< 0.00050	-	-
Chlordane (cis)	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	-	-	< 0.00050	-	-	< 0.00050	-	-
Chlordane (trans)	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	-	-	< 0.00050	-	-	< 0.00050	-	-
d-BHC	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
4,4 DDD	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
4,4 DDT	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
DDT+ DDE+ DDD - Lab Calc	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Dieldrin	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endosulfan	µg/kg	< 0.50	< 0.50	0	< 0.50	< 0.50	0	< 0.50	-	-	< 0.50	-	-	< 0.50	-	-
Endosulfan I (alpha)	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endosulfan II (beta)	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endosulfan Sulfate	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endrin	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endrin aldehyde	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endrin ketone	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
g-BHC (Lindane)	mg/kg	< 0.00025	< 0.00025	0	< 0.00025	< 0.00025	0	< 0.00025	< 0.005	0	< 0.00025	-	-	< 0.00025	-	-
Heptachlor	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Heptachlor epoxide	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Hexachlorobenzene	µg/kg	< 0.50	< 0.50	0	< 0.50	< 0.50	0	< 0.50	< 5	0	< 0.50	-	-	< 0.50	-	-
Methoxychlor	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Oxychlordane	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	-	-	< 0.00050	-	-	< 0.00050	-	-
Toxaphene	mg/kg	-	-	-	-	-	-	-	< 0.1	-	-	-	-	-	-	-
PCBs																
Arochlor 1016	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1221	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1232	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1242	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1248	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1254	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1260	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
PCBs (Total)	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
SVOCs																
Coronene	mg/kg	< 0.005	< 0.005	0	< 0.005	< 0.005	0	< 0.005	-	-	< 0.005	-	-	< 0.005	-	-

**RPDs have only been considered where a concen
**Elevated RPDs are highlighted as per QAQC Pro
***Interlab Duplicates are matched on a per compo

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		19/10/2021			19/10/2021			19/10/2021			19/10/2021			19/10/2021		
		SD05_0.0-0.5	FD08		SD05_0.0-0.5	FD09		SD05_0.0-0.5	FD09		SD05_0.0-0.5	FD09		SD05_0.0-0.5	21-No29603	
		EB2130323	EB2130323		EB2130323	EB2130323		EB2130323	840516		EB2130323	846766		EB2130323	RN1335142	
		Soil	Soil	RPD	Soil	Soil	RPD	Soil	Soil	RPD	Soil	Soil	RPD	Soil	Soil	RPD
	Unit															
Metals																
Aluminium	mg/kg	1,470	1,530	4	1,470	1,290	13	1,470	-	-	1,470	-	-	1,470	-	-
Antimony	mg/kg	< 0.50	< 0.50	0	< 0.50	< 0.50	0	< 0.50	-	-	< 0.50	< 0.5	0	< 0.50	-	-
Arsenic	mg/kg	4.34	4.99	14	4.34	5.51	24	4.34	-	-	4.34	5.3	20	4.34	-	-
Cadmium	mg/kg	< 0.1	< 0.1	0	< 0.1	< 0.1	0	< 0.1	-	-	< 0.1	< 0.1	0	< 0.1	-	-
Chromium (III+ VI)	mg/kg	5.0	5.4	8	5.0	6.3	23	5.0	-	-	5.0	7.0	33	5.0	-	-
Cobalt	mg/kg	1.1	1.2	9	1.1	1.3	17	1.1	-	-	1.1	-	-	1.1	-	-
Copper	mg/kg	6.4	6.3	2	6.4	7.0	9	6.4	-	-	6.4	7.2	12	6.4	-	-
Iron	mg/kg	3,550	3,750	5	3,550	3,280	8	3,550	-	-	3,550	-	-	3,550	-	-
Lead	mg/kg	2.4	2.5	4	2.4	3.1	25	2.4	-	-	2.4	3.1	25	2.4	-	-
Manganese	mg/kg	38	41	8	38	45	17	38	-	-	38	-	-	38	-	-
Mercury	mg/kg	< 0.01	0.01	0	< 0.01	< 0.01	0	< 0.01	-	-	< 0.01	0.01	0	< 0.01	-	-
Nickel	mg/kg	2.4	2.7	12	2.4	3.2	29	2.4	-	-	2.4	3.3	32	2.4	-	-
Selenium	mg/kg	0.2	0.2	0	0.2	0.2	0	0.2	-	-	0.2	-	-	0.2	-	-
Silver	mg/kg	< 0.1	< 0.1	0	< 0.1	< 0.1	0	< 0.1	-	-	< 0.1	-	-	< 0.1	-	-
Vanadium	mg/kg	6.6	6.8	3	6.6	7.6	14	6.6	-	-	6.6	-	-	6.6	-	-
Zinc	mg/kg	20.1	20.2	0	20.1	24.4	19	20.1	-	-	20.1	24	18	20.1	-	-
Organo Metals																
Dibutyltin as Sn	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0029	-
Monobutyltin as Sn	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0044	-
Tributyltin	mg/kg	0.0008	0.0008	0	0.0008	0.0008	0	-	-	-	0.0008	-	-	0.0008	-	-
Tributyltin (as Sn)	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0055	-
BTEXN																
Benzene	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Toluene	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Ethylbenzene	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Xylene (o)	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Xylene (m & p)	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Xylene Total	mg/kg	< 0.5	< 0.5	0	< 0.5	< 0.5	0	< 0.5	-	-	< 0.5	-	-	< 0.5	-	-
BTEX (Sum of Total) - Lab Calc	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Naphthalene (BTEXN suite)	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	< 0.5	0	< 0.2	-	-	< 0.2	-	-
TRH - NEPM 2013																
F1 (C6-C10 minus BTEX)	mg/kg	< 3.0	< 3.0	0	< 3.0	< 3.0	0	< 3.0	< 20	0	< 3.0	-	-	< 3.0	-	-
C6-C10 Fraction	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 20	0	< 3	-	-	< 3	-	-
F2 (> C10-C16 minus	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 50	0	< 3	-	-	< 3	-	-
> C10-C16 Fraction	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 50	0	< 3	-	-	< 3	-	-
F3 (> C16-C34 Fraction)	mg/kg	9	< 3	100	9	11	20	9	< 100	0	9	-	-	9	-	-
F4 (> C34-C40 Fraction)	mg/kg	< 5	< 5	0	< 5	< 5	0	< 5	< 100	0	< 5	-	-	< 5	-	-
> C10-C40 (Sum of Total)	mg/kg	9	< 3	100	9	11	20	9	< 100	0	9	-	-	9	-	-
TRH - NEPM 1999																
C6-C9 Fraction	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 20	0	< 3	-	-	< 3	-	-
C10-C14 Fraction	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 20	0	< 3	-	-	< 3	-	-
C15-C28 Fraction	mg/kg	6	< 3	67	6	7	15	6	< 50	0	6	-	-	6	-	-
C29-C36 Fraction	mg/kg	< 5	< 5	0	< 5	6	18	< 5	< 50	0	< 5	-	-	< 5	-	-
C10-C36 (Sum of Total)	mg/kg	6	< 3	67	6	13	74	6	< 50	0	6	-	-	6	-	-
PAHs - standard 16																
Acenaphthene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Acenaphthylene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Anthracene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Benz(a)anthracene	mg/kg	0.005	< 0.004	22	0.005	< 0.004	22	0.005	< 0.005	0	0.005	-	-	0.005	-	-
Benzo(a)pyrene	mg/kg	0.006	< 0.004	40	0.006	< 0.004	40	0.006	< 0.005	18	0.006	-	-	0.006	-	-
Benzo(b+ j)fluoranthene	mg/kg	0.005	0.004	22	0.005	< 0.004	22	0.005	< 0.005	0	0.005	-	-	0.005	-	-
Benzo(k)fluoranthene	mg/kg	0.004	< 0.004	0	0.004	< 0.004	0	0.004	< 0.005	0	0.004	-	-	0.004	-	-
Benzo(g,h,i)perylene	mg/kg	0.004	< 0.004	0	0.004	< 0.004	0	0.004	< 0.005	0	0.004	-	-	0.004	-	-
Chrysene	mg/kg	0.01	0.005	67	0.01	< 0.004	86	0.01	< 0.005	67	0.01	-	-	0.01	-	-
Dibenz(a,h)anthracene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Fluoranthene	mg/kg	0.009	0.008	12	0.009	0.006	40	0.009	< 0.005	57	0.009	-	-	0.009	-	-
Fluorene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg	0.004	< 0.004	0	0.004	< 0.004	0	0.004	< 0.005	0	0.004	-	-	0.004	-	-
Naphthalene-PAH	mg/kg	0.011	0.009	20	0.011	0.008	32	0.011	< 0.005	75	0.011	-	-	0.011	-	-
Phenanthrene	mg/kg	0.006	0.008	29	0.006	0.005	18	0.006	< 0.005	18	0.006	-	-	0.006	-	-
Pyrene	mg/kg	0.009	0.008	12	0.009	0.005	57	0.009	< 0.005	57	0.009	-	-	0.009	-	-
PAHs (Sum of total) - Lab calc	mg/kg	0.077	0.042	59	0.077	0.024	105	0.077	< 0.005	176	0.077	-	-	0.077	-	-
Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc	mg/kg	0.008	< 0.004	67	0.008	< 0.004	67	0.008	-	-	0.008	-	-	0.008	-	-
Total 8 PAHs (as BaP TEQ) (half LOR) - Lab Calc	mg/kg	0.01	0.005	67	0.01	0.005	67	0.01	-	-	0.01	-	-	0.01	-	-
Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc	mg/kg	0.012	0.01	18	0.012	0.01	18	0.012	-	-	0.012	-	-	0.012	-	-
PAHs - extended																
2-methylnaphthalene	mg/kg	< 0.005	< 0.005	0	< 0.005	< 0.005	0	< 0.005	-	-	< 0.005	-	-	< 0.005	-	-
Benzo(e)pyrene	mg/kg	0.004	< 0.004	0	0.004	< 0.004	0	0.004	-	-	0.004	-	-	0.004	-	-
Perylene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	-	-	< 0.004	-	-	< 0.004	-	-
QC Pesticides																
Organochlorine pesticides	mg/kg	-	-	-	-	-	-	-	< 0.01	-	-	-	-	-	-	-
Other organochlorine pesticides EPAVic	mg/kg	-	-	-	-	-	-	-	< 0.01	-	-	-	-	-	-	-
4,4'-DDE	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
a-BHC	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Aldrin	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Aldrin + Dieldrin	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
b-BHC	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Chlordane	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.01	0	< 0.00050	-	-	< 0.00050	-	-
Chlordane (cis)	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	-	-	< 0.00050	-	-	< 0.00050	-	-
Chlordane (trans)	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	-	-	< 0.00050	-	-	< 0.00050	-	-
d-BHC	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
4,4 DDD	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
4,4 DDT	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
DDT+ DDE+ DDD - Lab Calc	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Dieldrin	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endosulfan	µg/kg	< 0.50	< 0.50	0	< 0.50	< 0.50	0	< 0.50	-	-	< 0.50	-	-	< 0.50	-	-
Endosulfan I (alpha)	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endosulfan II (beta)	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endosulfan Sulfate	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endrin	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endrin aldehyde	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endrin ketone	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
g-BHC (Lindane)	mg/kg	< 0.00025	< 0.00025	0	< 0.00025	< 0.00025	0	< 0.00025	< 0.005	0	< 0.00025	-	-	< 0.00025	-	-
Heptachlor	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Heptachlor epoxide	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Hexachlorobenzene	µg/kg	< 0.50	< 0.50	0	< 0.50	< 0.50	0	< 0.50	< 5	0	< 0.50	-	-	< 0.50	-	-
Methoxychlor	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Oxychlordane	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	-	-	< 0.00050	-	-	< 0.00050	-	-
Toxaphene	mg/kg	-	-	-	-	-	-	-	< 0.1	-	-	-	-	-	-	-
PCBs																
Arochlor 1016	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1221	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1232	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1242	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1248	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1254	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1260	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
PCBs (Total)	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
SVOCs																
Coronene	mg/kg	< 0.005	< 0.005	0	< 0.005	< 0.005	0	< 0.005	-	-	< 0.005	-	-	< 0.005	-	-

**RPDs have only been considered where a concen
**Elevated RPDs are highlighted as per QAQC Pro
***Interlab Duplicates are matched on a per compo

		19/10/2021			19/10/2021			19/10/2021			19/10/2021			19/10/2021		
		SD05_0.5-1.0	FD10		SD05_0.5-1.0	FD11		SD05_0.5-1.0	FD11		SD05_0.5-1.0	FD11		SD05_0.5-1.0	21-No29604	
		EB2130323	EB2130323		EB2130323	EB2130323		EB2130323	840516		EB2130323	846766		EB2130323	RN1335142	
		Soil	Soil	RPD	Soil	Soil	RPD	Soil	Soil	RPD	Soil	Soil	RPD	Soil	Soil	RPD
	Unit															
Metals																
Aluminium	mg/kg	1,610	1,740	8	1,610	1,610	0	1,610	-	-	1,610	-	-	1,610	-	-
Antimony	mg/kg	< 0.50	< 0.50	0	< 0.50	< 0.50	0	< 0.50	-	-	< 0.50	< 0.5	0	< 0.50	-	-
Arsenic	mg/kg	4.95	6.24	23	4.95	4.67	6	4.95	-	-	4.95	4.1	19	4.95	-	-
Cadmium	mg/kg	< 0.1	< 0.1	0	< 0.1	< 0.1	0	< 0.1	-	-	< 0.1	< 0.1	0	< 0.1	-	-
Chromium (III+ VI)	mg/kg	5.4	5.6	4	5.4	5.7	5	5.4	-	-	5.4	4.9	10	5.4	-	-
Cobalt	mg/kg	1.2	1.2	0	1.2	1.2	0	1.2	-	-	1.2	-	-	1.2	-	-
Copper	mg/kg	39.0	10.0	118	39.0	9.2	124	39.0	-	-	39.0	7.6	135	39.0	-	-
Iron	mg/kg	3,920	4,340	10	3,920	3,840	2	3,920	-	-	3,920	-	-	3,920	-	-
Lead	mg/kg	3.3	4.4	29	3.3	3.9	17	3.3	-	-	3.3	3.0	10	3.3	-	-
Manganese	mg/kg	41	43	5	41	40	2	41	-	-	41	-	-	41	-	-
Mercury	mg/kg	0.01	0.01	0	0.01	0.01	0	0.01	-	-	0.01	< 0.01	0	0.01	-	-
Nickel	mg/kg	2.7	2.8	4	2.7	2.9	7	2.7	-	-	2.7	2.9	7	2.7	-	-
Selenium	mg/kg	0.1	0.2	67	0.1	0.2	67	0.1	-	-	0.1	-	-	0.1	-	-
Silver	mg/kg	< 0.1	< 0.1	0	< 0.1	< 0.1	0	< 0.1	-	-	< 0.1	-	-	< 0.1	-	-
Vanadium	mg/kg	7.5	7.9	5	7.5	7.3	3	7.5	-	-	7.5	-	-	7.5	-	-
Zinc	mg/kg	32.8	26.9	20	32.8	25.7	24	32.8	-	-	32.8	51	43	32.8	-	-
Organo Metals																
Dibutyltin as Sn	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0027	-
Monobutyltin as Sn	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0022	-
Tributyltin	mg/kg	0.0006	0.0017	96	0.0006	0.0012	67	-	-	-	0.0006	-	-	0.0006	-	-
Tributyltin (as Sn)	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0012	-
BTEXN																
Benzene	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Toluene	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Ethylbenzene	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Xylene (o)	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Xylene (m & p)	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Xylene Total	mg/kg	< 0.5	< 0.5	0	< 0.5	< 0.5	0	< 0.5	-	-	< 0.5	-	-	< 0.5	-	-
BTEX (Sum of Total) - Lab Calc	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	-	-	< 0.2	-	-	< 0.2	-	-
Naphthalene (BTEXN suite)	mg/kg	< 0.2	< 0.2	0	< 0.2	< 0.2	0	< 0.2	< 0.5	0	< 0.2	-	-	< 0.2	-	-
TRH - NEPM 2013																
F1 (C6-C10 minus BTEX)	mg/kg	< 3.0	< 3.0	0	< 3.0	< 3.0	0	< 3.0	< 20	0	< 3.0	-	-	< 3.0	-	-
C6-C10 Fraction	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 20	0	< 3	-	-	< 3	-	-
F2 (> C10-C16 minus	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 50	0	< 3	-	-	< 3	-	-
> C10-C16 Fraction	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 50	0	< 3	-	-	< 3	-	-
F3 (> C16-C34 Fraction)	mg/kg	18	17	6	18	16	12	18	< 100	0	18	-	-	18	-	-
F4 (> C34-C40 Fraction)	mg/kg	< 5	< 5	0	< 5	< 5	0	< 5	< 100	0	< 5	-	-	< 5	-	-
> C10-C40 (Sum of Total)	mg/kg	18	17	6	18	16	12	18	< 100	0	18	-	-	18	-	-
TRH - NEPM 1999																
C6-C9 Fraction	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 20	0	< 3	-	-	< 3	-	-
C10-C14 Fraction	mg/kg	< 3	< 3	0	< 3	< 3	0	< 3	< 20	0	< 3	-	-	< 3	-	-
C15-C28 Fraction	mg/kg	12	10	18	12	9	29	12	< 50	0	12	-	-	12	-	-
C29-C36 Fraction	mg/kg	8	9	12	8	9	12	8	< 50	0	8	-	-	8	-	-
C10-C36 (Sum of Total)	mg/kg	20	19	5	20	18	11	20	< 50	0	20	-	-	20	-	-
PAHs - standard 16																
Acenaphthene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Acenaphthylene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Anthracene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Benz(a)anthracene	mg/kg	0.005	< 0.004	22	0.005	0.005	0	0.005	< 0.005	0	0.005	-	-	0.005	-	-
Benzo(a)pyrene	mg/kg	0.006	< 0.004	40	0.006	0.006	0	0.006	< 0.005	18	0.006	-	-	0.006	-	-
Benzo(b+ j)fluoranthene	mg/kg	0.005	0.004	22	0.005	0.006	18	0.005	< 0.005	0	0.005	-	-	0.005	-	-
Benzo(k)fluoranthene	mg/kg	< 0.004	< 0.004	0	< 0.004	0.005	22	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Benzo(g,h,i)perylene	mg/kg	0.005	< 0.004	22	0.005	0.005	0	0.005	< 0.005	0	0.005	-	-	0.005	-	-
Chrysene	mg/kg	0.006	< 0.004	40	0.006	0.006	0	0.006	< 0.005	18	0.006	-	-	0.006	-	-
Dibenz(a,h)anthracene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Fluoranthene	mg/kg	0.012	0.005	82	0.012	0.012	0	0.012	< 0.005	82	0.012	-	-	0.012	-	-
Fluorene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	< 0.005	0	< 0.004	-	-	< 0.004	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg	0.005	< 0.004	22	0.005	0.004	22	0.005	< 0.005	0	0.005	-	-	0.005	-	-
Naphthalene-PAH	mg/kg	< 0.005	< 0.005	0	< 0.005	< 0.005	0	< 0.005	< 0.005	0	< 0.005	-	-	< 0.005	-	-
Phenanthrene	mg/kg	0.009	0.004	77	0.009	0.006	40	0.009	< 0.005	57	0.009	-	-	0.009	-	-
Pyrene	mg/kg	0.012	0.006	67	0.012	0.011	9	0.012	< 0.005	82	0.012	-	-	0.012	-	-
PAHs (Sum of total) - Lab calc	mg/kg	0.069	0.019	114	0.069	0.07	1	0.069	< 0.005	173	0.069	-	-	0.069	-	-
Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc	mg/kg	0.008	< 0.004	67	0.008	0.008	0	0.008	-	-	0.008	-	-	0.008	-	-
Total 8 PAHs (as BaP TEQ) (half LOR) - Lab Calc	mg/kg	0.01	0.005	67	0.01	0.01	0	0.01	-	-	0.01	-	-	0.01	-	-
Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc	mg/kg	0.012	0.01	18	0.012	0.012	0	0.012	-	-	0.012	-	-	0.012	-	-
PAHs - extended																
2-methylnaphthalene	mg/kg	< 0.005	< 0.005	0	< 0.005	< 0.005	0	< 0.005	-	-	< 0.005	-	-	< 0.005	-	-
Benzo(e)pyrene	mg/kg	0.004	< 0.004	0	0.004	0.004	0	0.004	-	-	0.004	-	-	0.004	-	-
Perylene	mg/kg	< 0.004	< 0.004	0	< 0.004	< 0.004	0	< 0.004	-	-	< 0.004	-	-	< 0.004	-	-
OC Pesticides																
Organochlorine pesticides	mg/kg	-	-	-	-	-	-	-	< 0.01	-	-	-	-	-	-	-
Other organochlorine pesticides EPAVic	mg/kg	-	-	-	-	-	-	-	< 0.01	-	-	-	-	-	-	-
4,4'-DDE	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
a-BHC	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Aldrin	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Aldrin + Dieldrin	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
b-BHC	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Chlordane	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.01	0	< 0.00050	-	-	< 0.00050	-	-
Chlordane (cis)	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	-	-	< 0.00050	-	-	< 0.00050	-	-
Chlordane (trans)	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	-	-	< 0.00050	-	-	< 0.00050	-	-
d-BHC	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
4,4 DDD	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
4,4 DDT	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
DDT+ DDE+ DDD - Lab Calc	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Dieldrin	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endosulfan	µg/kg	< 0.50	< 0.50	0	< 0.50	< 0.50	0	< 0.50	-	-	< 0.50	-	-	< 0.50	-	-
Endosulfan I (alpha)	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endosulfan II (beta)	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endosulfan Sulfate	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endrin	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endrin aldehyde	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Endrin ketone	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
g-BHC (Lindane)	mg/kg	< 0.00025	< 0.00025	0	< 0.00025	< 0.00025	0	< 0.00025	< 0.005	0	< 0.00025	-	-	< 0.00025	-	-
Heptachlor	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Heptachlor epoxide	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Hexachlorobenzene	µg/kg	< 0.50	< 0.50	0	< 0.50	< 0.50	0	< 0.50	< 5	0	< 0.50	-	-	< 0.50	-	-
Methoxychlor	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	< 0.005	0	< 0.00050	-	-	< 0.00050	-	-
Oxychlordane	mg/kg	< 0.00050	< 0.00050	0	< 0.00050	< 0.00050	0	< 0.00050	-	-	< 0.00050	-	-	< 0.00050	-	-
Toxaphene	mg/kg	-	-	-	-	-	-	-	< 0.1	-	-	-	-	-	-	-
PCBs																
Arochlor 1016	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1221	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1232	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1242	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1248	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1254	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
Arochlor 1260	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
PCBs (Total)	µg/kg	< 5.0	< 5.0	0	< 5.0	< 5.0	0	< 5.0	< 100	0	< 5.0	-	-	< 5.0	-	-
SVOCs																
Coronene	mg/kg	< 0.005	< 0.005	0	< 0.005	< 0.005	0	< 0.005	-	-	< 0.005	-	-	< 0.005	-	-

**RPDs have only been considered where a concen
**Elevated RPDs are highlighted as per QAQC Pro
***Interlab Duplicates are matched on a per compo

12554729

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.118/11/2021 10:48:20 AM
From File	data for ucl calcs.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Tributyltin #1

General Statistics

Total Number of Observations	26	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	5.0000E-4	Mean	0.00689
Maximum	0.0954	Median	9.5000E-4
SD	0.0194	Std. Error of Mean	0.0038
Coefficient of Variation	2.809	Skewness	4.268

Normal GOF Test

Shapiro Wilk Test Statistic	0.363	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.427	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.0134	95% Adjusted-CLT UCL (Chen-1995)	0.0165
		95% Modified-t UCL (Johnson-1978)	0.0139

Gamma GOF Test

A-D Test Statistic	3.329	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.82	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.257	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.182	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.445	k star (bias corrected MLE)	0.419
Theta hat (MLE)	0.0155	Theta star (bias corrected MLE)	0.0164
nu hat (MLE)	23.12	nu star (bias corrected)	21.79
MLE Mean (bias corrected)	0.00689	MLE Sd (bias corrected)	0.0106
		Approximate Chi Square Value (0.05)	12.18
Adjusted Level of Significance	0.0398	Adjusted Chi Square Value	11.71

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.0123	95% Adjusted Gamma UCL (use when n<50)	0.0128

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.793	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.92	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.29	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.17	Data Not Lognormal at 5% Significance Level

56	**Data Not Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59						Minimum of Logged Data	-7.601			Mean of logged Data	-6.432	
60						Maximum of Logged Data	-2.35			SD of logged Data	1.45	
61												
62	**Assuming Lognormal Distribution**											
63						95% H-UCL	0.0114			90% Chebyshev (MVUE) UCL	0.00875	
64						95% Chebyshev (MVUE) UCL	0.0108			97.5% Chebyshev (MVUE) UCL	0.0136	
65						99% Chebyshev (MVUE) UCL	0.0191					
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data do not follow a Discernible Distribution (0.05)**											
69												
70	**Nonparametric Distribution Free UCLs**											
71						95% CLT UCL	0.0131			95% Jackknife UCL	0.0134	
72						95% Standard Bootstrap UCL	0.0131			95% Bootstrap-t UCL	0.0577	
73						95% Hall's Bootstrap UCL	0.0406			95% Percentile Bootstrap UCL	0.0137	
74						95% BCA Bootstrap UCL	0.0175					
75						90% Chebyshev(Mean, Sd) UCL	0.0183			95% Chebyshev(Mean, Sd) UCL	0.0234	
76						97.5% Chebyshev(Mean, Sd) UCL	0.0306			99% Chebyshev(Mean, Sd) UCL	0.0447	
77												
78	**Suggested UCL to Use**											
79						95% Chebyshev (Mean, Sd) UCL	0.0234					
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	Recommendations are based upon data size, data distribution, and skewness.											
83	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
84	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
85												

Appendix D

Quality assurance and control

Results and discussion regarding quality assurance (QA) and quality control (QC) are presented below.

Field QC

Relative percent differences

A total of four intra-laboratory duplicates and four inter-laboratory duplicates were submitted to the laboratories for analysis. Relative percent differences (RPDs) were calculated, with results summarised in Table 8 in Appendix C.

RPD exceedances are summarised in the Table D.1.

Table D.1 Duplicate RPD exceedances

QC Sample	Parent Sample	Analyte	RPD (%)	Comment
FD04	SD04_0.0_0.5	Tributyltin	105	Concentrations were relatively low and the difference in concentrations between the primary and duplicate samples was marginal and generally by less than one order of magnitude. The difference in concentrations is likely attributed to the heterogeneity of the sample material. Concentrations of the analytes are either well below or above the adopted assessment criteria, hence this variation is not considered to affect the outcome of the assessment.
		Fluoranthene	55	
FD05	SD04_0.0_0.5	Selenium	67	
		Naphthalene-PAH	82	
		Mercury	100	
FD06	SD04_0.5_1.0	Selenium	76	
FD07	SD04_0.5_1.0	F3 (>C16-C34 Fraction)	108	
		C15-C28 Fraction	80	
		Fluoranthene	67	
		Pyrene	67	
		Chromium (III+VI)	35	
		Copper	32	
		Lead	36	
		Nickel	38	
		Zinc	38	
FD08	SD05_0.0-0.5	F3 (>C16-C34 Fraction)	100	
		C15-C28 Fraction	67	
		Chrysene	67	
FD09	SD05_0.0-0.5	Pyrene	57	
		Chrysene	67	
		Fluoranthene	57	
		Naphthalene-PAH	75	
		Pyrene	57	
		Chromium (III+VI)	33	
		Nickel	32	
FD10	SD05_0.5-1.0	Copper	118	
		Selenium	67	
		Tributyltin	96	
		Fluoranthene	82	
		Phenanthrene	77	
		Pyrene	67	

QC Sample	Parent Sample	Analyte	RPD (%)	Comment
FD11	SD05_0.5-1.0	Copper	124	
		Selenium	67	
		Tributyltin	67	
		Fluoranthene	82	
		Phenanthrene	57	
		Pyrene	82	
		Copper	135	
		Zinc	43	

The above duplicate RPD exceedances are considered to be relatively marginal and likely attributed to sample heterogeneity, which is expected given the material (sediment) encountered. Further, it is noted that concentrations of the analytes above are either well below (including less than the LOR) or well above the adopted assessment criteria for all samples. On this basis, GHD considers that the indicated variability has not impacted the quality of the dataset and doesn't affect the outcome of the assessment.

Laboratory QAQC

The laboratory carried out internal QC procedures as part of its NATA accreditation, which included analysis of QC samples (duplicates, method blanks, control samples, laboratory controlled spikes, matrix spikes, and sample surrogates). Laboratory QAQC documentation, including holding time compliance, frequency of QC samples, and QC results are provided in Appendix E. The documents were reviewed by GHD and indicated that the laboratory was generally operating and providing results within its acceptable limits.

A summary of the laboratory QC outliers is presented in Table D.2.

Table D.2 Laboratory QC outliers

Laboratory batch	QC sample type	Analyte	Result	Limits	Comment
840516 – Eurofins MGT Triplicate Samples	Matrix spike	Aroclor - 1016	0.0 %	70-130 %	An acceptable recovery was obtained for the laboratory control sample indicating sample matrix interference
		Aroclor - 1260	0.0 %	70-130 %	

These outliers are not considered to significantly affect this assessment, given concentrations of PCB were all below the LOR and all other QA/QC procedures and samples/analytes were acceptable.

In general, the data was considered to be valid and of sufficient quality for use in this assessment.

Appendix E

Laboratory documents

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2130323**	Page	: 1 of 31
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR JESSE SIMKUS	Contact	: Andrew Epps
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8639
Project	: 12554729 Crowdy Head REF	Date Samples Received	: 25-Oct-2021 08:50
Order number	: 12554729	Date Analysis Commenced	: 26-Oct-2021
C-O-C number	: EB_OCR__20211025113636_2510202	Issue Date	: 05-Nov-2021 14:15
Sampler	: Jesse Simkus		
Site	: ----		
Quote number	: BN/405/21		
No. of samples received	: 29		
No. of samples analysed	: 26		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Matt Frost	Assistant Laboratory Manager	Brisbane Organics, 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 Contact 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.
- EP131A: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- **Ultra Trace OCP, PCB, PAH and Bulk Density analysis is conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- EG020-SD (Total Metals in Sediments by ICP-MS): Sample SD05_0.5-1.0 (EB2130323-011) shows poor duplicate results due to sample heterogeneity. Confirmed by visual inspection.
- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- ALS is not NATA accredited for the analysis of bulk density in a soil matrix.

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD01_0.0-0.5	SD01_0.5-1.0	SD01_1.0-1.5	SD02_0.0-0.5	SD02_0.5-1.0
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-001	EB2130323-002	EB2130323-003	EB2130323-004	EB2130323-005
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	8.5	8.8	8.8	8.7	8.7
pH (Fox)	----	0.1	pH Unit	6.6	6.7	6.7	6.7	6.7
Reaction Rate	----	1	Reaction Unit	3	3	3	3	3
EA051 : Bulk Density								
ø Bulk Density	BULK_DENSITY	1	kg/m3	----	----	----	1020	1200
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	26.5	28.7	34.5	45.2	32.1
EA150: Particle Sizing								
+75µm	----	1	%	----	----	----	82	84
+150µm	----	1	%	----	----	----	39	43
+300µm	----	1	%	----	----	----	4	4
+425µm	----	1	%	----	----	----	2	2
+600µm	----	1	%	----	----	----	2	1
+1180µm	----	1	%	----	----	----	1	<1
+2.36mm	----	1	%	----	----	----	<1	<1
+4.75mm	----	1	%	----	----	----	<1	<1
+9.5mm	----	1	%	----	----	----	<1	<1
+19.0mm	----	1	%	----	----	----	<1	<1
+37.5mm	----	1	%	----	----	----	<1	<1
+75.0mm	----	1	%	----	----	----	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	----	----	8	6
Silt (2-60 µm)	----	1	%	----	----	----	8	9
Sand (0.06-2.00 mm)	----	1	%	----	----	----	83	85
Gravel (>2mm)	----	1	%	----	----	----	1	<1
Cobbles (>6cm)	----	1	%	----	----	----	<1	<1
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	----	----	2.64	2.64
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	1340	1680	1790	2660	2130
Iron	7439-89-6	50	mg/kg	3540	4070	4280	6220	5020
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1.00	mg/kg	5.90	5.26	4.64	6.58	5.30

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD01_0.0-0.5	SD01_0.5-1.0	SD01_1.0-1.5	SD02_0.0-0.5	SD02_0.5-1.0
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-001	EB2130323-002	EB2130323-003	EB2130323-004	EB2130323-005
				Result	Result	Result	Result	Result
EG020-SD: Total Metals in Sediments by ICPMS - Continued								
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	5.7	6.6	6.4	8.9	7.2
Copper	7440-50-8	1.0	mg/kg	1.4	2.6	3.1	9.2	7.4
Cobalt	7440-48-4	0.5	mg/kg	1.2	1.4	1.4	2.1	1.6
Lead	7439-92-1	1.0	mg/kg	1.3	1.7	1.9	3.3	2.6
Manganese	7439-96-5	10	mg/kg	53	62	69	75	59
Nickel	7440-02-0	1.0	mg/kg	2.8	3.3	3.0	4.8	3.8
Selenium	7782-49-2	0.1	mg/kg	0.1	0.1	0.4	0.3	0.3
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2.0	mg/kg	7.4	8.8	8.7	11.8	9.4
Zinc	7440-66-6	1.0	mg/kg	8.3	12.3	12.6	24.8	19.4
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	%	0.25	0.36	0.46	0.85	0.70
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
>C10 - C16 Fraction	----	3	mg/kg	<3	4	<3	7	4
>C16 - C34 Fraction	----	3	mg/kg	<3	15	12	58	29
>C34 - C40 Fraction	----	5	mg/kg	<5	<5	<5	16	9
>C10 - C40 Fraction (sum)	----	3	mg/kg	<3	19	12	81	42
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg	<3	4	<3	7	4
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	6	3
C15 - C28 Fraction	----	3	mg/kg	<3	11	9	33	19
C29 - C36 Fraction	----	5	mg/kg	<5	7	5	34	15
^ C10 - C36 Fraction (sum)	----	3	mg/kg	<3	21	14	73	37
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	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
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD01_0.0-0.5	SD01_0.5-1.0	SD01_1.0-1.5	SD02_0.0-0.5	SD02_0.5-1.0
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-001	EB2130323-002	EB2130323-003	EB2130323-004	EB2130323-005
				Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued								
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								
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	**1.2**	**0.6**
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.50	µg/kg	----	----	----	<0.50	<0.50
alpha-BHC	319-84-6	0.50	µg/kg	----	----	----	<0.50	<0.50
beta-BHC	319-85-7	0.50	µg/kg	----	----	----	<0.50	<0.50
delta-BHC	319-86-8	0.50	µg/kg	----	----	----	<0.50	<0.50
4.4`-DDD	72-54-8	0.50	µg/kg	----	----	----	<0.50	<0.50
4.4`-DDE	72-55-9	0.50	µg/kg	----	----	----	<0.50	<0.50
4.4`-DDT	50-29-3	0.50	µg/kg	----	----	----	<0.50	<0.50
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.50	µg/kg	----	----	----	<0.50	<0.50
Dieldrin	60-57-1	0.50	µg/kg	----	----	----	<0.50	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg	----	----	----	<0.50	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg	----	----	----	<0.50	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg	----	----	----	<0.50	<0.50
^ **Endosulfan (sum)**	115-29-7	0.50	µg/kg	----	----	----	<0.50	<0.50
Endrin	72-20-8	0.50	µg/kg	----	----	----	<0.50	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg	----	----	----	<0.50	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg	----	----	----	<0.50	<0.50
Heptachlor	76-44-8	0.50	µg/kg	----	----	----	<0.50	<0.50
Heptachlor epoxide	1024-57-3	0.50	µg/kg	----	----	----	<0.50	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	----	----	----	<0.50	<0.50
gamma-BHC	58-89-9	0.25	µg/kg	----	----	----	<0.25	<0.25
Methoxychlor	72-43-5	0.50	µg/kg	----	----	----	<0.50	<0.50
cis-Chlordane	5103-71-9	0.50	µg/kg	----	----	----	<0.50	<0.50
trans-Chlordane	5103-74-2	0.50	µg/kg	----	----	----	<0.50	<0.50
^ **Total Chlordane (sum)**	----	0.50	µg/kg	----	----	----	<0.50	<0.50

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD01_0.0-0.5	SD01_0.5-1.0	SD01_1.0-1.5	SD02_0.0-0.5	SD02_0.5-1.0
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-001	EB2130323-002	EB2130323-003	EB2130323-004	EB2130323-005
				Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued								
Oxychlordane	27304-13-8	0.50	µg/kg	----	----	----	<0.50	<0.50
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.50	µg/kg	----	----	----	<0.50	<0.50
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	----	----	----	<5.0	<5.0
Aroclor 1016	12674-11-2	5.0	µg/kg	----	----	----	<5.0	<5.0
Aroclor 1221	11104-28-2	5.0	µg/kg	----	----	----	<5.0	<5.0
Aroclor 1232	11141-16-5	5.0	µg/kg	----	----	----	<5.0	<5.0
Aroclor 1242	53469-21-9	5.0	µg/kg	----	----	----	<5.0	<5.0
Aroclor 1248	12672-29-6	5.0	µg/kg	----	----	----	<5.0	<5.0
Aroclor 1254	11097-69-1	5.0	µg/kg	----	----	----	<5.0	<5.0
Aroclor 1260	11096-82-5	5.0	µg/kg	----	----	----	<5.0	<5.0
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	18	11	19	15
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	8
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	6
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	5	9
Phenanthrene	85-01-8	4	µg/kg	<4	14	12	19	68
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	6	19
Fluoranthene	206-44-0	4	µg/kg	<4	22	20	35	117
Pyrene	129-00-0	4	µg/kg	<4	21	19	30	96
Benz(a)anthracene	56-55-3	4	µg/kg	<4	12	10	18	52
Chrysene	218-01-9	4	µg/kg	<4	15	13	43	51
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	11	11	15	48
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	10	8	11	32
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	9	8	10	32
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	12	10	13	48
Perylene	198-55-0	4	µg/kg	<4	5	4	5	16
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	8	7	8	32
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	9
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	7	6	8	27
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	9
^ Sum of PAHs	----	4	µg/kg	<4	164	139	245	694
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<4	16	14	19	74

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	SD01_0.0-0.5	SD01_0.5-1.0	SD01_1.0-1.5	SD02_0.0-0.5	SD02_0.5-1.0
				Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit		EB2130323-001	EB2130323-002	EB2130323-003	EB2130323-004	EB2130323-005
					Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg		5	18	16	21	74
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg		10	20	18	23	74
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		82.0	97.3	83.0	97.8	82.2
Toluene-D8	2037-26-5	0.2	%		73.6	67.3	70.5	68.7	69.1
4-Bromofluorobenzene	460-00-4	0.2	%		94.7	94.7	92.9	94.2	88.8
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		106	138	93.2	95.2	102
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.50	%		----	----	----	71.1	51.6
EP131T: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.5	%		----	----	----	65.0	55.0
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		110	124	107	106	115
Anthracene-d10	1719-06-8	10	%		116	110	113	97.9	109
4-Terphenyl-d14	1718-51-0	10	%		114	102	107	89.6	103

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD03_0.0-0.5	SD03_0.5-1.0	SD04_0.0-0.5	SD04_0.5-1.0	SD05_0.0-0.5
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-006	EB2130323-007	EB2130323-008	EB2130323-009	EB2130323-010
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	8.8	8.8	8.6	8.8	8.8
pH (Fox)	----	0.1	pH Unit	6.6	6.6	6.7	6.7	6.6
Reaction Rate	----	1	Reaction Unit	3	3	3	3	3
EA051 : Bulk Density								
ø Bulk Density	BULK_DENSITY	1	kg/m3	----	----	1540	1430	1650
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	28.5	25.7	25.2	25.8	25.4
EA150: Particle Sizing								
+75µm	----	1	%	----	----	95	92	93
+150µm	----	1	%	----	----	64	60	59
+300µm	----	1	%	----	----	3	4	8
+425µm	----	1	%	----	----	<1	2	3
+600µm	----	1	%	----	----	<1	1	2
+1180µm	----	1	%	----	----	<1	<1	1
+2.36mm	----	1	%	----	----	<1	<1	<1
+4.75mm	----	1	%	----	----	<1	<1	<1
+9.5mm	----	1	%	----	----	<1	<1	<1
+19.0mm	----	1	%	----	----	<1	<1	<1
+37.5mm	----	1	%	----	----	<1	<1	<1
+75.0mm	----	1	%	----	----	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	----	1	4	4
Silt (2-60 µm)	----	1	%	----	----	3	3	2
Sand (0.06-2.00 mm)	----	1	%	----	----	96	93	93
Gravel (>2mm)	----	1	%	----	----	<1	<1	1
Cobbles (>6cm)	----	1	%	----	----	<1	<1	<1
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	----	2.64	2.65	2.64
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	1110	1080	1380	1260	1470
Iron	7439-89-6	50	mg/kg	3120	2860	3540	3250	3550
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1.00	mg/kg	5.14	4.69	5.10	4.59	4.34

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD03_0.0-0.5	SD03_0.5-1.0	SD04_0.0-0.5	SD04_0.5-1.0	SD05_0.0-0.5
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-006	EB2130323-007	EB2130323-008	EB2130323-009	EB2130323-010
				Result	Result	Result	Result	Result
EG020-SD: Total Metals in Sediments by ICPMS - Continued								
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	4.1	3.9	5.8	4.2	5.0
Copper	7440-50-8	1.0	mg/kg	1.8	2.0	3.3	3.4	6.4
Cobalt	7440-48-4	0.5	mg/kg	1.0	0.9	1.1	1.0	1.1
Lead	7439-92-1	1.0	mg/kg	1.1	1.1	1.5	1.6	2.4
Manganese	7439-96-5	10	mg/kg	40	34	44	40	38
Nickel	7440-02-0	1.0	mg/kg	1.9	1.9	2.8	1.9	2.4
Selenium	7782-49-2	0.1	mg/kg	0.2	<0.1	0.1	0.1	0.2
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2.0	mg/kg	6.3	5.4	7.0	6.7	6.6
Zinc	7440-66-6	1.0	mg/kg	7.5	7.8	12.2	11.6	20.1
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	%	0.27	0.16	0.24	0.23	0.31
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
>C10 - C16 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
>C16 - C34 Fraction	----	3	mg/kg	13	3	14	10	9
>C34 - C40 Fraction	----	5	mg/kg	<5	<5	<5	<5	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg	13	3	14	10	9
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg	<3	<3	<3	<3	<3
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	9	<3	10	7	6
C29 - C36 Fraction	----	5	mg/kg	6	<5	7	<5	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg	15	<3	17	7	6
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	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
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD03_0.0-0.5	SD03_0.5-1.0	SD04_0.0-0.5	SD04_0.5-1.0	SD05_0.0-0.5
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-006	EB2130323-007	EB2130323-008	EB2130323-009	EB2130323-010
				Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued								
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								
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	<0.5	<0.5	**0.8**
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
alpha-BHC	319-84-6	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
beta-BHC	319-85-7	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
delta-BHC	319-86-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
4.4`-DDD	72-54-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
4.4`-DDE	72-55-9	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
4.4`-DDT	50-29-3	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Dieldrin	60-57-1	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
^ Endosulfan (sum)	115-29-7	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Endrin	72-20-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Heptachlor	76-44-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Heptachlor epoxide	1024-57-3	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
gamma-BHC	58-89-9	0.25	µg/kg	----	----	<0.25	<0.25	<0.25
Methoxychlor	72-43-5	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
cis-Chlordane	5103-71-9	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
trans-Chlordane	5103-74-2	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
^ Total Chlordane (sum)	----	0.50	µg/kg	----	----	<0.50	<0.50	<0.50

