Appendix D

Sediment Geochemical Assessment Report and Preliminary SAP Summary

CLIENTS | PEOPLE | PERFORMANCE

Newcastle Port Corporation

Report on Capital Strategic Dredging

Sediment Geochemical Investigation

October 2012

Revision 1

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 Project Background

Newcastle Port Corporation (NPC) seeks to obtain planning approval from the NSW Department of Planning under Part 5.1 of the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act) for the capital dredging of 12 berth boxes and ancillary channel widening in the South Arm of the Hunter River in the Port of Newcastle. The site location is shown on Figure 1 (Appendix A).

The Capital Dredging Project (the Project) is a vital step in the NCP strategy of diversifying trade options available in the Port of Newcastle.

GHD understands that the Project forms part of NPC's broader project objectives for the development of the Port of Newcastle and will assist with the strategy of developing and promoting diversification of trade in the Port. The objectives of the Project are to:

- Promote diversification of trade in the Port.
- Obtain in-principal project approval for the dredging of 12 berths.
- Develop a range of disposal options for the dredged material, with an overview of the potential environmental impacts associated with each disposal option.
- Align the development of the wharf and landside development opportunities with adjoining projects.

Whilst approval for the disposal of dredged material will not be sought as part of the current Environmental Impact Statement (EIS), an assessment needs to be undertaken of the potential levels of contamination that may exist in the sediments to be dredged, and the implications that any contamination may have for disposal or management of the dredged sediments.

1.2 Objectives

The objectives of this geochemical assessment are to:

- Characterise the sediments to be dredged during the proposed capital dredging.
- Assess the suitability of sediments for potential disposal options including unconfined ocean disposal under the *National Assessment Guidelines for Dredging* (NAGD, 2009).

2. Project Background

2.1 Site Identification

The Port of Newcastle is a river port located on the Hunter River, approximately 70 nautical miles north of Sydney. NPC has identified a number of sites with the potential for future development of berthing facilities within the Port of Newcastle as part of its Berth and Channel Plan.

The berth sites are located at:

- Kooragang Island (K1).
- Walsh Point (W1, W2 and W3).
- Mayfield (M1, M2, M3, M4, M5, M6 and M7).
- Dyke 3 (D3).

The existing riverbed within the footprint of the proposed berth sites consists of a combination of unprotected river banks and previous berth developments/foreshore protection measures. Dredging of these areas is required to provide suitable access and berthing areas for future berth developments.

The proposed berth sites in the South Arm would be dredged and excavated to the required depth and the banks battered back and protected with a rock revetment to prevent scour and erosion. The development of the berth infrastructure adjacent to the berths would occur over time as required by associated land-based developments. These new berths, and any land-based development, would be subject to separate assessment and approval processes.

Table 2-1 provides a summary of the previous and intended use of the 12 berth sites. For the purpose of this geochemical assessment, the berths have been grouped into four distinct areas based on adjoining berth sites. The location of the berth sites and four investigation areas is shown on Figure 1 (Appendix A).

Table 2-1 Site Identification Summary

Area	Current / Historical Use	Intended Use	Proposed Dredge Details
Mayfield Berths 5, 6 and 7	Located adjacent to the former BHP Billiton (BHPB) area. The existing bank adjacent to the proposed Mayfield 5, 6, and 7 berths consists of a permanent sheet steel pile wall, which was constructed as part of the Hunter River Remediation Project (HRRP) to enable the contaminated sediments located adjacent to the sheet pile wall to be removed down to the sand/silt interface. Contaminated sediments were removed to a level approximately 0.5 metres below the interface between the soft silty clay and underlying sand.	M5 and M6 to be developed for Panamax sized vessels. M7 to be developed as a bulk liquids berth for Panamax sized vessels	Dredge to -16 m below NHTG. Estimated dredge volume: 520,000 m^3

Area	Current / Historical Use	Intended Use	Proposed Dredge Details
Mayfield Berths 3 and 4	Located adjacent to the former BHPB area. Currently there exists a berth belonging to Koppers Carbon and Chemicals.	General purpose	Dredge to 13.3 m below NHTG. Estimated dredge volume: 65,000 m^3
Mayfield Berths 1 and 2	Former BHPB wharf area. The existing bank adjacent to the Mayfield 1 and 2 Berths is of variable configuration, consisting of timber and concrete wharf structures, a sheet pile wall and a rock revetment batter, some of which may need to be demolished and removed. In some areas the bank is unprotected and has been noted to have eroded, becoming potentially unstable. Previous investigations have revealed that the banks of Mayfield site may be constructed from rock, soil, building rubble, steelworks waste products, slag and coal washery waste. In addition, previous investigations have noted that the existing banks may contain contaminants like tar and PAHs and may be providing a barrier to such contaminants migrating into the Hunter River from the fill behind the wall.	M1 to be used as an operational berth for mooring NPC vessels M2 to be used as a bulk cargo berth for Panamax sized vessels	Dredge to 15.3 m below NHTG. Estimated dredge volume: 310,000 m^3
Kooragang 1 and Walsh Point Berths	The existing bank adjacent to the Kooragang 1 and Walsh Point Berths is of variable configuration, primarily consisting of rock and concrete lined embankments, and a largely unprotected grassy foreshore at the southern end of Walsh Point. The area proposed for the K1 berth contains disused boat ramps and significant underwater structures that will require removal prior to the commencement of dredging activities. Previous investigations have revealed that the banks of Kooragang Island may be constructed from materials such as rock, soil, building rubble and waste products. In addition, previous investigations have noted that a potential contamination “hotspot” exists near the southern end of Heron Road where geochemical testing has revealed elevated levels of PAH’s, as discussed in Section 4.2.1.	General cargo berths for Panamax and Handy Class vessels.	Dredge to 14.5 m below NHTG. Estimated dredge volume: 675,000 m^3

Area	Current / Historical Use	Intended Use	Proposed Dredge Details
Dyke Berth 3	Disused berth box at Dyke 3. Previously used as a bulk berth site. The existing bank adjacent to the proposed Dyke 3 Berth primarily consists of a rock revetment with existing concrete and timber wharves. NPC has previously advised that the existing rock revetment is prone to slumping.	Deep draught standby berth.	Dredge to 17 m below NHTG. Estimated dredge volume: 300,000 m^3

- Displays actual dredge levels, which includes an over-dredging allowance of an additional 0.5 metres in depth in all proposed dredging areas, which would be provided as a buffer to provide for sedimentation that may occur between maintenance dredging programs.

2.2 Disposal of Dredge Materials

GHD understand that although disposal of the dredged material will be the responsibility of the proponent which carries out the berth box dredging, identification of disposal options for dredged material is required as part of the EIS. Details regarding spoil disposal options are discussed further in the EIS. Potential disposal options may include, but not be limited to:

- Beneficial re-use options including beach nourishment.
- Ocean disposal.
- Land reclamation.
- On-shore disposal to a suitably licensed landfill facility.

This sediment investigation is aimed at identifying the levels of contamination that may exist in the sediments to be dredged, and the implications that any contamination may have for disposal or management of the dredged sediments.

3. Basis for Assessment

3.1 Overview of Guidelines

The objective of this assessment is to evaluate potential options for re-use / disposal of dredged materials from the berth sites.

The framework for the assessment has been developed based on the following guidelines:

- Environment Australia 2009, *National Assessment Guidelines for Dredging*, 2009 (NAGD 2009).
- NSW DECC (2009) *Waste Classification Guidelines Part 1 – Classifying Waste*.
- ANZECC (2000), "*National Water Quality Management Strategy, Paper No. 4*, Australian and New Zealand Guidelines for Fresh and Marine Water Quality", October 2000, Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ).

An overview of the key requirements of these guidelines, including identification of investigation levels, is provided in the following sections.

3.2 National Assessment Guidelines for Dredging

3.2.1 Decision Framework

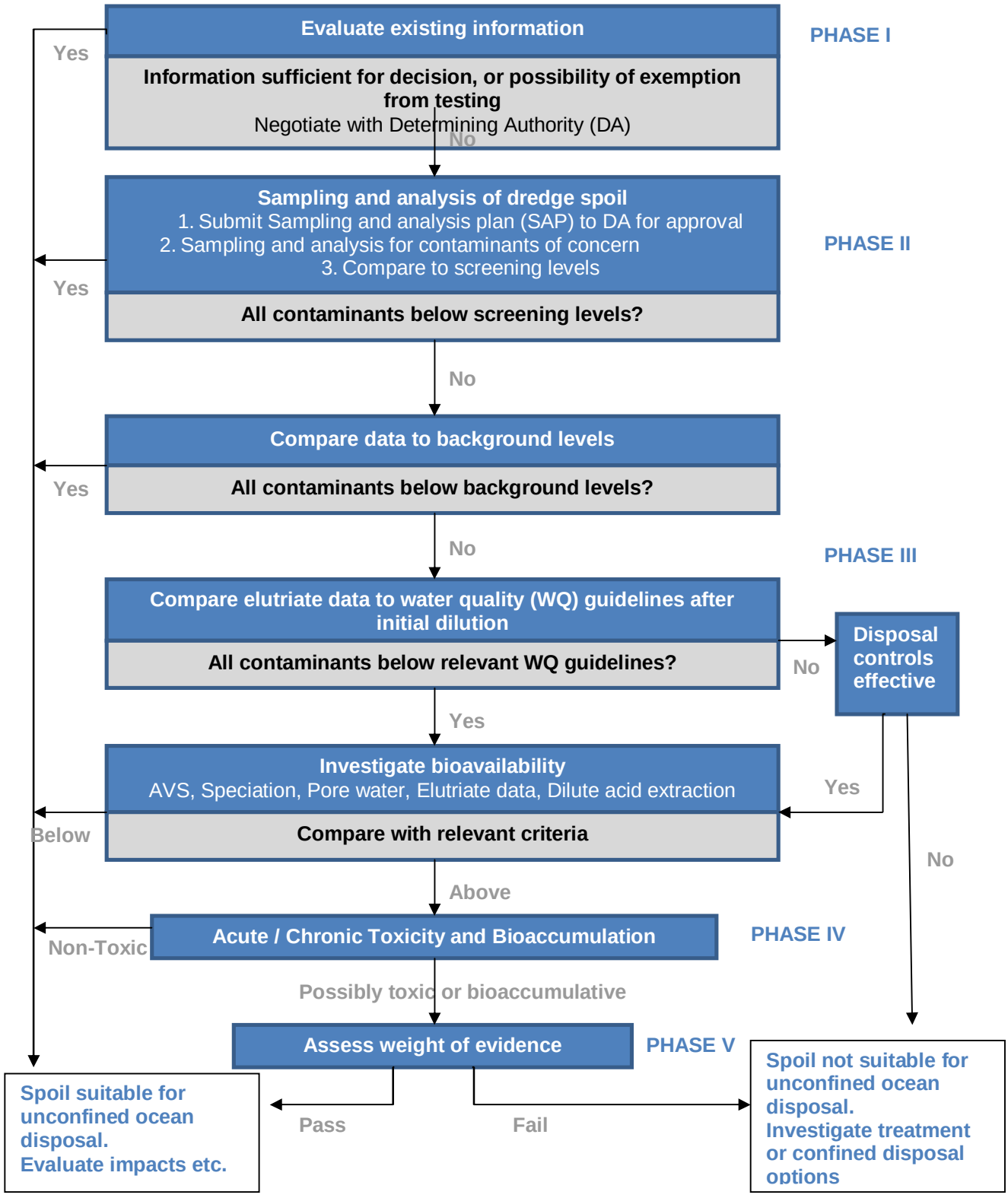
The decision framework for assessing the quality of sediments and suitability of the material for off-shore disposal is based on five key steps including:

- Phase 1 – Evaluation of existing data.
- Phase 2 – Sampling and analysis of sediments.
- Phase 3 – Elutriate and bioavailability testing.
- Phase 4 – Toxicity and bioaccumulation testing.
- Phase 5 – Weight of evidence assessment.

As outlined in the NAGD (2009), the material may be classified as suitable for ocean disposal at several points throughout the process without and further need for additional chemical testing.

An overview of the decision framework is provided in Chart 1.

Chart 1 Decision Framework (Adapted from NAGD 2009)



3.2.2 Screening Levels

For the purpose of this geochemical assessment, the screening levels have been adopted from the Sediment Quality Guidelines (SQG) documented in Tables 2 and 4 of the NAGD (2009).

A summary of the screening levels is provided in Table 3-1.

Table 3-1 Interim Sediment Quality Guidelines

Patameter	SQG Low	SQG High
Metals	**(mg/kg = ppm)**	
Arsenic (As)	20 mg/kg	70 mg/kg
Cadmium (Cd)	1.5 mg/kg	10 mg/kg
Chromium (Cr)	80 mg/kg	370 mg/kg
Copper (Cu)	65 mg/kg	270 mg/kg
Lead (Pb)	50 mg/kg	220 mg/kg
Mercury (Hg)	0.15 mg/kg	1 mg/kg
Nickel (Ni)	21 mg/kg	52 mg/kg
Zinc (Zn)	200 mg/kg	410 mg/kg
Organics [(a)]	**(µg/kg = ppb)**	
Total Polychlorinated Biphenyls (PCBs)	23 µg/kg	-
DDD	2 µg/kg	20 µg/kg
DDE	2.2 µg/kg	27 µg/kg
Total DDT	1.6 µg/kg	46 µg/kg
Dieldrin	280 µg/kg	270 / 620 µg/kg
Chlordane	0.5 µg/kg	6 µg/kg
Lindane	0.32 µg/kg	1 µg/kg
Endrin	10 µg/kg	120 / 220 µg/kg
Total Polycyclic Aromatic Hydrocarbons (PAH)	10,000 µg/kg	50,000 (45,000) µg/kg
Total Petroleum Hydrocarbons (TPH)	550 µg/kg	-
Tributyltin (TBT)	9 µg Sn/kg	70 µg Sn/kg

(a) Normalised to 1% Total Organic Carbon (TOC)

3.2.3 Data Normalisation

Most natural and anthropogenic substances, including metals and organic contaminants, show a higher affinity to fine grained particulate matter than coarse fraction sediments, with organic matter and clay minerals generally exhibiting the strongest adsorption capacity for contaminants (OSPAR, 2001)[1].

Analysis of the whole sediment (as undertaken in this investigation) provides an indication of the distribution of contaminant concentrations in bedded sediments. If sediments within a given area are predominately fine grained, the influence of grain size distribution is of minor importance, however in areas where grain size varies considerably, the distribution of contaminants will be closely related to the distribution of fine grained sediments, obscuring the true spatial distribution of contaminants (AMPS, 2004)[2].

Two different approaches are commonly used to correct for variable sediment composition:

- Contaminant concentrations may be normalised using components of the sediment that represent its affinity to bind contaminants (such as organic matter). Total Organic Carbon (TOC) is one of the most widely used 'normalisers' for organic contaminants.
- Isolation of the fine fraction sediments (<63 µm) by sieving for physical grain size normalisation, effectively removing the coarse grained particulates which display a lower affinity to bind anthropogenic contaminants.

The objective of using normalisation techniques is to reduce the variability between samples arising from differences in sediment properties, such as grain size distribution. However, it is noted that the correlation between contaminant and co-factor concentrations may be weak or absent in some areas (OSPAR, 2009).

For organic contaminants, values are normalised to 1% organic carbon, as recommended in ANZECC/ ARMCANZ (2000). If the sediment organic carbon content if markedly higher than 1%, ANZECC/ARMCANZ (2000) recommends that the guideline values should be relaxed owing to the presence of additional carbon binding sites which act to reduce the contaminants bioavailability. For the purpose of this data, the following points are made:

- Where TOC was less than 1%, normalisation was not required and the actual reported concentration of organic contaminants has been used.
- Where TOC was greater than 1%, normalisation of the total PAH concentration was undertaken and the normalised concentration was used in statistical calculations. Calculations used in normalising the data were as follows:
  - Where TOC is greater than 1% but less than 10%, the concentration was divided by the TOC.
  - Where the TOC is greater than 10%, the concentration was divided by 10.

[1] OSPAR (2009) Update of *JAMP guidelines for monitoring contaminants in sediment: Technical annex on normalisation of contaminant concentrations in sediment.*

[2] AMPS (2004) *Discussion document on Sediment Monitoring Guidance for the EU Water Framework Directive, Version 2* May 2004

3.2.4 Calculation of the 95% Upper Confidence Limit

In accordance with the requirements of the NAGD (2009), the upper 95 per cent confidence limit (95% UCL) is used to determine compliance with the screening levels. The United States Environmental Protection Agency (USEPA) has software (ProUCL) that can calculate 95% present UCLs from data sets containing detect and non-detect observations. ProUCL calculates the most reliable 95% UCL value based on the specific distribution of data points within each data set, thereby accounting for normally distributed, gamma distributed and non-normally distributed data that are commonly encountered in environmental data.

For data sets that appear normally distributed, the Student's t-Test has been used to calculate each 95% UCL, while for data sets that appear log-normal the 95% H-UCL test has been used. For data sets with gamma distribution, the nonparametric Jack-knife method has been used to calculate the 95% UCL.

Where concentrations are reported below the practical quantitation limit (PQL), a value of half the PQL is adopted for the purpose of statistical calculations.

3.3 Waste Classification Guidelines

The NSW DECC (2009), "*Waste Classification Guidelines Part 1: Classifying Waste*" provides criteria for assessing the appropriate waste classification and subsequent disposal location for solid and liquid wastes.

The guidelines provide a six-step guide to the classification of waste:

- Step 1: establish if the waste should be classified as a special waste.
- 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 classified. A number of commonly generated wastes have been pre-classified.
- Step 4: If the waste is not a special waste, liquid or is suitable for pre classification, establish whether it has certain hazardous characteristics and may therefore be classified as hazardous.
- Step 5: If the waste does not possess hazardous characteristics, it needs to be chemically assessed to determine what class of waste it is.
- Step 6: if the waste is chemically assessed as general solid waste, a further test is available to determine whether the waste is putrescible or non-putrescible.

The classification process for non–liquid wastes focuses on the potential for the waste to release chemical contaminants into the environment through contact with liquids (leachates). The principal test used for assessing non–liquid waste is the Toxicity Characteristic Leaching Procedure (TCLP), which estimates the potential for waste to release chemical contaminants in to 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, restricted solid. If the level exceeds industrial the waste criteria the material is classified as hazardous waste.

The second test used to complete the assessment of waste, is the Specific Contamination 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 inert, solid, industrial waste. If the level exceeds the industrial waste criteria the material must be classified as hazardous waste.

3.4 Water Quality Guidelines

The ANZECC 2000 guidelines are approved as guidelines under Section 105 of the *Contaminated Land Management Act 1997* as of 6 December 2001.

ANZECC 2000 outlines the principles, objectives and philosophical basis underpinning the development and application of the guidelines. It also outlines the management framework recommended for applying the water quality guidelines to the natural and semi-natural marine and freshwater resources in Australia and New Zealand.

The guidelines provide a risk-based decision framework where possible, to help refine trigger values for application at local and/or regional scales.

In the event that elevated concentrations of contaminants of potential concern are reported in sediments, Phase III of the sediment investigation process requires elutriate testing to be completed to assess the potential impacts to water quality. Analytical results are compared against the relevant marine water quality trigger levels for 95% protection of species (ANZECC 2000).

4. Background Data Review

4.1 Sediments of the Hunter River

The Port of Newcastle is a river port, centrally located on the east coast of Australia, approximately 70 nautical miles north of Sydney and was Australia's first commercial port, exporting coal from 1799, and has since grown to be one of Australia's major bulk export ports. The dry lands of the Port cover an area of approximately 510 hectares.

The Port of Newcastle is surrounded by the City of Newcastle, with land use adjacent to the Port areas primarily comprising industrial and urban development.

The sediments of the South Arm of the Hunter River have been studied in detail by numerous previous studies including the South Arm Dredging Environmental Impact Statement (EIS) completed by GHD in 2003. During this study a "geotechnical model" was developed, which generally comprised the following material types in sequence from bed level:

- Variable fill from dredging and industrial activities placed for reclamation purposes outside the proposed dredge areas.
- Soft soil including very soft river-bed sediments and soft alluvial (non-river) clay.
- Marine sands, typically fine to medium grained with occasional alluvial clay lenses/layers.
- Bedrock comprising sandstone, siltstone, shale and minor coal seams.

4.2 Previous Investigations

Numerous geotechnical and geochemical investigations have been undertaken within the sediments of Newcastle Harbour as part of routine monitoring and previous dredging assessments. In addition, a number of investigations have been undertaken to assess the extent of contamination associated with the former BHPB steelworks site and toxicity investigations have been undertaken by CSIRO as part of the South Arm Dredging Project.

Available documentation was reviewed by GHD as part of the preliminary stage of works and the development of the Sampling and Analytical Plan (SAP). Whilst a significant volume of the available data is greater than five years old, the comprehensive nature of the previous sampling regime provides a detailed background on the nature and extent of contamination within the sediments of Newcastle Port and assists with the evaluation of trends in geochemical data.

Appendix B provides an overview of the some of the key sediment sampling programs completed in the South Arm of the Hunter River.

4.2.1 Existing Data Review

Review of existing data for the South Arm of the Hunter River has been undertaken previously by others and discussion of available data is presented in several reports including:

- GHD (2003) Proposed Extension of Shipping Channels, Port of Newcastle, Sediment Quality Data.
- Patterson Britton & Partners (2005) Channel Improvement Project Feasibility Study.

As part of the Channel Improvement Project, Patterson Britton completed an assessment of contaminant concentrations reported in areas classified as maintenance and capital dredging based on available historical data. A summary of the mean level of contaminants in sediments reported by Patterson Britton and Partners (2005) is provided in Table 4-1.

Table 4-1 Average Contaminant Concentrations [(a)]

	Number of samples	Mean	95% UCL	Number of samples	Mean	95% UCL
Arsenic	260	6.2 mg/kg	6.6 mg/kg	183	6 mg/kg	6 mg/kg
Cadmium	357	2.8 mg/kg	**3.3 mg/kg**	183	0.6 mg/kg	0.7 mg/kg
Chromium	343	30 mg/kg	33 mg/kg	183	43 mg/kg	45 mg/kg
Copper	329	38 mg/kg	40 mg/kg	183	29 mg/kg	31 mg/kg
Nickel	381	52 mg/kg	**57 mg/kg**	226	37 mg/kg	**39 mg/kg**
Lead	362	65 mg/kg	**69 mg/kg**	226	50 mg/kg	**60 mg/kg**
Zinc	401	357 mg/kg	**398 mg/kg**	183	195 mg/kg	**215 mg/kg**
Mercury	356	0.19 mg/kg	**0.22 mg/kg**	183	0.14 mg/kg	0.15 mg/kg
Silver	3	<1.0 mg/kg	-	-	NT	NT
Total PCBs	70	<5 µg/kg	-	26	<5 µg/kg	-
Pesticides	73	<50 µg/kg	-	25	<50 µg/kg	-
Total PAH	201	4.0 mg/kg	**4.9 mg/kg**	110	1.8 mg/kg	2.7 mg/kg

(a) Data sourced from Patterson Britton and Partners (2005) Table 1, *Mean level of contaminants in the soft silty clay maintenance dredged material* AND Table 2, *Estimated mean level of contaminants in the soft silty clay portion of the potential capital dredged material*.

BOLD: Concentration exceeds screening level (refer to **Table 3-1**)

NT: Not tested

Patterson Britton and Partners (2005) reported a potential hotspot of PAH contamination located adjacent to the foreshore of Walsh Point, near the southern end of Heron Road. The report stated the following:

- Concentrations of total PAH of 83 mg/kg and 101 mg/kg (not normalised to TOC) were reported in sediments at two locations. Given the absence of TOC data, it was not possible to compare analytical results against the guidelines.
- If a TOC concentration of 3% (typical for the soft silty clays of Newcastle Port) is adopted, the total PAH concentration at these two locations would be 28 mg/kg and 34 mg/kg respectively and would exceed the CSIRO guideline level of 15 mg/kg.

The approximate location of the PAH hotspot located off Walsh Point is shown on Figure 2.

4.2.2 Remediation of Contaminated Sediments

Contaminated sediments associated with the former BHPB steelworks site were delineated and subsequently remediated in 2010/2011 in accordance with the requirements of the Remedial Action Plan (CH2MHill, 2009), Validation Protocol (BHPB, 2010) and other regulatory requirements.

Validation of the Secondary Remediation Zone (SRZ) was completed by CH2MHill (2010). The results of the validation are reported in:

- CH2MHill 2010 Hunter River South Arm – Nearshore Sediment Validation, December 2010.

Validation of the sediments within the Primary Remediation Zone (PRZ) was completed by GHD in May 2011 and documented in Interim Validation Reports:

- GHD 2011(a) Hunter River Remediation Project, Interim Validation Report – Surgical Dredging Area (SDA) January 2011;
- GHD 2011(b) Hunter River Remediation Project – Interim Validation Report, Zone 1 February 2011;
- GHD 2011(c) Hunter River Remediation Project – Interim Validation Report, Zones 2-6 May 2011;

The location of the SRZ and PRZ is shown on **Figure 1**.

4.3 Summary Historical Findings

Based on a review of the available historical data, the following points are noted:

- Contamination has historically been reported within the sediments (soft silty clays) found in the South Arm of the Hunter River, primary comprising heavy metals (cadmium, chromium, copper, lead, mercury, nickel, and zinc), PAH and TPH. Further discussion regarding the contaminants of potential concern is provided in Section 5.
- Contaminant concentrations generally increase towards the southern foreshore of the South Arm.
- Concentrations of total PAH and benzo(a)pyrene in the silty clays varied according to depth and location.
- A hotspot of PAH impacted sediments was reported off Walsh Point, near the southern end of Heron Road.
- Contaminants were typically reported from the riverbed surface down to the interface between the silty clays and the underlying estuarine sands.
- Sediment toxicity data from the South Arm Dredging Project by CSIRO has shown that the metals present with the soft silty clays of the South Arm of the Hunter River are not bioavailable (Patterson Britton & Partners, 2005).
- Elevated levels of contaminants, in particular PAH's, were reported in the vicinity of proposed berths M5-M7, adjacent to the former BHPB steelworks site. As outlined in Section 4.2.2, PAH impacted sediments were subsequently remediated and validated.

5. Contaminants of Potential Concern

Following review of the available data, and based on GHD's understanding of the nature and extent of contamination typically encountered within working harbours, a number of contaminants of potential concern were identified. A summary of the primary contaminants of potential concern is provided in Table 5-1.

Table 5-1 Potential Contaminants of Concern and Potential Sources of these Contaminants

Potential Contaminants		Potential Sources
Metals	◗ Arsenic (As) ◗ Mercury (Hg) ◗ Cadmium (Cd) ◗ Chromium (Cr) ◗ Copper (Cu) ◗ Lead (Pb) ◗ Nickel (Ni) ◗ Zinc (Zn)	Historic industrial and domestic discharges into waterways. Antifouling paints. Stormwater and catchment runoff. Pesticides and fertilisers. Marine fabrication.
Hydrocarbons	◗ Total Petroleum Hydrocarbons (TPHs) ◗ Polycyclic Aromatic Hydrocarbons (PAHs) ◗ BTEX	Current and historical industrial practices adjacent to the Port. Fuel oils. Lubricants. Ballast water.
Pesticides	◗ Organochlorine (OC) ◗ Organophosphorus (OP)	Runoff from agricultural areas and catchment inputs
Organotins	◗ Tributyltin (TBT)	Antifouling paints. Can occur as paint flakes in sediments. May dissolve into the water column and attach to sediment particles. Restricted use in Australia since 1989, though TBT may still be used on larger vessels.
Phenol, Phenolics	◗ Phenol ◗ Cresol etc	Catchment inputs
PCBs		Historic industrial and domestic discharges into waterways.
Nutrients	◗ Phosphorus ◗ Nitrogen	Fertiliser runoff from domestic and agricultural areas. Nutrients attached to sediment eroded from catchment.

6. Sampling and Analysis

6.1 Overview

In accordance with the requirement of NAGD (2009), a Sampling and Analysis Plan (SAP) was prepared. The objectives of the SAP were to:

- Provide a brief summary of the proposed dredging operations relevant to the SAP.
- Identify potential contaminants of concern for inclusion in the testing of sediments based on potential contaminant sources and the results of previous testing.
- Identify procedures for the collection, handling, preservation and Quality Assurance/Quality Control of sediment samples for analysis.
- Describe procedures for reporting on the data, results, and conclusions of the sediment sampling.

The sediment sampling program was completed by GHD in May 2011. An overview of GHD's approach to the program and summary of the sampling methodology is provided in the following sections.

6.2 Sediment Sampling Locations

Appendix D of the NADG outlines the number of sampling locations required to assess the minimum number of sampling locations recommended to assess specified volumes of potentially contaminated material to be dredged.

The NAGD allows for capital dredging projects to calculate the volume of potentially contaminated material to be used to determine the number of sample locations required, rather than the total dredge volume. As such, the focus is on the sediments where contamination is likely to occur, rather than entire volume of material to be dredged. Further, the NAGD makes allowance for the number of sampling locations to be halved for 'probably clean' and 'probably contaminated' categories, where there is good quality current data on sediment chemistry for the area or site and the pollution status of the site has not changed.

Whilst the NAGD provide recommended numbers of sample locations, GHD understand that additional investigations will be undertaken by the proponent prior to undertaking dredging activities. As a result, GHD's approach for this investigation was to consolidate the existing data set and undertake supplementary analyses in targeted locations to meet the overall project objectives and enable an assessment to be made for potential disposal options for dredged materials.

For the purpose of this EIS, sediment samples were collected from 24 locations for the combined purpose of geochemical and geotechnical assessment.

In developing the sampling program, the proposed berth sites were divided into four distinct areas based on consecutive berth sites. An overview of the sampling areas, including the number of samples collected from each area, is provided in Table 6-1. Sampling locations are shown on Figure 2 (35).

Table 6-1 Number of Sampling Locations

Berth Sites	Sampling Locations	Rationale
K1, W1, W2 and W3	11	Sampling locations selected to provide additional data to support / confirm existing data
D3	5	
M1 and M2	8	
M3 and M4	0	Outside the scope of the investigation at the time of the sampling program. Berths later included for the purpose of the EIS.
M5, M6 and M7	0	Former remediation area validated (May 2011) prior to hand over to NPC. Refer to Section 4.2.2
Total	**24**	

6.3 Sampling Methodology

6.3.1 Vibrocoring Methodology Overview

Samples were collected using vibrocoring equipment, comprising an industrial (415 volt) vibrocorer attached to 100 mm diameter, 6-9 metre long steel sample tubes. The vibrocorer head was attached to the top of the sample tube, and was lowered to the seabed using a crane mounted on a workboat or barge.

The vibrocores were taken to full penetration of the sampling tube, unless (unexpected) prior refusal is encountered. The tops of the sample tubes were sealed following recovery to the deck of the barge and after cutting off any excess (empty) tube above the top of the sample.

6.3.2 Logging and Sample Management

The recovered vibrocore samples were cut longitudinally in order to allow the samples to be photographed, logged and sub-sampled.

The sediment logging and sub-sampling procedure is summarised as follows:

- Sediments were extracted from the core using core cutting equipment. The sediments were extracted into disposable aluminium trays. New trays were used for each core to avoid the potential for cross contamination between samples.
- Core logging was undertaken in the laboratory by experienced Environmental and Geotechnical Professionals from GHD. Log sheets were maintained, including a record of the nature of sediments throughout the core profile and observations of potential contamination such as odours or staining.
- A photographic log of the sediment core was maintained.

- Composite sediment samples were collected from the following depth ranges:
  - 0 to 0.5 metres.
  - 0.5 to 1 metres.
  - Half metre intervals along the length of the core, to be placed on hold at the laboratory for further analyses if required.

  It is important to note that the thinnest layer that can be dredged reliably and handled selectively using equipment routinely available is approximately 0.5 metres, so sub-sampling at smaller intervals along the core was considered to be redundant.
- The samples were transferred to laboratory provided containers appropriate for the analyses required and assigned a unique sample identifier. Care was taken to fill sample jars to reduce headspace and minimise the potential loss of volatiles prior to analyses.
- Samples were labelled with a unique identifier, particular to that sample location and depth and were placed in chilled coolers for transport to the project analytical laboratory.
- Sampling, handling, transportation, storage, preservation and labelling techniques were conducted in accordance with the NAGD.

6.4 Analytical Schedule

The analytical schedule was developed taking into account existing information pertaining to the geochemical composition of sediments within the Hunter River and GHD's experience conducting projects of a similar nature.

Sediments were selected for analysis to provide an overview of the concentrations of contaminants of potential concern across a range of depths in each of the three areas. Samples were analysed:

- Moisture content and TOC.
- Heavy metals, including As, Cd, Cr, Cu, Pb, Hg, Ni and Zn).
- TPH and BTEX.
- PAH.
- Phenols.
- OCPs.
- PCBs.
- TPH.
- Nutrients including ammonia, nitrate, nitrite, nitrogen and phosphorus.

All samples were analysed by Australian Laboratory Services (ALS) who are NATA accredited for the analyses required.

7. Quality Assurance and Quality Control

This section provides an overview of the quality assurance and quality control (QA/QC) methods implemented during the course of the sampling program.

7.1 Field QA/QC

All fieldwork was conducted in general accordance with GHD's Standard Field Operating Procedures and the protocols presented in the SAP, which are aimed at ensuring that all environmental samples are collected by a set of uniform and systematic methods, as required by GHD's Quality Assurance system.

Field QA/QC procedures followed during the sampling program included:

- Sampling was conducted by staff with appropriate experience and training.
- Decontamination procedures - including the use of new disposable gloves for the collection of each sample, decontamination of the sampling equipment between each sampling location (using DECON 90[3]) and the use of dedicated sampling containers provided by the laboratory.
- Stainless steel equipment was used, where practicable, to minimise the risk of cross-contamination of samples.
- Logging procedures - the Unified Soil Classification System (USCS) was used as the basis for the logging of the retrieved cores.
- Sample identification procedures - all sample containers were clearly labelled with a sample number, sample location, sample depth, sample date and sampler's initials. At the end of the day the cores were transferred to a cool box for sample preservation prior to and during shipment to the testing laboratory. Samples collected from each of the cores in the project laboratory were placed in containers of appropriate composition and preservation for the required laboratory analysis.
- Chain of custody information requirements - a chain-of-custody form was completed and forwarded to the testing laboratory with each batch of samples collected.
- Field logs noting the outcomes of field activities, weather and site conditions at the time of sampling were recorded by the diving contractor.

7.1.1 Collection of Field QA/QC Samples

A summary of field quality control samples collected during the course of this sampling program is provided in Table 7-1.

[3] Non dedicated equipment only.

Table 7-1 Field Quality Control Sampling Methods

Sample	Rationale
Intra Laboratory Field Duplicate (Blind)	Comprise a single sample divided into two separate sampling containers. Both samples were sent anonymously to the project laboratory. Blind duplicates provide an indication of the analytical precision of the laboratory, but are inherently influenced by other factors such as sampling techniques and sample media heterogeneity.
Trip Blank	A sample of laboratory supplied de-ionised water which is present throughout the sampling procedure and is analysed as part of the sample batch. One blank sample was submitted as part of the analytical schedule. Field trip blank samples provide an indication of cross contamination from volatile substances during field sampling.
Rinsate Blank	These were prepared by rinsing laboratory supplied deionised water over the sampling equipment. The blank sample was analysed for the identical set of parameters requested for other samples collected from the site. Rinsate blanks provide an indication of the thoroughness of decontamination of sampling equipment.

7.1.2 Evaluation of Field QA/QC

An evaluation of the field quality control procedures (as outlined in Appendix V of the NSW DEC (2006) *Guidelines for the NSW Site Auditor Scheme*) implemented during the course of this sampling program, is provided in Table 7-2.

Table 7-2 Field QA/QC Assessment

Criterion	Comments
QA/QC program includes replicate samples	Intra laboratory duplicate samples were collected and analysed at a rate of not less than 10% for the primary contaminants of concern. Calculation of RPDs for selected parameters, including OCPs, PCBs and TBT, was not possible as corresponding primary / duplicate samples were incorrectly selected for analysis. However, it is noted that concentrations of these parameters were reported below the laboratory PQL or ISQG-low and the absence of RPD data for these parameters is not considered to cast doubt on the integrity of the data set for the purpose of this investigation. RPD results are presented in **Tables A** to **C** (**Appendix C**). Elevated RPDs, exceeding GHD's nominally accepted range of 30% for inorganic and 50% for organic compounds, were reported, in particular duplicate sample pair Q14 / M1-2/2.5-3.0. It is noted that concentrations were generally low and close to the laboratory limit of reporting in both samples and as such, a relatively small rise in concentration gives rise to a large RPD value. Overall, the elevated RPDs are not considered to cast doubt on the integrity of the data set for the purpose of this assessment, or whether assessment criteria were exceeded.
All relevant media assessed	Sediments were collected at the nominated locations specified in the SAP to provide spatial coverage across the three areas and current data to enable trend evaluation. Samples were collected and analysed from different depth profiles throughout the cores, to provide representative data throughout different sediment horizons.

Criterion	Comments
Sample collection, handling and transportation procedures and field QA/QC plan	Dedicated sampling core tubes were used for each location to minimise the risk of cross contamination of sediment samples. Sediment cores were stored under chilled conditions prior to extraction. Following extraction, samples were placed in dedicated sampling containers of appropriate composition provided by the laboratory. Sample jars were stored in a refrigerator on site prior to transport to the project analytical laboratory under chain of custody conditions. Dedicated sampling equipment was used for the extraction and logging of sediment cores (i.e. disposable nitrile gloves and dedicated aluminium trays). The stainless steel mixing bowls used for compositing samples were cleaned between each sample using a mixture of Decon 90 and potable water. Rinsate samples were collected for each bowl at the end of the sampling program to assess the effectiveness of the decontamination procedure. The collection, handling, storage and transport of the samples were undertaken in accordance with the procedures presented in the SAP. The chain of custody forms and the sample receipt notification identified the samples collected, the requested analytes and the date of collection. Logs of each sample were recorded (Appendix D).
Overall Field QA/QC	Appropriate field quality control procedures were maintained throughout the sampling program.

7.2 Laboratory QA/QC

The project laboratories, ALS (primary) and SGS (secondary) adopted their internal procedures and NATA accredited methods in accordance with their quality assurance system.

7.2.1 Laboratory QA/QC Procedures

Laboratory quality control procedures are summarised in Table 7-3.

Table 7-3 Laboratory QA/QC Methods

Method	Comment	Acceptance Limits
Laboratory duplicate sample	The analytical laboratory collects duplicate sub samples from one sample submitted for analytical testing at a rate equivalent to one in twenty samples per analytical batch, or one sample per batch if less than twenty samples are analysed in a batch. A laboratory duplicate provides data on the analytical precision and reproducibility of the test result.	Laboratory duplicate samples should return RPDs within the NEPM acceptance criteria of ±30%.
Matrix spike	An authentic field sample was 'spiked' by adding an aliquot of known concentration of the target analyte(s) prior to sample extraction and analysis. A spike documents the effect of the sample matrix on the extraction and analytical techniques. Spiked samples are analysed for each batch where samples are analysed for organic chemicals of concern.	Percent recovery is used to assess spike samples. Percent recovery should normally range from about 70-130%.

Method	Comment	Acceptance Limits
Laboratory control spike	A reference standard of known (certified) concentration was analysed along with a batch of samples. The Certified Reference Standard (CRS) or Laboratory Control Spike provides an indication of the analytical accuracy and the precision of the test method and is used for inorganic analyses.	Percent recovery is used to assess spike samples.
Surrogate standard / spike	Organic compounds which are similar to the analyte of interest in terms of chemical composition, extractability, and chromatographic conditions (retention time), but which are not normally found in environmental samples. These surrogate compounds were 'spiked' into blanks, standards and samples submitted for organic analyses by gas-chromatographic techniques prior to sample extraction. Surrogate Standard/Spikes provide a means of checking that no gross errors have occurred during any stage of the test method leading to significant analyte loss.	Percent recovery is used to assess spike samples.
Method blank	Usually an organic or aqueous solution that is as free as possible of analytes of interest to which is added all the reagents, in the same volume, as used in the preparation and subsequent analysis of the samples. The reagent blank was carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The reagent blank is used to correct for possible contamination resulting from the preparation or processing of the sample.	Method (laboratory) blanks should return analyte concentrations as 'below PQL.

7.2.2 Evaluation of Laboratory QA/QC Results

Laboratory QA/QC procedures were reviewed by the project analytical laboratory and interpretive quality control reports are presented in Appendix E.

A summary of the evaluation of the laboratory QA/QC program (as outlined in Appendix V of the NSW DEC (2006) *Guidelines for the NSW Site Auditor Scheme*) is provided in Table 7-4.

Table 7-4 Evaluation of Laboratory QA/QC

Criterion	Comments
Appropriate methods used for sample analyses	The primary analytical laboratory was Australian Laboratory Services (ALS) who are NATA accredited (NATA Registration Number 825) for all analyses undertaken. All laboratory reports were NATA stamped and signed by a NATA signatory. Statistical data presented in the laboratory QA / QC reports were considered adequate in demonstrating the precision and accuracy of the methods used to analyse field samples.
Appropriate PQLs	All sediment sample results were reported with PQLs appropriate for the investigation.
Samples analysed within the appropriate holding times.	Extraction for low level OCPs, PCBs and PAH were marginally outside the laboratory holding time (maximum exceedence of 4 days). Samples remained stored under refrigerated conditions at the project laboratory and potential for degradation within this 4 day (maximum) period would be expected to be low. Further, it is noted that all samples reported concentrations significantly below the nominated investigation levels.
Laboratory QA / QC plan	Copies of signed chain of custody forms are presented in Appendix E. With the exception of analyses for low level detections of PAH, OCP and PCBs, all samples were received and analysed within specified laboratory holding times. The analytical methods used were documented on the laboratory reports. Laboratory QC samples included laboratory control samples, internal duplicates, matrix spike and matrix spike duplicates and method blanks. The types of QA/QC samples analysed by the laboratories for the documented samples were considered sufficient to assess the precision and accuracy of the laboratory methods used.
QC Outliers	QC outliers are presented in the laboratory interpretive quality control report provided in Appendix E. Following review of the interpretive quality control reports, and discussion with the laboratories, analytical results were considered acceptable and were not considered to cast doubt on the overall integrity of the data set for the purpose of this validation program.
Overall Laboratory QA / QC	The statistical data presented in the laboratory QA/QC reports were generally considered adequate in demonstrating the precision and accuracy of the methods used to analyse field samples.

8. Results

8.1 Field Observations

Field observations made during sample logging are presented on geotechnical logs in Appendix D. In summary, the following points are noted:

- With the exception of two locations (K1-1 and K1-1A) where refusal was encountered at 1.6 metres and 1.2 metres respectively, vibrocores were generally continued to depths of approximately 4 to 6 metres prior refusal.
- Material generally comprised high plasticity clay (alluvium) underlain by alternating bands of medium to coarse grained sands and clay.
- Visual and olfactory signs of potential contamination were noted in sediments at some locations including:
  - Hydrocarbon odours were reported at depth in several locations including M1-1A (2.8 and 3.4 metres), M2-1 (3.7 metres), W1-3 (5.9 metres) and D3-1 (2.5 to 3 metres).
  - Coal fragments were noted at two locations including W1-2 (5.8 metres) and K1-1 (1.2 metres).
  - Slag fragments were noted at W1-3 (0.5 metres) and W2-1 (2.3 metres).
  - Sulphur odour was noted at 0.5 metres at location D3-3.

8.2 Concentrations of Metals in Sediments

8.2.1 Overview of Metal Concentrations in Sediments

Concentrations of metals in sediments are reported in Table A (Appendix C). A summary of the range of analytical results and calculated 95% UCL average concentrations is provided in Table 8-1.

In summary, the following points are noted:

- Concentrations of arsenic, cadmium, chromium and copper were reported below the applicable SQG-low.
- Concentrations of lead and mercury exceeded the SQG-low at several locations. Concentrations were generally consistent across each of the three investigation areas.
- Concentrations of nickel were reported in excess of the SQG-low in 21 of the 23 samples submitted for analysis. Of these, three samples reported concentrations in excess of the SQG-high, with a maximum concentration of 69 mg/kg reported in surface sediments at sampling location W1-2.
- Concentrations of zinc were reported above the SQG-low in 18 of the 24 primary samples selected for analysis. Of these, eight reported concentrations in excess of the SQG-high, with a maximum concentration of 1170 mg/kg reported in underlying sediment collected from a depth of 3.5 to 4 metres at sampling location M2-1.

Table 8-1 Summary Analytical Results – Metal Concentrations in Sediments

	SQG $_{Low}$	SQG $_{HIGH}$	Minimum	Maximum	95% UCL [(a)]	SD [(b)]
As	20	70	<PQL [(c)]	15	10.5	2.8
Cd	1.5	10	<PQL [(c)]	1	0.56	0.1
Cr	80	370	<PQL [(c)]	74	61.65	16.6
Cu	65	270	<PQL [(c)]	63	56.98	16.3
Pb	50	220	<PQL [(c)]	196	**81.95**	49.76
Hg	0.15	1	<PQL [(c)]	0.4	**0.23**	0.1
Ni	21	52	<PQL [(c)]	69	**54.44**	14.36
Zn	200	410	<PQL [(c)]	1420	**586.8**	349.3
Key						
(a)	95% UCL calculated using ProUCL. Data outputs provided in **Appendix F**					
(b)	Standard Deviation					
(c)	Where concentration reported below the PQL, a value of half the PQL was used to calculate the 95% UCL					
BOLD	95% UCL average concentration exceeds the SQG low					
BOLD	95% UCL average concentration exceeds the SQG high					

Following review of available historical data, concentrations of metals were generally consistent with those reported previously within the south arm of the Hunter River (refer to Table 4-1).

Concentrations of lead and zinc reported during the current sampling program were generally lower than those previously reported. Comparison of the current data with historical data indicates that concentrations of some metals, including lead, mercury, nickel and zinc have historically been reported at elevated concentrations within the south arm of the Hunter River.

An evaluation of concentrations of metals in sediments by area and depth is provided in the following sections.

8.2.2 Metal Concentrations by Area

With the exception of lead, zinc and mercury, concentrations of metals were generally consistent across each of the three investigation areas with no obvious ‘hotspots’ of contamination detected.

Maximum concentrations of lead were generally reported at Mayfield 1 and 2, in particular within the bounds of the proposed M1-berth, where all samples reported concentrations of lead in excess of the SQG-low.

Concentrations of lead within the bounds of the Kooragang and Walsh Point area typically increased towards the southern extent of the area (towards W3), with the maximum concentration of lead for the area reported in sample W3-2 (128 mg/kg).

Elevated concentrations of zinc, exceeding the SQG-high were reported in three main areas:

- M1 berths – five samples reported concentrations of zinc in excess of the SQG-high
- W2/W3 – two samples reported concentrations of zinc in excess of the SQG-high; and
- D3-2 – one sample reported concentration of zinc in excess of the SQG-high.

The distribution of locations reporting elevated concentrations of zinc was consistent with those locations reporting elevated lead and mercury concentrations.

8.2.3 Metal Concentrations by Depth

With the exception of lead, zinc and mercury, concentrations of metals were generally consistent with depth.

