Appendix E3

Contamination - Dredging and disposal area

Australian Industrial Energy

Port Kembla Gas Terminal

Sediment Contamination Assessment Report

November 2018

Executive summary

Australian Industrial Energy (AIE) proposes to develop the Port Kembla Gas Terminal (the project) in Port Kembla, New South Wales (NSW). The project involves the development of a liquefied natural gas (LNG) import terminal including a Floating Storage and Regasification Unit (FSRU) moored at Berth 101 in the Inner Harbour, visiting LNG carriers, wharf offloading facilities and the installation of new pipeline to connect to the existing gas transmission network.

The development of the facility would require dredging and excavation of the sediments off Berth 101 in order to accommodate the FRSU and visiting LNG carriers. The material removed during dredging off Berth 101, would be disposed of on the south side of the Outer Harbour in a designated reclamation area. This report provides the results of the contamination assessment of the sediments from the proposed dredging area and the sediments in the proposed Outer Harbour reclamation area.

The objectives of the assessment were to:

- Assess the likely contamination based on previous marine sediment investigations.
- Assess the sediments and contamination of the proposed dredging area off Berth 101.
- Assess the sediments and contamination of the sediments likely to be removed for construction of the bund around the proposed disposal area.
- Assess the potential presence of Acid Sulphate Soils (ASS)

Background information

Port Kembla was developed in the late 1800's to service the coal industry in the Illawarra region, and has since serviced a variety of industries. Since that time several capital dredging campaigns have been undertaken to facilitate the development of shipping berths such as Berth 103, 105 and 107. Maintenance dredging activities are undertaken less frequently, with the last port wide maintenance dredging campaign carried out in 1986. Management of declared depths is primarily managed through annual sweep dredging (i.e. bed levelling using a sweep bar). These operations result in repeated mobilisation of sediments from within the channel and berth areas.

The site, for investigation of marine sediment contamination, consists of two investigation areas. One comprising the waters off Berth 101 and another area in the Outer Harbour, where the dredge sediment will be disposed of as part of harbour reclamation works.

Several investigations have previously been undertaken to assess the contamination of the marine sediments in Port Kembla Harbour. Based on the information obtained during the background information review, the following points are noted:

- Commonly two main sedimentary units were identified with a soft silty clay layer overlying a stiffer clay layer.
- The upper soft silty clays were contaminated throughout all sampling areas.
- Heavy metals commonly exceeded the screening levels for cadmium, chromium, copper, lead, nickel, mercury and zinc.
- Tributyltin (TBT), dioxins and polycyclic aromatic hydrocarbons (PAHs) were reported above the nominated guidelines in several studies

Sampling approach

Fresh sampling for the project was completed in October 2018 and included seven sampling locations within the dredge footprint off Berth 101 and two locations at the reclamation area including vibracoring (five locations) and hand coring (four locations). As a result of weather conditions, the sampling approach was revised for the second day of sampling as vibracoring was not considered a safe option due to heavy rain conditions.

Sampling locations were selected at random from a grid of the area for the area of Berth 101 and to target the outer edge of the reclamation area.

Key findings

Two main sedimentary units were identified in the dredge footprint at Berth 101 comprising a soft silty clay layer overlying a stiffer clay layer. Sediments encountered at the disposal area were stratigraphcially different to Berth 101, predominantly comprising black-brown clayey silt.

The sediment sampling program was limited owing to weather conditions and the need to revise the sampling approach during the course of the works. Whilst the depth of sampling was limited to approximately 0.7 metres for some locations, no obvious vertical trend in contaminant concentration with depth was noted in sediment cores collected from the dredge footprint at Berth 101 where shallow (0-0.5) and underlying samples were analysed.

Elevated metal concentrations were reported above the nominated screening levels in the dredge footprint at both Berth 101 and the disposal area. Other contaminants of potential concern, including PAH, TBT and hydrocarbons reported 95% UCL average concentrations below the nominated screening levels in the dredge area at Berth 101.

With the exception of one sampling location at the disposal area (REA01-1-1.5), concentrations of heavy metals were generally consistent between the Berth 101 dredging area and disposal area. Some metals, notably lead, mercury and zinc, were an order of magnitude higher in sample REA01_1-1.5 than other samples. With the exception of one sample (REA01_1-1.5), concentrations of PAH, TBT and TPH in the disposal area were largely consistent with data reported for the dredge area. Statistical evaluation of the dataset from the disposal area was not considered valid based on the variability of material encountered and number of sampling locations and as such individual results were reviewed with reference to the screening criteria. Concentrations of PAH and TPH in sample REA01-1.1.5 exceeded the NAGD (2009) screening levels.

Dioxin levels were largely consistent across the two sampling areas with the sediments from the Berth 101 dredge footprint and disposal area reporting WHO $TEQ_{(0.5\ LOR)}$ of 9.4 ppt and 12.2 ppt respectively. Whilst Australian guidelines for dioxins are not currently available, these levels are within the range of background concentrations reported for Australian sediments (Muller et al., 2004) and consistent with the mean WHO $TEQ_{(0.5\ LOR)}$ reported by Worley Parsons (2012) of 15.4 ppt.

Analytical results were generally consistent with those reported previously by others including AECOM (2010) and Worley Parsons (2012). No new contaminants of potential concern were identified at levels exceeding screening criteria during the current investigation. Elutriate testing was not completed during the current investigation. However, based on the comparison of data with previous sampling events, the results of elutriate testing reported by AECOM (2010), Worley Parsons (2012) and Geochemical Assessments (2013) are considered relevant to these works and likely indicative of current conditions.

Consistent with the findings of previous investigations including AECOM (2010), Worley Parsons (2012) and Geochemical Assessments (2013), the results indicate the presence of PASS and potential acid generating capacity of the sediments.

Conclusions

Overall, the findings of the investigation indicate the presence of contaminated sediments within the proposed dredging and disposal areas. Concentrations of contaminants of concern were largely consistent across the two areas, with concentrations of heavy metals exceeding the screening criteria in both the Berth 101 dredge area and disposal area. PAH and hydrocarbons were reported above the screening criteria in one sediment sample collected from the disposal area.

With reference to potential impacts on the project, the following points are noted:

- The project will involve dredging of sediments from Berth 101 and emplacement within the disposal area. Contaminated sediments will be placed within the perimeter bund of the disposal area and capped with clean sediments. Details for the management of this process will be documented in the dredge management plan.
- There is the potential for mobilisation of contaminants, notably heavy metals, into the water column during dredging activities. Based on review of the information obtained during this investigation, and the findings of previous investigations, the following points are noted:
  - Elutriate testing completed by Worley Parsons (2012) indicates that whilst concentrations of heavy metals may have been reported above the screening levels in sediments, concentrations of dissolved metals in elutriate waters were below the ANZECC trigger levels for 95% protection of species.
  - Bioavailability testing indicates that some heavy metals, notably cadmium, chromium copper, lead and zinc, have the potential to be bioavailable to marine organisms within the sediments.
  - The potential bioavailability of contaminants, including detailed review of existing available data, will be considered during development of the dredge management strategy and in the implementation of the dredge management plan.
- Contaminated sediments will be placed within the perimeter bund of the disposal area and capped with clean sediments. Details for the management of this process will be documented in the dredge management plan.
- Dredging activities will result in the suspension of sediments, potentially remobilising contamination into the water column. Mitigation measures to minimise impacts to receiving waters may include the use of a turbidity curtain to restrict the generation of turbidity plumes and localise any water quality issues. Details of these mitigation measures, including the approach for surface water monitoring, will be outlined in the dredge management plan.
- The results of the sediment sampling program indicate PASS conditions are present within the dredge footprint. An Acid Sulphate Soil Management Plan (ASSMP) will be prepared in line with the requirements of the *Acid Sulphate Soils Management Advisory Committee Guidelines* (ASSMAC, August 1998 and as updated). The ASSMP will be prepared to identify, manage and treat the PASS encountered during dredging to minimise the production of acid leachate. The dredging strategy will be designed to limit the timeframe for potential for oxidisation of the sediments. The potential for ASS generation would reduce greatly due to sediments being transferred to the disposal area immediately after dredging, limiting time for oxidation.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.5 and the assumptions and qualifications contained throughout the Report.

List of Acronyms

Abbreviation	Description
AIE	Australian Industrial Energy
ANZECC/ARMCANZ	Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand
ASS	Acid sulphate soils
ASSMAC	Acid Sulfate Soils Management Advisory Committee
AVS/SEM	Acid volatile sulfide/simultaneously extracted metals
BTEX	benzene, toluene, ethylbenzene and xylene
CCME	Canadian Council of Ministers of the Environment
COC	Chain of custody
CRS	Chromium reducible sulphur
DECC	Department of Environment Climate Change
DEMP	Dredging Environmental Management Plan
ECGP	East Coast Gas Project
FSRU	Floating Storage and Regasification Unit
LNG	Liquified natural gas
LOR	Limit of reporting
NAGD	National Assessment Guidelines for Dredging (2009)
NEPC	National Environment Protection Council
NODGDM	National Ocean Disposal Guidelines for Dredged Material (EA 2002)
OCP	Organochlorine pesticides
PAH	Polycyclic aromatic hydrocarbons
PASS	Potenital acid sulphate soils
PCB	Polychlorinated biphenol
PID	Photo-ionization detector
PSD	Particle size distribution
RAP	Remedial action plan
SOP	Standard operating procedure
SPOCAS	Suspension peroxide oxidation combined acidity and sulphur
TBT	Tributyltin
TCLP	Toxic characteristic leaching procedure
TEQ	Toxic equivalent quantity
TOC	Total organic carbon
TRH	Total recoverable hydrocarbons
UCL	Upper confidence limit
USCS	Unified Soil Classification System

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1. Introduction

1.1 Background

Australian Industrial Energy (AIE) proposes to develop the Port Kembla Gas Terminal (the project) in Port Kembla, New South Wales (NSW). The project involves the development of a liquified natural gas (LNG) import terminal including a Floating Storage and Regasification Unit (FSRU) moored at Berth 101 in the Inner Harbour, visiting LNG carriers, wharf handling facilities and the installation of a new pipeline to connect to the existing gas transmission network.

The development of the facility would require dredging and excavation of the sediments off Berth 101 in order to accommodate the FSRU and visiting LNG carriers. The proposed dredging area is presented in Appendix A, Figure 1.

The material removed during dredging off Berth 101, would be disposed of on the south side of the Outer Habout in a designated reclamation area (Appendix A, Figure 2).

This report provides the results of the contamination assessment of the sediments from the proposed dredging area and the sediments in the proposed Outer Harbour reclamation area.

The sediment investigation was undertaken in conjunction with the contaminated land assessment for Berth 101. The findings of the contamination assessment are reported in GHD (2018) *Australian Industrial Energy, East Coast Gas Project, Contamination Assessment Report*, October 2018

1.2 Objectives

The objectives of the assessment were to:

- Assess the likely contamination based on previous marine sediment investigations.
- Assess the sediments and contamination of the proposed dredging area off Berth 101.
- Assess the sediments and contamination of the sediments likely to be removed for construction of the bund around the proposed disposal area.
- Assess the potential presence of Acid Sulphate Soils (ASS)

1.3 Scope of work

The work carried out by GHD to meet the above objectives included:

- A review of previous contamination assessments of the marine sediments of Port Kembla Harbour.
- A marine sediment investigation comprising:
  - Three vibracores in the waters off Berth 101 to between 2.65 m and 4.4 m.
  - Two vibracores in the proposed disposal area in the Outer Harbour to 3.45 m and 3.6 m.
  - Four hand cores in the waters off Berth 101
  - Logging of sediment units in all cores
- Laboratory analysis of:
  - 17 samples from the cores for: contaminants of potential concern including heavy metals, dioxins, cyanide, ammonia, total recoverable hydrocarbons (TRH), benzene, toluene, ethyl benzene and total xylene (BTEX), polycyclic aromatic hydrocarbons (PAH),

tributyl tin (TBT) and physical properties including total organic carbon(TOC), moisture content and particle size distribution (PSD).

– 28 samples for screening for potential acid sulphate soils

– 12 samples for chromium reducible sulphur suite

- Quality control sampling including duplicate and triplicate sediment samples, trip blanks, trip spikes and rinsate samples from sampling equipment.
- Preparation of this report summarising previous knowledge of the sediments of Port Kembla Harbour, presenting and interpreting analytical results and findings, comparing chemical concentrations to applicable guidelines, and making recommendations with respect to the objectives outlined in Section 1.2. The contamination aspects of the report were prepared with reference to NSW EPA approved guidelines.

1.4 Basis for assessment

As outlined in Section 1.2, the works were completed to assess the contamination status of sediments within the proposed dredge footprint to inform options evaluation for the management of contaminated sediments during the proposed works. GHD understands dredge materials are proposed to be relocated to the reclamation area in the outer harbour.

The assessment criteria for sediment contamination proposed for this project were sourced from available guidelines including:

- National Assessment Guidelines for Dredging (NAGD 2009).
- ANZECC/ ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality (as recommended in the NAGD (2009)).

The results for acid sulphate soils were compared to

- QLD (2014) Acid Sulfate Soils Technical Manual – Soil management Guidelines V4.0 based on greater than 1,000 tonnes of fine texture soils to be disturbed. Which is based on the guidelines of the Acid Sulphate Soils Management Advisory Committee (ASSMAC 1998).

The assessment criteria are referenced in the analytical results tables which are presented in Appendix B.

1.5 Limitations

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

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

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

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

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

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

Limited information is available on the early history of the site and therefore, some site activities may not have been identified. In addition, aerial photographs are up to 13 years apart and other site history information available prior to 1950 is limited. We cannot preclude that potentially contaminating activities took place during these periods. Allowances for uncertainties and potential unexpected finds should be made during planning and development phases.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

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

In preparing this report, current guidelines for assessment and management of contaminated land were followed. This work has been conducted in good faith in accordance with GHD understanding of the client's brief and general accepted practice for environmental consulting.

This report was prepared for Australian Industrial Energy based on the objectives and scope of work list in Sections 1.2 and 1.4. No warranty, expressed or implied, is made as to the information and professional advice included in this report. Anyone using this document does so at their own risk and should satisfy themselves concerning its applicability and, where necessary, should seek expert advice in relation to the particular situation.

2. Site setting

2.1 Overview

Details of the wider site and the proposed development can be found in sections 3.1, 3.2, and 3.3 of the contamination report (GHD, 2018).

2.2 The site

Port Kembla was developed in the late 1800's to service the coal industry in the Illawarra region, and has since serviced a variety of industries. Since that time several capital dredging campaigns have been undertaken to facilitate the development of shipping berths such as Berth 103, 105 and 107. Maintenance dredging activities are undertaken less frequently, with the last port wide maintenance dredging campaign carried out in 1986. Management of declared depths is primarily managed through annual sweep dredging (i.e. bed levelling using a sweep bar). These operations result in repeated mobilisation of sediments from within the channel and berth areas.

The site, for investigation of marine sediment contamination, consists of two investigation areas. One comprising the waters off Berth 101 and another area in the Outer Harbour, where the dredge sediment will be disposed of as part of harbour reclamation works.

The wharf of Berth 101 (Photograph 1) extends into the water and is supported by timber piles. Revetments consisting of angular boulders protect the shoreline to the south of Berth 101, comprising half of the length of the study area. The water off Berth 101 is a high traffic area for cargo ships accessing the eastern and western basins of the inner harbour. The water off Berth 101 was turbid with a high suspended sediment load, water based dust suppression systems were observed on Berth 101 and a coal/coke stockpile was located at the northern end of Berth 101, these are assumed to be contributing runoff to the marine area.

The reclamation area encompasses a portion of the waters of the outer harbour, and has a wharf at its eastern end (Photograph 2) approximately 150 m from the outer harbour wall. The wharf is armoured on its western side with angular boulders, and the remainder of the shoreline on the southern side is comprised of a sand beach at water level (Photograph 3).The area is low traffic for shipping with smaller vessels using the wharf. Water of the reclamation area was of lower turbidity, with a reduced suspended sediment load.

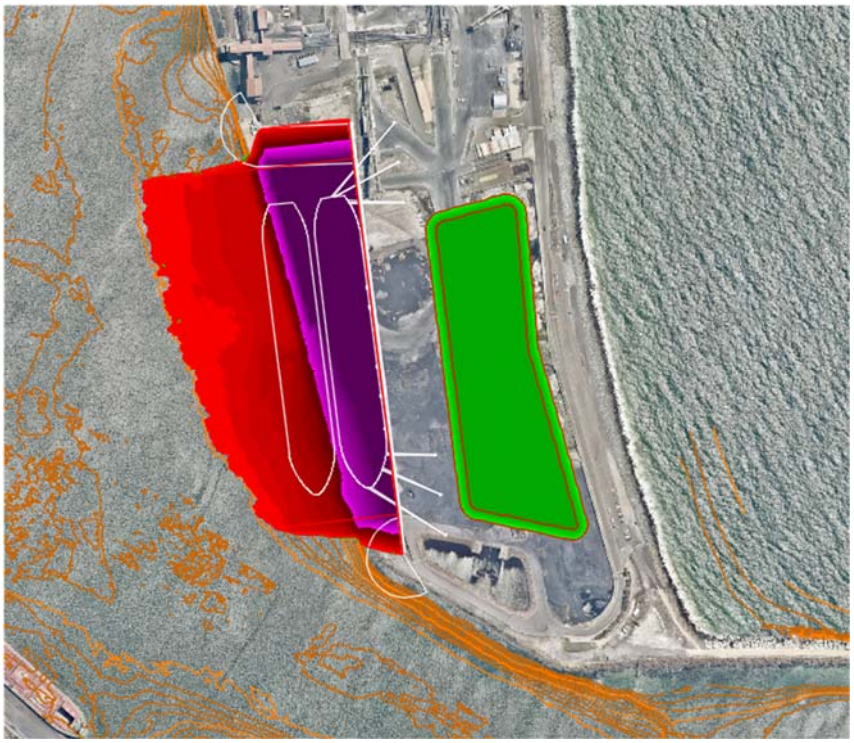

Figure A – Excavation of Berth 101

Purple area is the current Berth and the red is the proposed dredging area. Green is the proposed stockpiling area.

Figure B – Proposed disposal area

The blue-green area southeast of the Berth is the proposed disposal area.

Photograph 1 Panorama of sampling area of shore of Berth 101, looking east to Berth 101 (03/10/2018)

Photograph 2 Wharf at east end of reclamation area (03/10/2018)

Photograph 3 South side of reclamation area (03/10/2018)

3. Existing information

Information relating to the history of the wider Port Kembla site can be found in Section 4 of the contamination assessment in Appendix E1 (GHD, 2018). In relation to contamination of the marine sediments Worley Parsons (2012) identified a number of previous land based activities that would have likely contributed to the possible contamination of marine sediments including:

- Industrial discharges associated with licensed activities
- Spill events within the harbour
- Overflows from Port Kembla Sewage Treatment Plant during storms
- Catchment road and industrial runoff
- Particulate matter, e.g. coal dust, through atmospheric deposition
- Redistribution of previously contaminated sediments through tug manoeuvring, passage of deep draft vessels and currents action , e.g. during floods
- Leaching from reclaimed and waste filled areas of the harbour foreshores
- Antifoulant coatings leaching and flaking, e.g. TBT

3.1 Previous sediment investigations

Several investigations have been undertaken previously to assess the contamination of the marine sediments in Port Kembla Harbour. These investigations are summarised below including the samples taken, the exceedances/non-exceedances reported and the recommendations and conclusions made.

3.1.1 Coffey Geotechnics/ Douglas Partners (2002/2003) Sediment Quality Investigation

Location Port Kembla Harbour

Scope / objectives To determine the toxicological and physical characteristics of sediments within the dredging footprint and assess the suitability for offshore disposal

Sampling Sampling consisted of 74 sediment cores to a maximum of 1 m depth. Samples were taken from the Inner Harbour, Outer Harbour and 'The Cut' with three of the samples from close to Berth 101.

Chemical testing was conducted on 39 cores and physical properties testing on 34. Chemical testing consisted of analysis for metals, PAH, TBT, nutrients, cyanide, TRH and potential acid sulphate soils. Physical properties testing included particle size analysis, percentage shell/grit and geotechnical parameters.

A second stage of testing consisted of elutriate, acid volatile sulfide / simultaneously extracted metals (AVS/SEM), and pore water testing and selection of samples for analysis for dioxin/furan and toxic characteristic leaching procedure (TCLP).

Relevant findings

The following findings were made regarding sediment contamination:

- Phenolics, OCPs (Organochlroine pesticides), PCBs (Polychlorinated Biphenol) and BTEX were below the limit of reporting (LOR)
- Cyanide was either below the LOR or <10 mg/kg
- Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Mercury (Hg), Silver (Ag), total normalised PAHs and normalised TBT exceeded the National Ocean Disposal Guidleines for Dredged Material (EA 2002) (NODGDM) screening levels
- Zinc (Zn) and Napthalene exceeded the NODGDM maximum level.
- Dioxins were present in all four samples analysed
- Nitrogen and Phosphorus as (PO_4) were present
- No potential acid sulphate soil was observed.

AVS/SEM results showed that metals were potentially bioavailable in six of seven samples and porewater testing complied with guideline criteria except for all analytes except copper. The results of elutriate testing complied with ARMCANZ (2000) Cr and Zn, 25 times the dilution required.

In general sediments are well mixed with hotspots in the north west corner, Allan's Creek inflow and north end of 'the Cut'. Physical testing of sediment showed predominantly silty-clay sediments ranging from sandy-silts to silty-sandy-clay with sands and fine gravels in the Outer Harbour. Settling tests showed the majority of suspended sediment settles within 2 hours, implying limited dispersion during dredging and dumping.