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD03_0.0-0.5	SD03_0.5-1.0	SD04_0.0-0.5	SD04_0.5-1.0	SD05_0.0-0.5
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-006	EB2130323-007	EB2130323-008	EB2130323-009	EB2130323-010
				Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued								
Oxychlordane	27304-13-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1016	12674-11-2	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1221	11104-28-2	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1232	11141-16-5	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1242	53469-21-9	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1248	12672-29-6	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1254	11097-69-1	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1260	11096-82-5	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	**9**	<5	**12**	**7**	**11**
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	**5**	**6**
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	<4	<4
Fluoranthene	206-44-0	4	µg/kg	<4	<4	<4	**8**	**9**
Pyrene	129-00-0	4	µg/kg	<4	<4	**6**	**8**	**9**
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	**5**	**5**
Chrysene	218-01-9	4	µg/kg	<4	<4	<4	**5**	**10**
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	<4	<4	**5**	**5**
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	**5**	**6**
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	**9**	<4	**18**	**48**	**77**
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	<4	<4	<4	**6**	**8**

Analytical Results

Sub-Matrix: **SEDIMENT** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Sample ID	SD03_0.0-0.5	SD03_0.5-1.0	SD04_0.0-0.5	SD04_0.5-1.0	SD05_0.0-0.5
				Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
					EB2130323-006	EB2130323-007	EB2130323-008	EB2130323-009	EB2130323-010
					Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg		5	5	5	8	10
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg		10	10	10	11	12
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		106	79.3	81.8	92.5	87.5
Toluene-D8	2037-26-5	0.2	%		69.9	70.4	64.6	70.2	68.5
4-Bromofluorobenzene	460-00-4	0.2	%		97.5	89.7	85.8	96.7	91.8
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		114	105	101	88.9	85.6
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.50	%		----	----	61.2	51.6	48.1
EP131T: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.5	%		----	----	81.2	61.2	55.0
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		117	110	112	116	112
Anthracene-d10	1719-06-8	10	%		119	94.9	109	112	106
4-Terphenyl-d14	1718-51-0	10	%		112	88.9	103	106	96.5

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD05_0.5-1.0	SD06_0.0-0.5	SD06_0.5-1.0	SD07_0.0-0.5	SD07_0.5-1.0
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-011	EB2130323-012	EB2130323-013	EB2130323-014	EB2130323-015
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	8.8	8.6	8.7	8.6	8.8
pH (Fox)	----	0.1	pH Unit	6.6	6.6	6.6	6.6	6.7
Reaction Rate	----	1	Reaction Unit	3	3	3	3	3
EA051 : Bulk Density								
ø Bulk Density	BULK_DENSITY	1	kg/m3	1480	1380	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	23.8	24.8	26.2	29.7	29.3
EA150: Particle Sizing								
+75µm	----	1	%	92	94	91	85	85
+150µm	----	1	%	64	61	48	42	43
+300µm	----	1	%	11	4	6	11	12
+425µm	----	1	%	6	<1	3	6	7
+600µm	----	1	%	4	<1	2	4	4
+1180µm	----	1	%	3	<1	2	1	2
+2.36mm	----	1	%	2	<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
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	4	2	4	6	8
Silt (2-60 µm)	----	1	%	3	3	4	8	6
Sand (0.06-2.00 mm)	----	1	%	91	95	91	85	85
Gravel (>2mm)	----	1	%	2	<1	1	1	1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.64	2.67	2.65	2.61	2.66
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	1610	1400	1740	2210	2540
Iron	7439-89-6	50	mg/kg	3920	3630	4160	5180	5780
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1.00	mg/kg	4.95	4.91	5.06	5.09	6.23

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD05_0.5-1.0	SD06_0.0-0.5	SD06_0.5-1.0	SD07_0.0-0.5	SD07_0.5-1.0
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-011	EB2130323-012	EB2130323-013	EB2130323-014	EB2130323-015
				Result	Result	Result	Result	Result
EG020-SD: Total Metals in Sediments by ICPMS - Continued								
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	5.4	4.6	6.2	7.0	7.8
Copper	7440-50-8	1.0	mg/kg	39.0	4.2	8.2	20.6	24.4
Cobalt	7440-48-4	0.5	mg/kg	1.2	1.1	1.3	1.5	1.6
Lead	7439-92-1	1.0	mg/kg	3.3	2.1	2.9	4.3	4.8
Manganese	7439-96-5	10	mg/kg	41	44	50	47	50
Nickel	7440-02-0	1.0	mg/kg	2.7	2.2	2.9	3.6	3.9
Selenium	7782-49-2	0.1	mg/kg	0.1	0.1	<0.1	0.3	0.3
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2.0	mg/kg	7.5	6.9	8.1	8.5	9.4
Zinc	7440-66-6	1.0	mg/kg	32.8	20.0	25.9	37.8	43.1
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.01	0.05	0.01	0.02	0.02
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.31	0.25	0.37	0.54	0.57
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
>C10 - C16 Fraction	----	3	mg/kg	<3	3	<3	3	<3
>C16 - C34 Fraction	----	3	mg/kg	18	22	17	22	16
>C34 - C40 Fraction	----	5	mg/kg	<5	6	5	6	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg	18	31	22	31	16
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg	<3	3	<3	3	<3
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	12	15	11	15	11
C29 - C36 Fraction	----	5	mg/kg	8	11	9	11	8
^ C10 - C36 Fraction (sum)	----	3	mg/kg	20	29	20	29	19
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	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
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD05_0.5-1.0	SD06_0.0-0.5	SD06_0.5-1.0	SD07_0.0-0.5	SD07_0.5-1.0
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-011	EB2130323-012	EB2130323-013	EB2130323-014	EB2130323-015
				Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued								
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								
Tributyltin	56573-85-4	0.5	µgSn/kg	**0.6**	<0.5	<0.5	**3.6**	**2.0**
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
alpha-BHC	319-84-6	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
beta-BHC	319-85-7	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
delta-BHC	319-86-8	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
4.4`-DDD	72-54-8	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
4.4`-DDE	72-55-9	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
4.4`-DDT	50-29-3	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
Dieldrin	60-57-1	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
alpha-Endosulfan	959-98-8	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
beta-Endosulfan	33213-65-9	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
Endosulfan sulfate	1031-07-8	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
^ **Endosulfan (sum)**	115-29-7	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
Endrin	72-20-8	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
Endrin aldehyde	7421-93-4	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
Endrin ketone	53494-70-5	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
Heptachlor	76-44-8	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
Heptachlor epoxide	1024-57-3	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
gamma-BHC	58-89-9	0.25	µg/kg	<0.25	<0.25	<0.25	----	----
Methoxychlor	72-43-5	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
cis-Chlordane	5103-71-9	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
trans-Chlordane	5103-74-2	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
^ **Total Chlordane (sum)**	----	0.50	µg/kg	<0.50	<0.50	<0.50	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD05_0.5-1.0	SD06_0.0-0.5	SD06_0.5-1.0	SD07_0.0-0.5	SD07_0.5-1.0
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-011	EB2130323-012	EB2130323-013	EB2130323-014	EB2130323-015
				Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued								
Oxychlordane	27304-13-8	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.50	µg/kg	<0.50	<0.50	<0.50	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	<5.0	<5.0	<5.0	----	----
Aroclor 1016	12674-11-2	5.0	µg/kg	<5.0	<5.0	<5.0	----	----
Aroclor 1221	11104-28-2	5.0	µg/kg	<5.0	<5.0	<5.0	----	----
Aroclor 1232	11141-16-5	5.0	µg/kg	<5.0	<5.0	<5.0	----	----
Aroclor 1242	53469-21-9	5.0	µg/kg	<5.0	<5.0	<5.0	----	----
Aroclor 1248	12672-29-6	5.0	µg/kg	<5.0	<5.0	<5.0	----	----
Aroclor 1254	11097-69-1	5.0	µg/kg	<5.0	<5.0	<5.0	----	----
Aroclor 1260	11096-82-5	5.0	µg/kg	<5.0	<5.0	<5.0	----	----
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	12	6	13	6
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	5	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	5	<4
Phenanthrene	85-01-8	4	µg/kg	9	<4	7	15	12
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	4	<4
Fluoranthene	206-44-0	4	µg/kg	12	<4	13	28	15
Pyrene	129-00-0	4	µg/kg	12	<4	14	27	16
Benz(a)anthracene	56-55-3	4	µg/kg	5	<4	7	13	8
Chrysene	218-01-9	4	µg/kg	6	<4	13	24	9
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	5	<4	7	25	8
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	5	13	7
Benzo(e)pyrene	192-97-2	4	µg/kg	4	<4	6	15	6
Benzo(a)pyrene	50-32-8	4	µg/kg	6	<4	7	14	9
Perylene	198-55-0	4	µg/kg	<4	<4	<4	5	4
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	5	<4	6	11	8
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	5	<4
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	5	<4	5	12	7
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	69	12	96	234	119
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	8	<4	10	26	12

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD05_0.5-1.0	SD06_0.0-0.5	SD06_0.5-1.0	SD07_0.0-0.5	SD07_0.5-1.0
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-011	EB2130323-012	EB2130323-013	EB2130323-014	EB2130323-015
				Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	10	5	12	26	14
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	12	10	14	26	16
EP080-SD: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	87.9	84.4	74.8	75.8	78.4
Toluene-D8	2037-26-5	0.2	%	56.6	70.3	62.7	66.7	70.8
4-Bromofluorobenzene	460-00-4	0.2	%	89.2	94.7	87.8	87.4	95.5
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	63.4	89.7	56.1	107	55.0
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.50	%	56.7	39.4	50.4	----	----
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.5	%	87.5	66.2	60.0	----	----
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	10	%	110	110	112	111	116
Anthracene-d10	1719-06-8	10	%	94.8	92.4	102	105	106
4-Terphenyl-d14	1718-51-0	10	%	88.3	84.9	114	104	98.4

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD07_1.0-1.3	SD08_0.0-0.5	SD08_0.5-1.0	FD04	FD05
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-016	EB2130323-017	EB2130323-018	EB2130323-022	EB2130323-023
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	9.0	8.6	8.6	----	----
pH (Fox)	----	0.1	pH Unit	6.8	6.7	6.8	----	----
Reaction Rate	----	1	Reaction Unit	3	3	3	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	20.0	35.4	36.6	29.2	26.5
EA150: Particle Sizing								
+75µm	----	1	%	----	73	71	----	----
+150µm	----	1	%	----	31	34	----	----
+300µm	----	1	%	----	6	8	----	----
+425µm	----	1	%	----	3	3	----	----
+600µm	----	1	%	----	2	2	----	----
+1180µm	----	1	%	----	<1	2	----	----
+2.36mm	----	1	%	----	<1	<1	----	----
+4.75mm	----	1	%	----	<1	<1	----	----
+9.5mm	----	1	%	----	<1	<1	----	----
+19.0mm	----	1	%	----	<1	<1	----	----
+37.5mm	----	1	%	----	<1	<1	----	----
+75.0mm	----	1	%	----	<1	<1	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	8	7	----	----
Silt (2-60 µm)	----	1	%	----	17	20	----	----
Sand (0.06-2.00 mm)	----	1	%	----	75	72	----	----
Gravel (>2mm)	----	1	%	----	<1	1	----	----
Cobbles (>6cm)	----	1	%	----	<1	<1	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	2.69	2.60	----	----
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	2020	3220	4580	1460	1360
Iron	7439-89-6	50	mg/kg	6090	7280	9840	3720	3580
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1.00	mg/kg	6.35	6.59	7.56	5.01	4.90
Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.2	0.2	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	5.7	10.0	10.8	4.7	4.6

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	SD07_1.0-1.3	SD08_0.0-0.5	SD08_0.5-1.0	FD04	FD05
				Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit		EB2130323-016	EB2130323-017	EB2130323-018	EB2130323-022	EB2130323-023
					Result	Result	Result	Result	Result
EG020-SD: Total Metals in Sediments by ICPMS - Continued									
Copper	7440-50-8	1.0	mg/kg		16.6	102	85.2	3.9	3.2
Cobalt	7440-48-4	0.5	mg/kg		1.4	1.8	2.2	1.2	1.1
Lead	7439-92-1	1.0	mg/kg		4.4	13.0	20.1	1.8	1.6
Manganese	7439-96-5	10	mg/kg		46	53	64	44	42
Nickel	7440-02-0	1.0	mg/kg		3.2	4.9	5.6	2.3	2.3
Selenium	7782-49-2	0.1	mg/kg		0.2	0.3	0.4	0.1	0.2
Silver	7440-22-4	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2.0	mg/kg		8.5	11.9	15.7	7.2	6.6
Zinc	7440-66-6	1.0	mg/kg		36.2	96.6	108	12.9	11.4
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.02	0.06	0.08	<0.01	<0.01
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.45	0.84	1.30	0.32	0.26
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		3	5	13	3	<3
>C16 - C34 Fraction	----	3	mg/kg		22	45	85	18	15
>C34 - C40 Fraction	----	5	mg/kg		6	10	20	5	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg		31	60	118	26	15
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		3	5	13	3	<3
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	4	6	3	3
C15 - C28 Fraction	----	3	mg/kg		15	34	67	13	11
C29 - C36 Fraction	----	5	mg/kg		12	18	35	8	7
^ C10 - C36 Fraction (sum)	----	3	mg/kg		27	56	108	24	21
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	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
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

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD07_1.0-1.3	SD08_0.0-0.5	SD08_0.5-1.0	FD04	FD05
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-016	EB2130323-017	EB2130323-018	EB2130323-022	EB2130323-023
				Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued								
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								
Tributyltin	56573-85-4	0.5	µgSn/kg	**3.0**	**30.4**	**124**	**1.6**	<0.5
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
alpha-BHC	319-84-6	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
beta-BHC	319-85-7	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
delta-BHC	319-86-8	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
4.4`-DDD	72-54-8	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
4.4`-DDE	72-55-9	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
4.4`-DDT	50-29-3	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-29-2	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
Dieldrin	60-57-1	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
^ Endosulfan (sum)	115-29-7	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
Endrin	72-20-8	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
Heptachlor	76-44-8	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
Heptachlor epoxide	1024-57-3	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
gamma-BHC	58-89-9	0.25	µg/kg	----	<0.25	<0.25	<0.25	<0.25
Methoxychlor	72-43-5	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
cis-Chlordane	5103-71-9	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
trans-Chlordane	5103-74-2	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
^ Total Chlordane (sum)	----	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
Oxychlordane	27304-13-8	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.50	µg/kg	----	<0.50	<0.50	<0.50	<0.50

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	SD07_1.0-1.3	SD08_0.0-0.5	SD08_0.5-1.0	FD04	FD05
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-016	EB2130323-017	EB2130323-018	EB2130323-022	EB2130323-023
				Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued								
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	----	<5.0	<5.0	<5.0	<5.0
Aroclor 1016	12674-11-2	5.0	µg/kg	----	<5.0	<5.0	<5.0	<5.0
Aroclor 1221	11104-28-2	5.0	µg/kg	----	<5.0	<5.0	<5.0	<5.0
Aroclor 1232	11141-16-5	5.0	µg/kg	----	<5.0	<5.0	<5.0	<5.0
Aroclor 1242	53469-21-9	5.0	µg/kg	----	<5.0	<5.0	<5.0	<5.0
Aroclor 1248	12672-29-6	5.0	µg/kg	----	<5.0	<5.0	<5.0	<5.0
Aroclor 1254	11097-69-1	5.0	µg/kg	----	<5.0	<5.0	<5.0	<5.0
Aroclor 1260	11096-82-5	5.0	µg/kg	----	<5.0	<5.0	<5.0	<5.0
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	18	12	13	8
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<4	13	21	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	22	7	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	19	14	<4	<4
Phenanthrene	85-01-8	4	µg/kg	11	69	33	<4	<4
Anthracene	120-12-7	4	µg/kg	<4	13	20	<4	<4
Fluoranthene	206-44-0	4	µg/kg	16	116	58	7	<4
Pyrene	129-00-0	4	µg/kg	14	103	65	7	4
Benz(a)anthracene	56-55-3	4	µg/kg	9	63	31	<4	<4
Chrysene	218-01-9	4	µg/kg	12	105	32	5	<4
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	12	72	50	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg	7	54	30	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg	8	50	33	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	11	79	54	<4	<4
Perylene	198-55-0	4	µg/kg	<4	23	19	<4	<4
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	8	52	40	<4	<4
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	27	18	<4	<4
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	7	57	40	<4	<4
Coronene	191-07-1	5	µg/kg	<5	21	18	<5	<5
^ Sum of PAHs	----	4	µg/kg	115	976	595	32	12
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg	15	132	88	<4	<4
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg	17	132	88	5	5
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg	19	132	88	10	10

Analytical Results

Sub-Matrix: **SEDIMENT** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Sample ID	SD07_1.0-1.3	SD08_0.0-0.5	SD08_0.5-1.0	FD04	FD05
				Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
					EB2130323-016	EB2130323-017	EB2130323-018	EB2130323-022	EB2130323-023
					Result	Result	Result	Result	Result
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		72.7	99.6	76.8	68.5	54.8
Toluene-D8	2037-26-5	0.2	%		76.9	66.2	67.0	67.1	61.1
4-Bromofluorobenzene	460-00-4	0.2	%		78.0	94.1	87.9	80.4	73.4
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		96.1	87.0	115	116	80.6
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.50	%		----	63.8	40.8	44.6	37.8
EP131T: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.5	%		----	68.8	66.2	52.5	53.8
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		93.3	104	111	116	109
Anthracene-d10	1719-06-8	10	%		87.6	102	106	118	100.0
4-Terphenyl-d14	1718-51-0	10	%		84.2	94.9	108	110	94.4

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	FD06	FD07	FD08	FD09	FD10
				Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit		EB2130323-024	EB2130323-025	EB2130323-026	EB2130323-027	EB2130323-028
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		29.8	28.7	29.4	23.3	28.6
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		1450	1150	1530	1290	1740
Iron	7439-89-6	50	mg/kg		3500	2910	3750	3280	4340
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1.00	mg/kg		4.80	3.47	4.99	5.51	6.24
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		5.2	3.6	5.4	6.3	5.6
Copper	7440-50-8	1.0	mg/kg		4.6	3.3	6.3	7.0	10.0
Cobalt	7440-48-4	0.5	mg/kg		1.1	0.8	1.2	1.3	1.2
Lead	7439-92-1	1.0	mg/kg		2.0	1.4	2.5	3.1	4.4
Manganese	7439-96-5	10	mg/kg		47	32	41	45	43
Nickel	7440-02-0	1.0	mg/kg		2.4	1.8	2.7	3.2	2.8
Selenium	7782-49-2	0.1	mg/kg		0.2	0.1	0.2	0.2	0.2
Silver	7440-22-4	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2.0	mg/kg		7.3	5.4	6.8	7.6	7.9
Zinc	7440-66-6	1.0	mg/kg		14.9	10.6	20.2	24.4	26.9
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	%		0.22	0.27	0.33	0.32	0.34
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
>C16 - C34 Fraction	----	3	mg/kg		8	<3	<3	11	17
>C34 - C40 Fraction	----	5	mg/kg		<5	<5	<5	<5	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg		8	<3	<3	11	17
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	<3	<3	<3	<3
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		6	<3	<3	7	10
C29 - C36 Fraction	----	5	mg/kg		<5	<5	<5	6	9

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	FD06	FD07	FD08	FD09	FD10
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit	EB2130323-024	EB2130323-025	EB2130323-026	EB2130323-027	EB2130323-028
				Result	Result	Result	Result	Result
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons - Continued								
^ C10 - C36 Fraction (sum)	----	3	mg/kg	**6**	<3	<3	**13**	**19**
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	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
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								
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	**0.8**	**0.8**	**1.7**
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
alpha-BHC	319-84-6	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
beta-BHC	319-85-7	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
delta-BHC	319-86-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
4.4`-DDD	72-54-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
4.4`-DDE	72-55-9	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
4.4`-DDT	50-29-3	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Dieldrin	60-57-1	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
^ Endosulfan (sum)	115-29-7	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Endrin	72-20-8	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg	<0.50	<0.50	<0.50	<0.50	<0.50

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	FD06	FD07	FD08	FD09	FD10
				Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit		EB2130323-024	EB2130323-025	EB2130323-026	EB2130323-027	EB2130323-028
					Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued									
Heptachlor	76-44-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Heptachlor epoxide	1024-57-3	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
gamma-BHC	58-89-9	0.25	µg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
Methoxychlor	72-43-5	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
cis-Chlordane	5103-71-9	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
trans-Chlordane	5103-74-2	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
^ Total Chlordane (sum)	----	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Oxychlordane	27304-13-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
EP131B: Polychlorinated Biphenyls (as Aroclors)									
^ Total Polychlorinated biphenyls	----	5.0	µg/kg		<5.0	<5.0	<5.0	<5.0	<5.0
Aroclor 1016	12674-11-2	5.0	µg/kg		<5.0	<5.0	<5.0	<5.0	<5.0
Aroclor 1221	11104-28-2	5.0	µg/kg		<5.0	<5.0	<5.0	<5.0	<5.0
Aroclor 1232	11141-16-5	5.0	µg/kg		<5.0	<5.0	<5.0	<5.0	<5.0
Aroclor 1242	53469-21-9	5.0	µg/kg		<5.0	<5.0	<5.0	<5.0	<5.0
Aroclor 1248	12672-29-6	5.0	µg/kg		<5.0	<5.0	<5.0	<5.0	<5.0
Aroclor 1254	11097-69-1	5.0	µg/kg		<5.0	<5.0	<5.0	<5.0	<5.0
Aroclor 1260	11096-82-5	5.0	µg/kg		<5.0	<5.0	<5.0	<5.0	<5.0
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		**6**	**5**	**9**	**8**	<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	**8**	**5**	**4**
Anthracene	120-12-7	4	µg/kg		<4	<4	<4	<4	<4
Fluoranthene	206-44-0	4	µg/kg		**5**	<4	**8**	**6**	**5**
Pyrene	129-00-0	4	µg/kg		**6**	<4	**8**	**5**	**6**
Benz(a)anthracene	56-55-3	4	µg/kg		<4	<4	<4	<4	<4
Chrysene	218-01-9	4	µg/kg		<4	<4	**5**	<4	<4
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

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	FD06	FD07	FD08	FD09	FD10
				Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	CAS Number	LOR	Unit		EB2130323-024	EB2130323-025	EB2130323-026	EB2130323-027	EB2130323-028
					Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
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		21	5	42	24	19
^ 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	%		52.6	94.0	72.7	69.8	77.0
Toluene-D8	2037-26-5	0.2	%		49.4	76.5	72.0	71.1	73.6
4-Bromofluorobenzene	460-00-4	0.2	%		62.2	97.7	80.2	78.9	80.7
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		71.1	118	106	96.3	58.8
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.50	%		41.2	46.6	39.5	49.1	50.2
EP131T: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.5	%		76.2	67.5	52.5	67.5	73.8
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		118	114	122	109	115
Anthracene-d10	1719-06-8	10	%		108	98.9	113	91.5	98.5
4-Terphenyl-d14	1718-51-0	10	%		102	93.2	105	86.2	94.2

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	FD11	----	----	----	----
				Sampling date / time	19-Oct-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2130323-029	--------	--------	--------	--------
					Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		**27.6**	----	----	----	----
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		**1610**	----	----	----	----
Iron	7439-89-6	50	mg/kg		**3840**	----	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.50	mg/kg		<0.50	----	----	----	----
Arsenic	7440-38-2	1.00	mg/kg		**4.67**	----	----	----	----
Cadmium	7440-43-9	0.1	mg/kg		<0.1	----	----	----	----
Chromium	7440-47-3	1.0	mg/kg		**5.7**	----	----	----	----
Copper	7440-50-8	1.0	mg/kg		**9.2**	----	----	----	----
Cobalt	7440-48-4	0.5	mg/kg		**1.2**	----	----	----	----
Lead	7439-92-1	1.0	mg/kg		**3.9**	----	----	----	----
Manganese	7439-96-5	10	mg/kg		**40**	----	----	----	----
Nickel	7440-02-0	1.0	mg/kg		**2.9**	----	----	----	----
Selenium	7782-49-2	0.1	mg/kg		**0.2**	----	----	----	----
Silver	7440-22-4	0.1	mg/kg		<0.1	----	----	----	----
Vanadium	7440-62-2	2.0	mg/kg		**7.3**	----	----	----	----
Zinc	7440-66-6	1.0	mg/kg		**25.7**	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		**0.01**	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		**0.35**	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		<3	----	----	----	----
>C16 - C34 Fraction	----	3	mg/kg		**16**	----	----	----	----
>C34 - C40 Fraction	----	5	mg/kg		<5	----	----	----	----
>C10 - C40 Fraction (sum)	----	3	mg/kg		**16**	----	----	----	----
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	----	----	----	----
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		**9**	----	----	----	----
C29 - C36 Fraction	----	5	mg/kg		**9**	----	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Sample ID	FD11	----	----	----	----
			Sampling date / time	19-Oct-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2130323-029	--------	--------	--------	--------
				Result	----	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons - Continued								
^ C10 - C36 Fraction (sum)	----	3	mg/kg	**18**	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	----	----	----	----
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg	<3.0	----	----	----	----
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								
Tributyltin	56573-85-4	0.5	µgSn/kg	**1.2**	----	----	----	----
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.50	µg/kg	<0.50	----	----	----	----
alpha-BHC	319-84-6	0.50	µg/kg	<0.50	----	----	----	----
beta-BHC	319-85-7	0.50	µg/kg	<0.50	----	----	----	----
delta-BHC	319-86-8	0.50	µg/kg	<0.50	----	----	----	----
4.4`-DDD	72-54-8	0.50	µg/kg	<0.50	----	----	----	----
4.4`-DDE	72-55-9	0.50	µg/kg	<0.50	----	----	----	----
4.4`-DDT	50-29-3	0.50	µg/kg	<0.50	----	----	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.50	µg/kg	<0.50	----	----	----	----
Dieldrin	60-57-1	0.50	µg/kg	<0.50	----	----	----	----
alpha-Endosulfan	959-98-8	0.50	µg/kg	<0.50	----	----	----	----
beta-Endosulfan	33213-65-9	0.50	µg/kg	<0.50	----	----	----	----
Endosulfan sulfate	1031-07-8	0.50	µg/kg	<0.50	----	----	----	----
^ Endosulfan (sum)	115-29-7	0.50	µg/kg	<0.50	----	----	----	----
Endrin	72-20-8	0.50	µg/kg	<0.50	----	----	----	----
Endrin aldehyde	7421-93-4	0.50	µg/kg	<0.50	----	----	----	----
Endrin ketone	53494-70-5	0.50	µg/kg	<0.50	----	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	FD11	----	----	----	----
				Sampling date / time	19-Oct-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2130323-029	--------	--------	--------	--------
					Result	----	----	----	----
EP131A: Organochlorine Pesticides - Continued									
Heptachlor	76-44-8	0.50	µg/kg		<0.50	----	----	----	----
Heptachlor epoxide	1024-57-3	0.50	µg/kg		<0.50	----	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg		<0.50	----	----	----	----
gamma-BHC	58-89-9	0.25	µg/kg		<0.25	----	----	----	----
Methoxychlor	72-43-5	0.50	µg/kg		<0.50	----	----	----	----
cis-Chlordane	5103-71-9	0.50	µg/kg		<0.50	----	----	----	----
trans-Chlordane	5103-74-2	0.50	µg/kg		<0.50	----	----	----	----
^ **Total Chlordane (sum)**	----	0.50	µg/kg		<0.50	----	----	----	----
Oxychlordane	27304-13-8	0.50	µg/kg		<0.50	----	----	----	----
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.50	µg/kg		<0.50	----	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors)									
^ **Total Polychlorinated biphenyls**	----	5.0	µg/kg		<5.0	----	----	----	----
Aroclor 1016	12674-11-2	5.0	µg/kg		<5.0	----	----	----	----
Aroclor 1221	11104-28-2	5.0	µg/kg		<5.0	----	----	----	----
Aroclor 1232	11141-16-5	5.0	µg/kg		<5.0	----	----	----	----
Aroclor 1242	53469-21-9	5.0	µg/kg		<5.0	----	----	----	----
Aroclor 1248	12672-29-6	5.0	µg/kg		<5.0	----	----	----	----
Aroclor 1254	11097-69-1	5.0	µg/kg		<5.0	----	----	----	----
Aroclor 1260	11096-82-5	5.0	µg/kg		<5.0	----	----	----	----
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		<4	----	----	----	----
Acenaphthene	83-32-9	4	µg/kg		<4	----	----	----	----
Fluorene	86-73-7	4	µg/kg		<4	----	----	----	----
Phenanthrene	85-01-8	4	µg/kg		**6**	----	----	----	----
Anthracene	120-12-7	4	µg/kg		<4	----	----	----	----
Fluoranthene	206-44-0	4	µg/kg		**12**	----	----	----	----
Pyrene	129-00-0	4	µg/kg		**11**	----	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg		**5**	----	----	----	----
Chrysene	218-01-9	4	µg/kg		**6**	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		**6**	----	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg		**5**	----	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg		**4**	----	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Sample ID	FD11	----	----	----	----
				Sampling date / time	19-Oct-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2130323-029	--------	--------	--------	--------
					Result	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(a)pyrene	50-32-8	4	µg/kg		**6**	----	----	----	----
Perylene	198-55-0	4	µg/kg		<4	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		**5**	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		<4	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		**4**	----	----	----	----
Coronene	191-07-1	5	µg/kg		<5	----	----	----	----
^ Sum of PAHs	----	4	µg/kg		**70**	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	4	µg/kg		**8**	----	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	4	µg/kg		**10**	----	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	4	µg/kg		**12**	----	----	----	----
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**70.6**	----	----	----	----
Toluene-D8	2037-26-5	0.2	%		**66.3**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		**73.7**	----	----	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		**128**	----	----	----	----
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.50	%		**40.7**	----	----	----	----
EP131T: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.5	%		**52.5**	----	----	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		**123**	----	----	----	----
Anthracene-d10	1719-06-8	10	%		**111**	----	----	----	----
4-Terphenyl-d14	1718-51-0	10	%		**105**	----	----	----	----

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	51	145
Toluene-D8	2037-26-5	42	144
4-Bromofluorobenzene	460-00-4	58	142
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP131S: OC Pesticide Surrogate			
Dibromo-DDE	21655-73-2	10	119
EP131T: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	10	106
EP132T: Base/Neutral Extractable Surrogates			
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 Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(SOIL) EP132B: Polynuclear Aromatic Hydrocarbons

(SOIL) EP132T: Base/Neutral Extractable Surrogates

(SOIL) EP131A: Organochlorine Pesticides

(SOIL) EP131S: OC Pesticide Surrogate

(SOIL) EP131B: Polychlorinated Biphenyls (as Aroclors)

(SOIL) EP131T: PCB Surrogate

(SOIL) EA051 : Bulk Density

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB2130323**	Page	: 1 of 18
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR JESSE SIMKUS	Contact	: Andrew Epps
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8639
Project	: 12554729 Crowdy Head REF	Date Samples Received	: 25-Oct-2021
Order number	: 12554729	Date Analysis Commenced	: 26-Oct-2021
C-O-C number	: EB_OCR__20211025113636_2510202	Issue Date	: 05-Nov-2021
Sampler	: Jesse Simkus		
Site	: ----		
Quote number	: BN/405/21		
No. of samples received	: 29		
No. of samples analysed	: 26		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Matt Frost	Assistant Laboratory Manager	Brisbane Organics, 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

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 (%)
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES (QC Lot: 3989227)									
EB2130323-001	SD01_0.0-0.5	EG005-SD: Aluminium	7429-90-5	50	mg/kg	1340	1360	1.6	0% - 20%
		EG005-SD: Iron	7439-89-6	50	mg/kg	3540	3690	4.1	0% - 20%
EB2130323-011	SD05_0.5-1.0	EG005-SD: Aluminium	7429-90-5	50	mg/kg	1610	1470	8.7	0% - 20%
		EG005-SD: Iron	7439-89-6	50	mg/kg	3920	4080	4.1	0% - 20%
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES (QC Lot: 3989230)									
EB2130323-024	FD06	EG005-SD: Aluminium	7429-90-5	50	mg/kg	1450	1390	3.7	0% - 20%
		EG005-SD: Iron	7439-89-6	50	mg/kg	3500	3450	1.6	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 3989229)									
EB2130323-001	SD01_0.0-0.5	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
EB2130323-011	SD05_0.5-1.0	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.01	0.01	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 3989232)									
EB2130323-024	FD06	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
EA003 :pH (field/fox) (QC Lot: 3977848)									
EB2130323-001	SD01_0.0-0.5	EA003: pH (F)	----	0.1	pH Unit	8.5	8.5	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	6.6	6.6	0.0	0% - 20%
EB2130323-011	SD05_0.5-1.0	EA003: pH (F)	----	0.1	pH Unit	8.8	8.8	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	6.6	6.6	0.0	0% - 20%
EA051: Bulk Density (QC Lot: 3989079)									
EB2129874-021	Anonymous	EA051: Bulk Density	BULK_DENSITY	1	kg/m3	1230	1220	0.4	0% - 20%
EB2129874-032	Anonymous	EA051: Bulk Density	BULK_DENSITY	1	kg/m3	1610	1590	1.3	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3989238)									
EB2130323-001	SD01_0.0-0.5	EA055: Moisture Content	----	0.1	%	26.5	26.6	0.0	0% - 20%
EB2130323-011	SD05_0.5-1.0	EA055: Moisture Content	----	0.1	%	23.8	24.2	1.7	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 (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3989239)									
EB2130323-024	FD06	EA055: Moisture Content	----	0.1	%	29.8	28.9	3.0	0% - 20%
EB2130668-002	Anonymous	EA055: Moisture Content	----	0.1	%	0.5	0.4	25.5	No Limit
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 3989228)									
EB2130323-001	SD01_0.0-0.5	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	0.1	0.1	0.0	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	<0.50	0.0	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	1.2	1.3	0.0	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	5.90	6.22	5.4	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	5.7	5.5	4.0	No Limit
		EG020-SD: Copper	7440-50-8	1	mg/kg	1.4	1.6	9.1	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	1.3	1.3	0.0	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	2.8	2.7	4.6	No Limit
		EG020-SD: Zinc	7440-66-6	1	mg/kg	8.3	8.7	5.0	No Limit
		EG020-SD: Manganese	7439-96-5	10	mg/kg	53	56	4.3	No Limit
		EG020-SD: Vanadium	7440-62-2	2	mg/kg	7.4	8.0	6.8	No Limit
EB2130323-011	SD05_0.5-1.0	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	0.1	0.2	0.0	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	<0.50	0.0	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	1.2	1.2	0.0	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	4.95	4.80	3.0	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	5.4	5.2	3.0	No Limit
		EG020-SD: Copper	7440-50-8	1	mg/kg	39.0	# 10.0	118	0% - 20%
		EG020-SD: Lead	7439-92-1	1	mg/kg	3.3	5.5	50.4	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	2.7	2.6	0.0	No Limit
		EG020-SD: Zinc	7440-66-6	1	mg/kg	32.8	# 73.1	76.1	0% - 20%
		EG020-SD: Manganese	7439-96-5	10	mg/kg	41	50	19.7	No Limit
		EG020-SD: Vanadium	7440-62-2	2	mg/kg	7.5	6.9	7.5	No Limit
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 3989231)									
EB2130323-024	FD06	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	0.2	<0.1	74.3	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	<0.50	0.0	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	1.1	0.9	18.9	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	4.80	4.03	17.4	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	5.2	4.3	19.4	No Limit
		EG020-SD: Copper	7440-50-8	1	mg/kg	4.6	3.9	16.7	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	2.0	1.7	17.5	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	2.4	2.0	19.4	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 (%)*
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 3989231) - continued									
EB2130323-024	FD06	EG020-SD: Zinc	7440-66-6	1	mg/kg	14.9	12.2	20.1	0% - 50%
		EG020-SD: Manganese	7439-96-5	10	mg/kg	47	37	22.6	No Limit
		EG020-SD: Vanadium	7440-62-2	2	mg/kg	7.3	6.0	19.2	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 3991889)									
EB2130323-001	SD01_0.0-0.5	EP003: Total Organic Carbon	----	0.02	%	0.25	0.24	0.0	0% - 50%
EB2130323-011	SD05_0.5-1.0	EP003: Total Organic Carbon	----	0.02	%	0.31	0.29	5.5	0% - 50%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 3991890)									
EB2130323-024	FD06	EP003: Total Organic Carbon	----	0.02	%	0.22	0.23	5.8	0% - 50%
EM2120804-001	Anonymous	EP003: Total Organic Carbon	----	0.02	%	0.06	0.05	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 3977653)									
EB2130323-001	SD01_0.0-0.5	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EB2130323-010	SD05_0.0-0.5	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 3977654)									
EB2130323-001	SD01_0.0-0.5	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	<5	0.0	No Limit
EB2130323-010	SD05_0.0-0.5	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	6	9	38.8	No Limit
		EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	6	16	90.9	No Limit
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	7	29.3	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 3977660)									
EB2130323-024	FD06	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 3977661)									
EB2130323-024	FD06	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	6	<3	60.2	No Limit
		EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	6	<3	66.7	No Limit
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	<5	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 3977719)									
EB2130323-016	SD07_1.0-1.3	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 3977653)									
EB2130323-001	SD01_0.0-0.5	EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	0.0	No Limit
EB2130323-010	SD05_0.0-0.5	EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 3977654)									
EB2130323-001	SD01_0.0-0.5	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: >C34 - C40 Fraction	----	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: 3977654) - continued									
EB2130323-010	SD05_0.0-0.5	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	9	14	42.3	No Limit
		EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	9	14	43.5	No Limit
		EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	<5	0.0	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 3977660)									
EB2130323-024	FD06	EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 3977661)									
EB2130323-024	FD06	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	8	<3	94.5	No Limit
		EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	8	<3	90.9	No Limit
		EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	<5	0.0	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 3977719)									
EB2130323-016	SD07_1.0-1.3	EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD: BTEXN (QC Lot: 3977653)									
EB2130323-001	SD01_0.0-0.5	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	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Total Xylenes	----	0.2	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EB2130323-010	SD05_0.0-0.5	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	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Total Xylenes	----	0.2	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP080-SD: BTEXN (QC Lot: 3977660)									
EB2130323-024	FD06	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	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Total Xylenes	----	0.2	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	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: BTEXN (QC Lot: 3977719)									
EB2130323-016	SD07_1.0-1.3	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	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Total Xylenes	----	0.2	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 3977655)									
EB2130323-001	SD01_0.0-0.5	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
EB2130323-011	SD05_0.5-1.0	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	0.6	0.7	21.2	No Limit
EP090: Organotin Compounds (QC Lot: 3977662)									
EB2130323-024	FD06	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	0.5	0.0	No Limit
EP131A: Organochlorine Pesticides (QC Lot: 3982044)									
EB2130323-004	SD02_0.0-0.5	EP131A: gamma-BHC	58-89-9	0.25	µg/kg	<0.25	<0.25	0.0	No Limit
		EP131A: cis-Chlordane	5103-71-9	0.25	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: trans-Chlordane	5103-74-2	0.25	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Total Chlordane (sum)	----	0.25	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDD	72-54-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDE	72-55-9	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDT	50-29-3	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
EB2130323-022	FD04	EP131A: gamma-BHC	58-89-9	0.25	µg/kg	<0.25	<0.25	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 (%)*
EP131A: Organochlorine Pesticides (QC Lot: 3982044) - continued									
EB2130323-022	FD04	EP131A: cis-Chlordane	5103-71-9	0.25	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: trans-Chlordane	5103-74-2	0.25	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Total Chlordane (sum)	----	0.25	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDD	72-54-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDE	72-55-9	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDT	50-29-3	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	<0.50	0.0	No Limit
EP131B: Polychlorinated Biphenyls (as Aroclors) (QC Lot: 3982043)									
EB2130323-004	SD02_0.0-0.5	EP131B: Total Polychlorinated biphenyls	----	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1016	12674-11-2	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1221	11104-28-2	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1232	11141-16-5	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1242	53469-21-9	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1248	12672-29-6	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1254	11097-69-1	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1260	11096-82-5	5	µg/kg	<5.0	<5.0	0.0	No Limit
EB2130323-022	FD04	EP131B: Total Polychlorinated biphenyls	----	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1016	12674-11-2	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1221	11104-28-2	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1232	11141-16-5	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1242	53469-21-9	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1248	12672-29-6	5	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1254	11097-69-1	5	µg/kg	<5.0	<5.0	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 (%)*
EP131B: Polychlorinated Biphenyls (as Aroclors) (QC Lot: 3982043) - continued									
EB2130323-022	FD04	EP131B: Aroclor 1260	11096-82-5	5	µg/kg	<5.0	<5.0	0.0	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3982081)									
EB2130323-001	SD01_0.0-0.5	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	205-99-2 205-82-3	4	µg/kg	<4	<4	0.0	No Limit
		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
EB2130323-011	SD05_0.5-1.0	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	9	5	65.9	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	12	9	34.0	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	12	8	37.1	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	5	5	0.0	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	6	5	22.4	No Limit
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	5	8	48.9	No Limit
		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	5	0.0	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	6	7	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	5	6	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: 3982081) - continued									
EB2130323-011	SD05_0.5-1.0	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	5	4	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	69	66	4.4	0% - 50%
		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: 3983181)									
EB2130323-025	FD07	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	5	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	205-99-2 205-82-3	4	µg/kg	<4	<4	0.0	No Limit
		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	5	9	57.1	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**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES (QCLot: 3989227)								
EG005-SD: Aluminium	7429-90-5	50	mg/kg	<50	12361 mg/kg	91.6	70.0	130
EG005-SD: Iron	7439-89-6	50	mg/kg	<50	30024 mg/kg	89.9	70.0	130
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES (QCLot: 3989230)								
EG005-SD: Aluminium	7429-90-5	50	mg/kg	<50	12361 mg/kg	83.6	70.0	130
EG005-SD: Iron	7439-89-6	50	mg/kg	<50	30024 mg/kg	82.1	70.0	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 3989229)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.087 mg/kg	105	70.0	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 3989232)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.087 mg/kg	86.8	70.0	130
EA152: Soil Particle Density (QCLot: 3977229)								
EA152: Soil Particle Density (Clay/Silt/Sand)	----	----	g/cm3	----	2.68 g/cm3	98.9	80.0	120
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 3989228)								
EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	----	----	----	----
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	95.11 mg/kg	97.9	80.0	124
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	1.349 mg/kg	94.6	87.0	122
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	16.52 mg/kg	98.8	79.0	129
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	44.06 mg/kg	102	85.0	118
EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	<0.5	9.77 mg/kg	102	70.0	130
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	58.1 mg/kg	101	86.0	119
EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	490.7 mg/kg	103	70.0	130
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	12.799 mg/kg	95.8	77.0	123
EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	2.48 mg/kg	113	70.0	130
EG020-SD: Vanadium	7440-62-2	2	mg/kg	<2.0	42.9 mg/kg	104	70.0	130
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	154.06 mg/kg	104	71.0	127
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 3989231)								
EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	----	----	----	----
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	95.11 mg/kg	83.4	80.0	124
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	1.349 mg/kg	88.4	87.0	122
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	16.52 mg/kg	81.5	79.0	129
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	44.06 mg/kg	93.2	85.0	118
EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	<0.5	9.77 mg/kg	89.8	70.0	130
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	58.1 mg/kg	107	86.0	119

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 3989231) - continued								
EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	490.7 mg/kg	90.9	70.0	130
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	12.799 mg/kg	84.0	77.0	123
EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	2.48 mg/kg	104	70.0	130
EG020-SD: Vanadium	7440-62-2	2	mg/kg	<2.0	42.9 mg/kg	87.6	70.0	130
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	154.06 mg/kg	94.2	71.0	127
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 3991889)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.56 %	90.4	50.0	100
				<0.02	0.54 %	109	70.0	110
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 3991890)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.56 %	90.2	50.0	100
				<0.02	0.54 %	104	70.0	110
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3977653)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	18 mg/kg	95.0	66.0	120
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3977654)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	157 mg/kg	107	43.0	126
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	245 mg/kg	90.8	66.0	140
EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	----	----	----	----
EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3977660)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	18 mg/kg	84.1	66.0	120
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3977661)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	157 mg/kg	103	43.0	126
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	245 mg/kg	107	66.0	140
EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	----	----	----	----
EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3977719)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	18 mg/kg	77.6	66.0	120
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 3977653)								
EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	22.5 mg/kg	90.4	66.0	119
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 3977654)								
EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	227 mg/kg	103	40.0	134
EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	162 mg/kg	88.7	66.0	136
EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	----	----	----	----
EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 3977660)								
EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	22.5 mg/kg	89.4	66.0	119