No obvious trend in the concentration of lead, zinc or mercury with depth was noted, with concentrations in both surface (0-0.5 metres) and underlying sediments (3.5 to 4 metres) reporting concentrations in excess of the nominated screening levels.

In particular, it is noted that the maximum concentration of zinc (1,170 mg/kg) was reported in deeper sediments collected from a depth of 3.5 to 4 metres at sampling location M2-1.

8.2.4 Elutriate Testing

Four samples reporting elevated concentrations of lead, mercury, nickel and zinc exceeding the nominated SQG were selected for elutriate testing. A sample of seawater from an off-shore location was used for the purpose of the elutriate testing.

It is noted that samples originally collected for geochemical purposes had been disposed of by the laboratory. As such, additional samples collected for geotechnical purposes were used for the analyses. It is noted that the geotechnical samples had not been stored in a refrigerator prior to the analysis and as such the potential for oxidation of the samples cannot be discounted. Concentrations of total metals reported in the geotechnical samples were generally comparable with the samples collected for geochemical analyses and elutriate testing was subsequently undertaken for lead, mercury, nickel and zinc.

Analytical results from the elutriate testing were compared against the ANZECC (2000) marine trigger values for 95% protection of species. The results are summarised as follows:

- Concentrations of mercury, lead and nickel were below the nominated ANZECC trigger values indicating that the metals demonstrate a low propensity to leach into solution.
- Concentrations of zinc were reported at concentrations marginally above the ANZECC trigger value of 15 µg/L in two of the four samples selected for analysis. However, it is noted that elevated concentrations of zinc were reported in the seawater sample (117 µg/L) used for the elutriate testing.

The results of the elutriate testing are summarised in Table 8-2.

Table 8-2 Summary Elutriate Testing Results

	Mercury		Lead		Nickel		Zinc	
	Total mg/kg	Elutriate (µg/L)	Total mg/kg	Elutriate (µg/L)	Total mg/kg	Elutriate (µg/L)	Total mg/kg	Elutriate (µg/L)
SQG $_{low}$	**0.15**	**-**	**50**	**-**	**21**	**-**	**200**	**-**
SQG $_{high}$	**1**	**-**	**220**	**-**	**52**	**-**	**410**	**-**
ANZECC	**-**	**0.4**	**-**	**4.4**		**70**		**15**
W3-2/0.5-0.6	**0.2**	<0.1	**149**	0.6	**63**	4.4	**590**	**22**
D3-4/2-2.2	0.1	-	46	-	**51**	2.9	**375**	7
M1-2/2.6-2.7	**0.3**	<0.1	**207**	<0.2	**45**	2.2	**1570**	**17**
M1-4/2.5-2.6	**0.5**	<0.1	**308**	0.2	**45**	4.3	**2320**	9
Seawater	-	<0.1	-	<0.2	-	1.2	-	**117**

BOLD Concentration exceeds nominated investigation level

8.3 Concentrations of PAH in Sediments

8.3.1 Overview of PAH Concentrations in Sediments

Concentrations of total PAH ranged from below the laboratory PQL to a maximum concentration of 26.5 mg/kg (26,500 µg/kg). The results are summarised in Table B (Appendix C).

In accordance with the requirements of NAGD (2009), all data was normalised to 1% TOC. Concentrations of TOC and normalised PAH results are presented in Table B (Appendix C).

In summary, the following points are noted:

- Concentrations of total PAH (normalised to 1% TOC) ranged from below the laboratory PQL to 8.6 mg/kg.
- The 95% UCL average concentration of total PAH (normalised to 1% TOC) was 3.5 mg/kg.
- All samples reported concentrations of total PAH (normalised to 1% TOC) below the SQG-low of 10 mg/kg.

8.3.2 PAH Concentrations by Area

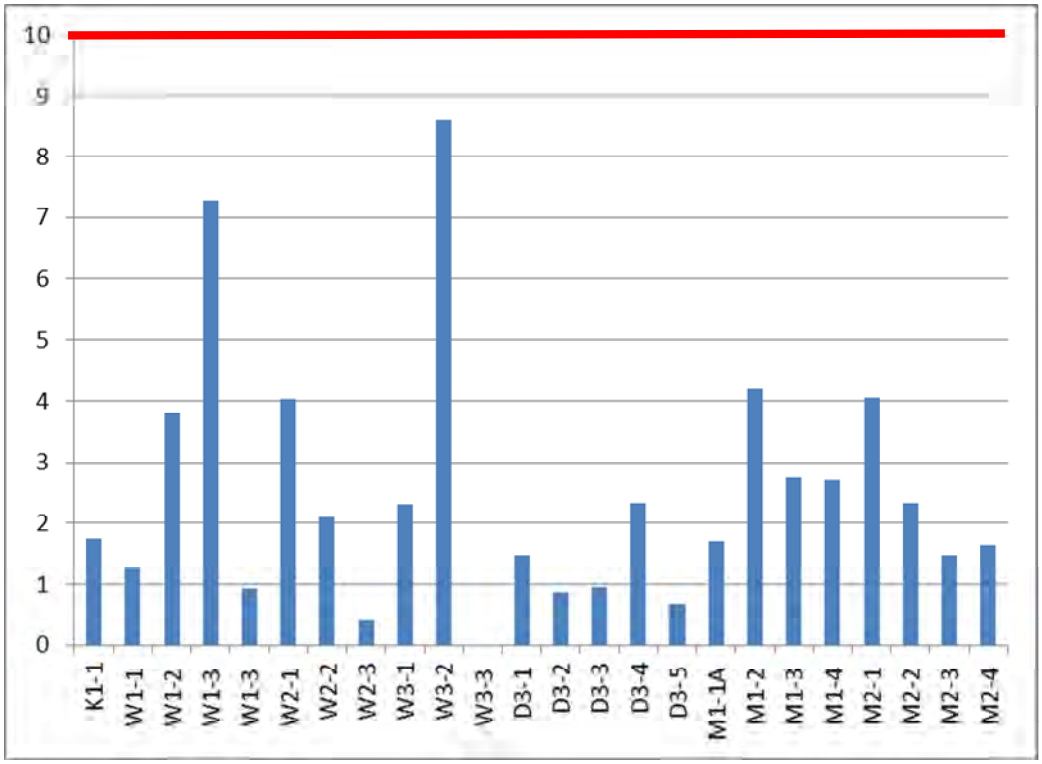
The highest concentrations of total PAH were reported in the vicinity of Walsh Point at locations W1-3 and W3-2. It is noted that concentrations of total PAH were lower than the previously reported PAH concentrations in sediments off Walsh Point (refer to Section 4.2 and 4.3).

The lowest concentrations of PAH in sediments were reported off Dyke Berth 3, with concentrations of total PAH (normalised to 1% TOC) ranging from 0.67 to 2.3 mg/kg).

Concentrations of PAH in sediments within Mayfield 1 and 2 berth sites, located downstream of the former BHPB remediation zone, were low with concentrations of total PAH (normalised to 1% TOC) ranging from 1.5 mg/kg to 4.2 mg/kg.

The distribution of PAH concentrations in sediments (adjusted to 1% TOC) is provided in Chart 2.

Chart 2 Concentrations of Total PAH_{adj} in Sediments



Concentrations reported in mg/kg

8.3.3 PAH Concentrations by Depth

The highest concentrations of total PAH were generally reported in surface samples collected from a depth of 0-0.5 metres.

A summary of the range of concentrations of total PAH and PAH normalised to 1% TOC (PAH_{adj}) reported across the sediment profile, is provided in Table 8-3.

Table 8-3 Summary Historical Data – PAH Concentrations

Depth Range	Number of samples	Concentration Range Total PAH (mg/kg)	Concentration Range Total PAH_{adj} (mg/kg)
0-0.5 m	8	0.6 to 26.5	0.6 to 8.6
0.5-1 m	3	1.7 to 3.6	0.9 to 1.6
1.5 – 2m	4	2.2 to 5.7	1.3 to 2.7

Depth Range	Number of samples	Concentration Range Total PAH (mg/kg)	Concentration Range Total PAH_{adj} (mg/kg)
2.5 – 3m	4	2.6 to 9.5	1.5 to 4.2
3.5 – 4m	1	9.5	4
4.5-5 m	4	<PQL to 0.9	<PQL to 1.5

8.4 Concentrations of TPH and BTEX in Sediments

Concentrations of volatile TPH in the fraction C_6-C_9 and BTEX were reported below the laboratory PQL in all samples selected for analysis.

With the exception of sample W3-2/0-0.5, all samples reported concentrations of TPH in the fraction C_{10}-C_{36} below the laboratory PQL. Sediment sample W3-2/0-0.5 reported a concentration of TPH in the fraction C_{10}-C_{36} of 560 mg/kg, primarily associated with heavier fraction hydrocarbons with carbon chain length of C_{15}-C_{28} and C_{29}-C_{36}.

For the purpose of comparison against the nominated sediment investigation levels, the data was normalised to 1% TOC resulting in a concentration of TPH in the fraction C_{10}-C_{36} (normalised to 1% TOC) of 187 mg/kg, which is below the SQG –low of 550 mg/kg.

It is noted that sediment samples collected from cores where hydrocarbon odours were reported (refer to Section 8.1) were all selected for analysis. Concentrations of TPH were reported below the practical quantitation limit

8.5 Concentrations of Other Organics in Sediments

Concentrations of OCPs, PCBs and Phenols were reported below the laboratory PQL in all samples submitted for analysis.

Six primary samples, selected to represent a range of depths and areas, were selected for analysis for TBT. Samples W2-1/0-0.5 and D3-3/0.5-1 reported concentrations of 3 µg Sn/kg and 2.8 µg Sn/kg of TBT respectively. Both samples reported concentrations of TBT (normalised to 1% TOC) of less than the SQG-low. Remaining samples reported concentrations below the laboratory PQL.

9. Discussion of Results

A summary of the key findings of the investigation is provided in Table 9-1.

Table 9-1 Summary Key Findings

Issue	Discussion of Results
Metal concentrations in sediments	Concentrations of some metals, including mercury, lead, nickel and zinc, were reported at concentrations exceeding the sediment quality guidelines (SQG) at several locations. Concentrations were generally consistent across each of the three investigation areas. Concentrations of metals in sediments were generally consistent with those reported previously within the South Arm of the Hunter River. Selected samples were submitted for elutriate testing for lead, mercury, nickel and zinc to assess potential impacts to water quality owing to the presence of elevated concentrations of metals in sediments. The analytical results were compared against the ANZECC/ARMCANZ (2000) marine water quality trigger values for 95 per cent protection. Additionally, previous elutriate testing has been completed by CSIRO (2001). Available data indicates that effects on organisms on the water column, associated with the presence of elevated concentrations of metals in sediments, would not be expected during disposal.
PAH concentrations in sediments	Concentrations of PAH in sediments were reported below the SQG in all samples submitted for analysis. It is noted that the PAH hotspot, previously identified in the vicinity of proposed berth site W2 was not identified during the current sediment sampling program and concentrations of PAH in sediments off Walsh Point were all reported below the SQG-low. It is however noted that evidence of slag and coal fragments were reported at three locations off Walsh Point and the potential for PAH impact in surrounding sediments cannot be discounted.
Hydrocarbon concentrations in sediments	Concentrations of hydrocarbons in sediments were low and below the practical quantitation limit (PQL) of the laboratory in most samples submitted for analysis. TPH in the fraction C10-C36 was reported in one surface sample (0-0.5m) collected from W3-2 at a concentration of 187 mg/kg, which is below the SQG of 550 mg/kg. Concentrations of volatile TPH and BTEX were reported below the laboratory PQL in all samples selected for analysis. Hydrocarbon odours were noted in sediments at three locations however it is noted that subsequent analyses of samples from these locations reported concentrations of TPH and BTEX below the laboratory PQL.
Other organic compounds in sediments	Concentrations of OCPs, PCBs and phenols were reported below the laboratory PQL in all samples submitted for analysis. Consistent with previous investigations, concentrations of TBT in sediments selected for analysis were low or below the laboratory PQL. No samples reported concentrations of TBT exceeding the SQG.

Issue	Discussion of Results
Bioavailability Testing	Bioavailability testing was not undertaken as part of the current investigation. However, it is noted that toxicity testing has been undertaken previously by CSIRO as part of the South Arm Dredging EIS process. The initial CSIRO toxicity investigations demonstrated that the contaminants of concern in the South Arm of the Hunter River were most likely to be PAHs and toxicity of the sediments was found to correlate reasonably well with total PAH concentrations. The extent of maximum PAH impact was delineated and identified as the Primary and Secondary Remediation Zones. These areas were subsequently remediated and validated. Further, it is noted that concentrations of PAH in sediments were reported below the SQG-low in all samples submitted for analysis as part of the current investigation.
Suitability of material for ocean disposal	Based on the results of the current sediment sampling program, the material would be considered suitable, from a contamination perspective, for unconfined ocean disposal. Previous investigations estimated the extent of the PAH hotspot off Walsh Point to comprised approximately 30,000 m^3 of impacted material which would not be considered suitable for unconfined ocean disposal. It is noted that this area has not been fully delineated and would require further investigation by the proponent(s) as part of any future berth development.
Waste Classification	Sediment analytical results reported during the recent sediment sampling program were compared against the threshold concentrations reported in NSW DECC (2009) *Waste Classification Guidelines Part 1: Classifying Waste*. Concentrations of lead and nickel were reported in excess of the contaminant threshold for general solid waste. Selected samples reporting elevated concentrations were selected for toxicity characteristic leaching potential extraction and analysis for lead and nickel. The results were reported below the threshold concentrations for general solid waste. All other contaminants of potential concern reported concentrations below the threshold concentrations for general solid waste. Based on the available data, the results indicate that sediments would be suitable for on-shore disposal as **General Solid Waste**.

10. Limitations

This Report:

- has been prepared by GHD Pty Ltd ("GHD") for Newcastle Port Corporation;
- may only be used and relied on by Newcastle Port Corporation and the Department of Sustainability, Environment, Water, Population and Communities;
- may only be used for the purpose of sediment sampling and analysis as specified in the Report (and must not be used for any other purpose).

This report was produced specifically for NCP for the purposes of this commission. No warranties, expressed or implied, are offered to any third parties and no liability will be accepted for use of this report by any third party. The services undertaken by GHD in connection with preparing this Report were limited to those specifically detailed in the Report. GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the qualifications being incorrect. The work conducted by GHD under this commission has been to the standard that would normally be expected of professional environmental consulting firm practising in this field in the State of New South Wales.

The must be reviewed by a competent and appropriate Environmental Scientist or Engineer, experienced in sediment assessments, before being used for any other purposes. GHD accepts no responsibility for other use of the data. It should be noted, that in gathering information for the study, GHD relied on third party information, on site records, and on a single visual inspection of the site, which may not have been independently verified. Where laboratory tests and similar work have been performed and recorded by others the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

The advice tendered in this report is based on information obtained from sample collection at discrete locations across the site and may not fully represent the conditions that may be encountered across the site at other than these locations. It is emphasised that the actual characteristics of the sub-surface and surface materials may vary significantly between adjacent test points and sample intervals and at locations other than where observations, explorations and investigations have been made. Sub-surface conditions and contaminant concentrations can change in a limited time. This should be borne in mind when assessing the data. It should be noted that because of the inherent uncertainties in the sub-surface evaluations, changed or unanticipated sub-surface conditions may occur that could affect the opinions GHD has expressed, which may need to be re-examined and changed. GHD does not accept responsibility for the consequences of significant variations in the conditions.

An understanding of the site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure-specific and some experienced based. Hence this report must be read in full and should not be altered, amended or abbreviated, issued in part or issued incomplete in any way without prior checking and approval by GHD.

Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation (September 2012). GHD expressly disclaims responsibility for any changes that may occur after this time.

11. References

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GHD Pty Ltd (2003) *Environmental Impact Statement.*

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OSPAR (2009) *Update of JAMP guidelines for monitoring contaminants in sediment: Technical annex on normalisation of contaminant concentrations in sediment.*

AMPS (2004) *Discussion document on Sediment Monitoring Guidance for the EU Water Framework Directive, Version 2* May 2004.

Appendix A

Figures

Figure 1: Site Locality

Figure 2: Berth Site Identification

Figure 3: Sampling Locations

LEGEND

- Berth Locations
- Study Area Locality
- Watercourse

1:75,000 (at A4)

0 250500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

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Newcastle Port Corporation
Capital Strategic Dredging Project

Job Number 22-15683
Revision 0
Date 10 SEP 2012

Project Location

Figure 1

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

G:\22\15683\GIS\Maps\Deliverables\Environmental Assessment\Appendix D - Geochem\2215683_G001_Locality_0.mxd

Data Source: LPMA: DTDB - 2007, Imagery - 2007. Created by: gmcdiarmid, fmackay, mabarnier

LEGEND

- Berth Locations
- BHPB Site
- Land to be Excavated
- Primary Remediation Zone
- Secondary Remediation Zone
- Approximate Location of PAH Hotspot

1:15,000 (at A4)

0 55 110 220 330 440

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

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Newcastle Port Corporation
Capital Strategic Dredging Project

Areas of Potential Environmental Concern

Figure 2

Job Number	22-15683
Revision	0
Date	10 Sep 2012

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com.au **W** www.ghd.com.au

G:\22\15683\GIS\Maps\Deliverables\Environmental Assessment\Appendix D - Geochem\2215683_G002_AreasOfConcern_0.mxd

Data Source: LPMA: DTDB - 2007, Imagery - 2007. Created by: gmcdiarmid, fmackay

Sample ID	Easting (MGA56)	Northing (MGA56)
D3-1	385,106	6,357,995
D3-2	385,096	6,358,064
D3-3	385,099	6,358,117
D3-4	385,082	6,358,189
D3-5	385,081	6,358,251
M1-1	384,967	6,359,141
M1-2	384,965	6,359,213
M1-3	384,950	6,359,274
M1-4	384,936	6,359,312
M2-1	384,907	6,359,407
M2-2	384,891	6,359,465
M2-3	384,884	6,359,532
M2-4	384,836	6,359,599
W1-1	385,293	6,358,897
W1-2	385,287	6,359,026
W1-3	385,279	6,359,095
W2-1	385,290	6,359,154
W2-2	385,263	6,359,215
W2-3	385,255	6,359,280
W3-1	385,259	6,359,369
W3-2	385,251	6,359,433
W3-3	385,225	6,359,482
K1-1	385,241	6,359,578
K1-2	385,248	6,359,670

Note: The final sampling locations may be subject to some change pending site conditions encountered during sampling.

LEGEND

- Sediment Sampling Locations
- Berth Locations

1:10,000 (at A4)

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

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Newcastle Port Corporation
Capital Strategic Dredging Project

Job Number 22-15683
Revision 0
Date 10 Sep 2012

Sediment Sampling Locations

Figure 3

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com.au **W** www.ghd.com.au

G:\22\15683\GIS\Maps\Deliverables\Environmental Assessment\Appendix D - Geochem\2215683_G003_ProposedSampleLocations_0.mxd

Data Source: LPMA: DTDB - 2007, Imagery - 2007. Created by: gmcdiarmid, fmackay

Appendix B

Previous Investigations

Appendix B Overview of Previous investigations

Investigation	Testing and Analyses	Purpose
Patterson Britton & Partners 2000, *South Arm vibrocoring*	Chemical analysis of sediment samples	Broad sampling to assess contamination levels of sediment throughout the South Arm of the Hunter River
GHD-Longmac 2001, *South Arm vibrocoring*	Chemical analysis of sediment samples from cores together with toxicity testing by CSIRO of selected samples. CSIRO toxicity testing documented in report titled "*Chemical and Ecotoxicological Testing of Dredged Sediment from Newcastle Harbour: South Arm Master Plan Dredge Area*" (CSIRO June, 2001)	Assessment of sediment contamination levels and toxicity within the South Arm Dredging EIS study area with a view to establish contamination levels acceptable for unconfined sea disposal
GHD-Longmac 2001, *MPT Stage 2/K7 vibrocoring*	Chemical analysis of sediment samples from cores together with toxicity testing by CSIRO of selected samples. CSIRO toxicity testing documented in report titled "*Chemical and Ecotoxicological Testing of Dredged Sediment from Newcastle Harbour: MPT Stage 2/K7 Area*" (CSIRO, June 2001)	Assessment of sediment contamination levels and toxicity within the MPT Stage 2/K7 Area with a view to establish contamination levels acceptable for unconfined sea disposal
Patterson Britton & Partners 2001, *Surface sampling adjacent to BHP former site*	Chemical and toxicity testing of sediment by CSIRO. CSIRO toxicity testing documented in report titled "*Relationship Between Chemical Contaminants and Ecotoxicological Effects for Dredged Newcastle Harbour Sediments*" (CSIRO, October 2001)	Collection of samples for toxicity testing to more accurately identify the toxicity causing contaminants and determine the levels of contaminants which could be tolerated by organisms, thereby deeming the sediments suitable for unconfined sea disposal
Patterson Britton & Partners 2002, *Surface sampling adjacent to BHP former site*	Chemical and toxicity testing of sediment by CSIRO. CSIRO toxicity testing documented in report titled "*Relationship Between PAHs and Ecotoxicological Effects on Algae, Amphipods and Bivalves for Newcastle Harbour Sediments*" (CSIRO, Draft December 2002)	Algae, amphipod and bivalve toxicity testing of ten samples to better confirm the relationship between total PAH concentrations in the sediments and toxicity. This sampling and testing exercise was based on the recommendations from a "scientific group" meeting held on 12.04.02 including representatives from EPA, CSIRO, EA, NPC, GHD & PBP.
GHD-Longmac Dec 02/Jan 03, *Vibrocoring adjacent to BHP former site*	Physical and chemical testing of sediment	Sampling and testing to refine the spatial extent and volume of material previously identified as potentially unsuitable for unconfined sea disposal. This sampling and testing exercise was based on the recommendations from a "scientific group" meeting held on 02.12.02 including representatives from EPA, CSIRO, EA, NPC, GHD & PBP.

Investigation	Testing and Analyses	Purpose
Patterson Britton & Partners & GHD-Longmac January 2003, *Bulk sampling of sediments adjacent the former BHP steelworks site*	Various testing including: chemical; physical; odour; dewatering; return water quality; and, toxicity testing.	Bulk sampling for bench testing of proposed removal and treatment processes for contaminated sediments (in particular odour and return water quality)
Patterson Britton & Partners January 2003, *Vibrocoring along southern bank of South Arm of Hunter River*	Physical and chemical testing of sediment	Broad sampling to assess contamination levels of sediment along southern bank of the South Arm of the Hunter River
Patterson Britton & Partners May 2003, *Benthic sediment and macroinvertebrate sampling in the proposed offshore dump ground*	Macroinvertebrate sampling, identification and statistical analysis, accompanied by sediment textural analysis	To aid in characterising the proposed dump ground both biologically and physically
Douglas Partners 2006, *Kooragang Berths K7 boreholes for Port Waratah Coal Services*	Physical and chemical testing of sediment	To provide additional current sediment quality data for the PWCS dredge footprint to confirm the material is suitable for unconfined sea disposal
Connell Hatch 2006 *Kooragang Berths K8 and K9 boreholes for NCIG*	Physical and chemical testing of sediment	To provide additional current sediment quality data for the NCIG dredge footprint to confirm the material is suitable for unconfined sea disposal
URS 2004, *Estimation of the Volume of Contaminated Sediments in the South Arm of the Hunter River*	Contamination dataset modelling	Application of kriging methodology to the existing data set (~700 samples) to determine the lateral and vertical extent of contamination in the Hunter River and propose a remediation area
URS 2004, *Vibrocoring for assessment of depth of contamination and collection of bulk material for bench scale treatment trials, South Arm Hunter River*	Benthic community sampling, sediment chemistry and ecotoxicity testing and weighted risk assessment	To assess the risk to human health associated with direct contact with sediment or consumption of biota; and to assess the risk to the benthic community from contaminated sediment adjacent to the closure area and the OneSteel site
URS 2006, *Vibrocoring to assess the depth and extent of sediment contamination, investigation area 2, South Arm Hunter River*	Physical and chemical testing of sediment	Determine the depth of PAH contamination, if present, in Investigation Area 2

Investigation	Testing and Analyses	Purpose
URS 2006 *Kriging estimate of the volume of contaminated sediment in the South Arm of the Hunter River*	Contaminated dataset modelling	Application of the kriging methodology (incorporating December 2004 and April 2006 vibrocoring investigations) to redefine the lateral and vertical distribution of PAH contamination in the Hunter River and propose a new remediation area
URS 2006, *Assessment of the depth and extent of PAH sediment contamination in the South Arm of the Hunter River*	Physical and chemical testing of sediment	Determine the vertical extent of contamination within previously defined remediation areas and determine the lateral and vertical extent and volume of contamination beyond those areas
URS 2007, *Final definition of sediments in the South Arm of the Hunter River beyond the Primary Remediation Zone*	Physical and chemical testing of sediment and contamination dataset modelling	Definition of the SRZ boundary and delineation of sediments in the SRZ requiring onshore remediation
URS 2008 *Hunter River South Arm – additional sediment coring in the PRZ*	Physical and chemical testing of sediments	Further define the spatial distribution and concentration of sediment contamination in the PRZ
CH2MHill 2010 *Hunter River South Arm – Nearshore sediment validation*	Physical and chemical testing of sediments	Validation of sediments following the removal of contaminated sediments from the SRZ
GHD 2011(a) *Hunter River Remediation Project, Interim Validation Report – Surgical Dredging Area*	Physical and chemical testing of sediments	Validation of sediments following the removal of contaminated sediments from the SDA
GHD 2011(b) *Hunter River Remediation Project, Interim Validation Report – Zone 1*	Physical and chemical testing of sediments	Validation of sediments following the removal of contaminated sediments from Zone 1 of the PRZ
GHD 2011(c) *Hunter River Remediation Project, Interim Validation Report – Zones 2-6*	Physical and chemical testing of sediments	Validation of sediments following the removal of contaminated sediments from Zones 2 to 6 of the PRZ

Appendix C

Summary Analytical Results

Table A: Summary Analytical Results - Metal and Cyanide Concentrations
Newcastle Ports Corporation
South Arm Hunter River - Sediment Sampling Data
2215683

				Metals								Cyanide
Sampling Location	Sampling Depth	Sample Date	Moisture Content	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	Mercury	Total Cyanide
Units			%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
SQG LOW (NAGD 2009)			-	20	1.5	80	65	50	21	200	0.15	-
SQG HIGH (NAGD 2009)			-	70	10	370	270	220	52	410	1	-
Laboratory PQL			1	5	1	2	5	5	2	5	0.1	1
Kooragang and Walsh Point												
K1-1	0.0-0.5	16/05/11	21.8	<5	<1	6	<5	<5	5	25	<0.1	<1
W1-1	1.5-2.0	14/05/11	48.0	6	<1	49	38	13	**50**	84	<0.1	<1
W1-2	0.0-0.5	16/05/11	48.4	7	<1	74	52	46	**69**	**303**	<0.1	<1
W1-3	0.0-0.5	14/05/11	40.8	8	<1	40	49	**86**	**34**	**375**	**0.2**	<1
W1-3	5.5-5.6	14/05/11	33.6	-	-	-	-	-	-	-	-	-
W2-1	0.0-0.5	16/05/11	47.1	9	<1	50	46	**89**	**39**	**442**	**0.2**	<1
W2-2	0.0-0.5	14/05/11	49.0	10	<1	49	45	41	**42**	**273**	0.1	<1
W2-3	4.5-5.0	16/05/11	36.9	8	<1	48	34	15	**44**	63	<0.1	<1
W3-1	1.5-2.0	14/05/11	42.9	8	<1	62	44	**50**	**59**	**305**	0.1	2
W3-2	0.0-0.5	16/05/11	43.8	12	<1	56	60	**128**	**43**	**543**	**0.3**	<1
W3-3	4.5-5.0	16/05/11	18.0	<5	<1	<2	<5	<5	<2	<5	<0.1	<1
Dyke Berth 3												
D3-1	2.5-3.0	17/05/11	40.5	8	<1	45	34	37	**42**	**302**	0.1	<1
D3-2	0.5-1.0	17/05/11	48.8	10	<1	46	55	**64**	**40**	**310**	**0.2**	<1
D3-3	0.5-1.0	17/05/11	48.2	10	<1	49	54	**81**	**43**	**332**	<0.1	<1
D3-4	2.5-3.0	17/05/11	46.7	11	<1	49	43	**106**	**43**	**790**	**0.2**	3
D3-5	0.0-0.5	17/05/11	48.9	9	<1	43	63	30	**37**	**239**	<0.1	<1
Mayfield 1 and 2												
M1-1A	2.5-3.0	17/05/11	43.4	10	<1	50	42	**72**	**43**	**430**	0.1	2
M1-2	2.5-3.0	17/05/11	47.7	12	1	52	52	**196**	**42**	**1430**	**0.3**	8
M1-3	1.5-2.0	17/05/11	47.2	9	<1	56	45	**74**	**47**	**459**	**0.2**	2
M1-4	1.5-2.0	16/05/11	51.8	9	<1	60	49	**101**	**53**	**704**	**0.4**	4
M2-1	3.5-4.0	17/05/11	44.4	11	<1	57	56	**156**	**48**	**1170**	**0.2**	6
M2-2	0.0-0.5	16/05/11	59.7	10	<1	50	42	34	**45**	**246**	<0.1	<1
M2-3	4.5-4.6	16/05/11	23.0	15	<1	21	12	11	**34**	43	<0.1	<1
M2-4	0.5-1.0	14/05/11	56.7	11	<1	57	50	40	**49**	**285**	<0.1	<1

BOLD	Concentration exceeds ISQG Low (NAGD 2009)
BOLD	Concentration exceeds ISQG High (NAGD 2009)

FIELD DUPLICATE SAMPLES - RELATIVE PERCENT DIFFERENCE CALCULATIONS												
Q03	Duplicate	16/05/11	47.8	8	<1	86	56	52	79	348	<0.1	<1
W1-2/0.0-0.5	Primary	16/05/11	48.4	7	<1	74	52	46	69	303	<0.1	<1
		RPD	1.2	13.3	NC	15.0	7.4	12.2	13.5	13.8	NC	NC
Q12	Duplicate	17/05/11	47.3	11	<1	58	55	72	47	326	<0.1	<1
D3-3/0.5-1.0	Primary	17/05/11	48.2	10	<1	49	54	81	43	332	<0.1	<1
		RPD	1.9	9.5	NC	16.8	1.8	11.8	8.9	1.8	NC	NC
Q14	Duplicate	17/05/11	48.2	11	*0.5*	58	52	58	43	363	*0.5*	*0.5*
M1-2/2.5-3.0	Primary	17/05/11	47.7	12	1	52	52	196	42	1430	0.3	8
		RPD	1.0	8.7	***66.7***	10.9	0.0	**108.7**	2.4	**119.0**	***50.0***	***176.5***

BOLD	RPD exceeds GHDs nominally accepted range of 30$ for inorganic compounds
	Concentration reported above the laboratory PQL in one sample and below the PQL in the other.
Italic	A value of half the PQL has been used to calculate the RPD

Table B: Summary Analytical Results - PAH, TPH and BTEX Concentrations
Newcastle Ports Corporation
South Arm Hunter River - Sediment Sampling Data
2215683

				TOC	Polycyclic Aromatic Hydrocarbons																		Total Petroleum Hydrocarbons						BTEX				
Sampling Location	Sampling Depth	Sample Date	Moisture Content	Total Organic Carbon	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	Sum of polycyclic aromatic hydrocarbons	Total PAH Normalised to 1% TOC	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	TPH C10-C36 Normalised to 1% TOC	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene
Units			%	%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
SQG LOW (NAGD 2009)			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10000	-	-	-	-	-	550	-	-	-	-	-
SQG HIGH (NAGD 2009)			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50000	-	-	-	-	-	-	-	-	-	-	-
Laboratory PQL			1	0.02	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	10	50	100	100	50	50	0.2	0.5	0.5	0.5	0.5
Kooragang and Walsh Point																																	
K1-1	0.0-0.5	16/05/11	21.8	0.35	109	21	17	11	43	18	60	58	35	27	44	14	43	21	6	26	607	1734.3	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
W1-1	1.5-2.0	14/05/11	48.0	1.78	20	51	8	19	102	78	245	236	135	92	106	69	147	136	48	144	2240	1258.4	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
W1-2	0.0-0.5	16/05/11	48.4	1.94	114	139	24	56	504	172	1010	994	454	372	614	281	663	333	62	466	7350	3788.7	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
W1-3	0.0-0.5	14/05/11	40.8	3.64	480	1320	273	344	3340	2070	3430	3320	1540	1240	1770	1170	1890	795	534	1010	26500	7280.2	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
W1-3	5.5-5.6	14/05/11	33.6	-	22	20	13	15	66	21	86	89	48	39	51	18	57	53	19	52	933	933.0	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
W2-1	0.0-0.5	16/05/11	47.1	3.08	404	320	109	173	1170	496	1500	1340	854	684	1110	597	1110	566	147	698	12400	4026.0	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
W2-2	0.0-0.5	14/05/11	49.0	2.96	514	148	113	73	332	184	724	676	447	315	608	252	568	271	63	350	6240	2108.1	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
W2-3	4.5-5.0	16/05/11	36.9	1.65	7	11	<4	6	18	10	45	43	27	16	21	10	24	21	10	24	661	400.6	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
W3-1	1.5-2.0	14/05/11	42.9	1.89	198	126	29	40	247	139	523	564	252	219	382	174	390	182	38	252	4370	2312.2	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
W3-2	0.0-0.5	16/05/11	43.8	2.99	596	600	195	187	1500	944	3060	2810	2510	1450	2830	914	2730	1070	237	1420	25700	8595.3	<10	<50	330	230	560	187.291	<0.2	<0.5	<0.5	<0.5	<0.5
W3-3	4.5-5.0	16/05/11	18.0	0.08	<5	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	ND	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
Dyke Berth 3																																	
D3-1	2.5-3.0	17/05/11	40.5	1.77	216	50	32	34	145	74	102	253	163	96	194	85	132	80	<4	97	2600	1468.9	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
D3-2	0.5-1.0	17/05/11	48.8	1.94	97	30	24	17	102	39	212	218	124	101	134	63	139	77	24	93	1660	855.7	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
D3-3	0.5-1.0	17/05/11	48.2	2.08	144	36	40	26	139	51	262	256	131	109	155	62	149	83	27	102	1980	951.9	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
D3-4	2.5-3.0	17/05/11	46.7	1.91	219	125	37	39	219	136	510	555	245	189	339	191	353	192	52	247	4440	2324.6	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
D3-5	0.0-0.5	17/05/11	48.9	2.40	226	30	45	29	119	44	197	191	101	69	105	49	103	56	10	71	1610	670.8	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
Mayfield 1 and 2																																	
M1-1A	2.5-3.0	17/05/11	43.4	2.08	155	76	39	34	178	84	367	392	197	169	294	137	269	147	40	182	3560	1711.5	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
M1-2	2.5-3.0	17/05/11	47.7	2.27	292	297	127	68	461	211	1100	1380	594	423	936	422	869	476	103	670	9510	4189.4	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
M1-3	1.5-2.0	17/05/11	47.2	2.07	245	117	56	50	294	141	621	699	349	263	452	224	472	240	65	356	5680	2744.0	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
M1-4	1.5-2.0	16/05/11	51.8	2.19	379	142	72	56	303	153	601	706	376	212	485	237	425	174	38	259	5920	2703.2	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
M2-1	3.5-4.0	17/05/11	44.4	2.34	573	266	120	118	557	311	1050	1160	612	428	811	356	708	291	71	425	9490	4055.6	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
M2-2	0.0-0.5	16/05/11	59.7	2.23	977	130	209	127	466	182	569	512	229	197	284	161	291	158	46	198	5210	2336.3	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
M2-3	4.5-4.6	16/05/11	23.0	0.09	12	5	<4	<4	8	<4	14	20	10	6	15	6	12	5	<4	7	133	1477.8	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
M2-4	0.5-1.0	14/05/11	56.7	2.19	740	63	147	79	251	100	319	282	150	116	142	62	190	197	68	210	3590	1639.3	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5

BOLD	Concentration exceeds ISQG Low (NAGD 2009)
BOLD	Concentration exceeds ISQG High (NAGD 2009)

FIELD DUPLICATE SAMPLES - RELATIVE PERCENT DIFFERENCE CALCULATIONS																																	
Q03		16/05/11	47.8	1.99	99	142	26	67	609	234	1060	977	525	420	679	329	723	351	68	482	7900	3969.8	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
W1-2/0.0-0.5		16/05/11	47.1	3.08	404	320	109	173	1170	496	1500	1340	854	684	1110	597	1110	566	147	698	12400	4026.0	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
		RPD	1.5	43.0	**121.3**	**77.1**	**123.0**	**88.3**	**63.1**	**71.8**	34.4	31.3	47.7	47.8	48.2	**57.9**	42.2	46.9	**73.5**	36.6	44.3	1.4	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Q12		17/05/11	47.3	2.19	188	34	37	26	135	60	250	228	137	100	156	95	154	70	17	100	1960	895.0	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
D3-3/0.5-1.0		17/05/11	48.2	2.08	144	36	40	26	139	51	262	256	131	109	155	62	149	83	27	102	1980	951.9	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
		RPD	1.9	5.2	26.5	5.7	7.8	0.0	2.9	16.2	4.7	11.6	4.5	8.6	0.6	42.0	3.3	17.0	45.5	2.0	1.0	6.2	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Q14		17/05/11	48.2	2.93	736	72	131	78	332	120	532	485	285	240	374	215	358	174	42	244	4880	1665.5	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
M1-2/2.5-3.0		17/05/11	47.7	2.27	292	297	127	68	461	211	1100	1380	594	423	936	422	869	476	103	670	9510	4189.4	<10	<50	<100	<100	<50	ND	<0.2	<0.5	<0.5	<0.5	<0.5
		RPD	1.0	25.4	**86.4**	**122.0**	3.1	13.7	32.5	**55.0**	**69.6**	**96.0**	**70.3**	**55.2**	**85.8**	**65.0**	**83.3**	**92.9**	**84.1**	**93.2**	**64.4**	**86.2**	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table C: Summary Analytical Results - PCBs, OCPs, Phenols and TBT
Newcastle Ports Corporation
South Arm Hunter River - Sediment Sampling Data
2215683

				TOC	PCBs	OCPs									Phenols	TBT	
Sampling Location	Sampling Depth	Sample Date	Moisture Content	Total Organic Carbon	Total PCBs	Heptachlor	Aldrin	Chlordane	Dieldrin	4.4`-DDE	Endrin	4.4`-DDD	4.4`-DDT	Total OCPs	Total Phenols	Tributyltin	Tributylton Normalised to 1% TOC
Units			%	%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg	µgSn/kg	µgSn/kg
SQG LOW (NAGD 2009)			-	-	23	-	-	0.5	280	2.2	10	2	1.6	-	-	-	9
SQG HIGH (NAGD 2009)			-	-	-	-	-	6	620	27	220	20	46	-	-	-	70
Laboratory PQL			1	0.02	5	0.5	0.5	0.25	0.5	0.5	0.5	0.5	0.5		2	0.5	
Kooragang and Walsh Point																	
K1-1	0.0-0.5	16/05/11	21.8	0.35	<5.0	<0.50	<0.50	<0.25	<0.50	<0.50	<0.50	<0.50	<0.50	ND	<0.5	<0.5	ND
W1-1	1.5-2.0	14/05/11	48.0	1.78	<5.0	<0.50	<0.50	<0.25	<0.50	<0.50	<0.50	<0.50	<0.50	ND	<0.5	<0.5	ND
W1-2	0.0-0.5	16/05/11	48.4	1.94	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
W1-3	0.0-0.5	14/05/11	40.8	3.64	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
W1-3	5.5-5.6	14/05/11	33.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
W2-1	0.0-0.5	16/05/11	47.1	3.08	<5.0	<0.50	<0.50	<0.25	<0.50	<0.50	<0.50	<0.50	<0.50	ND	<0.5	3.0	0.97
W2-2	0.0-0.5	14/05/11	49.0	2.96	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
W2-3	4.5-5.0	16/05/11	36.9	1.65	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
W3-1	1.5-2.0	14/05/11	42.9	1.89	<5.0	<0.50	<0.50	<0.25	<0.50	<0.50	<0.50	<0.50	<0.50	ND	<0.5	<0.5	ND
W3-2	0.0-0.5	16/05/11	43.8	2.99	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
W3-3	4.5-5.0	16/05/11	18.0	0.08	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
Dyke Berth 3																	
D3-1	2.5-3.0	17/05/11	40.5	1.77	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
D3-2	0.5-1.0	17/05/11	48.8	1.94	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
D3-3	0.5-1.0	17/05/11	48.2	2.08	<5.0	<0.50	<0.50	<0.25	<0.50	<0.50	<0.50	<0.50	<0.50	ND	<0.5	2.8	1.35
D3-4	2.5-3.0	17/05/11	46.7	1.91	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
D3-5	0.0-0.5	17/05/11	48.9	2.40	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
Mayfield 1 and 2																	
M1-1A	2.5-3.0	17/05/11	43.4	2.08	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
M1-2	2.5-3.0	17/05/11	47.7	2.27	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
M1-3	1.5-2.0	17/05/11	47.2	2.07	<5.0	<0.50	<0.50	<0.25	<0.50	<0.50	<0.50	<0.50	<0.50	ND	<0.5	<0.5	ND
M1-4	1.5-2.0	16/05/11	51.8	2.19	-	-	-	-	-	-	-	-	-	-	<0.8	-	-
M2-1	3.5-4.0	17/05/11	44.4	2.34	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
M2-2	0.0-0.5	16/05/11	59.7	2.23	-	-	-	-	-	-	-	-	-	-	<0.8	-	-
M2-3	4.5-4.6	16/05/11	23.0	0.09	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
M2-4	0.5-1.0	14/05/11	56.7	2.19	-	-	-	-	-	-	-	-	-	-	<0.8	-	-

BOLD	Concentration exceeds ISQG Low (NAGD 2009)
BOLD	Concentration exceeds ISQG High (NAGD 2009)

FIELD DUPLICATE SAMPLES - RELATIVE PERCENT DIFFERENCE CALCULATIONS																	
Q03	Duplicate	16/05/11	47.8	1.99	<5.0	<0.50	<0.50	<0.25	<0.50	<0.50	<0.50	<0.50	<0.50	ND	<0.5	<0.5	ND
W1-2/0.0-0.5	Primary	16/05/11	48.4	1.94	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
		RPD	1.2	2.5	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Q12	Duplicate	17/05/11	47.3	2.19	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
D3-3/0.5-1.0	Primary	17/05/11	48.2	2.08	<5.0	<0.50	<0.50	<0.25	<0.50	<0.50	<0.50	<0.50	<0.50	ND	<0.5	2.8	1.35
		RPD	1.9	5.2	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Q14	Duplicate	17/05/11	48.2	2.93	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
M1-2/2.5-3.0	Primary	17/05/11	47.7	2.27	-	-	-	-	-	-	-	-	-	-	<0.5	-	-

Appendix D

Logs

BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. D3-1**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 1**	
Position :	Refer Site Plan	**Surface RL:** -8.8m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	V/Vibrocore **Mounting:** Barge	**Contractor :** M. Lennons	**Driller :** Alan McLennan	**Checked :**
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** AKS	**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
					0.78 (-9.58)		CH	CLAY, dark grey, high plasticity, trace fine graine sand (alluvium).	W	VS	
					0.80 (-9.60)		SP	SAND, grey, fine to medium grained, trace shell fragments (5-30mm long) (alluvium).		-	
							CH	CLAY, dark grey, highplasticity, trace fine grained sand (alluvium).		-	
1				D ASS				Below 1.31 fissuring observed.	-		
2											
				D ASS							2.5-3.0 hydro carbon odours (intermittent zones).
3					3.50 (-12.25)		SP	SAND, grey fine to medium grained (alluvium).	M	-	
				D ASS	3.95 (-12.70)		CH	CLAY, grey high plasticity (alluvium).	M	St VSt	3.95-4.08 transition from sand into clay.
4				U	4.36 (-13.11)			Vibrocore refusal at 4.36 metres.			
5											

See standard sheets for details of abbreviations & basis of descriptions

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Job No. 2120617

BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD GEO TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. D3-2**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 1**	
Position :	Refer Site Plan	**Surface RL:** -7.4m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McKenna's	**Driller :** Alan McLennan	**Checked :**
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** CMC/AKS	**Date :** 6/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							CH	CLAY, dark grey, trace sand (alluvium).	W	Vs	
1				D ASS							
								From 1.7m, becoming fissured.			
2											
				D ASS							
3											
									VM		
4					4.00 (-11.36)		SP	SAND, grey, medium to coarse grained trace shell fragments (alluvium).		-	
				D ASS D							
					4.51 (-11.87)		CH	CLAY, grey, high plasticity (alluvium).	M	St	
					4.80 (-12.16)			Vibrocore refusal at 4.8 metres.			
5											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. D3-3**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 2**	
Position :	Refer Site Plan **Surface RL:** -6.4m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	V1 Vibrocore **Mounting:** Barge **Contractor :** McKennans	**Driller :** Glen McKennan	**Checked :**
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** CMC	**Date :** 14/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							CH	CLAY, dark grey, trace sand with modular structure (alluvium)	W	Vs	
				ASS				0.5m, strong salpher odour.			
1											
				D ASS				From 1.6m becoming fissured.			
2											
				D ASS							
3											
4				D ASS							
5											

See standard sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. D3-3**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		**SHEET 2 OF 2**
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW		
Position :	Refer Site Plan	**Surface RL:** -6.4m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Alan McLennan	**Checked :**
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** CMC	**Date :** 5/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
6							CH	As previous.	W	Vs	
					5.65 (-12.05)		SP	SAND, grey, medium to coarse grained with shells (alluvium).	W	-	
					5.80 (-12.20)		CH	CLAY, grey fissured (alluvium).	M	F-St	
					6.10 (-12.50)			End of Vibrocore at 6.1 metres.			
7											
8											
9											
10											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE_2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. D3-4**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 1**	
Position :	Refer to Plan	**Surface RL:** -8.4m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Shane McLennan	**Checked :** [illegible]
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** CMC	**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							CH	CLAY, dark grey with modular structure (alluvium).	W	Vs	
1				D ASS							
2				D ASS							
3				U	3.05 (-11.47)		SP	SAND, grey, coarse grained (alluvium)	W	-	
					3.20 (-11.62)		CH	CLAY, grey, fissured (alluvium).	M	F	
					3.60 (-12.02)			Vibrocore refusal at 3.6 metres.			
4											
5											

See standard sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. D3-5**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 1**	
Position :	Refer Site Plan	**Surface RL:** -8.4m	**Angle from Horiz. :** 90°	**Processed :**
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Alan McLennan	**Checked :**
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** CMC	**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
0							CH	CLAY, dark grey to black with modular structure (Alluvium).	W	Vs	
1				D ASS							
2											
3				D ASS	2.95 (-11.37) 3.20 (-11.62)		SP CH	2.95, black stain. SAND, grey, medium to coarse grained with shells (Alluvium). 3.1m, unidentified odour. CLAY, grey with orange brown mottle, fissured (Alluvium).	W W	- F	
4				D	3.90 (-12.32)			Vibrocore refusal at 3.9 metres.			
5											
6											
7											
8											
9											
10											

See standard sheets for details of abbreviations & basis of descriptions

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Job No. 2120617

BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. K1-1**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 1**	
Position :	Refer Site Plan **Surface RL:** -12.1m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge **Contractor :** McLennans	**Driller :** Alan McLennan	**Checked :**
Date Started : 14/5/11	**Date Completed :** 14/5/11	**Logged by :** CMC	**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
				D + ASS	0.20 (-12.26)		CH	CLAY, with sand dark brown (alluvium).	W	Vs	
							SP	SAND, grey, medium to coarse with shells (alluvium).			
1				D ASS				Below 1.2m, frequent coal fragments.			
					1.60 (-13.66)			Vibrocore refusal at 1.6 metres.			
2											
3											
4											
5											

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GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

BOREHOLE LOG SHEET WITH VIBROCORE

Client : NEWCASTLE PORT CORPORATION

Project : SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT

Location : HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW

HOLE No. K1-1A

SHEET 1 OF 1

Position : Refer Site Plan		**Surface RL:** -11.0m	**Angle from Horiz. :** 90°		**Processed :** KP
Rig Type : Vibrocore	**Mounting:** Barge	**Contractor :** McLennans	**Driller :** Stan McLennan		**Checked :** MB
Date Started : 14/5/11		**Date Completed :** 14/5/11	**Logged by :** CMC		**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
1				D ASS			CH	CLAY, grey to black, with modular structure (alluvium).	W	Vs	
					1.20 (-12.16)			Vibrocore refusal at 1.2 metres.			
2											
3											
4											
5											
6											
7											
8											
9											
10											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client : NEWCASTLE PORT CORPORATION

Project : SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT

Location : HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW

HOLE No. M1-1

SHEET 1 OF 1

Position : Refer Site Plan	**Surface RL:** -5.8m	**Angle from Horiz. :** 90°		**Processed :** RY
Rig Type : Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Mark McLennan		**Checked :** MRB
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** CMC		**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
								No recovery, probable the vibrocore was blocked by slag frament / rock fragment.			