Conclusions and recommendations

It was concluded that while the NODGM maximum was exceeded for a number of contaminants, these contaminants would not be released during disposal, and the bioavailability was not established. The levels of dioxins were considered to be at high risk to certain aquatic species.

The report recommended that, if required acute toxicity testing should be conducted for priority PAH, tributyltin, pesticides and PCBs. If the sediment was found to be toxic, then treatment or confined disposal was recommended to be investigated. If the sediments were at or below the 95% upper confidence limit (UCL) of the mean of the disposal site, they would be considered non-toxic and be acceptable for ocean disposal.

3.1.2 Patterson, Britton and Partners (2003) Sediment Quality Investigations After summary in (WorleyParsons 2012)

Location	Port Kembla – Inner Harbour
Scope / objectives	Determination of heavy metal concentrations in sediments and subsequent toxicity and tributyltin analyses.
Sampling	Ten locations sampled for heavy metal concentrations, from the results of these four samples were submitted for toxicity testing and tributyltin analyses.

Relevant findings

The contamination assessment showed that Cu, Cr, Hg, Pb, Zn and TBT were above guideline screening levels. Organic contaminants were generally low and PAH concentrations were all below the guideline upper level. In all sediments pesticides except methooxychlor were below analytical detection limits. PCBs were below guideline screening levels in all except one sample. The toxicity testing showed that sediments were toxic to juvenile amphipod in all four samples measured, and to benthic algae in three of the four samples measured.

Conclusions and recommendations

Patterson Britton and Partners (2003) concluded that the toxicity of Port Kembla sediments is caused by metal contaminants, in particular zinc. The levels of Dioxins, total petroleum hydrocarbons (TPHs), BTEX and cyanide reported by Coffey (2002) were interpreted as insufficiently high to be the cause of the observed toxicity. The sediment that was tested for toxicity were deemed not suitable for unconfined sea disposal in accordance with NODGDM.

3.1.3 SMEC (2011) Port Kembla Outer Harbour Reclamation - Phase 2 Factual and Interpretive Report (SMEC 2011)

Location	Port Kembla – Outer Harbour reclamation area
Scope / objectives	Geotechnical investigation in the outer harbour to support reclamation works
Sampling	Drilling of 26 over water boreholes for geotechnical purposes

Relevant findings

SMEC (2011) provided a summary of historical information relating to the outer harbour reclamation area. In summary the following points are noted:

- Planning for outer harbour reclamation commenced in early 1990's when larger port operations were almost exclusively performed in the inner harbour
- Following identification of the reclamation footprint, the area was subject to disposal of dredge spoil that could not be taken out to sea for unconfined sea disposal
- Dredge spoil was deposited in what had been identified as the footprint of future reclamation, resulting in an estimated minimum of 460,000 m^3 of dredged slag and spoil from the inner harbour being deposited in the outer harbour.
- In 2008, a major review of development options for the outer harbour was undertaken, resulting in the development of a new strategy for development of the outer harbour

SMEC (2011) provides a summary of dredge campaigns completed between 1994 and 2008 which resulted in the deposition of sediments within the outer harbour reclamation area, including approximately 45000 m^3 of uncrushed blast furnace rock slag which was deposited as part of the 2006 major inner harbour dredging and deposition campaign and used to construct a containment bund which was subsequently capped and backfilled with 165,000 m^3 of dredged clay materials from the inner harbour.

3.1.4 Patterson, Britton and Partners (2005) Sediment quality sampling for dredging and disposal after summary in (WorleyParsons 2012)

Location	Port Kembla – Eastern Basin No.3, Western Basin Multipurpose Berth No. 4
Scope / objectives	Assess sediment quality for dredging and disposal relating to the creation of Eastern Basin No.3 and Multipurpose Berth No.4 in the western basin
Sampling	Coring and sampling was undertaken to the full extent of dredging

Relevant findings

Two sediment units were identified, an overlying soft clay unit and an underlying unit of stiff clay. The overlying clay contained concentrations of Nickel (Ni), Cd, Cr, Cu, Pb, Hg, Zn, PAHs and TBT above the NODGDM screening levels, the concentrations of which generally increased with depth. Typical values for OCPs and PCBs were less than laboratory detection levels.

Patterson Britton (2005) reported that the underlying clay unit was uncontaminated.

Conclusions and recommendations

From the results of the contamination assessment completed by Patterson and Britton (2005), toxicity testing was not deemed necessary.

3.1.5 AECOM (2010) Sediment Investigation

Location	Port Kembla Outer Harbour
Scope / objectives	The report consists of a review of previous investigations, collection of samples from anoxic and oxidic sediment layer in the dredge footprints and the underwater emplacement area. The objective being to produce a risk assessment for human health and ecological risk of sediment and groundwater contamination including maps of the distribution of sediment contamination.
Sampling	Samples were collected from 33 locations in the container berth dredge area to maximum depth of 2m and from ten locations in the underwater emplacement area. Samples were also collected in two locations between the emplacement area and the multipurpose berth. Oxidic sediment was sampled in 30 locations, six of which were near the stormwater outlet and seven near the creek discharge into the harbour. Water samples were taken from the inner and outer harbour, three at high tide and three at low tide. Samples were also taken for elutriate testing.

Relevant findings

Sediments were considered to be typical of estuarine sediment consisting of silty clays with some sands with the below results:

- Heavy metals were reported in the majority of samples, with concentrations exceeding the nominated screening levels.
- TPH in the volatile fraction C_6-C_9 was reported at concentrations less than laboratory LOR for all 72 samples

- TPH in the fraction C_{10}-C_{36} was reported at concentrations greater than NSW EPA (1994) in 12 of 72.
- BTEX was reported at concentrations below laboratory LOR in all samples
- Total PAHs did not exceed ISQG high or SIL_4 (NEPC 1999). 47 samples exceeded the ISQG-low.
- Total cyanide was reported at concentrations greater than laboratory LOR in 1 of 13 samples
- TBT was reported at concentrations greater than ISQG-low in 15 of 91, 2 of 91 greater than the ISQG-high
- PCBs and OCPs were less than LOR in all 35 samples
- TOC ranged from 0.03% to 40.1%, mostly in the expected range for estuarine sediments (2-8%).
- Suspension peroxide combine acidity and sulphur (SPOCAS) assessment for acid sulphate soils – all above the ASSMAC (1998) action levels in the anoxic layer.

In elutriate tests of 51 samples Cu, vanadium (V), zinc and arsenic (As) exceeded the ANZECC (2000) in one or more samples. However, PAH and Phenols were all less than the laboratory LOR.

In six harbour water samples copper exceeded the ANZECC (2000) in one sample and cadmium in two. All other heavy metals and arsenic were below the ANZECC (2000) level in all samples. OCPS, Phenols and PCBS were not detected in any sample and total PAH was below the assessment criteria, cyanide was below the laboratory LOR. The harbour water was likely influenced by freshwater as seen in the low TDS values of 2 – 20 mg/L

Conclusions and recommendations

AECOM (2010) concluded that there was heavy metal contamination across the majority of the dredge footprint with the highest concentrations in the upper metre. PAH contamination was reported across the majority of the dredge footprint in shallow sediment with the highest concentrations in the emplacement area. TBT contamination was confined to the southern end of the container berth dredge area. SPOCAS analysis indicated PASS at 0 – 3.3 m.

Elutriate testing indicated the impact of As and Cu during dredging and reclamation could exceed the ANZECC (2000) 95% Marine trigger values. However, the high values coincide with ‘hot spot’ materials so are considered unlikely to have a significant impact on the receiving environment.

The report recommended the preparation of a Dredging Environmental Management Plan (DEMP) for sediments to be dredged and placed in the reclamation area with a Surface Water Management Plan in place until the reclamation area was paved. Mitigation measures would be outlined in the DEMP to be to be put in place during dredging to minimise impact on the receiving environment. It was also recommended that a harbour water quality and turbidity monitoring plan should be developed along with an acid sulphate soil management plan prior to dredging and reclamation. If the risk assessment determined that the contamination hotspots present an unacceptable risk a remedial action plan (RAP) should be prepared.

The sediments were considered likely to be able to be managed using typical dredging technologies and standard mitigation measures. It was recommended that a further sediment investigation should be conducted in the area north and south of the Gateway Berth and south of the northern breakwater, as further dredging would be required.

3.1.6 WorleyParsons (2012) Dredge Spoil Contamination Assessment – Stage 2 DSI

Location Berth 101, Port Kembla Harbour

Scope / objectives The objective of the study was to provide representative sediment quality data for the proposed dredge footprint. Specific objectives included the assessment of physical and chemical properties to inform the dredge methodology and to determine the suitability of untreated materials for reuse and/or disposal options through their physical and chemical properties. The report included assessment of the impacts from dissolved contaminants during dredging and disposal and recommending the testing requirements of cement stabilised material during a dredging and stabilisation trial.

Sampling 13 vibracore cores were collected and sampled.

All samples were analysed for suite of metals, PAHs and TOC. TBT analysis was conducted on 50% of samples and 10% of samples were analysed for dioxins /furans, PCBs, organochlorine and organophosphate pesticides, phenols, BTEX, cyanide, TPH/TRH and nutrients.

Relevant findings

The sediments were divided into upper soft silty clays and underlying stiff clays. The upper soft silty clays contained levels of Cd, Cu and Pb which exceeded the NAGD maximum levels.

Based on information reported by Worley Parsons (2012), results of sediments samples collected from the upper soft silty clays were summarised as follows:

- Phenolics, pesticides, and PCBs were reported below laboratory LOR
- Sb, Ag, and TPHs were below NAGD screening levels
- Total PAHs exceeded the NAGD screening levels in six of 50 samples. Median and 95% UCL of the means total PAH concentration were above NAGD, but below SQG-high value
- Low concentrations of BTEX were reported
- Individual concentrations of As above NAGD. 95% UCL of the mean, below the screening level.
- Most individual and 95% UCL of the mean were above NAGD screening level for Cd, Cr, Cu. Pb, Ni, Hg and in some samples Cd, Cu and Pb exceeded the NAGD maximum levels.
- Zn, majority of individual and the 95% UCL of the mean exceeded the NAGD max level.
- TBT levels above NAGD screening in four of 26 samples and above the SQG high value for three. Median and 95% UCL of the mean were above the NAGD screening level but below the SQG-high value.
- TOC generally less than 14% with exception of four samples.
- Toxic Equivalent Quantity$_{0.5LOR}$ (TEQ$_{0.5LOR}$) for all seven dioxin samples exceeded the Canadian Council of Ministers of the Environment (CCME 2001) ISQG. Six of the seven and the median TEQ $_{0.5LOR}$ exceeded the CCME (2001) PEL.

The underlying stiff clays reported levels of As, Cd and Ag below the laboratory LOR and all other contaminants were below the NAGD (2000) screening levels.

Samples were elutriate tested and for those analytes which exceeded the NAGD (2009) guidelines the concentration of dissolved metals was below the ANZECC/ARMCANZ (2000) at 95% level and 99% where available.

Testing for bioavailabilty showed that whilst total As, Ni, Hg exceeded NAGD (2009) guidelines, the bioavailable fractions were below the screening levels.

When testing for acid sulphate soils approximately 50% of the samples exceeded the action criteria in Stone et al. (1998).

Conclusions and recommendations

Based on the findings of the works, Worley Parsons (2012) concluded that the elevated concentrations of contaminants in upper soft silty clays are not vertically variable and that they were unsuitable for unconfined sea disposal due to concentrations of metals, TBT and dioxins.

The upper soft silty clays were also concluded to be acid generating and would require neutralisation. The upper soft silty clays were concluded to be suitable for classification as general solid waste for disposal at a licensed facility provided that the acid generating material was neutralised. Cement stabilisation was determined to be appropriate to minimise potential leaching of contaminants and neutralise acid generating capacity.

Consideration was also made for onsite reuse at an industrial land use area based on the results of TCLP extraction and analyses. Worley Parsons (2012) noted that if materials were reused in an industrial land use area, the soft silty clays would be treated or capped to limit exposure pathways. Mean dioxins were within the range for Australian soils and below the remediation range and TBT concentrations were below the conservative upper sediment limits and sediment leaching values for free-reuse land use criteria.

The report recommended that testing for leaching properties and net acid generating capacity be conducted prior to dredging, and that an assessment of ambient contaminant concentrations and pH in groundwater be conducted to assess for the potential of zinc and manganese to leach into untreated materials.

3.1.7 Geochemical Assessments (2013) Pilot sediment investigation for potential maintenance dredge areas

Location	Port Kembla Inner Harbour
Scope / objectives	The objective of this investigation by Geochemical Assessments (2013) was to identify any significant changes to contamination since 2002/2003 and to determine the spatial distribution of key contaminants
Sampling	Sampling from 27 locations within the Inner Harbour consisting of 23 surface sediment samples and four cores. The samples were analysed for: Ag, As, Cd, Cobalt (Co), Cr, Cu, Hg, Manganese (Mn), Ni, Pb, Antimony (Sb), Selenium (Se), V, Zn, TBT, PAHS, TPH, TOC, grainsize and acid sulphate soil. Elutriate and toxicity testing for selected contaminants of concern was also conducted

Relevant findings

The key exceedances in sediment were found:

- Cd, Cr, Cu, Hg, Pb, Zn, total PAHS and TBT which all exceeded the NAGD (2009) screening levels
- Cu, Pb, Hg, Zn and TBT exceeded the NAGD (2009) by more than two times.

- Ag, As, Ni, TPH below respective screening levels.
- Sb below LOR.

Of ten elutriate samples, four exceeded the ANZECC/ARMCANZ (2000) for Cu, two for Fluranthane, and one for Phenanthrene, Anthracene and Benzo(a)pyrene. However, Geochemical Assessments (2013) noted that the contaminants are expected to undergo a dilution factor of more than 100, so elutriate test values were not considered of concern.

In regards to bioavailability the concentrations of Cu, Pb, Zn and Cd exceeded NAGD (2009) screening levels in a number of samples. The 95% UCL of bioavailable concentration of trace metals suggested AVS/SEM, pore water and/or toxicity testing was required.

Conclusions and recommendations

Based on the findings of the works, Geochemical Assessments (2013) concluded that there was no area in the Inner Harbour where all COPCs are below the NAGD screening. The sediments in Port Kembla Harbour were classified as suitable for offshore disposal with regards to metals but additional testing would be required for TBT and PAH.

The report recommended that the harbour should be divided into dredge management units and that any sediments unsuitable for offshore disposal should be classified as Restricted Soils[1] Waste under NSW Waste Guidelines (DECC 2009). A recommendation was also made to conduct further sampling and analyses for TBT and PAH to the depth of proposed dredging.

3.2 Summary previous investigations

Based on the information obtained during the background information review, the following points are noted:

- Commonly two main sedimentary units were identified with a soft silty clay layer overlying a stiffer clay layer.
- The upper soft silty clays were contaminated throughout all sampling areas.
- Heavy metals commonly exceeded the screening levels for cadmium, chromium, copper, lead, nickel, mercury and zinc.
- Tributyltin, dioxins and PAHs were reported above the nominated guidelines in several studies
- A number of dredge campaigns have been completed since 1994 which have resulted in the deposition of sediments within the outer harbour reclamation area, including approximately 45000 m^3 of uncrushed blast furnace rock slag which was deposited as part of the 2006 major inner harbour dredging and deposition campaign

[1] The DECC (2009) Waste Classification Guidelines have since been superseded and the restricted waste classification is no longer relevant

4. Methodology

The sampling strategy for this work was developed with reference to the approach outlined in the NAGD (2009). GHD notes the current proposal is to dispose of sediments from the dredge footprint in the Outer Harbour.

4.1 Sediment sampling event

Fieldwork for sediment sampling was undertaken on 03/10/18 and 04/10/18. The investigation area incorporated two sampling areas. The first encompassing the waters off Berth 101 and the second the reclamation area in the outer harbour, to the south-east of Berth 101. These sampling areas are shown in Appendix A, Figure 1 and Figure 2, respectively.

Vibracoring on 3 October 2018 was undertaken under overcast conditions with occasional light rain and light winds.

As a result of weather conditions, the sampling approach was revised for the second day of sampling as vibracoring was not considered a safe option due to heavy rain conditions. Hand coring on 4 October 2018 was undertaken under overcast conditions with heavy rain and moderate winds.

Drilling and sediment sampling were conducted in accordance with GHDs standard operating procedures. Vibracoring and hand coring were conducted on 3 and 4 October 2018 by divers and drillers from McLennans Diving Service with drilling completed from a barge operated by Polaris Marine, accompanied on 3 October 2018 by an environmental scientist from GHD.

Table 1 – Summary of cores

Location	Area	Date of coring	Core length (m)	Core casing material	Coring method
SED01	Berth 101	04/10/18	0.67	Aluminium	Hand push-core
SED02	Berth 101	04/10/18	0.67	Aluminium	Hand push-core
SED03	Berth 101	04/10/18	0.67	Aluminium	Hand push-core
SED04	Berth 101	03/10/18	2.65	Steel	Vibracore
SED05	Berth 101	03/10/18	2.87	Steel	Vibracore
SED06	Berth 101	03/10/18	4.4	Steel	Vibracore
SED07	Berth 101	04/10/18	0.67	Aluminium	Hand push-core
REA01	Reclamation area	03/10/18	3.6	Steel	Vibracore
REA02	Reclamation area	03/10/18	3.45	Steel	Vibracore

4.2 Sediment sampling and core logging methodology

Sampling locations were selected at random from a grid of the area for the area of Berth 101 and to target the outer edge of the reclamation area.

SED04, SED05, SED06, REA01 and REA02 were sampled using a vibracore from a barge. Upon extraction, cores were sealed and made airtight for transport. Cores SED01, SED02, SED03 and SED07 were sampled by divers pushing an aluminium tube into the upper layers of sediment.

Cores were cut open at McLennans Diving Service facility and sampled by an environmental scientist from GHD.

As soon as cores were opened a phot-ionization detector (PID), fitted with a 10.6eV lamp and calibrated with isobutylene gas at a concentration of 100 ppm, was run along the length of the core as per GHD's standard operating procedure (SOP). The instruments calibration certificate is provided in Appendix E. PID readings are presented on the bore hole logs, however due to the time taken to cut open each core these results should be treated as evidence of deviation from background rather than true readings.

Sub sampling comprised:

- One subsample over a 0.1 m interval at 0.5 m increments along the entirety of the core e.g. 0.0 m to 0.1 m; 0.5 to 0.6 m.
- A bulk homogenised samples representing a 0.5 m interval at 0.5 m increments along the entirety of the core, e.g. 0 m to 0.5 m; 0.5 m to 1.0 m, as per the NAGD (2009).

Samples were collected in 250 ml glass sample jars and filled to the brim and sealed with Teflon lined caps to lower the potential for loss of volatile contaminants. Approximately 100 g of sample was collected for acid sulphate soil analysis and sealed in designated zip lock bags. Approximately 500 g of sediment was collected and sealed in designated zip lock bags for particle size distribution analysis. When sampling, sediment that had been in contact with the core casing was avoided. Samples were stored on ice immediately after being sampled.

The following samples were submitted to ALS (the primary laboratory) for analysis:

- From all cores over 1m two samples for chemical analysis and particle size distribution. One at 0.0 m to 0.5 m and one from either 1.0 m to 1.5 m or 2.0 m to 2.5 m.
- For cores under 1 m, a sample was submitted to represent 0.0 m to 0.5 m and one for the remainder of the depth of the core, e.g. 0.5 m to 0.65 m. the remainder of the samples were placed on hold with the primary laboratory.
- From all cores three samples were submitted to the primary laboratory for potential acid sulphate soil analysis.

Quality control samples were taken to represent 10% of the samples collected. Triplicate samples incorporating the sample, a field split and a field duplicate. The field duplicates were labelled FD01 to FD08 and the field splits FS01 to FS08. Samples FD01 to FD08 were sent to the secondary lab for analysis. Of the triplicates sampled a number were selected for analysis to represent 10% of the samples analysed, the remainder were placed on hold.

Rinsate samples were taken from the trowel used for sediment sampling, for confirmation of correct decontamination protocol. One rinsate sample was taken for each day of sediment sampling (two in total).

For each day of sampling a trip spike and trip blank was also analysed (two in total).
The test reports, chains of custody (COC), and sample receipts are provided in **Appendix E**.

4.3 Data evaluation

Analytical results were compared against the nominated guidelines as outlined in Section 1.4.

4.3.1 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)[2].

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)[3].

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

4.3.2 Calculation of 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.

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

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

5. Results

5.1 Subsurface conditions

5.1.1 Berth 101

Logs of the cores taken are presented in Appendix C and particle size distribution analysis is presented in Table B1, Appendix B. In the sediments off Berth 101 there were typically two types of sediment with some variation within the stratigraphy.

Upper silty clay

The upper parts of all cores were comprised of a unit of black-brown clayey silt mud ranging from very wet to saturated. This mud unit ranged from 0.2 to 0.7 m in depth. This mud gradationally overlies one or more units of silty clays categorised under the Unified Soil Classification System (USCS) as MH – CH some with traces of sand sized material. The upper silty clays were found in the entirety of cores SED01, SED02, SED03 and SED07 and to depths of 2.3 m to 4.45 m in SED04, SED05 and SED06.