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 3977661)								
EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	227 mg/kg	105	40.0	134
EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	162 mg/kg	106	66.0	136
EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	----	----	----	----
EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 3977719)								
EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	22.5 mg/kg	81.2	66.0	119
EP080-SD: BTEXN (QCLot: 3977653)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	90.6	73.0	105
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	1 mg/kg	82.5	73.0	105
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	1 mg/kg	89.0	67.0	104
EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	2 mg/kg	95.9	66.0	106
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	1 mg/kg	101	68.0	105
EP080-SD: Total Xylenes	----	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Sum of BTEX	----	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	1 mg/kg	84.8	72.0	115
EP080-SD: BTEXN (QCLot: 3977660)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	80.5	73.0	105
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	1 mg/kg	88.9	73.0	105
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	1 mg/kg	80.4	67.0	104
EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	2 mg/kg	85.8	66.0	106
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	1 mg/kg	84.4	68.0	105
EP080-SD: Total Xylenes	----	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Sum of BTEX	----	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	1 mg/kg	88.3	72.0	115
EP080-SD: BTEXN (QCLot: 3977719)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	77.7	73.0	105
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	1 mg/kg	81.9	73.0	105
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	1 mg/kg	73.3	67.0	104
EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	2 mg/kg	79.5	66.0	106
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	1 mg/kg	80.4	68.0	105
EP080-SD: Total Xylenes	----	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Sum of BTEX	----	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	1 mg/kg	85.3	72.0	115
EP090: Organotin Compounds (QCLot: 3977655)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	107	52.0	139

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP090: Organotin Compounds (QCLot: 3977662)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	85.2	52.0	139
EP131A: Organochlorine Pesticides (QCLot: 3982044)								
EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	5 µg/kg	121	38.0	139
EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	5 µg/kg	119	17.6	136
EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	5 µg/kg	97.2	30.5	131
EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	5 µg/kg	99.1	37.0	140
EP131A: 4.4`-DDD	72-54-8	0.5	µg/kg	<0.50	5 µg/kg	95.5	25.9	141
EP131A: 4.4`-DDE	72-55-9	0.5	µg/kg	<0.50	5 µg/kg	87.4	35.0	129
EP131A: 4.4`-DDT	50-29-3	0.5	µg/kg	<0.50	5 µg/kg	72.7	23.4	138
EP131A: Sum of DDD + DDE + DDT	72-54-8/72-5 5-9/50-2	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	5 µg/kg	130	30.2	140
EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	5 µg/kg	122	38.0	140
EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	5 µg/kg	123	32.0	152
EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	5 µg/kg	108	36.0	155
EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	5 µg/kg	131	25.8	158
EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	5 µg/kg	86.9	20.1	118
EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	5 µg/kg	127	13.4	135
EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	5 µg/kg	132	39.0	155
EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	5 µg/kg	121	34.0	148
EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	5 µg/kg	108	26.1	152
EP131A: gamma-BHC	58-89-9	0.25	µg/kg	<0.25	5 µg/kg	114	31.2	137
EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	5 µg/kg	95.2	36.0	152
EP131A: cis-Chlordane	5103-71-9	0.25	µg/kg	<0.25	5 µg/kg	120	36.0	142
EP131A: trans-Chlordane	5103-74-2	0.25	µg/kg	<0.25	5 µg/kg	122	29.5	138
EP131A: Total Chlordane (sum)	----	0.25	µg/kg	<0.25	----	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 3982043)								
EP131B: Total Polychlorinated biphenyls	----	5	µg/kg	<5.0	50 µg/kg	96.0	45.0	115
EP131B: Aroclor 1016	12674-11-2	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1221	11104-28-2	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1232	11141-16-5	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1242	53469-21-9	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1248	12672-29-6	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1254	11097-69-1	5	µg/kg	<5.0	50 µg/kg	96.0	45.0	115
EP131B: Aroclor 1260	11096-82-5	5	µg/kg	<5.0	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3982081)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	86.2	63.0	129

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3982081) - continued								
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	99.7	64.0	128
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	96.6	65.0	129
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	95.7	68.0	132
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	95.3	68.0	124
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	93.3	64.0	134
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	89.9	65.0	131
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	91.1	64.0	130
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	86.8	67.0	133
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	99.1	62.0	130
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	94.0	65.0	133
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	25 µg/kg	88.9	68.0	120
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	96.2	61.0	133
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	89.4	63.0	127
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	94.9	66.0	118
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	89.9	69.0	119
EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	88.4	66.0	120
EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	89.5	64.0	122
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	89.7	64.0	120
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	82.4	68.0	136
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3983181)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	91.1	63.0	129
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	99.7	64.0	128
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	84.0	65.0	129
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	97.0	68.0	132
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	90.1	68.0	124
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	84.5	64.0	134
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	84.0	65.0	131
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	79.0	64.0	130
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	81.6	67.0	133
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	82.4	62.0	130
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	85.3	65.0	133
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	25 µg/kg	87.3	68.0	120
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	92.3	61.0	133
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	84.9	63.0	127
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	81.2	66.0	118
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	90.4	69.0	119

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3983181) - continued								
EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	85.4	66.0	120
EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	82.5	64.0	122
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	82.7	64.0	120
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	106	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**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 3989229)							
EB2130323-002	SD01_0.5-1.0	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	89.8	70.0	130
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 3989232)							
EB2130323-025	FD07	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	98.0	70.0	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 3989228)							
EB2130323-002	SD01_0.5-1.0	EG020-SD: Arsenic	7440-38-2	100 mg/kg	95.4	70.0	130
		EG020-SD: Cadmium	7440-43-9	25 mg/kg	88.8	70.0	130
		EG020-SD: Chromium	7440-47-3	100 mg/kg	92.8	70.0	130
		EG020-SD: Copper	7440-50-8	100 mg/kg	89.9	70.0	130
		EG020-SD: Cobalt	7440-48-4	100 mg/kg	92.5	70.0	130
		EG020-SD: Lead	7439-92-1	100 mg/kg	89.1	70.0	130
		EG020-SD: Manganese	7439-96-5	100 mg/kg	89.6	70.0	130
		EG020-SD: Nickel	7440-02-0	100 mg/kg	90.9	70.0	130
		EG020-SD: Vanadium	7440-62-2	100 mg/kg	98.2	70.0	130
		EG020-SD: Zinc	7440-66-6	100 mg/kg	87.4	70.0	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 3989231)							
EB2130323-025	FD07	EG020-SD: Arsenic	7440-38-2	100 mg/kg	95.9	70.0	130
		EG020-SD: Cadmium	7440-43-9	25 mg/kg	93.1	70.0	130
		EG020-SD: Chromium	7440-47-3	100 mg/kg	92.7	70.0	130
		EG020-SD: Copper	7440-50-8	100 mg/kg	90.2	70.0	130
		EG020-SD: Cobalt	7440-48-4	100 mg/kg	92.3	70.0	130
		EG020-SD: Lead	7439-92-1	100 mg/kg	95.4	70.0	130
		EG020-SD: Manganese	7439-96-5	100 mg/kg	97.9	70.0	130
		EG020-SD: Nickel	7440-02-0	100 mg/kg	92.5	70.0	130
		EG020-SD: Vanadium	7440-62-2	100 mg/kg	98.0	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: 3989231) - continued							
EB2130323-025	FD07	EG020-SD: Zinc	7440-66-6	100 mg/kg	91.6	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3977653)							
EB2130323-002	SD01_0.5-1.0	EP080-SD: C6 - C9 Fraction	----	8 mg/kg	78.6	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3977654)							
EB2130323-002	SD01_0.5-1.0	EP071-SD: C10 - C14 Fraction	----	157 mg/kg	107	70.0	130
		EP071-SD: C15 - C28 Fraction	----	245 mg/kg	91.0	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3977660)							
EB2130323-025	FD07	EP080-SD: C6 - C9 Fraction	----	8 mg/kg	77.5	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3977661)							
EB2130323-025	FD07	EP071-SD: C10 - C14 Fraction	----	157 mg/kg	99.7	70.0	130
		EP071-SD: C15 - C28 Fraction	----	245 mg/kg	93.6	70.0	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 3977653)							
EB2130323-002	SD01_0.5-1.0	EP080-SD: C6 - C10 Fraction	C6_C10	8 mg/kg	70.0	70.0	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 3977654)							
EB2130323-002	SD01_0.5-1.0	EP071-SD: >C10 - C16 Fraction	----	227 mg/kg	103	70.0	130
		EP071-SD: >C16 - C34 Fraction	----	162 mg/kg	88.6	70.0	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 3977660)							
EB2130323-025	FD07	EP080-SD: C6 - C10 Fraction	C6_C10	8 mg/kg	70.0	70.0	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 3977661)							
EB2130323-025	FD07	EP071-SD: >C10 - C16 Fraction	----	227 mg/kg	94.8	70.0	130
		EP071-SD: >C16 - C34 Fraction	----	162 mg/kg	96.7	70.0	130
EP080-SD: BTEXN (QCLot: 3977653)							
EB2130323-002	SD01_0.5-1.0	EP080-SD: Benzene	71-43-2	2 mg/kg	75.3	70.0	130
		EP080-SD: Toluene	108-88-3	2 mg/kg	72.5	70.0	130
EP080-SD: BTEXN (QCLot: 3977660)							
EB2130323-025	FD07	EP080-SD: Benzene	71-43-2	2 mg/kg	78.0	70.0	130
		EP080-SD: Toluene	108-88-3	2 mg/kg	74.5	70.0	130
EP090: Organotin Compounds (QCLot: 3977655)							
EB2130323-002	SD01_0.5-1.0	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	88.8	20.0	130
EP090: Organotin Compounds (QCLot: 3977662)							
EB2130323-025	FD07	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	90.0	20.0	130
EP131A: Organochlorine Pesticides (QCLot: 3982044)							
EB2130323-004	SD02_0.0-0.5	EP131A: Aldrin	309-00-2	5 µg/kg	38.0	23.4	153
		EP131A: alpha-BHC	319-84-6	5 µg/kg	63.7	17.6	156

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP131A: Organochlorine Pesticides (QCLot: 3982044) - continued							
EB2130323-004	SD02_0.0-0.5	EP131A: beta-BHC	319-85-7	5 µg/kg	41.2	24.9	153
		EP131A: delta-BHC	319-86-8	5 µg/kg	47.5	25.2	147
		EP131A: 4.4`-DDD	72-54-8	5 µg/kg	42.3	25.9	150
		EP131A: 4.4`-DDE	72-55-9	5 µg/kg	31.5	31.2	125
		EP131A: 4.4`-DDT	50-29-3	5 µg/kg	89.2	23.4	163
		EP131A: Dieldrin	60-57-1	5 µg/kg	51.1	30.2	140
		EP131A: alpha-Endosulfan	959-98-8	5 µg/kg	62.1	28.8	135
		EP131A: beta-Endosulfan	33213-65-9	5 µg/kg	49.1	22.6	141
		EP131A: Endosulfan sulfate	1031-07-8	5 µg/kg	62.5	16.1	156
		EP131A: Endrin	72-20-8	5 µg/kg	73.3	17.7	162
		EP131A: Endrin aldehyde	7421-93-4	5 µg/kg	38.3	20.1	116
		EP131A: Endrin ketone	53494-70-5	5 µg/kg	46.6	13.4	151
		EP131A: Heptachlor	76-44-8	5 µg/kg	44.1	23.8	170
		EP131A: Heptachlor epoxide	1024-57-3	5 µg/kg	40.5	28.3	140
		EP131A: Hexachlorobenzene (HCB)	118-74-1	5 µg/kg	47.2	17.7	144
		EP131A: gamma-BHC	58-89-9	5 µg/kg	71.9	21.8	158
		EP131A: Methoxychlor	72-43-5	5 µg/kg	53.4	24.4	158
		EP131A: cis-Chlordane	5103-71-9	5 µg/kg	72.3	27.3	139
		EP131A: trans-Chlordane	5103-74-2	5 µg/kg	64.7	29.5	138
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 3982043)							
EB2130323-004	SD02_0.0-0.5	EP131B: Total Polychlorinated biphenyls	----	50 µg/kg	82.5	44.0	136
		EP131B: Aroclor 1254	11097-69-1	50 µg/kg	82.5	44.0	136
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3982081)							
EB2130323-001	SD01_0.0-0.5	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	104	70.0	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	90.5	70.0	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	97.8	70.0	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	95.9	70.0	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	117	70.0	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	96.2	70.0	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	87.1	70.0	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	96.1	70.0	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	89.3	70.0	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	104	70.0	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	96.0	70.0	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	25 µg/kg	104	70.0	130
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	81.6	70.0	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	91.2	70.0	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	101	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: 3982081) - continued							
EB2130323-001	SD01_0.0-0.5	EP132B-SD: Perylene	198-55-0	25 µg/kg	90.9	70.0	130
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	25 µg/kg	92.3	70.0	130
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	25 µg/kg	93.6	70.0	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	95.1	70.0	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	83.7	70.0	130
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3983181)							
EB2130323-025	FD07	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	77.8	70.0	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	113	70.0	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	106	70.0	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	93.4	70.0	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	82.2	70.0	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	97.7	70.0	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	95.2	70.0	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	116	70.0	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	110	70.0	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	110	70.0	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	107	70.0	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	25 µg/kg	108	70.0	130
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	105	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	108	70.0	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	105	70.0	130
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	25 µg/kg	105	70.0	130
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	25 µg/kg	89.9	70.0	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	104	70.0	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	94.9	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2130323**	Page	: 1 of 14
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR JESSE SIMKUS	Telephone	: +61 7 3552 8639
Project	: 12554729 Crowdy Head REF	Date Samples Received	: 25-Oct-2021
Site	: ----	Issue Date	: 05-Nov-2021
Sampler	: Jesse Simkus	No. of samples received	: 29
Order number	: 12554729	No. of samples analysed	: 26

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 Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **Duplicate 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

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

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
Duplicate (DUP) RPDs							
EG020-SD: Total Metals in Sediments by ICPMS	EB2130323--011	SD05_0.5-1.0	**Copper**	7440-50-8	118 %	0% - 20%	**RPD exceeds LOR based limits**
EG020-SD: Total Metals in Sediments by ICPMS	EB2130323--011	SD05_0.5-1.0	**Zinc**	7440-66-6	76.1 %	0% - 20%	**RPD exceeds LOR based limits**

Regular Sample Surrogates

Sub-Matrix: **SEDIMENT**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP090S: Organotin Surrogate	EB2130323-002	SD01_0.5-1.0	**Tripropyltin**	----	138 %	35.0-130 %	**Recovery greater than upper 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
EA003 :pH (field/fox)							
Snap Lock Bag							
SD01_0.0-0.5,	SD01_0.5-1.0,	27-Oct-2021	20-Oct-2021	**7**	----	----	----
SD01_1.0-1.5,	SD02_0.0-0.5,						
SD02_0.5-1.0,	SD03_0.0-0.5,						
SD03_0.5-1.0,	SD04_0.0-0.5,						
SD04_0.5-1.0,	SD05_0.0-0.5,						
SD05_0.5-1.0,	SD06_0.0-0.5,						
SD06_0.5-1.0,	SD07_0.0-0.5,						
SD07_0.5-1.0,	SD07_1.0-1.3,						
SD08_0.0-0.5,	SD08_0.5-1.0						

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Soil Particle Density	0	12	0.00	10.00	NEPM 2013 B3 & ALS QC Standard

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.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA003 :pH (field/fox)								
Snap Lock Bag (EA003)								
SD01_0.0-0.5,	SD01_0.5-1.0,	**19-Oct-2021**	**27-Oct-2021**	20-Oct-2021	×	**27-Oct-2021**	25-Jan-2022	✓
SD01_1.0-1.5,	SD02_0.0-0.5,							
SD02_0.5-1.0,	SD03_0.0-0.5,							
SD03_0.5-1.0,	SD04_0.0-0.5,							
SD04_0.5-1.0,	SD05_0.0-0.5,							
SD05_0.5-1.0,	SD06_0.0-0.5,							
SD06_0.5-1.0,	SD07_0.0-0.5,							
SD07_0.5-1.0,	SD07_1.0-1.3,							
SD08_0.0-0.5,	SD08_0.5-1.0							
EA051 : Bulk Density								
Soil Glass Jar - Unpreserved (EA051)								
SD02_0.0-0.5,	SD02_0.5-1.0,	**19-Oct-2021**	**----**	----	----	**02-Nov-2021**	17-Apr-2022	✓
SD04_0.0-0.5,	SD04_0.5-1.0,							
SD05_0.0-0.5,	SD05_0.5-1.0,							
SD06_0.0-0.5								
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)								
SD01_0.0-0.5,	SD01_0.5-1.0,	**19-Oct-2021**	**----**	----	----	**02-Nov-2021**	02-Nov-2021	✓
SD01_1.0-1.5,	SD02_0.0-0.5,							
SD02_0.5-1.0,	SD03_0.0-0.5,							
SD03_0.5-1.0,	SD04_0.0-0.5,							
SD04_0.5-1.0,	SD05_0.0-0.5,							
SD05_0.5-1.0,	SD06_0.0-0.5,							
SD06_0.5-1.0,	SD07_0.0-0.5,							
SD07_0.5-1.0,	SD07_1.0-1.3,							
SD08_0.0-0.5,	SD08_0.5-1.0,							
FD04,	FD05,							
FD06,	FD07,							
FD08,	FD09,							
FD10,	FD11							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing								
Snap Lock Bag (EA150H)								
SD07_0.0-0.5,	SD07_0.5-1.0	**19-Oct-2021**	**----**	----	----	**02-Nov-2021**	17-Apr-2022	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H)								
SD02_0.0-0.5,	SD02_0.5-1.0,	**19-Oct-2021**	**----**	----	----	**02-Nov-2021**	17-Apr-2022	✓
SD04_0.0-0.5,	SD04_0.5-1.0,							
SD05_0.0-0.5,	SD05_0.5-1.0,							
SD06_0.0-0.5,	SD06_0.5-1.0,							
SD08_0.0-0.5,	SD08_0.5-1.0							
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H)								
SD07_0.0-0.5,	SD07_0.5-1.0	**19-Oct-2021**	**----**	----	----	**02-Nov-2021**	17-Apr-2022	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H)								
SD02_0.0-0.5,	SD02_0.5-1.0,	**19-Oct-2021**	**----**	----	----	**02-Nov-2021**	17-Apr-2022	✓
SD04_0.0-0.5,	SD04_0.5-1.0,							
SD05_0.0-0.5,	SD05_0.5-1.0,							
SD06_0.0-0.5,	SD06_0.5-1.0,							
SD08_0.0-0.5,	SD08_0.5-1.0							
EA152: Soil Particle Density								
Snap Lock Bag (EA152)								
SD07_0.0-0.5,	SD07_0.5-1.0	**19-Oct-2021**	**----**	----	----	**02-Nov-2021**	17-Apr-2022	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA152)								
SD02_0.0-0.5,	SD02_0.5-1.0,	**19-Oct-2021**	**----**	----	----	**02-Nov-2021**	17-Apr-2022	✓
SD04_0.0-0.5,	SD04_0.5-1.0,							
SD05_0.0-0.5,	SD05_0.5-1.0,							
SD06_0.0-0.5,	SD06_0.5-1.0,							
SD08_0.0-0.5,	SD08_0.5-1.0							
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Soil Glass Jar - Unpreserved (EG005-SD)								
SD01_0.0-0.5,	SD01_0.5-1.0,	**19-Oct-2021**	**02-Nov-2021**	17-Apr-2022	✓	**03-Nov-2021**	17-Apr-2022	✓
SD01_1.0-1.5,	SD02_0.0-0.5,							
SD02_0.5-1.0,	SD03_0.0-0.5,							
SD03_0.5-1.0,	SD04_0.0-0.5,							
SD04_0.5-1.0,	SD05_0.0-0.5,							
SD05_0.5-1.0,	SD06_0.0-0.5,							
SD06_0.5-1.0,	SD07_0.0-0.5,							
SD07_0.5-1.0,	SD07_1.0-1.3,							
SD08_0.0-0.5,	SD08_0.5-1.0,							
FD04,	FD05,							
FD06,	FD07,							
FD08,	FD09,							
FD10,	FD11							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			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)								
SD01_0.0-0.5,	SD01_0.5-1.0,	**19-Oct-2021**	**02-Nov-2021**	17-Apr-2022	✓	**03-Nov-2021**	17-Apr-2022	✓
SD01_1.0-1.5,	SD02_0.0-0.5,							
SD02_0.5-1.0,	SD03_0.0-0.5,							
SD03_0.5-1.0,	SD04_0.0-0.5,							
SD04_0.5-1.0,	SD05_0.0-0.5,							
SD05_0.5-1.0,	SD06_0.0-0.5,							
SD06_0.5-1.0,	SD07_0.0-0.5,							
SD07_0.5-1.0,	SD07_1.0-1.3,							
SD08_0.0-0.5,	SD08_0.5-1.0,							
FD04,	FD05,							
FD06,	FD07,							
FD08,	FD09,							
FD10,	FD11							
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035T-LL)								
SD01_0.0-0.5,	SD01_0.5-1.0,	**19-Oct-2021**	**02-Nov-2021**	16-Nov-2021	✓	**03-Nov-2021**	16-Nov-2021	✓
SD01_1.0-1.5,	SD02_0.0-0.5,							
SD02_0.5-1.0,	SD03_0.0-0.5,							
SD03_0.5-1.0,	SD04_0.0-0.5,							
SD04_0.5-1.0,	SD05_0.0-0.5,							
SD05_0.5-1.0,	SD06_0.0-0.5,							
SD06_0.5-1.0,	SD07_0.0-0.5,							
SD07_0.5-1.0,	SD07_1.0-1.3,							
SD08_0.0-0.5,	SD08_0.5-1.0,							
FD04,	FD05,							
FD06,	FD07,							
FD08,	FD09,							
FD10,	FD11							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP003: Total Organic Carbon (TOC) in Soil							
Pulp Bag (EP003)							
SD01_0.0-0.5, SD01_0.5-1.0, SD01_1.0-1.5, SD02_0.0-0.5, SD02_0.5-1.0, SD03_0.0-0.5, SD03_0.5-1.0, SD04_0.0-0.5, SD04_0.5-1.0, SD05_0.0-0.5, SD05_0.5-1.0, SD06_0.0-0.5, SD06_0.5-1.0, SD07_0.0-0.5, SD07_0.5-1.0, SD07_1.0-1.3, SD08_0.0-0.5, SD08_0.5-1.0, FD04, FD05, FD06, FD07, FD08, FD09, FD10, FD11	**19-Oct-2021**	**03-Nov-2021**	16-Nov-2021	✓	**03-Nov-2021**	16-Nov-2021	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP071-SD)							
SD01_0.0-0.5, SD01_0.5-1.0, SD01_1.0-1.5, SD02_0.0-0.5, SD02_0.5-1.0, SD03_0.0-0.5, SD03_0.5-1.0, SD04_0.0-0.5, SD04_0.5-1.0, SD05_0.0-0.5, SD05_0.5-1.0, SD06_0.0-0.5, SD06_0.5-1.0, SD07_0.0-0.5, SD07_0.5-1.0, SD07_1.0-1.3, SD08_0.0-0.5, SD08_0.5-1.0, FD04, FD05	**19-Oct-2021**	**01-Nov-2021**	02-Nov-2021	✓	**03-Nov-2021**	11-Dec-2021	✓
Soil Glass Jar - Unpreserved (EP071-SD)							
FD06, FD07, FD08, FD09, FD10, FD11	**19-Oct-2021**	**02-Nov-2021**	02-Nov-2021	✓	**03-Nov-2021**	12-Dec-2021	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		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)							
SD01_0.0-0.5, SD01_0.5-1.0, SD01_1.0-1.5, SD02_0.0-0.5, SD02_0.5-1.0, SD03_0.0-0.5, SD03_0.5-1.0, SD04_0.0-0.5, SD04_0.5-1.0, SD05_0.0-0.5, SD05_0.5-1.0, SD06_0.0-0.5, SD06_0.5-1.0, SD07_0.0-0.5, SD07_0.5-1.0, SD07_1.0-1.3, SD08_0.0-0.5, SD08_0.5-1.0, FD04, FD05	**19-Oct-2021**	**01-Nov-2021**	02-Nov-2021	✓	**03-Nov-2021**	11-Dec-2021	✓
Soil Glass Jar - Unpreserved (EP071-SD)							
FD06, FD07, FD08, FD09, FD10, FD11	**19-Oct-2021**	**02-Nov-2021**	02-Nov-2021	✓	**03-Nov-2021**	12-Dec-2021	✓
Soil Glass Jar - Unpreserved (EP080-SD)							
SD07_1.0-1.3	**19-Oct-2021**	**26-Oct-2021**	02-Nov-2021	✓	**02-Nov-2021**	02-Nov-2021	✓
Soil Glass Jar - Unpreserved (EP080-SD)							
SD01_0.0-0.5, SD01_0.5-1.0, SD01_1.0-1.5, SD02_0.0-0.5, SD02_0.5-1.0, SD03_0.0-0.5, SD03_0.5-1.0, SD04_0.0-0.5, SD04_0.5-1.0, SD05_0.0-0.5, SD05_0.5-1.0, SD06_0.0-0.5, SD06_0.5-1.0, SD07_0.0-0.5, SD07_0.5-1.0, SD08_0.0-0.5, SD08_0.5-1.0, FD04, FD05, FD06, FD07, FD08, FD09, FD10, FD11	**19-Oct-2021**	**27-Oct-2021**	02-Nov-2021	✓	**02-Nov-2021**	02-Nov-2021	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080-SD)							
SD07_1.0-1.3	**19-Oct-2021**	**26-Oct-2021**	02-Nov-2021	✓	**02-Nov-2021**	02-Nov-2021	✓
Soil Glass Jar - Unpreserved (EP080-SD)							
SD01_0.0-0.5, SD01_0.5-1.0, SD01_1.0-1.5, SD02_0.0-0.5, SD02_0.5-1.0, SD03_0.0-0.5, SD03_0.5-1.0, SD04_0.0-0.5, SD04_0.5-1.0, SD05_0.0-0.5, SD05_0.5-1.0, SD06_0.0-0.5, SD06_0.5-1.0, SD07_0.0-0.5, SD07_0.5-1.0, SD08_0.0-0.5, SD08_0.5-1.0, FD04, FD05, FD06, FD07, FD08, FD09, FD10, FD11	**19-Oct-2021**	**27-Oct-2021**	02-Nov-2021	✓	**02-Nov-2021**	02-Nov-2021	✓
EP080-SD: BTEXN							
Soil Glass Jar - Unpreserved (EP080-SD)							
SD07_1.0-1.3	**19-Oct-2021**	**26-Oct-2021**	02-Nov-2021	✓	**02-Nov-2021**	02-Nov-2021	✓
Soil Glass Jar - Unpreserved (EP080-SD)							
SD01_0.0-0.5, SD01_0.5-1.0, SD01_1.0-1.5, SD02_0.0-0.5, SD02_0.5-1.0, SD03_0.0-0.5, SD03_0.5-1.0, SD04_0.0-0.5, SD04_0.5-1.0, SD05_0.0-0.5, SD05_0.5-1.0, SD06_0.0-0.5, SD06_0.5-1.0, SD07_0.0-0.5, SD07_0.5-1.0, SD08_0.0-0.5, SD08_0.5-1.0, FD04, FD05, FD06, FD07, FD08, FD09, FD10, FD11	**19-Oct-2021**	**27-Oct-2021**	02-Nov-2021	✓	**02-Nov-2021**	02-Nov-2021	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP090: Organotin Compounds								
Soil Glass Jar - Unpreserved (EP090)								
SD01_0.0-0.5,	SD01_0.5-1.0,	**19-Oct-2021**	**01-Nov-2021**	02-Nov-2021	✓	**03-Nov-2021**	11-Dec-2021	✓
SD01_1.0-1.5,	SD02_0.0-0.5,							
SD02_0.5-1.0,	SD03_0.0-0.5,							
SD03_0.5-1.0,	SD04_0.0-0.5,							
SD04_0.5-1.0,	SD05_0.0-0.5,							
SD05_0.5-1.0,	SD06_0.0-0.5,							
SD06_0.5-1.0,	SD07_0.0-0.5,							
SD07_0.5-1.0,	SD07_1.0-1.3,							
SD08_0.0-0.5,	SD08_0.5-1.0,							
FD04,	FD05							
Soil Glass Jar - Unpreserved (EP090)								
FD06,	FD07,	**19-Oct-2021**	**02-Nov-2021**	02-Nov-2021	✓	**04-Nov-2021**	12-Dec-2021	✓
FD08,	FD09,							
FD10,	FD11							
EP131A: Organochlorine Pesticides								
Soil Glass Jar - Unpreserved (EP131A)								
SD02_0.0-0.5,	SD02_0.5-1.0,	**19-Oct-2021**	**29-Oct-2021**	02-Nov-2021	✓	**04-Nov-2021**	08-Dec-2021	✓
SD04_0.0-0.5,	SD04_0.5-1.0,							
SD05_0.0-0.5,	SD05_0.5-1.0,							
SD06_0.0-0.5,	SD06_0.5-1.0,							
SD08_0.0-0.5,	SD08_0.5-1.0,							
FD04,	FD05,							
FD06,	FD07,							
FD08,	FD09,							
FD10,	FD11							
EP131B: Polychlorinated Biphenyls (as Aroclors)								
Soil Glass Jar - Unpreserved (EP131B)								
SD02_0.0-0.5,	SD02_0.5-1.0,	**19-Oct-2021**	**29-Oct-2021**	02-Nov-2021	✓	**04-Nov-2021**	08-Dec-2021	✓
SD04_0.0-0.5,	SD04_0.5-1.0,							
SD05_0.0-0.5,	SD05_0.5-1.0,							
SD06_0.0-0.5,	SD06_0.5-1.0,							
SD08_0.0-0.5,	SD08_0.5-1.0,							
FD04,	FD05,							
FD06,	FD07,							
FD08,	FD09,							
FD10,	FD11							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP132B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP132B-SD)								
SD01_0.0-0.5,	SD01_0.5-1.0,	**19-Oct-2021**	**29-Oct-2021**	02-Nov-2021	✓	**01-Nov-2021**	08-Dec-2021	✓
SD01_1.0-1.5,	SD02_0.0-0.5,							
SD02_0.5-1.0,	SD03_0.0-0.5,							
SD03_0.5-1.0,	SD04_0.0-0.5,							
SD04_0.5-1.0,	SD05_0.0-0.5,							
SD05_0.5-1.0,	SD06_0.0-0.5,							
SD06_0.5-1.0,	SD07_0.0-0.5,							
SD07_0.5-1.0,	SD07_1.0-1.3,							
SD08_0.0-0.5,	SD08_0.5-1.0,							
FD04,	FD05,							
FD06,	FD07,							
FD08,	FD09,							
FD10,	FD11							

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)							
Bulk Density	EA051	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	4	36	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organochlorine Pesticides (Ultra-trace)	EP131A	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	3	26	**11.54**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	3	26	**11.54**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PCB's (Ultra-trace)	EP131B	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH field/fox	EA003	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Soil Particle Density	EA152	0	12	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	3	26	**11.54**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	3	26	**11.54**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	3	26	**11.54**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	4	36	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	3	26	**11.54**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	4	26	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PCB's (Ultra-trace)	EP131B	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Soil Particle Density	EA152	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	4	36	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	3	26	**11.54**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PCB's (Ultra-trace)	EP131B	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	36	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	2	26	**7.69**	**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*	
Method Blanks (MB) - Continued							
TRH Volatiles/BTEX in Sediments	EP080-SD	3	26	**11.54**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PCB's (Ultra-trace)	EP131B	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	2	26	**7.69**	**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
pH field/fox	EA003	SOIL	In house: Referenced to Ahern et al 1998 - determined on a 1:5 soil/water extract designed to simulate field measured pH and pH after the extract has been oxidised with peroxide.
Bulk Density	* EA051	SOIL	The Determination of bulk density requires the measurments of the mass of soil in a measured volume
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 by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1: Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Total Fe and Al in Sediments by ICPAES	EG005-SD	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3). LORs per NODG
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 AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(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 SnCl2 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 CO2) is automatically measured by infra-red detector.
TPH - Semivolatile Fraction	EP071-SD	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 quanitified against an established calibration curve.
Organochlorine Pesticides (Ultra-trace)	EP131A	SOIL	In house: Referenced to USEPA Method 3640 (GPC cleanup),3620 (Florisil), 8081/8082 (GC/µECD/µECD) This technique is compliant with NEPM Schedule B(3)
PCB's (Ultra-trace)	EP131B	SOIL	In house: Referenced to USEPA Method 3640 (GPC cleanup),3620 (Florisil), 8081/8082 (GC/µECD/µECD) This technique is compliant with NEPM Schedule B(3)
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 only	EN020D	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	#
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, Na2SO4 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/ Sample Cleanup	ORG17A-UTP	SOIL	In house: Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. Samples are extracted, concentrated (by KD) and exchanged into an appropriate solvent for GPC and florisil cleanup as required.
Tumbler Extraction of Solids for LVI (Non-concentrating)	ORG17D	SOIL	In house: 10g of sample, Na2SO4 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.

CHAIN OF CUSTODY

ALS Environmental

ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

☐BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com

☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

☐NEWCASTLE 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com

☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500

Environmental Division Brisbane

Work Order Reference

EB2130323

Telephone : - 61-7-3243 7222

CLIENT: GHD	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date):	28/10/2021
OFFICE: Newcastle		☐ Non Standard or urgent TAT (List due date):	
PROJECT: Crowdy Head REF	**ALS QUOTE NO.:** BN / 405 / 21	**COC SEQUENCE NUMBER (Circle)**	
ORDER NUMBER: 12554729		COC: 1 2 3 4 5 6 7	
PROJECT MANAGER: Jesse Simkus	**CONTACT PH:** 0404542354	OF: 1 2 3 4 5 6 7	
SAMPLER: Jesse Simkus	**SAMPLER MOBILE:**	**RELINQUISHED BY:**	**RECEIVED BY:** ROZEA TAYOR
COC emailed to ALS? Yes	**EDD FORMAT (or default):** Esdat		
Email Reports to (will default to PM if no other addresses are listed):		DATE/TIME:	DATE/TIME: 8:50 25.10.21
Email Invoice to (will default to PM if no other addresses are listed): accountspayablefss@ghd.com			

RELINQUISHED DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: SEDIMENT SAMPLES - NAGD ANALYSIS AS PER QUOTE. Sample volume to be carefully managed to allow for potential additional analyses. Bulk Density to be analysed from 500mL bag where possible.

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ASS field screen	TOC	Bulk Density, PSD (sieve + hydrometer)	SD-03	TPH-SD	Organotins	OCP + PCB (ultratrace)	Ultra-trace PAHs in Sediments	Additional Information
01	SD01_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag*	4	X	X		X	X	X		X	* Minimal volume
02	SD01_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X		X	X	X		X	
03	SD01_1.0-1.5	19-Oct	S	2x Glass jar, Med bag	3	X	X		X	X	X		X	* No 500ml bag
04	SD02_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
05	SD02_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
06	SD03_0.0-0.5	19-Oct	S	2x Glass jar, Med bag	3	X	X		X	X	X		X	* No 500ml bag
07	SD03_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X		X	X	X		X	
08	SD04_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
09	SD04_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
10	SD05_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
11	SD05_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
12	SD06_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
				TOTAL										

URGENT

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

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ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

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☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

☐NEWCASTLE 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

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☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: GHD	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date): 28/10/2021
OFFICE: Newcastle		☐ Non Standard or urgent TAT (List due date):
PROJECT: Crowdy Head REF	**ALS QUOTE NO.:** BN / 405 / 21	**COC SEQUENCE NUMBER (Circle)**
ORDER NUMBER: 12554729		COC: 1 **2** 3 4 5 6 7
PROJECT MANAGER: Jesse Simkus	**CONTACT PH:** 0404542354	OF: 1 2 **3** 4 5 6 7
SAMPLER: Jesse Simkus	**SAMPLER MOBILE:**	**RELINQUISHED BY:**
COC emailed to ALS? Yes	**EDD FORMAT (or default):** Esdat	**RECEIVED BY:**
Email Reports to (will default to PM if no other addresses are listed):		DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed): accountspayablefss@ghd.com		**RELINQUISHED BY:**
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: SEDIMENT SAMPLES - NAGD ANALYSIS AS PER QUOTE		**RECEIVED BY:**
		DATE/TIME:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). ASS field screen	TOC	PSD (sieve + hydrometer	SD-03	TPH-SD	Organotins	OCP + PCB (ultratrace)	Ultra-trace PAHs in Sediments	Additional Information
13	SD06_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
14	SD07_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X		X	
15	SD07_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X		X	
16	SD07_1.0-1.3	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X		X	
17	SD08_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	Possibly elevated organotins / contam
18	SD08_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	Possibly elevated organotins / contam
19	FD01	19-Oct	S	2x Glass jar	2									Hold
20	FD02	19-Oct	S	2x Glass jar	2									Hold
21	FD03	19-Oct	S	2x Glass jar	2									Hold
22	FD04	19-Oct	S	2x Glass jar	2		X		X	X	X	X	X	
23	FD05	19-Oct	S	2x Glass jar	2		X		X	X	X	X	X	
24	FD06	19-Oct	S	2x Glass jar	2		X		X	X	X	X	X	
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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☐BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com

☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

☐NEWCASTLE 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com

☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

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CLIENT: GHD	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT **(List due date):**	**28/10/2021**
OFFICE: Newcastle		☐ Non Standard or urgent TAT **(List due date):**	
PROJECT: Crowdy Head REF	**ALS QUOTE NO.:** BN / 405 / 21	**COC SEQUENCE NUMBER (Circle)**	
ORDER NUMBER: 12554729		COC: 1 2 **3** 4 5 6 7	
PROJECT MANAGER: Jesse Simkus	**CONTACT PH:** 0404542354	OF: 1 2 **3** 4 5 6 7	
SAMPLER: Jesse Simkus	**SAMPLER MOBILE:**	**RELINQUISHED BY:**	**RECEIVED BY:**
COC emailed to ALS? Yes	**EDD FORMAT (or default):** Esdat	DATE/TIME:	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):		**RELINQUISHED BY:**	**RECEIVED BY:**
Email Invoice to (will default to PM if no other addresses are listed): accountspayablefss@ghd.com		DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: SEDIMENT SAMPLES - NAGD ANALYSIS AS PER QUOTE

ALS USE ONLY	SAMPLE DETAILS (MUST BE COMPLETED)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ASS field screen	TOC	PSD (sieve + hydrometer	SD-03	TPH-SD	Organotins	OCP + PCB (ultratrace)	Ultra-trace PAHs in Sediments	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
25	FD07	19-Oct	S	2x Glass jar	2		X		X	X	X	X	X	
26	FD08	19-Oct	S	2x Glass jar	2		X		X	X	X	X	X	
27	FD09	19-Oct	S	2x Glass jar	2		X		X	X	X	X	X	
28	FD10	19-Oct	S	2x Glass jar	2		X		X	X	X	X	X	
29	FD11	19-Oct	S	2x Glass jar	2		X		X	X	X	X	X	
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

Certificate of Analysis

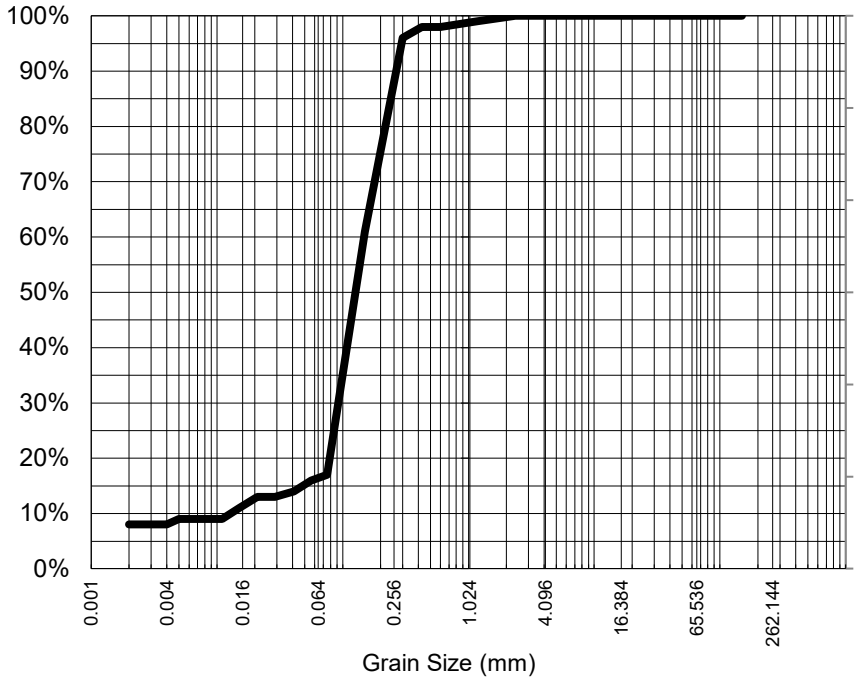
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2 Byth Street
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pH 07 3243 7222
samples.brisbane@alsenviro.com

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CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-004 / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD02_0.0-0.5

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	98%
0.425	98%
0.300	96%
0.150	61%
0.075	17%
Particle Size (microns)	
56	16%
41	14%
29	13%
21	13%
15	11%
11	9%
8	9%
5	9%
2	8%

Median Particle Size (mm)*	0.131

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 27-Oct-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.64

NATA Accreditation: 825 Site: Brisbane
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Satish Trivedi
Soil Senior Chemist
Authorised Signatory

Certificate of Analysis

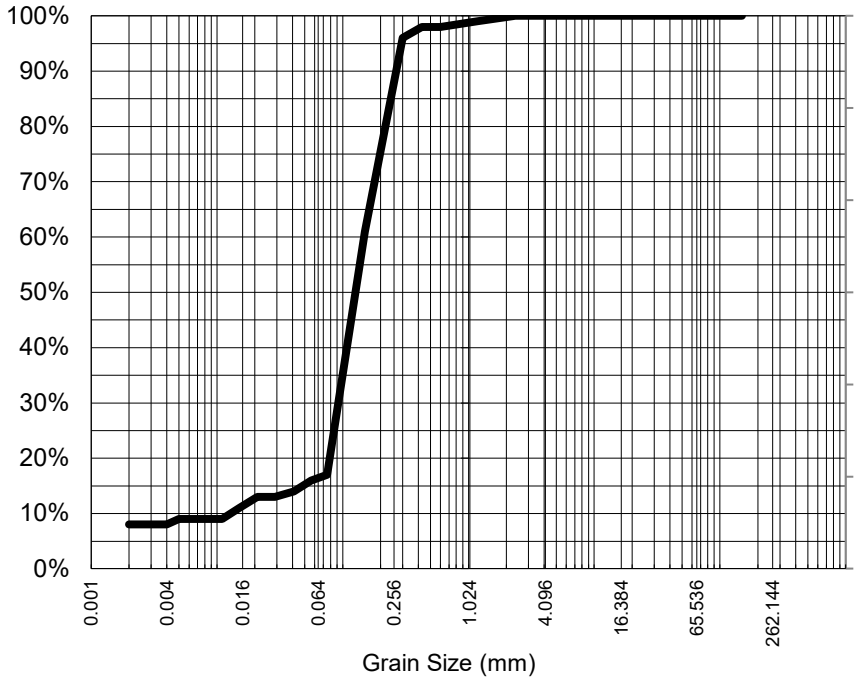
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CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-004DUP / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD02_0.0-0.5