1 2 3 4 5 6 7 8 9 10

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. M1-1A**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 1**	
Position :	Refer Site Plan	**Surface RL:** -7.6m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Ron McLennan	**Checked :**
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** AKS CMC	**Date :** 14/12/11

DRILLING					MATERIAL					
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							CH	CLAY, dark grey, highplasticity trace fine grained sand (alluvium).	M	Vs	
1				ASS D							
2											
				D ASS				Below 2.65m, becoming fissured.			2.8 weak hydro coarbon odour.
3					3.42 (-11.03)		CH	CLAY, grey/ orange brown, high plasticity (Alluvium).	M	Vst	3.42 - 3.5 weak hydro carbon odour.
				U	3.90 (-11.51)			Vibrocore refusal at 3.90 metres.			
4											
5											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. M1-2**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		**SHEET 1 OF 2**
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW		
Position :	Refer to Plan	**Surface RL:** -6.7m	**Angle from Horiz. :** 90°
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Alan McLennan
Date Started : 16/5/11		**Date Completed :** 16/5/11	**Logged by :** AKS

Processed : RY
Checked :
Date : 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
								CLAY, dark grey, high plasticity, trace fine grained sand (alluvium).	W	Vs	
1				D ASS							
2								Below 2.25m becoming fissured.			
				D ASS							
3								2.88 - 2.04m, shells (coarse gravel size) and angular cobbles (ballast).	VM		
4					4.34 (-11.01)		SP	SAND, grey, medium to coarse grained, with fragments of shell (alluvium).		-	
				D ASS	4.55 (-11.22)		CH	CLAY, grey with dark orange-brown mottling, high plasticity (alluvium).	VM	St	
5											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. M1-2**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 2 OF 2**	
Position :	Refer Site Plan	**Surface RL:** -6.7m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennan	**Driller :** Hans McLennan	**Checked :**
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** AKS	**Date :** 15/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
				U			CH	As previous.	VM	St	
					5.26 (-11.93)			Vibrocore refusal at 5.26 metres.			
6											
7											
8											
9											
10											

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BOREHOLE LOG SHEET WITH VIBROCORE

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Client :	NEWCASTLE PORT CORPORATION	**HOLE No. M1-3**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		**SHEET 1 OF 2**
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW		
Position :	Refer Site Plan	**Surface RL:** -6.7m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Alan McLennan	**Checked :**
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** AKS	**Date :** 13/12/11

DRILLING					MATERIAL					
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
				D ASS			CH	CLAY, dark grey, trace fine grained sand (alluvium).	W	Vs	
1									VM		
2				D ASS				Below 2.35m, clay and fissured			
3											
4				D ASS							
5											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client : NEWCASTLE PORT CORPORATION
Project : SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT
Location : HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW

HOLE No. M1-3

SHEET 2 OF 2

Position : Refer Site Plan	**Surface RL:** -6.7m	**Angle from Horiz. :** 90°		**Processed :** RY
Rig Type : Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Alan McLennan		**Checked :**
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** AKS		**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
6							CH	As previous. 5.80 - 5.90m, fine to medium gravel sized shells and shell fragments.	W	Vs	
				D ASS	6.35 (-13.00)		SC	Clayey SAND, grey, fine to medium grained (alluvium).	M	St	
					6.50 (-13.15)		CH	CLAY, grey, high plasticity fissured (alluvium).		Vst	
				U	6.96 (-13.61)			Vibrocore refusal at 6.96 metres.			
7											
8											
9											
10											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. M1-4**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		SHEET 1 OF 2
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW		
Position :	Refer to Plan	**Surface RL:** -6.7m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	V Bore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Ken McLennan	**Checked :**
Date Started : 14/5/11	**Date Completed :** 14/5/11	**Logged by :** CMC	**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							CH	CLAY, dark grey, clay has a modular structure (alluvium).	W	Vs	
1				D ASS							
								1.5 - 4.7m, some fissuring, becoming black.			
2											
				D ASS							
3											
4											
5											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. M1-4**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 2 OF 2**	
Position :	Refer Site Plan	**Surface RL:** -6.7m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennan	**Driller :** Mark McLennan	**Checked :**
Date Started : 14/5/11	**Date Completed :** 14/5/11	**Logged by :** CMC	**Date :** 15/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
				D ASS			CH	As previous.	W	Vs	
					5.60 (-12.31)		CH	CLAY, grey and brown, fissured (alluvium).	M	St	
6				D	6.10 (-12.81)			Vibrocore refusal at 6.1 metres.			
7											
8											
9											
10											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. M2-1**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 2**	
Position :	Refer Site Plan	**Surface RL:** -7.8m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Alan McLennan	**Checked :**
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** AKS	**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							CH	CLAY, dark grey, high plsticity, trace fine grained sand (alluvium).	W	Vs	
									VM		0.45-0.66, medium to coarse angular (shale) gravel observed.
1				D ASS							
								1.7 - 2.15m, band of darker clay.			
2											
								Below 2.80m, fissuring observed.			2.8m, 60mm diametre shell
3				D ASS							
											3.80, 20mm diametre shell
4											3.70-4.0m, hydro carbon odour
				D	4.09 (-11.89)		CL	Sandy CLAY, grey, low plasticity, fine to medium grained ssand (alluvium).		St	
					4.35 (-12.15)		CH	CLAY, grey, high plasticity, fissured (alluvium).		VSt	4.3 - 4.6, enviro Around 4.35m transitions into residual clay
					4.63 (-12.43)			CORE LOSS, 730mm thick			
5											

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Client :	NEWCASTLE PORT CORPORATION	**HOLE No. M2-1**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 2 OF 2**	
Position :	Refer Site Plan	**Surface RL:** -7.8m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Ron Ackerman	**Checked :** MB
Date Started : 16/5/11	**Date Completed :** 16/5/11	**Logged by :** AKS	**Date :** 14/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
					5.36 (-13.16)			End of Vibrocore at 5.36m			
6											
7											
8											
9											
10											

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Client : NEWCASTLE PORT CORPORATION

Project : SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT

Location : HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW

HOLE No. M2-2

SHEET 1 OF 1

Position : Refer Site Plan | Surface RL: -9.0m | Angle from Horiz. : 90° | Processed : RY

Rig Type : Vibrocore | Mounting: Barge | Contractor : McLennans | Driller : Alan McLennan | Checked : NB

Date Started : 14/5/11 | Date Completed : 14/5/11 | Logged by : CMC | Date : 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
1				D ASS			CH	CLAY, dark grey, clay has modular structure (alluvium).	W	Vs	
2				D ASS							
					2.80 (-11.75)		CH	CLAY, light grey with orange mottle, fissured (alluvium).	M	St	
3				U							
					3.40 (-12.35)			Vibrocore refusal at 3.4 metres.			
4											
5											

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Client : NEWCASTLE PORT CORPORATION

Project : SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT

Location : HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW

HOLE No. M2-3

SHEET 1 OF 1

Position : Refer Site Plan | Surface RL: -9.5m | Angle from Horiz. : 90° | Processed : RY

Rig Type : Vibrocore | Mounting: Barge | Contractor : M Lennan | Driller : Alan M Lennan | Checked :

Date Started : 14/5/11 | Date Completed : 14/5/11 | Logged by : CMC | Date : 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
1				D ASS			CH	CLAY, black (alluvium).	W	Vs	
2				D ASS				From 1.7m, clay has some consistency and structure i.e. fissures.			
3											
4				U	3.90 (-13.39)		CH	CLAY, grey brown (alluvium).	W M	S-Vs St	
5					4.60 (-14.09)			Vibrocore refusal at 4.6 metres.			

See standard sheets for details of abbreviations & basis of descriptions

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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No. 2120617

BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. M2-4**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		**SHEET 1 OF 1**
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW		
Position :	Refer Site Plan	**Surface RL:** -8.6m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Alan McLennan	**Checked :**
Date Started : 13/5/11	**Date Completed :** 13/5/11	**Logged by :** CMC	**Date :** 6/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
				D ASS			CH	CLAY, dark grey, trace sand, clay has modular structure (alluvium).	W	VS	
1											
2				D ASS							
3				U	3.35 (-11.97)		CH	CLAY, brown, fissured (alluvium).	M	St	
					3.80 (-12.42)			Vibrocore refusal at 3.8 metres.			
4											
5											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE_2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W1-1**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 2**	
Position :	Refer Site Plan	**Surface RL:** -2.3m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Alan McLennan	**Checked :**
Date Started : 13/5/11	**Date Completed :** 13/5/11	**Logged by :** CMC	**Date :** 15/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
1				D ASS			CH	CLAY, dark grey, trace sand, sand is fine, clay has modular structure (alluvium).	W	VS	
2				D ASS				1.5m hydrocarbon odour and black staining.			
3								2.9m, some evidence of fisscuring, no modular structure present (residual? still very soft).			
4				D ASS				3.7m, apparent bedding parting 3.7-3.87m, light brown beds 15-20mm spacing.			
5											

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GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W1-1**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		**SHEET 2 OF 2**
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW		
Position :	Refer Site Plan	**Surface RL:** -2.3m	**Angle from Horiz. :** 90°
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Alan McLennan
Date Started : 13/5/11	**Date Completed :** 13/5/11	**Logged by :** CMC	

Processed : RY
Checked :
Date : 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
6				D ASS	6.10 (-8.39)		CH	From 5.0m, fissuring becoming more pronounced.	W	VS	
								End of Vibrocore at 6.1 metres.			
7											
8											
9											
10											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W1-2**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 2**	
Position :	Refer Site Plan	**Surface RL:** -4.0m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Stan McLennan	**Checked :**
Date Started : 14/5/11	**Date Completed :** 14/5/11	**Logged by :** CMC	**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
1				D ASS			CH	CLAY, dark grey to black, trace sand, with mondular structure slag frament at 0.01m (alluvium).	W	VS	
2				D ASS				Below 1.55m becoming fussured with relict light brown beds 10-20mm spacing.			
3											
4				D ASS							
5											

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Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W1-2**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		**SHEET 2 OF 2**
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW		
Position :	Refer Site Plan	**Surface RL:** -4.0m	**Angle from Horiz. :** 90°
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Stan McLennan
Date Started : 14/5/11	**Date Completed :** 14/5/11	**Logged by :** CMC	

Processed : RY
Checked :
Date : 15/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							CH	As previous.	W	VS	
					5.90 (-9.90)		SP	At 5.85m, coal fragment SAND, grey, medium to coarse with shells (alluvium).			
6				D ASS	6.10 (-10.10)			End of Vibrocore at 6.1 metres.			
7											
8											
9											
10											

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Client : NEWCASTLE PORT CORPORATION

Project : SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT

Location : HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW

HOLE No. W1-3

SHEET 1 OF 2

Position : Refer Site Plan | Surface RL: -4.1m | Angle from Horiz. : 90° | Processed : RY

Rig Type : Vibrocore | Mounting: Barge | Contractor : McLennans | Driller : Ian McLennan | Checked : MF

Date Started : 13/5/11 | Date Completed : 13/5/11 | Logged by : CMC | Date : 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							CH	CLAY, dark grey to black, trace sand, fine grained (alluvium).	W	VS	
					0.30 (-4.35)		SP	SAND with clay, fine to medium sand, slag fragment at 0.5m (alluvium).	W	-	
					0.60 (-4.65)		CH	CLAY, dark grey, trace sand, fine sand (alluvium).	W	VS	
				D ASS							
1											
								From 1.6m modular structure.			
2				D D							
								From 3.0m highly fissured.			
3											
				D ASS							
4											
5											

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Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W1-3**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		**SHEET 2 OF 2**
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW		
Position :	Refer Site Plan	**Surface RL:** -4.1m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Stan McLennan	**Checked :**
Date Started : 13/5/11	**Date Completed :** 13/5/11	**Logged by :** CMC	**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							CH	As previous.	W	VS	
				Dx2	5.80 (-9.85)			SAND, grey, medium grained with shells, possible degraded hydrocarbon odour.	W	-	
					5.90 (-9.95)			End of Vibrocore at 5.9 metres.			
6											
7											
8											
9											
10											

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Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W2-1**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 1**	
Position :	Refer Site Plan	**Surface RL:** -3.9m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** barge	**Contractor :** McLennans	**Driller :** Shane McLennan	**Checked :**
Date Started : 13/5/11	**Date Completed :** 13/5/11	**Logged by :** CMC	**Date :** 13/12/11

DRILLING					MATERIAL					
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
0							CH	CLAY, dark grey to black, with organics (decomposed roots) (alluvium).			
1				D ASS				At 1.1m, pieces of rubber.			
2											
3				D ASS	3.15 (-7.03)			Vibrocore refusal at 3.15 metres.			
4											
5											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W2-2**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 2**	
Position :	Refer Site Plan	**Surface RL:** -4.1m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Glen McLennan	**Checked :**
Date Started : 13/5/11	**Date Completed :** 13/5/11	**Logged by :** CMC	**Date :** 13/12/11

DRILLING					MATERIAL					
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							CH	CLAY, dark brown / grey, trace sand (alluvium).	W	VS	
								At 0.5m, slag fragment.			
1				D ASS				From 1.5m, becoming modular.			
2								At 2.3m, slag fragment.			
				D ASS							
3								From 3.2m, becoming fissured with light brown beds at 25mm centres.			
4					4.60 (-8.69)		SC	Clayey SAND, dark grey with shells and organics, fine to coarse sand (alluvium).	W	-	
				D ASS							
5											

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BOREHOLE LOG SHEET WITH VIBROCORE

Client : NEWCASTLE PORT CORPORATION

Project : SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT

Location : HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW

HOLE No. W2-2

SHEET 2 OF 2

Position : Refer Site Plan	**Surface RL:** -4.1m	**Angle from Horiz. :** 90°		**Processed :** RY
Rig Type : Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Stan McLennan		**Checked :**
Date Started : 13/5/11	**Date Completed :** 13/5/11	**Logged by :** CMC		**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							SC	As previous.	W	-	
				ASS	5.20 (-9.29)		PT	PEAT, clay with sand with frequent plant fibres.	W	VS	
					5.30 (-9.39)		SC	Clayey SAND, as above.	W	-	
				D + ASS	5.50 (-9.59)		PT	PEAT, as above.	W	VS	
					5.65 (-9.74)		CH	CLAY, dark grey, trace sand (alluvium).			
					5.80 (-9.89)			End of Vibrocore at 5.8 metres			

6 7 8 9 10

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Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W2-3**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 2**	
Position :	Refer Site Plan	**Surface RL:** -4.7m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Alan McLennan	**Checked :** MS
Date Started : 14/5/11	**Date Completed :** 14/5/11	**Logged by :** CMC	**Date :** 15/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
1				D ASS			CH	CLAY, dark grey, trace sand (alluvium).	W	VS	
2				D ASS	1.85 (-6.55)		SP	SAND, grey, medium to coarse grained, with shells and trace clay modulaes (alluvium). 2.17-2.2m, CLAY as above.	W	-	
3					2.45 (-7.15)		CH	CLAY, dark grey, trace sand (alluvium).	W	VS	
					3.00 (-7.70)		SP	SAND, grey, medium to coarse with shells and trace clay (alluvium).	W	-	
					3.05 (-7.75)		CH	CLAY, dark grey, trace sand and organic fibres, fissured with light brown beds 10-20mm (alluvium).	W	VS	
4				D ASS							
5					5.00						

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Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W2-3**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		**SHEET 2 OF 2**
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW		
Position :	Refer Site Plan	**Surface RL:** -4.7m	**Angle from Horiz. :** 90°
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Stan McLennan
Date Started : 14/5/11	**Date Completed :** 14/5/11	**Logged by :** CMC	

Processed : RY
Checked :
Date : 13/12/11

DRILLING					MATERIAL					
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
				D ASS	(-9.70)		SP	SAND, grey, medium to coarse with shells and trace CLAY (alluvium).			
6					6.10 (-10.80)			End of Vibrocore at 6.1 metres.			
7											
8											
9											
10											

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Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W3-1**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 2**	
Position :	Refer Site Plan	**Surface RL:** -6.2m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Sean McLennan	**Checked :**
Date Started : 13/5/11	**Date Completed :** 13/5/11	**Logged by :** CMC	**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							CH	CLAY, with trace sand, dark grey, fine sand, clay has a clumpy, mdoular structure, decreasing with depth, mild sulphurous odour (alluvium).	W	VS	
1				D							
				D							
2								2.0m, piece of steel ~ 40mm diameter, welding waste.			
					2.30 (-8.51)		SC	Clayey SAND, dark grey, fine to medium sand (alluvium).	W	-	
					2.45 (-8.66)		CH	CLAY, with trace sand, dark grey, fine sand, clay has modular structure (alluvium).	W	VS	
				D	2.60 (-8.81)		SP	SAND with clay, dark grey and light grey, medium grained with some clay nodules.	W	-	
				ASS							
3								3.64-.3.68m, lense of soft grey CLAY.			
				D				3.74-.3.76m, lense of soft grey CLAY.			
				ASS				3.8m, becoming fine to medium grained with shells.			
4					4.10 (-10.31)		SP	SAND, light grey, medium grained with sea shells.			
								4.6, becoming medium to coarse.			
5											

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BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client : NEWCASTLE PORT CORPORATION

Project : SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT

Location : HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW

HOLE No. W3-1

SHEET 2 OF 2

Position : Refer Site Plan | Surface RL: -6.2m | Angle from Horiz. : 90° | Processed : RY

Rig Type : Vibrocore | Mounting: Barge | Contractor : McConnell | Driller : Shane McLennan | Checked :

Date Started : 13/5/11 | Date Completed : 13/5/11 | Logged by : CMC | Date : 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
				D ASS			SP	As previous.			
					5.70 (-11.91)			CORE LOSS, 300mm thick.			
6					6.00 (-12.21)			End of Vibrocore at 6.0 metres.			
7											
8											
9											
10											

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Job No. 2120617

BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W3-2**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 1**	
Position :	Refer Site Plan	**Surface RL:** -4.6m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** McLennans	**Driller :** Alan McLennan	**Checked :**
Date Started : 14/5/11	**Date Completed :** 14/5/11	**Logged by :** CMC		**Date :** 13/12/11

DRILLING					MATERIAL					
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
				D ASS			CH	CLAY, with trace sand, dark grey with modular strcutre (alluvium).	W	VS	
1											
								1.4m, becoming fissured			
2				D ASS							
					2.70 (-7.32)		SP	SAND, grey, medium to coarse grained (alluvium).	W	-	
3											
								3.45-3.45 band of clay as above.			
				D ASS							
4											
								4.25-4.35 clay as above.			
					4.50 (-9.12)			Vibrocore refusal at 4.5 metres.			
5											

See standard sheets for details of abbreviations & basis of descriptions

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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No. 2120617

BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W3-3**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW	**SHEET 1 OF 2**	
Position :	Refer Site Plan	**Surface RL:** -4.8m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** Barge	**Contractor :** M. Lennans	**Driller :** Alan McLennan	**Checked :**
Date Started : 14/5/11	**Date Completed :** 14/5/11	**Logged by :** CMC	**Date :** 13/12/11

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
				D ASS			CH	CLAY, dark grey, trace sand with modular strcutre with sheels, some graments of sandstone at 0m (alluvium).	W	VS	
					0.90 (-5.72)		SP	SAND, grey, emdium to coarse grained with some shells (alluvium).	W	-	
1								1.4-1.5m, 1.73-1.8m, 2.07-2.09m, 2.35-2.41m, CLAY, dark grey, high plasticity, very soft.			
2				D ASS							
3				D ASS				3.5m, ignificant increases in shell content.			
4					4.05 (-8.87)		SP	SAND, light grey, medium to coarse (alluvium).	W	-	
5											

See standard sheets for details of abbreviations & basis of descriptions

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Job No. 2120617

BOREHOLE LOG SHEET WITH VIBROCORE

GEO_BOREHOLE 2120617.GPJ GHD_GEO_TEMPLATE.GDT 13/12/11

Client :	NEWCASTLE PORT CORPORATION	**HOLE No. W3-3**	
Project :	SOUTH ARM DREDGING PART 3A ENVIRONMENTAL ASSESSMENT		**SHEET 2 OF 2**
Location :	HUNTER RIVER SOUTH ARM, NEWCASTLE, NSW		
Position :	Refer Site Plan	**Surface RL:** -4.8m	**Angle from Horiz. :** 90°	**Processed :** RY
Rig Type :	Vibrocore **Mounting:** barge	**Contractor :** McLennans	**Driller :** Alan McLennan	**Checked :**
Date Started :	14/5/11	**Date Completed :** 14/5/11	**Logged by :** CMC	**Date :**

DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
6				D ASS			SP	As previous.	W	-	
					6.05 (-10.87)			End of Vibrocore at 6.05 metres.			
7											
8											
9											
10											

See standard sheets for details of abbreviations & basis of descriptions

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Job No. 2120617

Appendix E

Laboratory Documentation

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1110202**	Page	: 1 of 35
Client	: **GHD SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Angela Pavlovic
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jacqui.hallchurch@ghd.com	E-mail	: angela.pavlovic@alsenviro.com
Telephone	: +61 02 9239 7100	Telephone	: +61 2 8784 8523
Facsimile	: +61 02 9239 7199	Facsimile	: +61 2 8784 8500
Project	: 221568306 NPC	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: 159123-139	Date Samples Received	: 18-MAY-2011
Sampler	: JS	Issue Date	: 09-JUN-2011
Site	: ----		
		No. of samples received	: 185
Quote number	: EN/005/10	No. of samples analysed	: 31

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Spectroscopist	Sydney Inorganics
Edwandy Fadjar	Senior Organic Chemist	Sydney Organics
Evie.Sidarta	Inorganic Chemist	Sydney Inorganics
Kim McCabe	Senior Inorganic Chemist	Stafford Minerals - AY
Matt Frost	Senior Organic Chemist	Brisbane Organics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Wisam.Marassa	Metals Coordinator	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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 insuffient 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.

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

- **EG005T: Poor precision was obtained for Zinc on sample ES1110202#66 due to sample heterogeneity.**
- **EG020A-T: Positive results for sample ES1110202 # 184 have been confirmed by redigestion and reanalysis**
- **EK059G: LOR raised for NOx analysis on sample ID(M2-3 4.5-4.6 & W2-3 4.5-5.0) due to sample matrix.**
- **EP071: Result of sample W3-2 0.0-0.5 has been confirmed by re-extraction and re-analysis.**
- **EP075(SIM) : LOR for samples #M1-4 1.5-2.0 ,# M2-2 0.0-0.5 and # M2-4 0.5-1.0 are raised due to the high amount of moisture is present.**
- **EP132B-SD : Particular sample #W1-3 0.0-0.5 required dilution prior to extraction due to matrix interferences. LOR values have been adjusted accordingly.**
- **EP132B-SD : Poor duplicate precision due to sample heterogeneity. Confirmed by re-extraction and re-analysis.**
- **EP132B-SD : Poor matrix spike recovery due to sample heterogeneity. Confirmed by re-extraction and re-analysis.**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: D3-1 2.5-3.0	D3-2 0.5-1.0	D3-3 0.5-1.0	D3-4 2.5-3.0	D3-5 0.0-0.5
				Client sampling date / time: 17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00
				ES1110202-004	ES1110202-008	ES1110202-015	ES1110202-024	ES1110202-026
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	40.5	48.8	48.2	46.7	48.9
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	8	10	10	11	9
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	45	46	49	49	43
Copper	7440-50-8	5	mg/kg	34	55	54	43	63
Lead	7439-92-1	5	mg/kg	37	64	81	106	30
Nickel	7440-02-0	2	mg/kg	42	40	43	43	37
Zinc	7440-66-6	5	mg/kg	302	310	332	790	239
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	0.1	0.2	<0.1	0.2	<0.1
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	1	mg/kg	<1	<1	<1	3	<1
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	120	<20	40	120	<20
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	1240	1460	1360	1440	1790
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	1240	1460	1360	1440	1790
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	943	902	979	1050	862
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.77	1.94	2.08	1.91	2.40
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
3- & 4-Methylphenol	1319-77-3	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: D3-1 2.5-3.0	D3-2 0.5-1.0	D3-3 0.5-1.0	D3-4 2.5-3.0	D3-5 0.0-0.5
				Client sampling date / time: 17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00
				ES1110202-004	ES1110202-008	ES1110202-015	ES1110202-024	ES1110202-026
EP075(SIM)A: Phenolic Compounds - Continued								
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pentachlorophenol	87-86-5	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080: BTEXN								
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	----	----	**2.8**	----	----
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	----	----
^ DDT (total)	----	0.50	µg/kg	----	----	<0.50	----	----
Dieldrin	60-57-1	0.50	µg/kg	----	----	<0.50	----	----

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: D3-1 2.5-3.0	D3-2 0.5-1.0	D3-3 0.5-1.0	D3-4 2.5-3.0	D3-5 0.0-0.5
				Client sampling date / time: 17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00
				ES1110202-004	ES1110202-008	ES1110202-015	ES1110202-024	ES1110202-026
EP131A: Organochlorine Pesticides - Continued								
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	----	----
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	0.25	µg/kg	----	----	<0.25	----	----
trans-Chlordane	5103-74-2	0.25	µg/kg	----	----	<0.25	----	----
^ Total Chlordane (sum)	----	0.25	µg/kg	----	----	<0.25	----	----
Oxychlordane	27304-13-8	0.50	µg/kg	----	----	<0.50	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	----	----	<5.0	----	----
Aroclor 1016	12974-11-2	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	**216**	**97**	**144**	**219**	**226**
2-Methylnaphthalene	91-57-6	5	µg/kg	**59**	**24**	**36**	**43**	**44**
Acenaphthylene	208-96-8	4	µg/kg	**50**	**30**	**36**	**125**	**30**
Acenaphthene	83-32-9	4	µg/kg	**32**	**24**	**40**	**37**	**45**
Fluorene	86-73-7	4	µg/kg	**34**	**17**	**26**	**39**	**29**
Phenanthrene	85-01-8	4	µg/kg	**145**	**102**	**139**	**219**	**119**
Anthracene	120-12-7	4	µg/kg	**74**	**39**	**51**	**136**	**44**
Fluoranthene	206-44-0	4	µg/kg	**102**	**212**	**262**	**510**	**197**
Pyrene	129-00-0	4	µg/kg	**253**	**218**	**256**	**555**	**191**
Benz(a)anthracene	56-55-3	4	µg/kg	**163**	**124**	**131**	**245**	**101**
Chrysene	218-01-9	4	µg/kg	**96**	**101**	**109**	**189**	**69**
Benzo(b)fluoranthene	205-99-2	4	µg/kg	**194**	**134**	**155**	**339**	**105**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: D3-1 2.5-3.0	D3-2 0.5-1.0	D3-3 0.5-1.0	D3-4 2.5-3.0	D3-5 0.0-0.5
				Client sampling date / time: 17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00
				ES1110202-004	ES1110202-008	ES1110202-015	ES1110202-024	ES1110202-026
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(k)fluoranthene	207-08-9	4	µg/kg	85	63	62	191	49
Benzo(e)pyrene	192-97-2	4	µg/kg	131	77	85	178	58
Benzo(a)pyrene	50-32-8	4	µg/kg	132	139	149	353	103
Perylene	198-55-0	4	µg/kg	660	51	62	517	51
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	97	93	102	247	71
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	24	27	52	10
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	80	77	83	192	56
Coronene	191-07-1	5	µg/kg	<5	18	21	53	12
^ Sum of PAHs	----	4	µg/kg	2600	1660	1980	4440	1610
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	127	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	----	99.0	----	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	----	----	65.1	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	106	104	106	101	109
2-Chlorophenol-D4	93951-73-6	0.1	%	106	108	110	106	108
2.4.6-Tribromophenol	118-79-6	0.1	%	84.2	91.8	92.6	87.7	88.8
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	110	116	117	113	117
Anthracene-d10	1719-06-8	0.1	%	109	108	110	105	112
4-Terphenyl-d14	1718-51-0	0.1	%	115	114	116	113	119
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	108	100	93.5	100	98.7
Toluene-D8	2037-26-5	0.1	%	109	103	97.5	104	102
4-Bromofluorobenzene	460-00-4	0.1	%	104	98.5	90.8	98.6	96.4
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	----	----	87.4	----	----
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	----	60.6	----	----
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	73.1	----	----
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	84.1	86.8	91.0	80.2	83.2
Anthracene-d10	1719-06-8	0.1	%	103	88.4	90.8	82.5	94.8

Analytical Results

Sub-Matrix: SOIL				Client sample ID	D3-1 2.5-3.0	D3-2 0.5-1.0	D3-3 0.5-1.0	D3-4 2.5-3.0	D3-5 0.0-0.5
				Client sampling date / time	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00
Compound	CAS Number	LOR	Unit		ES1110202-004	ES1110202-008	ES1110202-015	ES1110202-024	ES1110202-026
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	0.1	%		**90.4**	**106**	**118**	**114**	**120**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: K1-1 0.0-0.5	M1-1A 2.5-3.0	M1-2 2.5-3.0	M1-3 1.5-2.0	M1-4 1.5-2.0
				Client sampling date / time: 16-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	16-MAY-2011 15:00
				ES1110202-031	ES1110202-039	ES1110202-044	ES1110202-049	ES1110202-057
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	21.8	43.4	47.7	47.2	51.8
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	10	12	9	9
Cadmium	7440-43-9	1	mg/kg	<1	<1	1	<1	<1
Chromium	7440-47-3	2	mg/kg	6	50	52	56	60
Copper	7440-50-8	5	mg/kg	<5	42	52	45	49
Lead	7439-92-1	5	mg/kg	<5	72	196	74	101
Nickel	7440-02-0	2	mg/kg	5	43	42	47	53
Zinc	7440-66-6	5	mg/kg	25	430	1430	459	704
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	0.1	0.3	0.2	0.4
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	1	mg/kg	<1	2	8	2	4
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	110	160	150	190
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	230	1230	1570	1520	1770
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	230	1230	1570	1520	1770
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	200	1070	1120	1090	1220
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.35	2.08	2.27	2.07	2.19
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
3- & 4-Methylphenol	1319-77-3	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.6
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: K1-1 0.0-0.5	M1-1A 2.5-3.0	M1-2 2.5-3.0	M1-3 1.5-2.0	M1-4 1.5-2.0
				Client sampling date / time: 16-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	16-MAY-2011 15:00
				ES1110202-031	ES1110202-039	ES1110202-044	ES1110202-049	ES1110202-057
EP075(SIM)A: Phenolic Compounds - Continued								
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
Pentachlorophenol	87-86-5	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080: BTEXN								
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	----	----	<0.5	----
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	----
^ DDT (total)	----	0.50	µg/kg	<0.50	----	----	<0.50	----
Dieldrin	60-57-1	0.50	µg/kg	<0.50	----	----	<0.50	----

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: K1-1 0.0-0.5	M1-1A 2.5-3.0	M1-2 2.5-3.0	M1-3 1.5-2.0	M1-4 1.5-2.0
				Client sampling date / time: 16-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	16-MAY-2011 15:00
				ES1110202-031	ES1110202-039	ES1110202-044	ES1110202-049	ES1110202-057
EP131A: Organochlorine Pesticides - Continued								
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	0.25	µg/kg	<0.25	----	----	<0.25	----
trans-Chlordane	5103-74-2	0.25	µg/kg	<0.25	----	----	<0.25	----
^ Total Chlordane (sum)	----	0.25	µg/kg	<0.25	----	----	<0.25	----
Oxychlordane	27304-13-8	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	12974-11-2	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	**109**	**155**	**292**	**245**	**379**
2-Methylnaphthalene	91-57-6	5	µg/kg	**17**	**35**	**32**	**53**	**61**
Acenaphthylene	208-96-8	4	µg/kg	**21**	**76**	**297**	**117**	**142**
Acenaphthene	83-32-9	4	µg/kg	**17**	**39**	**127**	**56**	**72**
Fluorene	86-73-7	4	µg/kg	**11**	**34**	**68**	**50**	**56**
Phenanthrene	85-01-8	4	µg/kg	**43**	**178**	**461**	**294**	**303**
Anthracene	120-12-7	4	µg/kg	**18**	**84**	**211**	**141**	**153**
Fluoranthene	206-44-0	4	µg/kg	**60**	**367**	**1100**	**621**	**601**
Pyrene	129-00-0	4	µg/kg	**58**	**392**	**1380**	**699**	**706**
Benz(a)anthracene	56-55-3	4	µg/kg	**35**	**197**	**594**	**349**	**376**
Chrysene	218-01-9	4	µg/kg	**27**	**169**	**423**	**263**	**212**
Benzo(b)fluoranthene	205-99-2	4	µg/kg	**44**	**294**	**936**	**452**	**485**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: K1-1 0.0-0.5	M1-1A 2.5-3.0	M1-2 2.5-3.0	M1-3 1.5-2.0	M1-4 1.5-2.0
				Client sampling date / time: 16-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	16-MAY-2011 15:00
				ES1110202-031	ES1110202-039	ES1110202-044	ES1110202-049	ES1110202-057
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(k)fluoranthene	207-08-9	4	µg/kg	14	137	422	224	237
Benzo(e)pyrene	192-97-2	4	µg/kg	22	141	418	229	286
Benzo(a)pyrene	50-32-8	4	µg/kg	43	269	869	472	425
Perylene	198-55-0	4	µg/kg	15	593	526	694	858
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	26	182	670	356	259
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	6	40	103	65	38
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	21	147	476	240	174
Coronene	191-07-1	5	µg/kg	<5	36	109	61	94
^ Sum of PAHs	----	4	µg/kg	607	3560	9510	5680	5920
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	110	----	----	103	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	96.6	----	----	90.1	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	68.0	----	----	76.4	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	111	106	102	107	114
2-Chlorophenol-D4	93951-73-6	0.1	%	114	108	103	110	115
2.4.6-Tribromophenol	118-79-6	0.1	%	93.5	89.2	86.7	90.2	94.1
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	121	114	109	116	120
Anthracene-d10	1719-06-8	0.1	%	112	108	103	110	115
4-Terphenyl-d14	1718-51-0	0.1	%	121	117	112	118	122
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	114	97.9	105	104	102
Toluene-D8	2037-26-5	0.1	%	116	101	110	103	98.6
4-Bromofluorobenzene	460-00-4	0.1	%	110	96.7	101	98.4	93.6
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	101	----	----	59.4	----
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	67.4	----	----	65.8	----
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	57.5	----	----	71.8	----
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	82.0	91.1	84.5	78.8	87.9
Anthracene-d10	1719-06-8	0.1	%	91.6	83.5	84.0	93.9	84.4

Analytical Results

Sub-Matrix: SOIL				Client sample ID	K1-1 0.0-0.5	M1-1A 2.5-3.0	M1-2 2.5-3.0	M1-3 1.5-2.0	M1-4 1.5-2.0
				Client sampling date / time	16-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	16-MAY-2011 15:00
Compound	CAS Number	LOR	Unit		ES1110202-031	ES1110202-039	ES1110202-044	ES1110202-049	ES1110202-057
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	0.1	%		**112**	**82.5**	**95.1**	**110**	**80.2**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: M2-1 3.5-4.0	M2-2 0.0-0.5	M2-3 4.5-4.6	M2-4 0.5-1.0	W1-1 1.5-2.0
				Client sampling date / time: 17-MAY-2011 15:00	16-MAY-2011 15:00	16-MAY-2011 15:00	14-MAY-2011 15:00	14-MAY-2011 15:00
				ES1110202-066	ES1110202-068	ES1110202-078	ES1110202-080	ES1110202-090
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	44.4	59.7	23.0	56.7	48.0
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	11	10	15	11	6
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	57	50	21	57	49
Copper	7440-50-8	5	mg/kg	56	42	12	50	38
Lead	7439-92-1	5	mg/kg	156	34	11	40	13
Nickel	7440-02-0	2	mg/kg	48	45	34	49	50
Zinc	7440-66-6	5	mg/kg	1170	246	43	285	84
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	0.2	<0.1	<0.1	<0.1	<0.1
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	1	mg/kg	6	<1	<1	<1	<1
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	130	20	20	110	190
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<1.0	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	1410	1780	220	1880	1570
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	1410	1780	220	1880	1570
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	817	1030	390	1500	1180
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	2.34	2.23	0.09	2.19	1.78
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	<0.5	<0.8	<0.5	<0.8	<0.5
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.8	<0.5	<0.8	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.8	<0.5	<0.8	<0.5
3- & 4-Methylphenol	1319-77-3	1.0	mg/kg	<1.0	<1.6	<1.0	<1.6	<1.0
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.8	<0.5	<0.8	<0.5
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.8	<0.5	<0.8	<0.5
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.8	<0.5	<0.8	<0.5
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.8	<0.5	<0.8	<0.5
4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.8	<0.5	<0.8	<0.5
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.8	<0.5	<0.8	<0.5

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: M2-1 3.5-4.0	M2-2 0.0-0.5	M2-3 4.5-4.6	M2-4 0.5-1.0	W1-1 1.5-2.0
				Client sampling date / time: 17-MAY-2011 15:00	16-MAY-2011 15:00	16-MAY-2011 15:00	14-MAY-2011 15:00	14-MAY-2011 15:00
				ES1110202-066	ES1110202-068	ES1110202-078	ES1110202-080	ES1110202-090
EP075(SIM)A: Phenolic Compounds - Continued								
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.8	<0.5	<0.8	<0.5
Pentachlorophenol	87-86-5	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080: BTEXN								
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	----	----	----	----	<0.5
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
^ DDT (total)	----	0.50	µg/kg	----	----	----	----	<0.50
Dieldrin	60-57-1	0.50	µg/kg	----	----	----	----	<0.50

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: M2-1 3.5-4.0 Client sampling date / time: 17-MAY-2011 15:00 ES1110202-066	Client sample ID: M2-2 0.0-0.5 Client sampling date / time: 16-MAY-2011 15:00 ES1110202-068	Client sample ID: M2-3 4.5-4.6 Client sampling date / time: 16-MAY-2011 15:00 ES1110202-078	Client sample ID: M2-4 0.5-1.0 Client sampling date / time: 14-MAY-2011 15:00 ES1110202-080	Client sample ID: W1-1 1.5-2.0 Client sampling date / time: 14-MAY-2011 15:00 ES1110202-090
EP131A: Organochlorine Pesticides - Continued								
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
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	0.25	µg/kg	----	----	----	----	<0.25
trans-Chlordane	5103-74-2	0.25	µg/kg	----	----	----	----	<0.25
^ Total Chlordane (sum)	----	0.25	µg/kg	----	----	----	----	<0.25
Oxychlordane	27304-13-8	0.50	µg/kg	----	----	----	----	<0.50
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1016	12974-11-2	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	**573**	**977**	**12**	**740**	**20**
2-Methylnaphthalene	91-57-6	5	µg/kg	**91**	**171**	<5	**174**	**7**
Acenaphthylene	208-96-8	4	µg/kg	**266**	**130**	**5**	**63**	**51**
Acenaphthene	83-32-9	4	µg/kg	**120**	**209**	<4	**147**	**8**
Fluorene	86-73-7	4	µg/kg	**118**	**127**	<4	**79**	**19**
Phenanthrene	85-01-8	4	µg/kg	**557**	**466**	**8**	**251**	**102**
Anthracene	120-12-7	4	µg/kg	**311**	**182**	<4	**100**	**78**
Fluoranthene	206-44-0	4	µg/kg	**1050**	**569**	**14**	**319**	**245**
Pyrene	129-00-0	4	µg/kg	**1160**	**512**	**20**	**282**	**236**
Benz(a)anthracene	56-55-3	4	µg/kg	**612**	**229**	**10**	**150**	**135**
Chrysene	218-01-9	4	µg/kg	**428**	**197**	**6**	**116**	**92**
Benzo(b)fluoranthene	205-99-2	4	µg/kg	**811**	**284**	**15**	**142**	**106**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: M2-1 3.5-4.0	M2-2 0.0-0.5	M2-3 4.5-4.6	M2-4 0.5-1.0	W1-1 1.5-2.0
				Client sampling date / time: 17-MAY-2011 15:00	16-MAY-2011 15:00	16-MAY-2011 15:00	14-MAY-2011 15:00	14-MAY-2011 15:00
				ES1110202-066	ES1110202-068	ES1110202-078	ES1110202-080	ES1110202-090
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(k)fluoranthene	207-08-9	4	µg/kg	356	161	6	62	69
Benzo(e)pyrene	192-97-2	4	µg/kg	461	146	7	90	61
Benzo(a)pyrene	50-32-8	4	µg/kg	708	291	12	190	147
Perylene	198-55-0	4	µg/kg	958	125	6	75	459
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	425	198	7	210	144
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	71	46	<4	68	48
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	291	158	5	197	136
Coronene	191-07-1	5	µg/kg	119	36	<5	131	77
^ Sum of PAHs	----	4	µg/kg	9490	5210	133	3590	2240
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	----	----	102
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	----	----	----	98.4
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	----	----	----	----	75.3
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	106	109	107	109	108
2-Chlorophenol-D4	93951-73-6	0.1	%	108	107	109	108	106
2.4.6-Tribromophenol	118-79-6	0.1	%	90.6	89.2	85.7	87.7	85.6
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	114	112	113	115	112
Anthracene-d10	1719-06-8	0.1	%	110	109	108	110	107
4-Terphenyl-d14	1718-51-0	0.1	%	114	117	115	119	116
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	111	100	124	107	109
Toluene-D8	2037-26-5	0.1	%	109	97.5	126	101	104
4-Bromofluorobenzene	460-00-4	0.1	%	102	95.3	120	97.7	102
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	----	----	----	----	49.6
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	----	----	----	52.0
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	----	----	53.3
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	86.2	81.9	88.7	81.5	82.5
Anthracene-d10	1719-06-8	0.1	%	78.9	83.0	103	76.2	88.2

Analytical Results

Sub-Matrix: SOIL				Client sample ID	M2-1 3.5-4.0	M2-2 0.0-0.5	M2-3 4.5-4.6	M2-4 0.5-1.0	W1-1 1.5-2.0
				Client sampling date / time	17-MAY-2011 15:00	16-MAY-2011 15:00	16-MAY-2011 15:00	14-MAY-2011 15:00	14-MAY-2011 15:00
Compound	CAS Number	LOR	Unit		ES1110202-066	ES1110202-068	ES1110202-078	ES1110202-080	ES1110202-090
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	0.1	%		**86.4**	**112**	**114**	**102**	**117**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: W1-2 0.0-0.5 Client sampling date / time: 16-MAY-2011 15:00 ES1110202-099	W1-3 0.0-0.5 14-MAY-2011 15:00 ES1110202-106	W1-3 5.5-5.6 14-MAY-2011 15:00 ES1110202-117	W2-1 0.0-0.5 16-MAY-2011 15:00 ES1110202-118	W2-2 0.0-0.5 14-MAY-2011 15:00 ES1110202-122
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	48.4	40.8	33.6	47.1	49.0
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	7	8	----	9	10
Cadmium	7440-43-9	1	mg/kg	<1	<1	----	<1	<1
Chromium	7440-47-3	2	mg/kg	74	40	----	50	49
Copper	7440-50-8	5	mg/kg	52	49	----	46	45
Lead	7439-92-1	5	mg/kg	46	86	----	89	41
Nickel	7440-02-0	2	mg/kg	69	34	----	39	42
Zinc	7440-66-6	5	mg/kg	303	375	----	442	273
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	0.2	----	0.2	0.1
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	1	mg/kg	<1	<1	----	<1	<1
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	80	<20	----	<20	<20
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	----	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	1260	1270	----	1600	1520
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	1260	1270	----	1600	1520
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	1280	1030	----	1180	1190
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.94	3.64	----	3.08	2.96
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
3- & 4-Methylphenol	1319-77-3	1.0	mg/kg	<1.0	<1.0	----	<1.0	<1.0
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: W1-2 0.0-0.5	W1-3 0.0-0.5	W1-3 5.5-5.6	W2-1 0.0-0.5	W2-2 0.0-0.5
				Client sampling date / time: 16-MAY-2011 15:00	14-MAY-2011 15:00	14-MAY-2011 15:00	16-MAY-2011 15:00	14-MAY-2011 15:00
				ES1110202-099	ES1110202-106	ES1110202-117	ES1110202-118	ES1110202-122
EP075(SIM)A: Phenolic Compounds - Continued								
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Pentachlorophenol	87-86-5	2.0	mg/kg	<2.0	<2.0	----	<2.0	<2.0
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080: BTEXN								
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	----	----	----	**3.0**	----
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	----
^ DDT (total)	----	0.50	µg/kg	----	----	----	<0.50	----
Dieldrin	60-57-1	0.50	µg/kg	----	----	----	<0.50	----