Proportions of clay varied from 19 % to 26% and silt from 34% to 63%. Commonly the coarser material present in the cores was coal based material ranging from fine sand to coarse gravel in size with occasional larger coal waste fragments. Various units were described with indistinct boundaries defined by changes in firmness, water content and sand quantity. The proportions of sand varied from 8 % to 38% and only SED01_0.0-0.5 contained gravel above the LOR. The black colouring of the cores was attributed to the presence of coal and all cores had a hydrocarbon odour ranging from weak to strong.

Lower units

Cores SED04, SED05 and SED06 refused at bedrock. The bedrock was highly weathered orange-brown sandstone with softening of the rock at the boundary. In SED04 and SED05 this bedrock was overlain by a thin unit of clay, from 0.22 m to 0.35 m thick, that differed from the upper silty clay units, primarily in its firmness; being firm and containing fragments of the underlying weathered sandstone with no odour and staining as signs of contamination and no coal refuse found.

5.1.2 Disposal area

The two cores collected from the reclamation areas (REA01 and REA02) differed stratigraphically from those in Berth 101 and from one another. Both cores refused at an unidentified surface at a depth of approximately 3.5 m below the seabed.

The cores were predominantly black-brown clayey silt, although sand was measured at up to 80% of the grains. The majority of the sediments were classified as MH under the USCS.

A moderate hydrocarbon odour was noted throughout REA01. Sediments at REA02 varied from having no odour to a weak hydrocarbon odour. Anthropogenic inclusions were noted in sediments at REA01 including coal waste material, wood and concrete fragments interpreted as fill including a 10 cm layer of coarse coal waste.

REA02 featured two lower units that were distinct from the overlying units; the uppermost a sand unit with characteristics typical of a marine sand and the lowermost very stiff clay, both with no odour. The lowermost unit of REA01 has a poorly defined boundary to the overlying silty clay and consisted clayey sand, with well-rounded, cobble sized pieces of concrete.

5.2 Data validation

5.2.1 Laboratory analysis

Sediment samples were transported in ice cooled chests from the sampling location (McLennans Diving Services, Banksmeadow, NSW) to the primary laboratory, ALS Environmental, Smithfield, NSW, under chain of custody conditions. Inter laboratory duplicates were forwarded to Eurofins|MGT laboratory, Lane Cove, NSW. A copy of the chain of custody for all batches is attached (**Appendix E**).

The laboratories selected to carry out analyses are NATA accredited for the analyses performed. Test methods are listed on the attached laboratory reports (Appendix E)

5.2.2 Field and laboratory quality control assessment

In order to validate the accuracy and validity of soil sampling results, a range of field and laboratory quality control (QC) samples were collected and assessed during the investigation.

- Field duplicates (Appendix B, Table B5): Within the two duplicates analysed, an RPD of 137% was recorded for Chromium Reducible Sulphur, exceeding the adopted limit (i.e. <30% for inorganics, <50% for organics or no limit if the result is less than 10 times the limit of reporting). Chromium, vcopper, lead nickel and zinc all exceeded the criteria of <30% in one duplicate. This result is likely reflective of the heterogeneity of the deposits, which is common in fill so the variability is not likely to affect the conclusions of this report.
- Interlab duplicate (Appendix B, Table B5): No exceedances of the adopted RPD limits were recorded for the interlab duplicate.
- The results of the rinsate samples (RN01_1 and RN02) showed the rinsates were below the laboratory limit of reporting for all analytes, thus validating the efficacy of the decontamination protocol.
- Laboratory control spikes: All recoveries were within the laboratory control limits.
- Matrix spikes: Cyanide recorded a recovery of 60% for report 621469 and TBT a recovery of 53.7 % for report ES1829588, outside the lower control limit of 70%. Laboratory blanks were all below the limit of reporting.
- No holding time exceedances were reported.
- Trip blank and trip spike results were within adopted control limits.
- QC sample outliers exist for Phenols and TRH semi-volatiles in water matrix. These correspond to rinsate samples, the results of which are all below the LOR.
- PID calibration passed and was within manufacturer's specifications. A copy of calibration certificates are presented in Appendix D.
- Laboratory duplicates are all within accepted limits.
- Insufficient sample was available for dioxins analysis for REA02_2.0-2.5, therefore REA02_2.0-2.1 was analysed for dioxins.

GHD considers that the laboratory QC results are representative of the soil conditions encountered at the locations sampled and therefore acceptable for the purposes of interpreting and verifying the analytical results of this assessment.

5.3 Analytical results summary

The laboratory analytical results for marine sediment are summarised in Appendix B. Original laboratory reports are included in Appendix E. Exceedances of the nominated screening levels were identified and are highlighted in Table B2, Table B3 and Table B4 (Appendix B).

The results of the sediment sampling program for the dredging area and disposal area are presented in Sections 5.1.1 and 5.3.2. Acid sulfate soil results are reported in Section 5.3.3.

5.3.1 Dredge footprint - Berth 101 sediments

Seven sampling locations were completed within the dredge footprint off Berth 101. Analytical data was reviewed with reference to the screening levels (ISQG trigger value) presented in Table B2 (Appendix B) of the NAGD (2009) and the ANZECC (2000) ISQG. As outlined in the NAGD, the 95% UCL was used to determine compliance with the screening levels.

As outlined in Section 4.3.1, organic compounds were normalised to 1% TOC as per the NAGD (2009). For the purpose of comparing organic data against the relevant screening levels, the 95% UCL of the normalised data set was applied.

Heavy metals in sediments

Concentrations of metals in sediments in the proposed dredging footprint at Berth 101 were generally consistent across the proposed dredging area, with no obvious hotspots of heavy metal contamination identified.

The depth of sampling for four of the seven locations was limited due to weather conditions and the need to switch from vibracoring to hand cores. Hand core locations were limited to a depth of approximately 0.7 metres. Of the three vibracore locations (SED04 to SED06), no obvious trend in heavy metal concentrations with depth was noted.

The 95% UCL average heavy metal concentrations in sediment samples from the proposed dredging area at Berth 101 were reviewed with reference to the screening levels (ISQG trigger value) presented in Table B2 (Appendix B) of the NAGD (2009). Analytical results are reported in Table B2 (Appendix B) and summarised in Table 2.

95% UCL average concentrations of chromium (Cr), copper (Cu), lead (Pb), mercury (Hg) and nickel (Ni) were reported above the NAGD (2009) screening level (SQG low). The 95% UCL average concentrations of zinc (Zn) was above the SQG high values presented in Table 4 of NAGD (2009).

In general, heavy metals results were generally consistent with those reported by Worley Parsons (2012) during the sediment sampling program adjacent to Berth 101.

Table 2 – Summary analytcial results – Metal concentrations at Berth 101

Heavy metal	SQG $_{Low}$	SQG $_{HIGH}$	Minimum (mg/kg)	Maximum (mg/kg)	95% UCL [(a)] (mg/kg)
As	20	70	9	21	18.82 (3.49)
Cd	1.5	10	ND	2	1.26 (0.61)
Cr	80	370	79	104	**94.86 (9.24)**
Cu	65	270	67	338	**258.9 (73.48)**
Pb	50	220	145	236	**196.72 (25.57)**
Hg	0.15	1	0.2	0.6	**0.46 (0.13)**
Ni	21	52	18	24	**21.5 (2.25)**
Zn	200	410	671	1120	**887.8 (154.04)**
NOTES					

Heavy metal	SQG Low	SQG HIGH	Minimum (mg/kg)	Maximum (mg/kg)	95% UCL [a] (mg/kg)
(a)	95% UCL calculated using ProUCL (Standard Deviation). 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				

Elutriate testing is used to assess the potential effects of dissolved contaminants in the water column during dredging and disposal. Bioavailability testing provides an indication of the amount of a contaminant which may be available for update by biological organisms, particularly benthic or sediment ingesting organisms following disposal of the sediments.

Elutriate testing and bioavailability testing was beyond the scope of the current investigation. However, as outlined in Section 3, elutriate testing has been completed within the Port Kembla harbour by others during previous sediment investigations including:

- Coffey (2003), completed a program of elutriate testing for metals, PAH and TBT and bioavailability testing for metals. The results of bioavaiability testing indicated metals were potentially bioavailable and porewater analyses indicated copper was bioavailable.
- The results of Worley Parsons (2012) are summarised as follows:
  - Concentrations of TPH, PAH and TBT below the limit of reporting in elutriate samples, indicating these compounds are not readily mobilized into the water column following disturbance.
  - In all instances where metals were reported in sediments at concentrations above the NAGD (2009) screening levels (such as cadmium, chromium, copper, lead, nickel, zinc and mercury), concentrations in the elutriate sample were below the ANZECC trigger levels for both the 95% and 99% species protection levels.
  - Some heavy metals, including iron, manganese and arsenic were reported in elutriate samples at concentrations above the ANZECC 95% trigger level however the concentration of these parameters in sediments were either below the NAGD (2009) screening level or sediment data was not available.
  - The bioavailable fraction of some heavy meals, including cadmium, chromium, copper, lead and zinc were above the NAGD (2009) screening levels
- AECOM (2010) and Geochemical Assessments (2013) reported concentrations of some heavy metals, including copper, zinc and arsenic, at concentrations which exceeded the ANZECC (2000) screening levels.

Noting that the results of the sediment sampling completed during the current investigation are largely consistent with those reported during previous investigations, the findings of the elutriate testing completed during those works are likely representative of the current data set.

Concentrations of TRH and BTEX

Concentrations of volatile TRH in the fraction C_6-C_{10} and BTEX were reported below the LOR in all samples selected for analysis.

All samples reported detections of TRH in the fraction C_{16}-C_{34}, with concentrations ranging from 200 mg/kg to 900 mg/kg. With the exception of one sample (SED03_0-0.5), all samples reported detections of TRH in the fraction C_{34}-C_{40}, with concentrations ranging from 140 mg/kg to 320 mg/kg.

NAGD (2009) presents a screening level of 550 mg/kg for total petroleum hydrocarbons (TPH). The concentration of TPH in the fraction C_{10}-C_{36} (normalised to 1% TOC) ranged from below the

limit of reporting to 240 mg/kg with a 95% UCL average of 123.83 mg/kg (standard deviation 53.33), below the SQG low of 550 mg/kg. Results were generally consistent with those reported by Worley Parsons (2012).

Concentrations of PAH

PAHs were detected in all samples, with concentrations of total PAH ranging from 30 mg/kg to 69 mg/kg. Whilst the majority of PAH's were reported in all samples, Napthalene, fluoranthene, phenanthrene and pyrene appeared as the primary PAH's within these sediments. The relative ratio of these compounds was relatively similar across all samples and no obvious trend in PAH concentration was noted where underlying samples were analysed (SED04 to SED06).

For the purpose of comparison of the data set for the berth area against the guidelines, total PAH data for the upper silty clays and underlying clay material was normalised to 1% TOC, resulting. Total PAH concentrations (normalised to 1% TOC) ranged from 1.3 mg/kg to 12.7 mg/kg with a 95% UCL average of 7.53 mg/kg (standard deviation 2.88), below the SQG of 10 mg/kg.

The data was generally consistent with that reported by Worley Parsons (2012) where the concentration of total PAH (normalised to 1% TOC) ranged from 0.6 mg/kg to 16.5 mg/kg with a 95% UCL average of 7.13 µg/kg.

Concentrations of other parameters

- Ammonia was recorded above the LOR in four of the 12 samples collected from Berth 101 at locations SED04, SED05 and SED06, with concentrations ranging from 20 mg/kg to 110 mg/kg
- Cyanide was reported above the LOR in eight of the 12 samples, with concentrations ranging from 1 to 27 mg/kg.
- Concentrations of TBT (normalised to 1% TOC) ranged from 0.18 µg Sn/kg to 11 µg Sn/kg. A 95% UCL of 6.7 µg Sn/kg was reported, below the NAGD (2009) SQG low[4] of 9 µg Sn/kg. TBT concentrations were lower than those reported by Worley Parsons (2012), which reported a maximum concentration of TBT (normalised to 1% TOC) of 132 µg Sn/kg and 95% UCL average of 27.4 µg Sn/kg.
- Total organic carbon ranged from 4.33 % to 11.6 %.

5.3.2 Disposal area sediments

Two vibracore locations were completed where sediments are likely to be removed for construction of the bund around the proposed disposal area. Sample locations are identified as REA01 and REA02. A total of four sediment samples (two from each location) were analysed as part of this phase of works including one sample from the surface horizon (0-0.5 metres) and one underlying deeper sample (REA01_1-1.5 and REA02_2-2.5).

Sediment materials have previously been deposited in this area as part of harbour reclamation efforts and material was observed to be stratigraphically different from sediment composition of the dredging area at Berth 101 and from each other. Calculation of 95% UCL average concentrations based on two sampling locations and the variability of material encountered was not considered statistically valid. As such individual results have been reviewed with reference to the screening criteria for the purpose of these works.

[4] TBT concentrations reported a log normal distribution

Heavy metals in sediments

The highest metal concentrations were reported in sample REA01_1-1.5. Concentrations of lead, mercury and zinc were an order of magnitude higher in this sample than in the other three samples.

Metal concentrations at location REA01 were higher than REA02 and higher than those reported in the Berth 101 dredging area. Metal concentrations at REA02 were generally consistent with those reported in the Berth 101 dredging area.

Heavy metal concentrations in sediment samples from the disposal area were reviewed with reference to the screening levels (ISQG trigger value) presented in Table B2 (Appendix B) of the NAGD (2009). Analytical results are reported in Table B2 (Appendix B) and summarised in Table 3. In summary the following points are noted:

- With the exception of sample REA02_0-0.5, all samples reported concentrations of one or more heavy metals above the nominated screening criteria.
- Sample REA01_1-1.5 reported the maximum concentration for all heavy metals. In some instances (lead, mercury and zinc), concentrations were an order or magnitude higher than in other samples, with concentrations largely exceeding the SQG high values.

Table 3 – Summary analytcial results – Metal concentrations at disposal area

Heavy metal	SQG $_{Low}$	SQG $_{HIGH}$	Minimum (mg/kg)	Maximum (mg/kg)	Guideline exceedances (a)
As	20	70	<5	77	SQG $_{low}$ 2 of 4 SQG $_{high}$ 1 of 4
Cd	1.5	10	<1	8	SQG $_{low}$ 2 of 4 SQG $_{high}$ 0 of 4
Cr	80	370	8	369	SQG $_{low}$ 2 of 4 SQG $_{high}$ 0 of 4
Cu	65	270	22	4180	SQG $_{low}$ 3 of 4 SQG $_{high}$ 3 of 4
Pb	50	220	17	1930	SQG $_{low}$ 3 of 4 SQG $_{high}$ 3 of 4
Hg	0.15	1	<0.1	3.6	SQG $_{low}$ 2 of 4 SQG $_{high}$ 1 of 4
Ni	21	52	3	69	SQG $_{low}$ 1 of 4 SQG $_{high}$ 1 of 4
Zn	200	410	58	12,300	SQG $_{low}$ 3 of 4 SQG $_{high}$ 3 of 4
NOTES					
(a)	Number of samples reporting exceedances of SQG low and SQG high guideline values from total of four samples analysed				

Concentrations of TRH and BTEX

Concentrations of volatile TRH in the fraction C_6-C_{10} and BTEX were reported below the LOR in all samples selected for analysis.

TRH in the fraction C_{16}-C_{34} was reported in three of the four samples, with concentrations ranging from 240 mg/kg to 1,620 mg/kg, which is largely consistent with the results reported from sediments at Berth 101. With the exception of one sample (REA02_0-0.1). TRH in the fraction C_{34}-C_{40}, was reported in sediments from location REA01, with a maximum concentration of 340 mg/kg which is consistent with the results reported from sediments at Berth 101.

NAGD (2009) presents a screening level of 550 mg/kg for total petroleum hydrocarbons (TPH). For the purpose of comparison of the data against the guidelines, TPH data reported by the laboratory was normalised to 1% TOC. The concentration of TPH in the fraction C_{10}-C_{36} (normalised to 1% TOC) ranged from 80 mg/kg to 776 mg/kg. With the exception of sample REA01_1-1.5, results were reported below the nominated screening criteria of 550 mg/kg.

Concentrations of PAH

PAHs were detected in all samples, with concentrations of total PAH ranging from 1 mg/kg to 33 mg/kg. The results were largely consistent with those reported for the dredging area off Berth 101, with Napthalene, fluoranthene, phenanthrene and pyrene reported as the primary PAH's within these sediments. The relative ratio of these compounds was relatively similar across all samples and no obvious trend in PAH concentration was noted with depth. PAH results at location REA01 were higher than REA02.

Sample REA01_1-1.5 reported a total PAH concentration (normalised to 1% TOC) of 11.4 mg/kg. All other samples reported total PAH concentrations (normalised to 1% TOC) were all below the NAGD (2009) screening value of 10 mg/kg.

The data was generally consistent with that reported from the dredging area at Berth 101 and during previous investigations including Worley Parsons (2012) where the concentration of total PAH (normalised to 1% TOC) ranged from 0.6 mg/kg to 16.5 mg/kg.

Concentrations of other parameters

- Ammonia was recorded above the LOR in sample REA01_1-1.5 only with a concentration of 30 mg/kg reported, lower than the ammonia concentration range reported in sediments at Berth 101.
- Cyanide was reported above the LOR in samples REA01_1-1.5 and REA02_2-2.5 at concentrations of 12 mg/kg and 3 mg./kg respectively. Cyanide concentrations were consistent with the range reported for sediments at Berth 101.
- Concentrations of TBT (normalised to 1% TOC) ranged from 0.6 µg Sn/kg to 1 µg Sn/kg, below the NAGD (2009) SQG low[5] of 9 µg Sn/kg. TBT concentrations were generally consistent with those reported at Berth 101.
- Total organic carbon ranged from 0.67 to 3.6%.

5.3.3 Dioxins

'Dioxins' refers to a group of persistent chlorinated chemical compounds known as polychlorinated dibenzodioxins (PCDD), which share certain similar chemical structures, properties and biological characteristics, including toxicity (Mueller, et al.., 2004). Dioxins are not deliberately produced, but are released into the environment as a result of combustion activities including power generation, waste incineration, metal smelting and manufacture of some chemicals (EPHC, 2005).

Dioxins occur as a complex mixture in most environmental media and as such, toxic equivalents (TEQs) are used to assist with interpretation of data, allowing the toxicity to be expressed as a single number. TEQs are calculated by normalising individual compounds to 2,3,7,8-tetrachlorodibenzo-p-dioxin, the most toxic PCDD. The total toxicity of any mixture is then expressed as the sum of the individual TEQs (Mueller, et al.., 2004)

[5] TBT concentrations reported a log normal distribution. Based on the available data set, calculation of the 95% UCL average for underlying clay horizon was not considered statistically valid

Sediment samples collected from both the dredge footprint at Berth 101 and the disposal area were analysed for dioxins. The results are reported in full in the laboratory report provided in Appendix E and summarised in this section. Both the World Health Organisation (WHO) TEQ and International TEQ (I-TEQ) are reported by the laboratory and summarised in Table 4. For the purpose of this report, the following TEQ values were applied

- WHO TEQ $_{(0.5\ LOR)}$ where value of half LOR was used to calculate the TEQ where results were reported by the laboratory as non detect
- I-TEQ $_{(0.5\ LOR)}$ where value of half LOR was used to calculate the TEQ where results were reported by the laboratory as non detect

Ten samples collected from the dredge footprint at Berth 101 and four samples from the disposal area were analysed for dioxins. Consistent with previous datasets, results from all samples were strongly dominated by OCDD (octachlorodibenzo-p-dioxin) with concentrations of OCDD reported orders of magnitude higher than the LOR and other dioxin-compounds within the same sample.

The results were relatively consistent across all samples and between the two sampling areas. Two samples per location were analysed from vibracore locations. The data from sediment cores at Berth 101 reported a marginal decrease in dioxin levels between surface (0-0.5) samples and underlying samples collected from either the 1-1.5 or 2-2.5 metre horizons. For the two locations completed within the disposal area (REA01 and REA02), total TEQ's were higher in deeper samples higher at both locations, with the maximum TEQ values reported in sample REA02_1-1.5.

Table 4- Dioxin summary results – Total TEQ

Sample ID	WHO TEQ $_{(0.5\ LOR)}$	I-TEQ $_{(0.5\ LOR)}$
Berth 101 Dredging Area		
SED01_0-0.5	11.7	19.26
SED02_0-0.5	8.78	15.23
SED03_0-0.5	16.02	22.78
SED04_0-0.5	8.62	14.54
SED04_1-1.5	8.47	13.65
SED05_0-0.5	9.95	16.08
SED05_1-1.5	8.46	13.74
SED06_0-0.5	8.49	13.4
SED06_2-2.5	5.1	7.26
SED07_0-0.5	8.7	14.02
Mean Average Total TEQ	**9.4**	**15**
Disposal Area		
REA01_0-0.5	13.29	18.58
REA01_1-1.5	21.82	32.36
REA02_0-0.5	4.66	6.72
REA02_2-2.1	9.05	14.14
Mean Average Total TEQ	**12.2**	**17.9**

In general, the results of the sampling were consistent with data reported during previous investigations. The results reported by Worley Parsons (2012) are summarised as follows:

- WHO_{98} TEQ (0.5 LOR): Mean average 15.4 and maximum 22.1
- I-TEQ (0.5 LOR): Mean 32.1 and maximum 51.1

5.3.4 Acid sulphate soils

Field screen

Samples for potential acid sulphate soil (PASS) were initially submitted to the lab for a pH field screen the results of the field screen are presented in Table B41 in Appendix B.