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	98%
0.425	98%
0.300	96%
0.150	61%
0.075	17%
Particle Size (microns)	
56	16%
41	14%
29	13%
21	13%
15	11%
11	9%
8	9%
5	9%
2	8%

Median Particle Size (mm)*	0.131

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 27-Oct-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.64

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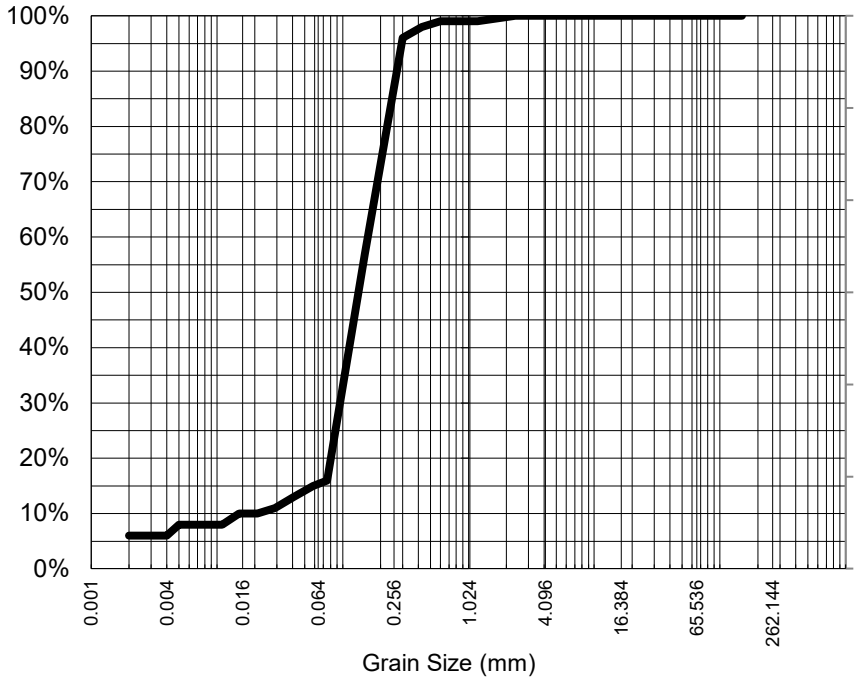
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CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-005 / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD02_0.5-1.0

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	99%
0.425	98%
0.300	96%
0.150	57%
0.075	16%
Particle Size (microns)	
58	15%
41	13%
29	11%
21	10%
15	10%
11	8%
8	8%
5	8%
2	6%

Median Particle Size (mm)*	0.137

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:		**Analysed:**	27-Oct-21
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.2/AS1289.3.6.3		
Soil Particle Density (<2.36mm)	2.64		

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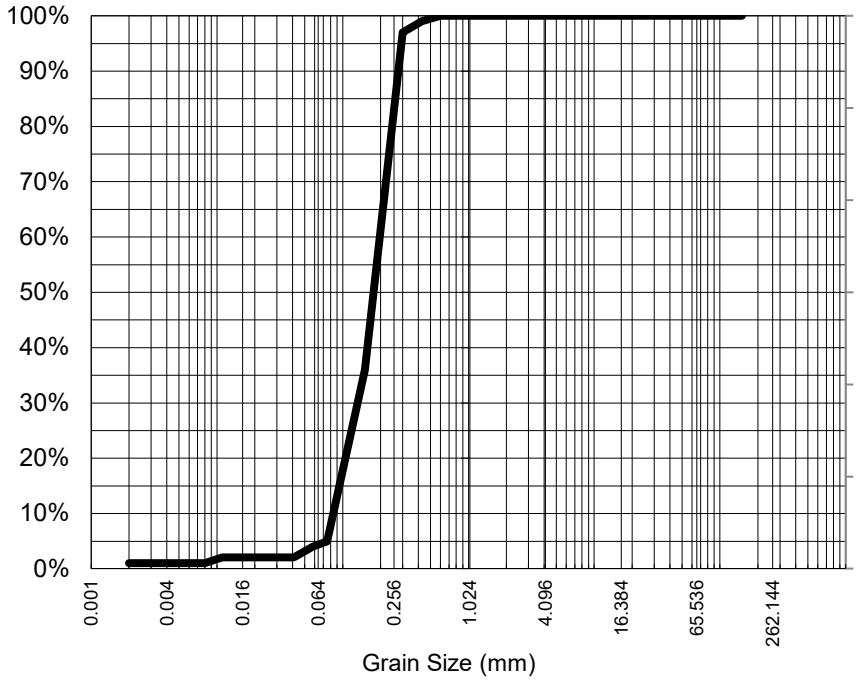
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Stafford, QLD 4053
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CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-008 / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD04_0.0-0.5

Particle Size Distribution



Particle Size (mm)	% Passing
0.600	100%
0.425	99%
0.300	97%
0.150	36%
0.075	5%
Particle Size (microns)	
58	4%
41	2%
29	2%
21	2%
15	2%
11	2%
8	1%
5	1%
2	1%

Median Particle Size (mm)*	0.184

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that hydrometer analysis is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	27-Oct-21
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.2/AS1289.3.6.3		
Soil Particle Density (<2.36mm)	2.64		

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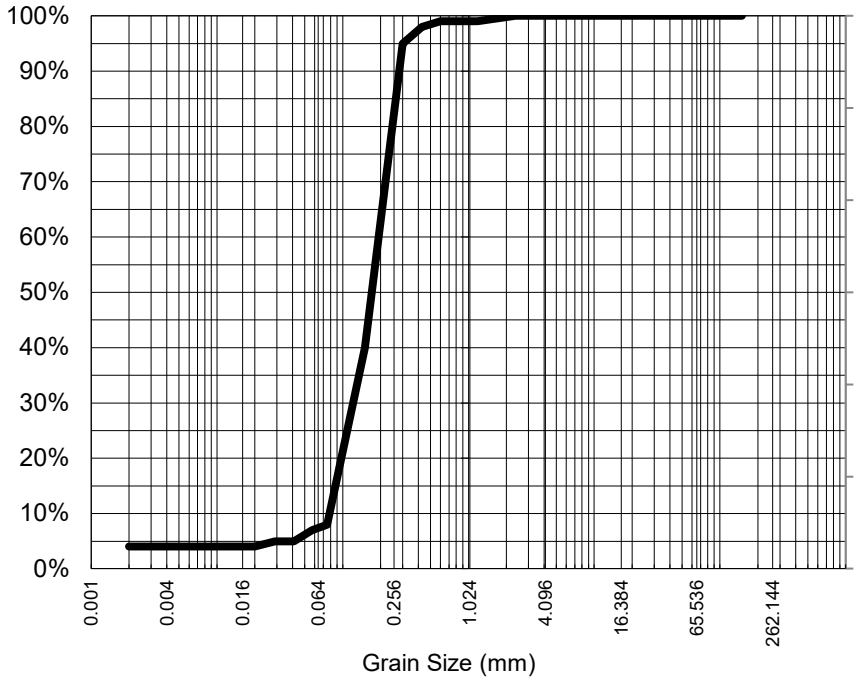
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CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-009 / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD04_0.5-1.0

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	99%
0.425	98%
0.300	95%
0.150	40%
0.075	8%
Particle Size (microns)	
57	7%
41	5%
29	5%
20	4%
15	4%
10	4%
7	4%
5	4%
2	4%

Median Particle Size (mm)*	0.177

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that hydrometer analysis is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	27-Oct-21
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.2/AS1289.3.6.3		
Soil Particle Density (<2.36mm)	2.65		

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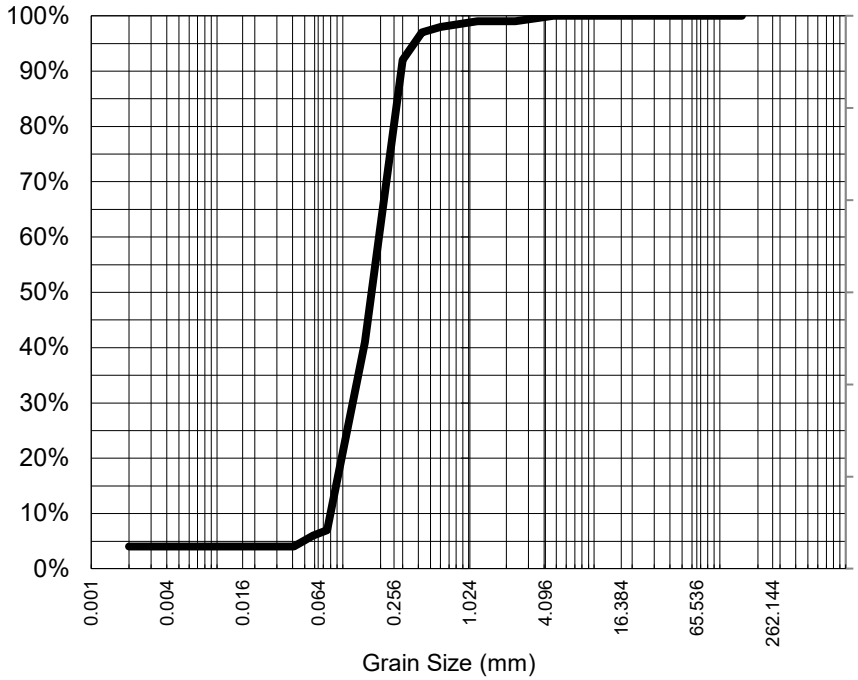
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pH 07 3243 7222
samples.brisbane@alsenviro.com

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CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-010 / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD05_0.0-0.5

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	99%
0.600	98%
0.425	97%
0.300	92%
0.150	41%
0.075	7%
Particle Size (microns)	
58	6%
41	4%
29	4%
21	4%
15	4%
11	4%
8	4%
5	4%
2	4%

Median Particle Size (mm)*	0.176

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that hydrometer analysis is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	27-Oct-21
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.2/AS1289.3.6.3		
Soil Particle Density (<2.36mm)	2.64		

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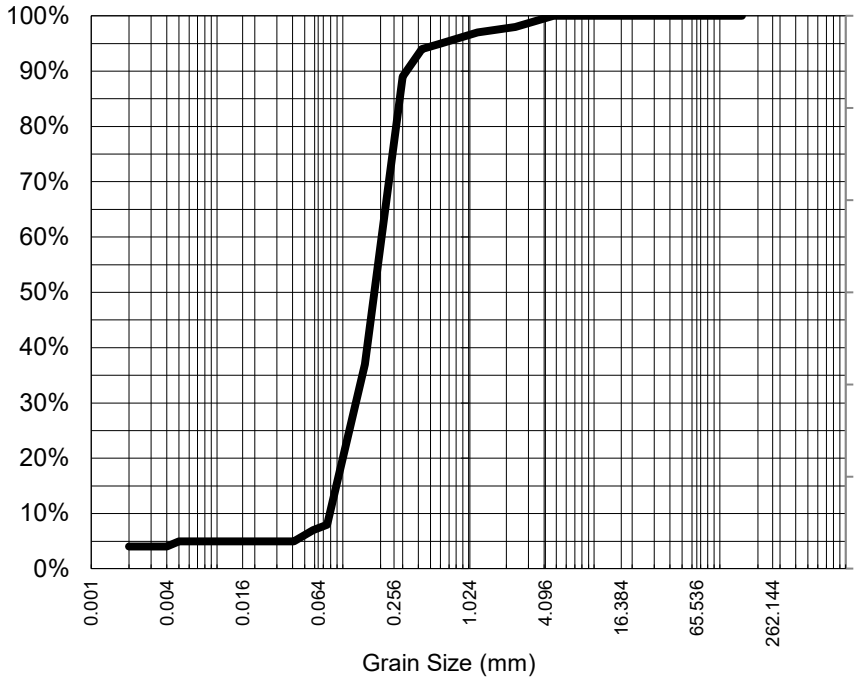
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2 Byth Street
Stafford, QLD 4053
pH 07 3243 7222
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CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-011 / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD05_0.5-1.0

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	98%
1.18	97%
0.600	95%
0.425	94%
0.300	89%
0.150	37%
0.075	8%
Particle Size (microns)	
58	7%
41	5%
29	5%
21	5%
15	5%
11	5%
8	5%
5	5%
2	4%

Median Particle Size (mm)*	0.188

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that hydrometer analysis is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	27-Oct-21
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.2/AS1289.3.6.3		
Soil Particle Density (<2.36mm)	2.64		

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Certificate of Analysis

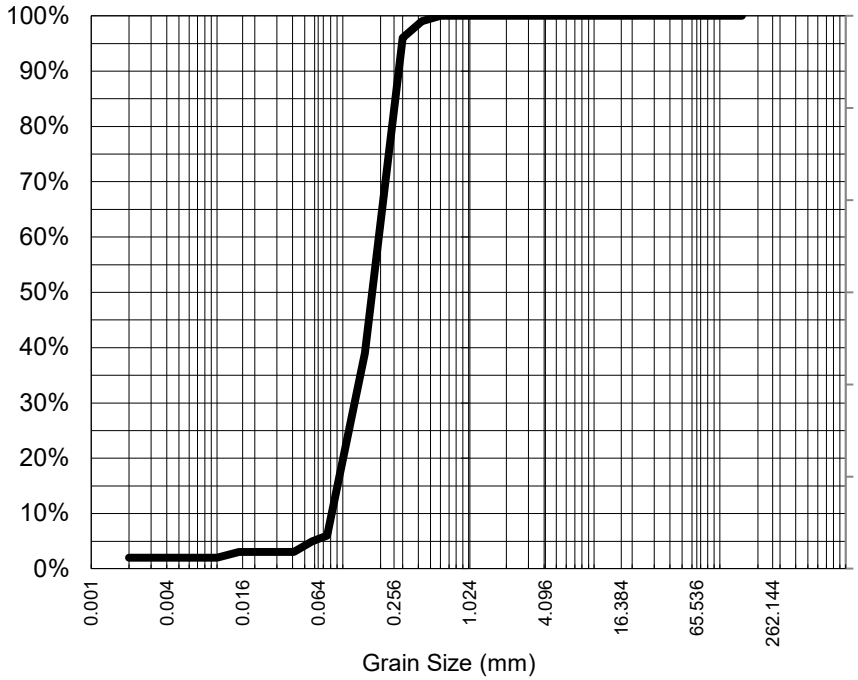
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Stafford, QLD 4053
pH 07 3243 7222
samples.brisbane@alsenviro.com

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CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-012 / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD06_0.0-0.5

Particle Size Distribution



Particle Size (mm)	% Passing
0.600	100%
0.425	99%
0.300	96%
0.150	39%
0.075	6%
Particle Size (microns)	
57	5%
41	3%
29	3%
20	3%
15	3%
10	2%
7	2%
5	2%
2	2%

Median Particle Size (mm)*	0.179

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that hydrometer analysis is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	27-Oct-21
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.2/AS1289.3.6.3		
Soil Particle Density (<2.36mm)	2.67		

NATA Accreditation: 825 Site: Brisbane
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NATA
WORLD RECOGNISED ACCREDITATION

Satish Trivedi
Soil Senior Chemist
Authorised Signatory

Certificate of Analysis

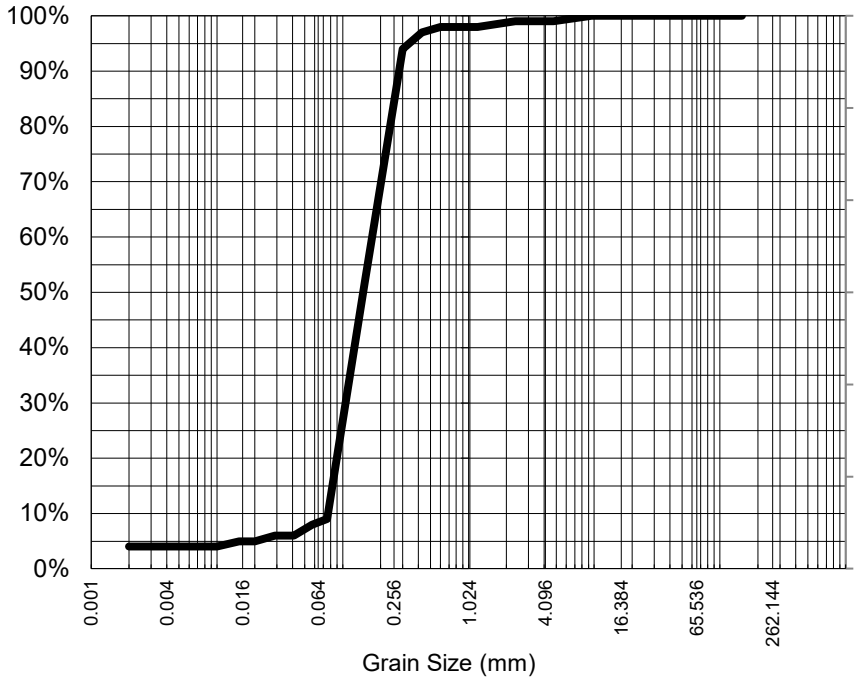
ALS Laboratory Group Pty Ltd
2 Byth Street
Stafford, QLD 4053
pH 07 3243 7222
samples.brisbane@alsenviro.com

ALS Environmental

Brisbane QLD

CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-013 / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD06_0.5-1.0

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	99%
1.18	98%
0.600	98%
0.425	97%
0.300	94%
0.150	52%
0.075	9%
Particle Size (microns)	
57	8%
41	6%
29	6%
20	5%
15	5%
10	4%
7	4%
5	4%
2	4%

Median Particle Size (mm)*	0.147

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that hydrometer analysis is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	27-Oct-21
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.2/AS1289.3.6.3		
Soil Particle Density (<2.36mm)	2.65		

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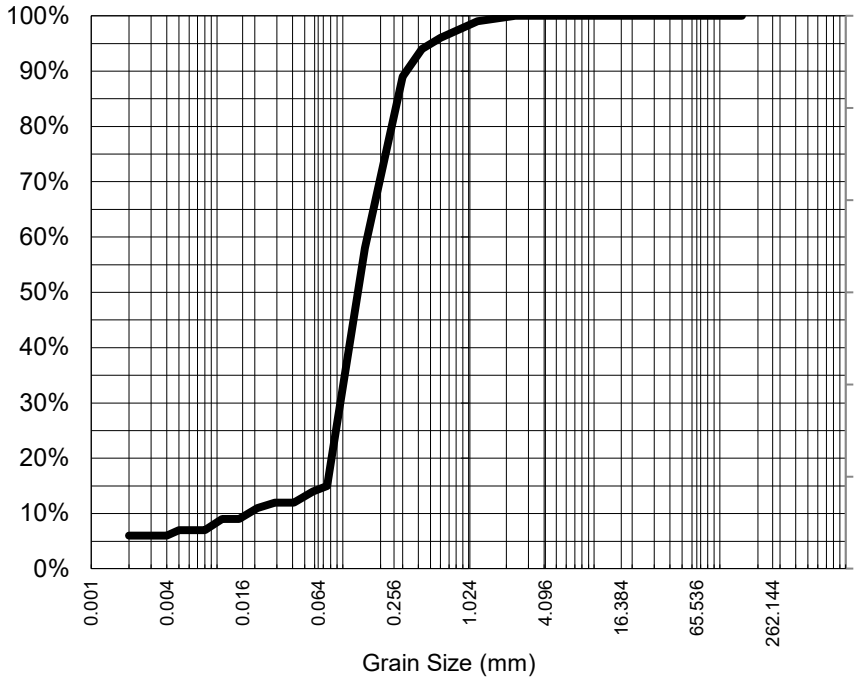
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Brisbane QLD

CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-014 / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD07_0.0-0.5

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	96%
0.425	94%
0.300	89%
0.150	58%
0.075	15%
Particle Size (microns)	
58	14%
41	12%
29	12%
21	11%
15	9%
11	9%
8	7%
5	7%
2	6%

Median Particle Size (mm)*	0.136

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 27-Oct-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.61

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Satish Trivedi
Soil Senior Chemist
Authorised Signatory

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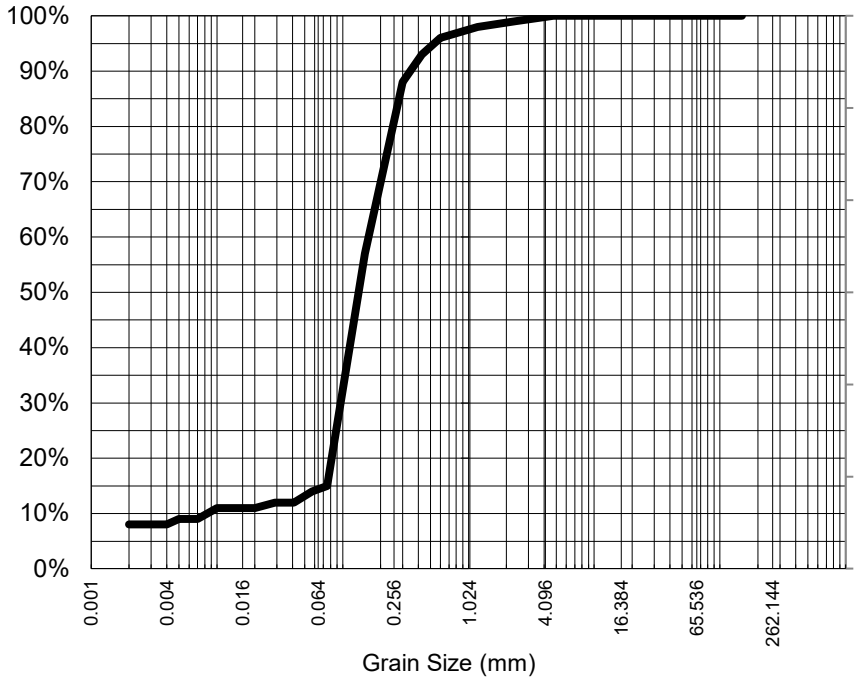
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Brisbane QLD

CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-015 / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD07_0.5-1.0

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	96%
0.425	93%
0.300	88%
0.150	57%
0.075	15%
Particle Size (microns)	
57	14%
41	12%
29	12%
20	11%
15	11%
10	11%
7	9%
5	9%
2	8%

Median Particle Size (mm)*	0.138

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 27-Oct-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.66

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Satish Trivedi
Soil Senior Chemist
Authorised Signatory

Certificate of Analysis

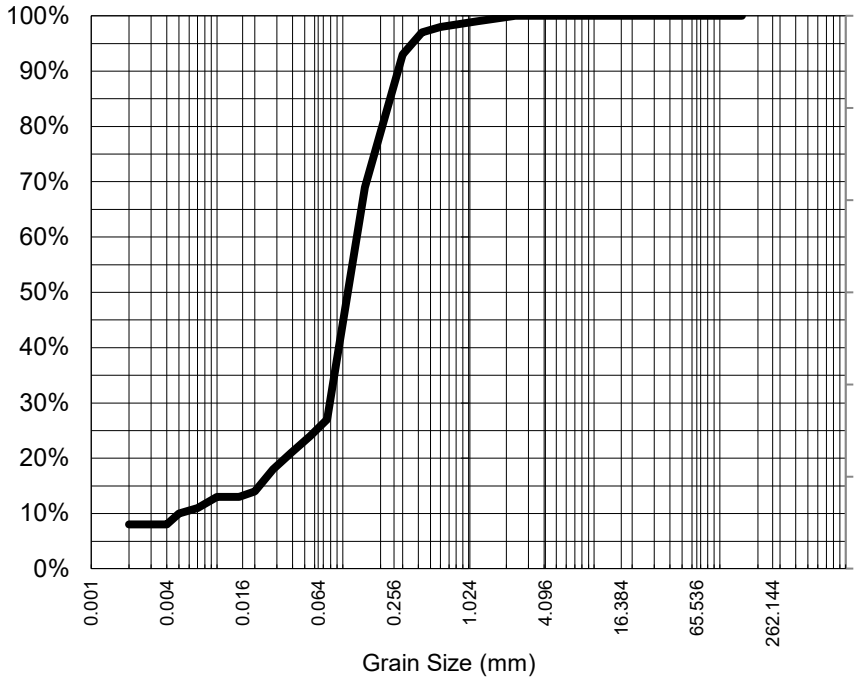
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2 Byth Street
Stafford, QLD 4053
pH 07 3243 7222
samples.brisbane@alsenviro.com

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Brisbane QLD

CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-017 / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD08_0.0-0.5

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	98%
0.425	97%
0.300	93%
0.150	69%
0.075	27%
Particle Size (microns)	
55	24%
39	21%
28	18%
20	14%
15	13%
10	13%
7	11%
5	10%
2	8%

Median Particle Size (mm)*	0.116

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 27-Oct-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.69

NATA Accreditation: 825 Site: Brisbane
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Soil Senior Chemist
Authorised Signatory

Certificate of Analysis

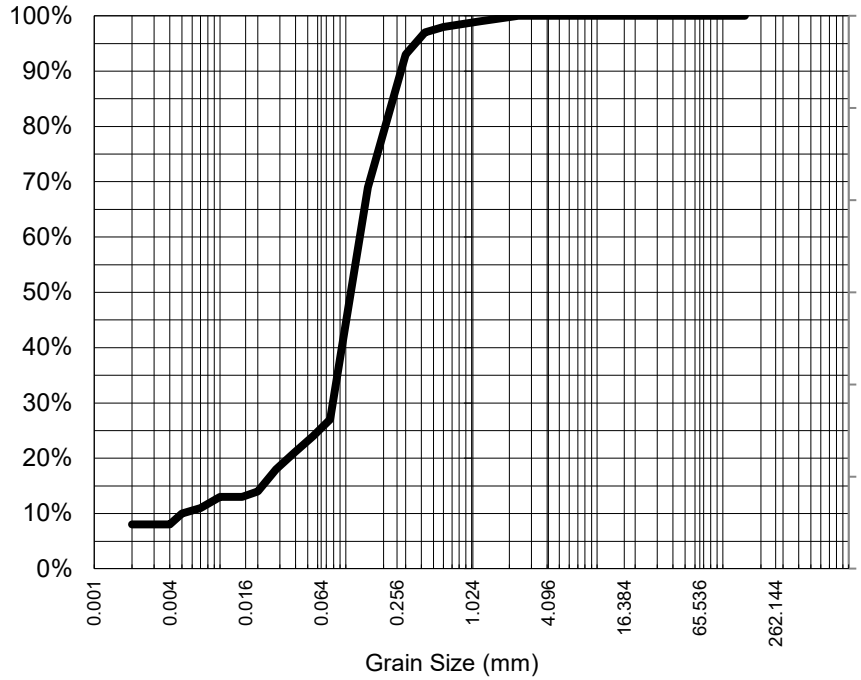
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CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-017DUP / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD08_0.0-0.5

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	98%
0.425	97%
0.300	93%
0.150	69%
0.075	27%
Particle Size (microns)	
55	24%
39	21%
28	18%
20	14%
15	13%
10	13%
7	11%
5	10%
2	8%

Median Particle Size (mm)*	0.116

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 27-Oct-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.69

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Authorised Signatory

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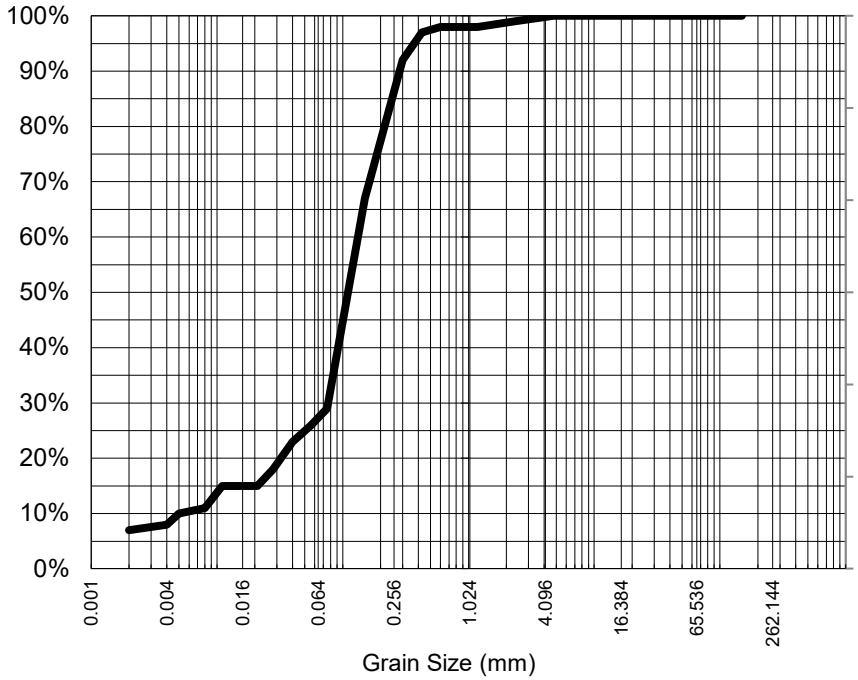
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Brisbane QLD

CLIENT:	JESSE SIMKUS	**DATE REPORTED:**	2-Nov-2021
COMPANY:	GHD PTY LTD	**DATE RECEIVED:**	25-Oct-2021
ADDRESS:	Level 3, Ghd Tower, 24 Honeysuc Newcastle	**REPORT NO:**	EB2130323-018 / PSD
PROJECT:	12554729 Crowdy Head REF	**SAMPLE ID:**	SD08_0.5-1.0

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	98%
0.425	97%
0.300	92%
0.150	67%
0.075	29%
Particle Size (microns)	
56	26%
40	23%
28	18%
21	15%
15	15%
11	15%
8	11%
5	10%
2	7%

Median Particle Size (mm)*	0.116

Analysis Notes

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 27-Oct-21

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.6

NATA Accreditation: 825 Site: Brisbane
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Satish Trivedi
Soil Senior Chemist
Authorised Signatory

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2132548**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR JESSE SIMKUS	Contact	: Andrew Epps
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8639
Project	: 12554729 Crowdy Head REF	Date Samples Received	: 12-Nov-2021 09:58
Order number	: 12554729	Date Analysis Commenced	: 17-Nov-2021
C-O-C number	:	Issue Date	: 17-Nov-2021 13:53
Sampler	: JESSE SIMKUS		
Site	: ----		
Quote number	: BN/405/21		
No. of samples received	: 10		
No. of samples analysed	: 10		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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

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*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, 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 Contact 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.

- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): 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: EA033 (CRS Suite): 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: **PULP**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Sample ID	SD01_0.0-0.5 EB2130323 #1	SD01_0.5-1.0 EB2130323 #2	SD01_1.0-1.5 EB2130323 #3	SD05_0.0-0.5 EB2130323 #10	SD05_0.5-1.0 EB2130323 #11
				Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
					EB2132548-001	EB2132548-002	EB2132548-003	EB2132548-004	EB2132548-005
					Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		**9.7**	**9.6**	**9.6**	**9.6**	**9.6**
Titratable Actual Acidity (23F)	----	2	mole H+ / t		<2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		**0.055**	**0.097**	**0.131**	**0.118**	**0.125**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		**34**	**60**	**82**	**74**	**78**
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3		**17.4**	**22.2**	**23.1**	**13.2**	**13.9**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t		**3480**	**4450**	**4620**	**2640**	**2780**
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S		**5.58**	**7.13**	**7.40**	**4.24**	**4.45**
EA033-E: 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		**0.06**	**0.10**	**0.13**	**0.12**	**0.12**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		**34**	**60**	**82**	**74**	**78**
Liming Rate excluding ANC	----	1	kg CaCO3/t		**2**	**4**	**6**	**6**	**6**

Analytical Results

Sub-Matrix: **PULP**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Sample ID	SD07_0.0-0.5 EB2130323 #14	SD07_0.5-1.0 EB2130323 #15	SD07_1.0-1.3 EB2130323 #16	SD08_0.0-0.5 EB2130323 #17	SD08_0.5-1.0 EB2130323 #18
				Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
					EB2132548-006	EB2132548-007	EB2132548-008	EB2132548-009	EB2132548-010
					Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		**9.5**	**9.4**	**9.4**	**9.3**	**9.0**
Titratable Actual Acidity (23F)	----	2	mole H+ / t		<2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		**0.233**	**0.308**	**0.331**	**0.401**	**0.869**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		**146**	**192**	**207**	**250**	**542**
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3		**14.9**	**15.8**	**10.4**	**15.2**	**14.4**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t		**2980**	**3150**	**2070**	**3050**	**2890**
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S		**4.79**	**5.05**	**3.32**	**4.88**	**4.63**
EA033-E: 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		**0.23**	**0.31**	**0.33**	**0.40**	**0.87**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		**146**	**192**	**207**	**250**	**542**
Liming Rate excluding ANC	----	1	kg CaCO3/t		**11**	**14**	**16**	**19**	**41**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB2132548**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR JESSE SIMKUS	Contact	: Andrew Epps
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8639
Project	: 12554729 Crowdy Head REF	Date Samples Received	: 12-Nov-2021
Order number	: 12554729	Date Analysis Commenced	: 17-Nov-2021
C-O-C number	:	Issue Date	: 17-Nov-2021
Sampler	: JESSE SIMKUS		
Site	: ----		
Quote number	: BN/405/21		
No. of samples received	: 10		
No. of samples analysed	: 10		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, 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

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 (%)
EA033-A: Actual Acidity (QC Lot: 4017462)									
EB2132548-001	SD01_0.0-0.5 EB2130323 #1	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	9.7	9.7	0.0	0% - 20%
EB2132681-002	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	8.7	8.7	0.0	0% - 20%
EA033-B: Potential Acidity (QC Lot: 4017462)									
EB2132548-001	SD01_0.0-0.5 EB2130323 #1	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.055	0.055	0.0	0% - 50%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	34	34	0.0	No Limit
EB2132681-002	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.735	0.710	3.4	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	459	443	3.4	0% - 20%
EA033-C: Acid Neutralising Capacity (QC Lot: 4017462)									
EB2132548-001	SD01_0.0-0.5 EB2130323 #1	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	17.4	17.4	0.2	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	5.58	5.57	0.2	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	3480	3480	0.2	0% - 20%
EB2132681-002	Anonymous	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	5.87	5.84	0.5	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 (%)*
EA033-C: Acid Neutralising Capacity (QC Lot: 4017462) - continued									
EB2132681-002	Anonymous	EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	1.88	1.87	0.0	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	1170	1170	0.5	0% - 20%

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**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 4017462)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.4 pH Unit	100	91.0	107
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	19 mole H+ / t	91.7	70.0	124
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 4017462)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.246 % S	99.0	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 4017462)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	102	91.0	112
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----

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.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2132548**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR JESSE SIMKUS	Telephone	: +61 7 3552 8639
Project	: 12554729 Crowdy Head REF	Date Samples Received	: 12-Nov-2021
Site	: ----	Issue Date	: 17-Nov-2021
Sampler	: JESSE SIMKUS	No. of samples received	: 10
Order number	: 12554729	No. of samples analysed	: 10

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.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

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.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-A: Actual Acidity							
Pulp Bag (EA033)							
SD01_0.0-0.5 - EB2130323 #1, SD01_0.5-1.0 - EB2130323 #2, SD01_1.0-1.5 - EB2130323 #3, SD05_0.0-0.5 - EB2130323 #10, SD05_0.5-1.0 - EB2130323 #11, SD07_0.0-0.5 - EB2130323 #14, SD07_0.5-1.0 - EB2130323 #15, SD07_1.0-1.3 - EB2130323 #16, SD08_0.0-0.5 - EB2130323 #17, SD08_0.5-1.0 - EB2130323 #18	**19-Oct-2021**	**17-Nov-2021**	19-Oct-2022	✓	**17-Nov-2021**	15-Feb-2022	✓
EA033-B: Potential Acidity							
Pulp Bag (EA033)							
SD01_0.0-0.5 - EB2130323 #1, SD01_0.5-1.0 - EB2130323 #2, SD01_1.0-1.5 - EB2130323 #3, SD05_0.0-0.5 - EB2130323 #10, SD05_0.5-1.0 - EB2130323 #11, SD07_0.0-0.5 - EB2130323 #14, SD07_0.5-1.0 - EB2130323 #15, SD07_1.0-1.3 - EB2130323 #16, SD08_0.0-0.5 - EB2130323 #17, SD08_0.5-1.0 - EB2130323 #18	**19-Oct-2021**	**17-Nov-2021**	19-Oct-2022	✓	**17-Nov-2021**	15-Feb-2022	✓
EA033-C: Acid Neutralising Capacity							
Pulp Bag (EA033)							
SD01_0.0-0.5 - EB2130323 #1, SD01_0.5-1.0 - EB2130323 #2, SD01_1.0-1.5 - EB2130323 #3, SD05_0.0-0.5 - EB2130323 #10, SD05_0.5-1.0 - EB2130323 #11, SD07_0.0-0.5 - EB2130323 #14, SD07_0.5-1.0 - EB2130323 #15, SD07_1.0-1.3 - EB2130323 #16, SD08_0.0-0.5 - EB2130323 #17, SD08_0.5-1.0 - EB2130323 #18	**19-Oct-2021**	**17-Nov-2021**	19-Oct-2022	✓	**17-Nov-2021**	15-Feb-2022	✓
EA033-D: Retained Acidity							
Pulp Bag (EA033)							
SD01_0.0-0.5 - EB2130323 #1, SD01_0.5-1.0 - EB2130323 #2, SD01_1.0-1.5 - EB2130323 #3, SD05_0.0-0.5 - EB2130323 #10, SD05_0.5-1.0 - EB2130323 #11, SD07_0.0-0.5 - EB2130323 #14, SD07_0.5-1.0 - EB2130323 #15, SD07_1.0-1.3 - EB2130323 #16, SD08_0.0-0.5 - EB2130323 #17, SD08_0.5-1.0 - EB2130323 #18	**19-Oct-2021**	**17-Nov-2021**	19-Oct-2022	✓	**17-Nov-2021**	15-Feb-2022	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-E: Acid Base Accounting							
Pulp Bag (EA033)							
SD01_0.0-0.5 - EB2130323 #1, SD01_0.5-1.0 - EB2130323 #2, SD01_1.0-1.5 - EB2130323 #3, SD05_0.0-0.5 - EB2130323 #10, SD05_0.5-1.0 - EB2130323 #11, SD07_0.0-0.5 - EB2130323 #14, SD07_0.5-1.0 - EB2130323 #15, SD07_1.0-1.3 - EB2130323 #16, SD08_0.0-0.5 - EB2130323 #17, SD08_0.5-1.0 - EB2130323 #18	**19-Oct-2021**	**17-Nov-2021**	19-Oct-2022	✓	**17-Nov-2021**	15-Feb-2022	✓

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)							
Chromium Suite for Acid Sulphate Soils	EA033	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	17	**5.88**	**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
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

From: Jesse Simkus <Jesse.Simkus@ghd.com>
Sent: Thursday, 11 November 2021 10:15 AM
To: ALSEnviro Brisbane <ALSEnviro.Brisbane@alsglobal.com>; Andrew Epps <Andrew.Epps@alsglobal.com>
Cc: Andrew Black (InTouch) <AndrewBlack@eurofins.com>
Subject: [EXTERNAL] - *URGENT* RE: RESULTS & EDD for ALS Workorder : EB2130323 | Your Reference: 12554729 Crowdy Head REF

CAUTION: This email originated from outside of ALS. Do not click links or open attachments unless you recognize the sender and are sure content is relevant to you.

Hi Andrew E / Bris enviro team

Please analyse the following samples for the Chromium suite for ASS as per quote BN/405/21:

1. SD01_0.0-0.5
2. SD01_0.5-1.0
3. SD01_1.0-1.5
4. SD05_0.0-0.5
5. SD05_0.5-1.0
6. SD07_0.0-0.5
7. SD07_0.5-1.0
8. SD07_1.0-1.3
9. SD08_0.0-0.5
10. SD08_0.5-1.0

And urgently send the following samples (which I forgot to request forward) to Eurofins for analysis as indicated in the original COC (attached FYI Andrew B) as per quote 210906GHDN:

- FD05
- FD07
- FD09
- FD11

Please send all remaining sample volume in jars and bags, and request immediate extraction (I understand there will be holding time exceedances).
Standard turn-around, noting urgency.

Thank you

Jesse Simkus | A GHD Associate
B. ENG (ENV)
Senior Environmental Engineer

GHD
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230 Harbour Drive Coffs Harbour NSW 2450 Australia
Level 3 GHD Tower 24 Honeysuckle Drive Newcastle NSW 2300 Australia
D +61 2 6650 5673 **M** +61 404 542 354 **E** jesse.simkus@ghd.com

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Connect

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Environmental Division
Brisbane
Work Order Reference
EB2132548

Telephone : - 61-7-3243 7222

CHAIN OF CUSTODY

ALS Environmental

ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

☐BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph. 07 7471 5600 E: gladstone@alsglobal.com

☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E mudgee.mail@alsglobal.com

☐NEWCASTLE 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E nowra@alsglobal.com

☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E samples.perth@alsglobal.com

☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

CLIENT: GHD	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date): 28/10/2021
OFFICE: Newcastle		☐ Non Standard or urgent TAT (List due date):
PROJECT: Crowdy Head REF	ALS QUOTE NO.: BN / 405 / 21	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7
ORDER NUMBER: 12554729		OF: 1 2 3 4 5 6 7
PROJECT MANAGER: Jesse Simkus	CONTACT PH: 0404542354	
SAMPLER: Jesse Simkus	SAMPLER MOBILE:	RELINQUISHED BY:
COC emailed to ALS? Yes	EDD FORMAT (or default): Esdat	RECEIVED BY: POZEA TAYOR
Email Reports to (will default to PM if no other addresses are listed):		DATE/TIME: 8:50 25.10.21
Email Invoice to (will default to PM if no other addresses are listed): accountspayablefss@ghd.com		RELINQUISHED DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: SEDIMENT SAMPLES - NAGD ANALYSIS AS PER QUOTE. Sample volume to be carefully managed to allow for potential additional analyses. Bulk Density

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ASS field screen	TOC	Bulk Density, PSD (slave + hydrometer)	SD-03	TPH-SD	Organotins	OCP + PCB (ultratrace)	Ultra-trace PAHs in Sediments	Additional Information
01	SD01_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag*	4	X	X		X	X	X		X	* Minimal volume
02	SD01_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X		X	X	X		X	
03	SD01_1.0-1.5	19-Oct	S	2x Glass jar, Med bag	3	X	X		X	X	X		X	* No 500ml bag
04	SD02_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
05	SD02_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
06	SD03_0.0-0.5	19-Oct	S	2x Glass jar, Med bag	3	X	X		X	X	X		X	* No 500ml bag
07	SD03_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X		X	X	X		X	
08	SD04_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
09	SD04_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
10	SD05_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
11	SD05_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
12	SD06_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

#840516

Chilled: ☑

Temp: 7.3 / 10.6 / 7.9

Correction Factor:

Final Temp:

12/11/21 3:00PM

CHAIN OF CUSTODY

ALS Environmental

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

NEWCASTLE 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2083 E: nowra@alsglobal.com

PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: GHD	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date): 28/10/2021	
OFFICE: Newcastle		☐ Non Standard or urgent TAT (List due date):	
PROJECT: Crowdy Head REF	ALS QUOTE NO.: BN / 405 / 21	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7	
ORDER NUMBER: 12554729		COF: 1 2 3 4 5 6 7	
PROJECT MANAGER: Jesse Simkus	CONTACT PH: 0404542354		
SAMPLER: Jesse Simkus	SAMPLER MOBILE:	RELINQUISHED BY:	RECEIVED BY:
COC emailed to ALS? Yes	EDD FORMAT (or default): Esdat	DATE/TIME:	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):		RELINQUISHED BY:	RECEIVED BY:
Email Invoice to (will default to PM if no other addresses are listed): accountspayablefss@ghd.com		DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: SEDIMENT SAMPLES - NAGD ANALYSIS AS PER SAQP

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ASS field screen	TOC	PSD (sieve + hydrometer	SD-03	TPH-SD	Organotins	OCP + PCB (ultratrace)	Ultra-trace PAHs in Sediments	Additional Information
						ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								
13	SD06_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	
14	SD07_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X		X	
15	SD07_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X		X	
16	SD07_1.0-1.3	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X		X	
17	SD08_0.0-0.5	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	Possibly elevated organotins / contam
18	SD08_0.5-1.0	19-Oct	S	2x Glass jar, Med bag, 500mL bag	4	X	X	X	X	X	X	X	X	Possibly elevated organotins / contam
19	FD01	19-Oct	S	2x Glass jar	2									Hold
20	FD02	19-Oct	S	2x Glass jar	2									Hold
21	FD03	19-Oct	S	2x Glass jar	2									Hold
22	FD04	19-Oct	S	2x Glass jar	2		X		X	X	X	X	X	
23	FD05	19-Oct	S	2x Glass jar	2		X		X	X	X	X	X	
24	FD06	19-Oct	S	2x Glass jar	2		X		X	X	X	X	X	
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle: ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Environmental

ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

☐BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com

☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

☐NEWCASTLE 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com

☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: GHD	TURNAROUND REQUIREMENTS : (Standard TAT-may be longer for some tests e.g.. Ultra Trace Organics)	☐ Standard TAT (List due date): 28/10/2021
OFFICE: Newcastle		☐ Non Standard or urgent TAT (List due date):
PROJECT: Crowdy Head REF	ALS QUOTE NO.: BN / 405 / 21	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7
ORDER NUMBER: 12554729		OF: 1 2 3 4 5 6 7
PROJECT MANAGER: Jesse Simkus	CONTACT PH: 0404542354	
SAMPLER: Jesse Simkus	SAMPLER MOBILE:	RELINQUISHED BY: / DATE/TIME:
COC emailed to ALS? Yes	EDD FORMAT (or default): Esdat	RECEIVED BY: / DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):		RELINQUISHED BY: / DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed): accountspayablefss@ghd.com		RECEIVED BY: / DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: SEDIMENT SAMPLES - NAGD ANALYSIS AS PER QUOTE

						ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ASS field screen	TOC	PSD (sieve + hydrometer	SD-03	TPH-SD	Organotins	OCP + PCB (ultratrace)	Ultra-trace PAHs in Sediments	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
25	FD07	19-Oct	S	2x Glass jar	2		x		x	x	x	x	x	
26	FD08	19-Oct	S	2x Glass jar	2		x		x	x	x	x	x	
27	FD09	19-Oct	S	2x Glass jar	2		x		x	x	x	x	x	
28	FD10	19-Oct	S	2x Glass jar	2		x		x	x	x	x	x	
29	FD11	19-Oct	S	2x Glass jar	2		x		x	x	x	x	x	
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

And urgently send the following samples (which I forgot to request forward) to Eurofins for analysis as indicated in the original COC (attached FYI Andrew B) as per quote 210906GHDN:

- FD05
- FD07
- FD09
- FD11

Please send all remaining sample volume in jars and bags, and request immediate extraction (I understand there will be holding time exceedances).