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: W1-2 0.0-0.5	W1-3 0.0-0.5	W1-3 5.5-5.6	W2-1 0.0-0.5	W2-2 0.0-0.5
				Client sampling date / time: 16-MAY-2011 15:00	14-MAY-2011 15:00	14-MAY-2011 15:00	16-MAY-2011 15:00	14-MAY-2011 15:00
				ES1110202-099	ES1110202-106	ES1110202-117	ES1110202-118	ES1110202-122
EP131A: Organochlorine Pesticides - Continued								
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	----
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	0.25	µg/kg	----	----	----	<0.25	----
trans-Chlordane	5103-74-2	0.25	µg/kg	----	----	----	<0.25	----
^ Total Chlordane (sum)	----	0.25	µg/kg	----	----	----	<0.25	----
Oxychlordane	27304-13-8	0.50	µg/kg	----	----	----	<0.50	----
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	----	----	----	<5.0	----
Aroclor 1016	12974-11-2	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	**114**	**480**	**22**	**404**	**514**
2-Methylnaphthalene	91-57-6	5	µg/kg	**14**	<50	**7**	**78**	**83**
Acenaphthylene	208-96-8	4	µg/kg	**139**	**1320**	**20**	**320**	**148**
Acenaphthene	83-32-9	4	µg/kg	**24**	**273**	**13**	**109**	**113**
Fluorene	86-73-7	4	µg/kg	**56**	**344**	**15**	**173**	**73**
Phenanthrene	85-01-8	4	µg/kg	**504**	**3340**	**66**	**1170**	**332**
Anthracene	120-12-7	4	µg/kg	**172**	**2070**	**21**	**496**	**184**
Fluoranthene	206-44-0	4	µg/kg	**1010**	**3430**	**86**	**1500**	**724**
Pyrene	129-00-0	4	µg/kg	**994**	**3320**	**89**	**1340**	**676**
Benz(a)anthracene	56-55-3	4	µg/kg	**454**	**1540**	**48**	**854**	**447**
Chrysene	218-01-9	4	µg/kg	**372**	**1240**	**39**	**684**	**315**
Benzo(b)fluoranthene	205-99-2	4	µg/kg	**614**	**1770**	**51**	**1110**	**608**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID	W1-2 0.0-0.5	W1-3 0.0-0.5	W1-3 5.5-5.6	W2-1 0.0-0.5	W2-2 0.0-0.5
				Client sampling date / time	16-MAY-2011 15:00	14-MAY-2011 15:00	14-MAY-2011 15:00	16-MAY-2011 15:00	14-MAY-2011 15:00
					ES1110202-099	ES1110202-106	ES1110202-117	ES1110202-118	ES1110202-122
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(k)fluoranthene	207-08-9	4	µg/kg		281	1170	18	597	252
Benzo(e)pyrene	192-97-2	4	µg/kg		308	804	26	533	267
Benzo(a)pyrene	50-32-8	4	µg/kg		663	1890	57	1110	568
Perylene	198-55-0	4	µg/kg		618	589	231	346	186
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		466	1010	52	698	350
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		62	534	19	147	63
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		333	795	53	566	271
Coronene	191-07-1	5	µg/kg		154	584	<5	140	70
^ Sum of PAHs	----	4	µg/kg		7350	26500	933	12400	6240
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		----	----	----	111	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.1	%		----	----	----	97.3	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.1	%		----	----	----	82.4	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		106	104	108	103	106
2-Chlorophenol-D4	93951-73-6	0.1	%		108	106	106	101	105
2.4.6-Tribromophenol	118-79-6	0.1	%		86.6	85.5	87.4	82.3	81.8
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		115	111	113	108	112
Anthracene-d10	1719-06-8	0.1	%		108	106	110	105	107
4-Terphenyl-d14	1718-51-0	0.1	%		117	115	118	114	117
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		103	106	108	104	106
Toluene-D8	2037-26-5	0.1	%		104	105	106	104	102
4-Bromofluorobenzene	460-00-4	0.1	%		102	103	102	99.4	99.7
EP090S: Organotin Surrogate									
Tripropyltin	----	0.1	%		----	----	----	75.8	----
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.1	%		----	----	----	52.0	----
EP131T: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		----	----	----	40.4	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		81.4	78.4	58.6	86.7	78.9
Anthracene-d10	1719-06-8	0.1	%		81.5	105	56.6	86.0	75.7

Analytical Results

Sub-Matrix: SOIL				Client sample ID	W1-2 0.0-0.5	W1-3 0.0-0.5	W1-3 5.5-5.6	W2-1 0.0-0.5	W2-2 0.0-0.5
				Client sampling date / time	16-MAY-2011 15:00	14-MAY-2011 15:00	14-MAY-2011 15:00	16-MAY-2011 15:00	14-MAY-2011 15:00
Compound	CAS Number	LOR	Unit		ES1110202-099	ES1110202-106	ES1110202-117	ES1110202-118	ES1110202-122
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	0.1	%		**110**	**116**	**83.4**	**102**	**90.3**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: W2-3 4.5-5.0 Client sampling date / time: 16-MAY-2011 15:00 ES1110202-139	W3-1 1.5-2.0 14-MAY-2011 15:00 ES1110202-144	W3-2 0.0-0.5 16-MAY-2011 15:00 ES1110202-153	W3-3 4.5-5.0 16-MAY-2011 15:00 ES1110202-163	Q03 16-MAY-2011 15:00 ES1110202-167
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	**36.9**	**42.9**	**43.8**	**18.0**	**47.8**
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	**8**	**8**	**12**	<5	**8**
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**48**	**62**	**56**	<2	**86**
Copper	7440-50-8	5	mg/kg	**34**	**44**	**60**	<5	**56**
Lead	7439-92-1	5	mg/kg	**15**	**50**	**128**	<5	**52**
Nickel	7440-02-0	2	mg/kg	**44**	**59**	**43**	<2	**79**
Zinc	7440-66-6	5	mg/kg	**63**	**305**	**543**	<5	**348**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	**0.1**	**0.3**	<0.1	<0.1
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	1	mg/kg	<1	**2**	<1	<1	<1
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	**140**	**120**	<20	<20	**80**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<1.0	<0.1	<0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	**1430**	**1230**	**1500**	<20	**1460**
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	**1430**	**1230**	**1500**	<20	**1460**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	**866**	**974**	**1390**	**27**	**1430**
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**1.65**	**1.89**	**2.99**	**0.08**	**1.99**
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
3- & 4-Methylphenol	1319-77-3	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: W2-3 4.5-5.0 Client sampling date / time: 16-MAY-2011 15:00 ES1110202-139	W3-1 1.5-2.0 14-MAY-2011 15:00 ES1110202-144	W3-2 0.0-0.5 16-MAY-2011 15:00 ES1110202-153	W3-3 4.5-5.0 16-MAY-2011 15:00 ES1110202-163	Q03 16-MAY-2011 15:00 ES1110202-167
EP075(SIM)A: Phenolic Compounds - Continued								
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pentachlorophenol	87-86-5	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	**330**	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	**230**	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	**560**	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	**460**	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	**150**	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	**610**	<50	<50
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080: BTEXN								
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	----	<0.5	----	----	<0.5
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
^ DDT (total)	----	0.50	µg/kg	----	<0.50	----	----	<0.50
Dieldrin	60-57-1	0.50	µg/kg	----	<0.50	----	----	<0.50

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: W2-3 4.5-5.0 Client sampling date / time: 16-MAY-2011 15:00 ES1110202-139	W3-1 1.5-2.0 14-MAY-2011 15:00 ES1110202-144	W3-2 0.0-0.5 16-MAY-2011 15:00 ES1110202-153	W3-3 4.5-5.0 16-MAY-2011 15:00 ES1110202-163	Q03 16-MAY-2011 15:00 ES1110202-167
EP131A: Organochlorine Pesticides - Continued								
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	0.25	µg/kg	----	<0.25	----	----	<0.25
trans-Chlordane	5103-74-2	0.25	µg/kg	----	<0.25	----	----	<0.25
^ Total Chlordane (sum)	----	0.25	µg/kg	----	<0.25	----	----	<0.25
Oxychlordane	27304-13-8	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	12974-11-2	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	**7**	**198**	**596**	<5	**99**
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	**31**	**97**	<5	**12**
Acenaphthylene	208-96-8	4	µg/kg	**11**	**126**	**600**	<4	**142**
Acenaphthene	83-32-9	4	µg/kg	<4	**29**	**195**	<4	**26**
Fluorene	86-73-7	4	µg/kg	**6**	**40**	**187**	<4	**67**
Phenanthrene	85-01-8	4	µg/kg	**18**	**247**	**1500**	<4	**609**
Anthracene	120-12-7	4	µg/kg	**10**	**139**	**944**	<4	**234**
Fluoranthene	206-44-0	4	µg/kg	**45**	**523**	**3060**	<4	**1060**
Pyrene	129-00-0	4	µg/kg	**43**	**564**	**2810**	<4	**977**
Benz(a)anthracene	56-55-3	4	µg/kg	**27**	**252**	**2510**	<4	**525**
Chrysene	218-01-9	4	µg/kg	**16**	**219**	**1450**	<4	**420**
Benzo(b)fluoranthene	205-99-2	4	µg/kg	**21**	**382**	**2830**	<4	**679**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: W2-3 4.5-5.0	W3-1 1.5-2.0	W3-2 0.0-0.5	W3-3 4.5-5.0	Q03
				Client sampling date / time: 16-MAY-2011 15:00	14-MAY-2011 15:00	16-MAY-2011 15:00	16-MAY-2011 15:00	16-MAY-2011 15:00
				ES1110202-139	ES1110202-144	ES1110202-153	ES1110202-163	ES1110202-167
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(k)fluoranthene	207-08-9	4	µg/kg	10	174	914	<4	329
Benzo(e)pyrene	192-97-2	4	µg/kg	12	184	1410	<4	336
Benzo(a)pyrene	50-32-8	4	µg/kg	24	390	2730	<4	723
Perylene	198-55-0	4	µg/kg	342	346	879	<4	639
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	24	252	1420	<4	482
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	10	38	237	<4	68
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	21	182	1070	<4	351
Coronene	191-07-1	5	µg/kg	14	54	273	<5	126
^ Sum of PAHs	----	4	µg/kg	661	4370	25700	<4	7900
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	107	----	----	109
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	90.3	----	----	95.4
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	----	67.0	----	----	74.5
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	104	110	109	110	107
2-Chlorophenol-D4	93951-73-6	0.1	%	104	107	108	106	101
2.4.6-Tribromophenol	118-79-6	0.1	%	94.4	97.1	94.2	92.5	94.1
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	109	110	112	111	108
Anthracene-d10	1719-06-8	0.1	%	108	111	110	111	109
4-Terphenyl-d14	1718-51-0	0.1	%	114	106	117	119	115
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	96.3	95.3	101	109	101
Toluene-D8	2037-26-5	0.1	%	98.1	95.8	98.7	106	97.2
4-Bromofluorobenzene	460-00-4	0.1	%	104	102	98.4	108	97.5
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	----	99.9	----	----	93.0
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	50.6	----	----	64.9
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	61.4	----	----	97.5
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	76.0	88.7	84.3	84.6	75.3
Anthracene-d10	1719-06-8	0.1	%	82.2	82.0	80.6	94.8	84.9

Analytical Results

Sub-Matrix: SOIL				Client sample ID	W2-3 4.5-5.0	W3-1 1.5-2.0	W3-2 0.0-0.5	W3-3 4.5-5.0	Q03
				Client sampling date / time	16-MAY-2011 15:00	14-MAY-2011 15:00	16-MAY-2011 15:00	16-MAY-2011 15:00	16-MAY-2011 15:00
Compound	CAS Number	LOR	Unit		ES1110202-139	ES1110202-144	ES1110202-153	ES1110202-163	ES1110202-167
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	0.1	%		**97.8**	**109**	**85.9**	**104**	**120**

Analytical Results

Sub-Matrix: SOIL				Client sample ID	Q12	Q14	----	----	----
				Client sampling date / time	17-MAY-2011 15:00	17-MAY-2011 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1110202-176	ES1110202-178	----	----	----
EA055: Moisture Content									
^ Moisture Content (dried @ 103°C)	----	1.0	%		47.3	48.2	----	----	----
EG005T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		11	11	----	----	----
Cadmium	7440-43-9	1	mg/kg		<1	<1	----	----	----
Chromium	7440-47-3	2	mg/kg		58	58	----	----	----
Copper	7440-50-8	5	mg/kg		55	52	----	----	----
Lead	7439-92-1	5	mg/kg		72	58	----	----	----
Nickel	7440-02-0	2	mg/kg		47	43	----	----	----
Zinc	7440-66-6	5	mg/kg		326	363	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	----	----	----
EK026G: Total Cyanide By Discrete Analyser									
Total Cyanide	57-12-5	1	mg/kg		<1	<1	----	----	----
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		20	<20	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		<0.1	<0.1	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		1610	1590	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		1610	1590	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		929	929	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		2.19	2.93	----	----	----
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	0.5	mg/kg		<0.5	<0.5	----	----	----
2-Chlorophenol	95-57-8	0.5	mg/kg		<0.5	<0.5	----	----	----
2-Methylphenol	95-48-7	0.5	mg/kg		<0.5	<0.5	----	----	----
3- & 4-Methylphenol	1319-77-3	1.0	mg/kg		<1.0	<1.0	----	----	----
2-Nitrophenol	88-75-5	0.5	mg/kg		<0.5	<0.5	----	----	----
2.4-Dimethylphenol	105-67-9	0.5	mg/kg		<0.5	<0.5	----	----	----
2.4-Dichlorophenol	120-83-2	0.5	mg/kg		<0.5	<0.5	----	----	----
2.6-Dichlorophenol	87-65-0	0.5	mg/kg		<0.5	<0.5	----	----	----
4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg		<0.5	<0.5	----	----	----
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg		<0.5	<0.5	----	----	----

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: Q12	Q14	----	----	----
				Client sampling date / time: 17-MAY-2011 15:00	17-MAY-2011 15:00	----	----	----
				ES1110202-176	ES1110202-178	----	----	----
EP075(SIM)A: Phenolic Compounds - Continued								
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	----	----	----
Pentachlorophenol	87-86-5	2.0	mg/kg	<2.0	<2.0	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	----	----	----
C10 - C14 Fraction	----	50	mg/kg	<50	<50	----	----	----
C15 - C28 Fraction	----	100	mg/kg	<100	<100	----	----	----
C29 - C36 Fraction	----	100	mg/kg	<100	<100	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	10	mg/kg	<10	<10	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg	<10	<10	----	----	----
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	----	----	----
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	----	----	----
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	----	----	----
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	----	----	----
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	----	----	----
EP080: BTEXN								
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	----	----	----
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	----	----	----
Naphthalene	91-20-3	1	mg/kg	<1	<1	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	**188**	**736**	----	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg	**38**	**111**	----	----	----
Acenaphthylene	208-96-8	4	µg/kg	**34**	**72**	----	----	----
Acenaphthene	83-32-9	4	µg/kg	**37**	**131**	----	----	----
Fluorene	86-73-7	4	µg/kg	**26**	**78**	----	----	----
Phenanthrene	85-01-8	4	µg/kg	**135**	**332**	----	----	----
Anthracene	120-12-7	4	µg/kg	**60**	**120**	----	----	----
Fluoranthene	206-44-0	4	µg/kg	**250**	**532**	----	----	----
Pyrene	129-00-0	4	µg/kg	**228**	**485**	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg	**137**	**285**	----	----	----
Chrysene	218-01-9	4	µg/kg	**100**	**240**	----	----	----

Analytical Results

Sub-Matrix: SOIL				Client sample ID	Q12	Q14	----	----	----
				Client sampling date / time	17-MAY-2011 15:00	17-MAY-2011 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1110202-176	ES1110202-178	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b)fluoranthene	205-99-2	4	µg/kg		156	374	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg		95	215	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg		78	191	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg		154	358	----	----	----
Perylene	198-55-0	4	µg/kg		59	116	----	----	----
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		100	244	----	----	----
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		17	42	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		70	174	----	----	----
Coronene	191-07-1	5	µg/kg		<5	48	----	----	----
^ Sum of PAHs	----	4	µg/kg		1960	4880	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		109	104	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		106	99.8	----	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		91.6	85.7	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		111	106	----	----	----
Anthracene-d10	1719-06-8	0.1	%		110	106	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		113	110	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		104	100	----	----	----
Toluene-D8	2037-26-5	0.1	%		99.1	96.2	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		97.5	96.8	----	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		83.0	90.3	----	----	----
Anthracene-d10	1719-06-8	0.1	%		84.9	79.4	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		93.8	107	----	----	----

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: R1	R2	R3	T1	----
				Client sampling date / time: 14-MAY-2011 15:00	16-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	----
				ES1110202-182	ES1110202-183	ES1110202-184	ES1110202-185	----
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	**0.002**	<0.001	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	**0.018**	<0.005	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Fluorene	86-73-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Anthracene	120-12-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Pyrene	129-00-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Benzo(b)fluoranthene	205-99-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.9	<0.9	<1.0	<0.9	----
EP080/071: Total Petroleum Hydrocarbons								
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	----
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	----
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	<100	<100	----

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: R1	R2	R3	T1	----
				Client sampling date / time: 14-MAY-2011 15:00	16-MAY-2011 15:00	17-MAY-2011 15:00	17-MAY-2011 15:00	----
				ES1110202-182	ES1110202-183	ES1110202-184	ES1110202-185	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	**32.5**	**27.2**	**25.2**	**24.0**	----
2-Chlorophenol-D4	93951-73-6	0.1	%	**73.0**	**61.3**	**56.0**	**52.8**	----
2.4.6-Tribromophenol	118-79-6	0.1	%	**70.8**	**65.5**	**58.6**	**55.9**	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	**69.7**	**55.8**	**48.7**	**51.6**	----
Anthracene-d10	1719-06-8	0.1	%	**71.0**	**66.7**	**62.0**	**60.1**	----
4-Terphenyl-d14	1718-51-0	0.1	%	**70.9**	**68.4**	**58.0**	**65.8**	----

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	30.8	155.7
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	19.5	167.0
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	22.7	163.5
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	56.3	133.3
2-Chlorophenol-D4	93951-73-6	53.8	133.8
2.4.6-Tribromophenol	118-79-6	23.1	134.9
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	58.9	132.7
Anthracene-d10	1719-06-8	55.0	137.6
4-Terphenyl-d14	1718-51-0	54.0	147.8
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	72.8	133.2
Toluene-D8	2037-26-5	73.9	132.1
4-Bromofluorobenzene	460-00-4	71.6	130.0
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP131S: OC Pesticide Surrogate			
Dibromo-DDE	21655-73-2	10	136
EP131T: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	10	164
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	30	115
Anthracene-d10	1719-06-8	27	133
4-Terphenyl-d14	1718-51-0	18	137

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	64.1
2-Chlorophenol-D4	93951-73-6	11.3	122.9
2.4.6-Tribromophenol	118-79-6	11.7	144.0
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	19.9	122.8
Anthracene-d10	1719-06-8	23.3	125.8

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)T: PAH Surrogates - Continued			
4-Terphenyl-d14	1718-51-0	20.3	134.5

QUALITY CONTROL REPORT

Work Order	: **ES1110202**	Page	: 1 of 26
Client	: **GHD SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Angela Pavlovic
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jacqui.hallchurch@ghd.com	E-mail	: angela.pavlovic@alsenviro.com
Telephone	: +61 02 9239 7100	Telephone	: +61 2 8784 8523
Facsimile	: +61 02 9239 7199	Facsimile	: +61 2 8784 8500
Project	: 221568306 NPC	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: 159123-139	Date Samples Received	: 18-MAY-2011
Sampler	: JS	Issue Date	: 09-JUN-2011
Order number	: ----		
		No. of samples received	: 185
Quote number	: EN/005/10	No. of samples analysed	: 31

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Spectroscopist	Sydney Inorganics
Edwandy Fadjar	Senior Organic Chemist	Sydney Organics
Evie.Sidarta	Inorganic Chemist	Sydney Inorganics
Kim McCabe	Senior Inorganic Chemist	Stafford Minerals - AY
Matt Frost	Senior Organic Chemist	Brisbane Organics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Wisam.Marassa	Metals Coordinator	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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 insuffient 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	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 1797868)									
ES1110202-004	D3-1 2.5-3.0	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	40.5	40.6	0.4	0% - 20%
ES1110202-057	M1-4 1.5-2.0	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	51.8	51.9	0.0	0% - 20%
EA055: Moisture Content (QC Lot: 1797869)									
ES1110202-139	W2-3 4.5-5.0	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	36.9	36.4	1.3	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 1798382)									
ES1110202-004	D3-1 2.5-3.0	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	45	46	2.2	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	42	43	2.5	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	8	9	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	34	36	5.4	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	37	41	10.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	302	340	11.6	0% - 20%
ES1110202-066	M2-1 3.5-4.0	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	57	55	4.0	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	48	47	0.0	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	11	10	9.4	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	56	65	15.0	0% - 50%
		EG005T: Lead	7439-92-1	5	mg/kg	156	142	9.2	0% - 20%
		EG005T: Zinc	7440-66-6	5	mg/kg	1170	952	# 20.3	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 1800438)									
ES1110202-139	W2-3 4.5-5.0	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	48	49	0.0	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	44	46	3.9	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	8	7	18.2	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	34	34	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	15	12	26.9	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	63	63	0.0	0% - 50%
ES1110495-004	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	4	3	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	14	14	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1798383)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1798383) - continued									
ES1110202-004	D3-1 2.5-3.0	EG035T: Mercury	7439-97-6	0.1	mg/kg	0.1	<0.1	0.0	No Limit
ES1110202-066	M2-1 3.5-4.0	EG035T: Mercury	7439-97-6	0.1	mg/kg	0.2	0.2	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1800439)									
ES1110202-139	W2-3 4.5-5.0	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES1110495-004	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EK026G: Total Cyanide By Discrete Analyser (QC Lot: 1799155)									
ES1110202-004	D3-1 2.5-3.0	EK026G: Total Cyanide	57-12-5	1	mg/kg	<1	1	0.0	No Limit
ES1110202-057	M1-4 1.5-2.0	EK026G: Total Cyanide	57-12-5	1	mg/kg	4	3	0.0	No Limit
EK026G: Total Cyanide By Discrete Analyser (QC Lot: 1799156)									
ES1110202-144	W3-1 1.5-2.0	EK026G: Total Cyanide	57-12-5	1	mg/kg	2	2	0.0	No Limit
EK055: Ammonia as N (QC Lot: 1801183)									
ES1110202-004	D3-1 2.5-3.0	EK055: Ammonia as N	7664-41-7	20	mg/kg	120	120	0.0	No Limit
ES1110202-068	M2-2 0.0-0.5	EK055: Ammonia as N	7664-41-7	20	mg/kg	20	20	0.0	No Limit
EK055: Ammonia as N (QC Lot: 1801184)									
ES1110202-139	W2-3 4.5-5.0	EK055: Ammonia as N	7664-41-7	20	mg/kg	140	140	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 1799170)									
ES1110202-004	D3-1 2.5-3.0	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES1110202-057	M1-4 1.5-2.0	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 1799171)									
ES1110202-144	W3-1 1.5-2.0	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 1798441)									
ES1110202-004	D3-1 2.5-3.0	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	1240	1370	10.4	0% - 20%
ES1110202-057	M1-4 1.5-2.0	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	1770	1500	16.1	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 1798444)									
ES1110202-144	W3-1 1.5-2.0	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	1230	1340	8.8	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 1798442)									
ES1110202-004	D3-1 2.5-3.0	EK067G: Total Phosphorus as P	----	2	mg/kg	943	1010	6.6	0% - 20%
ES1110202-057	M1-4 1.5-2.0	EK067G: Total Phosphorus as P	----	2	mg/kg	1220	1300	5.9	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 1798443)									
ES1110202-144	W3-1 1.5-2.0	EK067G: Total Phosphorus as P	----	2	mg/kg	974	1080	10.5	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 1807068)									
ES1110202-004	D3-1 2.5-3.0	EP003: Total Organic Carbon	----	0.02	%	1.77	1.79	1.3	0% - 20%
ES1110202-066	M2-1 3.5-4.0	EP003: Total Organic Carbon	----	0.02	%	2.34	2.26	3.5	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 1807069)									
ES1110202-144	W3-1 1.5-2.0	EP003: Total Organic Carbon	----	0.02	%	1.89	1.87	1.1	0% - 20%
EP075(SIM)A: Phenolic Compounds (QC Lot: 1798891)									
ES1110202-004	D3-1 2.5-3.0	EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP075(SIM)A: Phenolic Compounds (QC Lot: 1798891) - continued									
ES1110202-004	D3-1 2.5-3.0	EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1.0	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075(SIM): Pentachlorophenol	87-86-5	2.0	mg/kg	<2.0	<2.0	0.0	No Limit
ES1110202-066	M2-1 3.5-4.0	EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1.0	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075(SIM): Pentachlorophenol	87-86-5	2.0	mg/kg	<2.0	<2.0	0.0	No Limit
EP075(SIM)A: Phenolic Compounds (QC Lot: 1800478)									
ES1110202-139	W2-3 4.5-5.0	EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1.0	mg/kg	<1.0	<1.0	0.0	No Limit
		EP075(SIM): Pentachlorophenol	87-86-5	2.0	mg/kg	<2.0	<2.0	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1797713)									
ES1110202-004	D3-1 2.5-3.0	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES1110202-066	M2-1 3.5-4.0	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1797746)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1797746) - continued									
ES1110202-139	W2-3 4.5-5.0	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES1110496-021	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1798890)									
ES1110202-004	D3-1 2.5-3.0	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
ES1110202-066	M2-1 3.5-4.0	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1800477)									
ES1110202-139	W2-3 4.5-5.0	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
ES1110549-004	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 1797713)									
ES1110202-004	D3-1 2.5-3.0	EP080: C6 - C10 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES1110202-066	M2-1 3.5-4.0	EP080: C6 - C10 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 1797746)									
ES1110202-139	W2-3 4.5-5.0	EP080: C6 - C10 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES1110496-021	Anonymous	EP080: C6 - C10 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 1798890)									
ES1110202-004	D3-1 2.5-3.0	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	110	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
ES1110202-066	M2-1 3.5-4.0	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 1800477)									
ES1110202-139	W2-3 4.5-5.0	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
ES1110549-004	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080: BTEXN (QC Lot: 1797713)									
ES1110202-004	D3-1 2.5-3.0	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080: BTEXN (QC Lot: 1797713) - continued									
ES1110202-004	D3-1 2.5-3.0	EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
ES1110202-066	M2-1 3.5-4.0	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EP080: BTEXN (QC Lot: 1797746)									
ES1110202-139	W2-3 4.5-5.0	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
ES1110496-021	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 1798977)									
ES1110202-031	K1-1 0.0-0.5	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
EP131A: Organochlorine Pesticides (QC Lot: 1813322)									
ES1110202-015	D3-3 0.5-1.0	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	<0.25	<0.25	0.0	No Limit
		EP131A: trans-Chlordane	5103-74-2	0.25	µg/kg	<0.25	<0.25	0.0	No Limit
		EP131A: Total Chlordane (sum)	----	0.25	µg/kg	<0.25	<0.25	0.0	No Limit
		EP131A: Aldrin	309-00-2	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-BHC	319-84-6	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-BHC	319-85-7	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: delta-BHC	319-86-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDD	72-54-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP131A: Organochlorine Pesticides (QC Lot: 1813322) - continued									
ES1110202-015	D3-3 0.5-1.0	EP131A: 4.4`-DDE	72-55-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4.4`-DDT	50-29-3	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: DDT (total)	----	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Dieldrin	60-57-1	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-Endosulfan	959-98-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-Endosulfan	33213-65-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan sulfate	1031-07-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan (sum)	115-29-7	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin	72-20-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin aldehyde	7421-93-4	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin ketone	53494-70-5	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor	76-44-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor epoxide	1024-57-3	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Methoxychlor	72-43-5	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
EP131B: Polychlorinated Biphenyls (as Aroclors) (QC Lot: 1813323)									
ES1110202-015	D3-3 0.5-1.0	EP131B: Total Polychlorinated biphenyls	----	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1016	12974-11-2	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1221	11104-28-2	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1232	11141-16-5	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1242	53469-21-9	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1248	12672-29-6	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1254	11097-69-1	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1260	11096-82-5	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1813288)									
ES1110202-004	D3-1 2.5-3.0	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	50	51	0.0	0% - 50%
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	32	32	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	34	33	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	145	146	0.9	0% - 20%
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	74	70	5.1	0% - 50%
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	102	103	0.0	0% - 20%
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	253	254	0.0	0% - 20%
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	163	152	7.0	0% - 20%
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	96	101	4.5	0% - 20%
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	194	185	4.9	0% - 20%
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	85	78	8.5	0% - 50%
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	131	127	3.0	0% - 20%
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	132	120	9.2	0% - 20%
		EP132B-SD: Perylene	198-55-0	4	µg/kg	660	672	1.7	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1813288) - continued									
ES1110202-004	D3-1 2.5-3.0	EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	97	104	6.6	0% - 20%
		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	80	84	5.5	0% - 20%
		EP132B-SD: Sum of PAHs	----	4	µg/kg	2600	2610	0.3	0% - 20%
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	216	215	0.5	0% - 20%
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	59	60	1.8	0% - 50%
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25	133	No Limit
ES1110202-039	M1-1A 2.5-3.0	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	76	77	1.7	0% - 50%
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	39	41	6.0	0% - 50%
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	34	35	4.5	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	178	177	0.8	0% - 20%
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	84	83	1.9	0% - 20%
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	367	356	3.1	0% - 20%
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	392	386	1.7	0% - 20%
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	197	199	0.8	0% - 20%
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	169	166	1.5	0% - 20%
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	294	294	0.0	0% - 20%
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	137	128	7.1	0% - 20%
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	141	139	1.4	0% - 20%
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	269	266	1.1	0% - 20%
		EP132B-SD: Perylene	198-55-0	4	µg/kg	593	549	7.7	0% - 20%
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	182	193	6.1	0% - 20%
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	40	38	3.9	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	147	140	5.1	0% - 20%
		EP132B-SD: Sum of PAHs	----	4	µg/kg	3560	3510	1.6	0% - 20%
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	155	168	8.6	0% - 20%
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	35	37	5.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	36	36	0.0	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1813289)									
ES1110202-139	W2-3 4.5-5.0	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	11	16	35.9	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	6	7	23.6	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	18	35	61.4	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	10	16	39.5	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	45	78	# 55.0	0% - 50%
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	43	70	48.0	0% - 50%
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	27	48	# 57.2	0% - 50%
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	16	31	61.2	No Limit
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	21	37	54.1	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1813289) - continued									
ES1110202-139	W2-3 4.5-5.0	EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	10	21	66.2	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	12	21	55.7	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	24	45	# 61.9	0% - 50%
		EP132B-SD: Perylene	198-55-0	4	µg/kg	342	387	12.4	0% - 20%
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	24	43	# 56.6	0% - 50%
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	10	18	58.4	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	21	40	# 61.2	0% - 50%
		EP132B-SD: Sum of PAHs	----	4	µg/kg	661	948	# 35.7	0% - 20%
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	7	9	24.2	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	14	26	55.2	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1816999)									
ES1110202-044	M1-2 2.5-3.0	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	297	304	2.4	0% - 20%
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	127	123	3.0	0% - 20%
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	68	64	7.0	0% - 50%
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	461	362	# 24.1	0% - 20%
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	211	196	7.3	0% - 20%
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	1100	826	# 28.8	0% - 20%
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	1380	1170	16.2	0% - 20%
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	594	480	# 21.3	0% - 20%
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	423	335	# 23.1	0% - 20%
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	936	782	17.9	0% - 20%
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	422	408	3.3	0% - 20%
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	418	364	13.9	0% - 20%
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	869	746	15.3	0% - 20%
		EP132B-SD: Perylene	198-55-0	4	µg/kg	526	531	0.9	0% - 20%
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	670	519	# 25.4	0% - 20%
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	103	85	19.7	0% - 20%
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	476	402	16.8	0% - 20%
		EP132B-SD: Sum of PAHs	----	4	µg/kg	9510	8200	14.9	0% - 20%
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	292	353	19.0	0% - 20%
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	32	33	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	109	114	3.6	0% - 20%

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals by ICP-MS (QC Lot: 1798140)									
ES1110202-182	R1	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020T: Total Metals by ICP-MS (QC Lot: 1798140) - continued									
ES1110202-182	R1	EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
ES1110306-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1797631)									
ES1110202-182	R1	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES1110331-008	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	0.0011	0.0010	0.0	0% - 50%

Method Blank (MB) and Laboratory Control Spike (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 (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 1798382)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	13.11 mg/kg	106	70	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	2.76 mg/kg	95.3	83.3	111
EG005T: Chromium	7440-47-3	2	mg/kg	<2	60.93 mg/kg	104	89.2	117
EG005T: Copper	7440-50-8	5	mg/kg	<5	54.68 mg/kg	103	90.1	114
EG005T: Lead	7439-92-1	5	mg/kg	<5	54.76 mg/kg	101	85.2	111
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.23 mg/kg	103	88.3	116
EG005T: Zinc	7440-66-6	5	mg/kg	<5	103.88 mg/kg	101	88.9	112
EG005T: Total Metals by ICP-AES (QCLot: 1800438)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	13.11 mg/kg	123	70	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	2.76 mg/kg	90.4	83.3	111
EG005T: Chromium	7440-47-3	2	mg/kg	<2	60.93 mg/kg	109	89.2	117
EG005T: Copper	7440-50-8	5	mg/kg	<5	54.68 mg/kg	103	90.1	114
EG005T: Lead	7439-92-1	5	mg/kg	<5	54.76 mg/kg	106	85.2	111
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.23 mg/kg	112	88.3	116
EG005T: Zinc	7440-66-6	5	mg/kg	<5	103.88 mg/kg	102	88.9	112
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1798383)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	1.4 mg/kg	88.4	67	118
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1800439)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	1.4 mg/kg	73.8	67	118
EK026G: Total Cyanide By Discrete Analyser (QCLot: 1799155)								
EK026G: Total Cyanide	57-12-5	1	mg/kg	<1	20.0 mg/kg	102	70	130
EK026G: Total Cyanide By Discrete Analyser (QCLot: 1799156)								
EK026G: Total Cyanide	57-12-5	1	mg/kg	<1	20.0 mg/kg	98.6	70	130
EK055: Ammonia as N (QCLot: 1801183)								
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	100 mg/kg	93.2	70	130
EK055: Ammonia as N (QCLot: 1801184)								
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	100 mg/kg	92.7	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1799170)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	4.8 mg/kg	117	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1799171)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	4.8 mg/kg	106	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1798441)								
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	1000 mg/kg	88.4	70	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1798444)								
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	1000 mg/kg	87.7	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1798442)								
EK067G: Total Phosphorus as P	----	2	mg/kg	<2	442 mg/kg	92.0	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1798443)								
EK067G: Total Phosphorus as P	----	2	mg/kg	<2	442 mg/kg	92.3	70	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 1807068)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	99.7	70	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 1807069)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	102	70	130
EP075(SIM)A: Phenolic Compounds (QCLot: 1798891)								
EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	4 mg/kg	106	73.9	115
EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	4 mg/kg	109	80.2	115
EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	4 mg/kg	104	76.8	114
EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1.0	mg/kg	<1.0	8 mg/kg	# 119	72	119
EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	4 mg/kg	82.9	60.3	117
EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	4 mg/kg	107	74.5	119
EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	4 mg/kg	95.6	71.6	113
EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	4 mg/kg	101	74.8	115
EP075(SIM): 4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg	<0.5	4 mg/kg	96.6	76.4	114
EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	4 mg/kg	108	62.2	115
EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	4 mg/kg	85.3	68.9	112
EP075(SIM): Pentachlorophenol	87-86-5	1.0	mg/kg	<1.0	8 mg/kg	26.4	1.23	91.6
EP075(SIM)A: Phenolic Compounds (QCLot: 1800478)								
EP075(SIM): Phenol	108-95-2	0.5	mg/kg	<0.5	4 mg/kg	105	73.9	115
EP075(SIM): 2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	4 mg/kg	107	80.2	115
EP075(SIM): 2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	4 mg/kg	107	76.8	114
EP075(SIM): 3- & 4-Methylphenol	1319-77-3	1.0	mg/kg	<1.0	8 mg/kg	112	72	119
EP075(SIM): 2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	4 mg/kg	95.0	60.3	117
EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	4 mg/kg	95.2	74.5	119
EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	4 mg/kg	93.8	71.6	113
EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	4 mg/kg	99.5	74.8	115
EP075(SIM): 4-Chloro-3-Methylphenol	59-50-7	0.5	mg/kg	<0.5	4 mg/kg	98.2	76.4	114
EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	4 mg/kg	106	62.2	115
EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	4 mg/kg	104	68.9	112
EP075(SIM): Pentachlorophenol	87-86-5	1.0	mg/kg	<1.0	8 mg/kg	43.6	1.23	91.6
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1797713)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	104	68.4	128
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1797746)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike	Spike Recovery (%)	Recovery Limits (%)
				Result	Concentration	LCS	Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1797746) - continued								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	93.8	68.4	128
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1798890)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	200 mg/kg	75.0	59	131
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	300 mg/kg	125	74	138
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	200 mg/kg	124	63	131
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1800477)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	200 mg/kg	103	59	131
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	300 mg/kg	134	74	138
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	200 mg/kg	112	63	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 1797713)								
EP080: C6 - C10 Fraction	----	10	mg/kg	<10	31 mg/kg	104	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 1797746)								
EP080: C6 - C10 Fraction	----	10	mg/kg	<10	31 mg/kg	98.4	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 1798890)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	250 mg/kg	97.6	59	131
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	350 mg/kg	123	74	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----
		50	mg/kg	----	150 mg/kg	96.0	63	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 1800477)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	250 mg/kg	113	59	131
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	350 mg/kg	133	74	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----
		50	mg/kg	----	150 mg/kg	72.2	63	131
EP080: BTEXN (QCLot: 1797713)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	105	63	121
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	107	69	122
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	101	61	117
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	102	62	118
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	106	63	117
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	118	63	131
EP080: BTEXN (QCLot: 1797746)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	103	63	121
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	107	69	122
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	99.8	61	117
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	96.1	62	118
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	98.5	63	117

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP080: BTEXN (QCLot: 1797746) - continued								
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	87.4	63	131
EP090: Organotin Compounds (QCLot: 1798977)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	96.3	19.5	129
EP131A: Organochlorine Pesticides (QCLot: 1813322)								
EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	5 µg/kg	124	31.7	140
EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	5 µg/kg	113	24.5	150
EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	5 µg/kg	101	36.9	139
EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	5 µg/kg	102	38.2	137
EP131A: 4.4`-DDD	72-54-8	0.5	µg/kg	<0.50	5 µg/kg	106	42.5	141
EP131A: 4.4`-DDE	72-55-9	0.5	µg/kg	<0.50	5 µg/kg	122	34.8	140
EP131A: 4.4`-DDT	50-29-3	0.5	µg/kg	<0.50	5 µg/kg	64.5	38	143
EP131A: DDT (total)	----	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	5 µg/kg	# 138	43.2	134
EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	5 µg/kg	111	23.7	139
EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	5 µg/kg	127	35.8	138
EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	5 µg/kg	95.6	7.45	158
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	84.6	21.6	162
EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	5 µg/kg	65.2	19.3	131
EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	5 µg/kg	115	17.9	141
EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	5 µg/kg	66.9	31	153
EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	5 µg/kg	121	34.3	138
EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	5 µg/kg	119	18.6	146
EP131A: gamma-BHC	58-89-9	0.5	µg/kg	<0.50	5 µg/kg	115	30.7	145
EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	5 µg/kg	110	15	157
EP131A: cis-Chlordane	5103-71-9	0.5	µg/kg	<0.50	5 µg/kg	98.0	22.3	145
EP131A: trans-Chlordane	5103-74-2	0.5	µg/kg	<0.50	5 µg/kg	85.9	42.4	139
EP131A: Total Chlordane (sum)	----	0.5	µg/kg	<0.50	----	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 1813323)								
EP131B: Total Polychlorinated biphenyls	----	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1016	12974-11-2	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	87.0	61.3	121
EP131B: Aroclor 1260	11096-82-5	5	µg/kg	<5.0	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1813288)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1813288) - continued								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	96.9	----	----
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	92.4	----	----
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	101	----	----
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	98.1	----	----
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	107	----	----
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	108	----	----
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	102	----	----
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	106	----	----
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	106	----	----
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	98.5	----	----
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	99.8	----	----
EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	25 µg/kg	97.5	----	----
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	96.0	----	----
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	95.8	----	----
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	97.1	----	----
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	95.8	----	----
EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	94.3	----	----
EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	94.4	----	----
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	94.8	----	----
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	93.8	----	----
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1813289)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	83.9	----	----
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	106	----	----
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	81.9	----	----
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	89.6	----	----
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	82.7	----	----
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	82.8	----	----
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	76.2	----	----
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	83.1	----	----
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	83.5	----	----
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	83.9	----	----
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	84.7	----	----
EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	25 µg/kg	81.4	----	----
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	79.0	----	----
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	79.0	----	----
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	79.4	----	----
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	78.6	----	----
EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	76.8	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1813289) - continued								
EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	76.8	----	----
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	77.6	----	----
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	76.4	----	----
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1816999)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	93.0	----	----
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	84.7	----	----
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	85.0	----	----
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	118	----	----
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	98.5	----	----
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	93.0	----	----
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	91.4	----	----
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	89.9	----	----
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	121	----	----
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	94.8	----	----
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	94.8	----	----
EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	25 µg/kg	99.2	----	----
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	80.3	----	----
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	92.1	----	----
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	94.4	----	----
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	94.6	----	----
EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	86.2	----	----
EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	90.1	----	----
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	89.2	----	----
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	107	----	----
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EG020T: Total Metals by ICP-MS (QCLot: 1798140)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	100	85	111
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	96.4	88	108
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	104	92	114
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	105	89	115
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	111	91	113
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	106	91	113
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	96.2	78	116
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1797631)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1797631) - continued								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.010 mg/L	93.4	81	119
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1798231)								
EP075(SIM): Naphthalene	91-20-3	0.2	µg/L	----	.5 µg/L	82.5	58.6	119
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Acenaphthylene	208-96-8	0.2	µg/L	----	.5 µg/L	87.6	63.6	114
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Acenaphthene	83-32-9	0.2	µg/L	----	.5 µg/L	88.1	62.2	113
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Fluorene	86-73-7	0.2	µg/L	----	.5 µg/L	94.0	63.9	115
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Phenanthrene	85-01-8	0.2	µg/L	----	.5 µg/L	102	62.6	116
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Anthracene	120-12-7	0.2	µg/L	----	.5 µg/L	99.9	64.3	116
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Fluoranthene	206-44-0	0.2	µg/L	----	.5 µg/L	111	63.6	118
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Pyrene	129-00-0	0.2	µg/L	----	.5 µg/L	112	63.1	118
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Benz(a)anthracene	56-55-3	0.2	µg/L	----	.5 µg/L	113	64.1	117
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Chrysene	218-01-9	0.2	µg/L	----	.5 µg/L	109	62.5	116
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.2	µg/L	----	.5 µg/L	88.4	61.7	119
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.2	µg/L	----	.5 µg/L	97.4	61.7	117
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Benzo(a)pyrene	50-32-8	0.2	µg/L	----	.5 µg/L	111	63.3	117
		0.5	µg/L	<0.5	----	----	----	----
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.2	µg/L	----	.5 µg/L	109	59.9	118
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.2	µg/L	----	.5 µg/L	109	61.2	117
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.2	µg/L	----	.5 µg/L	109	59.1	118
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	1	µg/L	<1.0	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1798230)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	79.5	58.9	131
EP071: C15 - C28 Fraction	----	100	µg/L	<100	500 µg/L	91.6	73.9	138
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	106	62.7	131

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 1798230)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	66.5	58.9	131
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	600 µg/L	99.0	73.9	138
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----
		50	µg/L	----	300 µg/L	114	62.7	131

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 1798382)							
ES1110202-004	D3-1 2.5-3.0	EG005T: Arsenic	7440-38-2	50 mg/kg	95.9	70	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	96.0	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	97.0	70	130
		EG005T: Copper	7440-50-8	250 mg/kg	106	70	130
		EG005T: Lead	7439-92-1	250 mg/kg	102	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	97.6	70	130
		EG005T: Zinc	7440-66-6	250 mg/kg	96.3	70	130
EG005T: Total Metals by ICP-AES (QCLot: 1800438)							
ES1110202-139	W2-3 4.5-5.0	EG005T: Arsenic	7440-38-2	50 mg/kg	96.4	70	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	92.1	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	88.2	70	130
		EG005T: Copper	7440-50-8	250 mg/kg	103	70	130
		EG005T: Lead	7439-92-1	250 mg/kg	98.3	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	89.2	70	130
		EG005T: Zinc	7440-66-6	250 mg/kg	92.9	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1798383)							
ES1110202-004	D3-1 2.5-3.0	EG035T: Mercury	7439-97-6	5 mg/kg	86.4	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1800439)							
ES1110202-139	W2-3 4.5-5.0	EG035T: Mercury	7439-97-6	5 mg/kg	81.7	70	130
EK026G: Total Cyanide By Discrete Analyser (QCLot: 1799155)							
ES1110202-004	D3-1 2.5-3.0	EK026G: Total Cyanide	57-12-5	20.0 mg/kg	102	70	130
EK026G: Total Cyanide By Discrete Analyser (QCLot: 1799156)							
ES1110202-144	W3-1 1.5-2.0	EK026G: Total Cyanide	57-12-5	20.0 mg/kg	101	70	130
EK055: Ammonia as N (QCLot: 1801183)							
ES1110202-008	D3-2 0.5-1.0	EK055: Ammonia as N	7664-41-7	20 mg/kg	90.2	70	130
EK055: Ammonia as N (QCLot: 1801184)							
ES1110202-178	Q14	EK055: Ammonia as N	7664-41-7	20 mg/kg	116	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1799170)							
ES1110202-004	D3-1 2.5-3.0	EK059G: Nitrite + Nitrate as N (Sol.)	----	3.0 mg/kg	82.0	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1799171)							
ES1110202-144	W3-1 1.5-2.0	EK059G: Nitrite + Nitrate as N (Sol.)	----	3.0 mg/kg	71.7	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1798441)							
ES1110202-004	D3-1 2.5-3.0	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	98.6	70	130

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1798444)							
ES1110202-144	W3-1 1.5-2.0	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	104	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1798442)							
ES1110202-004	D3-1 2.5-3.0	EK067G: Total Phosphorus as P	----	100 mg/kg	107	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1798443)							
ES1110202-144	W3-1 1.5-2.0	EK067G: Total Phosphorus as P	----	100 mg/kg	125	70	130
EP075(SIM)A: Phenolic Compounds (QCLot: 1798891)							
ES1110202-004	D3-1 2.5-3.0	EP075(SIM): Phenol	108-95-2	10 mg/kg	110	70	130
		EP075(SIM): 2-Chlorophenol	95-57-8	10 mg/kg	114	70	130
		EP075(SIM): 2-Nitrophenol	88-75-5	10 mg/kg	109	60	130
		EP075(SIM): 4-Chloro-3-Methylphenol	59-50-7	10 mg/kg	111	70	130
		EP075(SIM): Pentachlorophenol	87-86-5	10 mg/kg	63.2	20	130
EP075(SIM)A: Phenolic Compounds (QCLot: 1800478)							
ES1110202-139	W2-3 4.5-5.0	EP075(SIM): Phenol	108-95-2	10 mg/kg	113	70	130
		EP075(SIM): 2-Chlorophenol	95-57-8	10 mg/kg	112	70	130
		EP075(SIM): 2-Nitrophenol	88-75-5	10 mg/kg	98.9	60	130
		EP075(SIM): 4-Chloro-3-Methylphenol	59-50-7	10 mg/kg	111	70	130
		EP075(SIM): Pentachlorophenol	87-86-5	10 mg/kg	74.4	20	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1797713)							
ES1110202-004	D3-1 2.5-3.0	EP080: C6 - C9 Fraction	----	32.5 mg/kg	77.6	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1797746)							
ES1110496-021	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	79.4	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1798890)							
ES1110202-004	D3-1 2.5-3.0	EP071: C10 - C14 Fraction	----	640 mg/kg	89.4	73	137
		EP071: C15 - C28 Fraction	----	3140 mg/kg	87.5	53	131
		EP071: C29 - C36 Fraction	----	2860 mg/kg	85.6	52	132
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1800477)							
ES1110202-139	W2-3 4.5-5.0	EP071: C10 - C14 Fraction	----	640 mg/kg	99.4	73	137
		EP071: C15 - C28 Fraction	----	3140 mg/kg	77.2	53	131
		EP071: C29 - C36 Fraction	----	2860 mg/kg	95.9	52	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 1797713)							
ES1110202-004	D3-1 2.5-3.0	EP080: C6 - C10 Fraction	----	37.5 mg/kg	79.6	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 1797746)							
ES1110496-021	Anonymous	EP080: C6 - C10 Fraction	----	37.5 mg/kg	83.3	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 1798890)							
ES1110202-004	D3-1 2.5-3.0	EP071: >C10 - C16 Fraction	----	850 mg/kg	88.4	73	137
		EP071: >C16 - C34 Fraction	----	4800 mg/kg	77.2	53	131