The results for initial pH of the sample (pH_F) range from 8.2 to 8.9. pH after digestion with hydrogen peroxide (pH_{Fox}) ranged from 5.1 to 8 with one sample with a value of 2.3. All samples showed a strong or extreme reaction with a decrease in pH for all samples ranging from 0.4 to 6.1. While a final pH of less than 3.5 is considered an indicator of potential acid sulphate soils (PASS), they cannot be excluded here as pH is often higher when samples are from a marine source.

Acid sulphate soils – Chromium Reducible Sulphur method

In order to supplement to acid sulphate soil (ASS) field screen twelve samples were selected for laboratory analyses at the primary laboratory using the chromium reducible sulphur suite (CRS). For the majority of cores a single sample was selected for ASS analyses as the intra-core coefficient of variation between both pH_F and pH_{Fox} was small. For cores where there was a large variation in either pH_F or pH_{Fox} additional samples were selected to be representative of this variation.

The results were compared to the action criteria provided in the QLD (2014) Acid Sulfate Soils Technical Manual – Soil management Guidelines V4.0 based on more than 1000 tonnes of fine texture soils to be disturbed.

The laboratory report is included in Appendix E. The results are summarised in Appendix B, Table B4.

All samples exceeded the action criteria of 0.03 % sulphur and 18 M H^+/t in both Berth101 and the disposal area at all depths. These samples all had pHKCl of more than 8 pH units and acid neutralising capacity that ranged from 757 to 7750 M H^+/t. The liming rates were less than 1 kg $CaCO_3$/t for all except one sample (REA01_2.0-2.1) which has a liming rate of 227 kg $CaCO_3$/t.

6. Conclusions

6.1 Summary findings

Based on the findings of these investigations, as outlined in Section 5, and subject to the limitations outlined in Section 1.5, key findings of the sediment investigations are summarised as follows:

- Two main sedimentary units were identified in the dredge footprint at Berth 101 comprising a soft silty clay layer overlying a stiffer clay layer. Sediments encountered at the disposal area were stratigraphcially different to Berth 101, predominantly comprising black-brown clayey silt. Anthropogenic inclusions were noted in sediments within the outer harbour disposal area at REA01 including coal waste material, wood and concrete fragments interpreted as fill including a 10 cm layer of coarse coal waste.
- Elevated metal concentrations were reported above the nominated screening levels in the dredge footprint at both Berth 101 and the disposal area. With the exception of one sampling location at the disposal area (REA01-1-1.5), concentrations of heavy metals were generally consistent between the Berth 101 dredging area and disposal area. Some metals, notably lead, mercury and zinc, were an order of magnitude higher in sample REA01_1-1.5 than other samples.
- Other contaminants of potential concern, including PAH, TBT and hydrocarbons reported 95% UCL average concentrations below the nominated screening levels in the dredge area at Berth 101. With the exception of one sample (REA01_1-1.5), concentrations of PAH, TBT and TPH in the disposal area were largely consistent with data reported for the dredge area. Statistical evaluation of the dataset from the disposal area was not considered valid based on the variability of material encountered and number of sampling locations and as such individual results were reviewed with reference to the screening criteria. Concentrations of PAH and TPH in sample REA01-1.1.5 exceeded the NAGD (2009) screening levels.
- Dioxin levels were largely consistent across the two sampling areas with the sediments from the Berth 101 dredge footprint and disposal area reporting WHO $TEQ_{(0.5\ LOR)}$ of 9.4 ppt and 12.2 ppt respectively. Whilst Australian guidelines for dioxins are not currently available, these levels are within the range of background concentrations reported for Australian sediments (Muller et al., 2004) and consistent with the mean WHO $TEQ_{(0.5\ LOR)}$ reported by Worley Parsons (2012) of 15.4 ppt.
- The sediment sampling program was limited owing to weather conditions and the need to revise the sampling approach during the course of the works. Whilst the depth of sampling was limited to approximately 0.7 metres for some locations, the following points are noted with respect to the vertical profile of contaminant concentrations
  - No obvious vertical trend in contaminant concentration with depth was noted in sediment cores collected from the dredge footprint at Berth 101 where shallow (0-0.5) and underlying samples were analysed.
  - Two sampling locations (REA01 and REA02) were completed within the vicinity of the disposal area, including locations targeting sediments which are likely to be removed to facilitate construction of the bund. Concentrations of contaminants of concern in REA01 were higher in the underlying sample collected from a depth of 1-1.5 whilst concentrations in sediments sampled from REA02 were relatively consistent with depth.

- Contaminant concentrations were generally consistent across the seven locations completed with the sampling area at Berth 101, with no obvious hotspots of contamination noted.
- Analytical results were generally consistent with those reported previously by others including AECOM (2010) and Worley Parsons (2012). No new contaminants of potential concern were identified at levels exceeding screening criteria during the current investigation.
- Elutriate testing was not completed during the current investigation. However, based on the comparison of data with previous sampling events, the results of elutriate testing reported by AECOM (2010), Worley Parsons (2012) and Geochemical Assessments (2013) are considered relevant to these works and likely indicative of current conditions.
- Consistent with the findings of previous investigations including AECOM (2010), Worley Parsons (2012) and Geochemical Assessments (2013), the results indicate the presence of PASS and potential acid generating capacity of the sediments.

6.2 Conclusions

Overall, the findings of the investigation indicate the presence of contaminated sediments within the proposed dredging and disposal areas. Concentrations of contaminants of concern were largely consistent across the two areas, with concentrations of heavy metals exceeding the screening criteria in both the Berth 101 dredge area and disposal area. PAH and hydrocarbons were reported above the screening criteria in one sediment sample collected from the disposal area.

With reference to potential impacts on the project, the following points are noted:

- There is the potential for mobilisation of contaminants, notably heavy metals, into the water column during dredging activities. Based on review of the information obtained during this investigation, and the findings of previous investigations, the following points are noted:
  - Elutriate testing completed by Worley Parsons (2012) indicates that whilst concentrations of heavy metals may have been reported above the screening levels in sediments, concentrations of dissolved metals in elutriate waters were below the ANZECC trigger levels for 95% protection of species.
  - Bioavailability testing indicates that some heavy metals, notably cadmium, chromium copper, lead and zinc, have the potential to be bioavailable to marine organisms within the sediments.
  - The potential bioavailability of contaminants, including detailed review of existing available data, will be considered during developing the dredge management strategy and in preparation of the dredge management plan.
- The project will involve dredging of sediments from Berth 101 and emplacement within the disposal area. Contaminated sediments will be placed within the perimeter bund of the disposal area and capped with clean sediments. Details for the management of this process will be documented in the dredge management plan.
- Dredging activities will result in the suspension of sediments, potentially remobilising contamination into the water column. Mitigation measures to minimise impacts to receiving waters may include the use of a turbidity curtain to restrict the generation of turbidity plumes and localise any water quality issues. Details of these mitigation measures, including the approach for surface water monitoring, will be outlined in the dredge management plan.

- The results of the sediment sampling program indicate PASS conditions are present within the dredge footprint. An Acid Sulphate Soil Management Plan (ASSMP) will be prepared in line with the requirements of the *Acid Sulphate Soils Management Advisory Committee Guidelines* (ASSMAC, August 1998 and as updated). The ASSMP will be prepared to identify, manage and treat the PASS encountered during dredging to minimise the production of acid leachate. The dredging strategy will be designed to limit the timeframe for potential for oxidisation of the sediments. The potential for ASS generation would reduce greatly due to sediments being transferred to the disposal area immediately after dredging, limiting time for oxidation.

7. References

ANZECC/ARMCANZ (2000) *Australian Water Quality Guidelines for Fresh and Marine Water Quality.* Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, October 2000

Acid Sulfate Soil Manual (1998) prepared by the Acid Sulfate Soil Management Advisory Committee (ASSMAC 1998).

AECOM (2010) *Port Kembla Outer harbour development Environmental Assessment*

Coffey Geosciences (2003) *Evaluation of sediment sampling and analysis, Port Kembla Port*.

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

Dear SE, Moore NG, Dobos SK, Watling KM and Ahern CR (2002). Soil Management Guidelines. In *Queensland Acid Sulfate Soil Technical Manual v.4.0 (2014)*. Department of Natural Resources and Mines, Indooroopilly, Queensland, Australia.

Douglas Partners (2002) *Report on sediment sampling and analysis Port Kembla Report. Technical report prepared for Port Kembla Port Corporation*.

EPHC (2005) *National Dioxins Program: National Action Plan for Addressing Dioxins in Australia*, July 2005

Geochemical Assessment (2013) *Pilot Sediment Investigations for Potential Maintenance Dredging Areas*

Mueller J, Muller R, Goudkamp K, Shaw M, Mortimer M, Haynes D, Paxman C, Hyne R, McTaggart A, Burniston D, Symons R and Moore M, (2004) *Dioxins in Aquatic Environments in Australia,* National Dioxin Program Technical Report No. 6, Australian Government Department of Environment and Heritage, Canberra

Worley Parsons (2012) Berth 101 *Upgrade Project Marine Assessment Dredge Spoil Contamination Assessment - Stage 2 Detailed Site Investigation*

Appendices

Appendix A - Figures

Paper Size ISO A4

0 20 40 60 80

Metres

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

N

GHD

Australian Industrial Energy
Port Kembla Gas Terminal

Proposed Dredging Area - Sampling Grid

Project No. **21-27477**
Revision No. **-**
Date **30/10/2018**

FIGURE 1

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Print date: 30 Oct 2018 - 09:57

Paper Size ISO A4

0 30 60 90 120

Metres

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

N

GHD

Australian Industrial Energy
Port Kembla Gas Terminal

Reclamation Area - Sampling Grid

Project No. **21-27477**
Revision No. **-**
Date **30/10/2018**

FIGURE 2

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Print date: 30 Oct 2018 - 09:53

Appendix B - Summary of Lab Results

Table B1 - Summary Analytical Results - Chemistry

					NA				Particle Size Analysis													Soil Bulk Density
					% Cobbles (>6cm)	% Gravel (>2mm)	% Sand (0.06-2.00 mm)	% Silt (2-60 µm)	% Clay (<2 µm)	% +75µm	% +150µm	% +300µm	% +425µm	% +600µm	% +1180µm	% +2.36mm	% +4.75mm	% +9.5mm	% +19.0mm	% +37.5mm	% +75.0mm	DENSITY
					%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	g/cm3
EQL					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.01
Location Code	**Date**	**Field ID**	**Sample Type**	**Matrix Type**																		
	5/10/2018	REA01_0.0-0.5	Normal	soil	<1	<1	17	61	22	10	4	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.4
	5/10/2018	REA01_1.0-1.5	Normal	soil	<1	7	58	21	14	61	54	41	37	33	16	3	<1	<1	<1	<1	<1	2.79
	5/10/2018	REA02_0.0-0.5	Normal	soil	<1	1	80	11	8	81	74	38	13	4	2	1	<1	<1	<1	<1	<1	2.62
	5/10/2018	REA02_2.0-2.5	Normal	soil	<1	3	69	16	12	69	50	12	8	6	4	3	2	<1	<1	<1	<1	2.54
	5/10/2018	SED01_0.0-0.5	Normal	soil	<1	11	36	34	19	45	37	29	26	22	15	9	5	<1	<1	<1	<1	2.34
	5/10/2018	SED02_0.0-0.5	Normal	soil	<1	<1	19	55	26	9	4	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.37
	5/10/2018	SED03_0.0-0.5	Normal	soil	<1	<1	25	49	26	15	8	4	2	1	<1	<1	<1	<1	<1	<1	<1	2.39
	5/10/2018	SED04_0.0-0.5	Normal	soil	<1	<1	15	63	22	7	3	1	1	<1	<1	<1	<1	<1	<1	<1	<1	2.37
	5/10/2018	SED04_1.0-1.5	Normal	soil	<1	<1	8	67	25	6	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.33
	5/10/2018	SED05_0.0-0.5	Normal	soil	<1	<1	12	65	23	8	3	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.34
	5/10/2018	SED05_1.0-1.5	Normal	soil	<1	<1	13	65	22	6	2	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.31
	5/10/2018	SED06_0.0-0.5	Normal	soil	<1	<1	26	53	21	18	12	7	3	2	<1	<1	<1	<1	<1	<1	<1	2.22
	5/10/2018	SED06_2.0-2.5	Normal	soil	<1	<1	38	43	19	30	10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.54
	5/10/2018	SED07_0.0-0.5	Normal	soil	<1	<1	25	53	22	19	8	3	1	<1	<1	<1	<1	<1	<1	<1	<1	2.39
Statistics																						
Number of Results					14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Minimum Value					<1	1	8	11	8	6	2	1	1	1	<1	1	<1	<1	<1	<1	<1	2.22
Maximum Value					<1	11	80	67	26	81	74	41	37	33	16	9	5	<1	<1	<1	<1	2.79
Median Value *					0.5	0.5	25	53	22	17	8	2	1.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2.38

* A Non Detect Multiplier of 0.5 has been applied.

Table B2 - Summary Analytical Results - Inorganics

					Metals											Nutrients
					Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc	Moisture (%)	Cyanide (Total)	Ammonia as N
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg
EQL					5	1	2	5	5	0.1	2	5	1	1	20
NAGD 2009 - SQG-High Values					70	10	370	270	220	1	52	410			
NAGD 2009 - Screening Level					20	1.5	80	65	50	0.15	21	200			
Location Code	**Date**	**Field ID**	**Sample Type**	**Matrix Type**											
	5/10/2018	REA01_0.0-0.5	Normal	soil	42	3	115	3,280	548	0.8	25	1,210	51.7	<2	<20
	5/10/2018	REA01_1.0-1.5	Normal	soil	77	8	369	4,180	1,930	3.6	69	12,300	38.8	12	30
	5/10/2018	REA02_0.0-0.5	Normal	soil	<5	<1	8	22	17	<0.1	3	58	23.7	<1	<20
	5/10/2018	FS08	Field_D - REA02_0.0-0.5	soil	<5	<1	4	12	10	<0.1	<2	27	18.6	<1	<20
	5/10/2018	REA02_2.0-2.5	Normal	soil	54	<1	20	309	431	0.5	13	475	23.6	3	<20
	5/10/2018	SED01_0.0-0.5	Normal	soil	15	<1	86	251	176	0.3	19	676	54.6	<2	<20
	5/10/2018	SED02_0.0-0.5	Normal	soil	19	<1	84	233	169	0.3	20	669	56.8	<2	<20
	5/10/2018	SED03_0.0-0.5	Normal	soil	18	<1	82	239	171	0.3	18	684	54.8	<2	<20
	5/10/2018	SED04_0.0-0.5	Normal	soil	20	<1	97	338	205	0.5	20	876	54.8	3	<20
	5/10/2018	SED04_1.0-1.5	Normal	soil	19	1	92	159	202	0.5	24	784	49.3	4	30
	5/10/2018	FS06	Field_D - SED04_1.0-1.5	soil	17	1	90	159	198	0.4	24	772	49.6	4	30
	5/10/2018	SED05_0.0-0.5	Normal	soil	15	<1	82	241	172	0.4	18	671	47.7	1	<20
	5/10/2018	SED05_1.0-1.5	Normal	soil	21	1	104	216	236	0.6	24	900	47.8	4	40
	5/10/2018	SED06_0.0-0.5	Normal	soil	15	2	104	157	168	0.5	21	930	48.1	4	<20
	5/10/2018	SED06_2.0-2.5	Normal	soil	9	2	85	67	145	0.2	20	1,120	37.6	27	110
	5/10/2018	SED07_0.0-0.5	Normal	soil	17	<1	79	262	175	0.3	18	675	55.3	2	<20
				Number of Results	14	7	16	16	16	14	15	16	16	10	5
				Minimum Concentration	9	1	4	12	10	0.2	3	27	18.6	1	30
				Maximum Concentration	77	8	369	4180	1930	3.6	69	12300	56.8	27	110
				Median Concentration *	18.5	2	85.5	236	175.5	0.45	20	728	48.7	4	30
				* A Non Detect Multiplier of 0.5 has been applied.											
				95% UCL - Berth101	18.82	1.26	94.86	258.9	196.72	0.46	21.5	888			

Table B3 - Summary Analytical Results - Organics

					TOC	Organo Metals		BTEXN							TRH - NEPM 2013								TRH - NEPM 1999						
					Total Organic Carbon	Tributyltin (as Sn)	Normalised TBT	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX (Sum of Total) - Lab Calc	F1 (C6-C10 minus BTEX)	C6-C10 Fraction	F2 (>C10-C16 minus Naphthalene)	>C10-C16 Fraction	F3 (>C16-C34 Fraction)	F4 (>C34-C40 Fraction)	>C10-C40 (Sum of Total)	Normalised c10-C40 Total	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 (Sum of Total)	Normalised C10-C36
					%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					0.02	0.0005		0.2	0.5	0.5	0.5	0.5	0.5	0.2	10	10	50	50	100	100	50		10	50	100	100	50	
NAGD 2009 - SQG-High Values						0.07	0.07																						
NAGD 2009 - Screening Level						0.009	0.009																				550	550	
ANZECC 2000 ISQG -High						0.07	0.07																						
ANZECC 2000 ISQG -Low						0.005	0.005																						
Location Code	**Date**	**Field ID**	**Sample Type**	**Matrix Type**																									
	5/10/2018	REA01_0.0-0.5	Normal	soil	3.60	0.0036	0.001	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	690	300	990	275	<10	<50	390	440	830	230.56
	5/10/2018	REA01_1.0-1.5	Normal	soil	2.64	0.0016	0.00060606	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	90	90	1,620	340	2,050	776.52	<10	<50	1,070	740	1,810	685.61
	5/10/2018	REA02_0.0-0.5	Normal	soil	0.67	0.0007	0.00104478	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50		<10	<50	<100	<100	<50	
	5/10/2018	FS08	Field_D - REA02_0.0-0.5	soil	0.41	<0.0005		<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	<100	<100	<50		<10	<50	<100	<100	<50	
	5/10/2018	REA02_2.0-2.5	Normal	soil	2.98	<0.0005		<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	240	<100	240	80.54	<10	<50	150	120	270	90.60
	5/10/2018	SED01_0.0-0.5	Normal	soil	6.26	0.0049	0.00078275	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	470	200	670	107.03	<10	<50	280	280	560	89.46
	5/10/2018	SED02_0.0-0.5	Normal	soil	6.90	0.0101	0.00146377	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	370	140	510	73.91	<10	<50	220	210	430	62.32
	5/10/2018	SED03_0.0-0.5	Normal	soil	8.88	0.0997	0.01122748	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	200	<100	200	22.52	<10	<50	<100	<100	<50	
	5/10/2018	SED04_0.0-0.5	Normal	soil	6.92	0.0059	0.0008526	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	460	220	680	98.27	<10	<50	270	290	560	80.92
	5/10/2018	SED04_1.0-1.5	Normal	soil	7.47	0.0255	0.00341365	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	710	220	930	124.50	<10	<50	440	380	820	109.77
	5/10/2018	FS06	Field_D - SED04_1.0-1.5	soil	7.48	0.0174	0.0023262	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	680	210	890	118.98	<10	<50	420	360	780	104.28
	5/10/2018	SED05_0.0-0.5	Normal	soil	8.76	0.0083	0.00094749	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	560	240	800	91.32	<10	<50	340	340	680	77.63
	5/10/2018	SED05_1.0-1.5	Normal	soil	7.51	0.0044	0.00058589	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	550	220	770	102.53	<10	<50	340	310	650	86.55
	5/10/2018	SED06_0.0-0.5	Normal	soil	11.60	0.0117	0.00100862	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	50	820	210	1,080	93.10	<10	<50	530	400	930	80.17
	5/10/2018	SED06_2.0-2.5	Normal	soil	4.33	0.0008	0.00018476	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	60	60	900	280	1,240	286.37	<10	<50	570	470	1,040	240.18
	5/10/2018	SED07_0.0-0.5	Normal	soil	7.79	0.0082	0.00105263	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<10	<10	<50	<50	340	160	500	64.18	<10	<50	210	210	420	53.92
				Number of Results	16	16	14	16	16	16	16	16	16	16	16	16	16	16	16	16	16	14	16	16	16	16	16	13
				Minimum Concentration	0.41	0.00	0.00	0.10	0.25	0.25	0.25	0.25	0.25	0.10	5.00	5.00	25.00	25.00	50.00	50	50	23	5	25	50	50	25	54
				Maximum Concentration	11.60	0.10	0.01	0.10	0.25	0.25	0.25	0.25	0.25	0.10	5.00	5.00	90.00	90.00	1,620.00	340	2050	776.52	5	25	1070	740	1810	685.61
				Median Concentration *	6.9	0.0054	0.0010	0.1	0.25	0.25	0.25	0.25	0.25	0.1	5	5	25	25	510	210	725	100	5	25	310	300	605	89
				* A Non Detect Multiplier of 0.5 has been applied.																									