Standard turn-around, noting urgency.

Thank you

Jesse Simkus | A GHD Associate
B. ENG (ENV)
Senior Environmental Engineer

GHD
Proudly employee-owned | ghd.com
230 Harbour Drive Coffs Harbour NSW 2450 Australia
Level 3 GHD Tower 24 Honeysuckle Drive Newcastle NSW 2300 Australia
D +61 2 6650 5673 **M** +61 404 542 354 **E** jesse.simkus@ghd.com

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Australian Government

National Measurement Institute

QUALITY ASSURANCE REPORT

Client: EUROFINS MGT

NMI QA Report No: EURO26/211116 **Sample Matrix:** Solid

Analyte	Method	LOR	Blank	Sample Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		ng/g	ng/g	ng/g	ng/g	%	%	%
Organics Section								
Organotin								
Monobutyltin	NR_35	0.5	<0.5	NA	NA	NA	109	NA
Dibutyltin	NR_35	0.5	<0.5	NA	NA	NA	103	NA
Tributyltin	NR_35	0.5	<0.5	NA	NA	NA	104	NA
Organotin Surrogate								
Tripropyltin (%Rec)	NR_35	-	-	NA	NA	NA	96	NA

Results expressed in percentage (%) or ng/g wherever appropriate.
Acceptable Spike recovery is 30-150% (monobutyltin and Tripropyltin); 40-160% (dibutyltin and tributyltin)
Maximum acceptable RPDs on spikes and duplicates is 60%.
'NA ' = Not Applicable.
RPD= Relative Percentage Difference, LCS = Laboratory Control Spike, LOR = Limit of Reporting.
This report shall not be reproduced except in full.

Signed:

Danny Slee
Organics Manager, NMI-North Ryde

Date: **25/11/2021**

REPORT OF ANALYSIS

Client	: EUROFINS MGT	**Job No.**	: EURO26/211116
	6 Monterey Road	**Quote No.**	: QT-02018
	Dandenong South VIC 3175	**Order No.**	: B21-435464-840516
		Date Received	: 16-NOV-2021
Attention	: JOHN NGUYEN	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Tim Reddan	**Phone**	: 03 9644 4854

Lab Reg No.	Sample Ref	Sample Description
N21/025493	21-No29601	SOIL FD05 REF 840516
N21/025494	21-No29602	SOIL FD07 REF 840516
N21/025495	21-No29603	SOIL FD09 REF 840516
N21/025496	21-No29604	SOIL FD11 REF 840516

Lab Reg No.	Units	N21/025493	N21/025494	N21/025495	N21/025496	Method
Date Sampled		19-OCT-2021	19-OCT-2021	19-OCT-2021	19-OCT-2021	
Sample Reference		21-No29601	21-No29602	21-No29603	21-No29604	
Organotins						
Monobutyltin as Sn	ng/g	1.1	0.78	4.4	2.2	NR_35
Dibutyltin as Sn	ng/g	<0.5	<0.5	2.9	2.7	NR_35
Tributyltin as Sn	ng/g	<0.5	<0.5	5.5	1.2	NR_35
Surrogate: Tripropyltin	%REC	110	102	103	113	NR_35
Dates						
Date extracted		23-NOV-2021	23-NOV-2021	23-NOV-2021	23-NOV-2021	
Date analysed		24-NOV-2021	24-NOV-2021	24-NOV-2021	24-NOV-2021	

Luke Baker, Analyst
Organics - NSW
Accreditation No. 198

25-NOV-2021

Lab Reg No.	Units	N21/025493	N21/025494	N21/025495	N21/025496	Method
Date Sampled		19-OCT-2021	19-OCT-2021	19-OCT-2021	19-OCT-2021	
Sample Reference		21-No29601	21-No29602	21-No29603	21-No29604	
Trace Elements						
Total Solids	%	73.7	76.7	77.5	74.5	NT2_49
Dates						
Date extracted		18-NOV-2021	18-NOV-2021	18-NOV-2021	18-NOV-2021	
Date analysed		19-NOV-2021	19-NOV-2021	19-NOV-2021	19-NOV-2021	

REPORT OF ANALYSIS

Report No. RN1335142

Lab Reg No.		N21/025493	N21/025494	N21/025495	N21/025496	
Date Sampled		19-OCT-2021	19-OCT-2021	19-OCT-2021	19-OCT-2021	
Sample Reference		21-No29601	21-No29602	21-No29603	21-No29604	
	Units					Method

Pankaj Barai, Analyst
Inorganics - NSW
Accreditation No. 198

25-NOV-2021

All results are expressed on a dry weight basis.

ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced except in full.
Results relate only to the sample(s) as received and tested.

This Report supersedes reports: *RN1335092* *RN1335141*

Measurement Uncertainty is available upon request.
Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

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www.eurofins.com.au EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261 Site # 1254

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Newcastle
4/52 Industrial Drive
Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448
NATA # 1261 Site # 25079

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool WA 6106
Phone : +61 8 6253 4444
NATA # 2377 Site # 2370

Eurofins Environment Testing NZ Limited
NZBN: 9429046024954

Auckland
35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Sample Receipt Advice

Company name:	GHD Pty Ltd NSW
Contact name:	Jesse Simkus
Project name:	CROWDY HEAD REF
Project ID:	12554729
Turnaround time:	5 Day
Date/Time received	Nov 12, 2021 3:00 PM
Eurofins reference	840516

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 7.9 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
✗	Split sample sent to requested external lab.
✓	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Please advise the analysis for "SD-03".

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

John Nguyen on phone : or by email: JohnNguyen@eurofins.com

Results will be delivered electronically via email to Jesse Simkus - Jesse.Simkus@ghd.com.

Note: A copy of these results will also be delivered to the general GHD Pty Ltd NSW email address.

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261 Site # 1254

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
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1/21 Smallwood Place
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46-48 Banksia Road
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NZBN: 9429046024954

Auckland
35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: GHD Pty Ltd NSW
Address: Level 15, 133 Castlereagh Street
Sydney
NSW 2000

Project Name: CROWDY HEAD REF
Project ID: 12554729

Order No.: 12554729
Report #: 840516
Phone: 02 9239 7100
Fax: 02 9239 7199

Received: Nov 12, 2021 3:00 PM
Due: Nov 19, 2021
Priority: 5 Day
Contact Name: Jesse Simkus

Eurofins Analytical Services Manager : John Nguyen

Sample Detail						Total Organic Carbon	Tributyltin*	Polychlorinated Biphenyls	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)	Organochlorine Pesticides (Trace level)
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217												
Brisbane Laboratory - NATA # 1261 Site # 20794												
Mayfield Laboratory - NATA # 1261 Site # 25079												
Perth Laboratory - NATA # 2377 Site # 2370												
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	FD05	Oct 19, 2021		Soil	B21-No29601	X	X	X	X	X	X	X
2	FD07	Oct 19, 2021		Soil	B21-No29602	X	X	X	X	X	X	X
3	FD09	Oct 19, 2021		Soil	B21-No29603	X	X	X	X	X	X	X
4	FD11	Oct 19, 2021		Soil	B21-No29604	X	X	X	X	X	X	X
Test Counts						4	4	5	4	4	4	4

GHD Pty Ltd NSW
Level 15, 133 Castlereagh Street
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Jesse Simkus**

Report **840516-S-V2**
Project name CROWDY HEAD REF
Project ID 12554729
Received Date Nov 12, 2021

Client Sample ID			**FD05**	**FD07**	**FD09**	**FD11**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**B21-No29601**	**B21-No29602**	**B21-No29603**	**B21-No29604**
Date Sampled			**Oct 19, 2021**	**Oct 19, 2021**	**Oct 19, 2021**	**Oct 19, 2021**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	< 50	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	< 50	< 50
TRH C10-C36 (Total)	50	mg/kg	< 50	< 50	< 50	< 50
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
Polychlorinated Biphenyls						
Aroclor-1016	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Aroclor-1221	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Aroclor-1232	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Aroclor-1242	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Aroclor-1248	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Aroclor-1254	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Aroclor-1260	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Total PCB*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Dibutylchlorendate (surr.)	1	%	132	133	133	64
Tetrachloro-m-xylene (surr.)	1	%	128	130	129	127
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	< 100	< 100
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Acenaphthylene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Anthracene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Benz(a)anthracene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Benzo(a)pyrene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Benzo(b&j)fluoranthene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Benzo(g.h.i)perylene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Benzo(k)fluoranthene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005

Client Sample ID			FD05	FD07	FD09	FD11
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-No29601	B21-No29602	B21-No29603	B21-No29604
Date Sampled			Oct 19, 2021	Oct 19, 2021	Oct 19, 2021	Oct 19, 2021
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Chrysene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Dibenz(a.h)anthracene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Fluoranthene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Fluorene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Naphthalene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Phenanthrene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Pyrene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Total PAH*	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
2-Fluorobiphenyl (surr.)	1	%	94	78	77	76
p-Terphenyl-d14 (surr.)	1	%	76	131	123	118
Organochlorine Pesticides (Trace level)						
4.4'-DDD	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
4.4'-DDE	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
4.4'-DDT	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
a-HCH	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Aldrin	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
b-HCH	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Chlordanes - Total	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
d-HCH	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Dieldrin	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Endosulfan I	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Endosulfan II	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Endosulfan sulphate	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Endrin	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Endrin aldehyde	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Endrin ketone	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
g-HCH (Lindane)	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Heptachlor	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Heptachlor epoxide	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Hexachlorobenzene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Methoxychlor	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Toxaphene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
DDT + DDE + DDD (Total)*	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Aldrin and Dieldrin (Total)*	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Vic EPA IWRG 621 OCP (Total)*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Vic EPA IWRG 621 Other OCP (Total)*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Organotins						
Tributyltin*	1.25	mg/kg	See attached	See attached	See attached	See attached
Total Organic Carbon	0.1	%	0.3	0.4	0.5	0.5
% Moisture	1	%	24	23	23	23

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Nov 16, 2021	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Nov 16, 2021	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Nov 16, 2021	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Polychlorinated Biphenyls	Melbourne	Nov 30, 2021	28 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water (USEPA 8082)			
Polycyclic Aromatic Hydrocarbons (Trace level)	Melbourne	Nov 30, 2021	14 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)			
Organochlorine Pesticides (Trace level)	Melbourne	Nov 16, 2021	14 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water (USEPA 8270) trace			
Organotins	Melbourne	Nov 16, 2021	14 Days
- Method: LTM-ORG-2400 Determination of organotins in solid & aqueous samples by LC-ICP-MS			
Total Organic Carbon	Melbourne	Nov 17, 2021	28 Days
- Method: LTM-INO-4060 Total Organic Carbon in water and soil			
% Moisture	Melbourne	Nov 12, 2021	14 Days
- Method: LTM-GEN-7080 Moisture			

eurofins | Environment Testing

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261 Site # 1254

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Newcastle
4/52 Industrial Drive
Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448
NATA # 1261 Site # 25079

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool WA 6106
Phone : +61 8 6253 4444
NATA # 2377 Site # 2370

Eurofins Environment Testing NZ Limited
NZBN: 9429046024954

Auckland
35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: GHD Pty Ltd NSW
Address: Level 15, 133 Castlereagh Street
Sydney
NSW 2000

Project Name: CROWDY HEAD REF
Project ID: 12554729

Order No.: 12554729
Report #: 840516
Phone: 02 9239 7100
Fax: 02 9239 7199

Received: Nov 12, 2021 3:00 PM
Due: Nov 19, 2021
Priority: 5 Day
Contact Name: Jesse Simkus

Eurofins Analytical Services Manager : John Nguyen

Sample Detail						Total Organic Carbon	Tributyltin*	Polychlorinated Biphenyls	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)	Organochlorine Pesticides (Trace level)
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217												
Brisbane Laboratory - NATA # 1261 Site # 20794												
Mayfield Laboratory - NATA # 1261 Site # 25079												
Perth Laboratory - NATA # 2377 Site # 2370												
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	FD05	Oct 19, 2021		Soil	B21-No29601	X	X	X	X	X	X	X
2	FD07	Oct 19, 2021		Soil	B21-No29602	X	X	X	X	X	X	X
3	FD09	Oct 19, 2021		Soil	B21-No29603	X	X	X	X	X	X	X
4	FD11	Oct 19, 2021		Soil	B21-No29604	X	X	X	X	X	X	X
Test Counts						4	4	5	4	4	4	4

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
ug/L: micrograms per litre
ppm: Parts per million
ppb: Parts per billion
%: Percentage
org/100mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs..

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM where no positive PFAS results have been reported have been reviewed and no data was affected.

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QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
Method Blank							
Polychlorinated Biphenyls							
Aroclor-1016	mg/kg	< 0.1			0.1	Pass	
Aroclor-1221	mg/kg	< 0.1			0.1	Pass	
Aroclor-1232	mg/kg	< 0.1			0.1	Pass	
Aroclor-1242	mg/kg	< 0.1			0.1	Pass	
Aroclor-1248	mg/kg	< 0.1			0.1	Pass	
Aroclor-1254	mg/kg	< 0.1			0.1	Pass	
Aroclor-1260	mg/kg	< 0.1			0.1	Pass	
Total PCB*	mg/kg	< 0.1			0.1	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Benzo(a)pyrene	mg/kg	< 0.005			0.005	Pass	
Total PAH*	mg/kg	-			0.005	N/A	
Method Blank							
Organochlorine Pesticides (Trace level)							
4.4'-DDD	mg/kg	< 0.005			0.005	Pass	
4.4'-DDE	mg/kg	< 0.005			0.005	Pass	
4.4'-DDT	mg/kg	< 0.005			0.005	Pass	
a-HCH	mg/kg	< 0.005			0.005	Pass	
Aldrin	mg/kg	< 0.005			0.005	Pass	
b-HCH	mg/kg	< 0.005			0.005	Pass	
Chlordanes - Total	mg/kg	< 0.01			0.01	Pass	
d-HCH	mg/kg	< 0.005			0.005	Pass	
Dieldrin	mg/kg	< 0.005			0.005	Pass	
Endosulfan I	mg/kg	< 0.005			0.005	Pass	
Endosulfan II	mg/kg	< 0.005			0.005	Pass	
Endosulfan sulphate	mg/kg	< 0.005			0.005	Pass	
Endrin	mg/kg	< 0.005			0.005	Pass	
Endrin aldehyde	mg/kg	< 0.005			0.005	Pass	
Endrin ketone	mg/kg	< 0.005			0.005	Pass	
g-HCH (Lindane)	mg/kg	< 0.005			0.005	Pass	
Heptachlor	mg/kg	< 0.005			0.005	Pass	
Heptachlor epoxide	mg/kg	< 0.005			0.005	Pass	
Hexachlorobenzene	mg/kg	< 0.005			0.005	Pass	
Methoxychlor	mg/kg	< 0.005			0.005	Pass	
Toxaphene	mg/kg	< 0.1			0.1	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	100			70-130	Pass	
TRH C10-C14	%	124			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	104			70-130	Pass	
TRH C6-C10	%	120			70-130	Pass	
LCS - % Recovery							
Polychlorinated Biphenyls							
Aroclor-1260	%	99			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	%	121			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Benzo(a)pyrene	%	89			70-130	Pass	
LCS - % Recovery							
Organochlorine Pesticides (Trace level)							
4.4'-DDD	%	72			70-130	Pass	
4.4'-DDE	%	123			70-130	Pass	
4.4'-DDT	%	76			70-130	Pass	
a-HCH	%	96			70-130	Pass	
Aldrin	%	93			70-130	Pass	
b-HCH	%	77			70-130	Pass	
Chlordanes - Total	%	102			70-130	Pass	
d-HCH	%	77			70-130	Pass	
Dieldrin	%	71			70-130	Pass	
Endosulfan I	%	76			70-130	Pass	
Endosulfan II	%	77			70-130	Pass	
Endosulfan sulphate	%	86			70-130	Pass	
Endrin	%	77			70-130	Pass	
Endrin aldehyde	%	78			70-130	Pass	
Endrin ketone	%	88			70-130	Pass	
g-HCH (Lindane)	%	78			70-130	Pass	
Heptachlor	%	72			70-130	Pass	
Heptachlor epoxide	%	86			70-130	Pass	
Hexachlorobenzene	%	71			70-130	Pass	
Methoxychlor	%	99			70-130	Pass	
LCS - % Recovery							
Total Organic Carbon	%	100			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M21-No39189	NCP	%	82			70-130	Pass	
TRH C10-C14	M21-No34976	NCP	%	122			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M21-No39189	NCP	%	106			70-130	Pass	
TRH C6-C10	M21-No39189	NCP	%	78			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M21-No34976	NCP	%	120			70-130	Pass	
Spike - % Recovery									

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Organochlorine Pesticides (Trace level)				Result 1					
4.4'-DDD	B21-No18934	NCP	%	123			70-130	Pass	
4.4'-DDE	B21-No18934	NCP	%	105			70-130	Pass	
4.4'-DDT	B21-No18934	NCP	%	99			70-130	Pass	
a-HCH	B21-No18934	NCP	%	87			70-130	Pass	
Aldrin	B21-No18934	NCP	%	77			70-130	Pass	
b-HCH	B21-No18934	NCP	%	115			70-130	Pass	
Chlordanes - Total	B21-No18934	NCP	%	87			70-130	Pass	
d-HCH	B21-No18934	NCP	%	73			70-130	Pass	
Dieldrin	B21-No18934	NCP	%	87			70-130	Pass	
Endosulfan I	B21-No18934	NCP	%	88			70-130	Pass	
Endosulfan II	B21-No18934	NCP	%	90			70-130	Pass	
Endosulfan sulphate	B21-No18934	NCP	%	99			70-130	Pass	
Endrin	B21-No18934	NCP	%	100			70-130	Pass	
Endrin aldehyde	B21-No18934	NCP	%	123			70-130	Pass	
Endrin ketone	B21-No18934	NCP	%	80			70-130	Pass	
g-HCH (Lindane)	B21-No18934	NCP	%	79			70-130	Pass	
Heptachlor	B21-No18934	NCP	%	78			70-130	Pass	
Heptachlor epoxide	B21-No18934	NCP	%	87			70-130	Pass	
Methoxychlor	B21-No18934	NCP	%	112			70-130	Pass	
Spike - % Recovery									
Polychlorinated Biphenyls				Result 1					
Aroclor-1016	M21-No23729	NCP	%	0.0000000			70-130	Fail	Q08
Aroclor-1260	M21-No23729	NCP	%	0.0000000			70-130	Fail	Q08
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1					
Benzo(a)pyrene	M21-No27354	NCP	%	108			70-130	Pass	
Spike - % Recovery									
Organochlorine Pesticides (Trace level)				Result 1					
Hexachlorobenzene	M21-No35875	NCP	%	89			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M21-No37532	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	M21-No34973	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M21-No34973	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	M21-No34973	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M21-No37532	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	M21-No37532	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	M21-No34973	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	M21-No34973	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	M21-No34973	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
Organochlorine Pesticides (Trace level)				Result 1	Result 2	RPD			
4.4'-DDD	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
4.4'-DDE	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
4.4'-DDT	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
a-HCH	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Aldrin	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
b-HCH	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	

Duplicate									
Organochlorine Pesticides (Trace level)				Result 1	Result 2	RPD			
Chlordanes - Total	L21-No36620	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
d-HCH	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Dieldrin	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Endosulfan I	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Endosulfan II	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Endosulfan sulphate	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Endrin	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Endrin aldehyde	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Endrin ketone	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
g-HCH (Lindane)	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Heptachlor	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Heptachlor epoxide	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Hexachlorobenzene	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Methoxychlor	L21-No36620	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Toxaphene	L21-No36620	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M21-No28763	NCP	%	8.2	7.7	7.0	30%	Pass	
Duplicate									
Polychlorinated Biphenyls				Result 1	Result 2	RPD			
Aroclor-1016	M21-No34774	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1221	M21-No34774	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1232	M21-No34774	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1242	M21-No34774	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1248	M21-No34774	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1254	M21-No34774	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Aroclor-1260	M21-No34774	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Total PCB*	M21-No34774	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1	Result 2	RPD			
Benzo(a)pyrene	M21-No34774	NCP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Organic Carbon	B21-No29603	CP	%	0.5	0.4	16	30%	Pass	

Comments

Analysis of Tributyltin (TBT) was performed by National Measurement Institute, NATA accreditation number 198, report reference RN1335142.
This report was revised V2 to amend project name to 'CROWDY HEAD REF' as per COC.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	Yes

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.

Authorised by:

John Nguyen	Analytical Services Manager
Vivian Wang	Senior Analyst-Volatile (VIC)
Scott Beddoes	Senior Analyst-Inorganic (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)



Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB2137607**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR JESSE SIMKUS	Contact	: Andrew Epps
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: jesse.simkus@ghd.com	E-mail	: andrew.epps@alsglobal.com
Telephone	: ----	Telephone	: +61 7 3552 8639
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: 12554729 Crowdy Head REF	Page	: 1 of 2
Order number	: 12554729	Quote number	: EB2021GHDSER0029 (BN/405/21)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 24-Dec-2021 16:33	Issue Date	: 24-Dec-2021
Client Requested Due Date	: 08-Mar-2022	Scheduled Reporting Date	: **08-Mar-2022**

Delivery Details

Mode of Delivery	: Samples On Hand	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: ----
Receipt Detail	: REBATCH	No. of samples received / analysed	: 5 / 0

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please be advised, A due date of the 8/03/22 has been assigned to this workorder based on a 9-week incubation period. If an extended incubation period of up to 19 weeks is required, the TAT will be adjusted accordingly. If you would like to discuss this please contact client services at ALSEnviro.Brisbane@alsglobal.com**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - CUSTOM AST Custom ASS/ARD methods
EB2137607-001	19-Oct-2021 00:00	SD05_0.0-0.5	✓
EB2137607-002	19-Oct-2021 00:00	SD05_0.5-1.0	✓
EB2137607-003	19-Oct-2021 00:00	SD07_0.0-0.5	✓
EB2137607-004	19-Oct-2021 00:00	SD07_0.5-1.0	✓
EB2137607-005	19-Oct-2021 00:00	SD07_1.0-1.3	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS INVOICE

- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com

Accounts Payable Australia

- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com

JESSE SIMKUS

- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jesse.simkus@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jesse.simkus@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jesse.simkus@ghd.com
- Attachment - Report (SUBCO)	Email	jesse.simkus@ghd.com
- Chain of Custody (CoC) (COC)	Email	jesse.simkus@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	jesse.simkus@ghd.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2137607**	Page	: 1 of 2
Amendment	: **1**		
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR JESSE SIMKUS	Contact	: Andrew Epps
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8639
Project	: 12554729 Crowdy Head REF	Date Samples Received	: 24-Dec-2021 16:33
Order number	: 12554729	Date Analysis Commenced	: 04-Feb-2022
C-O-C number	: ----	Issue Date	: 09-Mar-2022 10:11
Sampler	: ----		
Site	: ----		
Quote number	: BN/405/21		
No. of samples received	: 5		
No. of samples analysed	: 5		

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

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*
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, 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 Contact 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
~ = Indicates an estimated value.

- Amendment 1 (09/03/2022): This report has been amended to allow the distribution of an Electronic Data Deliverable (EDD) not previously provided. All analysis results are as per the previous report.
- EA027 (ANC Corroboration by Chip Tray Incubation): A due date of (8/03/22) has been assigned to this work order based on a 9-week incubation period.

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Sample ID	SD05_0.0-0.5	SD05_0.5-1.0	SD07_0.0-0.5	SD07_0.5-1.0	SD07_1.0-1.3
			Sampling date / time	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00	19-Oct-2021 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB2137607-001**	**EB2137607-002**	**EB2137607-003**	**EB2137607-004**	**EB2137607-005**
				Result	Result	Result	Result	Result
EA027: ANC Corroboration by Chip Tray Incubation								
pH (INC)	----	0.1	pH Unit	**7.2**	**7.2**	**7.1**	**7.1**	**7.0**
ANC Corroborated	----	-	-	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB2137607**	Page	: 1 of 3
Amendment	: **1**		
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR JESSE SIMKUS	Contact	: Andrew Epps
Address	: Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle 2300	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8639
Project	: 12554729 Crowdy Head REF	Date Samples Received	: 24-Dec-2021
Order number	: 12554729	Date Analysis Commenced	: 04-Feb-2022
C-O-C number	: ----	Issue Date	: 09-Mar-2022
Sampler	: ----		
Site	: ----		
Quote number	: BN/405/21		
No. of samples received	: 5		
No. of samples analysed	: 5		

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*
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, 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

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 (%)*
EA027: ANC Corroboration by Chip Tray Incubation (QC Lot: 4155134)									
EB2137607-001	SD05_0.0-0.5	EA027: pH (INC)	----	0.1	pH Unit	7.2	7.2	0.0	0% - 20%

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.

- **No Method Blank (MB) or Laboratory Control Spike (LCS) Results are required to be reported.**

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.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2137607**	Page	: 1 of 4
Amendment	: **1**		
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR JESSE SIMKUS	Telephone	: +61 7 3552 8639
Project	: 12554729 Crowdy Head REF	Date Samples Received	: 24-Dec-2021
Site	: ----	Issue Date	: 09-Mar-2022
Sampler	: ----	No. of samples received	: 5
Order number	: 12554729	No. of samples analysed	: 5

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.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

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.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA027: ANC Corroboration by Chip Tray Incubation							
Soil Glass Jar - Unpreserved (EA027)							
SD05_0.0-0.5, SD05_0.5-1.0, SD07_0.0-0.5, SD07_0.5-1.0, SD07_1.0-1.3	**19-Oct-2021**	**----**	----	----	**04-Feb-2022**	19-Oct-2022	✓

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)							
ANC Corroboration by Chip Tray Incubation	EA027	1	5	**20.00**	**10.53**	✓	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
ANC Corroboration by Chip Tray Incubation	* EA027	SOIL	In house: Based on National ASS Guidance Laboratory Method NLM-8.2. Following a 9-week incubation at field capacity moisture level (moist, aerobic conditions), sample pH is measured. If the incubated pH ≥ 6.5, ANC is included in Net Acidity and Liming Rate calculations. If the incubated pH < 6.5, ANC is excluded in Net Acidity and Liming Rate calculations.

From: Jesse Simkus <Jesse.Simkus@ghd.com>
Sent: Thursday, 23 December 2021 4:00 PM
To: Andrew Epps <Andrew.Epps@alsglobal.com>
Cc: ALSEnviro Brisbane <ALSEnviro.Brisbane@alsglobal.com>; Lisa King <Lisa.King@ghd.com>; Kavita Gifford <Kavita.Gifford@ghd.com>
Subject: RE: 21BNCC476: [EXTERNAL] - EB2132548 - CRS Results

Hi Andrew, please commence ANC incubation trials on the following:

- SD05_0.0-0.5
- SD05_0.5-1.0
- SD07_0.0-0.5
- SD07_0.5-1.0
- SD07_1.0-1.3

Environmental Division
Brisbane
Work Order Reference
EB2137607



Telephone : +61-7-3243 7222

Thank you

Jesse Simkus | A GHD Associate
B. ENG (ENV)
Senior Environmental Engineer

GHD
Proudly employee-owned | ghd.com
230 Harbour Drive Coffs Harbour NSW 2450 Australia
Level 3 GHD Tower 24 Honeysuckle Drive Newcastle NSW 2300 Australia
D +61 2 6650 5673 **M** +61 404 542 354 **E** jesse.simkus@ghd.com

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Appendix F Construction and Maintenance Noise Estimator

Distanced Based Assessment (Noisiest Plant)

Please pick from drop-down list in orange cells

Noise area category		R1
RBL or L_{A90} Background level (dB(A))	Day	40
	Evening	35
	Night	30
$L_{Aeq(15minute)}$ Noise Mangement Level (dB(A))	Day	50
	Day (OOHW)	45
	Evening	40
	Night	35
Noisiest plant		Microdrilling Rig (Soilmec SM-5)
Is there line of sight to receiver?		Yes

Steps for Assessment:

1. Schedule noisy works to occur in standard hours where possible or before 11pm and implement Standard Measures.
2. Select the representative noise area category. The worksheet titled 'Representative Noise Environ.' provides a number of examples to help select the noise area category.
3. Select the noisiest plant. If not found in drop-down list, refer to 'Source List' and select a representative plant with equivalent sound power level.
4. Is there line of sight to receiver? Select the appropriate scenario from the drop down list .

Identify and implement standard mitigation measures where feasible and reasonable. Include any shielding implemented as part of the standard mitigation measures by changing the selection in the 'Is there line of sightoiaw to receiver' drop-down list. Solid barriers can be in the form of road cutting, timber lapped and capped fence, shipping container, site office, etc. Substantial solid barriers are barriers greater than 5 metres in height or multiple rows of houses or a sound barrier specifically designed to mitigate construction noise. Please note that vegetation and trees are not considered to be a form of solid barrier and any gaps would compromise the acoustic integrity of the solid barrier.

5. Determine if there are any receivers (both residential and non-residential receivers) within the affected distance for each relevant time period . Consider background LA90 noise measurements to check assumption in Step #2 if:

(a) there are many affected receivers and the impact duration at any one receiver is more than 3 weeks; or

(b) there are a few affected receivers and the impact duration at any one receiver is more than 6 weeks.

Note that consideration need to be given to the construction staging plan when determining impact duration.

7. Identify if there are any receivers within the additional mitigation measures distances and identify feasible and reasonable measures at each receiver.
8. Where night works are involved, identify sleep disturbance affected distance.
9. Document the outcomes of these steps.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a Roads and Maritime noise speciliast for more information)

Abbreviation	Measure
N	Notification
SN	Specific notifications
PC	Phone calls
IB	Individual briefings
RO	Respite offer
R1	Respite period 1
R2	Respite period 2
DR	Duration respite
AA	Alternative accommodation
V	Verification

Note that spot check verification of noise levels and individual briefings are not required for projects with less than 3 weeks impact duration

Residential receiver

			$L_{Aeq(15minute)}$ noise level above background (L_{A90})									$L_{Aeq(15minute)}$ 75 dB(A) or greater (Highly affected)			Sleep disutrbance L_{Amax} 65 dB(A)
			5 to 10 dB(A) Noticeable			10 to 20 dB(A) Clearly audible			20 to 30 dB(A) Moderately intrusive			> 30 dB(A) Highly intrusive					
		Affected distance (m)	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Affected distance (m)
Undeveloped green fields, rural areas with isolated dwellings	Day	270							N	130	60	N	50	70	N, PC, RO	30	75	
	Day (OOHW)	390				N, R1, DR	270	50	N, R1, DR	130	60	N, R1, DR, PC, SN	50	70	N, PC, RO	30	75	
	Evening	565				N, R1, DR	390	45	N, R1, DR	185	55	N, R1, DR, PC, SN	85	65	N, PC, RO	30	75	
	Night	815	N	815	35	N, R2, DR	565	40	N, PC, SN, R2, DR	270	50	AA, N, PC, SN, R2, DR	130	60	N, PC, RO	30	75	120
	Highly Affected	30													N, PC, RO	30	75	
Developed settlements (urban and suburban)	Day	335							N	145	60	N	55	70	N, PC, RO	35	75	
	Day (OOHW)	500				N, R1, DR	335	50	N, R1, DR	145	60	N, R1, DR, PC, SN	55	70	N, PC, RO	35	75	
	Evening	745				N, R1, DR	500	45	N, R1, DR	220	55	N, R1, DR, PC, SN	95	65	N, PC, RO	35	75	
	Night	1090	N	1090	35	N, R2, DR	745	40	N, PC, SN, R2, DR	335	50	AA, N, PC, SN, R2, DR	145	60	N, PC, RO	35	75	135
	Highly Affected	35													N, PC, RO	35	75	
Propagation across a valley / over water	Day	445							N	175	60	N	65	70	N, PC, RO	40	75	
	Day (OOHW)	690				N, R1, DR	445	50	N, R1, DR	175	60	N, R1, DR, PC, SN	65	70	N, PC, RO	40	75	
	Evening	1040				N, R1, DR	690	45	N, R1, DR	280	55	N, R1, DR, PC, SN	105	65	N, PC, RO	40	75	
	Night	1530	N	1530	35	N, R2, DR	1040	40	N, PC, SN, R2, DR	445	50	AA, N, PC, SN, R2, DR	175	60	N, PC, RO	40	75	160
	Highly Affected	40													N, PC, RO	40	75	

Non-residential receiver
Undeveloped green fields, rural areas with isolated dwellings

		Standard hours		$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	185				N	85	65	N, PC, RO	30	75
Hospital wards and operating theatres	Day	65	85							N, PC, RO	30	75
Place of worship	Day	55	185				N	85	65	N, PC, RO	30	75
Active recreation	Day	65	85							N, PC, RO	30	75
Passive recreation	Day	60	130				N	50	70	N, PC, RO	30	75
Industrial premise	Day	75	30							N, PC, RO	30	75
Offices, retail outlets	Day	70	50							N, PC, RO	30	75

		OOHW		$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	85				N, R1, DR	50	70	N, R1, DR	17	80	N, R1, DR, PC, SN	5	90
	Night	65	85	N	85	65	N, R2, NR	50	70	N, PC, SN, R2, DR	17	80	AA, N, PC, SN, R2, DR	5	90
Place of worship	Evening	55	185				N, R1, DR	130	60	N, R1, DR	50	70	N, R1, DR, PC, SN	17	80
	Night	55	185	N	185	55	N, R2, NR	130	60	N, PC, SN, R2, DR	50	70	AA, N, PC, SN, R2, DR	17	80
Active recreation	Evening	65	85				N, R1, DR	50	70	N, R1, DR	17	80	N, R1, DR, PC, SN	5	90
Passive recreation	Evening	60	130				N, R1, DR	85	65	N, R1, DR	30	75	N, R1, DR, PC, SN	9	85
Industrial premise	Evening	75	30				N, R1, DR	17	80	N, R1, DR	5	90	N, R1, DR, PC, SN	2	100
	Night	75	30	N	30	75	N, R2, NR	17	80	N, PC, SN, R2, DR	5	90	AA, N, PC, SN, R2, DR	2	100
Offices, retail outlets	Evening	70	50				N, R1, DR	30	75	N, R1, DR	9	85	N, R1, DR, PC, SN	3	95
	Night	70	50	N	50	70	N, R2, NR	30	75	N, PC, SN, R2, DR	9	85	AA, N, PC, SN, R2, DR	3	95

Non-residential receiver
Developed settlements (urban and suburban)

		Standard hours		$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	220				N	95	65	N, PC, RO	35	75
Hospital wards and operating theatres	Day	65	95							N, PC, RO	35	75
Place of worship	Day	55	220				N	95	65	N, PC, RO	35	75
Active recreation	Day	65	95							N, PC, RO	35	75
Passive recreation	Day	60	145				N	55	70	N, PC, RO	35	75
Industrial premise	Day	75	35							N, PC, RO	35	75
Offices, retail outlets	Day	70	55							N, PC, RO	35	75

Road Traffic Noise Estimator

Please input information into yellow cells
Please pick from drop-down list in orange cells

Ground type	Developed settlements (urban and suburban areas)
Road surface	DGA
Road type	Local road

Note that a road is new if a road's functional class changes during construction. For example, rerouting traffic from an arterial road temporarily to a collector road changes the functional class of the collector road for the duration of the temporary reroute.

	Day	Night
Noise criteria (residences)	55	50
Existing speed	70	70
Speed during construction	70	70

	Day (7am to 10pm)		Night (10pm to 7am)		Worst Case 1-hour Day		Worst Case 1-hour Night	
Existing traffic	**Light vehicles**	**Heavy vehicles**	**Light vehicles**	**Heavy vehicles**	**Light vehicles**	**Heavy vehicles**	**Light vehicles**	**Heavy vehicles**
Direction (1)	10000	800	3420	380	400	80	25	2.5
Direction (2)	8000	700	3420	380	200	40	25	2.5
Additional traffic								
Direction (1)	0	0	0	0	200	20	0	0
Direction (2)	0	0	3125	235			0	0

	Day	Night
Change in noise levels (dBA)	0.9	0.0
Mitigation level (dBA)	55	50
Is the change in noise level greater than 2.0 dBA?	No	No
Require consideration of additional mitigation measures?	No	No
Mitigation distance (m)		

To assess noise impacts from construction traffic or a temporary reroute due to a road closure or both an initial screening test should be undertaken by evaluating whether noise levels will increase by more than 2dB(A). Where increases are 2dBA or less then no further assessment is required. Where noise levels increase by more than 2dBA (2.1dBA) and noise levels exceed the controlling criterion then the receiver qualifies for consideration of noise mitigation under the Noise Mitigation Guideline. [note: the assessment methodology is similar to minor works so in any instance the only trigger for noise mitigation under the NMG shall be due to noise level increase]

Mitigation Measures

Management of construction related traffic or traffic reroutes noise should as a minimum include the following controls:
- Scheduling and routing of vehicle movements
- Speed of vehicles
- Driver behaviour and avoidance of the use of engine compression brakes
- Ensuring vehicles are adequately silenced before allowing them to access the site

Where noise impacts are greater than one year then consideration should be given to the following measures where feasible and reasonable:
- temporary noise barriers
- at-receiver noise mitigation

Feasible and reasonable considerations should also include:
- time of day of the noise increase and exceedance of criteria
- time of use of affected receivers
- how many decibels the noise levels are to increase
- how long the mitigation will provide benefit to the receiver during the project

Calculating noise level at the receiver

Distance to receiver (m)	
Direction (1)	60
Direction (2)	60

	Day	Night
Predicted noise levels (dBA) @ 1m from the façade	63.0	51.4

Note:
(1) Noise reports present noise levels rounded to the nearest integer and differences between two noise levels rounded to a single decimal place.
(2) noise barriers more than 3 metres high, if designed using Roads and Maritime guidelines, would generally provide an insertion loss of around 5 dB(A) at the most affected residence.
(3) noise barriers more than 5 metres high, if designed using Roads and Maritime guidelines, would generally provide an insertion loss of around 10 dB(A) at the most affected residence.

Appendix G Marine Biodiversity Assessment

Marine Biodiversity Assessment

Crowdy Head Harbour Upgrade

Transport for NSW

26 April 2022

→ **The Power of Commitment**



GHD Pty Ltd | ABN 39 008 488 373
GHD Tower, Level 3, 24 Honeysuckle Drive
Newcastle, New South Wales 2300, Australia
T +61 2 4979 9999 | **F** +61 2 9475 0725 | **E** ntlmail@ghd.com | **ghd.com**

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			Name	Signature	Name	Signature	Date
S4	0	M Hooper	L King		S Murphy		26/04/22

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1. Introduction

GHD Pty Ltd (GHD) has been engaged by Transport for NSW (TfNSW) to prepare this Marine Biodiversity Assessment to support the Review of Environmental Factors (REF) for the proposed upgrade of the Crowdy Head Harbour (the proposal).

The works proposed include:

– Removal of the long central jetty (Jetty 1) and shorter eastern jetty (Jetty 2).
– Dredging of areas of the harbour to provide a safe clearance depth of between 2.6 and 3.0 metres.
– Construction of a new pontoon jetty in place of Jetty 2.
– Disposal of dredge spoil on the southern side of Crowdy Head.

2. Methodology

2.1 Desktop assessment

In order to identify all potential protected species that may require consideration of impact management and/or permits in relation to the proposed works, GHD undertook a desktop review of existing information and publicly available databases. GHD reviewed the following data sources on 24 November 2021 as part of the desktop assessment:

- NSW Department of Primary Industries (DPI) Fish Communities and Threatened Species Distribution of NSW
- DPI Critical Habitat Register and Key Fish Habitat maps
- DPI maps of estuarine habitats of NSW
- Office of Environment and Heritage (OEH) BioNet Atlas for records of threatened species, populations and endangered ecological communities listed under the *Biodiversity Conservation Act 2016* (BC Act) and *Fisheries Management Act 199*4 (FM Act) that have been recorded within the study area and surrounding environment
- OEH Areas of Outstanding Biodiversity Value
- Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) predicted to occur in the locality
- Any data available for use from MidCoast Council
- Aerial imagery from Nearmap to inform habitat features

All species identified in database searches are reproduced in the likelihood of occurrence table in Appendix A. The PMST search report is provided in Appendix B.

2.2 Field assessment - towed underwater camera

To support the desktop assessment, GHD collected underwater towed video footage across two separate field survey events along the jetty piles, the seabed within the harbour and at three locations in the open ocean nearby corresponding with the potential spoil disposal areas. Together these areas comprise the study area (Figure 2.1).

During the first field survey a total of eight transects were completed, five of which were located within the harbour (Figure 2.1). The transect lines were selected to gain further understanding of habitat features noted in aerial photo review. The second field survey was concentrated in the harbour, where the entire perimeter of the harbour was mapped, in addition to a further three transects within the harbour. Two transects were undertaken over the reef south of the headland on either side of the reef (Figure 2.1). The field survey was designed based on knowledge of species habitat and appropriate survey methods to detect cryptic species.



Paper Size ISO A4

0 50 100 150 200 250

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Transport for NSW
Crowdy Head Harbour Upgrade
Review of Environmental Factors

Field survey transect lines
Harbour and Open Water

Project No. **12554729**
Revision No. **0**
Date **26/04/2022**

FIGURE 1

N:\AU\Sydney\Projects\21\12554729\GIS\Maps\Marine_REF_0.aprx
Print date: 26 Apr 2022 - 12:59

Data source: LPI: DCDB, DTDB, 2017. Metromap Tile Service: .
Created by: tmorton

2.3 Limitations

This report has been prepared by GHD for TfNSW and may only be used and relied on by TfNSW for the purpose agreed between GHD and the TfNSW as set out in this report.