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 1798890) - continued							
ES1110202-004	D3-1 2.5-3.0	EP071: >C34 - C40 Fraction	----	2400 mg/kg	83.0	52	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 1800477)							
ES1110202-139	W2-3 4.5-5.0	EP071: >C10 - C16 Fraction	----	850 mg/kg	96.3	73	137
		EP071: >C16 - C34 Fraction	----	4800 mg/kg	78.8	53	131
		EP071: >C34 - C40 Fraction	----	2400 mg/kg	99.7	52	132
EP080: BTEXN (QCLot: 1797713)							
ES1110202-004	D3-1 2.5-3.0	EP080: Benzene	71-43-2	2.5 mg/kg	80.6	70	130
		EP080: Toluene	108-88-3	2.5 mg/kg	82.5	70	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	90.1	70	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	90.6	70	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	94.4	70	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	84.3	70	130
EP080: BTEXN (QCLot: 1797746)							
ES1110496-021	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	81.0	70	130
		EP080: Toluene	108-88-3	2.5 mg/kg	79.4	70	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	85.0	70	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	83.6	70	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	86.9	70	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	93.1	70	130
EP090: Organotin Compounds (QCLot: 1798977)							
ES1110202-015	D3-3 0.5-1.0	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	66.8	20	130
EP131A: Organochlorine Pesticides (QCLot: 1813322)							
ES1110202-015	D3-3 0.5-1.0	EP131A: Aldrin	309-00-2	5 µg/kg	70.5	31.7	140
		EP131A: alpha-BHC	319-84-6	5 µg/kg	51.0	24.5	150
		EP131A: beta-BHC	319-85-7	5 µg/kg	79.2	36.9	139
		EP131A: delta-BHC	319-86-8	5 µg/kg	65.0	38.2	137
		EP131A: 4.4`-DDD	72-54-8	5 µg/kg	69.8	42.5	141
		EP131A: 4.4`-DDE	72-55-9	5 µg/kg	66.8	34.8	140
		EP131A: 4.4`-DDT	50-29-3	5 µg/kg	61.0	38	143
		EP131A: Dieldrin	60-57-1	5 µg/kg	74.3	43.2	134
		EP131A: alpha-Endosulfan	959-98-8	5 µg/kg	62.1	23.7	139
		EP131A: beta-Endosulfan	33213-65-9	5 µg/kg	68.7	35.8	138
		EP131A: Endosulfan sulfate	1031-07-8	5 µg/kg	82.3	7.45	158
		EP131A: Endrin	72-20-8	5 µg/kg	74.3	21.6	162
		EP131A: Endrin aldehyde	7421-93-4	5 µg/kg	56.6	19.3	131
		EP131A: Endrin ketone	53494-70-5	5 µg/kg	73.8	17.9	141

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Spike Recovery (%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP131A: Organochlorine Pesticides (QCLot: 1813322) - continued							
ES1110202-015	D3-3 0.5-1.0	EP131A: Heptachlor	76-44-8	5 µg/kg	78.0	31	153
		EP131A: Heptachlor epoxide	1024-57-3	5 µg/kg	71.9	34.3	138
		EP131A: Hexachlorobenzene (HCB)	118-74-1	5 µg/kg	51.0	18.6	146
		EP131A: gamma-BHC	58-89-9	5 µg/kg	50.4	30.7	145
		EP131A: Methoxychlor	72-43-5	5 µg/kg	75.0	15	157
		EP131A: cis-Chlordane	5103-71-9	5 µg/kg	75.5	22.3	145
		EP131A: trans-Chlordane	5103-74-2	5 µg/kg	59.9	42.4	139
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 1813323)							
ES1110202-015	D3-3 0.5-1.0	EP131B: Aroclor 1254	11097-69-1	50 µg/kg	63.8	61.3	121
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1813288)							
ES1110202-004	D3-1 2.5-3.0	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	# Not Determined	70	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	# 70.0	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	72.1	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	76.0	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	70.3	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	91.9	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	71.6	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	# 2.7	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	# 54.3	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	85.2	70	130
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	# 51.0	70	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	# 177	70	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	25 µg/kg	87.7	70	130
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	25 µg/kg	# 143	70	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	99.6	70	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	# 146	70	130
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1813289)							
ES1110202-139	W2-3 4.5-5.0	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	# 61.4	70	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	77.6	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	89.2	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	79.8	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	75.7	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	102	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	79.1	70	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Spike Recovery (%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1813289) - continued							
ES1110202-139	W2-3 4.5-5.0	EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	82.6	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	83.6	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	96.5	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	95.2	70	130
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	25 µg/kg	108	70	130
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	# 58.2	70	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	79.2	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	83.6	70	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	25 µg/kg	# 52.5	70	130
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	25 µg/kg	# 58.4	70	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	# 51.4	70	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	# 42.2	70	130
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1816999)							
ES1110202-044	M1-2 2.5-3.0	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	# Not Determined	70	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	# 52.5	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	# 51.4	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	74.0	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	25 µg/kg	# 48.2	70	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	# Not Determined	70	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	# 42.0	70	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Spike Recovery (%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EG020T: Total Metals by ICP-MS (QCLot: 1798140)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 1798140) - continued							
ES1110202-183	R2	EG020A-T: Arsenic	7440-38-2	1 mg/L	89.2	70	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	87.8	70	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	94.9	70	130
		EG020A-T: Copper	7440-50-8	1 mg/L	95.1	70	130
		EG020A-T: Lead	7439-92-1	1 mg/L	103	70	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	91.3	70	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	91.0	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1797631)							
ES1110202-183	R2	EG035T: Mercury	7439-97-6	0.010 mg/L	101	70	130

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1110202**	Page	: 1 of 23
Client	: GHD SERVICES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Angela Pavlovic
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
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Telephone	: +61 02 9239 7100	Telephone	: +61 2 8784 8523
Facsimile	: +61 02 9239 7199	Facsimile	: +61 2 8784 8500
Project	: 221568306 NPC	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: 159123-139	Date Samples Received	: 18-MAY-2011
Sampler	: JS	Issue Date	: 09-JUN-2011
Order number	: ----		
		No. of samples received	: 185
Quote number	: EN/005/10	No. of samples analysed	: 31

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

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
EA055: Moisture Content							
Soil Glass Jar - Unpreserved							
M2-4 0.5-1.0, W1-1 1.5-2.0, W1-3 0.0-0.5, W1-3 5.5-5.6, W2-2 0.0-0.5, W3-1 1.5-2.0	**14-MAY-2011**	**----**	----	----	**20-MAY-2011**	28-MAY-2011	✓
Soil Glass Jar - Unpreserved							
K1-1 0.0-0.5, M1-4 1.5-2.0, M2-2 0.0-0.5, M2-3 4.5-4.6, W1-2 0.0-0.5, W2-1 0.0-0.5, W2-3 4.5-5.0, W3-2 0.0-0.5, W3-3 4.5-5.0, Q03	**16-MAY-2011**	**----**	----	----	**20-MAY-2011**	30-MAY-2011	✓
Soil Glass Jar - Unpreserved							
D3-1 2.5-3.0, D3-2 0.5-1.0, D3-3 0.5-1.0, D3-4 2.5-3.0, D3-5 0.0-0.5, M1-1A 2.5-3.0, M1-2 2.5-3.0, M1-3 1.5-2.0, M2-1 3.5-4.0, Q12, Q14	**17-MAY-2011**	**----**	----	----	**20-MAY-2011**	31-MAY-2011	✓

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
EG005T: Total Metals by ICP-AES								
Soil Glass Jar - Unpreserved								
M2-4 0.5-1.0,	W1-1 1.5-2.0,	**14-MAY-2011**	**22-MAY-2011**	10-NOV-2011	✓	**23-MAY-2011**	10-NOV-2011	✓
W1-3 0.0-0.5,	W2-2 0.0-0.5							
Soil Glass Jar - Unpreserved								
W3-1 1.5-2.0		**14-MAY-2011**	**23-MAY-2011**	10-NOV-2011	✓	**24-MAY-2011**	10-NOV-2011	✓
Soil Glass Jar - Unpreserved								
K1-1 0.0-0.5,	M1-4 1.5-2.0,	**16-MAY-2011**	**22-MAY-2011**	12-NOV-2011	✓	**23-MAY-2011**	12-NOV-2011	✓
M2-2 0.0-0.5,	M2-3 4.5-4.6,							
W1-2 0.0-0.5,	W2-1 0.0-0.5							
Soil Glass Jar - Unpreserved								
W2-3 4.5-5.0,	W3-2 0.0-0.5,	**16-MAY-2011**	**23-MAY-2011**	12-NOV-2011	✓	**24-MAY-2011**	12-NOV-2011	✓
W3-3 4.5-5.0,	Q03							
Soil Glass Jar - Unpreserved								
D3-1 2.5-3.0,	D3-2 0.5-1.0,	**17-MAY-2011**	**22-MAY-2011**	13-NOV-2011	✓	**23-MAY-2011**	13-NOV-2011	✓
D3-3 0.5-1.0,	D3-4 2.5-3.0,							
D3-5 0.0-0.5,	M1-1A 2.5-3.0,							
M1-2 2.5-3.0,	M1-3 1.5-2.0,							
M2-1 3.5-4.0								
Soil Glass Jar - Unpreserved								
Q12,	Q14	**17-MAY-2011**	**23-MAY-2011**	13-NOV-2011	✓	**24-MAY-2011**	13-NOV-2011	✓
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved								
M2-4 0.5-1.0,	W1-1 1.5-2.0,	**14-MAY-2011**	**22-MAY-2011**	11-JUN-2011	✓	**30-MAY-2011**	11-JUN-2011	✓
W1-3 0.0-0.5,	W2-2 0.0-0.5							
Soil Glass Jar - Unpreserved								
W3-1 1.5-2.0		**14-MAY-2011**	**23-MAY-2011**	11-JUN-2011	✓	**26-MAY-2011**	11-JUN-2011	✓
Soil Glass Jar - Unpreserved								
K1-1 0.0-0.5,	M1-4 1.5-2.0,	**16-MAY-2011**	**22-MAY-2011**	13-JUN-2011	✓	**30-MAY-2011**	13-JUN-2011	✓
M2-2 0.0-0.5,	M2-3 4.5-4.6,							
W1-2 0.0-0.5,	W2-1 0.0-0.5							
Soil Glass Jar - Unpreserved								
W2-3 4.5-5.0,	W3-2 0.0-0.5,	**16-MAY-2011**	**23-MAY-2011**	13-JUN-2011	✓	**26-MAY-2011**	13-JUN-2011	✓
W3-3 4.5-5.0,	Q03							
Soil Glass Jar - Unpreserved								
D3-1 2.5-3.0,	D3-2 0.5-1.0,	**17-MAY-2011**	**22-MAY-2011**	14-JUN-2011	✓	**30-MAY-2011**	14-JUN-2011	✓
D3-3 0.5-1.0,	D3-4 2.5-3.0,							
D3-5 0.0-0.5,	M1-1A 2.5-3.0,							
M1-2 2.5-3.0,	M1-3 1.5-2.0,							
M2-1 3.5-4.0								
Soil Glass Jar - Unpreserved								
Q12,	Q14	**17-MAY-2011**	**23-MAY-2011**	14-JUN-2011	✓	**26-MAY-2011**	14-JUN-2011	✓

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
EK026G: Total Cyanide By Discrete Analyser							
Soil Glass Jar - Unpreserved M2-4 0.5-1.0, W1-1 1.5-2.0, W1-3 0.0-0.5, W2-2 0.0-0.5, W3-1 1.5-2.0	**14-MAY-2011**	**23-MAY-2011**	21-MAY-2011	×	**24-MAY-2011**	06-JUN-2011	✓
Soil Glass Jar - Unpreserved K1-1 0.0-0.5, M1-4 1.5-2.0, M2-2 0.0-0.5, M2-3 4.5-4.6, W1-2 0.0-0.5, W2-1 0.0-0.5, W2-3 4.5-5.0, W3-2 0.0-0.5, W3-3 4.5-5.0, Q03	**16-MAY-2011**	**23-MAY-2011**	23-MAY-2011	✓	**24-MAY-2011**	06-JUN-2011	✓
Soil Glass Jar - Unpreserved D3-1 2.5-3.0, D3-2 0.5-1.0, D3-3 0.5-1.0, D3-4 2.5-3.0, D3-5 0.0-0.5, M1-1A 2.5-3.0, M1-2 2.5-3.0, M1-3 1.5-2.0, M2-1 3.5-4.0, Q12, Q14	**17-MAY-2011**	**23-MAY-2011**	24-MAY-2011	✓	**24-MAY-2011**	06-JUN-2011	✓
EK055: Ammonia as N							
Soil Glass Jar - Unpreserved M2-4 0.5-1.0, W1-1 1.5-2.0, W1-3 0.0-0.5, W2-2 0.0-0.5, W3-1 1.5-2.0	**14-MAY-2011**	**----**	----	----	**24-MAY-2011**	10-NOV-2011	✓
Soil Glass Jar - Unpreserved K1-1 0.0-0.5, M1-4 1.5-2.0, M2-2 0.0-0.5, M2-3 4.5-4.6, W1-2 0.0-0.5, W2-1 0.0-0.5, W2-3 4.5-5.0, W3-2 0.0-0.5, W3-3 4.5-5.0, Q03	**16-MAY-2011**	**----**	----	----	**24-MAY-2011**	12-NOV-2011	✓
Soil Glass Jar - Unpreserved D3-1 2.5-3.0, D3-2 0.5-1.0, D3-3 0.5-1.0, D3-4 2.5-3.0, D3-5 0.0-0.5, M1-1A 2.5-3.0, M1-2 2.5-3.0, M1-3 1.5-2.0, M2-1 3.5-4.0, Q12, Q14	**17-MAY-2011**	**----**	----	----	**24-MAY-2011**	13-NOV-2011	✓

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
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Soil Glass Jar - Unpreserved M2-4 0.5-1.0, W1-1 1.5-2.0, W1-3 0.0-0.5, W2-2 0.0-0.5, W3-1 1.5-2.0	**14-MAY-2011**	**24-MAY-2011**	10-NOV-2011	✓	**24-MAY-2011**	10-NOV-2011	✓
Soil Glass Jar - Unpreserved K1-1 0.0-0.5, M1-4 1.5-2.0, M2-2 0.0-0.5, M2-3 4.5-4.6, W1-2 0.0-0.5, W2-1 0.0-0.5, W2-3 4.5-5.0, W3-2 0.0-0.5, W3-3 4.5-5.0, Q03	**16-MAY-2011**	**24-MAY-2011**	12-NOV-2011	✓	**24-MAY-2011**	12-NOV-2011	✓
Soil Glass Jar - Unpreserved D3-1 2.5-3.0, D3-2 0.5-1.0, D3-3 0.5-1.0, D3-4 2.5-3.0, D3-5 0.0-0.5, M1-1A 2.5-3.0, M1-2 2.5-3.0, M1-3 1.5-2.0, M2-1 3.5-4.0, Q12, Q14	**17-MAY-2011**	**24-MAY-2011**	13-NOV-2011	✓	**24-MAY-2011**	13-NOV-2011	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Soil Glass Jar - Unpreserved M2-4 0.5-1.0, W1-1 1.5-2.0, W1-3 0.0-0.5, W2-2 0.0-0.5, W3-1 1.5-2.0	**14-MAY-2011**	**23-MAY-2011**	10-NOV-2011	✓	**23-MAY-2011**	10-NOV-2011	✓
Soil Glass Jar - Unpreserved K1-1 0.0-0.5, M1-4 1.5-2.0, M2-2 0.0-0.5, M2-3 4.5-4.6, W1-2 0.0-0.5, W2-1 0.0-0.5, W2-3 4.5-5.0, W3-2 0.0-0.5, W3-3 4.5-5.0, Q03	**16-MAY-2011**	**23-MAY-2011**	12-NOV-2011	✓	**23-MAY-2011**	12-NOV-2011	✓
Soil Glass Jar - Unpreserved D3-1 2.5-3.0, D3-2 0.5-1.0, D3-3 0.5-1.0, D3-4 2.5-3.0, D3-5 0.0-0.5, M1-1A 2.5-3.0, M1-2 2.5-3.0, M1-3 1.5-2.0, M2-1 3.5-4.0, Q12, Q14	**17-MAY-2011**	**23-MAY-2011**	13-NOV-2011	✓	**23-MAY-2011**	13-NOV-2011	✓

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
EK067G: Total Phosphorus as P by Discrete Analyser							
Soil Glass Jar - Unpreserved M2-4 0.5-1.0, W1-1 1.5-2.0, W1-3 0.0-0.5, W2-2 0.0-0.5, W3-1 1.5-2.0	**14-MAY-2011**	**23-MAY-2011**	10-NOV-2011	✓	**23-MAY-2011**	10-NOV-2011	✓
Soil Glass Jar - Unpreserved K1-1 0.0-0.5, M1-4 1.5-2.0, M2-2 0.0-0.5, M2-3 4.5-4.6, W1-2 0.0-0.5, W2-1 0.0-0.5, W2-3 4.5-5.0, W3-2 0.0-0.5, W3-3 4.5-5.0, Q03	**16-MAY-2011**	**23-MAY-2011**	12-NOV-2011	✓	**23-MAY-2011**	12-NOV-2011	✓
Soil Glass Jar - Unpreserved D3-1 2.5-3.0, D3-2 0.5-1.0, D3-3 0.5-1.0, D3-4 2.5-3.0, D3-5 0.0-0.5, M1-1A 2.5-3.0, M1-2 2.5-3.0, M1-3 1.5-2.0, M2-1 3.5-4.0, Q12, Q14	**17-MAY-2011**	**23-MAY-2011**	13-NOV-2011	✓	**23-MAY-2011**	13-NOV-2011	✓
EP003: Total Organic Carbon (TOC) in Soil							
Pulp Bag W1-1 1.5-2.0, W1-3 0.0-0.5, W2-2 0.0-0.5, W3-1 1.5-2.0	**14-MAY-2011**	**27-MAY-2011**	11-JUN-2011	✓	**27-MAY-2011**	11-JUN-2011	✓
Pulp Bag K1-1 0.0-0.5, M1-4 1.5-2.0, M2-2 0.0-0.5, W1-2 0.0-0.5, W2-1 0.0-0.5, W2-3 4.5-5.0, W3-2 0.0-0.5, W3-3 4.5-5.0, Q03	**16-MAY-2011**	**27-MAY-2011**	13-JUN-2011	✓	**27-MAY-2011**	13-JUN-2011	✓
Pulp Bag D3-1 2.5-3.0, D3-2 0.5-1.0, D3-3 0.5-1.0, D3-4 2.5-3.0, D3-5 0.0-0.5, M1-1A 2.5-3.0, M1-2 2.5-3.0, M1-3 1.5-2.0, M2-1 3.5-4.0, Q12, Q14	**17-MAY-2011**	**27-MAY-2011**	14-JUN-2011	✓	**27-MAY-2011**	14-JUN-2011	✓
Soil Glass Jar - Unpreserved M2-4 0.5-1.0	**14-MAY-2011**	**27-MAY-2011**	11-JUN-2011	✓	**27-MAY-2011**	11-JUN-2011	✓
Soil Glass Jar - Unpreserved M2-3 4.5-4.6	**16-MAY-2011**	**27-MAY-2011**	13-JUN-2011	✓	**27-MAY-2011**	13-JUN-2011	✓

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
EP075(SIM)A: Phenolic Compounds							
Soil Glass Jar - Unpreserved M2-4 0.5-1.0, W1-1 1.5-2.0, W1-3 0.0-0.5, W2-2 0.0-0.5	**14-MAY-2011**	**23-MAY-2011**	28-MAY-2011	✓	**23-MAY-2011**	02-JUL-2011	✓
Soil Glass Jar - Unpreserved W3-1 1.5-2.0	**14-MAY-2011**	**24-MAY-2011**	28-MAY-2011	✓	**24-MAY-2011**	03-JUL-2011	✓
Soil Glass Jar - Unpreserved K1-1 0.0-0.5, M1-4 1.5-2.0, M2-2 0.0-0.5, M2-3 4.5-4.6, W1-2 0.0-0.5, W2-1 0.0-0.5	**16-MAY-2011**	**23-MAY-2011**	30-MAY-2011	✓	**23-MAY-2011**	02-JUL-2011	✓
Soil Glass Jar - Unpreserved W2-3 4.5-5.0, W3-2 0.0-0.5, W3-3 4.5-5.0, Q03	**16-MAY-2011**	**24-MAY-2011**	30-MAY-2011	✓	**24-MAY-2011**	03-JUL-2011	✓
Soil Glass Jar - Unpreserved D3-1 2.5-3.0, D3-2 0.5-1.0, D3-3 0.5-1.0, D3-4 2.5-3.0, D3-5 0.0-0.5, M1-1A 2.5-3.0, M1-2 2.5-3.0, M1-3 1.5-2.0, M2-1 3.5-4.0	**17-MAY-2011**	**23-MAY-2011**	31-MAY-2011	✓	**23-MAY-2011**	02-JUL-2011	✓
Soil Glass Jar - Unpreserved Q12, Q14	**17-MAY-2011**	**24-MAY-2011**	31-MAY-2011	✓	**24-MAY-2011**	03-JUL-2011	✓

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
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved M2-4 0.5-1.0, W1-1 1.5-2.0, W1-3 0.0-0.5, W1-3 5.5-5.6, W2-2 0.0-0.5	**14-MAY-2011**	**20-MAY-2011**	28-MAY-2011	✓	**23-MAY-2011**	28-MAY-2011	✓
Soil Glass Jar - Unpreserved W3-1 1.5-2.0	**14-MAY-2011**	**20-MAY-2011**	28-MAY-2011	✓	**24-MAY-2011**	28-MAY-2011	✓
Soil Glass Jar - Unpreserved M2-4 0.5-1.0, W1-1 1.5-2.0, W1-3 0.0-0.5, W1-3 5.5-5.6, W2-2 0.0-0.5	**14-MAY-2011**	**23-MAY-2011**	28-MAY-2011	✓	**23-MAY-2011**	02-JUL-2011	✓
Soil Glass Jar - Unpreserved W3-1 1.5-2.0	**14-MAY-2011**	**24-MAY-2011**	28-MAY-2011	✓	**24-MAY-2011**	03-JUL-2011	✓
Soil Glass Jar - Unpreserved K1-1 0.0-0.5, M1-4 1.5-2.0, M2-2 0.0-0.5, M2-3 4.5-4.6, W1-2 0.0-0.5, W2-1 0.0-0.5	**16-MAY-2011**	**20-MAY-2011**	30-MAY-2011	✓	**23-MAY-2011**	30-MAY-2011	✓
Soil Glass Jar - Unpreserved W2-3 4.5-5.0, W3-2 0.0-0.5, W3-3 4.5-5.0, Q03	**16-MAY-2011**	**20-MAY-2011**	30-MAY-2011	✓	**24-MAY-2011**	30-MAY-2011	✓
Soil Glass Jar - Unpreserved K1-1 0.0-0.5, M1-4 1.5-2.0, M2-2 0.0-0.5, M2-3 4.5-4.6, W1-2 0.0-0.5, W2-1 0.0-0.5	**16-MAY-2011**	**23-MAY-2011**	30-MAY-2011	✓	**23-MAY-2011**	02-JUL-2011	✓
Soil Glass Jar - Unpreserved W2-3 4.5-5.0, W3-2 0.0-0.5, W3-3 4.5-5.0, Q03	**16-MAY-2011**	**24-MAY-2011**	30-MAY-2011	✓	**24-MAY-2011**	03-JUL-2011	✓
Soil Glass Jar - Unpreserved D3-1 2.5-3.0, D3-2 0.5-1.0, D3-3 0.5-1.0, D3-4 2.5-3.0, D3-5 0.0-0.5, M1-1A 2.5-3.0, M1-2 2.5-3.0, M1-3 1.5-2.0, M2-1 3.5-4.0	**17-MAY-2011**	**20-MAY-2011**	31-MAY-2011	✓	**23-MAY-2011**	31-MAY-2011	✓
Soil Glass Jar - Unpreserved Q12, Q14	**17-MAY-2011**	**20-MAY-2011**	31-MAY-2011	✓	**24-MAY-2011**	31-MAY-2011	✓
Soil Glass Jar - Unpreserved D3-1 2.5-3.0, D3-2 0.5-1.0, D3-3 0.5-1.0, D3-4 2.5-3.0, D3-5 0.0-0.5, M1-1A 2.5-3.0, M1-2 2.5-3.0, M1-3 1.5-2.0, M2-1 3.5-4.0	**17-MAY-2011**	**23-MAY-2011**	31-MAY-2011	✓	**23-MAY-2011**	02-JUL-2011	✓
Soil Glass Jar - Unpreserved Q12, Q14	**17-MAY-2011**	**24-MAY-2011**	31-MAY-2011	✓	**24-MAY-2011**	03-JUL-2011	✓

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
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft							
Soil Glass Jar - Unpreserved M2-4 0.5-1.0, W1-1 1.5-2.0, W1-3 0.0-0.5, W1-3 5.5-5.6, W2-2 0.0-0.5	**14-MAY-2011**	**20-MAY-2011**	28-MAY-2011	✓	**23-MAY-2011**	28-MAY-2011	✓
Soil Glass Jar - Unpreserved W3-1 1.5-2.0	**14-MAY-2011**	**20-MAY-2011**	28-MAY-2011	✓	**24-MAY-2011**	28-MAY-2011	✓
Soil Glass Jar - Unpreserved M2-4 0.5-1.0, W1-1 1.5-2.0, W1-3 0.0-0.5, W1-3 5.5-5.6, W2-2 0.0-0.5	**14-MAY-2011**	**23-MAY-2011**	28-MAY-2011	✓	**23-MAY-2011**	02-JUL-2011	✓
Soil Glass Jar - Unpreserved W3-1 1.5-2.0	**14-MAY-2011**	**24-MAY-2011**	28-MAY-2011	✓	**24-MAY-2011**	03-JUL-2011	✓
Soil Glass Jar - Unpreserved K1-1 0.0-0.5, M1-4 1.5-2.0, M2-2 0.0-0.5, M2-3 4.5-4.6, W1-2 0.0-0.5, W2-1 0.0-0.5	**16-MAY-2011**	**20-MAY-2011**	30-MAY-2011	✓	**23-MAY-2011**	30-MAY-2011	✓
Soil Glass Jar - Unpreserved W2-3 4.5-5.0, W3-2 0.0-0.5, W3-3 4.5-5.0, Q03	**16-MAY-2011**	**20-MAY-2011**	30-MAY-2011	✓	**24-MAY-2011**	30-MAY-2011	✓
Soil Glass Jar - Unpreserved K1-1 0.0-0.5, M1-4 1.5-2.0, M2-2 0.0-0.5, M2-3 4.5-4.6, W1-2 0.0-0.5, W2-1 0.0-0.5	**16-MAY-2011**	**23-MAY-2011**	30-MAY-2011	✓	**23-MAY-2011**	02-JUL-2011	✓
Soil Glass Jar - Unpreserved W2-3 4.5-5.0, W3-2 0.0-0.5, W3-3 4.5-5.0, Q03	**16-MAY-2011**	**24-MAY-2011**	30-MAY-2011	✓	**24-MAY-2011**	03-JUL-2011	✓
Soil Glass Jar - Unpreserved D3-1 2.5-3.0, D3-2 0.5-1.0, D3-3 0.5-1.0, D3-4 2.5-3.0, D3-5 0.0-0.5, M1-1A 2.5-3.0, M1-2 2.5-3.0, M1-3 1.5-2.0, M2-1 3.5-4.0	**17-MAY-2011**	**20-MAY-2011**	31-MAY-2011	✓	**23-MAY-2011**	31-MAY-2011	✓
Soil Glass Jar - Unpreserved Q12, Q14	**17-MAY-2011**	**20-MAY-2011**	31-MAY-2011	✓	**24-MAY-2011**	31-MAY-2011	✓
Soil Glass Jar - Unpreserved D3-1 2.5-3.0, D3-2 0.5-1.0, D3-3 0.5-1.0, D3-4 2.5-3.0, D3-5 0.0-0.5, M1-1A 2.5-3.0, M1-2 2.5-3.0, M1-3 1.5-2.0, M2-1 3.5-4.0	**17-MAY-2011**	**23-MAY-2011**	31-MAY-2011	✓	**23-MAY-2011**	02-JUL-2011	✓
Soil Glass Jar - Unpreserved Q12, Q14	**17-MAY-2011**	**24-MAY-2011**	31-MAY-2011	✓	**24-MAY-2011**	03-JUL-2011	✓

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: BTEX								
Soil Glass Jar - Unpreserved								
M2-4 0.5-1.0,	W1-1 1.5-2.0,	**14-MAY-2011**	**20-MAY-2011**	28-MAY-2011	✓	**23-MAY-2011**	28-MAY-2011	✓
W1-3 0.0-0.5,	W1-3 5.5-5.6,							
W2-2 0.0-0.5								
Soil Glass Jar - Unpreserved								
W3-1 1.5-2.0		**14-MAY-2011**	**20-MAY-2011**	28-MAY-2011	✓	**24-MAY-2011**	28-MAY-2011	✓
Soil Glass Jar - Unpreserved								
K1-1 0.0-0.5,	M1-4 1.5-2.0,	**16-MAY-2011**	**20-MAY-2011**	30-MAY-2011	✓	**23-MAY-2011**	30-MAY-2011	✓
M2-2 0.0-0.5,	M2-3 4.5-4.6,							
W1-2 0.0-0.5,	W2-1 0.0-0.5							
Soil Glass Jar - Unpreserved								
W2-3 4.5-5.0,	W3-2 0.0-0.5,	**16-MAY-2011**	**20-MAY-2011**	30-MAY-2011	✓	**24-MAY-2011**	30-MAY-2011	✓
W3-3 4.5-5.0,	Q03							
Soil Glass Jar - Unpreserved								
D3-1 2.5-3.0,	D3-2 0.5-1.0,	**17-MAY-2011**	**20-MAY-2011**	31-MAY-2011	✓	**23-MAY-2011**	31-MAY-2011	✓
D3-3 0.5-1.0,	D3-4 2.5-3.0,							
D3-5 0.0-0.5,	M1-1A 2.5-3.0,							
M1-2 2.5-3.0,	M1-3 1.5-2.0,							
M2-1 3.5-4.0								
Soil Glass Jar - Unpreserved								
Q12,	Q14	**17-MAY-2011**	**20-MAY-2011**	31-MAY-2011	✓	**24-MAY-2011**	31-MAY-2011	✓
EP080: BTEXN								
Soil Glass Jar - Unpreserved								
M2-4 0.5-1.0,	W1-1 1.5-2.0,	**14-MAY-2011**	**20-MAY-2011**	28-MAY-2011	✓	**23-MAY-2011**	28-MAY-2011	✓
W1-3 0.0-0.5,	W1-3 5.5-5.6,							
W2-2 0.0-0.5								
Soil Glass Jar - Unpreserved								
W3-1 1.5-2.0		**14-MAY-2011**	**20-MAY-2011**	28-MAY-2011	✓	**24-MAY-2011**	28-MAY-2011	✓
Soil Glass Jar - Unpreserved								
K1-1 0.0-0.5,	M1-4 1.5-2.0,	**16-MAY-2011**	**20-MAY-2011**	30-MAY-2011	✓	**23-MAY-2011**	30-MAY-2011	✓
M2-2 0.0-0.5,	M2-3 4.5-4.6,							
W1-2 0.0-0.5,	W2-1 0.0-0.5							
Soil Glass Jar - Unpreserved								
W2-3 4.5-5.0,	W3-2 0.0-0.5,	**16-MAY-2011**	**20-MAY-2011**	30-MAY-2011	✓	**24-MAY-2011**	30-MAY-2011	✓
W3-3 4.5-5.0,	Q03							
Soil Glass Jar - Unpreserved								
D3-1 2.5-3.0,	D3-2 0.5-1.0,	**17-MAY-2011**	**20-MAY-2011**	31-MAY-2011	✓	**23-MAY-2011**	31-MAY-2011	✓
D3-3 0.5-1.0,	D3-4 2.5-3.0,							
D3-5 0.0-0.5,	M1-1A 2.5-3.0,							
M1-2 2.5-3.0,	M1-3 1.5-2.0,							
M2-1 3.5-4.0								
Soil Glass Jar - Unpreserved								
Q12,	Q14	**17-MAY-2011**	**20-MAY-2011**	31-MAY-2011	✓	**24-MAY-2011**	31-MAY-2011	✓

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								
W1-1 1.5-2.0,	W3-1 1.5-2.0	**14-MAY-2011**	**23-MAY-2011**	28-MAY-2011	✓	**26-MAY-2011**	02-JUL-2011	✓
Soil Glass Jar - Unpreserved								
K1-1 0.0-0.5, Q03	W2-1 0.0-0.5,	**16-MAY-2011**	**23-MAY-2011**	30-MAY-2011	✓	**26-MAY-2011**	02-JUL-2011	✓
Soil Glass Jar - Unpreserved								
D3-3 0.5-1.0,	M1-3 1.5-2.0	**17-MAY-2011**	**23-MAY-2011**	31-MAY-2011	✓	**26-MAY-2011**	02-JUL-2011	✓
EP131A: Organochlorine Pesticides								
Soil Glass Jar - Unpreserved								
W1-1 1.5-2.0,	W3-1 1.5-2.0	**14-MAY-2011**	**01-JUN-2011**	28-MAY-2011	×	**03-JUN-2011**	11-JUL-2011	✓
Soil Glass Jar - Unpreserved								
K1-1 0.0-0.5, Q03	W2-1 0.0-0.5,	**16-MAY-2011**	**01-JUN-2011**	30-MAY-2011	×	**03-JUN-2011**	11-JUL-2011	✓
Soil Glass Jar - Unpreserved								
D3-3 0.5-1.0,	M1-3 1.5-2.0	**17-MAY-2011**	**01-JUN-2011**	31-MAY-2011	×	**03-JUN-2011**	11-JUL-2011	✓
EP131B: Polychlorinated Biphenyls (as Aroclors)								
Soil Glass Jar - Unpreserved								
W1-1 1.5-2.0,	W3-1 1.5-2.0	**14-MAY-2011**	**01-JUN-2011**	28-MAY-2011	×	**03-JUN-2011**	11-JUL-2011	✓
Soil Glass Jar - Unpreserved								
K1-1 0.0-0.5, Q03	W2-1 0.0-0.5,	**16-MAY-2011**	**01-JUN-2011**	30-MAY-2011	×	**03-JUN-2011**	11-JUL-2011	✓
Soil Glass Jar - Unpreserved								
D3-3 0.5-1.0,	M1-3 1.5-2.0	**17-MAY-2011**	**01-JUN-2011**	31-MAY-2011	×	**03-JUN-2011**	11-JUL-2011	✓
EP132B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved								
M2-4 0.5-1.0, W1-3 0.0-0.5, W2-2 0.0-0.5,	W1-1 1.5-2.0, W1-3 5.5-5.6, W3-1 1.5-2.0	**14-MAY-2011**	**01-JUN-2011**	28-MAY-2011	×	**02-JUN-2011**	11-JUL-2011	✓
Soil Glass Jar - Unpreserved								
K1-1 0.0-0.5, M2-3 4.5-4.6, W2-1 0.0-0.5, W3-3 4.5-5.0,	M2-2 0.0-0.5, W1-2 0.0-0.5, W2-3 4.5-5.0, Q03	**16-MAY-2011**	**01-JUN-2011**	30-MAY-2011	×	**02-JUN-2011**	11-JUL-2011	✓
Soil Glass Jar - Unpreserved								
M1-4 1.5-2.0,	W3-2 0.0-0.5	**16-MAY-2011**	**03-JUN-2011**	30-MAY-2011	×	**06-JUN-2011**	13-JUL-2011	✓
Soil Glass Jar - Unpreserved								
D3-1 2.5-3.0, D3-3 0.5-1.0, D3-5 0.0-0.5, M1-3 1.5-2.0, Q14	D3-2 0.5-1.0, D3-4 2.5-3.0, M1-1A 2.5-3.0, Q12,	**17-MAY-2011**	**01-JUN-2011**	31-MAY-2011	×	**02-JUN-2011**	11-JUL-2011	✓
Soil Glass Jar - Unpreserved								
M1-2 2.5-3.0,	M2-1 3.5-4.0	**17-MAY-2011**	**03-JUN-2011**	31-MAY-2011	×	**06-JUN-2011**	13-JUL-2011	✓

Matrix: **WATER**

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
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered R1	**14-MAY-2011**	**21-MAY-2011**	10-NOV-2011	✓	**23-MAY-2011**	10-NOV-2011	✓
Clear Plastic Bottle - Nitric Acid; Unfiltered R2	**16-MAY-2011**	**21-MAY-2011**	12-NOV-2011	✓	**23-MAY-2011**	12-NOV-2011	✓
Clear Plastic Bottle - Nitric Acid; Unfiltered R3, T1	**17-MAY-2011**	**21-MAY-2011**	13-NOV-2011	✓	**23-MAY-2011**	13-NOV-2011	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered R1	**14-MAY-2011**	**----**	----	----	**23-MAY-2011**	11-JUN-2011	✓
Clear Plastic Bottle - Nitric Acid; Unfiltered R2	**16-MAY-2011**	**----**	----	----	**23-MAY-2011**	13-JUN-2011	✓
Clear Plastic Bottle - Nitric Acid; Unfiltered R3, T1	**17-MAY-2011**	**----**	----	----	**23-MAY-2011**	14-JUN-2011	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved R1	**14-MAY-2011**	**21-MAY-2011**	21-MAY-2011	✓	**23-MAY-2011**	30-JUN-2011	✓
Amber Glass Bottle - Unpreserved R2	**16-MAY-2011**	**21-MAY-2011**	23-MAY-2011	✓	**23-MAY-2011**	30-JUN-2011	✓
Amber Glass Bottle - Unpreserved R3, T1	**17-MAY-2011**	**21-MAY-2011**	24-MAY-2011	✓	**23-MAY-2011**	30-JUN-2011	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved R1	**14-MAY-2011**	**21-MAY-2011**	21-MAY-2011	✓	**23-MAY-2011**	30-JUN-2011	✓
Amber Glass Bottle - Unpreserved R2	**16-MAY-2011**	**21-MAY-2011**	23-MAY-2011	✓	**23-MAY-2011**	30-JUN-2011	✓
Amber Glass Bottle - Unpreserved R3, T1	**17-MAY-2011**	**21-MAY-2011**	24-MAY-2011	✓	**23-MAY-2011**	30-JUN-2011	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft							
Amber Glass Bottle - Unpreserved R1	**14-MAY-2011**	**21-MAY-2011**	21-MAY-2011	✓	**23-MAY-2011**	30-JUN-2011	✓
Amber Glass Bottle - Unpreserved R2	**16-MAY-2011**	**21-MAY-2011**	23-MAY-2011	✓	**23-MAY-2011**	30-JUN-2011	✓
Amber Glass Bottle - Unpreserved R3, T1	**17-MAY-2011**	**21-MAY-2011**	24-MAY-2011	✓	**23-MAY-2011**	30-JUN-2011	✓

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(where) 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)							
Buchi Ammonia	EK055	3	26	**11.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Moisture Content	EA055-103	5	38	**13.2**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	3	26	**11.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organochlorine Pesticides (Ultra-trace)	EP131A	1	7	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organotin Analysis	EP090	1	8	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	3	27	**11.1**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	4	27	**14.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	7	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	2	17	**11.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	2	16	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TKN as N By Discrete Analyser	EK061G	3	28	**10.7**	**9.5**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Cyanide By Discrete Analyser	EK026G	3	26	**11.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	4	39	**10.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	4	40	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	3	26	**11.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosporus By Discrete Analyser	EK067G	3	26	**11.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	4	38	**10.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	4	34	**11.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Buchi Ammonia	EK055	2	26	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	2	26	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organochlorine Pesticides (Ultra-trace)	EP131A	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organotin Analysis	EP090	1	8	**12.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	2	27	**7.4**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	3	27	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	17	**5.9**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	16	**6.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TKN as N By Discrete Analyser	EK061G	2	28	**7.1**	**4.8**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Cyanide By Discrete Analyser	EK026G	2	26	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	39	**5.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	40	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	2	26	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosporus By Discrete Analyser	EK067G	2	26	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	2	38	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	34	**5.9**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							

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							
Buchi Ammonia	EK055	2	26	7.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	2	26	7.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organochlorine Pesticides (Ultra-trace)	EP131A	1	7	14.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organotin Analysis	EP090	1	8	12.5	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	2	27	7.4	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	3	27	11.1	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	7	14.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	17	5.9	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	16	6.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TKN as N By Discrete Analyser	EK061G	2	28	7.1	4.8	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Cyanide By Discrete Analyser	EK026G	2	26	7.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	39	5.1	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	40	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	2	26	7.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosporus By Discrete Analyser	EK067G	2	26	7.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	2	38	5.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	34	5.9	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Buchi Ammonia	EK055	2	26	7.7	5.0	✓	ALS QCS3 requirement
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	2	26	7.7	5.0	✓	ALS QCS3 requirement
Organochlorine Pesticides (Ultra-trace)	EP131A	1	7	14.3	5.0	✓	ALS QCS3 requirement
Organotin Analysis	EP090	1	8	12.5	5.0	✓	ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	2	27	7.4	5.0	✓	ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	3	27	11.1	5.0	✓	ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	7	14.3	5.0	✓	ALS QCS3 requirement
Pesticides by GCMS	EP068	1	17	5.9	5.0	✓	ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	16	6.3	5.0	✓	ALS QCS3 requirement
TKN as N By Discrete Analyser	EK061G	2	28	7.1	4.8	✓	ALS QCS3 requirement
Total Cyanide By Discrete Analyser	EK026G	2	26	7.7	5.0	✓	ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	39	5.1	5.0	✓	ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	40	5.0	5.0	✓	ALS QCS3 requirement
Total Phosporus By Discrete Analyser	EK067G	2	26	7.7	5.0	✓	ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	2	38	5.3	5.0	✓	ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	34	5.9	5.0	✓	ALS QCS3 requirement

Matrix: **WATER**

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)							
Total Mercury by FIMS	EG035T	2	18	11.1	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Matrix: **WATER**

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 Control Samples (LCS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	14	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	14	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	14	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	14	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Total Mercury by FIMS	EG035T	1	18	**5.6**	**5.0**	✓	ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement

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
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2010 Draft) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	(APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES) 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 (1999) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	AS 3550, APHA 21st ed., 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 (1999) Schedule B(3)
Total Cyanide By Discrete Analyser	EK026G	SOIL	APHA 21st 4500 CN - C & N. Caustic leach extracts of the sample are distilled with sulphuric acid, converting all CN species to HCN. The distillates are analyzed for CN by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Method 403)
Buchi Ammonia	EK055	SOIL	APHA 21st ed., 4500 NH3+-B&G, H Samples are steam distilled (Buchi) prior to analysis and quantified using titration, FIA or Discrete Analyser.
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	SOIL	APHA 21st ed., 4500 NO3- F. Combined oxidised Nitrogen (NO2+NO3) in a water extract is determined by Cadmium Reduction, and direct colourimetry by Discrete Analyser.
TKN as N By Discrete Analyser	EK061G	SOIL	APHA 21st ed., 4500-Norg-D Soil samples are digested using Kjeldahl digestion followed by determination by Discrete Analyser.
Total Nitrogen as N (TKN + NOx) By Discrete Analyser	EK062G	SOIL	APHA 21st ed., 4500 Norg/NO3- Total Nitrogen is determined as the sum of TKN and Oxidised Nitrrogen, each determined seperately as N.
Total Phosporus By Discrete Analyser	EK067G	SOIL	APHA 21st ed., 4500 P-B&F This procedure involves sulfuric acid digestion and quantification using Discrete Analyser.
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 LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automaticaly measured by infra-red detector.
Polychlorinated Biphenyls (PCB)	EP066	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 504)
Pesticides by GCMS	EP068	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM (1999) Schedule B(3) (Method 504,505)
TPH - Semivolatile Fraction	EP071	SOIL	(USEPA SW 846 - 8015A) Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C36. This method is compliant with NEPM (1999) Schedule B(3) (Method 506.1)
PAH/Phenols (SIM)	EP075(SIM)	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 502 and 507)
TPH Volatiles/BTEX	EP080	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 501)

Analytical Methods	Method	Matrix	Method Descriptions
Organotin Analysis	EP090	SOIL	(USEPA SW 846 - 8270D) 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	USEPA Method 3640 (GPC cleanup),3620 (Florisil), 8081/8082 (GC/uECD/uECD) This technique is compliant with NEPM (1999) Schedule B(3) (Method 504)
PCB's (Ultra-trace)	EP131B	SOIL	USEPA Method 3640 (GPC cleanup),3620 (Florisil), 8081/8082 (GC/uECD/uECD) This technique is compliant with NEPM (1999) Schedule B(3) (Method 504)
PAHs in Sediments by GCMS(SIM)	EP132B-SD	SOIL	8270 GCMS Capillary column, SIM mode using large volume programmed temperature vaporisation injection.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	(APHA 21st ed., 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.
Total Mercury by FIMS	EG035T	WATER	AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The 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 (1999) Schedule B(3) (Appdx. 2)
TPH - Semivolatile Fraction	EP071	WATER	USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Preparation Methods	Method	Matrix	Method Descriptions
NaOH leach for TCN in Soils	EK026PR	SOIL	APHA 21st ed., 4500 CN- C & N. Samples are extracted by end-over-end tumbling with NaOH.
TKN/TP Digestion	EK061/EK067	SOIL	APHA 21st ed., 4500 Norg- D; APHA 21st ed., 4500 P - H. Macro Kjeldahl digestion.
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	USEPA 200.2 Mod. 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 (1999) Schedule B(3) (Method 202)
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(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 (Option B - Non-concentrating)	ORG17B	SOIL	In-house, Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 20mL 1:1 DCM/Acetone by end over end tumble. The solvent is transferred directly to a GC vial for analysis.
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.