Table B3 - Summary Analytical Results - Organics

					PAHs																			
					Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo[b+j]fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Naphthalene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	PAHs (Sum of total) - Lab calc	normalisedPAHs (Sum of total) - Lab calc	Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ)(half LOR) - Lab Calc	Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5
NAGD 2009 - SQG-High Values																					50	50			
NAGD 2009 - Screening Level																					10	10			
ANZECC 2000 ISQG -High					0.5	0.64	1.1	1.6	1.6				2.8	0.26	5.1	2.1	0.54		1.5	2.6	45	45			
ANZECC 2000 ISQG -Low					0.016	0.044	0.085	0.261	0.43				0.384	0.063	0.6	0.16	0.019		0.24	0.665	4	4			
Location Code	**Date**	**Field ID**	**Sample Type**	**Matrix Type**																					
	5/10/2018	REA01_0.0-0.5	Normal	soil	<0.8	<0.8	0.8	2.3	3.0	3.6	1.3	1.6	2.2	<0.8	5.0	5.5	<0.8	1.4	2.8	4.2	33.7	9.36	3.9	4.1	4.4
	5/10/2018	REA01_1.0-1.5	Normal	soil	<0.5	1.0	0.8	1.1	1.4	1.8	0.6	0.8	1.1	<0.5	2.9	11.1	0.7	0.7	2.8	3.3	30.1	11.40	1.8	2.1	2.3
	5/10/2018	REA02_0.0-0.5	Normal	soil	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.5	<0.5	<0.5	<0.5	<0.5	1.0	1.49	<0.5	0.6	1.2
	5/10/2018	FS08	Field_D - REA02_0.0-0.5	soil	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	0.6	1.2
	5/10/2018	REA02_2.0-2.5	Normal	soil	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	0.8	<0.5	<0.5	<0.5	0.7	2.2	0.74	<0.5	0.6	1.2
	5/10/2018	SED01_0.0-0.5	Normal	soil	<0.8	0.9	1.2	1.9	2.7	3.3	1.1	1.4	2.0	<0.8	4.3	9.8	0.9	1.2	3.6	4.0	38.3	6.12	3.5	3.7	4.0
	5/10/2018	SED02_0.0-0.5	Normal	soil	<0.8	<0.8	1.0	1.6	2.2	2.7	0.9	1.1	1.7	<0.8	3.6	8.5	<0.8	1.0	3.0	3.3	30.6	4.43	2.8	3.1	3.3
	5/10/2018	SED03_0.0-0.5	Normal	soil	<0.8	<0.8	<0.8	0.9	0.9	1.3	<0.8	0.9	0.9	<0.8	1.8	2.5	<0.8	<0.8	1.0	1.6	11.8	1.33	1.1	1.4	1.7
	5/10/2018	SED04_0.0-0.5	Normal	soil	<0.8	0.9	1.2	2.0	2.8	3.4	1.1	1.6	2.1	<0.8	4.5	9.9	0.9	1.3	3.6	4.1	39.4	5.69	3.6	3.9	4.1
	5/10/2018	SED04_1.0-1.5	Normal	soil	<0.5	1.2	1.7	2.7	3.9	4.7	1.8	2.1	2.8	0.6	6.2	11.4	1.3	1.8	4.9	5.5	52.6	7.04	5.6	5.6	5.6
	5/10/2018	FS06	Field_D - SED04_1.0-1.5	soil	<0.5	1.2	1.7	2.6	3.8	4.6	1.4	2.1	2.7	0.6	6.0	11.6	1.3	1.8	4.8	5.3	51.5	6.89	5.5	5.5	5.5
	5/10/2018	SED05_0.0-0.5	Normal	soil	<0.5	1.1	1.6	2.6	3.5	4.3	1.3	2.2	2.6	0.5	5.5	12.7	1.2	1.8	4.6	5.0	50.5	5.76	5.0	5.0	5.0
	5/10/2018	SED05_1.0-1.5	Normal	soil	<0.5	1.0	1.4	2.1	3.2	3.8	1.3	1.9	2.2	0.5	5.1	9.1	1.1	1.6	4.0	4.5	42.8	5.70	4.6	4.6	4.6
	5/10/2018	SED06_0.0-0.5	Normal	soil	<0.5	1.6	2.4	3.8	5.5	6.9	2.6	3.5	4.1	0.9	8.1	11.2	1.9	3.0	6.5	7.4	69.4	5.98	8.1	8.1	8.1
	5/10/2018	SED06_2.0-2.5	Normal	soil	<0.5	1.9	1.5	1.4	2.0	2.3	0.8	1.3	1.6	<0.5	4.5	24.9	1.4	1.0	4.8	5.6	55.0	12.70	2.6	2.8	3.1
	5/10/2018	SED07_0.0-0.5	Normal	soil	<0.8	<0.8	1.0	1.8	2.3	2.8	1.0	1.2	1.8	<0.8	3.7	7.0	<0.8	1.1	2.8	3.4	29.9	3.84	3.0	3.2	3.5
				Number of Results	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	15	16	16	16
				Minimum Concentration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
				Maximum Concentration																					
				Median Concentration *																					
				* A Non Detect Multiplier of 0.5 has been applied.																					

Table B4 - Summary Analytical Results - Acid Sulfate Soils

					ASS - Field			ASS - pH	ASS - Acidity Trail		ASS - Potential Acidity		ASS - ANC			ASS - Acid Base Accounting						
					pHF	pH-FOX	Reaction rate	pHKCl	Titratable Actual Acidity	Titratable Actual Acidity (sulfur units)	Chromium Reducible Sulfur	Chromium Reducible Sulphur (acidity units)	Acid Neutralising Capacity	Acid Neutralising Capacity (acidity units)	Acid Neutralising Capacity (sulfur units)	s-Net Acidity without ANCE	s-Net Acidity without - ANCE	ANC Fineness Factor	Net Acidity (acidity units)	Net Acidity (sulfur units)	Liming Rate	Liming Rate excluding ANC
					pH Units	pH Units	-	pH Units	mole H+/t	%S	%S	mole H+/t	% CaCO3	mole H+/t	%S	%S	mole H+/t	-	mole H+/t	%S	kg CaCO3/t	kg CaCO3/t
EQL					0.1	0.1	1	0.1	2	0.02	0.005	10	0.01	10	0.01	0.02	10	0.5	10	0.02	1	1
ASSMAC (1998)											0.03	18										
Location Code	**Date**	**Field ID**	**Sample Type**	**Matrix Type**																		
	4/10/2018	REA01_0.0-0.1	Normal	soil	8.7	7.6	4	8.7	<2	<0.02	0.677	422	38.8	7,760	12.4	0.68	422	1.5	<10	<0.02	<1	32
	4/10/2018	REA01_1.0-1.1	Normal	soil	8.8	7.5	4															
	4/10/2018	REA01_2.0-2.1	Normal	soil	8.4	2.30	4	8.00	<2	<0.02	6.29	3920.00	6.74	1350.00	2.16	6.29	3920.00	1.50	3020.00	4.85	227.00	294.00
	4/10/2018	REA02_0.0-0.1	Normal	soil	8.6	6.50	3	9.00	<2	<0.02	0.11	70.00	2.65	529.00	0.85	0.11	70.00	1.50	<10	<0.02	<1	5.00
	4/10/2018	REA02_1.0-1.1	Normal	soil	8.5	6.60	4															
	4/10/2018	REA02_2.0-2.1	Normal	soil	8.4	7.8	4															
	4/10/2018	FS03	Field_D_ REA02_2.0-2.1	soil	8.8	7.6	4															
	4/10/2018	SED01_0.0-0.1	Normal	soil	8.2	6.30	4	8.10	<2	<0.02	0.27	169.00	5.43	1080.00	1.74	0.27	169.00	1.50	<10	<0.02	<1	13.00
	5/10/2018	SED01_0.0-0.5	Normal	soil	8.4	6.30	4															
	5/10/2018	SED01_0.5-0.65	Normal	soil	8.4	6.40	4															
	4/10/2018	SED02_0.0-0.1	Normal	soil	8.2	6.30	4	8.50	<2	<0.02	0.14	89.00	4.65	929.00	1.49	0.14	89.00	1.50	<10	<0.02	<1	7.00
	5/10/2018	SED02_0.0-0.5	Normal	soil	8.2	6.20	4															
	5/10/2018	SED02_0.55-0.65	Normal	soil	8.6	6.20	4															
	4/10/2018	SED03_0.0-0.1	Normal	soil	8.4	6.30	4	8.50	<2	<0.02	0.13	81.00	5.14	1030.00	1.64	0.13	81.00	1.50	<10	<0.02	<1	6.00
	5/10/2018	SED03_0.0-0.1	Normal	soil	8.4	6.30	4															
	5/10/2018	SED03_0.0-0.5	Normal	soil	8.6	6.30	4															
	5/10/2018	SED03_0.5-0.65	Normal	soil	8.4	6.40	4															
	4/10/2018	SED04_0.0-0.1	Normal	soil	8.6	6.20	4	8.50	<2	<0.02	0.16	102.00	5.08	1020.00	1.63	0.16	102.00	1.50	<10	<0.02	<1	8.00
	5/10/2018	SED04_0.5-0.6	Normal	soil	8.4	6.40	4															
	5/10/2018	SED04_1.0-1.1	Normal	soil	8.8	6.20	4															
	4/10/2018	SED04_1.5-1.6	Normal	soil	8.9	6.50	4	8.40	<2	<0.02	0.37	230.00	5.27	1050.00	1.69	0.37	230.00	1.50	<10	<0.02	<1	17.00
	4/10/2018	FS04	Field_D_SED04_1.5-1.6	soil	8.8	6.6	4	8.4	<2	<0.02	0.399	249	5.19	1,040	1.66	0.4	249	1.5	<10	<0.02	<1	19
	5/10/2018	SED04_2.0-2.1	Normal	soil	8.8	7.20	4															
	5/10/2018	SED04_2.5-2.6	Normal	soil	8.2	6.10	4															
	4/10/2018	SED05_0.0-0.1	Normal	soil	8.3	6.40	3	8.60	<2	<0.02	0.10	64.00	4.95	989.00	1.58	0.10	64.00	1.50	<10	<0.02	<1	5.00
	4/10/2018	SED05_1.0-1.1	Normal	soil	8.5	7.20	4															
	4/10/2018	SED05_2.0-2.1	Normal	soil	8.8	7.20	4															
	4/10/2018	SED06_0.0-0.1	Normal	soil	8.5	6.40	3	8.60	<2	<0.02	0.12	76.00	4.78	954.00	1.53	0.12	76.00	1.50	<10	<0.02	<1	6.00
	4/10/2018	SED06_2.0-2.1	Normal	soil	8.4	8.00	4															
	4/10/2018	SED06_3.0-3.1	Normal	soil	8.4	6.50	4	8.30	<2	<0.02	0.64	397.00	3.79	757.00	1.21	0.64	397.00	1.50	<10	<0.02	<1	30.00
	4/10/2018	FS01	Field_D SED06_3.0-3.1	soil	8.5	5.1	4	8.2	<2	<0.02	3.38	2,110	15.2	3,040	4.87	3.38	2,110	1.5	81	0.13	6	158
	4/10/2018	SED07_0.0-0.65	Normal	soil	8.5	6.40	4	8.60	<2	<0.02	0.11	70.00	5.06	1010.00	1.62	0.11	70.00	1.50	<10	<0.02	<1	5.00
Statistics																						
Number of Results					32	32		13	0	0	13	13	13	13	13	13	13	13	11	11	11	13
Minimum Concentration					8.2	2.3		8	<2	<0.02	0.103	64	2.65	529	0.85	0.1	64	1.5	<10	<0.02	<1	5
Maximum Concentration					9	8		9	<2	<0.02	6	3,920	39	7,760	12	6	3,920	2	3,020	5	227	294
Median Concentration *					8.5	6.4		8.5	1	0.01	0.217	135.5	5.11	1,025	1.635	0.215	135.5	1.5	5	0.01	0.5	8.0

* A Non Detect Multiplier of 0.5 has been applied

Appendix C – Core Logs

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE SED01

Client Australian Industrial Energy
Project Preliminary Contamination Assessment
Project No. 2127477
Site Port Kembla Hrbour
Location Berth 101
Date Drilled 04/10/2018 - 04/10/2018

Drill Co. McLennans Diving Services
Driller D Allchin
Rig Type
Total Depth (m) 0.67
Diameter (mm) 160

Easting 306800.27
Northing 6184996.98
Grid Ref GDA94_MGA_zone_56
Elevation
Logged By Sarah Eccleshall
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
0.1	hand push	0.2	SED01_0.0-0.1 SED01_0.0-0.5		MH - Clayey SILT dark black- brown, some sand	S	VS	weak hydrocarbon odour Black colouring from coal, some coal refuse	-0.1
0.2									-0.2
0.3					MH - Clayey SILT dark black- brown, some fine sand	W	S	weak hydrocarbon odour Black colouring from coal, some coal refuse	-0.3
0.4									-0.4
0.5		0.6	SED01_0.5-0.65						-0.5
0.6									-0.6
0.7					Termination Depth at: 0.67 m. Target depth achieved.				-0.7
0.8									-0.8
0.9									-0.9
1									-1
1.1									-1.1
1.2									-1.2
1.3									-1.3
1.4									-1.4
1.5									-1.5
1.6									-1.6
1.7									-1.7
1.8									-1.8
1.9									-1.9

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V-Vibracore, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE SED02

Client Australian Industrial Energy
Project Preliminary Contamination Assessment
Project No. 2127477
Site Port Kembla Harbour
Location Berth 101
Date Drilled 04/10/2018 - 04/10/2018

Drill Co. McLennans Diving Services
Driller D Allchin
Rig Type
Total Depth (m) 0.67
Diameter (mm) 160

Easting 306844.37
Northing 6184974.51
Grid Ref GDA94_MGA_zone_56
Elevation
Logged By Sarah Eccleshall
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
0.1	hand push	0.2	SED02_0.0-0.1 SED02_0.0-0.5		MH - Clayey SILT dark black- brown, some fine sand	W	VS	weak hydrocarbon odour Black colouring from coal	-0.1
0.2									-0.2
0.3		0.9							-0.3
0.4									-0.4
0.5		0.3	SED02_0.5-0.65					distinct hydrocarbon odour	-0.5
0.6					MH - Clayey SILT dark black- grey, some fine sand, some coal refuse	VM	S	Black colouring from coal. Large coal pieces at 0.53-0.6, some coal refuse	-0.6
0.7					Termination Depth at: 0.67 m. Target depth achieved.				-0.7
0.8									-0.8
0.9									-0.9
1									-1
1.1									-1.1
1.2									-1.2
1.3									-1.3
1.4									-1.4
1.5									-1.5
1.6									-1.6
1.7									-1.7
1.8									-1.8
1.9									-1.9

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations

AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V-Vibracore, WB-Wash Bore, WS-Window Sampler

Moisture Abbreviations

D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated

Consistency Abbreviations

Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense

Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE SED03

Client Australian Industrial Energy
Project Preliminary Contamination Assessment
Project No. 2127477
Site Port Kembla Harbour
Location Berth 101
Date Drilled 04/10/2018 - 04/10/2018

Drill Co. McLennans Diving Services
Driller D Allchin
Rig Type
Total Depth (m) 0.67
Diameter (mm) 160

Easting 306876.82
Northing 6184874.64
Grid Ref GDA94_MGA_zone_56
Elevation
Logged By Sarah Eccleshall
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
	hand push	2.7	SED03_0.0-0.1 SED03_0.0-0.5 (FS05 FD05)		MH - Clayey SILT dark brown- black, some coal refuse, some fine sand	S		weak hydrocarbon odour Black colouring from coal, some coal refuse	
0.1		0.3			MH - Clayey SILT dark brown- black, some coal refuse, some fine sand	S	VS	weak hydrocarbon odour Black colouring from coal, some coal refuse	-0.1
0.2									-0.2
0.3					MH - Clayey SILT dark brown- black, some coal refuse, some fine sand	W	S	weak hydrocarbon odour Black colouring from coal, some coal refuse	-0.3
0.4									-0.4
0.5		0.6	SED03_0.5-0.65						-0.5
0.6		0.2			MH - Clayey SILT dark brown- black, some fine sand	W	F	weak hydrocarbon odour Black colouring from coal, some coal refuse	-0.6
0.7					Termination Depth at: 0.67 m. Target depth achieved.				-0.7
0.8									-0.8
0.9									-0.9
1									-1
1.1									-1.1
1.2									-1.2
1.3									-1.3
1.4									-1.4
1.5									-1.5
1.6									-1.6
1.7									-1.7
1.8									-1.8
1.9									-1.9

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V-Vibracore, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE SED04

Client Australian Industrial Energy
Project Preliminary Contamination Assessment
Project No. 2127477
Site Port Kembla Harbour
Location Berth 101
Date Drilled 03/10/2018 - 03/10/2018

Drill Co. McLennans Diving Services
Driller D Allchin
Rig Type Rossfelder Vibracore
Total Depth (m) 0.67
Diameter (mm) 160

Easting 306863
Northing 6184863
Grid Ref GDA94_MGA_zone_56
Elevation
Logged By Sarah Eccleshall
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
0	V	0.2	SED04_0.0-0.1 SED04_0.0-0.5		MH - Clayey SILT dark brown- black, some fine sand	W	VS	weak hydrocarbon odour Black colouring from coal	0
0.5			SED04_0.5-0.6 SED04_0.5-1.0						-0.5
0.7					MH - Clayey SILT dark brown- black, some coal refuse, some fine sand			distinct hydrocarbon odour Black colouring from coal, some coal refuse	-0.7
1			SED04_1.0-1.1 SED04_1.0-1.5						-1
1.1		0.3							-1.1
1.3					MH - Clayey SILT black, some coal refuse, trace fine sand	VM	S	distinct hydrocarbon odour Black colouring from coal, some coal refuse	-1.3
1.5			SED04_1.5-1.6 (FS04, FD04) SED04_1.5-2.0 (FS06, FD06)						-1.5

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V-Vibracore, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE SED04

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
2.1			SED04_2.0-2.1 SED04_2.0-2.5						-2.1
2.2					CH - CLAY grey- black, some silt	M	F	weak hydrocarbon odour no staining, Weathered sandstone inclusions in base of core	-2.2
2.3									-2.3
2.4									-2.4
2.5			SED04_2.5-2.6						-2.5
2.6									-2.6
2.7					Termination Depth at: 2.65m, refusal at bedrock				-2.7
2.8									-2.8
2.9									-2.9
3									-3
3.1									-3.1
3.2									-3.2
3.3									-3.3
3.4									-3.4
3.5									-3.5
3.6									-3.6
3.7									-3.7
3.8									-3.8
3.9									-3.9
4									-4
4.1									-4.1
4.2									-4.2
4.3									-4.3

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V-Vibracore, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE SED05

Client Australian Industrial Energy
Project Preliminary Contamination Assessment
Project No. 2127477
Site Port Kembla Harbour
Location Berth 101
Date Drilled 03/10/2018 - 03/10/2018

Drill Co. McLennans Diving Services
Driller D Allchin
Rig Type Rossfelder Vibracore
Total Depth (m) 2.87
Diameter (mm) 160

Easting 306887
Northing 6184720
Grid Ref GDA94_MGA_zone_56
Elevation
Logged By Sarah Eccleshall
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
0	V	0.2	SED05_0.0-0.1 SED05_0.0-0.5		MH - Clayey SILT dark grey- brown, some fine sand	S	VS	weak hydrocarbon odour Black colouring from coal	0
0.5			SED05_0.5-0.6 SED05_0.5-1.0						-0.5
0.7					MH - Clayey SILT dark black- grey, some coal refuse, some fine sand	W	S	distinct hydrocarbon odour Black colouring from coal, some coal refuse	-0.7
1			SED05_1.0-1.1 SED05_1.0-1.5						-1
1.5			SED05_1.5-1.6 SED05_1.5-2.0						-1.5

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V - Vibracore, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE SED05

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
2									2
2.1			SED05_2.0-2.1 SED05_2.0-2.5		MH - Clayey SILT dark black- grey, some fine sand	VM	S	weak hydrocarbon odour Black colouring from coal	-2.1
2.2									-2.2
2.3									-2.3
2.4									-2.4
2.5			SED05_2.5-2.6						-2.5
2.6									-2.6
2.7					CH - CLAY pale grey	M	F	no odour no staining, Weathered sandstone bedrock at boundary	-2.7
2.8									-2.8
2.9					Termination Depth at: 2.87 m. Refusal on bedrock.				-2.9
3									-3
3.1									-3.1
3.2									-3.2
3.3									-3.3
3.4									-3.4
3.5									-3.5
3.6									-3.6
3.7									-3.7
3.8									-3.8
3.9									-3.9
4									-4
4.1									-4.1
4.2									-4.2
4.3									-4.3

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V - Vibracore, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE SED06

Client Australian Industrial Energy
Project Preliminary Contamination Assessment
Project No. 2127477
Site Port Kembla Harbour
Location Berth 101
Date Drilled 04/10/2018 - 04/10/2018

Drill Co. McLennans Diving Services
Driller D Allchin
Rig Type Rossfelder Vibracore
Total Depth (m) 4.50
Diameter (mm) 160

Easting 306932
Northing 6184733
Grid Ref GDA94_MGA_zone_56
Elevation
Logged By Sarah Eccleshall
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
0	V	0.4	SED06_0.0-0.1 SED06_0.0-0.5		MH - Clayey SILT dark brown- black, some fine sand	W	VS	weak hydrocarbon odour Black colouring from coal	0
0.1									-0.1
0.2									-0.2
0.3									-0.3
0.4									-0.4
0.5			SED06_0.5-0.6 SED06_0.5-1.0						-0.5
0.6		0.6							-0.6
0.7					MH - Clayey SILT dark grey- black, some coal refuse, some fine sand	W	S	distinct hydrocarbon odour Black colouring from coal. Slight reduction in water content down unit	-0.7
0.8									-0.8
0.9									-0.9
1			SED06_1.0-1.1 SED06_1.0-1.5						-1
1.1									-1.1
1.2									-1.2
1.3									-1.3
1.4									-1.4
1.5			SED06_1.5-1.6 SED06_1.5-2.0						-1.5
1.6									-1.6
1.7									-1.7
1.8									-1.8
1.9									-1.9
2									-2

Notes Vibracore from seabed

This log is not intended for geotechnical purposes.