GHD otherwise disclaims responsibility to any person other than TfNSW arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect. GHD has prepared this report in good faith on the basis of information provided by TfNSW and others who provided information to GHD (including Government authorities by way of desktop searches), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and survey undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points. Investigations undertaken in respect of this report are constrained by the site conditions, such as the location of buildings, services and vegetation and presence of marine species. As a result, this report does not represent to be an exhaustive account of all possible conditions, species, risks or otherwise that may occur on site. GHD has undertaken the field survey with consideration to the species mapped to occur on site, targeting where possible the habitat features known to be favoured by that particular species to the best available standard considering the project constraints.

Site conditions (including the presence of hazardous substances and/or site contamination, threatened and protected species) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

3. Existing environment

3.1 Marine habitats

The study area includes the harbour environment and the open ocean surrounding the harbour. The harbour has been created by the construction of the breakwater, which supports seagrass and rocky reef habitats. The open ocean surrounding the harbour is largely open expanses of medium grain sands with sporadic algae. These habitat types are discussed further below and include:

– Open sandy expanses
– Seagrass beds
– Macroalgae
– Sub-tidal rocky reef
– Inter-tidal rocky shores
– Vertical artificial reefs (created by built infrastructure present)

3.1.1 Key fish habitat

'Key fish habitat' are aquatic habitats that are considered important to the sustainability of the recreational, commercial fishing industry, the maintenance of fish populations generally, and the survival and recovery of threatened aquatic species. DPI assesses habitat sensitivity as defined by the importance of the habitat to fish survival and the habitat's ability to withstand disturbance.

Key fish habitat refers to all marine and estuarine habitats up to the highest astronomical tide level and more semi-permanent freshwater habitats including rivers, creeks, lakes, lagoons, billabongs, weir pools, impoundments up to their top bank. This definition covers all waterways of significance to fish population sustainability, excluding only very low value habitat such as irrigation channels, urban ponds, sewage and salt evaporation ponds.

Key fish habitat (KFH) is delineated by 'type' pertaining to the level of sensitivity attributed to the waterway, being Type 1 (highly sensitive), Type 2 (moderately sensitive) and Type 3 (minimally sensitive) (DPI, 2003). With consideration to 'Table 1 – Key Fish Habitat and associated sensitivity classification scheme' within the DPI Policy and Guidelines for Fish Habitat Conservation and Management (2013), Crowdy Head is Type 1 KFH, due to the presence of Zostera seagrasses in patches exceeding five square metres and suitable habitat for threatened species, including the *Hippocampus whitei* (White's Seahorse).

The results of the desktop and field assessments are described in the following sections.

3.2 Benthic environment

The benthic environment of the study area is comprised of medium grain loosely consolidated sands. In the open ocean transects, organic detritus and shell material was present in some areas, carried by tides and wave activity. Sporadically occurring stalking algae and ascidians were noted during the transects. The typical environment observed in the open ocean transects (6-8), with the exception of Transect 6, can be seen in Figure 3.1.



Figure 3.1 Open Ocean benthic environment observed in transects 7 and 8

3.2.1 Seagrass beds

Seagrass beds are highly productive marine habitats that play a critical role in ecosystem function, are habitat for marine macrophytes and are sensitive to impacts from coastal development. Australia is home to substantial seagrass beds, with an estimated 51,000 square kilometres (km^2) of seagrass along the coastline, with 159 km^2 of that occurring in NSW (OEH, 2017). Three dominant species of seagrass occur in NSW, being *Halophila ovalis, Zostera muelleri* and *Posidonia australis.* While all seagrasses in NSW are protected, *P. australis* is also a Threatened Ecological Community (TEC), listed as endangered under the EPBC Act in the Hawkesbury-Manning Marine Bioregion from Wallis Lakes to Cronulla. No *P. australis* occurs inside, or within 10 kilometres of the study area.

Aggregated patches of *Z. muelleri* (Figure 3.2) were observed within the harbour, primarily concentrated at the mouth of the harbour. Isolated patches of *H.ovalis* was observed co-occurring with *Z. muelleri.* The patch size at the entrance is approximately 1,480 square metres (m^2). Seagrass is seasonal, often varying in patch size throughout the year, dying back in winter and expanding and flowering in spring. Given the timing of survey (Oct/Nov), during the spring growth season, the patch extent observed can be considered representative of maximum patch size. Epiphyte load (algae/protozoan recruitment) on seagrass blades was minimal (~20 %) to moderate (50 %). Overall seagrass was of good quality.

Two Olive Ridley Turtles (*Lepidochelys olivacea*) (Figure 3.3) were observed at the decommissioned slipway where there is rocky reef habitat as well as mixed seagrass and algae beds.



Figure 3.2 Zostera muelleri seagrass aggregated patch located at mouth of harbour (Transect 1)



Figure 3.3 Olive Ridley Turtle observed near slipway

3.2.2 Macroalgae

Macroalgae are significant contributors to marine life, producing 50 – 75 percent of the earth's oxygen and uptaking 25 per cent of carbon dioxide (Miller, 2011). Macroalgae is considered a fragile habitat that is easily impacted by anthropogenic activities including the development of foreshore structures and resulting siltation. Indirectly, macroalgae is also significantly impacted by shading (Miller 2011).

Macroalgae was observed sporadically occurring alongside the rocky reef within the harbour and throughout Transect 6 (see Figure 3.4). The two dominant species of macroalgae observed were Sargassum (*Sargassum* spp*.)* and Common Kelp (*Ecklonia radiata)*. Strap Weed (*Phyllospora comosa)* and Peacock Weed *(Lobophora variegata)* were also noted frequently during the survey.



Figure 3.4 ***Macroalgae habitat observed in (Transect 1). Image: a. Sargassum spp. and Australian Mado (Atyptichthys strigatu), b. Dusky Flathead (Platycephalus fuscus), c. Mixed meadow of Zostera muelleri and Halophila ovalis seagrass adjoining macroalgae patches, d. Various species of algae including Peacock Weed (Lobophora variegate)***

3.2.3 Subtidal rocky reef, intertidal rocky shore and vertical artificial reefs

Rocky reef habitats support a range of species and are highly diverse habitats. The harbour is mostly bounded on the eastern and western extents by rock forming part of the breakwater. Subtidal rocky reefs and intertidal rocky shores form as a result of the in-situ structures and are frequently colonised by various limpets, rock oysters, encrusting algae and various ascidians. Subtidal rocky reef platforms, crevices and caves provide suitable and ideal habitat for the Black Rock Cod (*Epinephelus daemelii)* mapped to occur in the area. However, the species was not identified during the marine habitat survey.

A large reef outcrop was noted on the southern side of Crowdy Headland running parallel to the headland. The reef measures approximately 430 metres long and 163 metres wide at its widest point (Figure 3.5). Due to the visibility on the day of survey and suspended sediment, the water clarity was sub-optimal. Nonetheless, a number of species were identified on the largely algae dominated rocky reef outcrop, including Cunjevoi (*Pyura stolonifera*), various encrusting sponges, encrusting coralline algae (Corallinaceae) (Figure 3.6) and a juvenile Giant Shovelnose Ray (*Glaucostegus typus*) (Figure 3.7).

The existing jetty structures are supported by piles, which have formed small niche artificial reef environments, comprising of Cunjevoi (*Pyura stoloniferas*), Common Kelp (*Ecklonia radiata)*, Flat Oyster (*Ostrea angasi)*, Fanweed (*Zonaria sp.), Sargassum* spp. and various species within *Cellana* genus, such as various limpets and porifera (sponges).



Figure 3.5 Reef surveyed immediately adjacent proposed spoil disposal location

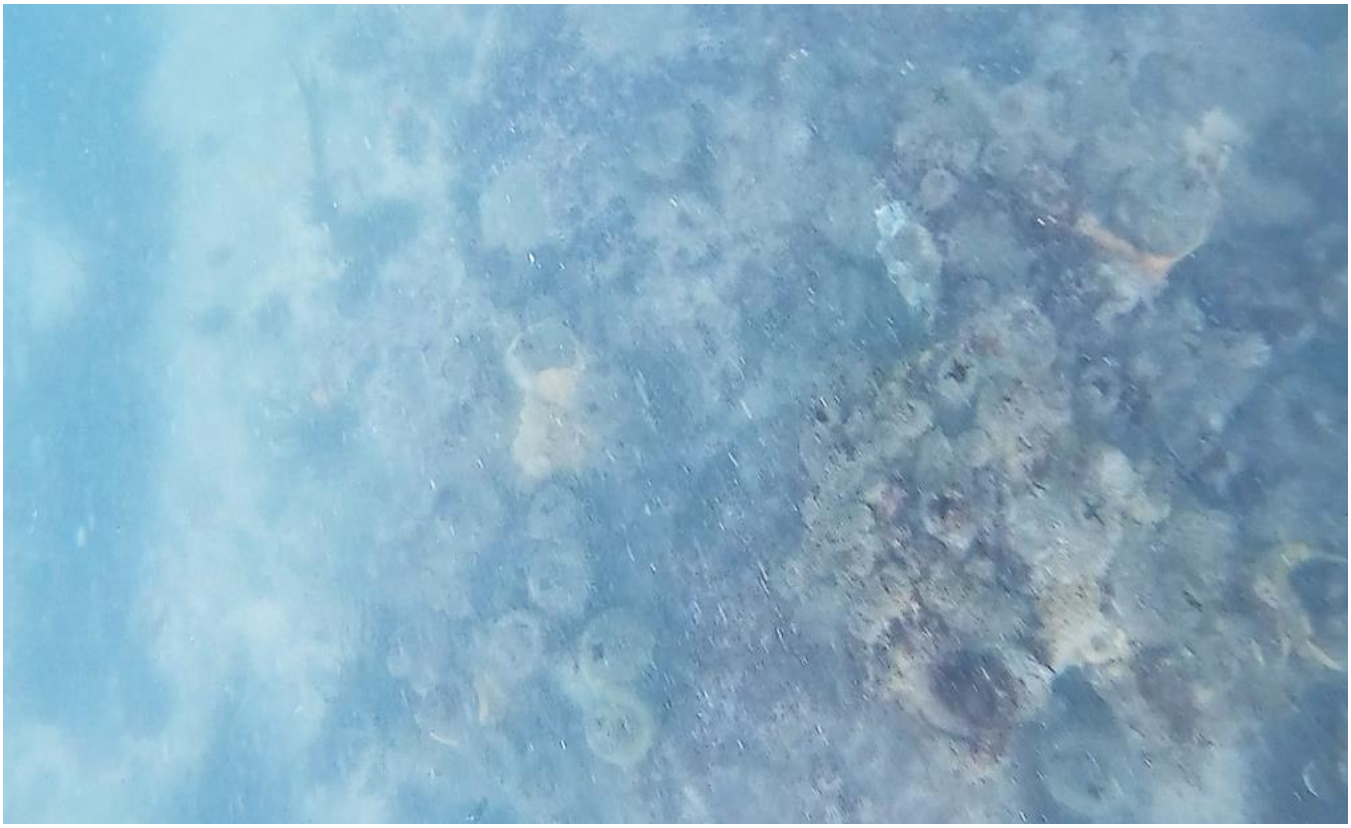


Figure 3.6 Rocky reef environment observed at Transect 6 (dominant coverage by Pyura)

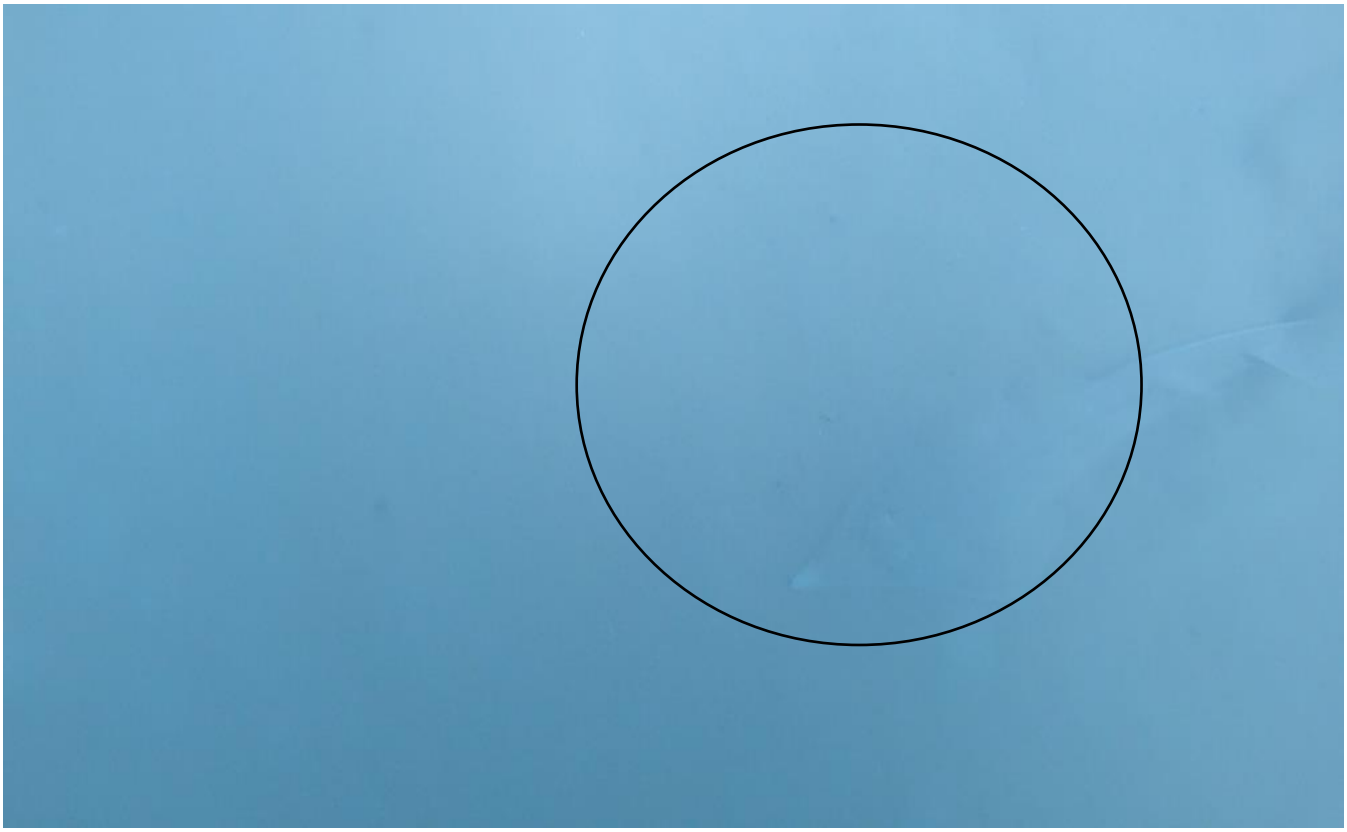


Figure 3.7 Giant Shovelnose Ray (Glaucostegus typus) observed at Transect 6



Figure 3.8 Niche reef habitat on pile at Transect 2

3.3 Marine fauna

3.3.1 Survey results

During the field assessment, the following species were incidentally encountered:

– Australian Mado (*Atyptichthys strigatu*)
– Dusky Flathead (*Platycephalus fuscus*)
– Australasian Snapper (*Chrysophrys auratus*)
– Giant Shovelnose Ray (*Glaucostegus typus*)
– Common Stingaree (*Trygonoptera testacea*)

Two Olive Ridley turtle (*Lepidochelys olivacea*), listed as endangered under the EPBC Act, were also observed during the field assessment.

3.3.2 Threatened species

Likelihood of occurrence

An assessment was conducted to determine the likelihood of occurrence for all conservation significant species under the EPBC Act and FM Act, with relevance to the study area (see Appendix A). The likelihood of occurrence assessment was based on a review of species distributions (through desktop assessments, including the standard 10 km buffer) and habitat requirements, available historical records for the region, and the results of the habitat assessments and field surveys undertaken within the study area. The likelihood of occurrence ranking was based on the framework outlined in Table 3.1. For the purposes of the likelihood of occurrence assessment, 'area' refers to the study area plus a 10-kilometre buffer zone.

Table 3.1 Likelihood of occurrence definitions

Likelihood of occurrence	Definition
Likely to occur	Species have been recorded in the study area AND potentially suitable habitat is present within the study area
May occur	Mapped species' distributions incorporate the study area AND potentially suitable habitat occurs within the surrounding area
Unlikely to occur	Species has not been recorded or there is a lack of suitable habitat in the area

A number of species identified in desktop searches with potential to occur in the study area are considered not relevant to this assessment given the scope of the assessment is limited to the sub-tidal shallow marine environment of Crowdy Heads. Threatened and migratory terrestrial species were omitted from further consideration.

The following sections describe the findings of the likelihood of occurrence assessment in Appendix A, which ranks relevant species identified in the desktop searches against pertinent legislation, life history and habitat information. The key for classification of threatened species under the EPBC Act, FM Act and BC Act is provided in Table 3.2.

Table 3.2 Threatened species listing key

Code	Description	Definition
Commonwealth legislation – EPBC Act		
ACAP	Agreement on the Conservation of Albatrosses and Petrels	The agreement strives to conserve albatrosses and petrels through international collaboration and activities that actively seek to mitigate threats to populations of albatross and petrels. Australia is one of 13 parties on this agreement.
Bonn	Bonn Convention / Convention on the Conservation of Migratory Species of Wild Animals	The Bonn Convention, also known as the Convention on Migratory Species (CMS) is administered by the United Nations taking the form of an environmental treaty to which Australia is signatory. The convention seeks to harmonise legal protections of migratory species for countries which form part of the species migratory pathway.

Code	Description	Definition
C	CAMBA	China-Australia Migratory Bird Agreement: Refers to species listed in the Bilateral Agreement between the Government of Australia and the Government of the People's Republic of China for the protection of Migratory. Birds and their Environment (Subdivision A of Division 1 of Part 5, Commonwealth EPBC Act 1999).
CE	Critically endangered	Refers to a native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (Subdivision A of Division 1 of Part 13, Commonwealth EPBC Act 1999).
E	Endangered	Refers to a native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria. (Subdivision A of Division 2 of Part 13, Commonwealth EPBC Act 1999).
J	JAMBA	Japan-Australia Migratory Bird Agreement: Refers to species listed in the Bilateral Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (Subdivision A of Division 1 of Part 5, Commonwealth EPBC Act 1999).
Ramsar	Ramsar Convention on Wetlands	The Ramsar Convention on Wetlands seeks to conserve wetlands worldwide, through the use of sharing policy making, capacity building and technology transfer that facilitates international cooperation across the signatory countries.
K	ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement: Refers to species listed in the Bilateral Agreement between the Government of Australia and the Government of the Republic of Korea for the protection of Migratory Birds and their Environment (Subdivision A of Division 1 of Part 5, Commonwealth EPBC Act 1999).
V	Vulnerable	Refers to a native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria (Subdivision A of Division 1 of Part 13, Commonwealth EPBC Act 1999).
NSW legislation – FM Act / BC Act		
P	Protected	Refers to the fauna listed in the FM Act.
CE	Critically endangered	Species face an extremely high risk of extinction in the immediate future as determined by the Fisheries Scientific Committee. A species is eligible for listing as critically endangered if it has undergone an extremely large reduction in abundance, geographic distribution or genetic diversity and is affected by a threatening process.
E	Endangered	Species face a very high risk of extinction in the near future as determined by the Fisheries Scientific Committee. A species is eligible for listing as critically endangered if it has undergone a very large reduction in abundance, geographic distribution or genetic diversity and is affected by a threatening process.
V	Vulnerable	Species face a high risk of extinction in the medium-term future as determined by the Fisheries Scientific Committee. A species is eligible for listing as vulnerable if it has undergone a large reduction in abundance, geographic distribution or genetic diversity and is affected by a threatening process.

Marine birds

The desktop searches identified 39 species of listed marine birds that were mapped with the potential to occur within 10 kilometres of the study area. Of these, six are considered as 'likely to occur' (see Appendix A). These comprised:

1. Five threatened species under the EPBC /BC Act:
    a. Red Knot (*Calidris canutus*)
    b. Curlew Sandpiper (*Calidris ferruginea*)
    c. Beach Stone Curlew (*Esacus mannirostris*)
    d. White Throated Needletail (*Hirundanus caudacutus*)
    e. Bar-tailed Godwit (*Limpsa lapponica baueri*)
2. One migratory marine bird under the EPBC Act:
    a. Lesser Frigatebird (*Fregata ariel*)

Terrestrial birds that were understood not to inhabit, or have a relationship with the marine environment, were excluded.

Fish

The desktop searches identified two species of listed marine fish that were mapped to occur within 10 kilometres of the study area, being the Black Rock Cod (*Epinephelus daemelii*) and the White's Seahorse (*Hippocampus whitei*). Both are considered 'likely to occur' and are listed threatened under the EPBC/FM/BC Act, see Appendix A. Based on this likelihood, additional field assessment was undertaken of the habitat within the harbour environment. Due to the shallow nature of the harbour, there is limited opportunity for larger fish to utilise the caves and crevices created by the pockets between rocks. It is possible that a juvenile Black Rock Cod may use the breakwater. Black Rock Cod are typically associated with ledges and drop off areas. Accordingly, the likelihood of occurrence was updated to "may occur" to reflect this.

All species within Syngnathidae, Solenostomidae and Pegasidae families are protected under the FM Act and are classified as 'marine' species under the EPBC Act, with the exception of species within the Pegasidae family. No species within families Syngnathidae, Solenostomidae and Pegasidae were detected during the field survey. Of particular relevance to the study area is the White's Seahorse (*Hippocampus whitei),* given the location and habitat types in the study area and local reports of the species within the harbour. The species is known to inhabit seagrass, macroalge, sponges, soft corals and artificial structures in recent history in the absence of their natural habitat (TSC 2020).

Marine mammals

The desktop searches identified five species of listed marine and migratory mammals that are mapped to occur within 10 kilometres of the study area. None of these five listed threatened species are considered 'likely to occur'. The likelihood of occurrence table for marine mammals is provided in Appendix A.

Marine reptiles

The desktop searches identified five species of listed marine reptiles that were mapped to occur within 10 kilometres of the study area. Of these, four are considered 'likely to occur'. The likelihood of occurrence table for marine reptiles is provided in Appendix A. The four species determined as 'likely to occur' include:

– *Loggerhead turtle (Caretta caretta)*
– *Green turtle (Chelonia mydas)*
– *Leatherback turtle (Dermochelys coriacea)*
– *Hawksbill turtle (Eretmochelys imbricata)*

While not mapped to occur within the study area through the desktop assessment, two Olive Ridley turtle (*Lepidochelys olivacea*) was observed during field assessment.

Sharks and rays

The desktop searches identified three species of listed marine sharks and rays that are mapped to occur within 10 kilometres of the study area. Of these, two are 'likely to occur'. The likelihood of occurrence table for sharks and rays is provided in Appendix A.

4. Potential impacts

4.1 Assessment approach

Potential impacts to marine biodiversity as a result of the proposed upgrade of the Crowdy Head Harbour are assessed using the following process:

– Describe which proposal activities have potential to harm which environmental features and why (hazard identification)
– Describe the consequences of the potential impact being realised
– Identify relevant management controls to reduce or eliminate the potential environmental risk
– Discuss overall environmental outcomes

Potential impacts to the threatened species identified in Section 3.3.2 were assessed under the EPBC Act Significant Impact Guidelines criteria (Appendix C) and/or FM Act/ BC Act 7-Part Test (Appendix D). Given no threatened marine mammals are likely to occur, no assessment of significance under the EPBC, FM or BC Act was undertaken for these species.

4.2 Impact assessment

The study area supports a range of marine habitats and accordingly, the proposed works have the potential to harm these environments. The proposed works could result in the following direct impacts:

– Biofouling and benthic community disturbance
– Removal of seagrass and of habitat for threatened species
– Decline in water quality
– Artificial noise

Indirect impacts could include:

– Increased shading of rocky reef and seagrass beds
– Introduction of marine pest species
– Collision with marine fauna
– Accidental release of hydrocarbons or other chemicals

An assessment of the potential direct and indirect impacts listed above is provided in the following sections. It considers the sensitivity of the environmental values, the level of disturbance, timing and duration and, where relevant, other factors that contribute towards the impact.

4.2.1 Biofouling and benthic community disturbance

Hazard

Disturbance of biofouling and benthic communities may occur during the following planned activities:

– Removal of existing jetty infrastructure including piles of both Jetty 1 and 2
– Dredging of harbour sediments
– Placement of dredged material ex-situ
– Pile driving
– Placement and anchoring of construction vessels

Impact assessment

Biofouling communities present on the piles, jetties and other associated infrastructure will be removed as piles are extracted and disposed of. Slow-moving or semi-sedentary species located on the infrastructure at the time of extraction are also likely to be lost; this may include syngnathids. Removal of these communities will result in both permanent and temporary loss of biodiversity from the proposal footprint. While both existing jetties are to be removed, one will be re-instated. The piles from the jetty not re-instated represents a permanent loss of biodiversity.

Following the installation of new jetty infrastructure, the submerged surface will be rapidly colonised by biofouling species under a long-term recruitment process unless surfaces are treated with an anti-fouling protective coat (Hammer and Mills, 2015). It is expected that a mature community comparable to the one currently present, will be achieved within a few years.

Dredging activities have the potential to impact benthic communities through direct removal of substrate within the harbour and deposition of material within the spoil ground. Indirect impacts may also occur to nearby communities, including biofouling, through the generation of turbidity plumes and impacts of increased suspended sediment levels on filter-feeding organisms (UNEP, 2013). These plumes are temporary and suspended sediments are expected to disperse rapidly as the proposal area is flushed with tides and wave action.

Extraction of existing piles and embedding of new piles will also have the potential to generate turbid plumes, however the plumes are expected to be comparably smaller in size to those generated by dredging activities and localised to the immediate area of works. As such, the area of disturbance due to piling activities is expected to be small and turbidity plumes generated are predicted to have little impact. Further to this, the removal of piles removes potential habitat for the listed White's Seahorse.

With the exception of seagrass removal (refer Section 4.2.2), impacts to benthic communities are not expected to be permanent, as migration and recolonisation of the disturbed footprint from adjacent habitats is predicted to occur over weeks and months subsequent to cessation of construction works. Removal of any seagrass or macroalgae habitat removes potential habitat for the listed White's Seahorse.

TfNSW has provided an overview of the proposed area to be dredged (Figure 4.1), which also highlights the sensitive areas of marine habitat to be avoided. The dredge footprint was substantially revised to avoid impact to sensitive areas following receipt and discussion of survey results.

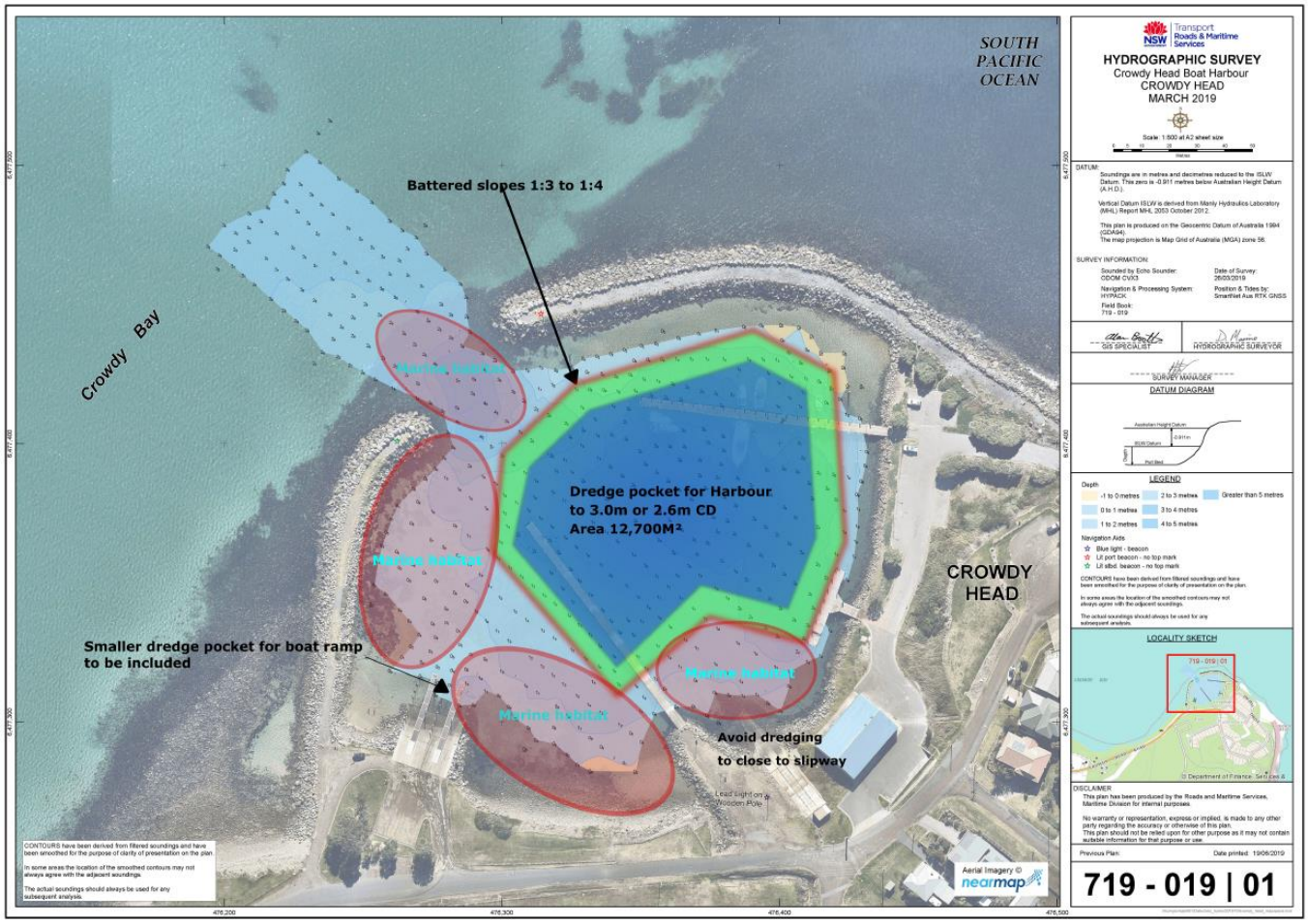


Figure 4.1 Proposed dredge plan area and marine habitat areas to be avoided

Environmental controls

To eliminate the impact of disturbance on biofouling and benthic communities, a number of management controls can be implemented:

- A White's Seahorse Relocation Plan will be prepared in consultation with DPI to include:
  - Details of the design and location of artificial alternative habitats ('seahorse hotels').
  - Requirements for visual inspection (via diving) for White's Seahorse on piles and seagrass by suitably qualified marine scientists prior to removal of piles and seagrass, with the intent to capture and relocate any individuals found.
  - Procedures for relocation of seahorses to the seahorse hotels.
  - Appropriate reporting as part of the FM Act Section 37 permit process following the relocation works.
  - Avoidance of any works during the breeding season of the White's Seahorse (September to February).
- Dredging will be carried out using a method appropriate to the sediment characteristics within the harbour, with the method reducing environmental impacts as far as reasonably practicable. Use of a cutter suction dredge will result in less environment impact as it is less impactful to the seabed, resulting in less suspended solids.
- Disposal of dredged material will be strictly limited to the approved disposal area.
- Where practicable a silt curtain will be used to limit the extent of the turbidity plume generated during dredge activities. Silt curtains to be placed around the works, not around the sensitive areas.
- Use tides to assist with entry of deep-draught vessels for dredging to avoid sediment resuspension from propeller wash as far as practicable.
- Monitoring of turbidity during dredging to understand the generation and migration of turbid plumes from the works. Monitoring should be undertaken with reference to trigger levels that are linked to management actions

such as adjustment of dredging works (e.g., movement of the dredge position, deployment of silt curtains, ceasing dredging to allow water quality to improve). It is recommended that monitoring comprise daily visual inspections during the active works. Observations should be made on a flood and ebb tide. Where it is evident that the water is becoming turbid as a result of active works, works are to stop and the deployment configuration of silt curtains reconsidered or time allowed for settlement of suspended solids to pass.

– A 'Maintenance Dredging Environmental Management Plan' will be developed that considers the long-term management of spoil in the harbour to include actions that minimise accretion in the harbour, justification for depth and width of dredging proposed, co-ordinates dredging proposed with beach renourishment proposals to make best use of material and establishes spoil disposal arrangements for maintenance dredging that minimises long term impacts. The Plan will also address approvals required, roles and responsibilities, environmental controls, risks and dredging operations proposed.

Environmental outcome

The works will take place in the Crowdy Head Harbour, whose benthic habitats are widely represented at a local scale within the North Coast area. Once the construction work has ceased, further disturbance to biofouling and benthic communities is not anticipated. New infrastructure installed in the marine environment will be rapidly recolonised and in the medium term (a few years), species diversity and maturity will be comparable to previously established communities.

The environmental risks associated with the planned dredge works and pile driving activities will be limited to the immediate surrounds of the harbour and are expected to be short term, with low risk to existing species with the implementation of the nominated management controls.

4.2.2 Removal of seagrass and of habitat for threatened species

Hazard

Removal of seagrass habitat and existing wharf and pile structures during dredging and removal works in the harbour.

Impact assessment

The following scopes of work will result in direct, or indirect, removal of habitat for threatened species:

– Removal of the long central jetty (Jetty 1) and the shorter eastern jetty (Jetty 2) will remove existing piles that are habitat forming.
– Dredging of the harbour to safe clearance depth between 2.6 to 3.0 metres resulting in removal of seagrass and macroalgae habitat.

The above-mentioned actions will result in reduced habitat substrate for the White's Seahorse and degrade the ecological functioning of the harbour, including the seagrass' role as a food source and shelter.

It is not anticipated that the works will require removal of rocky reef habitat.

Environmental controls

The following environmental controls are advised:

– Preparation and implementation of a White's Seahorse Relocation Plan in consultation with DPI (as described in Section 4.2.1).
– Clear delineation of dredge boundaries to preserve seagrass outside the footprint. This can be achieved by markers to delineate no-go zones and use of live GPS on dredge plant with reference to digital dredge boundaries.

– Replanting or revegetation of areas of seagrass removal in consultation with DPI.
– A permit will be required under Section 205 of the FM Act to harm marine vegetation. Offsetting of the seagrass may be required if avoidance and/ or replanting/ revegetation is not possible, in accordance with the 2013 Policy and guidelines for fish habitat conservation and management offset ratio of 2:1 compensatory loss at a rate of $102 per square metre (m2). Final determination of the offset value, if required, will be determined via negotiation with DPI.

Environmental outcome

There is potential for long-term harm without strict adherence to mitigation controls to minimise the risk and extent of removal.

4.2.3 Decline in water quality

Hazard

Water quality will decline during dredging and piling works.

Impact assessment

– Increased turbidity has the potential to affect the feeding ability of fish, with piscivorous fish being affected to a greater extent than planktivorous fish due to the requirement of visually identifying prey over great distances (de Robertis et al. 2003). In extreme cases, high levels of suspended sediments can also cause gill damage in fish (Au et al., 2004; Wong et al. 2013). The increase in turbidity may also affect the feeding and respiratory apparatus of filter-feeding organisms (Airoldi, 2003; Maldonado et al. 2008). Short term localised impacts to water quality may persist for the duration of works.

Environmental controls

The following environmental controls are advised:

– Monitor water quality at the site to determine if water quality is declining from the dredge works. Water quality objectives should be established and managed as part of the Construction Environmental Management Plan (CEMP). Monitoring of turbidity during dredging to understand the generation and migration of turbid plumes from the works. Monitoring should be undertaken with reference to trigger levels that are linked to management actions such as adjustment of dredging works (e.g. movement of the dredge position, deployment of silt curtains, ceasing dredging to allow water quality to improve).
– Contractor to undertake piling and dredging works in accordance with relevant Australian Standards (i.e. AS2159-1978) and the methodology followed be suitable for the sediment type (sand).
– Deployment of a silt curtain during piling and dredging.

Environmental outcome

Piling and dredging works will generate sediment plumes. The management controls, including the use of physical barrier, will reduce the environmental impacts as low as reasonably practicable.

4.2.4 Artificial noise

Hazard

Removal of existing infrastructure, pile driving to install new piles and dredging will generate artificial noise and vibration impacts resulting in physiological and/or behavioural stress to marine life, particularly marine turtles and mammals. Sound pressure levels (SPL) for the works are dependent on the method employed. For impact pile driving, the sound environment is in the order of 100 kilopascal (kPa), (which assumes a 1 m pile diameter) and for vibratory pile driving, the sound environment is 100 – 1,000 kPa (Dahl, 2014). Disturbance to marine fauna from above ground and underwater activities may occur in response to noise generated by these activities.

Impact assessment

Marine mammals

There is extensive evidence that marine species are susceptible to noise generated from human activities underwater (Lindy, 2013), with impacts including hearing impairment, physiological response (i.e., stress), behavioural changes, impact on prey species, avoidance responses, displacement and changes in communication.

Table 4.1 outlines behavioural and physiological noise criteria for marine megafauna. This indicates that behavioural or physiological impacts from the planned activities is unlikely. It is more likely that noise and vibration will displace marine fauna from the area. From the likelihood of occurrence (Appendix A), the main species of concern is the Indo-Pacific Humpback Dolphin (Sousa chinensis). Accordingly, the corresponding noise criteria for behavioural and physiological impacts appropriate for that species are bolded below in Table 4.1.

Table 4.1 Noise criteria for some species of marine mammals

Species	Impact	Noise criteria
Cetaceans and pinnipeds	Behavioural	SPL 160 dB re: 1 µPa
Low frequency cetaceans (All baleen whales, including southern right whale and humpback whale)	Physiological (TTS)	Peak 224 dB re: 1 µPa SEL 183 dB (Mlf) re: 1 μPa^2-s
	Physiological (PTS)	Peak 230 dB re: 1 µPa SEL 198 dB (Mmf) re: 1 μPa^2-s
Mid frequency cetaceans (Majority of toothed whales including dolphins and killer whale)	Physiological (TTS)	Peak 224 dB re: 1 µPa SEL 183 dB (Mmf) re: 1 μPa^2-s
	Physiological (PTS)	Peak 230 dB re: 1µPa SEL 198 dB (Mmf) re: 1 μPa^2-s
High frequency cetaceans (Other toothed whales)	Physiological (TTS)	Peak 224 dB re: 1 µPa SEL 183 dB (Mhf) re: 1 μPa^2-s
	Physiological (PTS)	Peak 230 dB re: 1 µPa SEL 198 dB (Mhf) re: 1 μPa^2-s
Pinnipeds	Physiological (TTS)	Peak 212 dB re: 1 µPa SEL 171 dB (Mpw) re: 1 μPa^2-s
	Physiological (PTS)	Peak 218 dB re: 1 µPa SEL 186 dB (Mpw) re: 1 μPa^2-s

Dolphins are classified as ‘medium frequency’ cetaceans. This is due to the species producing and using sounds ranging from tens of kilohertz (kHz) to 100 kHz for echolocation, communication and navigation.

Animals are expected to avoid areas where artificial noise is being generated. Following cessation of works, animals are expected to return to the area, as such any displacement is expected to be temporary and will support mitigation of risk of impact upon the animals.

Subsurface noise generated by the proposed activities also has the potential to disrupt the ability of marine fauna to perceive natural sounds, in a phenomenon called ‘auditory masking’. It is possible for auditory masking to interfere with communication and the social functions of marine animals, the identification of predators and prey, and the navigation and coordination capabilities of these animals. Piling activities are expected to be below the noise criteria thresholds, therefore noise generated from piling is not expected to cause direct physical damage to cetaceans.

Marine turtles

Turtles are thought to be highly sensitive to low frequency sound and are able to detect frequencies in the 100 to 700 Hz range (Bartol and Musick 2003). Literature on the impacts of sound on turtles is currently in its infancy and the topic is poorly understood; however observations by McCauley et al (2002) report erratic swimming behaviour and increased swimming activity in response to increased levels of artificial sound. Exposure of marine turtles to airgun arrays firing at full strength (175 decibels or greater) resulted in a strong initial avoidance response (Lindy, 2013). As such, the proposed piling activities have the potential to affect these species and risks associated with these activities should therefore be managed. The most likely impact on marine turtles will be behavioural changes which can result in temporary avoidance of the area until the cessation of the noise.

Sharks and fish

Grey Nurse Shark (Carcharias taurus) and Great White Shark (Carcharodon carcharias) are known to transit the area. Sharks and other elasmobranchs utilise low frequency sounds to detect prey, are sensitive to frequencies ranging from 40 hertz (Hz) to 800 Hz (Myrberg 2001), and are thus likely to avoid the study area during piling activities. The majority of fish are classified as having poor hearing and reduced sensitivity to noise, with some species, including the Black Rock Cod, having no known sensitivities to noise (Nedwell et al. 2016). The acoustic sensitivity of syngnathids is not currently known; however Anderson (2009) has observed them to exhibit physiological stress under noisy conditions. It is expected that impacts on fish from piling activities will be short-term in nature, potentially resulting in avoidance behaviour and are not expected to be significant at the population level.

Marine birds

A variety of migratory birds are likely to occur in the study area, with populations and species being highly dependent upon the time of year. Piling and other associated activities have the potential to disturb birds in residence via the generation of artificial noise, which may cause a local reduction in shorebird use of the study area during proposed works.

Environmental controls

The following controls can be implemented for the purposes of decreasing or mitigating the impact of noise on marine fauna when feasible:

– Bubble curtains to be used during pile driving.

– Activities that generate underwater noise (such as piling) should be timed to occur outside of peak migration months to reduce overlap with migratory movements and therefore reduce the potential threat to migratory marine mammals, turtles and migratory marine birds. Table 4.2 provides the peak migration months for relevant species that are both listed as likely to occur under the EPBC Act, FM Act or BC Act and are migratory species with known migration patterns.

Table 4.2 Species migration periods

Species (Common name)	Migration months (SPRAT profile)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Marine turtles (Loggerhead Turtle, Green Turtle, Olive Ridley Turtle, Leatherback Turtle, Hawksbill Turtle)	X	X	X	X						X	X	X
Red Knot	X	X	X	X					X	X	X	X
Curlew Sandpiper	X	X	X	X				X	X	X	X	X
Bar-tailed Godwit	X	X						X	X	X	X	X
Lesser Frigatebird	X	X	X			X	X	X	X	X	X	X
White-throated Needletail	X	X	X							X	X	X

– It is likely that migratory avifauna would be less impacted by noise than marine mammals and turtles as they are aerial and can disperse more readily. Therefore key dates to avoid for piling activities would be October – April when turtles are most likely to be seen closer to shore.