Preparation Methods	Method	Matrix	Method Descriptions
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.
Digestion for Total Recoverable Metals	EN25	WATER	USEPA SW846-3005 Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Separatory Funnel Extraction of Liquids	ORG14	WATER	USEPA SW 846 - 3510B 500 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2). ALS default excludes sediment which may be resident in the container.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

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							
EG005T: Total Metals by ICP-AES	ES1110202-066	M2-1 3.5-4.0	**Zinc**	7440-66-6	20.3 %	0-20%	**RPD exceeds LOR based limits**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Phenanthrene**	85-01-8	24.1 %	0-20%	**RPD exceeds LOR based limits**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Fluoranthene**	206-44-0	55.0 %	0-50%	**RPD exceeds LOR based limits**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Fluoranthene**	206-44-0	28.8 %	0-20%	**RPD exceeds LOR based limits**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Benz(a)anthracene**	56-55-3	21.3 %	0-20%	**RPD exceeds LOR based limits**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Benz(a)anthracene**	56-55-3	57.2 %	0-50%	**RPD exceeds LOR based limits**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Chrysene**	218-01-9	23.1 %	0-20%	**RPD exceeds LOR based limits**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Benzo(a)pyrene**	50-32-8	61.9 %	0-50%	**RPD exceeds LOR based limits**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Benzo(g.h.i)perylene**	191-24-2	25.4 %	0-20%	**RPD exceeds LOR based limits**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Benzo(g.h.i)perylene**	191-24-2	56.6 %	0-50%	**RPD exceeds LOR based limits**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Indeno(1.2.3.cd)pyrene**	193-39-5	61.2 %	0-50%	**RPD exceeds LOR based limits**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Sum of PAHs**	----	35.7 %	0-20%	**RPD exceeds LOR based limits**
Laboratory Control Spike (LCS) Recoveries							
EP075(SIM)A: Phenolic Compounds	2117291-007	----	**3- & 4-Methylphenol**	1319-77-3	119 %	72-119%	**Recovery greater than upper control limit**
EP131A: Organochlorine Pesticides	2135137-002	----	**Dieldrin**	60-57-1	138 %	43.2-134%	**Recovery greater than upper control limit**
Matrix Spike (MS) Recoveries							
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-004	D3-1 2.5-3.0	**Naphthalene**	91-20-3	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Naphthalene**	91-20-3	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Naphthalene**	91-20-3	61.4 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-004	D3-1 2.5-3.0	**2-Methylnaphthalene**	91-57-6	70.0 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**2-Methylnaphthalene**	91-57-6	52.5 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Acenaphthylene**	208-96-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Acenaphthene**	83-32-9	51.4 %	70-130%	**Recovery less than lower data quality objective**

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries - Continued							
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Phenanthrene**	85-01-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Anthracene**	120-12-7	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Fluoranthene**	206-44-0	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-004	D3-1 2.5-3.0	**Fluoranthene**	206-44-0	2.7 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-004	D3-1 2.5-3.0	**Pyrene**	129-00-0	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Pyrene**	129-00-0	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Benz(a)anthracene**	56-55-3	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-004	D3-1 2.5-3.0	**Benz(a)anthracene**	56-55-3	54.3 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Chrysene**	218-01-9	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-004	D3-1 2.5-3.0	**Benzo(b)fluoranthene**	205-99-2	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Benzo(b)fluoranthene**	205-99-2	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Benzo(k)fluoranthene**	207-08-9	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Benzo(k)fluoranthene**	207-08-9	58.2 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-004	D3-1 2.5-3.0	**Benzo(k)fluoranthene**	207-08-9	51.0 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-004	D3-1 2.5-3.0	**Benzo(e)pyrene**	192-97-2	Not Determined	----	**Matrix spike recovery not determined due to sample matrix interference.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Benzo(e)pyrene**	192-97-2	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries - Continued							
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Benzo(a)pyrene**	50-32-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-004	D3-1 2.5-3.0	**Benzo(a)pyrene**	50-32-8	177 %	70-130%	**Recovery greater than upper data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Perylene**	198-55-0	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Perylene**	198-55-0	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-004	D3-1 2.5-3.0	**Perylene**	198-55-0	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Benzo(g.h.i)perylene**	191-24-2	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Benzo(g.h.i)perylene**	191-24-2	52.5 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-004	D3-1 2.5-3.0	**Dibenz(a.h)anthracene**	53-70-3	143 %	70-130%	**Recovery greater than upper data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Dibenz(a.h)anthracene**	53-70-3	58.4 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Dibenz(a.h)anthracene**	53-70-3	48.2 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Indeno(1.2.3.cd)pyrene**	193-39-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Indeno(1.2.3.cd)pyrene**	193-39-5	51.4 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-044	M1-2 2.5-3.0	**Coronene**	191-07-1	42.0 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-139	W2-3 4.5-5.0	**Coronene**	191-07-1	42.2 %	70-130%	**Recovery less than lower data quality objective**
EP132B: Polynuclear Aromatic Hydrocarbons	ES1110202-004	D3-1 2.5-3.0	**Coronene**	191-07-1	146 %	70-130%	**Recovery greater than upper data quality objective**

- **For all matrices, no Method Blank value outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **SOIL**

Matrix: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EK026G: Total Cyanide By Discrete Analyser							
Soil Glass Jar - Unpreserved							
M2-4 0.5-1.0,	W1-1 1.5-2.0,	23-MAY-2011	21-MAY-2011	**2**	----	----	----
W1-3 0.0-0.5,	W2-2 0.0-0.5,						
W3-1 1.5-2.0							
EP131A: Organochlorine Pesticides							
Soil Glass Jar - Unpreserved							
W1-1 1.5-2.0,	W3-1 1.5-2.0	01-JUN-2011	28-MAY-2011	**4**	----	----	----
Soil Glass Jar - Unpreserved							
K1-1 0.0-0.5,	W2-1 0.0-0.5,	01-JUN-2011	30-MAY-2011	**2**	----	----	----
Q03							
Soil Glass Jar - Unpreserved							
D3-3 0.5-1.0,	M1-3 1.5-2.0	01-JUN-2011	31-MAY-2011	**1**	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors)							
Soil Glass Jar - Unpreserved							
W1-1 1.5-2.0,	W3-1 1.5-2.0	01-JUN-2011	28-MAY-2011	**4**	----	----	----
Soil Glass Jar - Unpreserved							
K1-1 0.0-0.5,	W2-1 0.0-0.5,	01-JUN-2011	30-MAY-2011	**2**	----	----	----
Q03							
Soil Glass Jar - Unpreserved							
D3-3 0.5-1.0,	M1-3 1.5-2.0	01-JUN-2011	31-MAY-2011	**1**	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved							
M2-4 0.5-1.0,	W1-1 1.5-2.0,	01-JUN-2011	28-MAY-2011	**4**	----	----	----
W1-3 0.0-0.5,	W1-3 5.5-5.6,						
W2-2 0.0-0.5,	W3-1 1.5-2.0						
Soil Glass Jar - Unpreserved							
K1-1 0.0-0.5,	M2-2 0.0-0.5,	01-JUN-2011	30-MAY-2011	**2**	----	----	----
M2-3 4.5-4.6,	W1-2 0.0-0.5,						
W2-1 0.0-0.5,	W2-3 4.5-5.0,						
W3-3 4.5-5.0,	Q03						
Soil Glass Jar - Unpreserved							
M1-4 1.5-2.0,	W3-2 0.0-0.5	03-JUN-2011	30-MAY-2011	**4**	----	----	----
Soil Glass Jar - Unpreserved							
D3-1 2.5-3.0,	D3-2 0.5-1.0,	01-JUN-2011	31-MAY-2011	**1**	----	----	----
D3-3 0.5-1.0,	D3-4 2.5-3.0,						
D3-5 0.0-0.5,	M1-1A 2.5-3.0,						
M1-3 1.5-2.0,	Q12,						
Q14							
Soil Glass Jar - Unpreserved							
M1-2 2.5-3.0,	M2-1 3.5-4.0	03-JUN-2011	31-MAY-2011	**3**	----	----	----

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

CERTIFICATE OF ANALYSIS

Work Order	: **ES1111343**	Page	: 1 of 5
Client	: **GHD SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Angela Pavlovic
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jacqui.hallchurch@ghd.com	E-mail	: angela.pavlovic@alsenviro.com
Telephone	: +61 02 9239 7100	Telephone	: +61 2 8784 8523
Facsimile	: +61 02 9239 7199	Facsimile	: +61 2 8784 8500
Project	: 221568306 NPC REBATCH OF ES1110202	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 31-MAY-2011
Sampler	: JS	Issue Date	: 03-JUN-2011
Site	: ----		
		No. of samples received	: 4
Quote number	: EN/005/10	No. of samples analysed	: 4

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Pabi Subba	Senior Organic Chemist	Sydney Organics
Wisam.Marassa	Metals Coordinator	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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 insuffient 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.

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

Analytical Results

Sub-Matrix: SOIL			Client sample ID	M1-2 2.5-3.0	M1-4 1.5-2.0	M2-1 3.5-4.0	W3-2 0.0-0.5	----
			Client sampling date / time	17-MAY-2011 15:00	16-MAY-2011 15:00	17-MAY-2011 15:00	16-MAY-2011 15:00	----
Compound	CAS Number	LOR	Unit	ES1111343-001	ES1111343-002	ES1111343-003	ES1111343-004	----
EN33: TCLP Leach								
Initial pH	----	0.1	pH Unit	**8.4**	**8.4**	**8.6**	**8.7**	----
After HCl pH	----	0.1	pH Unit	**2.3**	**2.3**	**2.1**	**2.2**	----
Extraction Fluid Number	----	1	-	**1**	**1**	**1**	**1**	----
Final pH	----	0.1	pH Unit	**5.4**	**5.3**	**5.3**	**5.4**	----

Analytical Results

Sub-Matrix: **TCLP LEACHATE**

Compound	CAS Number	LOR	Unit	Client sample ID: M1-2 2.5-3.0	M1-4 1.5-2.0	M2-1 3.5-4.0	W3-2 0.0-0.5	----
				Client sampling date / time: 02-JUN-2011 12:00	02-JUN-2011 12:00	02-JUN-2011 12:00	02-JUN-2011 12:00	----
				ES1111343-001	ES1111343-002	ES1111343-003	ES1111343-004	----
EG005C: Leachable Metals by ICPAES								
Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
Nickel	7440-02-0	0.1	mg/L	<0.1	**0.1**	**0.1**	<0.1	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Benzo(a)pyrene	50-32-8	0.5	µg/L	----	----	----	<0.5	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	----	----	----	**31.5**	----
2-Chlorophenol-D4	93951-73-6	0.1	%	----	----	----	**76.6**	----
2.4.6-Tribromophenol	118-79-6	0.1	%	----	----	----	**105**	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	----	----	----	**82.4**	----
Anthracene-d10	1719-06-8	0.1	%	----	----	----	**83.4**	----
4-Terphenyl-d14	1718-51-0	0.1	%	----	----	----	**93.0**	----

Surrogate Control Limits

Sub-Matrix: **TCLP LEACHATE**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	64.1
2-Chlorophenol-D4	93951-73-6	11.3	122.9
2.4.6-Tribromophenol	118-79-6	11.7	144.0
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	19.9	122.8
Anthracene-d10	1719-06-8	23.3	125.8
4-Terphenyl-d14	1718-51-0	20.3	134.5

QUALITY CONTROL REPORT

Work Order	: **ES1111343**	Page	: 1 of 5
Client	: **GHD SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Angela Pavlovic
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jacqui.hallchurch@ghd.com	E-mail	: angela.pavlovic@alsenviro.com
Telephone	: +61 02 9239 7100	Telephone	: +61 2 8784 8523
Facsimile	: +61 02 9239 7199	Facsimile	: +61 2 8784 8500
Project	: 221568306 NPC REBATCH OF ES1110202	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 31-MAY-2011
Sampler	: JS	Issue Date	: 03-JUN-2011
Order number	: ----		
		No. of samples received	: 4
Quote number	: EN/005/10	No. of samples analysed	: 4

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Pabi Subba	Senior Organic Chemist	Sydney Organics
Wisam.Marassa	Metals Coordinator	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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 insuffient 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: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG005C: Leachable Metals by ICPAES (QC Lot: 1814390)									
ES1111295-001	Anonymous	EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	0.0	No Limit
		EG005C: Nickel	7440-02-0	0.1	mg/L	<0.1	<0.1	0.0	No Limit

Method Blank (MB) and Laboratory Control Spike (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: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005C: Leachable Metals by ICPAES (QCLot: 1814390)								
EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	0.1 mg/L	101	70	130
EG005C: Nickel	7440-02-0	0.1	mg/L	<0.1	0.1 mg/L	99.5	70	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1815239)								
EP075(SIM): Benzo(a)pyrene	50-32-8	0.2	µg/L	----	2 µg/L	103	63.3	117
		0.5	µg/L	<0.5	----	----	----	----

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: **WATER**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005C: Leachable Metals by ICPAES (QCLot: 1814390)							
ES1111343-001	M1-2 2.5-3.0	EG005C: Lead	7439-92-1	1 mg/L	102	70	130
		EG005C: Nickel	7440-02-0	1 mg/L	98.4	70	130

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1111343**	Page	: 1 of 5
Client	: GHD SERVICES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Angela Pavlovic
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jacqui.hallchurch@ghd.com	E-mail	: angela.pavlovic@alsenviro.com
Telephone	: +61 02 9239 7100	Telephone	: +61 2 8784 8523
Facsimile	: +61 02 9239 7199	Facsimile	: +61 2 8784 8500
Project	: 221568306 NPC REBATCH OF ES1110202	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 31-MAY-2011
Sampler	: JS	Issue Date	: 03-JUN-2011
Order number	: ----		
		No. of samples received	: 4
Quote number	: EN/005/10	No. of samples analysed	: 4

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

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
EG005C: Leachable Metals by ICPAES							
Clear Plastic Bottle - Nitric Acid; Unfiltered							
M1-2 2.5-3.0, M1-4 1.5-2.0, M2-1 3.5-4.0, W3-2 0.0-0.5	**02-JUN-2011**	**02-JUN-2011**	29-NOV-2011	✓	**02-JUN-2011**	29-NOV-2011	✓
EN33: TCLP Leach							
Lab Split: Leach for metals excl. Hg							
M1-4 1.5-2.0	**16-MAY-2011**	**---**	12-NOV-2011	----	**02-JUN-2011**	12-NOV-2011	✓
Lab Split: Leach for metals excl. Hg							
M1-2 2.5-3.0, M2-1 3.5-4.0	**17-MAY-2011**	**---**	13-NOV-2011	----	**02-JUN-2011**	13-NOV-2011	✓
LabSplit: Leach for organics and other tests							
W3-2 0.0-0.5	**16-MAY-2011**	**---**	12-NOV-2011	----	**02-JUN-2011**	12-NOV-2011	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved							
W3-2 0.0-0.5	**02-JUN-2011**	**02-JUN-2011**	09-JUN-2011	✓	**02-JUN-2011**	12-JUL-2011	✓

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(where) 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: **WATER**

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)							
Leachable Metals by ICPAES	EG005C	1	6	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Leachable Metals by ICPAES	EG005C	1	6	**16.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	1	**100.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Leachable Metals by ICPAES	EG005C	1	6	**16.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	1	**100.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Leachable Metals by ICPAES	EG005C	1	6	**16.7**	**5.0**	✓	ALS QCS3 requirement

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
Leachable Metals by ICPAES	EG005C	SOIL	APHA 21st ed., 3120; USEPA SW 846 - 6010 The ICPAES technique ionises leachate sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	SOIL	USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals in TCLP Leachate	EN25C	SOIL	USEPA SW846-3005 Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
TCLP for Non & Semivolatile Analytes	EN33a	SOIL	(USEPA SW846-1311, ALS QWI-EN/33) The TCLP procedure is designed to determine the mobility of both organic and inorganic analytes present in wastes. The standard TCLP leach is for non-volatile and Semivolatile test parameters.
Separatory Funnel Extraction of Liquids	ORG14	SOIL	USEPA SW 846 - 3510B 500 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2). ALS default excludes sediment which may be resident in the container.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- **No Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

CERTIFICATE OF ANALYSIS

Work Order	: **ES1117270**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Holly Moore
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jacqui.hallchurch@ghd.com	E-mail	: Holly.Moore@alsglobal.com
Telephone	: +61 02 9239 7100	Telephone	: +61 2 8784 8555
Facsimile	: +61 02 9239 7199	Facsimile	: +61 2 8784 8531
Project	: 2215683-06 NPC SEDIMENT INVESTIGATION	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: REBATCH OF ES1117080		
C-O-C number	: ----	Date Samples Received	: 11-AUG-2011
Sampler	: ----	Issue Date	: 15-AUG-2011
Site	: ----		
		No. of samples received	: 5
Quote number	: EN/005/10	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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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.

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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

Analytical Results

Sub-Matrix: **ELUTRIATE**

Compound	CAS Number	LOR	Unit	Client sample ID: W3-2/0.5-0.6	D3-4/2-2.2	M1-2/2.6-2.7	M1-4/2.5-2.6	SEAWATER
				Client sampling date / time: 08-AUG-2011 15:00	08-AUG-2011 15:00	08-AUG-2011 15:00	08-AUG-2011 15:00	08-AUG-2011 15:00
				ES1117270-001	ES1117270-002	ES1117270-003	ES1117270-004	ES1117270-005
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	<0.0001	<0.0001	<0.0001
EG093T: Total Metals in Saline Water by ORC-ICPMS								
Lead	7439-92-1	0.2	µg/L	**0.6**	----	<0.2	**0.2**	<0.2
Nickel	7440-02-0	0.5	µg/L	**4.4**	**2.9**	**2.2**	**4.3**	**1.2**
Zinc	7440-66-6	5	µg/L	**22**	**7**	**17**	**9**	**117**

Analytical Results

Sub-Matrix: SEDIMENT				Client sample ID	W3-2/0.5-0.6	D3-4/2-2.2	M1-2/2.6-2.7	M1-4/2.5-2.6	SEAWATER
				Client sampling date / time	08-AUG-2011 15:00	08-AUG-2011 15:00	08-AUG-2011 15:00	08-AUG-2011 15:00	08-AUG-2011 15:00
Compound	CAS Number	LOR	Unit		ES1117270-001	ES1117270-002	ES1117270-003	ES1117270-004	ES1117270-005
EN68: Seawater Elutriate Testing Procedure									
Seawater Sampling Date	----	0.1	-		**11/08/2011**	**11/08/2011**	**11/08/2011**	**11/08/2011**	**11/08/2011**

QUALITY CONTROL REPORT

Work Order	: **ES1117270**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Holly Moore
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Facsimile	: +61 02 9239 7199	Facsimile	: +61 2 8784 8531
Project	: 2215683-06 NPC SEDIMENT INVESTIGATION	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-AUG-2011
Sampler	: ----	Issue Date	: 15-AUG-2011
Order number	: REBATCH OF ES1117080		
		No. of samples received	: 5
Quote number	: EN/005/10	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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 insuffient 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: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1911261)									
ES1117270-001	W3-2/0.5-0.6	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 1911315)									
EB1115954-001	Anonymous	EG093A-T: Lead	7439-92-1	0.2	µg/L	0.5	0.4	30.7	No Limit
		EG093A-T: Nickel	7440-02-0	0.5	µg/L	0.7	0.8	14.7	No Limit
		EG093A-T: Zinc	7440-66-6	5	µg/L	<5	<5	0.0	No Limit
ES1117270-005	SEAWATER	EG093A-T: Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	0.0	No Limit
		EG093A-T: Nickel	7440-02-0	0.5	µg/L	1.2	1.2	0.0	No Limit
		EG093A-T: Zinc	7440-66-6	5	µg/L	117	116	0.9	0% - 20%

Method Blank (MB) and Laboratory Control Spike (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: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1911261)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.010 mg/L	112	81	119
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 1911315)								
EG093A-T: Lead	7439-92-1	0.2	µg/L	<0.2	10 µg/L	108	89	121
EG093A-T: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	112	85	125
EG093A-T: Zinc	7440-66-6	5	µg/L	<5	10 µg/L	96.8	82	128

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: **WATER**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1911261)							
ES1117270-001	W3-2/0.5-0.6	EG035T: Mercury	7439-97-6	0.010 mg/L	75.2	70	130
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 1911315)							
EB1115954-001	Anonymous	EG093A-T: Lead	7439-92-1	50 µg/L	104	70	130
		EG093A-T: Nickel	7440-02-0	50 µg/L	107	70	130
		EG093A-T: Zinc	7440-66-6	50 µg/L	87.9	70	130

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1117270**	Page	: 1 of 5
Client	: GHD PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Holly Moore
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Facsimile	: +61 02 9239 7199	Facsimile	: +61 2 8784 8531
Project	: 2215683-06 NPC SEDIMENT INVESTIGATION	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-AUG-2011
Sampler	: ----	Issue Date	: 15-AUG-2011
Order number	: REBATCH OF ES1117080		
		No. of samples received	: 5
Quote number	: EN/005/10	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

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
EG035T: Total Recoverable Mercury by FIMS							
Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered							
W3-2/0.5-0.6, M1-2/2.6-2.7, M1-4/2.5-2.6, SEAWATER	**08-AUG-2011**	**----**	----	----	**12-AUG-2011**	08-SEP-2011	✓
EG093T: Total Metals in Saline Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered							
W3-2/0.5-0.6, D3-4/2-2.2, M1-2/2.6-2.7, M1-4/2.5-2.6, SEAWATER	**08-AUG-2011**	**12-AUG-2011**	07-FEB-2012	✓	**12-AUG-2011**	07-FEB-2012	✓
EN68: Seawater Elutriate Testing Procedure							
Lab Split : Leach for Hg, Cr(VI) and other metal							
W3-2/0.5-0.6, M1-2/2.6-2.7, M1-4/2.5-2.6, SEAWATER	**08-AUG-2011**	**---**	05-SEP-2011	----	**11-AUG-2011**	05-SEP-2011	✓
Lab Split: Leach for metals excl. Hg							
D3-4/2-2.2	**08-AUG-2011**	**---**	04-FEB-2012	----	**11-AUG-2011**	04-FEB-2012	✓

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(where) 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: **WATER**

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)							
Total Mercury by FIMS	EG035T	1	4	**25.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	2	11	**18.2**	**9.5**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Total Mercury by FIMS	EG035T	1	4	**25.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	11	**9.1**	**4.8**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Total Mercury by FIMS	EG035T	1	4	**25.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	11	**9.1**	**4.8**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Total Mercury by FIMS	EG035T	1	4	**25.0**	**5.0**	✓	ALS QCS3 requirement
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	11	**9.1**	**4.8**	✓	ALS QCS3 requirement

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
Total Mercury by FIMS	EG035T	SOIL	AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The 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 (1999) Schedule B(3) (Appdx. 2)
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	SOIL	APHA 21st ed., 3125; USEPA SW846 - 6020 Samples are 0.45 um filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals - ORC	EN25-ORC	SOIL	Modified USEPA SW846-3005. This is an Ultrapure Nitric acid digestion procedure used to prepare surface and ground water samples for analysis by ORC- ICPMS. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Seawater Elutriate Testing Procedure	* EN68a	SOIL	USEPA Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Guide, 1991, EPA-503/8-91/001, USEPA and US Army Corps of Engineers. ANZECC Interim Ocean Disposal Guidelines, December, 1998 This Procedure outlines the preparation of leachate designed to simulate release of contaminants from sediment during the disposal of dredged material. Release can occur by physical processes or a variety of chemical changes such as oxidation of metal sulphides and release of contaminants adsorbed to particles or organic matter.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- **No Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

GHD

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	J Hallchurch	A Monkley	*A Monkley*	C Gilmore	*C Gilmore*	
1	J Hallchurch	A Monkley		A Monkley		18/10/2012

Preliminary SAP Summary

This preliminary Sampling and Analysis Plan (SAP) Summary provides details on the technical terms and methodology used in the Contamination assessment for the Environmental Impact Statement (EIS). Refer to Chapter 9 of the EIS for the findings and conclusions of the assessment.

1.1 Sediment Sampling and Analysis Plan

1.1.1 Methodology

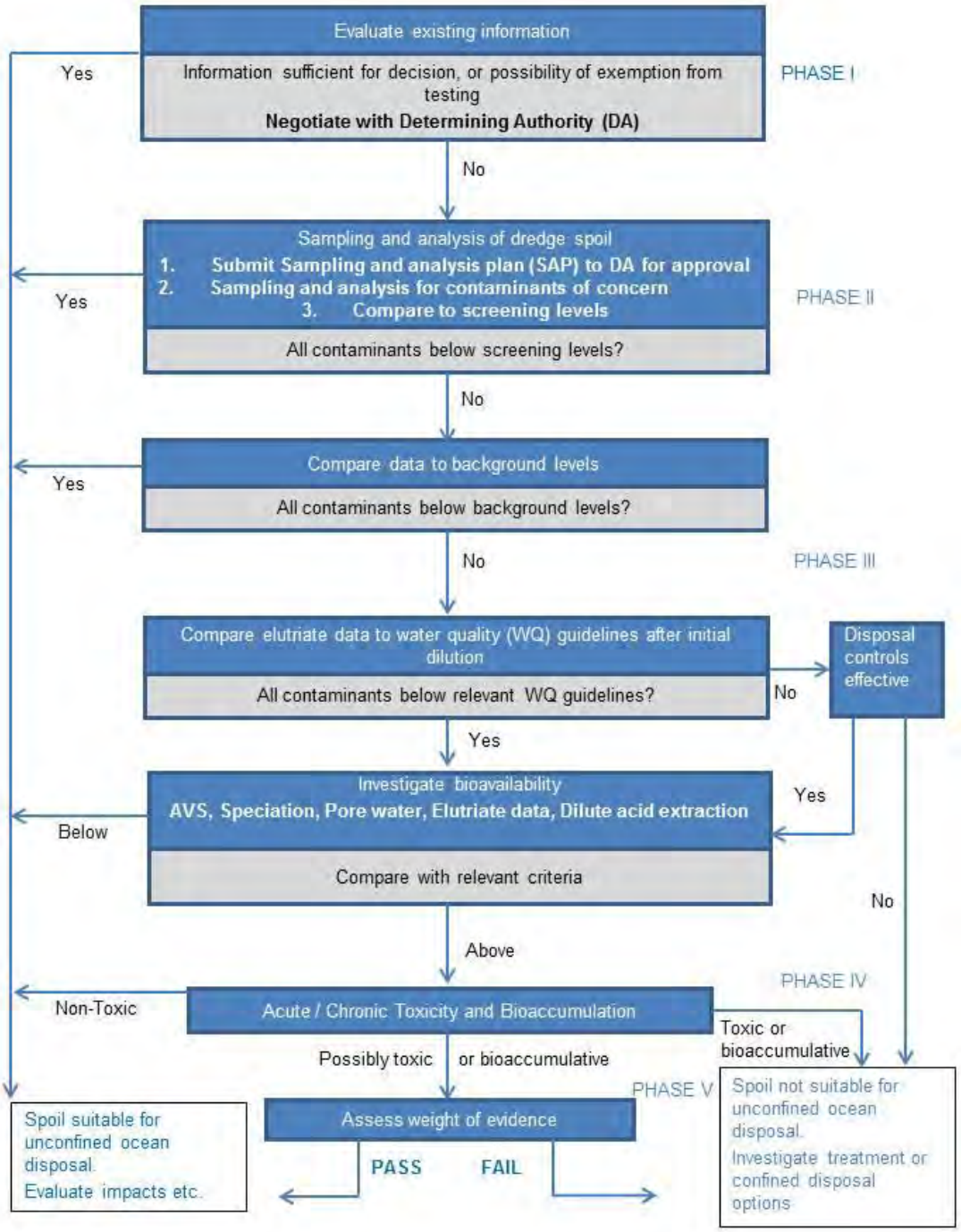
As part of NPC's broader Project objectives for the development of the Port of Newcastle sediment sampling in accordance with a Commonwealth government (SEWPaC) approved Sampling and Analysis Plan (SAP) was conducted for berths M2, M3, M4, M7 and D3. This is to support a Sea Dumping Permit (SDP) being prepared for the identified berths. The results for M3 and M4 from the SAP investigation have been included herein as these berths were not sampled during the pilot study. It is also important to note that the sediment sampling and analysis program for the proposed Sea Dumping Permit is still underway at the time of this EIS, and therefore data presented below is preliminary only.

The assessment of sediments for the purposes of determining their suitability for disposal at sea follows a decision tree process outlined in the National Assessment Guidelines for Dredging (NAGD) (refer to Figure 9.3). Phase II assessments are the first field sampling component, whereby the sampling and analysis of sediments aims to adequately characterise the sediments to be dredged. Phase III assessments are required if Phase II assessments identify COPC (i.e. where the 95% Upper Confidence Limit (UCL) is greater than screening levels and greater than ambient conditions). The Phase III assessment involves elutriate and bioavailability testing of samples containing the COPC, in order to assess if contaminants identified during Phase II assessments are bioavailable to marine organisms. If Phase III testing identifies that analytes are bioavailable, then Phase IV toxicity testing is therefore required.

For the current project, a vibracore was used to collect sufficient volumes of sediments at locations SC11 and SC10 within M3 and M4, respectively (Figure 9.4). The vibracore was 6 metres long and 40 millimetres wide, deployed by divers, with at least three cores collected at each location. Additionally, sediment sampling took place at a reference area at Fullerton Cove. This area was used to provide an understanding of the natural ambient levels of analytes within the project surrounds. At Fullerton Cove, ten locations were sampled using a van veen grab.

For sediment samples collected using the vibracore, once individual cores were collected and field information and logging completed, sediment from each 0.5 metres sample interval was mixed well to ensure a thoroughly homogenised sample. An exception to this procedure was a portion of the core that was analysed for volatiles, which was not mixed and was collected from midway of each interval along the cores, in accordance with the NAGD. It is important to note that the thinnest layer that can be dredged reliably and handled selectively using equipment routinely available is approximately 0.5 metres, so sub-sampling at smaller intervals down the core was deemed redundant. As such, sediment samples were collected in intervals of 0.5 metres (e.g. .0 to 0.5 metres, 0.5 to 1.0 metres).

Figure 9.3 Decision Tree Framework outlined in the NAGD



All samples collected from the M3 and M4 berths were tested for the heavy metals and metalloids arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc and acid sulfate soils (ASS). In addition, samples collected from the top 1 metre of sediments were tested for total organic carbon (TOC), BTEX, TPH, PAH and TBT. At Fullerton Cove, only heavy metals and metalloids were tested.

To provide a comparison to the NAGD screening levels, for Phase II assessments the 95 percent upper confidence limit (UCL) was determined for the aforementioned analytes. Confidence intervals were calculated using ProUCL 4.0 (2007), as ProUCL calculates the most reliable 95 percent UCL value based on the specific distribution of data points within each data set (United State Environmental Protection Agency (USEPA)). For determinations of the 95 percent UCL, where analytes recorded concentrations less than the laboratory practical quantitation limit (PQL), these concentrations were multiplied by 0.5, with the resultant concentration being used in the dataset to produce 95 percent UCL (NAGD 2009).

To compare the levels of concentration to the reference area at Fullerton Cove, the mean value of concentrations from M3 and M4 were compared to the 80th percentile from Fullerton Cove. Analytes were assessed to be greater than ambient levels if the mean value for an analyte exceeded the 80th percentile from Fullerton Cove.

1.1.2 Summary of Results

The following results describe those gained from Phase II and, where required, initial Phase III testing at M3 and M4.

Phase II Testing

Fullerton Cove

From the reference area, arsenic, cadmium, chromium, copper, mercury and lead returned concentrations for all samples less than their respective *National Assessment Guidelines for Dredging* (NAGD) screening levels (Table 9.2). As such the 95 percent Upper Confidence Limit (UCL) for these analytes were less than the NAGD screening levels.

The concentrations for zinc ranged from 47.2 mg/kg to 275 mg/kg, with two of 10 samples returning concentrations greater than the NAGD screening level of 200 mg/kg (Table 9.2). The 95 percent UCL for zinc was 200.6 mg/kg, which exceeded the NAGD Screening level.

The concentrations for nickel ranged from 6.3 mg/kg to 35.6 mg/kg. Of these, seven of 10 samples returned concentrations for nickel that exceeded the NAGD screening level of 21 mg/kg. Overall, the 95 percent UCL of 28.2 mg/kg exceeded the NAGD screening level (Table 9.2).

Legend

- Berth Location
- Sampling Grid
- Actual Core Sample Location
- Proposed Core Sample Location

1:2,500 (at A4)

0 25 50 100

Metres

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

N

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Newcastle Port Corporation
Capital Strategic Dredging Project

Job Number 22-15954
Revision A
Date 26 Feb 2013

Proposed and Actual Sampling Locations within Mayfield Berths, M3 & M4

Figure 9.4

G:\22\15954\GIS\Maps\Deliverables\22_15954_014_berthsM3M4_revA.mxd
Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com

Data Source: GHD: Ajoining Projects, Berth Locations - 2011; LPMA: RoadSegment, Suburb, Watercourse, Placepoint - 2007, Imagery - 2007. Created by: aj, jvc

Table 9.2 Metals and metalloids results from Fullerton Cove.

	Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
PQL	1	0.1	1	1	1	0.01	1	1
NAGD 2009 - Screening Level	20	1.5	80	65	50	0.15	21	200
NAGD 2009 - SQG-High Values	70	10	370	270	220	1	52	410
Statistical Summary								
Number of Results	10	10	10	10	10	10	10	10
Number of Detects	10	7	10	10	10	10	10	10
Minimum Concentration	2.43	<0.1	4.1	1.9	3.2	0.01	6.3	47.2
Minimum Detect	2.43	0.1	4.1	1.9	3.2	0.01	6.3	47.2
Maximum Concentration	9.19	0.3	33.7	16.6	15.2	0.05	35.6	275
Maximum Detect	9.19	0.3	33.7	16.6	15.2	0.05	35.6	275
Average Concentration	6.3	0.17	22	10	9.9	0.03	23	158
Median Concentration	6.89	0.2	24.7	11.85	10.9	0.03	23.85	170.5
Standard Deviation	2	0.1	9.6	4.7	3.9	0.012	9.7	74
80th Percentile	7.41	0.22	27.5	13.4	12.84	0.04	28.9	206.2
Number of Guideline Exceedances	0	0	0	0	0	0	7	2
95 % UCL	7.501	0.221	27.331	13.151	12.141	0.0381	28.21	200.61
95 % UCL Exceedance	No	No	No	No	No	No	Yes	Yes

Notes:

1: Student's UCL for-normally distributed data (for a mix of detects and non-detects, non-detects are calculated at 0.5 x PQL).

Mayfield berths 3 and 4

At the locations SC10 (M3) and SC11 (M4), all samples tested for arsenic, chromium and copper returned concentrations less than their respective *National Assessment Guidelines for Dredging* (NAGD) screening levels (Table 9.3). As such, the 95 percent upper confidence limit (UCL) for these analytes were less than screening levels, and Phase III testing was not required.

For cadmium a single sample at SC11 0.5-1.0 returned a concentration of 1.6 mg/kg, which was greater than the NAGD screening level of 1.5 mg/kg. All samples at SC10 were less than the laboratory practical quantitation limit (PQL). As such, the overall 95 percent UCL of 0.88 mg/kg was less than the NAGD screening level (Table 9.3), and thus, Phase III testing was not required.

For mercury a single sample at SC11 0.5-1.0 returned a concentration of 0.16 mg/kg, which was greater than the NAGD screening level of 0.15 mg/kg. All samples at SC10 were less than the laboratory PQL (Table 9.3). As such, the overall 95 percent UCL of 0.09 mg/kg was less than the NAGD screening level, and thus, Phase III testing was not required.

Two samples at SC11 0.0-0.5 and SC11 0.5-1.0 returned concentrations for nickel of 51.2 mg/kg and 49.9 mg/kg, respectively. These two concentrations were greater than the NAGD screening level of 21 mg/kg. Although the overall 95 percent UCL returned a concentration greater than the NAGD screening level, the average concentration of nickel from M3 and M4 was less than the 80th percentile from Fullerton Cove (Table 9.3). As such, the concentrations of nickel at M3 and M4 were less than ambient levels, and Phase III testing was not required.

For lead, two samples at SC11 0.0-0.5 and SC11 0.5-1.0 returned concentrations of 146 mg/kg and 198 mg/kg, respectively. These two concentrations were greater than the NAGD screening level of 50 mg/kg. The overall 95 percent UCL of 114.5 mg/kg was greater than the NAGD screening level. Unlike nickel, however, the average concentration of lead from M3 and M4 was greater than the 80th percentile from Fullerton Cove (Table 9.3). As such, the concentrations of lead at M3 and M4 were greater than ambient levels, and Phase III testing was required.

For zinc, two samples at SC11 0.0-0.5 and SC11 0.5-1.0 returned concentrations of 822 mg/kg and 865 mg/kg, respectively. These two concentrations were greater than both NAGD screening level of 50 mg/kg and the NAGD sediment quality guideline high value (SQHV) of 410 mg/kg. The overall 95 percent UCL of 555.4 mg/kg was greater than both the NAGD screening level and the NAGD SQHV. As with lead, the average concentration of zinc from M3 and M4 was greater than the 80th percentile from Fullerton Cove (Table 9.3). As such, the concentrations of zinc at M3 and M4 were greater than ambient levels, and Phase III testing was required.

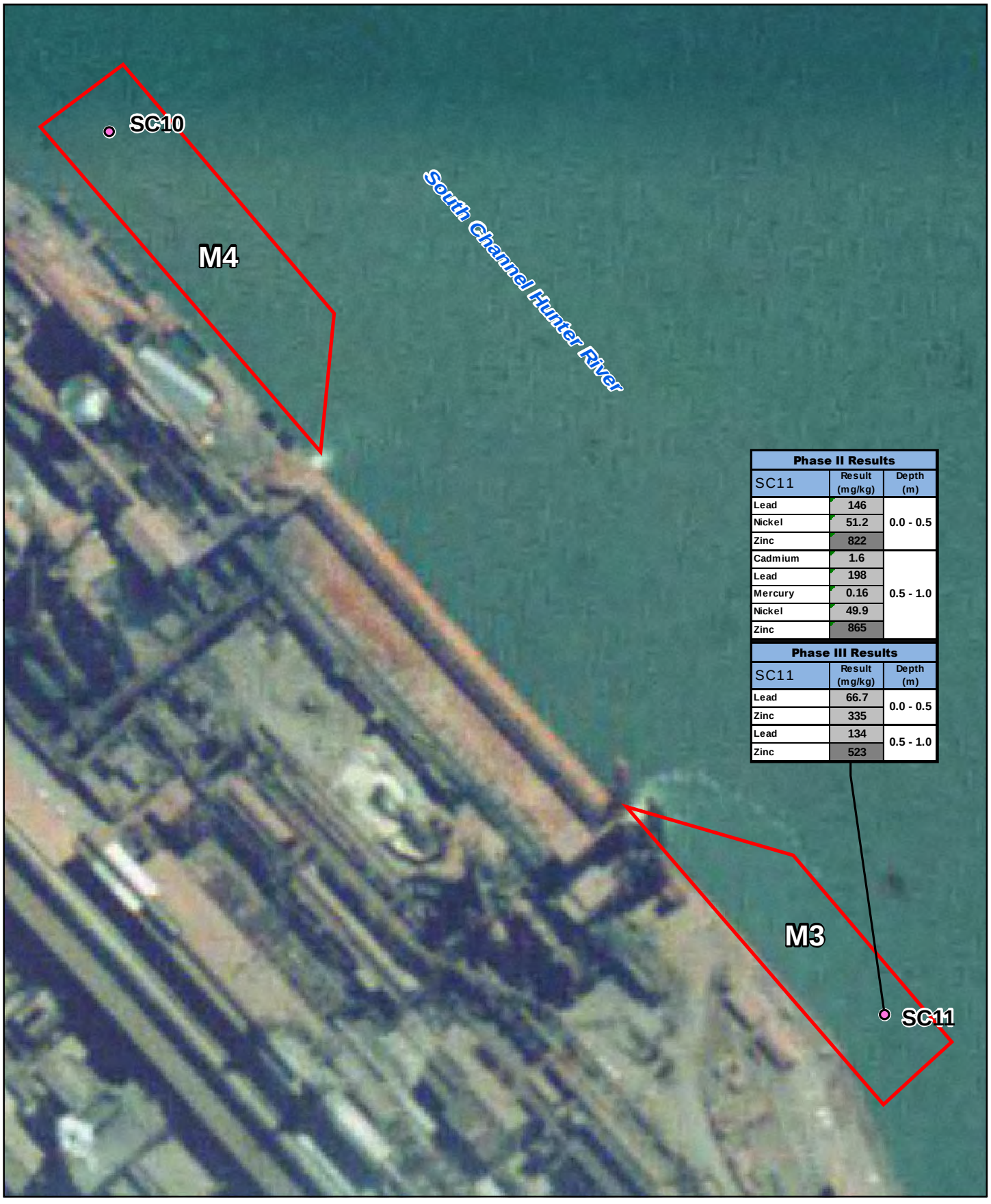
Figure 9.5 demonstrates the exceedances that were recorded from the Mayfield berths 3 and 4.

Table 9.3 Metals and metalloids results from Mayfield berths 3 and 4.

	Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
PQL	1	0.1	1	1	1	0.01	1	1
NAGD 2009 - Screening Level	20	1.5	80	65	50	0.15	21	200
NAGD 2009 - Sediment Quality High Value	70	10	370	270	220	1	52	410
Statistical Summary								
Number of Results	7	7	7	7	7	7	7	7
Number of Detects	7	3	6	4	4	5	4	6
Minimum Concentration	1.42	<0.1	<1	<1	<1	<0.01	<1	<1
Minimum Detect	1.42	0.1	1.1	1.6	2.5	0.01	2	1.5
Maximum Concentration	13	1.6	69.3	62.4	198	0.16	51.2	865
Maximum Detect	13	1.6	69.3	62.4	198	0.16	51.2	865
Average Concentration	5	0.41	23	19	54	0.05	17	261
Median Concentration	2.42	0.05	3.2	1.6	2.5	0.01	2	13.5
Standard Deviation	5.1	0.63	31	28	83	0.062	23	400
Number of Guideline Exceedances	0	4	1	3	13	6	15	15
95 % UCL	8.781	0.881	45.231	39.551	114.51	0.091	34.341	555.41
95 % UCL Exceedance	No	No	No	No	Yes	No	Yes	Yes
80th Percentile from Fullerton Cove	7.406	0.22	27.5	13.4	12.84	0.04	28.9	206.2
80th Percentile Exceedance and 95 % UCL Exceeded	-	-	-	-	Yes	No	No	Yes

Notes:

1: Jacknife UCL for non-normally distributed data (for a mix of detects and non-detects, non-detects are calculated at 0.5 x PQL).



Phase II Results		
SC11	Result (mg/kg)	Depth (m)
Lead	146	0.0 - 0.5
Nickel	51.2	
Zinc	822	
Cadmium	1.6	0.5 - 1.0
Lead	198	
Mercury	0.16	
Nickel	49.9	
Zinc	865	

Phase III Results		
SC11	Result (mg/kg)	Depth (m)
Lead	66.7	0.0 - 0.5
Zinc	335	
Lead	134	0.5 - 1.0
Zinc	523	

Legend

Berth Location

Core Sample Location

Note

The results shown are only those that are greater than adopted guidelines:

- NAGD 2009 - Screening Level
- NAGD 2009 - SQG-High Values

1:2,500 (at A4)

0 25 50 100

Metres

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

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Newcastle Port Corporation
Capital Strategic Dredging Project

Job Number 22-15954
Revision A
Date 26 Feb 2013

Locations within Mayfield Berths, M3 & M4
Phase II & III Dilute Acid Extraction (DAE)

Figure 9.5

G:\22\15954\GIS\Maps\Deliverables\22_15954_015_berthsM3M4results_revA.mxd Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com

Data Source: GHD: Ajoining Projects, Berth Locations - 2011; LPMA: RoadSegment, Suburb, Watercourse, Placepoint - 2007, Imagery - 2007. Created by: aj, jvc

The concentrations of the sum of total polycyclic aromatic hydrocarbons (PAHs) ranged from 12 µg/kg to 26,500 µg/kg. When normalised to total organic carbon (TOC), the sum of total PAHs ranged from 60 µg/kg to 7181.6 µg/kg. All values were less than the NAGD screening level of 10,000 µg/kg, with the 95 percent UCL being 9073 µg/kg. As such, Phase III testing was not required for this suite of analytes.

For Tributyltin (TBT), two samples from SC10 (M4) were less than the laboratory PQL. From SC11 (M3), the concentrations ranged from 7 µgSn/kg. to 7.6 µgSn/kg. Both samples recorded concentrations less than the NAGD screening level of 9 µgSn/kg. When normalised to 1 pecent TOC, all concentrations were less than NAGD screening level. As such, Phase III testing was not required for this analyte.

The sum of total total petroleum hydrocarbons (TPH) from M3 and M4 ranged from <3 mg/kg to 327 mg/kg. When normalised to 1 percent TOC, the concentrations ranged from 15 mg/kg to 64.78 mg/kg. All values were less than the NAGD screening level of 550 mg/kg, with the 95 percent UCL being 65.79 mg/kg. As such, Phase III testing was not required for this suite of analytes.

For benzene, toluene, ethylbenzene and xylene (BTEX), all concentrations were less that the PQL for each respective analyte. Therefore, Phase III testing was not required for this suite of analytes, as no potential contamination was present.

Summary of Phase II testing

Excluding metals, all analytes returned 95 percent UCL less than their respective *National Assessment Guidelines for Dredging* (NAGD) screening levels. As such, no further testing was required.

For metals, lead, nickel and zinc returned 95 percent upper confidence limit (UCL) greater than their respective NAGD screening levels. All other metals were less than the NAGD screening levels, and thus, no further testing was required. For nickel, although the concentrations were greater than the NAGD screening levels, when compared to the control site, the overall concentration was less than ambient conditions. As such, no further testing was required for nickel.

Both lead and zinc had concentrations greater than the NAGD screening levels as well as concentrations greater than ambient conditions. These results therefore identified lead and zinc within M3 and M4 as contaminants of potential concern (COPC), and therefore Phase III testing was required to determine their bioavailability within the marine environment.

1.1.3 Phase III Testing

Mayfield berths 3 and 4

Phase II assessments identified that both lead and zinc were COPC. As such, Phase III bioavailability and elutriate testing was required. However, as the study tested Mayfield berths 2, 3, 4 and 7, mercury was also tested during Phase III assessments, as this analyte was a COPC throughout all Mayfield berths. Additionally, as results from Phase II indicated that SC10 within M4 had concentrations less than the NAGD screening level (Table 9.3), Phase III elutriate and bioavailability testing did not occur at this location. Elutriates were a seawater leachate test whereas bioavailability tests were dilute acid extraction (DAE), as outlined in the NAGD.

Elutriate tests results were compared to the 95 percent marine water quality triggers ANZECC guidelines. For DAE, as only metals were investigated, the 95 percent UCL bioavailability results were compared to the NAGD screening levels.

Elutriate testing

All concentrations for lead, mercury and zinc from SC11 (M3) returned concentrations less than the laboratory practical quantitation limit (PQL) and therefore less than their respective ANZECC (2000) 95 percent marine water guidleines values. As such, Phase IV toxicity testing was not required,

Dilute acid extraction (DAE) testing

For DAE results, mercury returned a single concentration less than the PQL. As such, this analyte is not bioavailable and Phase IV testing is not required. For both lead and zinc, the two concentrations from SC11 were greater than the NAGD screening level (Table 9.4). For zinc, SC11 0.5-1.0 returned a concentration of 523 mg/kg, which is greater than the NAGD SQHV of 410 mg/kg.