Drilling Abbreviations

AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V-Vibracore, WB-Wash Bore, WS-Window Sampler

Moisture Abbreviations

D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated

Consistency Abbreviations

Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense

Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE SED06

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
2		0.5	SED06_2.0-2.1 SED06_2.0-2.5						2
2.1									-2.1
2.2									-2.2
2.3									-2.3
2.4									-2.4
2.5			SED06_2.5-2.6 SED06_2.5-3.0						-2.5
2.6									-2.6
2.7									-2.7
2.8					MH - Clayey SILT dark grey- black, trace fine sand, some coal	W	F	weak hydrocarbon odour Black colouring from coal, coal refuse	-2.8
2.9									-2.9
3			SED06_3.0-3.1 (FD01, FS01) SED06_3.0-3.5						-3
3.1									-3.1
3.2		0.6							-3.2
3.3									-3.3
3.4									-3.4
3.5			SED06_3.5-3.6 SED06_3.5-4.0						-3.5
3.6									-3.6
3.7									-3.7
3.8									-3.8
3.9									-3.9
4			SED06_4.0-4.1 SED06_4.0-4.4						-4
4.1									-4.1
4.2									-4.2
4.3									-4.3

Notes Vibracore from seabed

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V-Vibracore, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE SED06

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
4.4									-4.4
4.5					Termination Depth at: 4.50 m. Refusal on bedrock.				-4.5
4.6									-4.6
4.7									-4.7
4.8									-4.8
4.9									-4.9
5									-5
5.1									-5.1
5.2									-5.2
5.3									-5.3
5.4									-5.4
5.5									-5.5
5.6									-5.6
5.7									-5.7
5.8									-5.8
5.9									-5.9
6									-6
6.1									-6.1
6.2									-6.2
6.3									-6.3
6.4									-6.4
6.5									-6.5
6.6									-6.6

Notes Vibracore from seabed

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V-Vibracore, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE SED07

Client Australian Industrial Energy
Project Preliminary Contamination Assessment
Project No. 2127477
Site Port Kembla Habour
Location Berth 101
Date Drilled 04/10/2018 - 04/10/2018

Drill Co. McLennans Diving Services
Driller D Allchin
Rig Type
Total Depth (m) 0.67
Diameter (mm) 160

Easting 306952.53
Northing 6184641.64
Grid Ref GDA94_MGA_zone_56
Elevation
Logged By Sarah Eccleshall
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
0.1	hand push	0.4	SED07_0.0-0.65		MH - Clayey SILT dark brown- black, trace coal, some fine sand	S	VS	weak hydrocarbon odour no staining, Black colouring from coal, some coal refuse. 70% of core lost from 0.0-0.6	-0.1
0.2									-0.2
0.3									-0.3
0.4									-0.4
0.5									-0.5
0.6					MH - Clayey SILT dark brown- black, some fine sand	W	F	weak hydrocarbon odour Black colouring from coal, some coal refuse	-0.6
0.7					Termination Depth at: 0.67 m. Target depth achieved.				-0.7
0.8									-0.8
0.9									-0.9
1									-1
1.1									-1.1
1.2									-1.2
1.3									-1.3
1.4									-1.4
1.5									-1.5
1.6									-1.6
1.7									-1.7
1.8									-1.8
1.9									-1.9

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations

AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V-Vibracore, WB-Wash Bore, WS-Window Sampler

Moisture Abbreviations

D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated

Consistency Abbreviations

Granular Soils VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense

Cohesive Soils VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE REA01

Client Australian Industrial Energy
Project Preliminary Contamination Assessment
Project No. 2127477
Site Port Kembla Harbour
Location Reclamation Area
Date Drilled 03/10/2018 - 03/10/2018

Drill Co. McLennans Diving Services
Driller D Allchin
Rig Type Rossfelder Vibracore
Total Depth (m) 3.57
Diameter (mm) 160

Easting 308069
Northing 6183381
Grid Ref GDA94_MGA_zone_56
Elevation
Logged By Sarah Eccleshall
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
0	V	0.1	REA01_0.0-0.1 REA01_0.0-0.5		MH - Clayey SILT dark black- brown, some coal refuse, some shells	W	VS	weak hydrocarbon odour Black colouring from coal, some coal refuse	0
0.1		0.3							-0.1
0.2					MH - Clayey SILT fine, dark black- brown, and fine sand, with coal refuse	W	S	distinct hydrocarbon odour Black colouring from coal, some coal refuse	-0.2
0.3									-0.3
0.4									-0.4
0.5			REA01_0.5-0.6 REA01_0.5-1.0						-0.5
0.6									-0.6
0.7									-0.7
0.8									-0.8
0.9					MH - Clayey SILT dark black- brown, trace coal refuse, with fine sand	W	S	distinct hydrocarbon odour Black colouring from coal, trace coal refuse	-0.9
1			REA01_1.0-1.1 REA01_1.0-1.5						-1
1.1					SP - SAND coarse, poorly graded, subangular, black	W	MD	Major consituent coal, coal	-1.1
1.2		1.6			MH - Clayey SILT dark black- brown, some coal refuse, some fine to medium sand	W	F	distinct hydrocarbon odour Black colouring from coal, some coal refuse	-1.2
1.3									-1.3
1.4									-1.4
1.5			REA01_1.5-1.6 REA01_1.5-2.0						-1.5
1.6									-1.6
1.7									-1.7
1.8									-1.8
1.9									-1.9

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon,V - Vibracore, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE REA01

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
2			REA01_2.0-2.1 (FS03, FD03) REA01_2.0-2.5						2
2.1									-2.1
2.2									-2.2
2.3									-2.3
2.4									-2.4
2.5			REA01_2.5-2.6 REA01_2.5-3.0						-2.5
2.6									-2.6
2.7									-2.7
2.8		0.4							-2.8
2.9									-2.9
3			REA01_3.0-3.1 REA01_3.0-3.5						-3
3.1					SW-SC - Clayey SAND fine to medium, well graded, rounded, dark black- brown mottled brown	M	D	strong hydrocarbon odour Black colouring from coal, some concrete	-3.1
3.2		0.7							-3.2
3.3									-3.3
3.4			REA01_3.4-3.5						-3.4
3.5									-3.5
3.6					Termination Depth at: 3.57 m. Refusal on unindentified surface.				-3.6
3.7									-3.7
3.8									-3.8
3.9									-3.9
4									-4
4.1									-4.1
4.2									-4.2
4.3									-4.3

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon,V - Vibracore, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE REA02

Client Australian Industrial Energy
Project Preliminary Contamination Assessment
Project No. 2127477
Site Port Kembla Harbour
Location Reclamation Area
Date Drilled 03/10/2018 - 03/10/2018

Drill Co. McLennans Diving Services
Driller D Allchin
Rig Type Rossfelder Vibracore
Total Depth (m) 3.45
Diameter (mm) 160

Easting 307895
Northing 6183523
Grid Ref GDA94_MGA_zone_56
Elevation
Logged By Sarah Eccleshall
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
0	V	0.4	REA02_0.0-0.1 REA02_0.0-0.5		SW-SM - SAND medium, well graded, subrounded to rounded, dark grey- brown, some clayey silt	W	D	no odour Black colouring from coal	0
0.1									-0.1
0.2									-0.2
0.3									-0.3
0.4									-0.4
0.5			REA02_0.5-0.6 REA02_0.5-1.0						-0.5
0.6									-0.6
0.7					MH - Clayey SILT dark grey- brown, trace fine sand	W	S	weak hydrocarbon odour Black colouring from coal. Decreasing sand content with depth in unit, some coal refuse	-0.7
0.8		0.2							-0.8
0.9									-0.9
1			REA02_1.0-1.1 REA02_1.0-1.5						-1
1.1									-1.1
1.2									-1.2
1.3									-1.3
1.4									-1.4
1.5			REA02_1.5-1.6 REA02_1.5-2.0						-1.5
1.6									-1.6
1.7									-1.7
1.8									-1.8
1.9									-1.9

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V - Vibracore, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-SOIL BORE

SOIL BORE REA02

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
2		0.3	REA02_2.0-2.1 (FD03, FS03) REA02_2.0-2.5						2
2.1					SM - Silty SAND dark grey- brown, some clay, trace fine gravel	W		weak hydrocarbon odour Slight black staining from coal	-2.1
2.2									-2.2
2.3									-2.3
2.4		0.2			SM - SAND medium, well graded, rounded, grey, some shells	M	D	no odour	-2.4
2.5			REA02_2.5-2.6 REA02_2.5-3.0						-2.5
2.6									-2.6
2.7									-2.7
2.8									-2.8
2.9					ML - CLAY grey- brown mottled pale brown, some silt	M	VST	no odour	-2.9
3			REA02_3.0-3.1						-3
3.1									-3.1
3.2									-3.2
3.3									-3.3
3.4									-3.4
3.5					Termination Depth at: 3.45 m. Refusal on unindentified surface.				-3.5
3.6									-3.6
3.7									-3.7
3.8									-3.8
3.9									-3.9
4									-4
4.1									-4.1
4.2									-4.2
4.3									-4.3

Notes

This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, V - Vibracore, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

Appendix D – Field Documentation

Calibration & Service Report
Gas Monitor

Company: Active Environmental Solutions Hire
Contact: Aleks Todorovic
Address: 2 Merchant Avenue
Thomastown Vic 3074
Phone: 03 9464 2300 | Fax: 03 9464 3421
Email: Hire@aesolutions.com.au

Manufacturer:	RAE Systems	Serial #:	592-901218
Instrument:	MiniRAE 3000	Asset #:	-
Model:	PGM 7320	Part #:	-
Configuration:	VOC	Sold:	-
Wireless:	-	Last Cal:	-
Network ID:	-	Job #:	-
Unit ID:	-	Cal Spec:	Std

Item	Test	Pass/Fail	Comments
Battery	Li Ion	✓	
Charger	Charger, Power supply	✓	
	Cradle	✓	
Pump	Flow	✓	>500 mL/min
Filter	Filter, fitting, etc	✓	
Alarms	Audible, visual, vibration	✓	
Display	Operation	✓	
PCB	Operation	✓	
Connectors	Condition	✓	
Firmware	Version	✓	2.16
Datalogger	Operation	✓	
Monitor Housing	Condition	✓	
Case	Condition/Type	✓	
Sensors			
Oxygen		-	
LEL		-	
PID	10.6eV	✓	
Toxic 1		-	
Toxic 2		-	
Toxic 3		-	
Toxic 4		-	
Toxic 5		-	

Engineer's Report

Setup, service and calibration for hire

Calibration Certificate

Sensor	Type	Serial No:	Span Gas	Concentration	Traceability Lot #	CF	Reading	
							Zero	Span
Oxygen								
LEL								
PID	10.6eV	2R003225	Isobutylene	100 PPM	WO148384-1	1	0	100 PPM
Toxic 1								
Toxic 2								
Toxic 3								
Toxic 4								
Toxic 5								

Calibrated/Repaired by: Milenko Sisic

Date: 2nd October 2018 Next due: 2nd April 2019

MDS Daily Vibrocoring Log Sheet

Site SED05	Day Wed	Date 03/10/18
GPS Location	Easting 306887	Northing 6184720.
Time on Site 4.01	Time off Site 2:35	
Personnel David Allchin		
Vessels	Polaris	Sea hunt
Weather	Wind Direction ~~NW~~ SW	Wind Strength 18. Knots
Type of Core Tube: Al / (Steel) / Plas	Length of Tube 4.5 Metres	Tube Gauge 1.6m mm
Target Depth Metres	Sounded Depth 13.35 Metres	Depth Reached 2.86 Metres
Vibration Strength	Duration of Vibrations 2.29 Mins	Corer Ballast Kilos
No. of Sub Samples	Sub Sample Spacing mm	Finger Gauge .9 mm
No. of Sub Samples given to Lab		Time Delivered

Description of Core

penetration - lost 500mm

Completed By: Date / /

MDS Daily Vibrocoring Log Sheet

Site SEP03	Day Thursday	Date 4/10/18
GPS Location	Easting	Northing
Time on Site 12.44	Time off Site 13.04	
Personnel DAVID ALLCHIN		
Vessels	Sea Hunt	
Weather RAIN	Wind Direction	Wind Strength Knots
Type of Core Tube: Al / (Steel) / Plas	Length of Tube 1.6 Metres	Tube Gauge mm
Target Depth Metres	Sounded Depth 12.5 Metres	Depth Reached 1.6 Metres
Vibration Strength	Duration of Vibrations Mins	Corer Ballast Kilos
No. of Sub Samples	Sub Sample Spacing mm	Finger Gauge mm
No. of Sub Samples given to Lab		Time Delivered

Description of Core

Hand Core - no vibrations used.

Silty muddy bottom with small Stones.

Completed By: Date / /

MDS Daily Vibrocoring Log Sheet

Site SED02.	Day Thursday	Date 4/10/18	
GPS Location	Easting	Northing	
Time on Site 12.23	Time off Site 12.40.		
Personnel DAVID ALLCHIN			
Vessels	Seahunt		
Weather RAIN	Wind Direction	Wind Strength	Knots
Type of Core Tube: Al / (Steel) / Plas	Length of Tube Metres	Tube Gauge 1.6.	mm
Target Depth Metres	Sounded Depth Metres	Depth Reached 1.6.	Metres
Vibration Strength	Duration of Vibrations Mins	Corer Ballast	Kilos
No. of Sub Samples	Sub Sample Spacing mm	Finger Gauge	mm
No. of Sub Samples given to Lab		Time Delivered	

Description of Core

Hand Core - no vibrations used

Silty muddy bottom.

Completed By: Date / /

MDS Daily Vibrocoring Log Sheet

Site REA02	Day Wed	Date 03/10/18
GPS Location	Easting 307895	Northing 6183523
Time on Site 12.44	Time off Site	
Personnel David ALLCHIN		
Vessels	Polaris	Seahunt
Weather	Wind Direction	Wind Strength Knots
Type of Core Tube: Al / (Steel) / Plas	Length of Tube 4.5 Metres	Tube Gauge 1.6 mm
Target Depth Metres	Sounded Depth 11.75 Metres	Depth Reached 3.45 Metres
Vibration Strength	Duration of Vibrations 3.10 Mins	Corer Ballast Kilos
No. of Sub Samples	Sub Sample Spacing mm	Finger Gauge .9 mm
No. of Sub Samples given to Lab		Time Delivered

Description of Core

11750

Completed By: Date / /

MDS Daily Vibrocoring Log Sheet

Site REA07	Day 03/10/18 Wed	Date 03/10/18
GPS Location 308069	Easting 308069	Northing 6183 381
Time on Site 11.25	Time off Site 12.11.	
Personnel David McLellan		
Vessels Polaris/Sea hunt	Polaris	Sea Hunt.
Weather	Wind Direction	Wind Strength Knots
Type of Core Tube: Al / (Steel) / Plas	Length of Tube 4.5 Metres	Tube Gauge 1.6 mm
Target Depth 4 Metres	Sounded Depth 7.2 Metres	Depth Reached 3.57 Metres
Vibration Strength	Duration of Vibrations 4.2 Mins	Corer Ballast Kilos
No. of Sub Samples	Sub Sample Spacing mm	Finger Gauge .9 mm
No. of Sub Samples given to Lab		Time Delivered

Description of Core

Penetration 4230.

3570
660
4230
1

Completed By: Date / /

MDS Daily Vibrocoring Log Sheet

Site SED04	Day Wed	Date 03/10
GPS Location	Easting 863	Northing 822.
Time on Site 16.00	Time off Site	16.24.
Personnel David ALLCHIN		
Vessels	Polaris	Sea Hunt.
Weather	Wind Direction	Wind Strength Knots
Type of Core Tube: Al / Steel / Plas	Length of Tube 4.5 Metres	Tube Gauge 1.6 mm
Target Depth Metres	Sounded Depth 14 Metres	Depth Reached 2.64 Metres
Vibration Strength	Duration of Vibrations 3.11 Mins	Corer Ballast Kilos
No. of Sub Samples	Sub Sample Spacing mm	Finger Gauge .9 mm
No. of Sub Samples given to Lab		Time Delivered

Description of Core

took refusal at bedrock.

Completed By: Date / /

MDS Daily Vibrocoring Log Sheet

Site SED07	Day Thursday	Date 4/10/18
GPS Location	Easting	Northing
Time on Site 11.45	Time off Site 12.00	
Personnel David AUCHIN		
Vessels	Sea hunt	
Weather RAIN	Wind Direction	Wind Strength Knots
Type of Core Tube: Al / (Steel) / Plas	Length of Tube 1.6 Metres	Tube Gauge 1.6 mm
Target Depth Metres	Sounded Depth Metres	Depth Reached 1.6 Metres
Vibration Strength	Duration of Vibrations Mins	Corer Ballast Kilos
No. of Sub Samples	Sub Sample Spacing mm	Finger Gauge mm
No. of Sub Samples given to Lab		Time Delivered

Description of Core

Hand core - no vibrations used.

Silty mud top Surface.

Completed By: Date / /

MDS Daily Vibrocoring Log Sheet

Site SED01	Day Thursday	Date 4/10/18
GPS Location	Easting	Northing
Time on Site 12.02	Time off Site	12.20
Personnel	David Allchin	
Vessels	Sea Hunt	
Weather RAIN	Wind Direction	Wind Strength Knots
Type of Core Tube: Al / (Steel) / Plas	Length of Tube Metres	Tube Gauge 1.6 mm
Target Depth Metres	Sounded Depth 15.5 Metres	Depth Reached 1.6. Metres
Vibration Strength	Duration of Vibrations Mins	Corer Ballast Kilos
No. of Sub Samples	Sub Sample Spacing mm	Finger Gauge mm
No. of Sub Samples given to Lab		Time Delivered

Description of Core

Hand core - No vibrations used.

Completed By: Date / /

MDS Daily Vibrocoring Log Sheet

Site SED06	Day Wed	Date 03/10/18
GPS Location	Easting 306932	Northing 6184733
Time on Site 3.26	Time off Site	3.43
Personnel David Allchin		
Vessels	Polaris	Sea Hunt
Weather	Wind Direction	Wind Strength Knots
Type of Core Tube: Al / (Steel) / Plas	Length of Tube 4.5 Metres	Tube Gauge 1.6 mm
Target Depth Metres	Sounded Depth 10.4 Metres	Depth Reached 4.5 Metres
Vibration Strength	Duration of Vibrations 3.24 Mins	Corer Ballast Kilos
No. of Sub Samples	Sub Sample Spacing mm	Finger Gauge .9 mm
No. of Sub Samples given to Lab		Time Delivered

Description of Core

full core, no refusal.