– Piling activities should implement mitigation measures outlined in the Government of South Australia's Underwater Noise Piling Guidelines (DPTI 2012):
– Pre-start procedure – The presence of marine turtles or mammals (namely, dolphins) should be visually monitored by a suitably trained crew member for at least 30 minutes before the commencement of the soft start procedure. The entire extent of the harbour and immediate surrounds of the outer breakwaters should be monitored. Observations should be made from the best vantage point available.
– Soft start procedure – If marine mammals have not been sighted within or are likely to enter the works zone (i.e. the harbour) during the pre-start procedure, the soft start procedure may commence in which the piling energy/speed is gradually increased over a 10 minute period. The soft start procedure should also be used after long breaks of more than 30 minutes in piling activity. Trained crew throughout soft starts should maintain visual observations of marine mammals and turtles within the safety zones. The soft start procedure may alert marine mammals to the presence of the rig and enable animals to move away to distances where injury is unlikely. Normal operation procedure – If marine turtles or mammals have not been sighted within or are not likely to enter the shut down or observation zone during the soft start procedure, piling may start at full impact energy. Trained crew should continuously undertake visual observations during piling activities and shut-down periods. After long breaks in piling activity or when visual observations ceased or were hampered by poor visibility, the prestart procedure should be used.
– Stand-by operations procedure – If a marine turtles or mammal is sighted within the observation zone during the soft start or normal operation procedures, the operator of the rig should be placed on stand-by to shut-down the rig. An additional trained crew member should continuously monitor the marine mammal in sight.
– Shut-down procedure – If a marine turtles or mammal is sighted within or about to enter the shutdown zone, the piling activity should be stopped immediately. If a shut-down procedure occurred and marine mammals have been observed to move outside the shut-down zone, or 30 minutes have lapsed since the last marine mammal sighting, then piling activities should recommence using the soft start procedure. If marine mammals are detected the shut-down zone during poor visibility, operations should stop until visibility improves.
– Vessel machinery should be maintained in accordance with manufacturers specifications to reduce noise emissions.
– The interaction of all vessels with marine mammals will be compliant with Part 8 of the Commonwealth Environment Protection and Biodiversity Conservation Regulation 2000 (EPBC Regulation). The Australian Guidelines for Whale and Dolphin Watching (Commonwealth of Australia, 2017) for seafaring activities will be implemented across the entire proposal site. This includes the implementation of the following guidelines:
    - Caution zone (300 metres either side of whales and 150 metres either side of dolphins) – vessels must operate at no wake speed in this zone.
    - Caution zone must not be entered when calf (whale or dolphin) is present.
    - No approach zone (100 metres either side of whales and 50 metres either side of dolphins) vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod or follow directly behind.
    - If there is a need to stop, reduce speed gradually.
    - Do not encourage bow riding.
    - If animals are bow riding, do not change course or speed suddenly.

Environmental outcome

Piling activity to install the new jetty will generate underwater noise and vibrations that may result in localised disturbance to marine fauna and with local mobile marine fauna (such as fish and syngnathids) and transitory marine fauna found in the wider area (marine mammals, turtles, sharks) likely to avoid the area during disturbance.

4.2.5 Increased shading of rocky reef and seagrass

Hazard

Shading of seagrass bed resulting from construction of new jetty.

Impact assessment

Seagrass is highly dependent upon sunlight for photosynthesis and shading created by structures can significantly inhibit the available sunlight for seagrasses. Outside of the dredge footprint, where shading occurs of seagrasses (i.e. under the new jetty), mortality may result.

Environmental controls

The following environmental controls are advised:

– Use perforated items where possible in the jetty construction to allow maximum sun penetration.
– Consider the need for a shading model, to determine the impact (if any) of shading on the seagrass within the harbour.
– Timing the bulk of the construction works in winter, when seagrass biomass and cover is low compared to spring and summer periods.

Environmental outcome

Eliminating any shading impact is likely unavoidable. However, where possible avoiding the start of the growth period may assist in reducing the impact to seagrasses present given their temporal nature.

4.2.6 Introduction of marine pest species

Hazard

Proposed activities may support the introduction, dispersal and spread of marine pest populations to the area. Vessels carrying invasive marine pests (IMP) may unintentionally, but successfully, introduce new species to the region where the activity is occurring. IMPs may be carried within the external biological fouling on the vessel hull, within seawater pipes (e.g. cooling water) and associated infrastructure or on submersible marine instruments and equipment. Ballast water exchange may also allow for the transportation and proliferation of IMPs within the area of activity. Before vessels can proceed to the site location, quarantine obligations will have to be fulfilled by all vessels. Where possible, construction vessels should be sourced locally to minimise IMP risk. For vessels sourced from high risk or international destinations, ballast water exchange record requirements will need to be complied with, including possession of Australian Quarantine and Inspection Service (AQIS) clearance documentation in order to verify compliance with ballast water and biofouling management measures.

Impact assessment

According to the Commonwealth Department of Agriculture and Water Resources (2015), IMP are species that are found in Australia due to human activity, whether by accidental or intentional release, escape, dissemination or placement. Marine pests are exotic marine species that are subject to national marine pest biosecurity and cause, or are likely to cause, unacceptable impacts to the environment, economy, human health or social values (Wells et al., 2009). The extent of the detrimental effects of introduced marine pests may include depletion of viable fishing areas and aquaculture stock, out-competing native flora and fauna, over-predation of native flora and fauna, reduction of coastal aesthetics and increased maintenance costs, human illness through released toxins, reduction in vessel performance, damage to vessel engines and propellers and damage to industrial infrastructure.

The introduction of new species is not a rare occurrence. However, the physical, chemical and biological circumstances of the environment into which the species has been introduced are important determining factors as to whether the species will successfully establish and become an invasive pest.

Barges, platforms and support vessels often have long residency times in ports, have numerous surfaces where marine species can attach, and may not have well-maintained antifouling. As such, this increases the likelihood of these vessels becoming infected by a potentially invasive marine species and infecting a port/harbour with said species. The risk is further increased where vessels are between ports with similar environmental characteristics.

Environmental controls

The following controls and processes should be employed, when possible, in order to mitigate or eliminate the risk of introducing pests:

– Where possible, vessels should be locally sourced to complete the proposed works.
– Any internationally sourced vessels will empty ballast water in accordance with the latest version of the Australian Ballast Water Management Requirements (DAWE 2020).
– If an invasive marine pest species is identified or suspected, then the contractor will notify the NSW Department of Primary Industries hotline on 1800 675 888 (24 hour line) within 24 hours.
– Proposal activities will adhere to the National Introduced Marine Pest Information System (NIMPIS) and NSW requirements for invasive marine pest species identification and management.

Environmental outcome

Elimination of risks associated with IMPs is often difficult and impractical; however, it is possible to reduce the risk that such species are introduced by implementing the management measures described above. Furthermore, construction vessels will ideally be sourced from within NSW waters, having undergone recent dry-dock inspection or cleaning prior to mobilising to the study area. The risk of introduction of an IMP is therefore considered as low as reasonably practicable.

4.2.7 Collision with marine fauna

Hazard

There is potential for collision to occur between marine fauna and vessels associated with the proposed activities. The consequences of such collisions between marine fauna and vessels/equipment for the fauna range from changes to behavioural patterns to injury or death of the fauna as a result of a direct collision.

Impact assessment

The vessels expected to be used in the piling and dredging activities are unlikely to be operated at great speeds and thus, the likelihood of collision with marine fauna is considered minimal. A number of collisions between vessels and cetaceans, resulting in the death of the animal, have been reported in Australian waters; however, the data suggests that such occurrences are associated with high-speed ferries and container ships (WDCS, 2006). The proposal activities are generally restricted to a small area within the harbour, thus the potential for encounters is limited. Furthermore, it is likely that marine fauna will avoid the study area in response to noise generated during proposed activities. The risk of potential vessel strike during piling activities is therefore considered low for the marine species likely to be present in the study area.

Environmental controls

The following controls may be adopted and should be executed, when possible, to mitigate or eliminate the risk of collision between vessels and marine fauna:

– Vessels will be operated in accordance with Part 8 of the EPBC Regulation (Interacting with Cetaceans and Whale Watching).
– The Australian Guidelines for Whale and Dolphin Watching (DoEE, 2017) for seafaring activities will be implemented across the proposal site. This includes the implementation of the following guidelines:
    - Caution zone (300 metres either side of whales and 150 metres either side of dolphins) vessels must operate at no wake speeds in this zone.
    - The caution zone must not be entered when a calf is present (either whale or dolphin).
    - No approach zone (100 metres either side of whales and 50 metres either side of dolphins): vessels should not enter this zone, should not be directly in the path of the animal or pod, and should not follow directly behind.

- If there is a need to stop, reduce speed gradually.
- Do not encourage bow riding.
- If animals are bow riding, do not change course or speed suddenly.

Environmental outcome

The piling and dredging activities require the presence of vessels and vessel movement within the study area, therefore elimination of vessels is not possible. All vessels associated with the proposal will be restricted to a four-knot speed limit and the management measures previously described will be implemented. The potential risks associated with a collision with marine fauna from proposal activities are therefore considered as low as reasonably practicable.

4.2.8 Accidental release of hydrocarbons or other chemicals

Hazard

Vessels require a wide variety of liquids, chemicals and hydrocarbon compounds to operate and to be maintained. Vessel engines and equipment such as cranes, pile drivers and heavy machinery operate on diesel fuel, while hydraulic and lubricating oils are required for the operation and continual maintenance of mechanical components. Fuel drums may also be retained in dedicated storage areas while some vessel engines adopt independent storage tanks. Examples of hazardous liquids include corrosion inhibitors, biocide and miscellaneous chemicals like cleaning agents and lubricating oils.

In addition, other liquid wastes may be generated during proposed activities. A number of scenarios may result in the accidental release of liquid wastes, including tank pipework failure or inadequate bunding. If refuelling is required during the proposed activity, then refuelling events have the potential to cause environmental impacts through reduction in water quality and/or contamination of marine flora and fauna. Spills during refuelling can occur through several pathways, including fuel hose breaks, coupling failure or tank overfilling.

Impact assessment

The likelihood that a leak or spill of hydrocarbons or other liquids occurring within the works area, including the spill of hazardous chemicals and waste, is low but possible. The accidental release would result in a decline in water quality in the immediate area as well as contamination of marine fauna in the near vicinity. As the proposal site is situated in a shallow area, contamination of shallow benthic and intertidal habitat may also occur. No refuelling facilities are known to be present in the harbour.

Environmental controls

The following controls can be adopted when feasible in order to mitigate or eliminate the potential for the spillage of hydrocarbons, environmentally hazardous chemicals and liquid waste to the marine environment:

– Chemicals and hydrocarbons will be packaged, marked, labelled and stowed in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex I, II and III regulations. These include provisions for all chemicals (environmentally hazardous) and hydrocarbons will be stored in closed, secure and appropriately bunded areas.
– A Material Safety Data Sheet (MSDS) will be available for all chemicals and hydrocarbons in locations nearby to where the chemicals/wastes are stored.
– Where required by legislation vessel operators will have an up-to-date Shipboard Oil Pollution Emergency Plan (SOPEP) and Shipboard Marine Pollution Emergency Plan (SMPEP). All shipboard chemical and hydrocarbon spills will be managed in accordance with these plans by trained and competent crew. Related mitigation measures in place:
    - Spill exercises will be conducted at minimum of every three months and recorded in the vessel log.
    - Spill kit will be located near high risk spill areas.

    - Spills will be cleaned up immediately, spill kits re-stocked and clean up material contained, and not washed overboard.
    - Vessel decks will be bunded. Scupper plugs should be available to prevent liquid discharges from decks.
- Any contaminated material collected will be contained on board for appropriate onshore disposal.
- Spill clean-up equipment will be located where chemicals and hydrocarbons are stored and frequently handled (i.e. 'high risk' areas). The quantity of spill recovery materials will be appropriate to the quantity of stored chemicals.
- Transfer deck run off discharges to the sea via the scuppers. Scupper plugs or equivalent will be available on vessel decks where chemicals and hydrocarbons are stored and frequently handled (i.e.' high risk' areas). Plugs will be utilised during handling of large quantities of hydrocarbons or hazardous chemicals.
- Any equipment or machinery with the potential to leak oil will be enclosed in continuous bunding or will have drip trays in place where appropriate.
- Following rainfall events, bunded areas on open decks of the vessels will be cleared of rainwater.
- All hoses for pumping and transfers will be maintained and checked.
- On board oily water disposal will be managed in accordance with the Marine Pollution Regulation 2006. The vessel operator will record the quantity, time and onshore location of the oily water disposal in the vessel Oil Record Book.
- If vessels are equipped with an oily water filter system, they may discharge oily water after treatment to 15 parts per million (ppm) in an oily water filter system (providing they have a current calibration certificate for the bilge alarm) as required by MARPOL Annex I Regulations (for the prevention of pollution by oil). To discharge, the vessels will require a current International Oil Pollution Prevention Certificate (IOPP) certificate for oily water filtering equipment, and a current calibration certificate for the bilge alarm.

The following controls can be implemented, when possible, for the purposes of mitigating or eliminating the risk of the spillage of hydrocarbon from refuelling:

- Refuelling operations will be a manned operation. In the event the refuelling pipe is ruptured, fuel bunkering will cease.
- Spill clean-up equipment will be located where hydrocarbons are stored and frequently handled (i.e. 'high risk' areas).
- Refuelling of a vessel will only occur in suitable weather conditions and within the harbour.
- Dry-break refuelling hose couplings and hose floats can be installed on the refuelling hose assembly.

Environmental outcome

The use of chemicals or hydrocarbons on-board vessels and heavy machinery is essential for the proposed activities. Similarly, since open deck drainage is an essential safety feature of any marine vessel, the risk of discharge from deck drainage cannot be eliminated. Spillage of hydrocarbons or environmentally hazardous chemicals may be attributed to machinery, engines and tanks leaking these liquids into the marine environment. It is anticipated that any impacts to water quality resulting from a hydrocarbon or chemical spillage would be temporary and constrained to the immediate vicinity, if such an incident did occur. Due to these limited impacts and the management controls implemented to reduce the risk of contaminants reaching the surrounding environment to levels as low as reasonably possible, the risks of a small hydrocarbon spill are considered to be environmentally acceptable.

Vessels will also adopt safety measures consistent with the requirements of the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and MARPOL Annex I, II and III. These safety precautions and safeguards may entail, among other measures, the assignment of correct stowage and designation of appropriate storage and handling areas. The risks of discharge to the environment are mitigated by the adoption of these safety control measures, resulting in the reduction of these risks to levels as low as reasonably possible. A variety of measures have been implemented to prepare for spill response should any incident occur. The risks and measures adopted to address any potential spill resulting from hydrocarbon refuelling are similar to those outlined for spills due to discharge. Refuelling of vessels or plant may only be carried out in controlled environment, which would reduce the effects of an accidental spill. Keeping equipment well serviced and maintaining spill clean-up and containment equipment are some of the safeguards that can be adopted. As such, the risk associated with unplanned releases of hydrocarbons, chemicals and other liquid wastes is considered as low as reasonably practicable.

4.3 Assessment of significance

This section provides an assessment of significance, pursuant to the requirements under the EPBC Act and FM Act and provides a concluding statement as to whether additional assessment, offsetting or approval is required, to address risk of significant impact upon protected marine fauna and flora.

4.3.1 EPBC Act

Fourteen marine species listed under the EPBC Act were considered likely to occur within the study area. These include:

- Red Knot (*Calidris canutus*) (Endangered) (Migratory)
- Curlew Sandpiper (*Calidris ferruginea*) (Critically endangered) (Migratory)
- Bar-tailed Godwit (*Limosa lapponica baueri*) (Vulnerable) (Migratory)
- Lesser Frigatebird *(Fregata ariel*) (Migratory)
- Black Rock Cod (*Epinephelus daemelii*) (Vulnerable)
- White's Seahorse (*Hippocampus whitei*) (Endangered)
- Indo-Pacific Humpback Dolphin (*Sousa chinensis*) (Migratory)
- Loggerhead Turtle (*Caretta caretta*) (Endangered) (Migratory)
- Green Turtle (*Chelonia mydas*) (Vulnerable) (Migratory)
- Leatherback Turtle (*Dermochelys coriacea*) (Endangered) (Migratory)
- Hawksbill Turtle (*Eretmochelys imbricata*) (Vulnerable) (Migratory)
- Olive Ridley (*Lepidochelys olivacea*) (Endangered) (Migratory)
- Grey Nurse Shark (*Carcharias taurus*) (Critically endangered)
- Great White Shark (*Carcharodon carcharias*) (Vulnerable) (Migratory)

The above species were assessed under the EPBC Act Significant Impact Assessment Criteria (Appendix C), assuming all mitigation measures recommended in Section 4.2 would be implemented.

With implementation of the proposed mitigation measures outlined in Section 4.2, the assessment found no significant impact to Syngnathids.

The assessment of significance also determined that the works are not likely to result in a significant impact to the Black Rock Cod, with the implementation of the proposed mitigation measures.

Marine turtles were assessed as 'endangered' for the Loggerhead Turtle, Leatherback Turtle and Olive Ridley Turtle and 'vulnerable' for vulnerable listed species being the Hawksbill Turtle and Green Turtle) All five species are considered likely to occur. Six species of marine birds are also considered likely to occur. It is not anticipated that the works, with the mitigation measures implemented, will result in a significant impact for marine turtles and marine birds.

In summary, with the implementation of the mitigation measures, the proposed works will not impact individuals, populations or habitats such that the population survival will be compromised or result in any significant effect on the population structure and function. A full justification of significance can be found in Appendix C.

TfNSW may wish to submit a precautionary referral to the Australian Government Environment Minister should TfNSW deem it necessary. Details presented herein would support both self-assessment and/or EPBC Act referral.

4.3.2 FM Act

Two marine species listed under the FM Act were considered likely to occur within the study area, being the White's Seahorse (*Hippocampus whitei*) and Black Rock Cod (*Epinephelus daemelii*) These species were assessed under Section 220ZZ of the FM Act (Appendix D), assuming all mitigation measures recommended in Section 4.2 would be implemented. The assessment found the works are not anticipated to result in a significant impact to these species.

Consultation should be undertaken with DPI as soon as reasonably practicable to affirm this assessment and proposed mitigation measures and seek guidance on how to implement the seahorse hotels and relocation strategy for the species.

In summary, with the implementation of the mitigation measures, the proposed works will not impact individuals, populations or habitats such that the population survival will be compromised or result in any significant effect on the population structure and function. A full justification of significance can be found in Appendix D.

The following permits will be required from the DPI under the FM Act:

– Section 37 Permit for the taking or possession of fish or marine vegetation that would otherwise be unlawful under the FM Act. This permit is required for the relocation works for the White's Seahorse.
– Part 7 Permit for the dredging works within the harbour.
– Section 205 Permit will also be required to harm marine animals and vegetation. Harm refers to the gathering, cutting, pulling up, destroying, poisoning digging up, removal, injury to, prevention of light or otherwise any harm to marine vegetation in whole, or part.

4.3.3 BC Act

Five species listed under the BC Act were considered likely to occur within the study area, being the Loggerhead turtle *(Caretta caretta)*, Green turtle *(Chelonia mydas)*, Leatherback turtle *(Dermochelys coriacea)*, White-throated needletail (*Hirundanus caudacutus)* and the Beach stone curlew (*Esacus mannirostris*). These species were assessed under Section 7.3 of the BC Act (Appendix D). Assuming all mitigation measures in Section 4.2 would be implemented, there will not be a significant impact to the species listed.

As there are no impacts likely to the species listed under the BC Act, there are no requirements for permits to be obtained under Part 2 of the Act.

4.3.4 Conclusion on significance of impacts

With the implementation of the mitigation measure detailed in Section 4.2, there is unlikely to be a significant impact to threatened species listed as likely to occur, including marine turtles, White's Seahorse and the Black Rock Cod. With the use of relocation and seahorse hotels within the harbour, individuals will be safely relocated in accordance with a relocation plan to be approved by DPI. There will be a loss of some habitat in the harbour via the removal of piles from Jetty 1 and Jetty 2. However, there will be partial reinstatement of piles (and habitat) with the re-build of Jetty 1. The seahorse hotels will create new habitat.

Detailed assessment of the significance of potential impacts is provided in Appendix C and Appendix D.

Engagement with DPI is required to confirm approval requirements and the adequacy of mitigation proposed for FM Act listed species.

TfNSW may wish to submit a precautionary referral to DAWE if TfNSW deems it necessary.

4.3.5 Biodiversity offsets

The proposal is likely to impact upon seagrass and macroalgae beds, particularly within the harbour environment itself. In accordance with the Policy and Guidelines for Fish Habitat Conservation and Management (2013), a permit to harm vegetation under Section 205 of the FM Act will be required.

As part of the ordinary permit conditions of consent, DPI enforces a no net loss habitat policy that may require proponents to conduct habitat rehabilitation and/or provide compensation. DPI calculates habitat compensation on a minimum 2:1 basis for all key fish habitat to capture the indirect impacts of the proposal. A greater compensation ratio may be required where opportunities for compensation are not available in the immediate vicinity, or the type of habitat that has been lost.

The potential area of macroalgae and seagrass to be removed has been minimised through design changes. This footprint is small and contains approximately 3-5 small patches ~3 m^2. This represents a total area of disturbance of between 9 m^2 and 15 m^2. A number of piles (exact number to be provided to DPI at time of consultation) will also be removed. These piles represent artificial reef habitat, that are currently providing habitat to species within the harbour, such as the White's Seahorse. The total area of all piles to be removed will also require offsetting. Exact offset obligations will be determined through consultation with DPI.

5. References

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Appendices

Appendix A

Likelihood of occurrence tables

Table A.1 Likelihood of occurrence for listed marine birds - 10 km Buffer Zone

Species *Scientific* (Common Name)	EPBC Act	FM Act	BC Act	Habitat Requirements	Likelihood of Occurrence
Listed Threatened species					
Apus pacificus (Fork-tailed Swift)	C, J, K Migratory		P	Almost exclusively aerial and occurring mostly inland on plains, foothills and coastal areas. The species is often occurring around cliffs and beaches and over islands and offshore (DoEE 2019).	Species or species habitat **may occur** within area
Calidris canutus (Red Knot)	E C, J, K, Bonn Migratory			Common on the east coast of Australia, the Red Knot typically inhabits intertidal sand, mud flats and sandy beaches of sheltered coasts, including in estuaries, inlets, lagoons and harbours (DoEE 2019).	Species or species habitat **known to occur** within area
Calidris ferruginea (Curlew Sandpiper)	CE C, J, K, Bonn			This species occurs primarily on intertidal mudflats in sheltered coastal areas, such as estuaries, inlets, bays and lagoons. The species is known to also occur inland. Roosting generally occurs on bare dry shingle, shell or sand beaches (DoEE 2019).	Species or species habitat **likely to occur** within area
Diomedea antipodensis (Antipodean Albatross)	V Migratory			This species is marine, pelagic and aerial. This species of albatross nests in openand patchy vegetation, avoiding steep coastal slopes or tall vegetation (DoEE 2019). Endemic to New Zealand, however is known to forage in open water in thesouth-west Pacific Ocean, Southern Ocean and the Tasman sea and notably off the coast of NSW (DoEE 2019).	Foraging, feeding or related behaviour **may occur** within area
Diomedea antipodensis gibsoni (Gibson's Albatross)	V			This species is a large pelagic marine birds, breeding is restricted to three islands of New Zealand. The species is known to forage between Green Cape and Newcastle off the NSW coast, particularly during winter (DoEE 2019).	Foraging, feeding or related behaviour **may occur** within area
Diomedea exulans (Wandering Albatross)	E, J, Bonn		E1, P	This oceanic species undertakes extensive circum-polar migrations. Breeding areas are confined to Antarctic and sub-Antarctic islands in the Atlantic Ocean, Indian Ocean and waters off the southern coast of New Zealand. There are a number of wandering albatross that migrate during the non-breeding season to thecoastal waters off Wollongong, south of Sydney (Nicholls and Robertson, 2002). Juveniles migrate from their natal grounds to the subtropical Indian Ocean and Tasman Sea (DoEE 2019).	Foraging, feeding or related behaviour **may occur** within area
Diomedea epomophora (Southern Royal Albatross)	V Migratory Bonn			Endemic to New Zealand, however is known to forage in open water in the south-west Pacific Ocean, Southern Ocean and the Tasman sea and notably off the coast of NSW (DoEE 2019).	Foraging, feeding or related behaviour **unlikely to occur** within area
Diomedea sanfordi (Northern Royal Albatross)	E Migratory Bonn				Foraging, feeding or related behaviour **unlikely to occur** within area

Species *Scientific* (Common Name)	EPBC Act	FM Act	BC Act	Habitat Requirements	Likelihood of Occurrence
Esacus magnirostris (Beach Stone Curlew)	Listed Marine		E4, P	Found exclusively along the coast, this species forages in intertidal zones on beaches, estuaries, islands, flats, banks and spits of sand, mud, gravel or rock or among mangroves (OEH 2019).	Species or species habitat **likely to occur** within area
Fregetta grallaris grallaria (White-bellied Storm Petrel)	V			Breeding grounds for this species occurs on Lord Howe Island. Pelagic distribution is poorly understood. Species has been recorded in the Tasman Sea,Coral Sea, north of New Zealand, near-shore waters off the coast of Queensland, New South Wales and Tasmania. In non-breeding periods, this species forages over near-shore waters off coasts on the Australian continental shelf.	Species or species habitat **may occur** within area
Grantiella picta (Painted Honeyeater)	V			This species is known to occur in Queensland and New South Wales to the westof the Great Dividing Range and prefers dry open forests and woodlands (Birdlife 2019).	Species or species habitat **unlikely to occur** within area
Haliaeetus leucogaster (White-bellied Sea Eagle)	Listed Marine		V, P	The species is distributed along the entire coastline (including offshore islands) of mainland Australia and Tasmania. Distribution also extends inland along larger waterways, particularly in eastern Australia. Prefers coastal and terrestrial wetlands in tropical and temperate of mainland Australia and its offshore islands.Must contain large areas of open water (DoEE 2019).	Species or species habitat **may occur** within area
Haematopus fuliginosus (Sooty Oystercatcher)			V, P	This species is distributed along the entire coastline of Australia, including offshore islands, but most common in the Bass Strait. Small populations of the species are known to be distributed along the NSW coastline. This species habitat preferences include rocky headlands, shorelines and exposed reefs, foraging on exposed rock or coral at low tide in search of limpets and mussels (NSW 2017).	Species or species habitat **may occur** within area
Haematopus longirostris (Pied Oystercatcher)	V C, J, K		E1, P	Pied Oystercatchers can be found scattered along the entire Australian coastline, although most common around in coastal Tasmania and Victoria and very thinly dispersed along the entire NSW coast, with fewer than 200 pairs spread across the NSW coastline. This species inhabits intertidal mud and sand flats, wetlands and coastal beaches where it feeds on bivalves, worms and crustaceans. Nests are shallow scrapes in the sand though will occasionally nest amongst salt marshes and grassy areas (NSW 2017).	Species or species habitat **may occur** within area
Hirundapus caudacutus (White-throated Needletail)			P	Almost exclusively aerial, it does prefer wooded, inland areas and heathland. In coastal areas they have been seen flying over mudflats and beaches. Widespread throughout eastern and south-eastern Australia. It has been recorded along all coastal regions of QLD and NSW (Barrett et al., 2003). The subspecies *caudacutus* leaves breeding grounds in eastern Siberia, north-eastern China and Japan between August to October. They arrive in Australia viathe Torres Strait during September and October. Upon arrival they move south along both sides of the Great Dividing Range in QLD and NSW. They head northagain, passing through NSW in February and March (DoEE 2019).	Species or species habitat **likely to occur** within area
Lathamus discolour (Swift Parrot)	CE			This species breeds in tree hollows in the Blue Gum forests of south-eastern Tasmania. The species occurs on inland slopes, but occasionally on the coast(DoEE, 2019).	Species or species habitat **unlikely to occur** within area

Species *Scientific* (Common Name)	EPBC Act	FM Act	BC Act	Habitat Requirements	Likelihood of Occurrence
Limosa lapponica bauera (Bar-tailed Godwit)	V C, J, K Migratory Bonn			This species occurs around most of the coastline of Australia (DoEE 2019). The species migrates to Australia in August, inhabiting estuarine mudflats, beaches and mangroves (Birdlife, 2019).	Species or species habitat **likely to occur** within area
Macronectes giganteus (Southern Giant Petrel)	E Migratory Bonn		E1, P	This oceanic species has a circumpolar pelagic range from Antarctica to approximately 20° S. During summer, southern giant petrels breed on the Antarctic peninsula and the surrounding subantarctic islands although frequently visit the coast of NSW when foraging for squid, krill and fish. Males are known to feed on animal carcasses from fishing vessels or on land (DoEE 2019).	Species or species habitat **may occur** within area
Macronectes halli (Northern Giant Petrel)	V Migratory Bonn			This species is marine and oceanic associated, occurring mainly in sub-Antarctic waters however with a range extending to subtropical waters mainly between winter and spring, including the Australian mainland and during this period are commonly seen offshore and within inshore waters from Fremantle to Sydney (DoEE 2019).	Species or species habitat **may occur** within area
Numenius madagascariensis (Eastern Curlew)	CE C, J, K Migratory Bonn			This species occurs across most of the coastline of Australia, arriving in August from its migration from Russia and north-eastern China. The species prefers intertidal mudflats. The species exhibits high avoidance behaviour and will take flight over small disturbances.	Species or species habitat **may occur** within area
Pachyptila turtur subantarctica (Fairy Prion (Southern)	V			This species breeds in two locations in Australia, including Macquarie Island and Bishop and Clerk Islands. Nesting for the species occurs in burrows between rocks or low lying vegetation. This species hunts from aerial predation on species on theocean surface and sub surface (DoEE 2019).	Species or species habitat **may occur** within area
Phoebetria fusca (Sooty Albatross)	V Migratory		V, P	This species is a marine and pelagic species, distributed on islands in the southern Indian and Atlantic Oceans, foraging out of 30° S between southern NSW and Argentina (DoEE 2019). The species has been observed foraging in inshore waters in Southern Australia, but is a rare occurrence and while probably migrant to Australia, being mostly in autumn and winter months along the eastern border (DoEE 2019).	Species or species habitat **may occur** within area
Pterodroma leucoptera (Gould's Petrel)	V		V	This species is a pelagic sea bird, occurring in tropical, subtropical and temperate waters of the Pacific Ocean. This species breeds on Lord Howe Island and Philip Island. Pelagic distribution is poorly known and occasionally reaches the eastern coast of mainland Australia (QLD and NSW) (DoEE 2019).	Species or species habitat **may occur** within area
Pterodroma neglecta neglecta (Kermadec Petrel (Western)	V		V		Foraging, feeding or related behaviour **may occur** within area
Rostratula australis (Australian Painted Snipe)	E			This species has been recorded in wetlands in all states of Australia and is most common in eastern Australia, where its records are scattered across Queensland, New South Wales, Victoria and South Australia. This species generally inhabits shallow freshwater wetlands (DoEE 2019).	Species or species habitat **unlikely to occur** within area

Species *Scientific* (Common Name)	EPBC Act	FM Act	BC Act	Habitat Requirements	Likelihood of Occurrence
Sternula nereis nereis (Australian Fairy Tern)	V			This species occurs along the coast of Tasmania, South Australia, Victoria and Western Australia. A population in NSW was historically known to occur, however it is unknown whether the bird occurs in NSW still. This species prefers sandy beaches that are well sheltered, spits and banks (DoEE 2019).	Species or species habitat **unlikely to occur** within area
Thalassarche bulleri (Buller's Albatross)	V Migratory Bonn			This species is marine and pelagic, inhabiting sub-tropical and subantarctic waters of the Southern Pacific Ocean (DoE, 2019). In Australian waters, this species can be observed inshore, offshore and in pelagic waters. Breeding occurs in New Zealand waters (DoEE 2019).	Species or species habitat **may occur** within area
Thalassarche cauta (Shy Albatross)	V Migratory Bonn		V, P	Occurs in Australian waters below 25 °S but is most frequently observed off southeast Australia and Tasmania. This species occurs more frequently inshore than offshore. Breeding areas occur in the Bass Strait and off southern Tasmania. Although endemic to Australia, this species does undertake migrations throughout.	Foraging, feeding or related behaviour **may occur** within area
Thalassarche eremita (Chatham Albatross)	E Migratory Bonn			This species is a marine species, with foraging range in coastal waters off eastern and southern New Zealand and Tasmania (DoEE 2019).	Foraging, feeding or related behaviour **unlikely to occur** within area
Thalassarche impavida (Campbell Albatross)	V Migratory Bonn			This species occurs in Antarctic and subantarctic waters and within areas of the subtropical South Pacific Ocean. This species visits Australia as non-breeders and can be seen foraging over offshore waters of Tasmania, Victoria and New Zealand (DoEE, 2019).	Species or species habitat **unlikely to occur** within area
Thalassarche melanophris (Black-browed Albatross)	V Migratory Bonn		V, P	This species occurs in Antarctic, subantarctic and temperate marine waters and occasionally enters the tropics. The population migrate northward at the cessation of breeding, and the species is common in the non-breeding periods at the continental shelf and shelf break of South Australia, Victoria, Tasmania and NSW (DoEE 2019).	Species or species habitat **unlikely to occur** within area
Thalassarche salvini (Salvin's Albatross)	V Migratory Bonn			This species is a non-breeding visitor to Australian waters, residing in subantarctic and subtropical waters and foraging also in southern Pacific Ocean. This species nests on gently sloping ledges and summits, usually with little vegetation and soil (DoEE 2019).	Foraging, feeding or related behaviour **unlikely to occur** within area
Thalassarche steadi (White-capped Albatross)	V Migratory Bonn			This species is a marine bird occurring in subantarctic and subtropical waters and is common off the coast of south–east Australia throughout the year. The habitat preferences of this species are not well known but are known to occur both inshore and offshore and enter harbours and bays. This species nests on sloping vegetation (DoEE 2019).	Foraging, feeding or related behaviour **unlikely to occur** within area
Thinornis rubricollis rubricollis (Hooded Plover (Eastern))	V			This species preferred habitat includes wide beaches which are backed by dunes and seaweed. The species nests above the high water mark on flat beaches and sparsely vegetated dunes (DoEE 2019).	Species or species habitat **may occur** within area

Species *Scientific* (Common Name)	EPBC Act	FM Act	BC Act	Habitat Requirements	Likelihood of Occurrence
Migratory Species					
Anous stolidus (Common Noddy)	C, J Migratory			In Australian waters, this species occurs mainly offshore in Queensland waters, but also along most of the eastern border of Australia. During breeding season, this species occurs on or nearby to islands, rocky islets and cliffs. Foraging occurs in waters close to the nest. Nesting may take place in low lying vegetation, such as bushes or salt bush. During non-breeding periods, this species is pelagic (DoEE 2019).	Species or species habitat **may occur** within area
Ardenna carneipes (Flesh-footed Shearwater)	J, K Migratory			A marine, pelagic shearwater. Distributed throughout the northwest Pacific Ocean, with breeding areas along the coast and/or islands of China, Japan, North Korea, South Korea and Russia. Recorded in NSW (DoEE 2019; Marchant and Higgins, 1990). Undertakes migrations to warmer waters during winter, typically to Vietnam, the Philippines, New Guinea and Australia (Marchant and Higgins, 1990; Takahashi et al., 2008; Yamamoto et al., 2010).	Foraging, feeding behaviour **may occur** within area
Calonectris leucomelas (Streaked Shearwater)	C, J, K Migratory			A marine, pelagic shearwater. Distributed throughout the northwest Pacific Ocean, with breeding areas along the coast and/or islands of China, Japan, North Korea, South Korea and Russia. Recorded in NSW (DoEE 2019; Marchant and Higgins, 1990). Undertakes migrations to warmer waters during winter, typically to Vietnam, the Philippines, New Guinea and Australia (Marchant and Higgins, 1990; Takahashi et al., 2008; Yamamoto et al., 2010).	Species or species habitat **unlikely to occur** within area
Fregata ariel (Lesser Frigatebird)	C, J, K Migratory			A marine, pelagic and inshore bird. Breeds on small, remote tropical and sub- tropical islands, mangroves or shrubs. It is found throughout the Indian Ocean, western and central Pacific Ocean and off Brazil in the Atlantic Ocean. It resides along the north-west Australia coast from Exmouth across to eastern Australia down to Sydney (DoEE 2019). Migration information is poorly documented; however, it is believed to migrate from Indonesia to Australia. It is suggested they breed throughout the year and transit between islands regularly (DoEE 2019).	Species or species habitat **likely to occur** within area
Fregata minor (Great Frigatebird)	C, J Migratory			This species inhabits open, tropical oceanic waters and neighbouring offshore, oceanic nesting islands. The species occurs between 25 °N and 25 °S (ADW, 2002).	Species or species habitat **may occur** within area
Sternula albifrons (Little Tern)	C, J, K Migratory Bonn		E1, P	Small, marine tern. Occurring along most of Australia's coastline from Broome in north-west WA, across north Australia and down to Adelaide in south Australia. However, it is relatively rare from Victoria to Adelaide. Breeding colonies in QLD have not been used recently, it more commonly breeds along the NSW coastline (Garnett and Crowley 2000). Nonbreeding range of this subpopulation is poorly known (DoEE 2019). They forage and nest in sheltered coastal environments suchas estuaries, river mouths, bays and harbours.	Species or species habitat **may occur** within area

Table A.2 Likelihood of occurrence for listed threatened marine fish - 10 km Buffer Zone

Species *Scientific* (Common Name)	EPBC Act	FM Act	BC Act	Habitat Requirements	Likelihood of Occurrence
Listed Threatened Species					
Epinephelus daemelii (Black Rock Cod)	V	V		The species is found throughout the southwest Pacific, from southern QLD to northern waters ofthe Bass Strait. Juveniles inhabit estuarine systems while larger specimens are found around rocky reefs and shelves. Black Rock Cod demonstrate high site fidelity, with individuals of the species often occupying an individual cave for most of their adult life (DoEE 2019). Suitable habitat exists within the region and rocky reefs which forms the core habitat forthis species are located inside the study area. However, the harbour is relatively small and shallow. There are limited opportunities for ledges and overhangs, which the species is usually associated with. The habitat created from the breakwaters forms small caves and crevices, however with the shallow nature of the harbour, there is limited opportunity for utilisation. If inhabited, it would be likely inhabited by a juvenile individual.	Species or species habitat **may occur**
Hippocampus whitei (White's Seahorse)	E Listed Marine	E		This species occurs at depths from 1 – 15 m and utilises a range of natural and artificial habitats. Preference is given to complex habitats that provide less predation risk through affording better protection and more available food sources. The species exhibits strong site fidelity; a study of tagged males over a 6000 m^2 study area for up to 56 months recorded no movement of individuals between sites. Individuals were not known to move far, with the furthest distance measured at 70 m. Individuals also exhibit strong micro scale site fidelity, staying on the same holdfast with their prehensile tail for up to 17 months (FSC 2019). This species received a final determination of 'Endangered' under the FM Act in July 2019 and has been recorded previously on the shark net in the study area. Anecdotal information is that the species is present in the harbour.	Species or species habitat **likely to occur** within area This species is **known to occur** within area
Solenostomidae, Syngnathidae, Pegasidae Syngnathids	Listed Marine	P		Distributed along the east coast of Australia, these species are found on tropical inshore reefs and temperate waters over shallow sand flats among sparse low plant growth and in algae bedsand are associated with rocky reefs. Further, these species are associated with sponge gardens, vertical rock walls and artificial structures such as wrecks and shark nets (DoEE 2019).	Species or species habitat **likely to occur** within area
Species may include:	*Acentronura tentaculata* (Shortpouch Pygmy Pipehorse), *Festucalex cinctus* (Girdled Pipefish), *Filicampus tigris* (Tiger Pipefish), *Heraldia nocturna* (Upside-Down Pipefish), *Histiogamphelus briggsii* (Crested Pipefish), *Hippichthys penicillus* (Big-belly Seahorse), *Lissocampus runa* (Javelin Pipefish), *Maroubra perserrata* (Sawtooth Pipefish), *Notiocampus ruber* (Red Pipefish), *Solegnathus spinosissimus* (Spiny Pipehorse), *Stigmatopora argus* (Spotted Pipefish), *Stigmatopora nigra* (Widebody Pipefish), *Syngnathoides biaculeatus* (Double ended pipefish), *Trachyrhamphus bicoarctatus* (Bentstick Pipefish), *Urocampus carinirostris* (Hairy Pipefish), *Vanacampus margaritifer* (Mother of Pearl Pipefish), *Phyllopteryx taeniolatus* (Weedy/ Common Seadragon).				

Table A.3 Likelihood of occurrence for listed threatened marine mammals - 10 km Buffer Zone

Species *Scientific* (Common Name)	EPBC Act	FM Act	BC Act	Habitat Requirements	Likelihood of Occurrence
Listed Threatened Species					
Balaenoptera borealis (Sei Whale)	V Migratory Bonn			An infrequent visitor to Australian waters and commonly confused with the Bryde's Whale, nonetheless Australian Antarctic waters serve important feeding grounds for Sei whales. Breeding occurs in tropical and subtropical waters (DoEE 2019).	Foraging, feeding or related behaviour **unlikely to occur** within area
Balaenoptera physalus (Blue Whale)	E Migratory Bonn			Two subspecies exist in Australia, including the Pygmy blue and Antarctic (true) blue. This species habitat is variable, with the Antarctic blue remaining at higher latitudes and migrating to lower altitudes for feeding, breeding and calving in the Australian summer. In contrast, the Pygmy blue range is wide ranging, expanding through the Indian Ocean with individuals moving between Australia and Indonesia (DoEE 2019).	Species or species habitat **may occur** within area
Balaenoptera physalus (Fin Whale)	V Migratory Bonn			The Australian Antarctic waters are vital feeding grounds for fin whales. No known mating or caving areas occur in Australian waters. The species has wide geographic distribution, in both hemispheres between latitudes 20 – 75 ° S and is common in temperate waters, the Arctic Ocean and the Southern Ocean. This species prefers steep bathymetry (DoEE 2019).	Foraging, feeding or related behaviour **unlikely to occur** within area
Eubalaena australis (Southern Right Whale)	E Migratory Bonn		E1, P	Very limited information exists on the feeding habitat of this species in Australian waters, however most feeding is considered deeper offshore ranging from subantarctic to south of 60 °S. This species prefers nearshore shallow water for calving and breeding (DoEE 2019).	Species or species habitat **unlikely to occur** within area
Megaptera novaeangliae (Humpback Whale)	V Migratory Bonn		V, P	The east Australian humpback population of whales migrates in close proximity to the coast on their way to their winter breeding areas. Migration progressively moves offshore as their northward migration continues. Breeding for the east coast population happens at two key areas off the Queensland coast, including Mackay and Gladstone (DoEE 2019).	Species or species habitat **unlikely to occur** within area
Migratory species (not already listed above)					
Balaena glacialis australis (Southern Right Whale)	E Migratory Bonn			The species is seasonally present along the Australia coast between April and November. Primarily found on the southern end of Australia, within their broader geographic range the species concentrates in certain areas to breed, all of which are within the Australian bite, Hobart of the eastern Victorian border (DoEE 2019).	Species or species habitat **unlikely to occur** within area
Balaenoptera edeni (Bryde's Whale)	Migratory Bonn			This species is found all year round in waters between 40 °S and 40 °N. No specific feeding or breeding grounds have been determined in Australia.	Species or species habitat **unlikely to occur**within the area
Caperea marginate (Pygmy Right Whale)	Migratory Bonn			This species occurs in temperate and subtropical waters to a depth of 1400 m in open water habitats. The species has been recorded in areas of upwelling. There is limited information of their preferred habitat, however, are known to refer water between 5 and 20 °S (DoEE 2019).	Foraging, feeding or related behaviour **unlikely to occur** within area

Species *Scientific* (Common Name)	EPBC Act	FM Act	BC Act	Habitat Requirements	Likelihood of Occurrence
Lagenorhynchus obscurus (Dusky Dolphin)	Migratory Bonn			Known from only 13 reports since 1828, with two sightings in the early 1980s. Occur across southern Australia from WA to Tasmania. Due to a lack of records, distribution and population size is poorly understood. Occurs mostly in temperate and sub-Antarctic waters, mainly preferring inshore waters but can also be pelagic. Movement patterns are poorly understood, however presence of this species in New Zealand and Argentina increase in summer months (DoEE 2019).	Species or species habitat **unlikely to occur** within area
Orcinus orca (Killer Whale)	Migratory Bonn			This species refers oceanic, pelagic and neritic marine environments in both warm and cold waters. It is more common in cold waters, often observed on continental slopes and on the shelf. The habitat preference of this species is wide and likely linked to behavioural requirements and movement of prey (DoEE 2019).	Species or species habitat **unlikely occur** within area
Sousa chinensis (Indo-Pacific Humpback Dolphin)	Migratory Bonn			Humpback dolphins are known to occur along the northern Australian coastline, as far down the east coast as Sydney. This species primarily occurs in shallow and protected habitats, including estuaries, rivers, shallow bays and inshore reefs (DoEE 2019). Humpback dolphins do not undertake large scale seasonal migrations, however seasonal changes in abundance occurs (DoEE 2019).	Species or species habitat **likely to occur** within area

Table A.4 Likelihood of occurrence for listed threatened marine turtles - 10 km Buffer Zone

Species *Scientific* (Common Name)	EPBC Act	FM Act	BC Act	Habitat Requirements	Likelihood of Occurrence
Listed Threatened Species					
Caretta caretta (Loggerhead turtle)	E Migratory Bonn		E1, P	Widely distributed throughout Australian coastal and offshore zones, suitable habitat includes coral reefs, rocky reefs, seagrass beds and inshore embayment's (DoEE 2019). Female turtles recorded from nesting sites in south-east QLD, have been observed in Australian waters off Northern Territory (NT), QLD and NSW (Limpus 2008). In NSW, Loggerhead turtles have been recorded feeding as far south as Jervis bay and Sydney. Suitable habitat for the species, including macroalgal and seagrass beds and rocky reef outcrops occur in the study area.	Species or species habitat **likely to occur** within area
Chelonia mydas (Green turtle)	V Migratory Bonn		V, P	Species is distributed throughout Australian coastal warm temperate to tropical seas. Nesting occurs throughout northern Australia between December and February (DES, 2019). Following hatching, neonate and juvenile turtles remain in pelagic and offshore waters until they reach approximately 30 to 40 cm carapace length (DoEE 2019). Adults are commonly encountered in seagrass beds and in proximity to macroalgal benthic habitats. Suitable habitat for the species, including macroglal and seagrass beds exist in the study area.	Foraging, feedingor related behaviour **likely to occur** within area
Dermochelys coriacea (Leatherback Turtle)	E Migratory Bonn		E, P	Circum-globally distributed in warm temperate to tropical seas for pelagic foraging. Foraging is common at high latitudes in the Southern Pacific Ocean. The species occurs in open ocean basins, making landfall to nest at known locations (DoEE 2019).	Foraging, feedingor related behaviour **likely to occur** within area
Eretmochelys imbricata (Hawksbill Turtle)	V Migratory Bonn			Nesting for this species occurs in far north QLD, NT and WA between December and February with individuals migrating up to 2400 km between foraging areas and nesting beaches (DES, 2019). Juvenile turtles remain in pelagic and offshore waters for the first five to ten years, drifting on ocean currents.	Species or species habitat **likely to occur**within area
Natator depressus (Flatback Turtle)	V Migratory Bonn			Feeding grounds are mostly over the Australian continental shelf, extending as far south as the Tropic of Capricorn, and off eastern Indonesian waters. All known breeding sites for the species are in tropical Australia, in Queensland, Northern Territory and Western Australia (DoEE 2019).	Foraging, feeding or related behaviour **unlikely to occur** within area
Lepidochelys olivacea (Olive Ridley)	E Migratory Bonn			The Olive Ridley turtle has a worldwide tropical and subtropical distribution, including northern Australia. Typically occurring in shallow soft-bottom habitats of protected waters. In Australia, they occur along the coast from southern Queensland and the Great Barrier Reef, northwards to Torres Strait, and across to Joseph Bonaparte Gulf in Western Australia.	Species or species habitat **known to occur** (observed during field survey) in the area.