As only two concentrations were returned for lead and zinc, 95 percent UCL could not be determined. However, given that all concentrations were greater than the NAGD screening level, results indicate that these metals are potentially bioavailable. As such, further Phase III testing is required, with the possibility of Phase IV toxicity testing which is to occur to support the development of the Sea Dumping Permit.

Figure 9-5 demonstrates the exceedances that were observed from the Mayfield berths 3 and 4 during Phase III testing.

Table 9.4 Phase III dilute acid extraction (DAE) results from Mayfield berth 3

	Lead	Mercury	Zinc
	mg/kg	mg/kg	mg/kg
PQL	1	0.1	1
NAGD 2009 - Screening Level	50	0.15	200
NAGD 2009 - SQHV	220	1	410
Statistical Summary			
Number of Results	2	1	2
Number of Detects	2	0	2
Minimum Concentration	65.7	<0.1	335
Minimum Detect	65.7	ND	335
Maximum Concentration	134	<0.1	523
Maximum Detect	134	ND	523
Average Concentration	99.85	-	429
Median Concentration	99.85	0.05	429
Standard Deviation	48.3	-	132.93
Number of Guideline Exceedances	2	0	2

Appendix E

Spoil Handling and Disposal Strategy

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Newcastle Port Corporation

Report on Capital Strategic Dredging

Dredging and Spoil Disposal Strategy

September 2012

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1. Introduction

1.1 Overview

This document outlines the preliminary dredging and spoil disposal strategy and foreshore treatment works that would be implemented to create the proposed berths. The strategy has been prepared to meet the Director General's Requirements (DGRs) and operational constraints in an efficient and cost effective manner. Information is provided on the types of dredges that would be used to dredge the river below high water mark, and the means of excavation above high water mark. The methods of dredging and excavation would depend on the types of materials within the bed and banks of the South Arm of the Hunter River.

1.2 Background

The existing riverbed within the proposed berths in the South Arm of the Hunter River consists of a combination of unprotected river banks and previous berth developments/foreshore protection measures. Dredging of these areas is required to provide suitable access and berthing areas for future berth developments.

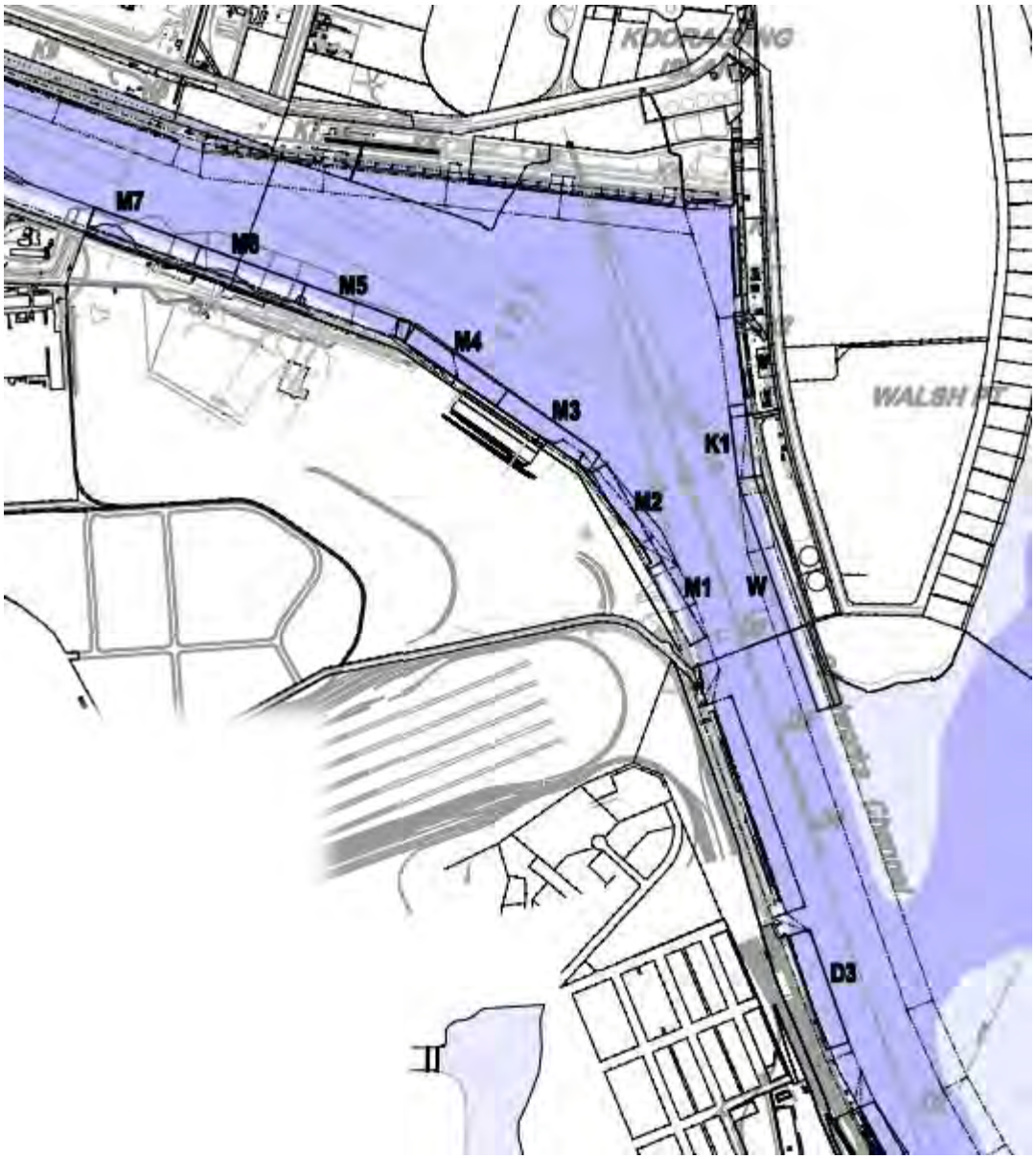
The proposed berths in the South Arm would be dredged and excavated to the required depth and the banks battered back and protected with a rock revetment to prevent scour and erosion. The development of the berth infrastructure adjacent to the berths would occur over time as required by associated land-based developments. The construction of new berth infrastructure, and any land-based development, would be subject to separate assessment and approval processes.

To allow shipping vessels to safely navigate the area between the existing shipping channel and the proposed Mayfield 1 and 2 berths and Walsh Point Berth Pocket, ancillary channel widening would be required at these locations.

It is estimated that approximately 1.87 million cubic metres of material would be removed by dredging and land-based excavation to create the proposed berths. Of this amount, approximately 30,000 cubic metres (or around 1.6 percent of the total volume) has been identified as contaminated material requiring some form of treatment before disposal or reuse.

The layout of the Project is shown in Figure 1. More detailed plans are provided in Appendix B of the EIS document.

Figure 1 Layout of the Proposal



1.3 Summary of berth requirements

A number of alternative berth layouts were considered as part of the overall planning of the port to accommodate proposed and future developments. Consideration has been given to the berth uses and associated vessel requirements associated with each of the 12 berths.

While new berth infrastructure does not form part of the Project being considered by this Environmental Impact Statement (EIS), factors affecting the general location and arrangement have been considered in the Project's concept design. A summary of the proposed berth details is presented Table 1-1 and summarised in Chapters 2 and 3.

Table 1-1 Overview of Proposed Berths

Berth name	Berth type	Design vessel	Length (m)	Width (m)	Design level (m)
Mayfield Berth No. 7	Bulk Liquids	Up to Panamax	310	55	-16.0
Mayfield Berth No. 6	Container	Up to Panamax	310	55	-16.0
Mayfield Berth No. 5	Container	Up to Panamax	310	55	-16.0
Mayfield Berth No. 4	Bulk/General Cargo	Up to Panamax	310	55	-13.3
Mayfield Berth No. 3	Bulk/General Cargo	Up to Panamax	310	55	-13.3
Mayfield Berth No. 2	Bulk Cargo	Up to Panamax	310	48*	-15.3
Mayfield Berth No. 1	NPC Operations	Various	240	48*	-15.3
Kooragang Berth No. 1	General Cargo	Up to Panamax	240	46	-14.5
Walsh Point Berth Pocket (up to three berth boxes)	General Cargo	Up to Panamax	630	46*	-14.5
Dyke Berth No. 3	Deep Draft Standby	Cape	330	65	-17.0

Notes

- Design Level relative to NHTG
- * Excludes required ancillary channel widening adjacent to Mayfield 1 and 2, and the Walsh Point Berth.
- Design levels are relative to the Newcastle Harbour Tide Gauge (NHTG) datum and include an over-dredging allowance of an additional 0.5 metres in depth in all proposed dredging areas, which would be provided as a buffer to provide for sedimentation that may occur between maintenance dredging programs.

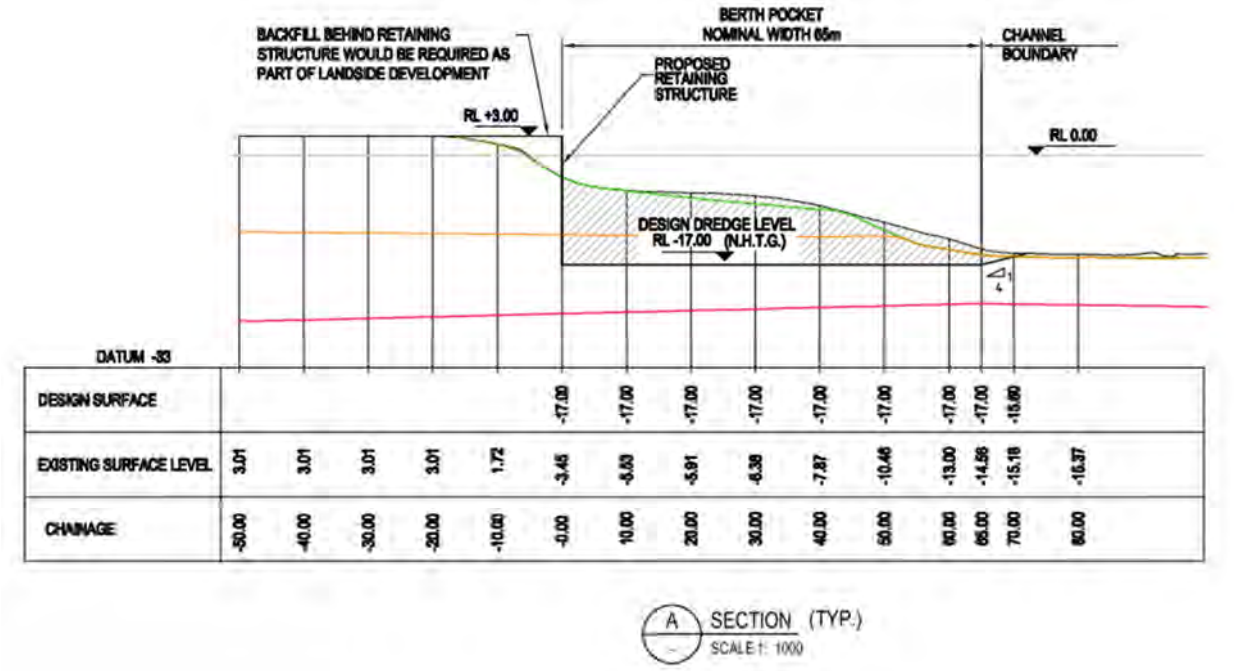
1.4 Existing river depths and sub-surface ground conditions

The existing river and channel depths, existing dredged berths and the proposed additional berths are shown in the drawings in Appendix B of the EIS document.

A number of historical investigations in the banks and bed of the South Arm have examined the geotechnical and geochemical nature of the sediments to be dredged. Additional vibrocoring, sampling and testing has been undertaken as part of this EIS to supplement the earlier testing. A description of these investigations is provided in Chapter 9 of the EIS document.

Typical cross-section profiles of the river showing material layering and dredging limits are included in Appendix B of the EIS document. Typically the river bed consists of fine grained, soft silty clay sediments overlying sand (typical cross-section profile is shown in Figure 2). The sand contains some lenses of clay and overlies deeper layers of clay, soft rock and hard rock below the proposed dredge profile. The physical properties of each of these materials considerably influences the method of dredging/excavation and reuse/disposal.

Figure 2 Typical cross-section profile



The soft, silty clay sediment contains varying levels of contaminants that have washed into the sediment layers from industrial developments in the region over an extended period of time. Geochemical and ecotoxicity testing of the sediments have demonstrated that the majority of these sediments are suitable for disposal at sea. The sand, clay, soft rock and rock are not contaminated and would not require treatment before reuse or disposal. However, some of the sediment may need to be treated before it is suitable for disposal or reuse. The relevant characteristics of the contaminated sediment chemistry and treatment processes are described in Chapter 9 of the EIS document.

The majority of the bank excavation work required for the Project would take place adjacent to the Mayfield berths. The information available on the history and characteristics of fill on these sites and this is described in Chapter 9 of the EIS document.

2. Dredge Batter Design and Foreshore Protection

2.1 Unprotected dredge batter slopes

Past experience with dredging of the sediments, sands, clay and rock in the South Arm, which have similar properties to materials that are proposed to be excavated, has shown that:

- The stiff marine clays and weathered rock would be stable in the short term at near-vertical slopes. However, with time, both classes of material are likely to form a stable long-term slope of approximately 1 vertical to 1.5 horizontal (1:1.5).
- The sands would be stable in the short term for submerged batter slopes at approximately 1:2.5. However, the unprotected sand slopes would gradually flatten with time and, for submerged slopes, this may result in a batter slope as flat as 1:5. In the tidal/wave zone the unprotected sand slopes may flatten to less than 1:10.
- The newly dredged slopes in the soft silty clay sediments might initially stand up at quite steep batter slopes. However, with time, these slopes would flatten out to be much less, for example, 1:20.
- Although no requirement for dredging in rock is anticipated, batters excavated in sound rock would be stable in the short term at near-vertical slopes. However, an assessment of bedding plane or jointing orientation would normally be undertaken to confirm the engineering feasibility of flattening of the batters in order to ensure long-term slope stability.

Although the ultimate batter slopes will be determined by the material types in which they are constructed, for the purposes of this EIS, unprotected internal batter slopes have been represented by an average slope of 1:4. It is envisaged that these slopes may be refined during subsequent detailed design activities.

2.2 Permanent bank protection works

In a river environment, it is usually not practical to design unprotected dredged batters in the medium to long term, as the relatively flat batters would result in excessive encroachments into the banks. As a result, it is common practice to provide some form of revetment protection in the form of rock rip rap, rock within PVC encased wire baskets, concrete filled mattresses or other protection systems. The presence or likely future presence of a berth structure on top of the slope and the potential risk of damage to that structure would also influence the batter protection method finally selected. The final design would depend on location, ground conditions and expected future development.

The stand-alone cost of these batter treatments varies greatly and alternatives are listed in decreasing cost per lineal metre of batter protection. Often these permanent batter protection works are incorporated into berth and wharf developments:

- Bulkhead wall berth structure. A vertical sheet piled, or similar wall with associated bank anchorage systems provides the batter protection.
- Suspended deck berth structure on widely spaced piles with a requirement for vehicle access all along the rear of the berth. This design would be suitable for a container or general purpose berth. The batter slope would have a thick combined rock berm at the toe of the batter and rock revetment, with a typical final riverside batter slope of 1:1.5.

- Open suspended deck berth structure on widely spaced piles, with limited vehicle access requirements. This design would be suitable for a bulk materials berth. The batter slope would have a thinner rock revetment with a typical riverside batter slope of 1:3.

The advantages and disadvantages associated with bulkhead wall and rock revetment solutions are described below in Sections 2.2.1 to 2.2.2.

2.2.1 Bulkhead wall

This alternative would involve a vertical wall with a buried tie-back anchorage system. The wall would either be located immediately adjacent to the berth to minimise landside encroachment, or alternatively, part-way up the dredge batter slope to provide the required navigation clearances whilst minimising the cost of a bulkhead wall option, as shown in Appendix B of the EIS document. There are a number of alternative construction methods for this anchored bulkhead wall, including:

- Driven steel or concrete sheet piles combined with an anchorage system.
- Driven steel soldier piles with infill precast concrete panels combined with an anchorage system.
- In situ excavated diaphragm wall constructed with an anchorage system.

Use of driven piles is preferred, however, the final construction method would depend on the nature of the materials that the piles would be driven through and the likely presence of obstructions, such as waste steel slabs. A better understanding of the sub-surface ground conditions would be gathered during geotechnical testing to be undertaken at the detailed design stage, this would assist with the selection of the preferred piling method. Depending on the detailed design a bulkhead wall would have a typical life in the order of 50 – 100 years.

Advantages

- Low permeability, which would inhibit leaching of any exposed contaminants and inhibit any potentially contaminated groundwater flows from the site into the Hunter River. The full impacts on the groundwater equilibrium would need to be assessed.
- Least amount of encroachment into the adjacent land.
- Wall and anchorages can be installed substantially in the dry before excavation/dredging.

Disadvantages

- High cost of construction.
- Ongoing maintenance of the steel piles and anchorages.
- Low permeability may result in adverse impacts on the groundwater regime. This issue would need to be studied further during detailed design.

2.2.2 Rock revetment

This alternative would involve initial construction of a temporary batter at a slope, for example, of 1:2.5, but ultimately the initial slope would depend on materials encountered during the excavation. This slope would then be built up into a rock berm with a final front batter slope of 1:1.5, which in turn would be protected by a rock revetment layer, as shown in Appendix B of the EIS document. Given the need to minimise encroachment into the adjacent portside land, rock revetments would only be used in conjunction with bulkhead walls and adjacent to the ends of each berth.

Advantages

- Lower cost than the sheet piled alternative.
- Higher permeability should not result in any significant adverse impacts on the groundwater regime.
- Lower long-term maintenance cost than for the sheet piled wall alternative.

Disadvantages

- Higher permeability that would have little effect in inhibiting the leaching of potential contaminants into the Hunter River.
- Greater encroachment on to the adjacent port land, than the bulkhead wall option.

The final details of this option would be determined during detailed design.

2.3 Temporary batters

If future proponents seek to independently develop a single berth at a time, the design has allowed for the dredging and development of each berth to be carried out independently of other berths.

In areas adjacent to previously dredged berths, temporary batter protection may be required. Dredging and re-construction of the batter in the short to medium would be required to accommodate a new berth adjacent to dredged areas. The typical types of temporary revetments are described as follows:

- For example, the slope would be battered to 1:3 for sand and clay, and would be protected by a relatively thin layer of revetment rock. This would be five metres below low water up to the top of the bank.
- Slopes of finer grained sediments would be assessed depending on the particular circumstances at that location of the site. The solution would depend on a number of factors, including the thickness of the sediment layer, whether the layer was submerged and the geotechnical properties of the material. Typically, the presence of a fine sediment layer within a batter would require a flatter slope or berm within the batter to maintain stability, followed by a relatively thin layer of rock on the exposed surfaces.

As with any unprotected batter profile in a marine environment (that is affected by environmental factors and vessel operations), the risk and consequence of localised slip circle batter failure would be carefully evaluated. This evaluation would consider the cost of revetment works and the significance of structures and/or the existing environment adjacent to the unprotected batter slope.

2.4 Summary of berth foreshore treatment measures

The new berth infrastructure and land-side development does not form part of the approval being sought by this EIS. However, factors influencing the general location and potential infrastructure arrangements have been considered in the development of the design.

The design has aimed to minimise the encroachment of the berths on the existing shipping channel and adjacent port land. Table 2-1 provides a summary of the potential foreshore treatment measures at each berth site.

Table 2-1 Foreshore treatment measures

Berth Site	Foreshore Design
Kooragang 1	Option 1 - A full depth vertical retaining structure such as a sheet piled wall. Option 2 - A partial depth retaining wall structure incorporating an armoured batter at 1 in 2.5 seaward of the structure.
Walsh Point Berth Pocket (up to three berth boxes)	Option 1 - A full depth vertical retaining structure such as a sheet piled wall. Option 2 - A partial depth retaining wall structure incorporating an armoured batter at 1 in 2.5 seaward of the structure.
Mayfield 1	A full depth vertical retaining structure such as a sheetpiled wall.
Mayfield 2	A full depth vertical retaining structure such as a sheetpiled wall.
Mayfield Berth Pocket (Mayfield 3 - 4)	A full depth vertical retaining structure such as a sheetpiled wall.
Mayfield 5	Option 1 - A full depth vertical retaining structure such as a sheet piled wall. Option 2 - A partial depth retaining wall structure incorporating an armoured batter at 1 in 2.5 seaward of the structure.
Mayfield 6	Option 1 - A full depth vertical retaining structure such as a sheet piled wall. Option 2 - A partial depth retaining wall structure incorporating an armoured batter at 1 in 2.5 seaward of the structure.
Mayfield 7	A partial depth retaining wall structure incorporating an armoured batter at 1 in 2.5 seaward of the structure and additional stability measures such as a secondary sheetpile toe wall.
Dyke Point 3	A full depth vertical retaining structure such as a sheetpiled wall.

3. Extent of Dredging Works

3.1 Note regarding future landside developments

The exact nature and extent of the future berth structures adjacent to each of the proposed berths is yet to be confirmed. The details of the wharf structures would be assessed by others and are not included in this EIS.

As a result, a number of alternate batter configurations have been considered in order to provide greater flexibility to accommodate a variety of berth structures. The likely berth developments and associated dredging requirements for each of the berths have been outlined in Sections 3.2 to 3.6.

3.2 Mayfield berths 5, 6 & 7

Mayfield berths 5, 6 and 7 have been designated for Panamax sized vessels. The berths have been designed according to the parameters outlined in Table 3-1.

Table 3-1 Proposed berth details – Mayfield berths 5, 6 & 7

Berth parameter	Mayfield berth No. 7	Mayfield berth No. 6	Mayfield berth No. 5
Berth type	Bulk liquids	Container	Container
Design vessel	Up to Panamax	Up to Panamax	Up to Panamax
Length (m)	310	310	310
Width (m)	55	55	55
Design level (m)[1]	-16.0	-16.0	-16.0

1. Design levels relative to NHTG, including overdredge allowance

The existing bank adjacent to the proposed Mayfield 5, 6, and 7 berths consists of a permanent sheet steel pile wall, which was constructed as part of the Hunter River Remediation Project (HRRP) to enable the contaminated sediments located adjacent to the sheet pile wall to be removed. This material has now been removed to a level approximately 0.5 metres below the interface between the soft silty clay and underlying sand and the level of contamination within the remaining material validated in June 2011.

Given the recent land based remediation works at the site and the geotechnical and geochemical properties of the underlying landside material, encroachment into this land and or removal of the existing sheet pile wall is not possible.

From an inspection of the sheet pile wall design drawings (WP, 2009), GHD understands that the existing wall has been designed to accommodate a maximum dredged level of around four metres below the previous bed level. Given that the required dredging to a level of -16 metres NHTG is well beyond the design limits of the existing sheet pile wall, the installation of additional stability measures will be required prior to the commencement of dredging activities.

To satisfy these requirements and geotechnical and erosion considerations, it is proposed to construct a dredged batter profile at a gradient of approximately 1:2.5, which would be protected with a rock

revetment. . However, as it would be difficult to construct this profile so that it is geotechnically stable, both in the short and long term, it is proposed that a relatively short steel sheet piled wall (approximately 10 metres long) be permanently installed. This would be seaward of the existing sheet pile wall prior to commencement of dredging activities. The location of the wall and configuration of the batter profile for these berths is shown in Drawing no. 21-15683-K040 and 21-15683-K041, in Appendix B of the EIS document.

Further investigation and design of the stability measures and/or additional anchorage systems would be undertaken during the detailed design stage to confirm the stability of the existing sheet pile wall and details of the secondary steel sheet pile wall at this location.

3.3 Mayfield berths 3 & 4

Mayfield berths 3 and 4 (the Mayfield Berth Pocket) have been designated as general cargo berths for Panamax Class vessels. The berths have been designed according to the parameters outlined in Table 3-2.

Table 3-2 Proposed Berth Details – Mayfield berths 3 & 4

Berth parameter	Mayfield berth No. 3	Mayfield berth No. 4
Berth type	Bulk/general cargo	Bulk/general cargo
Design vessel	Up to Panamax	Up to Panamax
Length (m)	310	310
Width (m)	55	55
Design level (m)[1]	-13.3	-13.3

1. Design levels relative to NHTG, including overdredge allowance

A section of the existing bank adjacent to the proposed Mayfield 3 and 4 berths consists of a vertical wall which was constructed as part of the existing Mayfield No. 4 Berth.

GHD understands that the existing wall has been designed to accommodate a berth design level of -12.8 metres NHTG (excluding overdredge allowance). In order to preserve the stability of the existing wall, the proposed Mayfield 3 and 4 berths would also be dredged to -12.8 metres NHTG immediately adjacent to the existing structure.

In addition, it is noted that dredging of the shipping channel adjacent to the proposed Mayfield 3 and 4 berths is currently being undertaken by NCIG.

The proposed berth face would comprise a vertical wall with a buried tie-back anchorage system and would be constructed in line with the existing Mayfield No. 4 Berth. There are a number of alternative construction methods for this anchored bulkhead wall solution, including:

- Driven steel or concrete sheet piles combined with an anchorage system.
- Driven steel soldier piles with infill precast concrete panels combined with an anchorage system; and
- In situ excavated diaphragm wall type construction constructed with an anchorage system.

The location of the wall and configuration of the batter profile for these berths is shown in drawing no. 21-15683-K040 and 21-15683-K041, in Appendix B of the EIS document.

3.4 Mayfield Berths 1 & 2

Mayfield 2 has been designated as a bulk cargo berth for Panamax sized vessels, whilst Mayfield 1 would serve as an operational berth for mooring NPC vessels such as the David Allen. Accordingly, the berths have been designed according to the parameters outlined in Table 3-3.

Table 3-3 Proposed Berth Details – Mayfield berths 1 & 2

Berth parameter	Mayfield berth No. 1	Mayfield berth No. 2
Berth type	NPC operations	Bulk cargo
Design vessel	Various	Up to Panamax
Length (m)	240	310
Width (m)	48 [2]	48 [2]
Design Level (m)[1]	-15.3	-15.3

1. Design levels relative to NHTG, including overdredge allowance

2. Excludes ancillary channel widening

In addition to the proposed dredging associated with the individual berth pockets, some channel widening would be required between the existing shipping channel and the proposed berths. This area would be dredged to a design depth of -15.3 metres NHTG to achieve a declared depth of -14.8 metres. This would form a roughly triangular wedge with a maximum width of approximately 40 metres at the centre of Mayfield berths 1 and 2.

The existing bank adjacent to the Mayfield berths 1 and 2 is of variable configuration, consisting of timber and concrete wharf structures, a sheet pile wall and a rock revetment batter. Some or all of these structures may need to be demolished and removed. In some areas the bank is unprotected and has eroded, becoming potentially unstable.

Previous investigations have revealed that the banks of Mayfield site may were constructed with imported fill including rock, soil, building rubble, steelworks waste products, slag and coal washery waste. In addition, previous investigations have noted that the existing banks may contain contaminants like tar and PAHs. The existing sheet pile wall may be providing a barrier to such contaminants migrating into the Hunter River from the fill behind the wall.

Ideally, the berth would be designed to limit any impacts on the integrity of the existing banks. However, removal of a small quantity of land based material will be required to achieve the required berth geometry without encroaching on the existing shipping channel or valuable portside land. In order to achieve these outcomes, a vertical wall with a buried tie-back anchorage system would be constructed. There are a number of alternative construction methods for this anchored bulkhead wall solution, including:

- Driven steel or concrete sheet piles combined with an anchorage system.
- Driven steel soldier piles with infill precast concrete panels combined with an anchorage system.

- In situ excavated diaphragm wall type construction constructed with an anchorage system.

In order to provide the required navigation clearances whilst minimising the cost of a bulkhead wall option, the wall could be located part-way up the dredge batter slope.

In the event that the detailed design requires the removal of significant quantities of land based material, the removal of this material would be undertaken using land based plant. The lower levels of the proposed bank batter below the toe of the existing seawall and revetment batter within the proposed excavation area would be within sand and clay, and could be removed using dredging equipment as discussed in Section 4.5.

3.5 Kooragang 1 and Walsh Point Berths

Kooragang 1 and Walsh Point Berth Pocket have been designated as general cargo berths for Panamax vessels. Accordingly, the berths have been designed according to the parameters outlined in Table 3-4.

Table 3-4 Proposed Berth Details – Kooragang 1 and Walsh Point Berths

Berth parameter	Kooragang berth No. 1	Walsh Point Berth Pocket
Berth type	General cargo	General cargo
Design vessel	Up to Panamax	Up to Panamax
Length (m)	240	630
Width (m)	46	46 [2]
Design level (m)[1]	-14.5	-14.5

1. Design levels relative to NHTG, including overdredge allowance

2. Excludes ancillary channel widening

In addition to the proposed dredging associated with the individual berths, some channel widening would be required between the existing shipping channel and the proposed berths. This area would be dredged to a design depth of -14.5 metres NHTG to achieve a declared depth of -14.0 metres. This would form a rectangular bench with a maximum width of approximately 34 metres.

The existing bank adjacent to the Kooragang 1 and Walsh Point Berth Pocket is of variable configuration, primarily consisting of rock and concrete lined embankments, and a largely unprotected grassy foreshore at the southern end of Walsh Point. The area proposed for the Kooragang 1 contains disused boat ramps and underwater structures that will require removal prior to the commencement of dredging activities.

Previous investigations have revealed that the banks of Kooragang Island are constructed of imported fill comprising materials such as rock, soil, building rubble and waste products. In addition, previous investigations have noted that a potential contamination “hotspot” exists near the southern end of Heron Road where geochemical testing has revealed elevated levels of PAH’s. However, the vibrocoring investigations undertaken in this area for the EIS did not identify this PAH hotspot.

The berths and associated dredging works have been designed to minimise the excavation of the existing river banks. This would be further refined at the detailed design stage to minimise the

mobilisation of potentially contaminated sediments during dredging, and to prevent the encroachment of batters onto portside land and important infrastructure such as Heron Road.

A dredged batter profile at a gradient of approximately 1:2.5, with rock revetment protection to satisfy geotechnical and erosion considerations is proposed. To further geotechnically protect the existing foreshore above the proposed batter, and stabilise the site in both the short and long term, a relatively short steel sheet piled wall (approximately 10 metres long) would be permanently installed immediately at the toe of the existing revetment, before dredging commences.

The lower levels of the proposed south bank batter below the toe of the existing seawall and revetment batter within the proposed excavation area would be within sand and clay. Alternatively, a full depth vertical wall with a buried tie-back anchorage system could be constructed. There are a number of alternative construction methods for this anchored bulkhead wall solution, including:

- Driven steel or concrete sheet piles combined with an anchorage system.
- Driven steel soldier piles with infill precast concrete panels combined with an anchorage system.
- In situ excavated diaphragm wall type construction constructed with an anchorage system.

The location of the wall and potential configurations of the batter profile for these berths is shown in drawing no. 21-15683-K020 and 21-15683-K021, in Appendix B of the EIS document. Further investigation and design of the stability measures would be undertaken during the detailed design stage to confirm the stability of the ultimate profile at this location.

3.6 Dyke Berth 3

Dyke Point 3 is proposed for use as a deep water stand-by berth primarily for laden cape class vessels departing the port. The berth's primary function would be to:

- Improve operational flexibility by allowing laden vessels to vacate the loading berths and to temporarily berth at the standby facility if tides do not permit immediate departure.
- Increase port capacity by allowing incoming vessels direct access to unoccupied loading berths (as vacated by vessels now berthed at the stand-by berth) and thereby optimising berth occupancy.

Although the berth's primary function would be as a temporary berth for outgoing vessels, the facility may also be used to berth incoming ballasted vessels which may require a berth in the case of emergencies. The berth has been designed according to the parameters outlined in Table 3-5.

Table 3-5 Proposed Berth Details – Dyke Point 3

Berth parameter	Dyke Point No. 3
Berth type	Deep Draft Standby
Design vessel	Cape Class
Length (m)	330
Width (m)	65
Design level (m)[1]	-17.0

1. Design levels relative to NHTG, including overdredge allowance

The existing bank adjacent to the proposed Dyke Point 3 primarily consists of a rock revetment with existing concrete and timber wharves. NPC advises that the existing rock revetment is prone to slumping.

There are existing services in the vicinity of the site including an active bunker line from Dyke Point 1. The proposed berth is also in close proximity to an existing rail yard and sidings. Consequently, the berth design is limited to solutions which minimise encroachment on the adjacent land and port infrastructure such as a vertical wall with a buried tie-back anchorage system.

The wall would either be located immediately adjacent to the berth pocket to minimise encroachment, or alternatively, part-way up the dredge batter slope to provide the required navigation clearances whilst minimising the cost of a bulkhead wall option. There are a number of alternative construction methods for this anchored bulkhead wall, including:

- Driven steel or concrete sheet piles combined with an anchorage system.
- Driven steel soldier piles with infill precast concrete panels combined with an anchorage system.
- In situ excavated diaphragm wall type construction constructed with an anchorage system.

The existing structures found on the wharf footprint would need to be demolished and removed. Adjacent structures (such as the redundant brick lined mooring block south of the berth) may potentially be reused but would be subject to verification.

The location of the wall and configuration of the batter profile for this berth is shown in drawing no. 21-15683-K010, in Appendix B of the EIS document.

3.7 Quantities and types of materials to be removed

Vibrocoring investigations included geotechnical and geochemical testing to determine the quantities and types of materials to be removed and disposed create the proposed berths.

The 12d® Model ™ was selected for this purpose on the basis that it can readily import data from the other existing geological/geotechnical models, efficiently manipulate data (including completion of volumetric calculations between three dimensional surfaces) and display the digital terrain model in a range of forms. The model was developed using a compilation of available geotechnical information and the latest bathymetric and onshore survey data.

A summary of the estimated quantities of the different material types to be removed in order to achieve the design profile specified in the drawings is provided below in Table 3-6.

Table 3-6 Summary of dredged material quantities

Material Type	Quantity
Contaminated sediments not suitable for immediate ocean disposal: (river silty clays within Walsh Point 'hot spot')	Approximately 30,000
Bank excavation: Primarily granular fill materials above RL 1.0 metres	75,000
Harbour Mud: River silts and clays overlying the idealised sand strata.	370,000
Sand (and associated fines): Sand has a grain size varying from 0.2 mm to 0.4 mm, with a D_{50} grain size of 0.275 mm. Approx 5 percent fines (less than 75 microns) and up to 10 percent shell.	1,045,000
Clay: Stiff clay layer at the bottom of the idealised sand strata.	350,000
TOTAL:	**1,870,000**

NOTES:

1. Quantities are based on the following:
   - Subject to the final design of the dredge batter profiles.
   - Quantities provided are the maximum envisaged and include an over-dredging allowance of an additional 0.5 metres in depth in all proposed dredging areas, which would be provided as a buffer to provide for sedimentation that may occur between maintenance dredging programs.
   - Bank excavation volumes represent a maximum volume, some of which could be dredged.
   - General arrangement of the excavation and dredge areas, as shown in Appendix B of the EIS document.
   - Section details as shown in Appendix B of the EIS document.
   - Batter profiles as shown in Appendix B of the EIS document.

4. Removal and Handling of Materials

A preliminary strategy for the removal and handling of materials has been developed. The strategy has been used to assess the potential environmental impacts associated with the dredging and bank excavation works, as well as the subsequent handling, transport and disposal of dredged spoil. It is important to note that the preliminary strategy outlined below, presents a number of options for plant and equipment selections and potential methodologies which may be employed by future proponents when creating the berths.

4.1 Order of activities

Some of the proposed berths may be dredged immediately, and some may be deferred until these berths are required to support the adjacent shore-side development. Consequently, the order in which the berths are dredged will depend on a number of factors such as market forces, detailed design and environmental approvals.

The general sequence of events for the program of the proposed works would involve:

- Site establishment.
- Installation of bulkhead walls and bank stability improvement measures.
- Targeted removal of contaminated sediments.
- Excavation of shorelines using land based plant.
- Removal of overlying marine silts and clays.
- Removal of sand.
- Removal of the underlying stiff clays.
- Progressive placement of batter protection rock.

4.2 Preliminary activities prior to dredging and excavation

Prior to dredging and excavation it would be necessary to:

- Establish the contractors' designated work and storage areas on the site.
- Identify and decommission services.
- Identify and remove artificial obstructions from the site.
- Install bulkhead wall and bank stability improvement measures.

Information on these preliminary activities is provided below.

4.2.1 Establish contractors' designated land based work areas

A number of contractors' land based work areas would be required. These would be located near the particular area of activity. Each site would possibly require vehicle access, an area for the contractors' offices and buildings, storage areas for construction materials including rock stockpiles and plant maintenance and associated storage areas. Some of the sites may also require temporary facilities for marine access.

4.2.2 Identification and removal of services

Prior to dredging and construction, the proponent would negotiate any relocation of utilities required with the relevant utility provider or private landholder and obtain any approvals required. Relocation of any service would be completed to meet the requirements of the relevant utility provider and/or private landowner.

4.2.3 Identification and removal of artificial obstructions

As a result of the past landuses in the surrounding area, it is anticipated that obstructions may be encountered during the dredging. These obstructions could include objects such as old structures, anchors, cables, chains and building materials and sunk vessels. Other materials that may be encountered include rock and/or building refuse.

To minimise lost time and damage to plant and equipment it would be necessary to identify and remove as many as possible of these obstructions before the start of dredging. A number of underwater technologies can be used to identify the location and nature of the artificial obstructions. These comprise:

- Detailed hydrographic survey.
- Magnetometer survey.
- Side scan survey.
- Continuous seismic profiling.
- Underwater seismic refraction.

This investigation would be completed during the detailed design phase.

Once identified, the location of any artificial obstruction would be charted and divers would confirm the position of the obstruction and nature of the object. A buoy would mark the position and, if needed, lifting equipment would be attached to facilitate the obstruction's removal by a lifting device such as an A-frame crane mounted on a barge. The obstruction would be subsequently disposed of off-site at an approved disposal site.

4.2.4 Installation of bank stability improvement measures

Prior to the commencement of dredging activities, it is likely that additional stability measures would be installed adjacent to the Mayfield 5, 6, and 7, Kooragang 1 and Walsh Point Berth Pocket. This would allow the batters immediately adjacent to the dredge area to remain geotechnically stable.

A number of potential improvement measures such as placement of toe rocks, installation of additional anchorage systems or installation of a sheet pile wall at the toe of the slope would be examined. Although the preferred option is subject to detailed design and may vary between berths, it is anticipated that the most likely solution would involve the installation of a sheet pile wall at the toe of the existing slope, rock revetment or sheet pile wall.

Further investigation and design of these measures, such as the sheetpile wall or additional anchorage systems, would be required at the detailed design stage. This investigation would confirm the stability of the existing batters and details of the proposed steel sheet pile walls.

The proposed location and alignment of the sheetpile walls is shown in Appendix B of the EIS document. The maximum total length of sheet piling potentially required at all berths is approximately two kilometres.

Based on preliminary design work, it has been estimated that a relatively lightweight steel sheet pile section is required. The pile lengths would vary depending on the material type, berth design and ultimate berth use but would be in the order of 10-20 metres.

Where possible, the sheet piling would be installed using land-based plant (within approximately 20 metres of the shoreline). The sheet piling would be installed most efficiently with a vibratory hammer. The hammer could be supported from an excavator (100 tonne) or mobile crane (50 tonne). In the case of the excavator, the hammer could be coupled to the excavator's hydraulic power pack. For the mobile crane, a separate power pack would be required.

In areas where the line of the sheet piled wall extends beyond the reach of a crane, it would be necessary to continue driving the piles from over the water. In shallow areas, this could involve using a spudded barge or self-elevating platform, which enables the operation to be completed accurately and independent of the tide. The barge/platform would support an excavator or mobile crane with vibratory hammer similar to that described above.

Piles would be driven to the required depth into the river bed. This could be achieved relatively easily through the upper three to four metres of soft silty clays, but some of the material at the greater depths through which the piles are to be driven is stiff clay, which would be more resistant to penetration. This would need be more closely investigated as part of the detailed design phase.

It has been estimated that each pile-driving rig would install approximately 30 piles per day. At this rate the total length of sheet piling would take approximately 64 days or 12 weeks to complete. However, it is likely the sheet piling would be advanced on a number of fronts, which would greatly reduce the total duration of sheet piling activities. For example the Mayfield and Kooragang / Walsh Point Berth Pocket could be undertaken simultaneously over a period of approximately 6 weeks.

4.2.5 Installation of bulkhead walls

Prior to the commencement of dredging activities at berths where a bulkhead wall is proposed, it would be necessary to drive the steel or concrete piles and excavate part of the landside area to install the accompanying anchor system. Further investigation and design of this wall and or additional anchorage systems would be required at the detailed design stage.

The proposed locations and alignments of the potential bulkhead walls are shown in Appendix B of the EIS document. In the event that full depth bulkhead walls are constructed at all berths, the maximum total length of piling required would be approximately three kilometres. It is important to note that this would remove the need for additional stability measures such as secondary sheet piled toe walls as described in Section 4.2.4.

Given the proximity of the potential bulkhead walls to the existing shoreline, it is anticipated that the required piling could be undertaken using land-based plant. The piles would be installed most efficiently with a vibratory or drop hammer. The hammer could be supported from an excavator (100 tonne) or mobile crane (50 tonne).

Piles would be driven to the required depth into the existing batters and river bed. This could be achieved relatively easily through the upper three to four metres of soft silty clays, but some of the material at the

greater depths through which the piles are to be driven is stiff clay, which would be more resistant to penetration. This would need to be more closely investigated as part of the detailed design phase.

It has been estimated that each pile-driving rig would install approximately 30 piles per day. At this rate the total length of sheet piling would take approximately 100 days or 18 weeks to complete. However, it is likely the sheet piling would be advanced on a number of fronts, which would greatly reduce the total duration of sheet piling activities.

4.3 Strategy for the removal and handling of materials

Dredging and excavation would involve the removal and handling of approximately 1.87 million cubic metres of material of many different types, in varying quantities, and from different locations within the area to be dredged. As a result, the materials would be removed using different technologies, and handled in a manner that would facilitate reuse, treatment and/or disposal at different locations.

The proposed strategy for achieving the removal of the materials in an efficient, cost-effective and environmentally sound manner is outlined below and summarised in Table 4-1.

It is important to note that the dredging stages described below will not be required for all berths. The stages required for each individual berth will depend on the final design as well as the geotechnical and geochemical properties of the sediments requiring removal at each berth.

This strategy may be subject to some refinement following completion of more detailed geotechnical investigations of the dredge area, confirmation of the requirements for reuse of materials and detailed design.

A description of the operation of the different dredges and other equipment (such as excavators) is provided in the following sections.

Table 4-1 Summary of removal of materials

Material type	Quantity to be excavated (m^3)[1]	Excavation and transport method[3]	Proposed receiving location and capacity (m^3)	Comments
Contaminated sediments not suitable for ocean disposal: (river silty clays)	Approximately 30,000	Backhoe excavator on barge and barge transport to shore (where required).	Licenced sites such as Kemps Creek *Capacity: More than 30,000*	Approximately 2,500 m^3 expected from M1-2 and the remainder from the Walsh Point "hotspot" to be treated and disposal of in accordance with Chapter 9 of the EIS document.
Bank excavation: Primarily granular fill materials.	75,000	Excavator (land based) and loaded into barges.	Unconfined sea disposal Or disposal to landfill *Capacity: More than 1,870,000*	Proposed offshore disposal site is the NPC disposal site (used 1989-1997), which is 5.8 kilometres southeast of Nobbys Head. Or Summerhill Waste Management Centre
Harbour Mud: River silts and clays overlying idealised sand strata.	370,000	Backhoe excavator on barge or trailer suction hopper dredge and barge transport to offshore spoil ground.	Unconfined sea disposal *Capacity: More than 1,870,000*	Proposed offshore disposal site is the NPC disposal site (as above).
Sand (and associated fines): Sand of varying grain size with approx 5 percent fines (less than 75 microns) and up to 10 percent shell.	1,045,000	Trailer suction hopper dredge and barge transport to offshore spoil ground. And/or beach nourishment. And/or Cutter Section Dredge with pipeline to onshore locations.	Offshore ocean disposal, or beneficial reuse where feasible *Capacity: More than 1,870,000*	Proposed offshore disposal site is the NPC disposal site (as above).
Clay: Stiff clay layer at the bottom of the idealised sand strata.	350,000	Backhoe Dredge and/or Cutter suction and/or trailer suction dredge.	Offshore disposal *Capacity: More than 1,870,000*	Insufficient land available for processing economically on shore. The proposed offshore disposal site is the NPC disposal site (as above).
TOTAL:	**1,870,000**		**1,870,000**	

NOTES

1. Quantities are based on the assumptions detailed in the notes following Table 3-6.
2. A portion of the bank excavation material may need to be treated, prior to final placement. (Actual quantities of material to be treated would be determined during excavation).

4.3.1 Stage 1 – Targeted removal of contaminated sediments

Previous studies identified a PAH “hotspot” in the vicinity of Walsh Point. Results from the vibrocoring undertaken for the Project did not identify this contamination. A conservative approach has been adopted and an allowance for approximately 30,000 cubic metres of soft marine silty clays that are unsuitable for unconfined sea disposal has been made. This material would be transported to an appropriate treatment facility.

It is most likely that a large backhoe dredge, operating in conjunction with two shallow draft flat top barges, would remove this material. This plant is preferred on the basis that it would minimise the potential for adverse environmental impacts such as:

- The presence of artificial obstructions.
- Odour generation.
- Onshore dewatering.
- Pump and pipeline blockages/breakdowns.
- Turbidity generation.

The backhoe dredge would be fitted with a specially designed grab or bucket that minimises turbidity in the water column during dredging operations. The material would be raised slowly within a turbidity curtain prior to its placement in a hopper barge anchored adjacent to the backhoe dredge. The use of the specially designed grab or bucket would significantly reduce the amount of material put into suspension. This approach would minimise migration of potentially contaminated materials, and also has the advantage of minimising the water content of the material.

The extent of this dredging work is shown in Appendix B of the EIS document.

The shallow-draft, flat-topped barges would incorporate an above-deck hopper (with a capacity of around 500-1000 cubic metres) and primary dewatering provisions. Alternatively, barge mounted skips could be lined with geotextile fabric and used to transfer dredged sediments onshore. These provisions would enable excess water to drain and return to the waterway within a silt curtain. The material would then be unloaded at an existing or purpose built temporary transfer facility to load trucks for transport to an appropriate treatment facility.

If required, the temporary transfer facility could consist of a small wharf deck supported on piles. The deck would be large enough to accommodate a large excavator. Berthing piles would be provided by each side of the platform to allow the barges to be moved along side of the deck in front of the excavator, to facilitate unloading. The facilities would be removed upon the completion of dredging.

Prior to transport to an appropriate treatment facility, measures may be required to improve the spadability of the sediments. This may include addition of lime, and would be subject to further development as part of the Dredge Management Plan. The construction contractor would be responsible for the development of the Dredge Management Plan.