Completed By: Date / /

Appendix E - Laboratory Documentation

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☑ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
☐BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
☐NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: GHD Pty Ltd

OFFICE: level 15, 133 Castlereagh St, Sydney

PROJECT: 21-27477 - Task 3J for Contamination

ORDER NUMBER: 2127477

PROJECT MANAGER: Jacqui Hallchurch — CONTACT PH: 0447 202 580

SAMPLER: Sarah Eccleshall — SAMPLER MOBILE: 0459 546 332

COC emailed to ALS? (YES / NO) — EDD FORMAT (or default):

Email Reports to: sarah.eccleshall@ghd.com; jacqui.hallchurch@ghd.com

Email Invoice to (will default to PM if no other addresses are listed):

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)
☑ Standard TAT (List due date):
☑ Non Standard or urgent TAT (List due date): 3 days

ALS QUOTE NO.: SY-236-18

COC SEQUENCE NUMBER (Circle)
COC: (1) 2 3 4 5 6 7
OF: 1 2 3 (4) 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No (N/A)
Free ice / frozen ice bricks present upon receipt? (Yes) No N/A
Random Sample Temperature on Receipt: °C
Other comment: 10

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
S. Eccleshall	ANDREW		
DATE/TIME: 4/10/18 21:00	DATE/TIME: 4/10/18 9:00 PM	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE | SAMPLE DETAILS MATRIX: SOLID (S) WATER (W) | CONTAINER INFORMATION

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)
Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	B7 Suite: TRH, BTEX, PAH, Metals (8)	TBT	Dioxins	Cyanide	Ammonia	TOC	PSD	Moisture content								Hold
	~~SED06~~																				
1	SED06_0.0-0.1	4/10/18 10:15	S	B, Jar	2																X
2	SED06_0.5-0.6	4/10/18 10:30	S	B, Jar	2																X
3	SED06_1.0-1.1	4/10/18 10:40	S	B, Jar	2																X
4	SED06_1.5-1.6	4/10/18 10:45	S	B, Jar	2																X
5	SED06_2.0-2.1	4/10/18 10:55	S	B, Jar	2																X
6	SED06_2.5-2.6	4/10/18 11:00	S	B, Jar	2																X
7	SED06_3.0-3.1	4/10/18 11:10	S	B, Jar	2																X
8	SED06_3.5-3.6	4/10/18 11:15	S	B, Jar	2																X
9	SED06_4.0-4.1	4/10/18 11:20	S	B, Jar	2																X
10	SED06_4.3-4.4	4/10/18 11:25	S	B, Jar	2																X
11	FD03	4/10/18	S	B, Jar	1																✓
					TOTAL																

TAT

Environmental Division
Sydney
Work Order Reference
ES1829388

Telephone: +61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass U... V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS... F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0690 E: adelaide@alsglobal.com
BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 45 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5800 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4958 9433 E: samples.newcastle@alsglobal.com
NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: GHD Pty Ltd	**TURNAROUND REQUIREMENTS:** ☐ Standard TAT (List due date):	**FOR LABORATORY USE ONLY (Circle)**	
OFFICE: level 15, 133 Castlereagh St, Sydney	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☑ Non Standard or urgent TAT (List due date):	Custody Seal Intact?	Yes / No / N/A
PROJECT: 21-27477 - Task 3J for Contamination	**ALS QUOTE NO.:** SY-236-18	Cooler / Frozen Ice Bricks present upon receipt?	Yes / No / N/A
ORDER NUMBER: 2127477	**COC SEQUENCE NUMBER (Circle)** COC: 1 (2) 3 4 5 6 7	Random Sample Temperature on Receipt	°C
PROJECT MANAGER: Jacqui Hallchurch **CONTACT PH:** 0447 202 580	SOF: 1 2 3 (4) 5 6 7	Other comments:	

SAMPLER: Sarah Eccleshall	**SAMPLER MOBILE:** 0459 546 332	**RELINQUISHED BY:** S. Eccleshall	**RECEIVED BY:**	**RELINQUISHED BY:**
COC emailed to ALS? (YES / NO)	**EDD FORMAT (or default):**			
Email Reports to: sarah.eccleshall@ghd.com; jacqui.hallchurch@ghd.com		**DATE/TIME:** 4/10/18 21:00	**DATE/TIME:**	**DATE/TIME:**
Email Invoice to (will default to PM if no other addresses are listed):				

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)
Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	B7 Suite: TRH, BTEX, PAH, Metals (8)	TBT	Dioxins	Cyanide	Ammonia	TOC	PSD	Moisture content								Hold
12	SEDOS_0.0-0.1	4/10/18 16:00	S	B, Jar	2																X
13	SEDOS_0.5-0.6	4/10/18																			X
14	SEDOS_1.0-1.1	4/10/18																			X
15	SEDOS_1.5-1.6	4/10/18																			X
16	SEDOS_2.0-2.1	4/10/18																			X
17	SEDOS_2.5-2.6	4/10/18																			X
	~~SEDOS_3.0-3.1~~	~~4/10/18~~																			X
18	FS01	4/10/18		Jar	1																X
19	FS02			"	1																X
20	FS03			"	1																X
21	FD01			"	1																X
22	FD02			"	1																X
				TOTAL																	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgeemail@alsglobal.com
NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
ORANGE 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: GHD Pty Ltd	**TURNAROUND REQUIREMENT:** ☐ Standard TAT (List due date):		**FOR LABORATORY USE ONLY (Circle)**
OFFICE: level 15, 133 Castlereagh St, Sydney	(Standard TAT may be longer for some tests e.g., Ultra Trace Organics) ☒ Non Standard or urgent TAT (List due date):		Custody Seal Intact? Yes / No / N/A
PROJECT: 21-27477 - Task 3J for Contamination	**ALS QUOTE NO.:** SY-236-18	**COC SEQUENCE NUMBER (Circle)**	Free Ice / Ice Bricks present upon receipt? Yes / No / N/A
ORDER NUMBER: 2127477		COC: 1 2 (3) 4 5 6 7	Random Sample Temperature on Receipt:
PROJECT MANAGER: Jacqui Hallchurch	**CONTACT PH:** 0447 202 580	OR: 1 2 3 (4) 5 6 7	Other Comments:
SAMPLER: Sarah Eccleshall	**SAMPLER MOBILE:** 0459 546 332	**RELINQUISHED BY:** Jacqui Hallchurch & Sarah Eccleshall	**RECEIVED BY:**
COC emailed to ALS? (YES / NO)	**EDD FORMAT (or default):**	DATE/TIME: 4/10/18 21:00	DATE/TIME:
Email Reports to: sarah.eccleshall@ghd.com; jacqui.hallchurch@ghd.com		**RELINQUISHED BY:**	**RECEIVED BY:**
Email Invoice to (will default to PM if no other addresses are listed):		DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS — MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price). Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).																
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	B7 Suite: TRH, BTEX, PAH, Metals (8)	TBT	Dioxins	Cyanide	Ammonia	TOC	PSD	Moisture content									Hold
23	REA01_0.0-0.1	4/10/18	S	B, Jar	2																	X
24	REA01_0.5-0.6	↓	↓	↓	2																	X
25	REA01_1.0-1.1				2																	X
26	REA01_1.5-1.6				2																	X
27	REA01_2.0-2.1				2																	X
28	REA01_2.5-2.6				2																	X
29	REA01_3.0-3.1				2																	X
30	REA01_3.5-3.5				2																	X
31	REA02_0.0-0.1				2																	X
32	REA02_0.5-0.6				2																	X
33	REA02_1.0_1.1				2																	X
34	REA02_1.5-1.6				2																	X
				TOTAL																		

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

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☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
☐NEWCASTLE 6 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
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☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: GHD Pty Ltd
OFFICE: level 15, 133 Castlereagh St, Sydney
PROJECT: 21-27477 - Task 3J for Contamination
ORDER NUMBER: 2127477
PROJECT MANAGER: Jacqui Hallchurch **CONTACT PH:** 0447 202 580
SAMPLER: Sarah Eccleshall **SAMPLER MOBILE:** 0459 546 332
COC emailed to ALS? (YES / NO) **EDD FORMAT (or default):**
Email Reports to: sarah.eccleshall@ghd.com; jacqui.hallchurch@ghd.com
Email Invoice to (will default to PM if no other addresses are listed):

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics) ☐ Standard TAT (List due date): ☒ Non Standard or urgent TAT (List due date):
ALS QUOTE NO.: SY-236-18

COC SEQUENCE NUMBER (Circle) COC: 1 2 3 (4) 5 6 7 OF: 1 2 3 (4) 5 6 7

FOR LABORATORY USE ONLY (Circle) Custody Seal Intact? Yes No N/A; Free ice / frozen ice bricks present upon receipt? Yes No N/A; Random Sample Temperature on Receipt; Other comment

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
S. Eccleshall			
DATE/TIME: 4/10/18 21:00	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).

ALS USE: LAB ID	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W): SAMPLE ID	DATE / TIME	MATRIX	CONTAINER INFORMATION: TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	B7 Suite: TRH, BTEX, PAH, Metals (8)	TBT	Dioxins	Cyanide	Ammonia	TOC	PSD	Moisture content								Hold
35	REA02_2.0-2.1	4/10/18	S	B, Jar	2																X
36	REA02_2.5-2.6	4/10/18	S	B, Jar	2																X
37	REA02_3.0-3.1	4/10/18	S	B, Jar	2																X
38	TRIP Blank	4/10/18	S	Jar	1	X															
SNR ~~39~~	TRIP SPIKE	4/10/18	S	Jar	1	X															
40	RN_01	4/10/18	W	V, N, AG, V	4	X		Please ask separ re standard rinsate analyses													
Received 39	TRIP Blank	2/10/18		Jar																	
41	RN01_01	4/10/18	W	V, V, N, AG	4																
42	TRIP SPIKE	2/10/18	S	Jar	1																
43	TSC																				
				TOTAL																	

ANDREW 5/10/18 8:29AM

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES1829388**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Brenda Hong
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	: Brenda.Hong@alsglobal.com
Telephone	: +61 02 9239 7100	Telephone	: (02) 8784 8504
Facsimile	: +61 02 9239 7199	Facsimile	: +61-2-8784 8500
Project	: 2127477	Page	: 1 of 4
Order number	: 2127477	Quote number	: ES2018GHDSER0015 (SY/236/18)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: 21-27477 - Task 3J for Contamination		
Sampler	: SARAH ECCLESHALL		

Dates

Date Samples Received	: 04-Oct-2018 21:00	Issue Date	: 06-Oct-2018
Client Requested Due Date	: 10-Oct-2018	Scheduled Reporting Date	: **10-Oct-2018**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Not Available
No. of coolers/boxes	: 2	Temperature	: 10.3 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 43 / 5

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Updated SRN Please note that sample 41-43 have been added as per client request.**
- **Updated SRN: only samples 1-40 are due on the 10/10/18, samples 41-43 are due on the 11/10/18**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Updated SRN: Please note that the scheduled reporting date has not been confirmed with laboratory management due to the late arrival of sample 41-43. If the scheduled reporting date is not achievable ALS will be in contact with you.
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - S-18 (NO MOIST) TRH(C6-C9)/BTEXN with No Moisture for TBs
ES1829388-001	04-Oct-2018 10:15	SED06_0.0-0.1	✓	
ES1829388-002	04-Oct-2018 10:30	SED06_0.5-0.6	✓	
ES1829388-003	04-Oct-2018 10:40	SED06_1.0-1.1	✓	
ES1829388-004	04-Oct-2018 10:45	SED06_1.5-1.6	✓	
ES1829388-005	04-Oct-2018 10:55	SED06_2.0-2.1	✓	
ES1829388-006	04-Oct-2018 11:00	SED06_2.5-2.6	✓	
ES1829388-007	04-Oct-2018 11:10	SED06_3.0-3.1	✓	
ES1829388-008	04-Oct-2018 11:15	SED06_3.5-3.6	✓	
ES1829388-009	04-Oct-2018 11:20	SED06_4.0-4.1	✓	
ES1829388-010	04-Oct-2018 11:25	SED06_4.3-4.4	✓	
ES1829388-011	04-Oct-2018 00:00	FD03	✓	
ES1829388-012	04-Oct-2018 16:00	SED05_0.0-0.1	✓	
ES1829388-013	04-Oct-2018 00:00	SED05_0.5-0.6	✓	
ES1829388-014	04-Oct-2018 00:00	SED05_1.0-1.1	✓	
ES1829388-015	04-Oct-2018 00:00	SED05_1.5-1.6	✓	
ES1829388-016	04-Oct-2018 00:00	SED05_2.0-2.1	✓	
ES1829388-017	04-Oct-2018 00:00	SED05_2.5-2.6	✓	
ES1829388-018	04-Oct-2018 00:00	FS01	✓	
ES1829388-019	04-Oct-2018 00:00	FS02	✓	
ES1829388-020	04-Oct-2018 00:00	FS03	✓	
ES1829388-021	04-Oct-2018 00:00	FD01	✓	
ES1829388-022	04-Oct-2018 00:00	FD02	✓	
ES1829388-023	04-Oct-2018 00:00	REA01_0.0-0.1	✓	
ES1829388-024	04-Oct-2018 00:00	REA01_0.5-0.6	✓	
ES1829388-025	04-Oct-2018 00:00	REA01_1.0-1.1	✓	
ES1829388-026	04-Oct-2018 00:00	REA01_1.5-1.6	✓	
ES1829388-027	04-Oct-2018 00:00	REA01_2.0-2.1	✓	
ES1829388-028	04-Oct-2018 00:00	REA01_2.5-2.6	✓	
ES1829388-029	04-Oct-2018 00:00	REA01_3.0-3.1	✓	
ES1829388-030	04-Oct-2018 00:00	REA01_3.4-3.5	✓	
ES1829388-031	04-Oct-2018 00:00	REA02_0.0-0.1	✓	
ES1829388-032	04-Oct-2018 00:00	REA02_0.5-0.6	✓	
ES1829388-033	04-Oct-2018 00:00	REA02_1.0-1.1	✓	
ES1829388-034	04-Oct-2018 00:00	REA02_1.5-1.6	✓	
ES1829388-035	04-Oct-2018 00:00	REA02_2.0-2.1	✓	

			(On Hold) SOIL No analysis requested	SOIL - S-18 (NO MOIST) TRH(C6-C9)/BTEXN with No Moisture for TBs
ES1829388-036	04-Oct-2018 00:00	REA02_2.5-2.6	✓	
ES1829388-037	04-Oct-2018 00:00	REA02_3.0-3.1	✓	
ES1829388-038	02-Oct-2018 00:00	Trip Blank		✓
ES1829388-039	02-Oct-2018 00:00	Trip Blank	✓	
ES1829388-042	02-Oct-2018 00:00	TRIP SPIKE		✓
ES1829388-043	02-Oct-2018 00:00	TSC		✓

Matrix: **WATER**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	WATER - W-26T TRH/BTEXN/PAH/Total 8 Metals
ES1829388-040	04-Oct-2018 00:00	RN_01	✓
ES1829388-041	04-Oct-2018 00:00	RN01_1	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE (Brisbane)

- A4 - AU Tax Invoice (INV)	Email	ap-fss@ghd.com

GHD LAB REPORTS

- *AU Certificate of Analysis - NATA (COA)	Email	ghdlabreports@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ghdlabreports@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ghdlabreports@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ghdlabreports@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	ghdlabreports@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	ghdlabreports@ghd.com

JACQUI HALLCHURCH

- *AU Certificate of Analysis - NATA (COA)	Email	jacqui.hallchurch@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jacqui.hallchurch@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jacqui.hallchurch@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jacqui.hallchurch@ghd.com
- Chain of Custody (CoC) (COC)	Email	jacqui.hallchurch@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	jacqui.hallchurch@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	jacqui.hallchurch@ghd.com

SARAH ECCLESHALL

- *AU Certificate of Analysis - NATA (COA)	Email	sarah.eccleshall@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	sarah.eccleshall@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	sarah.eccleshall@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	sarah.eccleshall@ghd.com
- Chain of Custody (CoC) (COC)	Email	sarah.eccleshall@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	sarah.eccleshall@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	sarah.eccleshall@ghd.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1829388**	Page	: 1 of 6
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Brenda Hong
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9239 7100	Telephone	: (02) 8784 8504
Project	: 2127477	Date Samples Received	: 04-Oct-2018 21:00
Order number	: 2127477	Date Analysis Commenced	: 05-Oct-2018
C-O-C number	: ----	Issue Date	: 10-Oct-2018 13:07
Sampler	: SARAH ECCLESHALL		
Site	: 21-27477 - Task 3J for Contamination		
Quote number	: SY/236/18		
No. of samples received	: 43		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

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 insufficient sample for analysis.

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP080: The trip spike and its control have been analysed for volatile TPH and BTEX only. The trip spike and control were prepared in the lab using reagent grade sand spiked with petrol. The spike was dispatched from the lab and the control retained.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	Trip Blank	TRIP SPIKE	TSC	----	----
				Client sampling date / time	02-Oct-2018 00:00	02-Oct-2018 00:00	02-Oct-2018 00:00	----	----
Compound	CAS Number	LOR	Unit		ES1829388-038	ES1829388-042	ES1829388-043	--------	--------
					Result	Result	Result	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	**22**	**28**	**----**	**----**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	**27**	**33**	**----**	**----**
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg		<10	<10	**12**	**----**	**----**
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	**0.2**	**----**	**----**
Toluene	108-88-3	0.5	mg/kg		<0.5	**8.4**	**10.4**	**----**	**----**
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	**1.0**	**1.2**	**----**	**----**
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	**5.6**	**6.7**	**----**	**----**
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	**2.2**	**2.6**	**----**	**----**
^ **Sum of BTEX**	----	0.2	mg/kg		<0.2	**17.2**	**21.1**	**----**	**----**
^ **Total Xylenes**	----	0.5	mg/kg		<0.5	**7.8**	**9.3**	**----**	**----**
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	**----**	**----**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**88.4**	**92.5**	**99.2**	**----**	**----**
Toluene-D8	2037-26-5	0.2	%		**89.9**	**91.4**	**101**	**----**	**----**
4-Bromofluorobenzene	460-00-4	0.2	%		**87.9**	**91.1**	**99.7**	**----**	**----**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	RN_01	RN01_1	----	----	----
			Client sampling date / time	04-Oct-2018 00:00	04-Oct-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ES1829388-040	ES1829388-041	--------	--------	--------
				Result	Result	----	----	----
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	<0.5	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RN_01	RN01_1	----	----	----
				Client sampling date / time	04-Oct-2018 00:00	04-Oct-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1829388-040	ES1829388-041	--------	--------	--------
					Result	Result	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	----	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	----	----	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	<100	----	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	----	----	----
Toluene	108-88-3	2	µg/L		<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
^ **Total Xylenes**	----	2	µg/L		<2	<2	----	----	----
^ **Sum of BTEX**	----	1	µg/L		<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**26.9**	**20.4**	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		**57.3**	**50.7**	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		**37.7**	**49.0**	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**84.8**	**66.3**	----	----	----
Anthracene-d10	1719-06-8	1.0	%		**75.3**	**66.2**	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		**87.2**	**78.8**	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**103**	**105**	----	----	----
Toluene-D8	2037-26-5	2	%		**102**	**104**	----	----	----
4-Bromofluorobenzene	460-00-4	2	%		**97.6**	**99.7**	----	----	----

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

ALS Environmental

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Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500
Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: GHD Pty Ltd

OFFICE: level 15, 133 Castlereagh St, Sydney

PROJECT: 21-27477 - Task 3J for Contamination

ORDER NUMBER: 2127477

PROJECT MANAGER: Jacqui Hallchurch **CONTACT PH:** 0447 202 580

SAMPLER: Sarah Eccleshall **SAMPLER MOBILE:** 0459 546 332

COC emailed to ALS? (YES / NO) **EDD FORMAT (or default):**

Email Reports to: sarah.eccleshall@ghd.com; jacqui.hallchurch@ghd.com

Email Invoice to (will default to PM if no other addresses are listed):

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)
☐ Standard TAT (List due date):
☒ Non Standard or urgent TAT (List due date): 3 days

ALS QUOTE NO.: SY-236-18

COC SEQUENCE NUMBER (Circle)
COC: (1) 2 3 4 5 6 7
OF: 1 2 3 4 (5) 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No (N/A)
Free ice / frozen ice bricks present upon receipt? (Yes) No N/A
Random Sample Temperature on Receipt: 5.2 °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
S. Eccleshall	ANDREW		
DATE/TIME: 5/10/18	DATE/TIME: 5/10/18 8:30pm	DATE/TIME:	DATE/TIME:

Subcon / Forward Lab / Analysis: Dioxins/Furans
Organised By / Date: ES1840028
PSD - Newcastle
TBT - Brisbane
Attach

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).															
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	B7 Suite: TRH, BTEX, PAH, Metals (8)	TBT	Dioxins/Furans	Cyanide	Ammonia	TOC	PSD	Moisture content								Hold
1	SED06_0.0-0.5	5/10/18	S	2x Jar, B	3	X	X	X	X	X	X	X	X								
2	SED06_0.5-1.0	↓	↓	↓	3																X
3	SED06_1.0-1.5				3	X	X	X	X	X	X	X	X								
4	SED06_1.5-2.0				3																X
5	SED06_2.0-2.5				3																X
6	SED06_2.5-3.0				3																X
7	SED06_3.0-3.5			Jar, B	2																X
8	SED06_3.5-4.0			Jar, B	2																X
9	SED06_4.0-4.4			Jar, B	2																✓
10	SED05_0.0-0.5				3	X	X	X	X	X	X	X	X								
11	SED05_0.5-1.0				3																X
12	SED05_1.0-1.5				3	X	X	X	X	X	X	X	X								

TAT

Environmental Division
Sydney
Work Order Reference
ES1829588

Telephone : + 61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ... ved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = V ... Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle ... g.

CHAIN OF CUSTODY

ALS Environmental

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CLIENT: GHD Pty Ltd

OFFICE: level 15, 133 Castlereagh St, Sydney

PROJECT: 21-27477 - Task 3J for Contamination

ORDER NUMBER: 2127477

PROJECT MANAGER: Jacqui Hallchurch **CONTACT PH:** 0447 202 580

SAMPLER: Sarah Eccleshall **SAMPLER MOBILE:** 0459 546 332

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Email Invoice to (will default to PM if no other addresses are listed):

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☐ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: SY-236-18

COC SEQUENCE NUMBER (Circle)
COC: 1 (2) 3 4 5 6 7
OF: 1 2 3 4 (5) 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE | **SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)** | **CONTAINER INFORMATION** | **ANALYSIS REQUIRED including SUITES** (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	B7 Suite: TRH, BTEX, PAH, Metals (8)	TBT	Dioxins/Furans	Cyanide	Ammonia	TOC	PSD	Moisture content								Hold
[redacted]	SED04_0.0-0.1	5/10/18	S	Jar, B	2	X	X	X	X	X	X	X	X								
14	SED04_0.5-0.6	5/10/18	S	Jar, B	2																X
[redacted]	SED04_1.0-1.1	5/10/18	S	Jar B	2	X	X	X	X	X	X	X	X								
16	SED04_1.5-1.6	5/10/18	S	Jar B	2																X
17	SED04_2.0-2.1	5/10/18	S	Jar B	2																X
18	SED04_2.5-2.6	5/10/18	S	Jar B	2																X
19	FD04	5/10/18	S	Jar B	1																X
20	FS04	5/10/18	S	Jar B	1																X
21	TRIP SPIKE	5/10/18	S	Jar B	1																
22	TRIP BLANK	5/10/18	S	Jar B	1	X															
23	RN02	5/10/18	W	AG, 2xV, N	4			Please check			for standard		rinsate		analyses						
[redacted]	~~FD08~~ / ~~FS08~~	5/10/18	S / S	Jar / Jar	1 / 1	X / X	X / X	X / X	X / X	X / X	X / X	X / X	X / X please forward		to Eurofins						
					TOTAL																

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

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☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: GHD Pty Ltd	**TURNAROUND REQUIREMENTS** (Standard TAT may be longer for some tests e.g., Ultra Trace Organics) ☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):		**FOR LABORATORY USE ONLY (Circle)** Custody Seal Intact? Yes No N/A; Free ice / frozen ice bricks present upon receipt? Yes No N/A; Random Sample Temperature on Receipt: °C; Other comment:
OFFICE: level 15, 133 Castlereagh St, Sydney			
PROJECT: 21-27477 - Task 3J for Contamination	**ALS QUOTE NO.:** SY-236-18	**COC SEQUENCE NUMBER (Circle)** COC: 1 2 (3) 4 5 6 7	
ORDER NUMBER: 2127477		OF: 1 2 3 4 (5) 6 7	
PROJECT MANAGER: Jacqui Hallchurch	**CONTACT PH:** 0447 202 580		
SAMPLER: Sarah Eccleshall	**SAMPLER MOBILE:** 0459 546 332	**RELINQUISHED BY:**	**RECEIVED BY:**
COC emailed to ALS? (YES / NO)	**EDD FORMAT (or default):**		
Email Reports to: sarah.eccleshall@ghd.com; jacqui.hallchurch@ghd.com		DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed):			

RELINQUISHED BY:	**RECEIVED BY:**
DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).															
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL CONTAINERS	B7 Suite: TRH, BTEX, PAH, Metals (8)	TBT	Dioxins	Cyanide	Ammonia	TOC	PSD	Moisture content								Hold
25	SED05_1.5-2.0	5/10/18	S	B, 2xJar	3																
26	SED05_2.0-2.5			B, Jar	2																
27	SED05_2.5-3.0	Received as SED05_2.5-2.8		B, Jar	2																
~~28~~	~~SED05_3.0-4.0~~				~~0~~	~~X~~															
29	REA01-0.0-0.5			B, 2xJar	3	X	X	X	X	X	X	X	X								
30	REA01_0.5-1.0				3																
31	REA01_1.0-1.5				3	X	X	X	X	X	X	X	X								
32	REA01_1.5-2.0				3																
33	REA01_2.0-2.5			B, Jar	2																
34	REA01_2.5-3.0			B, Jar	2																
35	~~REA01_3~~ REA01_30-35	SNR		B, Jar	2																
36	REA02-2.5-3.0			B, Jar	2																
				TOTAL																	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental	CHAIN OF CUSTODY ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
☐BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
☐NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townesville.environmental@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: GHD Pty Ltd	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE: level 15, 133 Castlereagh St, Sydney		
PROJECT: 21-27477 - Task 3J for Contamination	ALS QUOTE NO.: SY-236-18	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 (4) 5 6 7 OF: 1 2 3 4 (5) 6 7
ORDER NUMBER: 2127477		
PROJECT MANAGER: Jacqui Hallchurch	CONTACT PH: 0447 202 580	
SAMPLER: Sarah Eccleshall	SAMPLER MOBILE: 0459 546 332	
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	
Email Reports to: sarah.eccleshall@ghd.com; jacqui.hallchurch@ghd.com		
Email Invoice to (will default to PM if no other addresses are listed):		

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)
Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).