Table A.5 Likelihood of occurrence for listed threatened marine sharks and rays - 10 km Buffer Zone

Species *Scientific* (Common Name)	EPBC Act	FM Act	BC Act	Habitat Requirements	Likelihood of Occurrence
Listed Threatened Species					
Carcharias taurus (Grey Nurse Shark)	CE			This species is regulatory reported around south-east Australia in primarily subtropical to cool temperate waters. They commonly reside around rocky reefs and islands, sandy seabed gutters, rocky caves and sometimes surf zones and shallow bays along the coast of NSW and southern Queensland (QLD). Migratory patterns are not well known, evidence suggests migration occurs in response to water temperatures up and down the coast. A known aggregation site for the species occurs at Mermaid Reef, approximately 6 km north of the study area.	Species or species habitat **known to occur** within area
Carcharodon carcharias (Great White Shark)	V Migratory Bonn			The species is distributed predominately throughout temperate Australia, with individuals known to undertake migrations into subtropical and tropical waters (DoEE 2019). Great white sharks typically occur from close inshore habitats at rocky reefs and shallow coastal bays to the continental shelf (depth between 100 m to 1,000 m). This species migrates along the south and east Australian coasts, moving north from April – September then moving south by early summer (DoEE 2019).	Species or species habitat **likely to occur** within area
Rhincodon typus (Whale Shark)	V Migratory Bonn			The species is an oceanic and coastal shark, residing in tropical to warm-temperate pelagic waters generally in waters 21-25 °C. In Australian waters, the whale shark is known from New South Wales, Queensland, Northern Territory, Western Australia and occasionally Victoria and South Australia, but most commonly seen in northern Western Australia, such as on Ningaloo Reef. Whale sharks are most often encountered offshore but do visit coastal areas including lagoons of coral atolls (DoEE 2019).	Species or species habitat **may occur** within area
Migratory species (not already listed above)					
Lamna nasus (Mackerel Shark)	Migratory Bonn			The species inhabits oceanic waters and edges of continental shelves. Occasionally, the shark will move inshore to coastal environments, but movements are short term likely in search of an immediate food source. Given its preference for temperate, subantarctic and subantarctic environments of 8 – 20 °C, in Australian waters the species occurs from southern Queensland to south-west Australia (DoEE 2019).	Species or species habitat **may occur** within area
Manta alfredi (Reef Manta Ray)	Migratory Bonn			The species is found in all three of the world's major oceans, although most commonly encountered in the Indian Ocean and south Pacific. Key aggregation sites include: Hawaii, Australia, Komodo, Maldives, Yap, Palau, Bali, and southern Mozambique. The species is known to occur off the eastern coast of Australia.	Species or species habitat **may occur** within area

Appendix B

PMST search report

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

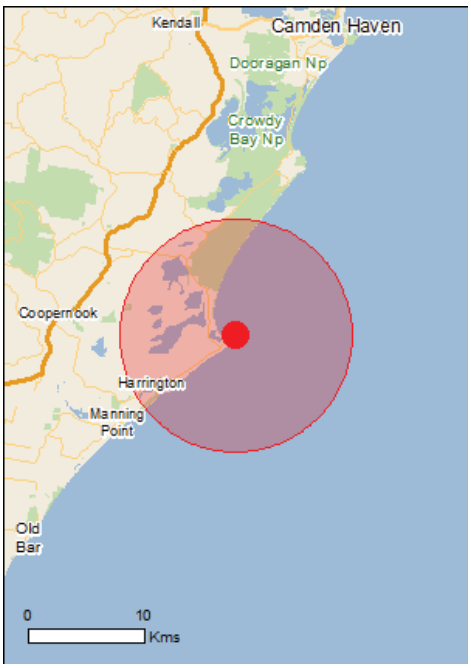
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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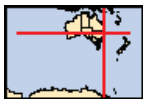
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 10.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	80
Listed Migratory Species:	63

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	83
Whales and Other Cetaceans:	14
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	33
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
Temperate East

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis cucullatus cucullatus Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat may occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]	Endangered	Species or species habitat likely to occur within area
Frogs		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Vulnerable	Species or species habitat likely to occur within area
Insects		
Argynnis hyperbius inconstans Australian Fritillary [88056]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Acronychia littoralis Scented Acronychia [8582]	Endangered	Species or species habitat likely to occur within area
Allocasuarina defungens Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat known to occur within area
Allocasuarina thalassoscopica [21927]	Endangered	Species or species habitat known to occur within area
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat likely to occur within area
Asperula asthenes Trailing Woodruff [14004]	Vulnerable	Species or species habitat may occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Macadamia integrifolia Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat may occur within area
Marsdenia longiloba Clear Milkvine [2794]	Vulnerable	Species or species habitat may occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat likely to occur within area
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat known to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Tylophora woollsii [20503]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area
Sharks		

Name	Status	Type of Presence
Carcharias taurus (east coast population) Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Foraging, feeding or related behaviour known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land - Telstra Corporation Limited

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Foraging, feeding or related behaviour known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Foraging, feeding or related behaviour known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Neophema chrysostoma Blue-winged Parrot [726]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable*	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]	Endangered	Species or species habitat likely to occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Solegnathus dunckeri Duncker's Pipehorse [66271]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding likely to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Crowdy Bay	NSW
Forestry Management Areas in Kendall (FMZ2)	NSW
LNE Special Management Zone No1	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish		Species or species

Name	Status	Type of Presence
Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Crowdy Bay National Park	NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-31.83904 152.74983

Acknowledgements

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

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

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

Please feel free to provide feedback via the Contact Us page.

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Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Appendix C

EPBC Act significant impact assessment

Critically endangered or endangered species

Species: Critically or endangered marine birds **Red Knot, Curlew Sandpiper, Beach-stone Curlew, Sooty Oystercatcher, White throated Needletail, Bar-tailed Godwit and Fork-tailed Swift**	**Assessment under the EPBC Act Significance Criteria**
An action is likely to have significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
Lead to the long-term decrease in the size of a population	The proposed works are unlikely to lead to a long-term decrease in the population size of critically endangered or endangered bird species. The study area does not lie near any known breeding grounds for bird species.
Reduce the area of occupancy of the species	If present, critically endangered or endangered bird species in the study area are expected to transit the proposal site are between food sources / foraging grounds. The proposed works will be short-term in nature and overall there will be no reduction in the area of occupancy of any bird species.
Fragment an existing population into two or more populations	The proposed activity will not fragment an existing population into two or more populations. The proposed works will not result in an overall change to the marine environment, nor will they create any barriers to bird movement.
Adversely affect habitat critical to the survival of a species	The proposed works will not adversely affect habitat critical to the survival of critically endangered or endangered bird species. The study area does not lie near any known breeding grounds for bird species.
Disrupt the breeding cycle of a population	The study area is not close to any known breeding grounds for critically endangered or endangered bird species and will not disrupt the breeding cycle of these species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The habitat for critically endangered or endangered bird species are unlikely to be significantly modified, destroyed, isolated or decrease due to the proposed works. Any impact on these species is unlikely and if impacts were to occur, would be short-term and localised in nature. Potential localised short-term impacts to individuals may include the following however, are considered highly unlikely: – Interaction with equipment during the proposed works – Behavioural avoidance of the area during the proposed works – Potential exposure to pollutants that arise as a consequence of the proposed works
Result in invasive species that are harmful to a critically endangered or endangered species become established in the endangered or critically endangered species' habitat	The proposed works will not result in any invasive species that are harmful to these species becoming established in the species habitat. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of invasive species to as low as reasonably practicable.
Introduce disease that may cause the species to decline, or	The proposed works will not result in the introduction of disease that may cause a critically endangered or endangered bird species to decline. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of disease to as low as reasonably practicable.
Interfere with the recovery of the species	The proposed works will not interfere with the recovery of a critically endangered or endangered bird species.
Statement of impact:	**The proposed works will NOT have a significant impact on the species.**
An action is likely to have significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
Lead to the long-term decrease in the size of a population	The proposed works are unlikely to lead to the long term decrease in the size of a population. The study area is not close to any known breeding grounds for the species.

Species: Critically or endangered marine birds Red Knot, Curlew Sandpiper, Beach-stone Curlew, Sooty Oystercatcher, White throated Needletail, Bar-tailed Godwit and Fork-tailed Swift	Assessment under the EPBC Act Significance Criteria
Reduce the area of occupancy of the species	Given the transient nature of the species, the localised works are unlikely to impact on the occupancy area for the species. If present, the species is likely to transit between food sources. The proposed works are short term in nature and overall, there will be no reduction to the area of occupancy for the species.
Fragment an existing population into two or more populations	Fragmentation of the turtles population is unlikely to occur due to the proposed works.
Adversely affect habitat critical to the survival of a species	The proposed works will not adversely affect habitat critical to the survival of the species. The study area is not close to any known breeding grounds for this species. Care should be taken to avoid direct impact to seagrass meadows.
Disrupt the breeding cycle of a population	No breeding grounds are located in the study area. These species locally migrates along most of the Australian coastline where they forage for sponges and seagrasses on coral reefs, rocky reefs and inshore embayments. This species may forage for seagrasses in the study area opportunistically. As the works are not located near a breeding area and feeding areas are located nearby the study area, it is not anticipated that the proposed works will impact on the breeding cycle of the species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposed works will not result in significant modification, destruction, removal, isolation of a reduction in the availability and quality of habitat to the extent that the species is likely to decline. Potential localized short term impacts include, but are considered unlikely: – Collision with marine equipment during the proposed works – Behavioural avoidance of the area during the proposed works – Potential exposure to pollutants that arise as a consequence of the proposed works
Result in invasive species that are harmful to a critically endangered or endangered species become established in the endangered or critically endangered species' habitat	The proposed works will not result in any invasive species that are harmful to these species becoming established in the species habitat. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of invasive species to as low as reasonably practicable.
Introduce disease that may cause the species to decline, or	The proposed works will not result in the introduction of disease that may cause a species to decline. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of disease to as low as reasonably practicable.
Interfere with the recovery of the species	The proposed works will not interfere with the recovery of the species.
Statement of impact:	**The proposed works will NOT have a significant impact on the species.**

Species: Grey Nurse Shark Critically Endangered	Assessment under the EPBC Act Significance Criteria
An action is likely to have significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
Lead to the long-term decrease in the size of a population	Given the mobile nature of the species, short term nature of the works and negligible risk of harm to the species, the proposed work are unlikely to lead to a long term decrease in the size of a population.
Reduce the area of occupancy of the species	Given the mobile nature of the species and short term nature of the works, the works are unlikely to result in a reduction of the area of occupancy for the species.

Species: Grey Nurse Shark Critically Endangered	Assessment under the EPBC Act Significance Criteria
Fragment an existing population into two or more populations	Given the mobile nature of the species and short term nature of the works, the works are unlikely to result in any population fragmentation.
Adversely affect habitat critical to the survival of a species	The study area is not critical habitat for the species. The closest critical habitat aggregation spot) for the species is Magic Point, south of Sydney. Therefore the proposed works will not adversely affect habitat critical to the survival of the species. An aggregation site is located approximately 6 km north (Mermaid Reef), but as a declared 'aggregation' site, is not classified as critical habitat. Nonetheless, the proposed works will not impact on the species, or interfere with the aggregation site.
Disrupt the breeding cycle of a population	The species migrates within its range north-south throughout the year to aggregation points thought to be associated with breeding. The proposed works will not impact on the species or interfere with the aggregation site.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Given the mobile nature of the species and short term nature of the works, the works are unlikely to result in modification, destruction, removal, isolation or a decrease in the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a critically endangered or endangered species become established in the endangered or critically endangered species' habitat	The proposed works will not result in any invasive species that are harmful to these species becoming established in the species habitat. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of invasive species to as low as reasonably practicable.
Introduce disease that may cause the species to decline, or	The proposed works will not result in the introduction of disease that may cause a species to decline. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of disease to as low as reasonably practicable.
Interfere with the recovery of the species	The proposed works will not interfere with the recovery of the species.
Statement of impact:	**The proposed works will NOT have a significant impact on the species.**

Species: Loggerhead Turtle, Leatherback Turtle and Olive Ridley Turtle Endangered	Assessment under the EPBC Act Significance Criteria
An action is likely to have significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
Lead to the long-term decrease in the size of a population	Given the mobile nature of the species, short term nature of the works and negligible risk of harm to the species, the proposed work are unlikely to lead to a long term decrease in the size of a population.
Reduce the area of occupancy of the species	Given the mobile nature of the species and short term nature of the works, the works are unlikely to result in a reduction of the area of occupancy for the species.
Fragment an existing population into two or more populations	Given the mobile nature of the species and short term nature of the works, the works are unlikely to result in any population fragmentation.
Adversely affect habitat critical to the survival of a species	The study area is not critical habitat for the species. No Critical Habitat as defined under Section 207A of the EPBC Act (Register of Critical Habitat) has been identified and listed for marine turtles. Care should be taken to avoid direct impact to seagrass meadows.
Disrupt the breeding cycle of a population	Nesting is unlikely to occur within Crowdy harbour and given the short term nature of the works, it is unlikely that the works will result in disruptions to the breeding cycle of the population of the Loggerhead, Leatherback or Olive Ridley turtles.

Species: Loggerhead Turtle, Leatherback Turtle and Olive Ridley Turtle Endangered	Assessment under the EPBC Act Significance Criteria
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Given the mobile nature of the species and short term nature of the works, the works are unlikely to result in modification, destruction, removal, isolation or a decrease in the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a critically endangered or endangered species become established in the endangered or critically endangered species' habitat	The proposed works will not result in any invasive species that are harmful to these species becoming established in the species habitat. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of invasive species to as low as reasonably practicable.
Introduce disease that may cause the species to decline, or	The proposed works will not result in the introduction of disease that may cause a species to decline. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of disease to as low as reasonably practicable.
Interfere with the recovery of the species	The proposed works will not interfere with the recovery of the species.
Statement of impact:	**The proposed works will NOT have a significant impact on the species.**

Species: Syngnathids Endangered	Assessment under the EPBC Act Significance Criteria
An action is likely to have significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
Lead to the long-term decrease in the size of an important population of a species	Without measures to provide alternative habitat and translocate individuals present, the proposed works have the potential to lead to a long-term decrease in the size of an important population, namely the White's Seahorse endemic to NSW. The species has been reported to inhabit the harbour previously. While not detected during field surveys, there is significant suitable habitat for the species within the harbour environment, including seagrasses and algae. It is common to not detect the species due to their cryptic nature, without a targeted approach to survey specifically for the species. It is presumed that the species is present in the harbour. Through the implementation of the proposed mitigation measures, it is not anticipated that the works will result in a long-term decrease in the population of the species within the harbour. All individuals will be located, as identified with a thorough pre-clearance survey and relocated to seahorse hotels immediately outside of the harbour. Following the works, the seahorse hotels will be moved into the harbour, to create new habitat for the species.
Reduce the area of occupancy of an important population	Unmitigated, the proposed works will impact the population and have the potential to place the population at risk of long term decline due to the species high site fidelity. Through the implementation of the proposed mitigation measures, new habitat will be created with the introduction of the seahorse hotels. A number of piles will be removed as part of the works and some new piles will be reinstated. The total number of piles will be less than those removed. Therefore, the works will result in some reduced area for the species. Use of seahorse hotels will create artificial habitat for seahorses to mitigate reduced habitat areas as a result of proposed works.
Fragment an existing important population into two or more populations	Unmitigated, the proposed works have the potential to fragment the existing population. This is due to the connectivity of the seagrass beds and macroalgae within the entire study area and the potential movement of individuals between seagrass beds locally within the Harbour. With the mitigation measures in place and with the reduction of dredging footprint, the works are not anticipated to result in fragmentation of the population. The works will largely not directly impact the seagrasses, largely maintaining the connectivity.

Species: Syngnathids Endangered	Assessment under the EPBC Act Significance Criteria
Adversely affect habitat critical to the survival of a species	The study area is not listed as critical habitat under the EPBC Act. Unmitigated, the proposed works have the potential to adversely affect habitat necessary for the survival of the family, as discussed above. With the mitigation measures in place, the works will still result in some habitat loss via the removal of the piles from Jetty 1 and Jetty 2 and partial reinstatement of new piles for 1 jetty re-build proposed. There will be new habitat created via the installation of seahorse hotels to be placed in-situ within the harbour following the completion of the works.
Disrupt the breeding cycle of an important population	The proposed works have the potential to disrupt the breeding cycle of a number of species in the syngnathids family, given some species brood all year. Relocation is likely to be stressful and may result in a reduction in breeding behaviours and intensity and therefore impact the success of a breeding cycle. The works will seek to try to avoid the breeding season for the species to reduce the stress on individuals and therefore the risk of stress-induced breeding successes.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposed works will remove available quality habitat for syngnathids. This is not anticipated to translate into a decline in the reduction of the species population, given that all individuals will be relocated to seahorse hotels within the same environment.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposed works will not result in any invasive species that are harmful to these species becoming established in the species habitat. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of invasive species to as low as reasonably practicable.
Introduce disease that may cause the species to decline, or	The proposed works will not result in the introduction of a disease that may cause syngnathids to decline. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of disease to as low as reasonably practicable.
Interfere substantially with the recovery of the species	Unmitigated, the proposed works will interfere substantially with the recovery of the species given syngnathids are under stress in NSW with their decline in their natural habitat. With the proposed mitigation measures in place the works will not interfere substantially with the recovery of the species.
Statement of impact:	**The proposed works will NOT have a significant impact on the species, provided that the recommended mitigation measures be implemented in their entirety.**

Vulnerable species

Species: Black Rock Cod Vulnerable	Assessment under the EPBC Act Significance Criteria
An action is likely to have significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
Lead to the long-term decrease in the size of an important population of a species	The proposed works will not result in the removal of, or damage to, any rocky reef habitat and therefore it is considered unlikely that the proposed works will result in long term decrease in the size of the species population.
Reduce the area of occupancy of an important population	The proposed works will not result in the removal or damage of any rocky reef habitat and therefore it is unlikely that the proposed works will reduce the area of occupancy of the species population.
Fragment an existing important population into two or more populations	The proposed works are unlikely to result in population fragmentation. The species is highly territorial and do not live-in groups permanently.
Adversely affect habitat critical to the survival of a species	The proposed works do not involve any alteration of the species preferred habitat (rocky reef). It is unlikely that the proposed works will significantly adversely affect critical habitat of the Black Rock cod.
Disrupt the breeding cycle of an important population	Given the short term nature of the proposed works, it is not anticipated that the works will result in a disruption to the breeding cycle of the Black Rock cod.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Rocky reef habitat will not be altered as part of the proposed works and it is unlikely that the proposed works will result in significant modification, removal, isolation or a decrease in the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposed works will not result in any invasive species that are harmful to these species becoming established in the species habitat. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of invasive species to as low as reasonably practicable.
Introduce disease that may cause the species to decline, or	The proposed works will not result in the introduction of disease that may cause a vulnerable species to decline. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of disease to as low as reasonably practicable.
Interfere substantially with the recovery of the species	The proposed works will not interfere with the recovery of the species.
Statement of impact:	**The proposed works will NOT have a significant impact on the species.**

Species: Marine turtles Vulnerable Green Turtle and Hawksbill Turtle	Assessment under the EPBC Act Significance Criteria
An action is likely to have significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
Lead to the long-term decrease in the size of an important population of a species	The proposed works are unlikely to lead to the long term decrease in the size of a population. The study area is not close to any known breeding grounds for the species.
Reduce the area of occupancy of an important population	Given the transient nature of the species, the localised works are unlikely to impact on the occupancy area for the species. If present, the species is likely to transit through between food sources. The proposed works are short term in nature and overall, there will be no reduction to the area of occupancy for the species.
Fragment an existing important population into two or more populations	Fragmentation of the turtles population is unlikely to occur due to the proposed works.

Species: Marine turtles Vulnerable Green Turtle and Hawksbill Turtle	Assessment under the EPBC Act Significance Criteria
Adversely affect habitat critical to the survival of a species	The study area is not critical habitat for the species. No Critical Habitat as defined under Section 207A of the EPBC Act (Register of Critical Habitat) has been identified and listed for marine turtles. Care should be taken to avoid direct impact to seagrass meadows.
Disrupt the breeding cycle of an important population	No breeding grounds are located in the study area. Multiple species locally migrate along most of the Australian coastline where it forages for sponges and seagrasses on coral reefs, rocky reefs and inshore embayment. This species may forage for seagrasses in the study area opportunistically. As the works are not located near a breeding area and feeding areas are located nearby the study area, it is not anticipated that the proposed works will impact on the breeding cycle of the species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposed works will not result in significant modification, destruction, removal, isolation of a reduction in the availability and quality of habitat to the extent that the species is likely to decline. Potential localized short term impacts include, but are considered unlikely: – Collision with marine equipment during the proposed works. – Behavioural avoidance of the area during the proposed works. – Potential exposure to pollutants that arise as a consequence of the proposed works.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposed works will not result in any invasive species that are harmful to these species becoming established in the species habitat. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of invasive species to as low as reasonably practicable.
Introduce disease that may cause the species to decline, or	The proposed works will not result in the introduction of disease that may cause a species to decline. Environmental management measures implemented are in conjunction with accepted international and domestic practice with risk of introduction of disease to as low as reasonably practicable.
Interfere substantially with the recovery of the species	The proposed works will not interfere with the recovery of the species.
Statement of impact:	**The proposed works will NOT have a significant impact on the species.**

Species: Great White Shark Vulnerable	Assessment under the EPBC Act Significance Criteria
An action is likely to have significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
Lead to the long-term decrease in the size of an important population of a species	Juveniles, sub-adults and adults appear to aggregate seasonally along the northern half of Stockton Beach up to Hawks Nest in NSW, (DoEE 2019). Adults can be found close inshore around rocky reefs, surf beaches and shallow costal bays through to outer continental shelf and slope areas. This species is distributed from Mackay, QLD, along the southern coast to north-west WA. This is a widely, but not evenly, dispersed species that does not rely on specific environments for core habitat and is a highly mobile species (DoEE 2019). Therefore, proposed activities are unlikely to lead to long term decrease in the size of the species population.
Reduce the area of occupancy of an important population	The proposed works are unlikely to reduce the area of occupancy of the species.
Fragment an existing important population into two or more populations	Given there are no known aggregation location near the study area, it is not anticipated to fragment an existing population into two or more populations and the likelihood of this occurring considered unlikely.

Species: Great White Shark Vulnerable	Assessment under the EPBC Act Significance Criteria
Adversely affect habitat critical to the survival of a species	This species does not specifically have any core habitat requirements in any particular area, being a highly mobile and adaptive species. The proposed works are unlikely to affect suitable habitat crucial to the survival of the species.
Disrupt the breeding cycle of an important population	The proposed works are unlikely to impact breeding cycles.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	It is anticipated that the proposed works are unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	It is unlikely that the proposed works will result in invasive species that are harmful to a vulnerable species becoming established in the species habitat.
Introduce disease that may cause the species to decline, or	It is unlikely that the proposed works introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	It is unlikely that the proposed works will interfere with the recovery of the species.
Statement of impact:	**The proposed works will NOT have a significant impact on the species.**

Appendix D

FM Act significant impact assessment

Species: Black Rock Cod **Vulnerable**	**Assessment under the FM Act Significance Criteria**
The following is to be taken into account for the purposes of determining under this division whether a proposed development or activity is likely to significantly affect threatened species, populations or ecological communities (unless it is carried out in a critical habitat)	
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposed works are not anticipated to result in adverse effects on the life cycle of the species, such that the local population of the species is likely to be placed at risk of extinction. While suitable habitat does exist in the study area, the proposed works will not likely impact the species and its habitat.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that contributes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	Not applicable
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction or ii) is likely to be substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	Not applicable
d) In relation to the habitat of a threatened species, population or ecological community: i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and iii) The importance of the habitat to be removed, modified, fragmented, or isolated to the long-term survival of the species, population or ecological community in the locality	The study area has suitable habitat for the species; however it is not anticipated to be removed or modified as a result of the proposed works. The habitat is unlikely to become fragmented as a result of the proposed works. The habitat in the study area that is suitable for the species forms a large portion of the study area and is in good condition. A number of horizontal rock ledges and overhangs are present in the rocky reef, which constitute ideal habitat for the species. No species were identified on the survey days. The preservation of rocky reef habitat is vitally important to the species given the species exhibits high site fidelity, often remaining in the same rocky reef all its life.
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The proposed works are unlikely to present a risk to the habitat of the species. No rocky reef habitat (namely, ledges, crevices that the species prefers) will be impacted directly from the works.
f) Whether the action proposed is consistent with a Priorities Action Statement	The action proposed is consistent with Priorities Action Statement for the species.
g) Whether the action proposed constitutes or is part of a key threatening process, or is likely to result in the operation of, or increase the impact of, a key threatening process	The proposed action is not part of a key threatening process listed under the FM Act.
Statement of impact:	**The proposed works will NOT have a significant impact on the species.**

Species: White's Seahorse **Endangered**	**Assessment under the FM Act Significance Criteria**
The following is to be taken into account for the purposes of determining under this division whether a proposed development or activity is likely to significantly affect threatened species, populations or ecological communities (unless it is carried out in a critical habitat)	
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	Syngnathids show high site fidelity, including to a micro-habitat scale (i.e. to a certain holdfast). Removal of habitat (i.e. seagrass) presents a significant risk to the life cycle of the species. Breeding season for the species occurs between September to February. Removing seagrass in the non-breeding season (March – August) can potentially reduce some of the risk. Litter mortality is high (at approximately 95 %), with males producing ~100 – 150 young per litter and can give birth up to 8 times per breeding season (September to February). However, with high mortality rates, the species recovery process can be slow. Young dispersal is low as the species is not associated with rafting (attaching to a floating object for dispersal) at a juvenile stage and is therefore highly likely to remain at its birthplace. Given the high site fidelity, removing seagrass may present unacceptable risk to the species. Relocating the species may alleviate some of the risk to the local population. Following initial identification of potential impacts associated with this species the dredge footprint design was revisited. Measures were taken to avoid impact as far as practicable resulting in a much smaller footprint (and thus impact) than originally designed.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that contributes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	Not applicable
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction or ii) is likely to be substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	Not applicable

Species: White's Seahorse **Endangered**	**Assessment under the FM Act Significance Criteria**
d) In relation to the habitat of a threatened species, population or ecological community: i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and iii) The importance of the habitat to be removed, modified, fragmented, or isolated to the long-term survival of the species, population or ecological community in the locality	The proposed works include the removal of the species habitat. The species is highly correlated with seagrass beds. Given the high site fidelity behaviour of the species, the removal of seagrass will fragment the local population. There are local reports of the species using the harbour and the proposed action will impact the population within the study area.
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	The study area is not listed as critical habitat under the FM Act.
f) Whether the action proposed is consistent with a Priorities Action Statement	The proposed action is inconsistent with the Priorities Action Statement for the species, given that the works will result in some small scale habitat removal. However the proposal is consistent with the action within the Statement to trial artificial habitats to promote recovery of White's Seahorse populations. TfNSW will work with the DPI to identify other draft actions from the Priorities Action Statement that may be able to be implemented at the site.
g) Whether the action proposed constitutes or is part of a key threatening process, or is likely to result in the operation of, or increase the impact of, a key threatening process	The proposed action if not part of a key threatening process listed under the FM Act.
Statement of impact:	**The proposed works will NOT have a significant impact on the species, provided that the proposed mitigation measures are implemented in their entirety.**

Appendix E

BC Act significant impact assessment

Endangered Species

Loggerhead turtle, Leatherback turtle **Endangered**	**Assessment under the BC Act 2016**
The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:	
in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	Impacts due to the proposed works are unlikely to cause an adverse impact on the lifecycle of this species. It is considered that potential life cycle impacts would only occur if works affected the breeding habitat. The proposed site is not close to any known breeding grounds for this species.
in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction* *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not applicable
in relation to the habitat of a threatened species or ecological community: *the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity*	The project is unlikely to modify, remove or isolate any habitat to the extent that a local population would be placed at the risk of extinction. It is considered that any effects on the habitat would be short-term and localised in nature.
whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity	Fragmentation of these species population is unlikely to occur due to the proposed works.
the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	No removal, modification, fragmentation isolation or decrease in the availability or quality of habitat to the extent that the species population is likely to negatively impact the long-term survival of the species.
whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	No declared areas of outstanding biodiversity exist within the study area.
whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	Key threatening processes are listed under Schedule 4 of the BC Act 2016. The relevant threatening process to these species involves the entanglement in or ingestion of anthropogenic debris in marine and estuarine environments. The proposed works may generate anthropogenic debris during the piling activities. There is potential for these species to ingest or become entangled in the debris. During piling works, there is also potential for mobilisation of contaminants contained in sediments and subsequent ingestion by the turtle. Identified management measures will be implemented to minimise the risk through appropriate debris management and removal from site to minimise any potential sediment plume. In the event that an individual becomes entangled during the works, the NSW ORRCA Whale and Dolphin Rescue or Australian Seabird and Turtle Rescue should be notified immediately.

Beach Stone Curlew **Endangered**	**Assessment under the BC Act 2016**
The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:	
in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	Impacts due to the proposed works are unlikely to cause an adverse impact on the lifecycle of this species. It is considered that potential life cycle impacts would only occur if works affected the breeding habitat. The proposed site is not close to any known breeding grounds for this species. Given their mobility, the species (if present) is likely to avoid the works area.
in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction* *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not applicable
in relation to the habitat of a threatened species or ecological community: *the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity*	The project is unlikely to modify, remove or isolate any habitat to the extent that a local population would be placed at the risk of extinction. The works are isolated to marine environment and do not form habitat of this species.
whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity	Fragmentation of this species population is unlikely to occur due to the proposed works.
the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	No removal, modification, fragmentation isolation or decrease in the availability or quality of habitat to the extent that the species population is likely to negatively impact the long-term survival of the species.
whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	No declared areas of outstanding biodiversity exist within the study area.
whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	Key threatening processes are listed under Schedule 4 of the BC Act 2016. The relevant threatening process to these species involves the entanglement in or ingestion of anthropogenic debris in marine and estuarine environments. The proposed works may generate anthropogenic debris during the piling activities. There is potential for these species to ingest or become entangled in the debris. Identified management measures will be implemented to minimise the risk through appropriate debris management and removal from site to minimise any potential sediment plume. In the event that an individual becomes entangled during the works, the Australian Seabird and Turtle Rescue should be notified immediately.

Vulnerable Species

Green Turtle **Vulnerable**	**Assessment under the BC Act 2016**
The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:	
in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	Impacts due to the proposed works are unlikely to cause an adverse impact on the lifecycle of this species. It is considered that potential life cycle impacts would only occur if works affected the breeding habitat. The proposed site is not close to any known breeding grounds for this species.
in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction* *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*	Not applicable
in relation to the habitat of a threatened species or ecological community: *the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity*	The project is unlikely to modify, remove or isolate any habitat to the extent that a local population would be placed at the risk of extinction. It is considered that any effects on the habitat would be short-term and localised in nature.
whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity	Fragmentation of this species population is unlikely to occur due to the proposed works.
the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	No removal, modification, fragmentation isolation or decrease in the availability or quality of habitat to the extent that the species population is likely to negatively impact the long-term survival of the species.
whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	No declared areas of outstanding biodiversity exist within the study area.
whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	Key threatening processes are listed under Schedule 4 of the BC Act 2016. The relevant threatening process to these species involves the entanglement in or ingestion of anthropogenic debris in marine and estuarine environments. The proposed works may generate anthropogenic debris during the piling activities. There is potential for these species to ingest or become entangled in the debris. During piling works, there is also potential for mobilisation of contaminants contained in sediments and subsequent ingestion by the turtle. Identified management measures will be implemented to minimise the risk through appropriate debris management and removal from site to minimise any potential sediment plume. In the event that an individual becomes entangled during the works, the NSW ORRCA Whale and Dolphin Rescue or Australian Seabird and Turtle Rescue should be notified immediately.

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The Power of Commitment

Appendix H Stage 1 PACHCI Assessment

30 June 2021

ID: A
File No: SF2021/

Gareth Doran | Project Officer Infrastructure Programs (South)
Maritime Infrastructure Delivery Office | Maritime
Greater Sydney | Transport for NSW
First Floor, 33 James Craig Road, Rozelle NSW 2039
https://www.rms.nsw.gov.au/boatingnow

Dear Mr Doran,

Preliminary assessment results for proposed Crowdy Head Boat Harbour Safety Upgrade located within the Mid Coast Council Local Government Area. Based on Stage 1 of the *Procedure for Aboriginal cultural heritage consultation and investigation* (the procedure).

The project study works (Please refer to stage 1 action 3), as described in the Stage 1 assessment checklist (Attachment A) was assessed as being unlikely to have an impact on Aboriginal cultural heritage. Please see Figure A for project location and figure C for project works location.

The assessment is based on the following due diligence considerations:

- The project is unlikely to harm known Aboriginal objects or places.
- The AHIMS search did indicate one valid site 30-6-0006 on AHIMS of an Aboriginal object or places outside of the study area. The site is over 100m outside of the project area and is in Muir Park between road reserve and axillary site and will not be impacted by these works, refer to figure B.
- The site was inspected by foot on 13 May 2021 with environment officer Brad Whittard with no new findings.
- If land Claim ALC36156 and ALC 36129 are going to be encroached at all the NSW Aboriginal Land Council will need to provide written approval. Please refer to figure D & E.
- The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage's *Due diligence Code of Practice for the Protection of Aboriginal objects in NSW* and the Roads and Maritime Services' procedure.
- Works are within previously disturbed road works and marine reserve.
- The cultural heritage potential of the study area appears to be reduced due to past disturbance, industrial area and previous road works.
- There is an absence of sandstone rock outcrops likely to contain Aboriginal art.

Your project may proceed in accordance with the environmental impact assessment process, as relevant, and all other relevant approvals.

If the scope of your project changes, you must contact me and your regional environmental staff Deborah Swan deborah.swan@transport.nsw.gov.au to reassess any potential impacts on Aboriginal cultural heritage.

Safe Guards: Muir Park cnr of Stewart Close and Deborah Street will be identified as a No Go Zones and will be highlighted for total exclusion for AHIMS site 30-6-0006 which is located on a public park outside of the project works area. Roads and Maritime Services' *Unexpected Archaeological Finds Procedure* provided by TfNSW Culture and Heritage Officer with initial WHS site induction to all workers on and what an unexpected find looks like including legislative requirements and procedures. Please note that if any potential Aboriginal objects (including skeletal remains) are discovered during the course of the project, all works in the vicinity of the find must cease, item/area protected with identified No Go Zone and Project Manager and Culture and Heritage Officer contacted immediately. Follow the steps outlined in the Roads and Maritime Services' ***Unexpected Archaeological Finds Procedure*****,** http://home.rta.nsw.gov.au/dts/cserv/os/original/environment/pn285p02.pdf.

For further assistance in this matter and do not hesitate to contact me.

Yours faithfully



Deborah Swan
Aboriginal Cultural Heritage Officer – Hunter

Figure A. Project Location – Crowdy Head Mid Coast Council LGA NSW

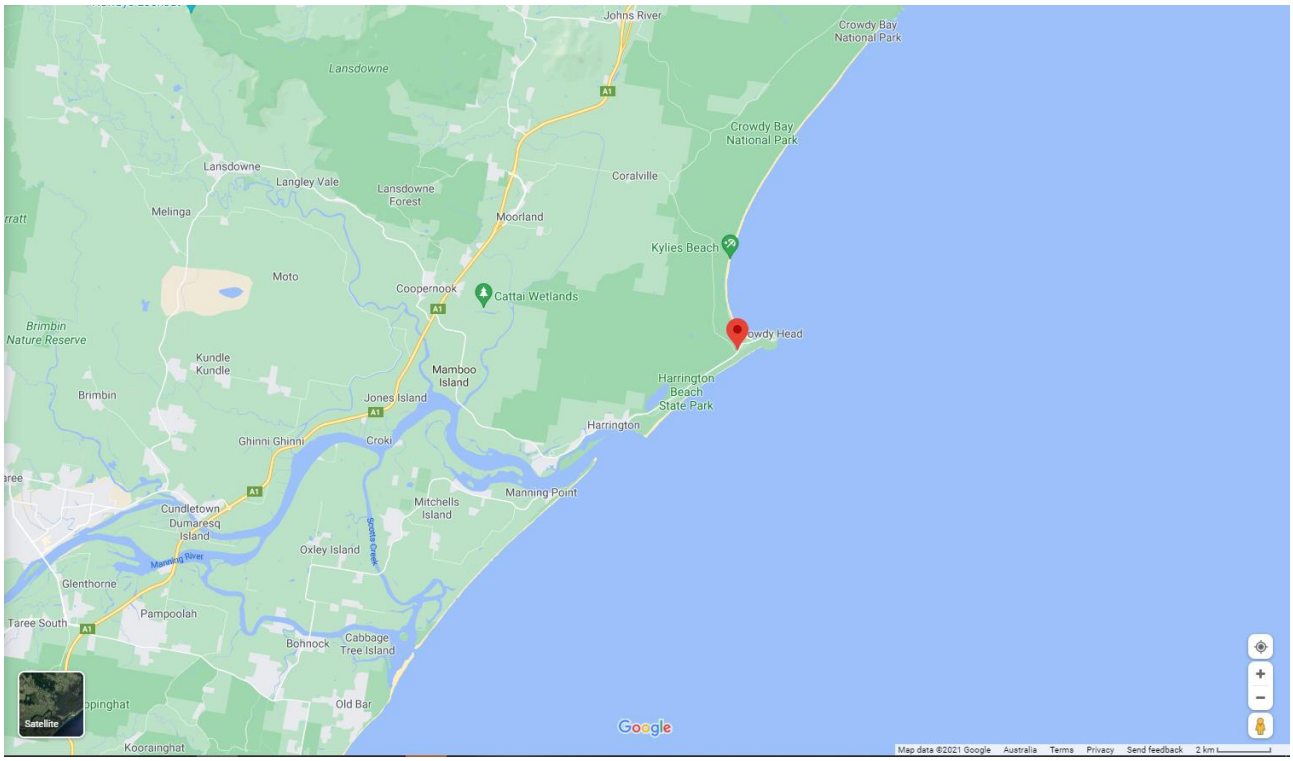


Figure B: No Go Zone AHIMS site 30-6-0006 cnr of Stewart Cl and Deborah St



Figure C: Project Works



Figure D: Project Works NSW Aboriginal Land Council Claim ALC 36129 over lot 1 DP 1077643



Figure E: NSW Aboriginal Land Council Claim ALC36156 over lot 2 and part lot 3



Attachment A Action checklist

Activity checklist

Procedure for Aboriginal cultural heritage consultation and investigation - Resource 1

1. Project details

Project name: Crowdy Head Boat Harbour Safety Upgrade located within the Mid Coast Council LGA

Name of Project Manager: Gareth Doran

Name of Aboriginal cultural heritage officer: Deborah Swan

Name of Environment Officer: Brad Whittard

Project WBS#: P.0060974.05

2. Purpose of this assessment

This resource provides a checklist of actions associated with the four stages of the *Procedure for Aboriginal cultural heritage consultation and investigation.* It can be used to:

- Assist Transport for NSW staff to ensure that the appropriate actions have been completed for a particular project.
- Demonstrate that Transport for NSW has been duly diligent in considering potential harm to Aboriginal cultural heritage prior to project implementation.

3. Project Objectives

- Safety upgrade to existing pontoon's.
- Proposed new Fishing Platform.

Glossary

The following terms are used in this resource:

ACHA – Aboriginal cultural heritage advisor
AFG – Aboriginal focus group meeting
AHIMS – OEH's Aboriginal heritage information management system
CHAR – Cultural heritage assessment report
OEH – Office of Environment and Heritage
PM – Project manager
RES – Regional environmental staff
SES(H) – Senior Environmental Specialist (Heritage)

Stage	Action	Completed ☑	Date completed and signature
Stage 1	**Action 1:** Is the activity exempt development in accordance with the *Environmental assessment procedure for routine and minor works*? If **yes**, the project may proceed in accordance with all other relevant approvals. If **no**, proceed to Action 2.	☑	**30/06/2021**

	Action 2: Undertake a Basic Search of AHIMS. Are sites located in the study area? If **yes**, undertake an Extensive Search.	☑	**07/05/2021** AHIMS basic search Crowdy Heads Mari AHIMS basic search Crowdy Head Bay.pc exstensive search Crowdy Heads.pdf
	Action 3: Provide project details and AHIMS results to ACHA and RES.	☑	**04/05/2021**
	Action 4: ACHA and RES to advise PM whether the project is likely to harm Aboriginal objects or places.	☑	**30/06/2021**
	Outcomes: Are known or potential impacts to objects or places likely? **If no, proceed in accordance with all other relevant approvals and environmental impact assessment processes.** If **yes**, proceed to Stage 2. <u>Note:</u> For large or complex projects, it may not be feasible to do a Stage 2 survey. Has a cultural heritage constraints mapping been suggested instead? If **yes**, engage an archaeologist and Aboriginal stakeholders to prepare this.	☑ **NO Proceed**	**30/06/2021**