The dredge would operate 24 hours per day, seven days per week with some delays due to equipment maintenance, refuelling and staff changes. The duration of this activity would be approximately 3 weeks.

4.3.2 Stage 2 - Excavation of fill using land based plant and equipment

Approximately 75,000 cubic metres of various fill materials may require removal adjacent to the proposed Mayfield berths using land-based earth moving equipment. It is anticipated that of the minimum landside excavation at Mayfield 1 and 2 (20,000 cubic metres), approximately 2,500 cubic metres could be contaminated and may require treatment in accordance with Chapter 9 of the EIS document.

The maximum extent of this excavation work is shown in the drawings in Appendix B of the EIS document.

The materials to be excavated potentially include rock, soil, building rubble, steelworks waste, slag, tar and coal washery waste.

The fill materials would be excavated using large civil engineering earth moving equipment such as large excavators and trucks. During excavation the material would be temporarily stockpiled and tested before being reused/disposed of in an acceptable manner.

The preferred method of spoil disposal is sea dumping, however potential beneficial reuses would be explored first. Material suitable for reuse would be trucked to a nearby development for use as fill material, capping layers or preloading. Contaminated material deemed unsuitable for reuse or sea dumping would be treated as necessary and trucked to an appropriately licensed waste facility.

Previous experience on similar sites on Kooragang Island and at Mayfield has shown that this material can be safely transported in road trucks with tight fitting or sealed tailgates. It is estimated that the land based excavation work would be undertaken during standard construction hours and would take approximately 10 weeks to complete.

4.3.3 Stage 3 - Removal of overlying marine muds

Approximately 370,000 cubic metres of soft marine silty clay sediments overlying sand would be removed. This material is considered unsuitable for beneficial reuse and it is proposed to dispose of it to an offshore disposal ground (subject to approval from The Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC).

The extent of this dredging work is shown in the drawings in Appendix B of the EIS document.

This material could be removed using either a medium sized trailer suction hopper dredge or alternatively a large backhoe or grab dredge. Whilst a trailer suction hopper dredge represents the worst case with respect to turbidity generation, the duration of dredging would be greatly reduced when compared to the use of a backhoe dredge.

If a trailer type dredge is used, a medium sized trailer suction hopper dredge with a capacity of between 2,000 and 4,000 cubic metres would be required to remove this material. The dredge would progressively create the berth pockets by dredging up and down the berths.

In order to dredge effectively, it would be necessary for the trailer suction hopper dredge to utilise its overflows for a time to displace a low density sediment/water mixture from its hoppers. Due to the nature of the marine silty clays, the use of the overflows would generate turbidity. Numerical modelling has been undertaken to simulate the turbidity generated by the trailer suction hopper dredge and this is summarised in Section 4.5.2. Monitoring and mitigation measures, such as deployment of a floating turbidity boom alongside mangroves and other sensitive areas that may be affected are discussed in Chapter 13 of the EIS document.

If a large backhoe or grab dredge is be used to remove the stiff clay material, the dredge would operate in conjunction with two or more barges. The barge size would be compatible with a dredge of this size and could be either self-propelled or moved around using a workboat. This type of dredge removes material efficiently at close to its in situ density, thereby maximising the load placed into the barges. A turbidity curtain would be placed around the backhoe dredge to minimise impacts on water quality.

The dredge would operate 24 hours per day, seven days per week with some delays due to equipment maintenance, refuelling and staff changes. A trailer suction hopper dredge would remove the material at a rate of around 600 cubic metres per hour. It is estimated that that this activity could be completed in approximately 5 weeks.

4.3.4 Stage 4 - Removal of sands

Approximately 1,045,000 cubic metres of sand sediments would be removed. The majority of this material would be disposed of to an offshore disposal ground (subject to approval from SEWPAC). An assessment of potentially suitable beneficial reuses would be undertaken and where feasible the material would be used as fill, for beach nourishment or would be stockpiled for future use.

Given that the timing of the berth developments is yet to be defined, it is not possible to accurately define the potential reuse/disposal sites. Therefore for the purposes of this EIS, it has been assumed that the sands will be transported to the offshore spoil disposal ground. Other disposal locations / beneficial reuse sites would be covered in subsequent EIS's if required.

This material could be removed using either a medium sized trailer suction hopper dredge or alternatively a large cutter suction dredge (CSD).

If used, the trailer suction hopper dredge would progressively create the berths by dredging up and down the berths. Material removed using the trailer suction hopper dredge could be transported and placed through a range of options, which are listed below and described in greater detail in Chapter 13 of the EIS document:

- Transported directly to the offshore disposal ground.
- Pumped onshore for reuse as fill material or stockpiling.
- Used as beach nourishment material through either pump-ashore, rainbowing/bowcasting or bottom dumping.

In order to dredge effectively, it would be necessary for the trailer suction hopper dredge to utilise its overflows for a time to displace a low density sediment/water mixture from its hoppers. Due to the nature of the marine silty clays, the use of the overflows would generate turbidity. As

noted above, numerical modelling has been undertaken to simulate the turbidity generated by the trailer suction hopper dredge and this is summarised in Chapter 8 of the EIS document. There would be an increase in turbidity due to this activity, though dredging in sands would generate less turbidity than in the finer sediments. Monitoring and mitigation measures are discussed in Chapter 13 of the EIS document.

The dredge would operate 24 hours per day, seven days per week with some delays due to equipment maintenance, refuelling and staff changes. The duration of this activity would be approximately 10 weeks.

Alternatively, a large cutter suction dredge could be used to remove this material before pumping it onshore for reuse / stockpiling. This approach would require installation of a discharge pipeline and onshore containment ponds (dewatering facility) for the capture of material and removal of excess water. The discharge pipeline would consist of a section of floating pipeline from the dredge to the shoreline and then a temporary, land-based pipeline to dewatering and fill site/s. The assessment and approval of the material transport handling associated with beneficial; reuse would be undertaken by others and is not included in this EIS.

The pipeline route(s) would be investigated and evaluated following the confirmation of the dredge material management area(s). Consideration would be given to a number of factors including the shore connection, types of discharge pipeline required (such as land based, floating or submersible), routes across existing structures, vegetation, foreshores, inter-tidal and riverbed areas, installation, maintenance, operational and removal considerations, reinstatement of vegetation (where required) and cost.

The sand would contain a minor percentage of fine-grained material that would be removed from suspension in the dredge water prior to this water returning to the surrounding water courses. This process typically involves a series of sedimentation ponds and, in some instances, flocculation and filtration prior to overflow of the surplus water. The assessment of these processes would be undertaken by others and is not included in this EIS.

The fine-grained product of these processes would be unsuitable for beneficial reuse due to its poor engineering properties and high moisture content. Consequently, this material may need to be trucked to a wharf facility for transfer to a barge for disposal at sea. Alternatively, this material could be dredged by a small cutter suction dredge within the sedimentation ponds and pumped to barges for disposal at sea. The assessment of these processes would be undertaken by others and is not part of this EIS.

4.3.5 Stage 5 - Removal of underlying stiff clays

Approximately 350,000 cubic metres of stiff clay is located beneath the sands and will require removal to create the berth pockets. This material is considered to be unsuitable for beneficial reuse and it is proposed to dispose of it to an offshore disposal ground (subject to approval from SEWPAC).

The extent of this dredging work is shown in the drawings in Appendix B of the EIS document.

A large backhoe or grab dredge, operating in conjunction with two or more barges, would remove the stiff clay material. The dredge would advance upstream. This type of dredge removes material efficiently at close to its in situ density, thereby maximising the load placed

into the barges. A turbidity curtain would be placed around the backhoe dredge to minimise impacts on water quality.

The dredge would operate 24 hours per day, seven days per week with some delays due to equipment maintenance, refuelling and staff changes. The anticipated removal rate would be around 125 cubic metres per hour. The barge size would be compatible with this production rate and could be either self-propelled or moved around using a workboat. At this rate, it is estimated that that this activity would be completed within 24 weeks.

Alternatively, a large cutter suction dredge, working in conjunction with a trailer suction hopper dredge, could also be used to remove this material. The cutter suction dredge would remove the stiff clay and place it back on the dredged bed of the South Arm within a turbidity curtain, prior to its subsequent removal by the trailer suction hopper dredge.

In order to dredge effectively it would be necessary for the trailer suction hopper dredge to utilise its overflows for a time. Due to the potential fine nature of the stiff clays, the use of the overflows would generate turbidity.

4.4 Batter protection works

Portions of the dredged batters adjacent to the proposed berth structures would be protected with rock. Rock would need to be transported to site by trucks from local quarries most likely in the Seaham and Karuah areas, where good quality rock suitable for extended exposure in a marine environment is available.

The rock would be temporarily stockpiled at the designated contractor storage areas. The rock would be subsequently transported to the placement location and placed on the dredged batters by a number of methods including:

- Land-based excavators and grab cranes working from the top of the river bank. Rock would be loaded onto trucks by front-end loaders working from the temporary stockpiles, for progressive delivery to these machines. The machines would place the rock directly onto the dredged batter, to the final profile. Due to the reach limitations, it is envisaged that rock would be able to be placed only on the top end of the sloping dredge batters on the banks using these techniques.
- Excavators or grab cranes mounted on floating barges. Rock would be loaded onto flat top barges by land-based excavators working from the temporary stockpiles. The flat top barges would travel to the site of the excavator/grab crane barge with the assistance of workboats. The floating excavator/grab crane would place the rock directly from the barges onto the dredged batter, to the final profile.

It is possible that the rock placement could be by one of a combination of these methods. The rock should not contain significant fine grained materials. Regardless, a turbidity curtain would be required to control river water quality.

4.5 Overview of equipment used for dredging and excavation

The equipment that would be used to remove the material from the bed and banks of the South Arm is described below.

4.5.1 Backhoe Dredge working in conjunction with barges

A backhoe dredge is an excavator mounted on a purpose-built barge, as shown in Plate 1.

The barge would be supported by three ‘spuds’ (large diameter piles that can be lowered or raised). The spuds can be lowered into the seabed and hold the position of the barge. Two spuds are located at the bow and a single spud is located at the stern of the barge. The spuds provide a stable, working platform that facilitates excellent control during the completion of the dredging activities. The stern spud can also incorporate a ram against which the barge can push itself forward (with bow spuds raised) in steps. The barge is not self-propelled and would be moved around the site by work boats when all the spuds have been raised.

The backhoe dredge would be fitted with a specially designed grab or bucket that minimises turbidity in the water column during dredging operations. The material would be raised slowly within a turbidity curtain prior to its placement in a hopper barge anchored adjacent to the backhoe dredge. The use of the specially designed grab or bucket would significantly reduce the amount of material put into suspension. It also has the advantage of minimising the water content of the material.

The excavator can be fitted with position-fixing equipment (both spatially and with depth). This would allow the operator to selectively remove material from the bed of the river and accurately control the operation.

In the case of material unsuitable for offshore disposal such as that located within the previously identified Walsh Point “hotspot”, shallow-draft, flat-topped barges incorporating an above-deck hopper would be used to transport the material as these craft are more easily unloaded at the temporary unloading wharf facilities. It is possible that the sediments could emit odours during this phase of the process. The results of previous odour testing trials on sediments of the South Arm have shown it is unlikely that odour would be an issue during dredging or transport of the contaminated sediments to shore. However, mitigation measures to reduce odour could involve the addition of lime or the placement of covers over the barge hopper.

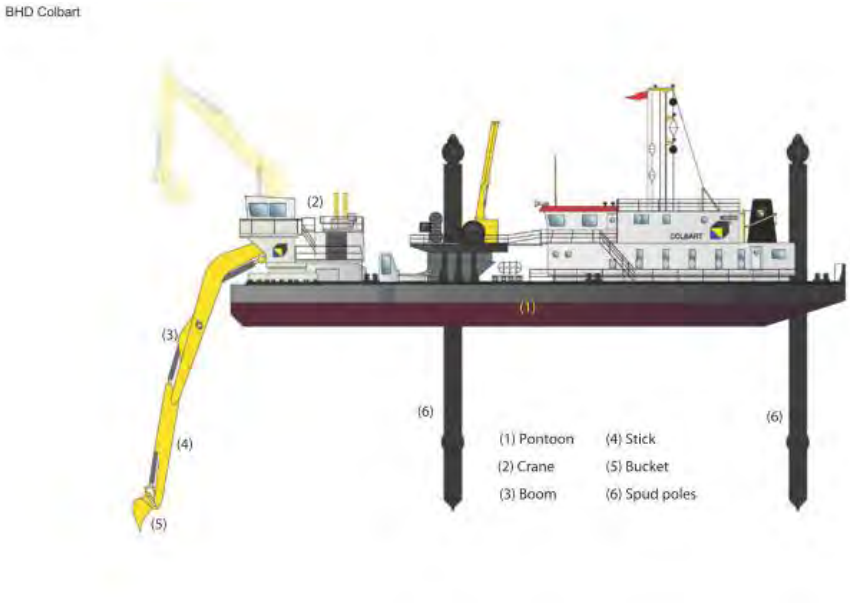
Depending on the nature of the contaminated sediments, the loading and transportation phase may also provide an opportunity to undertake some primary dewatering of the material. This could be achieved by incorporating underdrainage provisions beneath the sediment and above the deck of the barge. Subject to further testing, this water could be returned to the river (refer to Chapter 11).

In the event that an existing wharf facility is not available to accommodate the barges, a temporary unloading wharf may be constructed adjacent to the dredge area. A similarly-sized and configured excavator to that mounted on the backhoe dredge would operate from the unloading wharf to ensure that the target production rates were achieved. Material could then be transferred from the barge to trucks for subsequent transport to temporary stockpiling and treatment areas.

In the case of the material suitable for offshore disposal, two split hopper barges with a hopper capacity of around 500-1000 cubic metres would be used. These barges would be ocean-going vessels that could be self-propelled or supported by a tug.

Plate 1 Typical Backhoe Dredge

Source: Royal Boskalis Westminster N.V.



4.5.2 Trailer Suction Hopper Dredges

A trailer suction hopper dredge is usually a self-propelled, ocean-going vessel with its own onboard hopper for carrying sand or other materials that can be readily loosened and agitated from the harbour bed. A trailer suction hopper dredge is shown in plate 2. A trailer suction hopper dredge with a typical hopper capacity of between 2,000 and 4,000 cubic metres could be used on this project. The dredge would operate 24 hours per day, seven days per week with some delays due to equipment maintenance, refuelling and staff changes. The trailer suction hopper dredge would be supported by at least one work boat.

During dredging operations, materials are removed from the seabed by trailing a draghead along the seabed. The draghead agitates the seabed as the dredge pulls it along. Agitated material is transported up the suction pipes in the form of hydraulic slurry (a mixture of removed material and seawater) and into the hopper by large inboard pumps. Trailer dredges may be fitted with one or two suction pipes, depending upon the size of the vessel.

In the hopper of the dredge, the sand (or coarser grained) particles settle out and the excess water and fine particles pass through a hopper overflow system back into the sea through a discharge outlet normally located at the keel level of the vessel. This reduces the potential for disposal of fine grained sediments in the upper level of the water column encouraging settlement of suitable overflow sediments.

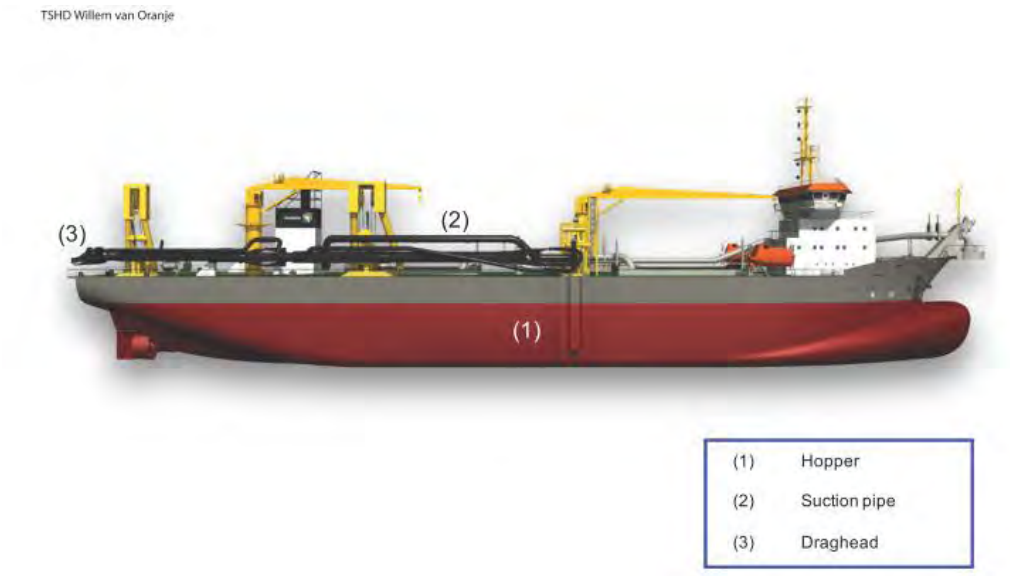
Once the dredge has loaded its hopper it ceases dredging by raising its dragheads off the seabed and travelling to the nominated disposal area. Discharge can be by one of three methods. The first of these is bottom dumping, a method in which the dredge hoppers split or the bottom doors open, allowing the material to fall to the sea floor. It is envisaged that this would be the method used to dispose of the materials at the proposed ocean disposal site.

The second method, pumping ashore, would be carried out when material is fluidised in the hopper prior to it being pumped onshore through a discharge pump, outlet and pipeline. Typically, the solids concentration of the slurry would be 10 to 15 percent by volume. This would normally involve the dredge anchoring in a mooring area within the safe operational limits of the vessel and coupling its discharge outlet to the discharge pipeline intake manifold supported by a floating buoy anchored to the seabed. The intake manifold would be connected to a discharge pipeline, which would comprise sections that are floating, submerged and onshore. A discharge outlet would be located onshore, from which deposited material would be reworked by an onshore crew including bulldozers and front-end loaders. The onshore outlet can be moved by extending sections of pipeline.

The third method, 'bow casting', is similar to the pump-ashore method of discharge, except that, rather than coupling the pump ashore discharge outlet to the discharge pipeline, material is pumped out of the pump ashore outlet onto the water surface some 50 metres or so in front of the bow of the dredge.

Plate 2 Trailer Suction Hopper Dredge

Source: Royal Boskalis Westminster N.V.



4.5.3 Cutter Suction Dredge

Cutter suction dredges are designed to remove material ranging from silt to hard clays and soft rock. The ability to dredge harder materials is a function of the power of the cutter head, the power of the side winches and the physical construction of the dredge.

A cutter suction dredge is generally not self-propelled. It is generally a floating barge with a number of major elements that include a cutter, ladder, onboard pipework and pumps, an onboard power plant, control room and anchoring system (comprising spuds, swing wires and anchors). A cutter suction dredge is shown in Plate 3.

During dredging operations the cutter, located at the end of a ladder, is lowered to the seabed. The cutter revolves through the bed material and in so doing loosens material. Agitated material in the form of a hydraulic slurry is sucked up into the pipe intake, located behind the cutter, by the onboard pumps. Typically, the solids concentration of the hydraulic slurry would be 10 to 15 percent by volume. The slurry would then be pumped through a discharge pipeline to the nominated disposal area.

This type of dredge works in a controlled manner with the vessel's pontoon normally held in position at the stern by a spud, which is dropped into the seabed. The cutting action is then facilitated by swinging the forward end of the pontoon in an arc across the seabed between two anchors set in front and to the side of the dredge. The dredge works on a fixed centreline. The cutterhead is lowered below water to the required dredging depth. Once the dredge face is cut down to the required depth, the dredge (and hence the cutterhead) is advanced along the centreline by means of moving the carriage in which the spud is mounted. To move forward the dredge is pushed against the spud by a hydraulic ram at a predetermined step size.

At the completion of a step an auxiliary spud is lowered and the main spud raised and returned to its starting position. The main spud is dropped and the auxiliary spud is raised prior to the recommencement of dredging operations. Small cutter dredges may not be fitted with a spud carriage and often advance by 'stepping' through the alternating use of the main working spud and the auxiliary spud.

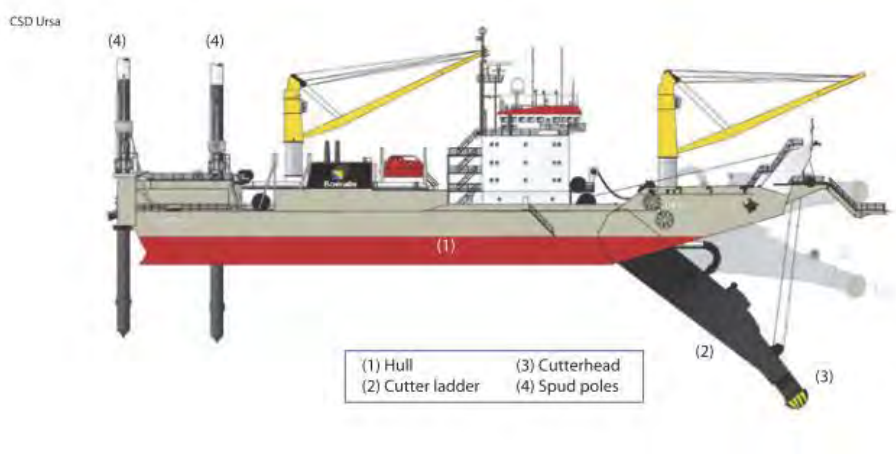
A large dredge would, typically, have a pump on its ladder and at least one additional inboard pump within the pump room.The discharge pipeline would comprise sections of floating and onshore pipeline. Typical dimensions for the onshore discharge pipeline would be approximately 450 – 800 millimetres.

Placement of the material from the discharge pipe on to the nominated onshore fill area is typically managed by controlling the direction of flow of the discharge water with conventional land-based plant and equipment such as bulldozers and front-end loaders. The material would be discharged into containment ponds. The containment ponds would incorporate dewatering provisions to collect and redirect decant supernatant and underdrainage back to receiving waters. The progress of the filling area reclamation would usually be controlled by a series of valves and pipeline off-takes to ensure that the material progresses in a prescribed manner.

In the event that the cutter suction dredge is used for loosening stiff clays, the dredge would return the material to the harbour bed for collection by a trailer suction hopper dredge. This would be achieved by using a diffuser pipe consisting of an articulated 'T-shaped' spreader pipe designed to redistribute material in an even manner to the sea-bed while at the same time reducing the discharge velocity and minimising the underwater turbulence generated. The spreader pipe would be supported from a floating barge located behind the dredge. The diffuser, when located within the water column just above the bed level, facilitates rapid settlement of material.

Plate 3 Cutter Suction Dredge

Source: Royal Boskalis Westminster N.V.



4.5.4 Land based excavation

Above-water excavation would be undertaken using large, land-based earthmoving plant and equipment, such as hydraulic excavators, both on-road and off-road trucks and potentially barges if material is to be disposed offshore. The proposed excavation for the Mayfield Berths is described earlier in this EIS. Typical capacities for on road trucks and trailers are 10 cubic metres and 7 cubic metres respectively and 20 cubic metres for an off road truck.

Appropriate management practices would be implemented to minimise environmental impacts associated with the haulage of excavated material. These practices could include:

- Silt fences between the roads and the South Arm to limit any spillage of pavement materials washing into the river.
- Spillage management on the haul road using graders, front-end loaders and street sweepers.
- Dust suppression using water carts.

Where trucks transporting the material may conflict with other vehicles, a temporary traffic management system, including devices (such as lights and signs) and personnel over this area, would be employed for the duration of the works.

The existing perimeter riverbank would remain until the final stages of the excavation, when excavators would progressively remove it, down to as low a level as possible. The subsequent removal of material in this area is proposed to be undertaken using marine-based plant and equipment. When the perimeter bund is being removed, a floating silt curtain would be placed at the bottom of the batter within the Hunter River to reduce the potential for turbid water to enter the river.

In the event that site water within the excavation area contains hydrocarbons, an oil containment boom would be provided close to the embankment and an oil-skimming machine would be used to collect the hydrocarbons. The hydrocarbon material would subsequently be taken to a trade waste disposal site. If required, a mobile water treatment plant may also be provided to improve water quality prior to final discharge of water into the Hunter River.

5. Spoil Disposal Options

This chapter provides information on the proposed disposal options for the materials dredged and excavated from the proposed berths. The timing of the development of each of the proposed berths is yet to be confirmed. Consequently, unconfined sea disposal has been selected as the default disposal option, with a view to confirming beneficial reuse locations once the timing of the berth development has been confirmed.

In addition to the offshore spoil grounds, the potential options include licenced waste facilities, beach nourishment areas, and nearby developments such as coal terminals, waste emplacement areas, industrial areas and road and rail extensions. The offshore disposal of sediments would be subject to approval from the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) and subject to a separate application for approval.

Although a general assessment of likely impacts associated with the alternative disposal options (such as beach re-nourishment, clean fill or landfill) has been provided, it is envisaged that these works will be the subject of subsequent environmental approvals. In addition, the future berth development proponent would be required to conduct additional investigations and supply management plans to adequately manage any potential impacts.

5.1 Overview of material disposal options

Although the default disposal option is unconfined sea disposal, as far as possible, the aim would be to beneficially reuse the material resulting from dredging and excavation. However, not all materials (such as, soft silty clays) can be reused. In addition, a small percentage of the total volume of materials requiring removal may be contaminated and require treatment before it can be reused.

Three basic means of disposal are proposed for materials resulting from the dredging and excavation process:

- Offshore disposal of sediments according to the provisions of the *Environment Protection (Sea Dumping) Act 1981.*
- Beneficial reuse of material.
- Treatment of contaminated sediments and subsequent re-use or disposal.

GHD has investigated several possibilities for land based disposal sites, as alternatives to unconfined sea disposal, including:

- Licenced waste facilities.
- Beach nourishment areas.
- Stockpile areas.
- Nearby developments such as:
    - coal terminals
    - waste emplacement areas
    - industrial areas
    - road and rail extensions.

5.2 Material balance

A summary of the overall excavation and disposal requirements has previously been presented in Table 3-6 (Section 3.7). A further simplified tabulation of the material quantities is present in Table 5-1. It should be noted that this table is based on the same assumptions previously presented in conjunction with Table 3-6.

Table 5-1 Summary of material quantities for disposal

Item	Material type	Excavation volume (m3)[1]	Proposed disposal site
1	Potentially contaminated materials adjacent to Walsh Point not suitable for offshore ocean disposal	30,000 (assumed)	Licenced waste facility such as Kemps Creek, Sydney
2	Landside excavation material	75,000	Unconfined Sea Disposal Nearby developments Beach nourishment areas Stockpile areas
3	Overlying marine muds (soft marine silty clay sediments)	370,000	Unconfined Sea Disposal
4	Sand with some minor clay	1,045,000	Unconfined Sea Disposal Nearby developments Beach nourishment areas Stockpile areas
5	Stiff Clay	350,000	Unconfined Sea Disposal
Total		**1,870,000**	

1. Quantities are estimates based on studies to date as outlined in Table 3-6.

5.3 Materials for disposal

5.3.1 Potentially contaminated dredged sediments

Approximately 30,000 cubic metres of potentially contaminated river sediments not suitable for offshore disposal is likely to require excavation, transportation, treatment and finally disposal at an appropriately licenced waste facility as described in Section 4.3.1. This material comprises approximately 1.6 percent of the total volume of material to be dredged. These materials generally consist of fine-grained silty clays, and sands that are contaminated with a variety of substances that require treatment prior to disposal or reuse. They are located adjacent to the southern end of Heron Road on Walsh Point and are surface sediments that have been contaminated from industrial developments along the bank of the south arm over approximately the last 100 years.

5.3.2 Landside excavation material

Approximately 75,000 cubic metres of various fill materials (some of which could be contaminated) may require removal adjacent to the proposed Mayfield Berths using land-based earth moving equipment, as described in Section 4.3.2.

The materials to be excavated potentially include rock, soil, building rubble, steelworks waste, slag, tar and coal washery waste. As noted in Section 4, it is anticipated that the majority of the fill material would be suitable for reuse. However, there is insufficient data to fully characterise the fill materials and the extent of potential contamination it would be difficult even with a comprehensive sampling and testing program to fully characterise the site, due to its varied history of filling.

5.3.3 Overlying marine muds

Approximately 370,000 cubic metres of low contamination river sediments are proposed to be dredged, transported from the dredge site and disposed of at sea, as described in Section 5.4. These materials are located in the upper profile of the materials to be dredged and like the potentially contaminated sediments unsuitable for offshore ocean disposal, have accumulated contaminants from nearby industrial activities over the last 100 years, though to a lesser extent. These materials would be excavated down to the interface with the underlying sands.

The physical properties of these sediments including, their fine grain size (which is mainly silt and clay size), their high plasticity and moisture content, combined with the significant disturbance to the sediment matrix that occurs during the dredging and transport process, dictates that this material is unsuitable for all but ocean disposal.

5.3.4 Dredged sand

Approximately 1,045,000 cubic metres of sand is proposed to be dredged, transported from the dredge site and disposed of at the offshore spoil disposal grounds or potentially reused, as described in Section 5.4.

Historical and recent geochemical testing has demonstrated that sand in the river bed does not contain significant levels of any contaminants. The relatively clean nature and medium grain size of the sand (which generally varies from 0.2 millimetre to 0.4 millimetre) makes this material suitable for a number of land based site development works, that are located within close vicinity of the dredging works.

5.3.5 Stiff Clay

Approximately 350,000 cubic metres of clay is required to be dredged using a backhoe dredge, and/or a combination of trailer suction / cutter suction dredging techniques, as described in Section 4.5. Like the overlying muds, the physical properties of the clays, including their fine-grained nature, combined with the extensive disturbance of the clay matrix that occurs during the dredging process, dictates that the only practical method to dispose of this volume of clay material is by ocean disposal. However, unlike the overlying muds, this clay has not been exposed to potential contaminants during historical industrial development and as a result, would not contain levels of contaminants that would preclude offshore disposal. The very significant cost, space and program requirements associated with any proposed land based beneficial use of this material would render these options unfeasible.

5.4 Offshore disposal of sediments

5.4.1 Volumes for disposal

The materials that would be dredged and subsequently disposed of offshore to approved dump grounds include:

- Landside excavation material (75,000 cubic metres).
- Overlying marine muds (370,000 cubic metres).
- Sand with some minor clay (1,045,000 cubic metres).
- Stiff clay (350,000 cubic metres).

As previously noted, potential options for beneficial reuse of suitable sediments would be investigated prior to commencement of dredging operations. Where possible, beneficial reuse would be adopted as the preferred disposal strategy (in preference to unconfined sea disposal).

5.4.2 Sea Dumping Act Permit Application

Any component of the proposed activities that involves sea disposal would be assessed by the Commonwealth Department of Sustainability, Environment. Water, Population and Communities (SEWPAC) through a detailed application process for a Permit under the *Environment Protection (Sea Dumping) Act 1981* to dispose of dredge or excavation material at sea.

5.4.3 Sediment quality for offshore placement

The sediments on the South Arm of the Hunter River have been previously subjected to extensive physical, chemical and ecotoxicological analyses, to ensure their suitability for unconfined sea disposal. As noted above, unconfined sea disposal of the sediments proposed for removal would be subject to approval by SEWPAC.

The investigation and testing of the contaminated sediments undertaken as part of this EIS, and previous assessments concluded that polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPHs) are considered to be the most likely cause of toxicity in some of the Hunter River sediments.

Based on the available data, CSIRO (2002) has previously recommended that sediment with total PAH concentrations greater than 75 mg/kg (normalised to 1 percent Total Organic Carbon) (TOC) and TPH concentrations greater than 450 mg/kg (sum of C_6-C_{36}, normalised to 1 percent TOC) are considered unsuitable for ocean disposal.

In addition, based on the available data concerning the protection of ecosystem and human health, it was recommended that sediments with 95 percent upper confidence level mean total PAH concentrations of greater than 15 mg/kg (normalised to 1 percent TOC) should be considered unsuitable for ocean disposal.

On the basis of these investigations, and the relevant guidelines (NAGD 2009), it is anticipated that the material proposed to be dredged would be suitable for offshore disposal as discussed in Chapter 13 of the EIS document.

5.4.4 Location of the proposed ocean disposal site

Four ocean disposal sites can be distinguished offshore from Newcastle, based on their dates of use:

- Prior to 1989.
- For major port deepening 1978 – 1983.
- 1989 – February 1997.
- February 1997 – present.

The proposed offshore disposal site corresponds to the area used as a disposal site by NPC between 1989 and February 1997. It is located in NSW State Waters offshore of Newcastle, approximately 3.8 – 5.8 kilometres southeast of Nobby's Head. The disposal ground falls just inside the 3 nautical mile State / Commonwealth waters boundary, and has an area of approximately 2 kilometres by 2 kilometres (or 4 km^2).

This disposal ground has been selected ahead of the three other disposal ground locations for the following reasons:

- It has been successfully used in the past for capital development and maintenance dredging projects undertaken by NPC, with minimal adverse environmental effects.
- There is a significant amount of information relating to this existing disposal ground and the behaviour of similar materials deposited at this location.
- This disposal site is larger and located in deeper water than other disposal sites, and accordingly can accommodate greater quantities of material, particularly material that would not readily disperse from the disposal site, such as rock.
- The transport and disposal activities at the disposal site for this Project would not interfere with the maintenance dredging activities currently undertaken by Newcastle Port Corporation, which deliver materials to another disposal site closer inshore.

As noted above, the proposed disposal site was used by NPC as the formal disposal ground between 1989 and February 1997. Since that time the disposal site has been used for disposal of sediments associated with the Kooragang Terminal Expansion and the Hunter River Remediation Project.

5.4.5 Characteristics of the disposal ground

A number of studies have been undertaken since 1989 to characterise the offshore area and to ascertain the fate of material placed in the disposal ground over time. Studies have included chemical and physical sediment analyses, sidescan sonar, biological sampling and Remotely Operated Vehicle (ROV) video surveys.

Water depth at the proposed disposal ground ranges from 35 to 45 metres below Chart Datum, and the seabed generally exhibits low relief and a gentle slope away from land. Sidescan sonar work undertaken in 1992 identified features including muddy mounds (roughly 40 to 60 metres in diameter and having approximately 1 metres relief) and areas of rock just inshore of the disposal ground, most likely attributable to disposal of rock from the major port deepening dredging over the period 1978 to 1983.

Analysis of sediment data undertaken for the Stage 2 Mobility Study for Dumped Dredge Spoil (PBP, 1992) and for the Offshore Sediment Sampling and Testing exercise (PBP, 2002) indicates a strong sedimentological signature in the offshore disposal grounds. The sediments exhibit a pronounced lithic character, such as high proportion of rock fragments, which is different to the sedimentological characteristics of the sediments in the same water depths away from the disposal area. The latter comprise more typically highly iron stained, quartzose marine sand. The sediments within the disposal area also have higher mud content, consistent with the convective descent processes for bottom disposal of dredge material.

Chemical testing of the sediment samples retrieved from the current spoil ground and surrounding offshore area revealed that levels of contamination were below NAGD screening levels or laboratory detection limits.

Searches of available published literature indicate the existence of various protected / migratory species in the region; in particular whales, seabirds and numerous species of pipefish / seahorses. The latter would most likely be contained in near shore habitats that provide access to seagrass and marine algae beds.

Benthic macro invertebrate populations at the proposed disposal site and two nearby control sites were investigated as part of the offshore permitting process associated with the South Arm EIS (GHD, 2003). The proposed dump ground was found to have a different sediment composition compared to the control locations identified during previous studies, particularly in the shallow depth stratum. It is noteworthy that there was little mud in these samples; this was probably redistributed away due to re-suspension and transport by wave and current action. Furthermore, the investigations noted that the sediments in the proposed dump ground showed little change since 1992, when they were last investigated. Compared to the control locations, the proposed dump ground had a very different composition of benthic invertebrates, both in terms of assemblage structure and biodiversity, total abundance and the abundance of common families (GHD, 2003).

5.4.6 Placement of dredged material

Trailing suction hopper dredges transporting material to the proposed disposal site would have hopper capacities between 1,500 to 2,500 cubic metres. The vessels would undertake the dredging on a continual basis transporting up to about five loads to the disposal site per day.

The duration over which material would be placed at the disposal site would vary depending on the nature of the materials being dredged. The total duration of the dredging program would extend over 28 weeks if all berths were dredged in close succession. However, it is likely the dredging and disposal activities associated with the development of each berth would be undertaken separately, possibly over a period of years.

The vessels would take the most direct route from the dredge area along the south arm to the port entrance. Once out of the port entrance, the vessels would turn southeast and travel directly to the disposal site.

During the transport of the dredge material from the dredge site to the offshore disposal area, and on the return journey, the vessels would observe all requirements of the Harbour Master in terms of vessel speed and other navigation requirements.

The trailing suction hopper dredges would navigate along the prescribed route and once at the disposal site would open the hopper ('doors' on vessel's hull) to release the dredged material over the disposal site.

The vessel would have a Global Positioning System that would enable the vessel to locate the prescribed disposal area. Also, a detailed plan for material placement would be followed and records of actual placement kept to so that the material is spread across the defined disposal site in a prescribed manner.

A management plan for the disposal of the material at the disposal site would be prepared as part of the permit application for approval by SEWPAC. This would cover the nature and volume of each of the materials, the extent of initial deposition and the anticipated long-term aerial extent of the deposited materials.

5.5 Alternative disposal / reuse sites

The timing of the development of each of the berths is yet to be determined. Consequently, a number of alternatives to unconfined sea disposal may exist at the time of dredging when the material requiring disposal/reuse becomes available.

The potential alternate locations for disposal/reuse of the dredged material are outlined in the following sections. Options include licenced waste facilities, beach nourishment areas, nearby developments such as coal terminals, waste emplacement areas, industrial areas and road and rail extensions.

5.5.1 Licenced waste facilities

A small percentage of the dredged material (in the order of 30,000 cubic metres) may be unsuitable for beneficial reuse or unconfined sea disposal due to its geochemical and geochemical properties. In addition, the fill material removed using land based equipment is likely to require onshore disposal.

The potentially contaminated material would be removed using a large backhoe dredge, operating in conjunction with two shallow draft flat top barges. The dredge spoil would then be removed from the barges at a temporary unloading wharf and transported to the treatment / disposal location using existing road or rail infrastructure, as described in Section 4.3.1.

Previous experience on similar sites on Kooragang Island and at Mayfield has shown that this material can be safely transported in road trucks with tight fitting or sealed tailgates.

The location of any temporary unloading wharf would be determined by the location of the disposal / treatment site and the availability of suitable existing infrastructure. Potential locations for temporary wharf facilities include:

- The cleared land at the southern end of Walsh Point, which provides access to Heron Road in close proximity to the proposed dredge area.
- The existing wharf facilities at Mayfield, which have recently been used for similar activities as part of the Hunter River Remediation Project.
- An alternate location on Kooragang Island adjacent to and immediately downstream of the Stockton road bridge. This location provides good water depths close to the shoreline (3.0

metres below NHTG) and can be accessed via the existing navigation channel located within the North Arm, which has a bed level of between 4.0 metres and 6.0 metres below NHTG.

The treatment and disposal locations for the material would be determined following the completion of additional geochemical testing to accurately define the nature and extent of the contaminated sediments.

On the basis of the investigations completed to data, it is envisaged that this material would be transported by road to Kemps Creek in Sydney for disposal in landfill.

In the case of the fill material to be excavated using land based equipment, as described in Section 4.3.1, it is expected that the material could be transported to the nearby Summerhill Waste Management Centre or to Kemps Creek in Sydney depending on levels of contamination.

Appropriate licences would be held by the waste facility and would cover the onsite handling and treatment of the unsuitable materials, which is not part of this EIS.

5.5.2 Land development

Nearby developments such as coal terminals, industrial areas and road and rail extensions are likely to require sands with a low fines content (such as those to be dredged from the proposed berths) for use as general fill, in capping layers, or as preloading material as part of ground improvement measures.

There are a number of projects that are either proposed or have development consent for the Newcastle and Hunter region. These include the Proposed PWCS T4 coal loader, Intertrade Industrial Park, Tomago Industrial Site / Redlake Enterprises Industrial Estate, F3 Freeway to Raymond Terrace Upgrade and other areas on Kooragang Island. The dewatering, temporary stockpiling and transport of this material to alternative sites, or the direct pumping and handling of the material at these sites, is to be assessed by others and is not part of this EIS.

In the event that no nearby developments require fill material at the time of dredging, the full volume of sand could be stockpiled for future use, subject to the availability of a suitable land area. Temporary dewatering and stockpiling of the entire volume would require approximately 40 - 50 hectares of land. However, smaller individual areas may also be suitable, for the development of individual berths. In addition, progressive reuse of the sand could significantly reduce this land requirement.

The most practical mode of transportation would depend on the type of dredging equipment used to remove the material and on the relative locations of the proposed berth pockets and the disposal / reuse locations. Potential transport methods include:

- Rail and truck.
- Barge and truck.
- Pumping.

It is envisaged that the sand would be removed hydraulically by a medium sized trailing suction hopper dredges or alternatively a medium to large cutter suction dredge . It is likely that the dredged spoil would be pumped directly to the spoil management area by a relatively large pipeline. In the event that material is required to be placed further than is economically feasible

using pipelines, the material would be dewatered and stockpiled prior to transportation to the final disposal location using existing road or rail infrastructure. The onsite handling of the sand, fine-grained materials and dredging return waters, and subsequent transport is being assessed by others and is not part of this EIS.

Whilst the cutter suction dredge would pump ashore directly from the berths, the trailing suction hopper dredges would require a temporary berthing area from which dredged material would be pumped to the proposed disposal site. The location of the temporary berthing area would depend on both the berths to be dredged and the location of the disposal / reuse site. Where possible this approach would utilise existing infrastructure.

The pipeline route(s) would be investigated and evaluated following the confirmation of the dredge material management area(s). Consideration would be given to a number of factors including the shore connection, types of discharge pipeline required (such as land based, floating or submersible), routes across existing structures, vegetation, foreshores, inter-tidal and riverbed areas, installation, maintenance, operational and removal considerations, reinstatement of vegetation (where required) and cost.

5.5.3 Beach nourishment

Another potential beneficial reuse option for a portion of the possible 1,045,000 cubic metres of sand, could be beach nourishment of nearby eroded coastal areas. Periods of severe erosion (particularly during major storms) have resulted in significant sediment losses from the sub-aerial (onshore) and near shore beach profile along some of the regions beaches, particularly at Stockton Beach.

The placement of dredged material with suitable physical characteristics (such as matching or complementing those of the existing beach sand) would be a beneficial reuse of the material, introducing a significant volume of sand into the sub aerial and near-shore beach profile.

Due to economic constraints on the maximum pumping distance for dredged material, Stockton Beach represents the only feasible location for beach nourishment. A brief engineering analysis was previously undertaken by the GHD engineering team to ascertain whether the Stockton Beach option was feasible. In addition Newcastle City Council (NCC) recently completed a scoping study (WP 2012) and has commissioned a number of previous studies which included investigation of beach nourishment as a potential management option in the draft Stockton Beach Coastal Zone Management Study (DHI 2009). A summary of the findings of these investigations are provided below.

Placement proposal

The area requiring nourishment has been generally identified as the southern portion of Stockton beach, from the northern harbour breakwater to the northern end of the sewage treatment ponds. A buffer distance of 100 metres would need to be provided to ensure a safe operational distance between the dredging plant and the northern breakwater.

The relative benefits of a number of potential nourishment options have been previously investigated and are listed below (DHI, 2009):

- Artificial beach nourishment requiring placement of 410,000 cubic metres initially and additional nourishment of 60,000 cubic metres every 2 years.

- Seawall with artificial beach nourishment requiring placement of 410,000 cubic metres initially and additional nourishment of 60,000 cubic metres every 2 years.
- Offshore breakwaters with artificial beach nourishment requiring placement of 438,000 cubic metres initially and minimal ongoing nourishment.
- Artificial headland with artificial beach nourishment requiring placement of 515,000 cubic metres initially and minimal ongoing nourishment.
- Multi-Functional Artificial Reef (MFAR) requiring placement of 450,000 cubic metres initially and minimal ongoing nourishment.

Material suitability

Ideally, the material used for beach nourishment would need to be compatible with the native beach material. In particular, it should have a similar:

- Size (or slightly coarser) and grading.
- Composition (quartz and shell content).
- Angularity (angular or well rounded).
- Colour.

A 1978 Department of Public Works feasibility study for renourishing Stockton Beach identified a median grain size at Stockton of approximately 0.26 millimetre diameter, grading to 0.7 millimetre approximately 10 kilometres north. The report concluded that the median grain size for nourishment sand for Stockton Beach should range between 0.3 millimetre and 0.5 millimetre; such as a medium to coarse grained sand. Although the profile of Stockton Beach has altered significantly through loss of material since 1978, subsequent investigations have typically identified a mean grain size of approximately 0.25 millimetre diameter.

Vibrocoring investigations within the proposed dredge areas have recently been undertaken by GHD to confirm the material types, layer depths and approximate volumes of materials to be dredged from the proposed berth pockets. Analyses indicate the sands generally have a median grain size of approximately 0.33 millimetres.

Consequently, it is expected that the medium to coarse-grained sand that would be made available as a result of the Project would be suitable for addition to the sub aerial and near-shore profile.

Dredging / Placement Procedures

The beach nourishment option would involve completion of the following key activities:

- Dredging of clean sand utilising a trailing suction hopper dredge or cutter suction dredge.
- Transfer of sand from the site via trailing suction hopper dredge, or discharge pipeline to the Stockton Beach near-shore area.

- Placement of the sand within the sub aerial and near-shore areas potentially using a variety of methods:
    - bottom dumping sand in the near shore area
    - bow casting (such as pumping/'spraying') sand off the bow of the vessel into the shallower 'surf zone'
    - pumping sand via constructed pipeline directly to the sub aerial beach profile, and spreading of the material using suitable land-based plant.

Electronic position fixing systems enable accurate positioning of the vessel during dredging and discharge activities. The volumetric model developed for the Project has identified locations (extent and depth) of suitable types of sand to be dredged and beneficially utilised along Stockton Beach.

As noted above, within the placement area the vessel would discharge its load of sand by bottom dumping, pumping ashore or bow casting. Detailed design for the Project would likely involve all three methods to ensure total nourishment of the full beach profile is achieved.

The trailing suction hopper dredge and/or barges selected would need to be ocean going, incorporate a reasonable sized hopper with bottom disposal capability and an accurate navigational system. It would be advantageous if they incorporate self-propulsion, a shallow draft and good manoeuvrability (with forward and aft thrusters).

Alternatively, a medium to large cutter suction dredge could be used to remove the sands, which could be pumped through a series of floating, submerged and overland pipelines for discharge onto Stockton Beach. The discharge outlet would be reworked by an onshore crew using land based plant and equipment such as bulldozers and front-end loaders. The onshore outlet could be moved by extending sections of pipeline.

Beach Nourishment Summary

Should Stockton Beach require nourishment at the time of dredging clean sands from the proposed berths, the reuse of a portion of the dredged materials for renourishment of Stockton Beach would appear to be feasible.

However, it should be reiterated that the reuse of dredged material for nourishment of Stockton Beach is subject to securing the required approvals and completion of the associated investigations prior to any nourishment work commencing.

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