ALS USE: LAB ID	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W): SAMPLE ID	DATE / TIME	MATRIX	CONTAINER INFORMATION: TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	~~pH and pH fox~~	B7 suite TRH, BTEX, PAH, Metals(8)	TBT	Dioxin/furans	Cyanide	Ammonia	TOC	PSD	Moisture content							Hold
37	SED04_0.0-0.5	5/10/18	S	Bag, Jar	3		X	X	X	X	X	X	X	X							
38	SED04-0.5-1.0	5/10/18	S	Bag, Jar	3																X
39	SED04-1.0-1.5	5/10/18	S	Bag, Jar	3		X	X	X	X	X	X	X	X							
40	SED04_1.5-2.0	5/10/18	S	Bag, Jar	2																X
41	SED04_2.0-2.5	5/10/18	S	Bag, Jar	3																X
	FD06	5/10/18	S	Jar	~~2~~ 1				Please forward to Eurofins												
[illegible]	FS06.	5/10/18	S	Jar	~~2~~ 1		X	X	X	X	X	X		X							
43	REA02_0.0-0.5	5/10/18	S	Bag, Jar	3		X	X	X	X	X	X	X	X							
44	REA02_0.5-1.0	5/10/18	S	Bag, Jar	3																X
(45)	REA02_1.0-1.5	5/10/18	S	Bag, Jar	3		X	X	X	X	X	X	X	X							
46	REA02_1.5-2.0	5/10/18	S	Bag, Jar	3																X
(47)	REA02_2.0-2.5	5/10/18	S	Bag, Jar	3																X
				TOTAL																	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
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☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
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☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townesville.environmental@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: GHD Pty Ltd	**TURNAROUND REQUIREMENTS** ☐ Standard TAT **(List due date):**	**FOR LABORATORY USE ONLY (Circle)**	
OFFICE: level 15, 133 Castlereagh St, Sydney	(Standard TAT may be longer for some tests e.g., Ultra Trace Organics) ☐ Non Standard or urgent TAT **(List due date):**	Custody Seal Intact?	Yes / No / N/A
PROJECT: 21-27477 - Task 3J for Contamination	**ALS QUOTE NO.:** SY-236-18	Free ice / frozen ice bricks present upon receipt?	Yes / No / N/A
ORDER NUMBER: 2127477	**COC SEQUENCE NUMBER (Circle)** COC: 1 2 3 4 (5) 6 7	Random Sample Temperature on Receipt:	°C
PROJECT MANAGER: Jacqui Hallchurch **CONTACT PH:** 0447 202 580	OF: 1 2 3 4 (5) 6 7	Other comments:	

SAMPLER: Sarah Eccleshall **SAMPLER MOBILE:** 0459 546 332	**RELINQUISHED BY:**	**RECEIVED BY:**	**RELINQUISHED BY:**	**RECEIVED BY:**
COC emailed to ALS? (YES / NO) **EDD FORMAT (or default):**				
Email Reports to: sarah.eccleshall@ghd.com; jacqui.hallchurch@ghd.com	DATE/TIME:	DATE/TIME:	DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed):				

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).															
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL CONTAINERS	B7 Suite: TRH, BTEX, PAH, Metals (8)	TBT	Dioxins	Cyanide	Ammonia	TOC	PSD	Moisture content								Hold
48	SED01_0.0-0.1	5/10/18	S	B, Jar, Jar	3																X
49	SED01_0.0-0.5	5/10/18	S	"	3	X	X	X	X	X	X	X	X								X
50	SED01_0.5-0.65	5/10/18	S	"	3																X
51	SED02-0.0-0.1	5/10/18	S	"	3																X
52	SED02_0.0-0.5	5/10/18	S	"	3	X	X	X	X	X	X	X	X								X
53	SED02_0.5-0.65	5/10/18	S	"	3																X
54	SED03_0.0-0.1	5/10/18	S	"	3																X
55	SED03_0.0-0.5	5/10/18	S	"	3	X	X	X	X	X	X	X	X								X
56	SED03_0.5-0.65	5/10/18	S	"	3																X
57	SED07_0.0-0.5	5/10/18	S	"	3	X	X	X	X	X	X	X	X								X
58	FD07	5/10/18	S	Jar	1																X
59	FS07	5/10/18	S	Jar	1																X
				TOTAL																	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

60 TRIP SPIKE CONTROL 02/10/18 S 1
61 FD05
62 ~~FD05~~ FS05

Helen Simpson

From: Sarah.Eccleshall@ghd.com
Sent: Monday, 8 October 2018 11:36 AM
To: Helen Simpson
Subject: RE: Urgent Change to COC order number 2127477 received 5/10/18

Hi,

Yes the 3rd line is SED06_2.0-2.5.
RN02 is W-26T, TRH/BTEX/PAH and 8 total metals

Apologies for the errors:
Sample REA01_3.0-3.5 does not exist.
Correct labelling is as per the jar for SED05_2.5-2.8
Extra samples FD05 and FS05, both soil. These should be on hold.

Thanks,
Sarah

From: Helen Simpson <helen.simpson@alsglobal.com>
Sent: Monday, 8 October 2018 11:30 AM
To: Sarah Eccleshall <Sarah.Eccleshall@ghd.com>
Subject: FW: Urgent Change to COC order number 2127477 received 5/10/18
Importance: High

Hi Sarah,

I've just got to this request.

Assuming that the 3rd line should be sample SED06_2.0-2.5 which needs to be analysed??

Please confirm analysis for RN02, should it be for W-26T, TRH/BTEX/PAH and 8 total metals?

Sample REA01_3.0-3.5 was not received.

Sample SED05_2.5-3.0 on the COC was labelled as SED05_2.5-2.8 on the jar, please confirm correct ID for reporting.

Extra samples FD05 and FS05, both soil, on hold.

Kind regards,

Helen Simpson
Sample Admin, Environmental

Sydney

T +61 2 8784 8555
F +61 2 8784 8500
helen.simpson@alsglobal.com
277-289 Woodpark

Smithfield, NSW, 2164

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From: Sarah.Eccleshall@ghd.com [mailto:Sarah.Eccleshall@ghd.com]
Sent: Saturday, 6 October 2018 6:40 AM
To: jacob.waugh@alsglobal.com.au; ALSEnviro Sydney <ALSEnviro.Sydney@ALSGlobal.com>; Brenda Hong <Brenda.Hong@alsglobal.com>
Subject: Urgent Change to COC order number 2127477 received 5/10/18

Hi,

Apologies for the multiple recipients, I wasn't sure who was best placed to assist with this.

I have a request for a COC submitted on 5/10/18 to be updated.
Sample SED06_1.0-1.5 should have been on hold and
SED__2.0-2.5 should have been selected for those analyses.
And REA02_1.0-1.5 should be been on hold and REA02_2.0-2.5 selected for analyses.
Analyses for both are B7 suite-TRH,BTEX, PAH, METALS (8); TBT; Dioxins/furans; cyanide; ammonia; TOC; PSD; and moisture content.

Please advise if this update is possible.

Many thanks

Sarah Eccleshall
MSc, BSc (Hons)
Contamination & Environmental Management

GHD
Proudly employee owned
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Level 15 133 Castlereagh Street Sydney NSW 2000 Australia | www.ghd.com
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SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES1829588**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Brenda Hong
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	: Brenda.Hong@alsglobal.com
Telephone	: +61 02 9239 7100	Telephone	: (02) 8784 8504
Facsimile	: +61 02 9239 7199	Facsimile	: +61-2-8784 8500
Project	: 21-27477	Page	: 1 of 4
Order number	:	Quote number	: ES2018GHDSER0015 (SY/236/18)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: SARAH ECCLESHALL		

Dates

Date Samples Received	: 05-Oct-2018 20:30	Issue Date	: 09-Oct-2018
Client Requested Due Date	: 11-Oct-2018	Scheduled Reporting Date	: **11-Oct-2018**

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: 5.2'c
Receipt Detail	:	No. of samples received / analysed	: 60 / 19

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Dioxins split into ES1890029.**
- **Sample REA01_3.0-3.5 was not received.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **PSD analysis will be conducted by ALS Newcastle.**
- **TOC analysis will be conducted by ALS Brisbane.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EA150H/EA152 Particle Sizing with Hydrometer + Soil Particle	SOIL - EK026SF (Solids) Total Cyanide By Segmented Flow Analyser	SOIL - EK055 (solids) Ammonia as N	SOIL - EP003 Total Organic Carbon (TOC) in Soil	SOIL - EP090 (solids) Organotins	SOIL - S-26 8 metals/TRH/BTEXN/PAH
ES1829588-001	05-Oct-2018 00:00	SED06_0.0-0.5	✓	✓	✓	✓	✓	✓	✓
ES1829588-005	05-Oct-2018 00:00	SED06_2.0-2.5	✓	✓	✓	✓	✓	✓	✓
ES1829588-010	05-Oct-2018 00:00	SED05_0.0-0.5	✓	✓	✓	✓	✓	✓	✓
ES1829588-012	05-Oct-2018 00:00	SED05_1.0-1.5	✓	✓	✓	✓	✓	✓	✓
ES1829588-013	05-Oct-2018 00:00	SED04_0.0-0.1	✓	✓	✓	✓	✓	✓	✓
ES1829588-015	05-Oct-2018 00:00	SED04_1.0-1.1	✓	✓	✓	✓	✓	✓	✓
ES1829588-024	05-Oct-2018 00:00	FS08	✓		✓	✓	✓	✓	✓
ES1829588-029	05-Oct-2018 00:00	REA01_0.0-0.5	✓	✓	✓	✓	✓	✓	✓
ES1829588-031	05-Oct-2018 00:00	REA01_1.0-1.5	✓	✓	✓	✓	✓	✓	✓
ES1829588-037	05-Oct-2018 00:00	SED04_0.0-0.1	✓	✓	✓	✓	✓	✓	✓
ES1829588-039	05-Oct-2018 00:00	SED04_1.0-1.5	✓	✓	✓	✓	✓	✓	✓
ES1829588-042	05-Oct-2018 00:00	FS06	✓		✓	✓	✓	✓	✓
ES1829588-043	05-Oct-2018 00:00	REA02_0.0-0.5	✓	✓	✓	✓	✓	✓	✓
ES1829588-047	05-Oct-2018 00:00	REA02_2.0-2.5	✓	✓	✓	✓	✓	✓	✓
ES1829588-049	05-Oct-2018 00:00	SED01_0.0-0.5	✓	✓	✓	✓	✓	✓	✓
ES1829588-052	05-Oct-2018 00:00	SED02_0.5-0.5	✓	✓	✓	✓	✓	✓	✓
ES1829588-055	05-Oct-2018 00:00	SED03_0.0-0.5	✓	✓	✓	✓	✓	✓	✓
ES1829588-057	05-Oct-2018 00:00	SED07_0.0-0.5	✓	✓	✓	✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested
ES1829588-002	05-Oct-2018 00:00	SED06_0.5-1.0	✓
ES1829588-003	05-Oct-2018 00:00	SED06_1.0-1.5	✓
ES1829588-004	05-Oct-2018 00:00	SED06_1.5-2.0	✓
ES1829588-006	05-Oct-2018 00:00	SED06_2.5-3.5	✓
ES1829588-007	05-Oct-2018 00:00	SED06_3.0-3.5	✓
ES1829588-008	05-Oct-2018 00:00	SED06_3.5-4.0	✓

			(On Hold) SOIL No analysis requested
ES1829588-009	05-Oct-2018 00:00	SED06_4.0-4.4	✓
ES1829588-011	05-Oct-2018 00:00	SED05_0.5-1.0	✓
ES1829588-014	05-Oct-2018 00:00	SED04_0.5-0.6	✓
ES1829588-016	05-Oct-2018 00:00	SED04_1.5-1.6	✓
ES1829588-017	05-Oct-2018 00:00	SED004_2.0-2.1	✓
ES1829588-018	05-Oct-2018 00:00	SED04_2.5-2.6	✓
ES1829588-019	05-Oct-2018 00:00	FD04	✓
ES1829588-020	05-Oct-2018 00:00	FS04	✓
ES1829588-021	02-Oct-2018 00:00	TRIP SPIKE	✓
ES1829588-022	02-Oct-2018 00:00	TRIP BLANK	✓
ES1829588-025	05-Oct-2018 00:00	SED05_1.5-2.0	✓
ES1829588-026	05-Oct-2018 00:00	SED05_2.0-2.5	✓
ES1829588-027	05-Oct-2018 00:00	SED05_2.5-2.8	✓
ES1829588-030	05-Oct-2018 00:00	REA01_0.5-1.0	✓
ES1829588-032	05-Oct-2018 00:00	REA01_1.5-2.0	✓
ES1829588-033	05-Oct-2018 00:00	REA01_2.0-2.5	✓
ES1829588-034	05-Oct-2018 00:00	REA01_2.5-3.0	✓
ES1829588-036	05-Oct-2018 00:00	REA02_2.5-3.0	✓
ES1829588-038	05-Oct-2018 00:00	SED04_0.5-1.0	✓
ES1829588-040	05-Oct-2018 00:00	SED04_1.5-2.0	✓
ES1829588-041	05-Oct-2018 00:00	SED04_2.0-2.5	✓
ES1829588-044	05-Oct-2018 00:00	REA02_0.5-1.0	✓
ES1829588-045	05-Oct-2018 00:00	REA02_1.0-1.5	✓
ES1829588-046	05-Oct-2018 00:00	REA02_1.5-2.0	✓
ES1829588-048	05-Oct-2018 00:00	SED01_0.0-0.1	✓
ES1829588-050	05-Oct-2018 00:00	SED01_0.5-0.65	✓
ES1829588-051	05-Oct-2018 00:00	SED02_0.0-0.1	✓
ES1829588-053	05-Oct-2018 00:00	SED02_0.55-0.65	✓
ES1829588-054	05-Oct-2018 00:00	SED03_0.0-0.1	✓
ES1829588-056	05-Oct-2018 00:00	SED03_0.5-0.65	✓
ES1829588-058	05-Oct-2018 00:00	FD07	✓
ES1829588-059	05-Oct-2018 00:00	FS07	✓
ES1829588-060	02-Oct-2018 00:00	TRIP SPIKE CONTROL	✓
ES1829588-061	05-Oct-2018 00:00	FD05	✓
ES1829588-062	05-Oct-2018 00:00	FS05	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - W-26T TRH/BTEXN/PAH/Total 8 Metals
ES1829588-023	06-Oct-2018 00:00	RN02	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE (Brisbane)

- A4 - AU Tax Invoice (INV)	Email	ap-fss@ghd.com

GHD LAB REPORTS

- *AU Certificate of Analysis - NATA (COA)	Email	ghdlabreports@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ghdlabreports@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ghdlabreports@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ghdlabreports@ghd.com
- Attachment - Report (SUBCO)	Email	ghdlabreports@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	ghdlabreports@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	ghdlabreports@ghd.com

JACQUI HALLCHURCH

- *AU Certificate of Analysis - NATA (COA)	Email	jacqui.hallchurch@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jacqui.hallchurch@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jacqui.hallchurch@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jacqui.hallchurch@ghd.com
- A4 - AU Tax Invoice (INV)	Email	jacqui.hallchurch@ghd.com
- Attachment - Report (SUBCO)	Email	jacqui.hallchurch@ghd.com
- Chain of Custody (CoC) (COC)	Email	jacqui.hallchurch@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	jacqui.hallchurch@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	jacqui.hallchurch@ghd.com
- EDI Format - XTab (XTAB)	Email	jacqui.hallchurch@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	jacqui.hallchurch@ghd.com

SARAH ECCLESHALL

- *AU Certificate of Analysis - NATA (COA)	Email	sarah.eccleshall@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	sarah.eccleshall@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	sarah.eccleshall@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	sarah.eccleshall@ghd.com
- Attachment - Report (SUBCO)	Email	sarah.eccleshall@ghd.com
- Chain of Custody (CoC) (COC)	Email	sarah.eccleshall@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	sarah.eccleshall@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	sarah.eccleshall@ghd.com
- EDI Format - XTab (XTAB)	Email	sarah.eccleshall@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	sarah.eccleshall@ghd.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1829588**	Page	: 1 of 17
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Brenda Hong
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9239 7100	Telephone	: (02) 8784 8504
Project	: 21-27477	Date Samples Received	: 05-Oct-2018 20:30
Order number	:	Date Analysis Commenced	: 08-Oct-2018
C-O-C number	: ----	Issue Date	: 23-Oct-2018 11:07
Sampler	: SARAH ECCLESHALL		
Site	: ----		
Quote number	: SY/236/18		
No. of samples received	: 60		
No. of samples analysed	: 19		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

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 insufficient sample for analysis.

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA150H: The majority of soil particle density results fell outside the scope of AS1289.3.6.3. Results should be scrutinised accordingly.
- EP075(SIM): LOR for samples raised due to high amount of moisture present.
- EG035: Positive Hg results for ES1829588 #29,31 have been confirmed by reanalysis.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	SED06_0.0-0.5	SED06_2.0-2.5	SED05_0.0-0.5	SED05_1.0-1.5	SED04_0.0-0.1
			Client sampling date / time	05-Oct-2018 00:00	05-Oct-2018 00:00	05-Oct-2018 00:00	05-Oct-2018 00:00	05-Oct-2018 00:00
Compound	CAS Number	LOR	Unit	ES1829588-001	ES1829588-005	ES1829588-010	ES1829588-012	ES1829588-013
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	48.1	37.6	47.7	47.8	55.7
EA150: Particle Sizing								
+75µm	----	1	%	18	30	8	6	6
+150µm	----	1	%	12	10	3	2	2
+300µm	----	1	%	7	<1	2	1	<1
+425µm	----	1	%	3	<1	<1	<1	<1
+600µm	----	1	%	2	<1	<1	<1	<1
+1180µm	----	1	%	<1	<1	<1	<1	<1
+2.36mm	----	1	%	<1	<1	<1	<1	<1
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	21	19	23	22	22
Silt (2-60 µm)	----	1	%	53	43	65	65	50
Sand (0.06-2.00 mm)	----	1	%	26	38	12	13	28
Gravel (>2mm)	----	1	%	<1	<1	<1	<1	<1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EA152: Soil Particle Density								
ø Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.22	2.54	2.34	2.31	2.36
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	15	9	15	21	17
Cadmium	7440-43-9	1	mg/kg	2	2	<1	1	<1
Chromium	7440-47-3	2	mg/kg	104	85	82	104	80
Copper	7440-50-8	5	mg/kg	157	67	241	216	240
Lead	7439-92-1	5	mg/kg	168	145	172	236	163
Nickel	7440-02-0	2	mg/kg	21	20	18	24	19
Zinc	7440-66-6	5	mg/kg	930	1120	671	900	639
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	0.5	0.2	0.4	0.6	0.4
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	1	mg/kg	4	27	1	4	<2

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SED06_0.0-0.5	SED06_2.0-2.5	SED05_0.0-0.5	SED05_1.0-1.5	SED04_0.0-0.1
				Client sampling date / time	05-Oct-2018 00:00	05-Oct-2018 00:00	05-Oct-2018 00:00	05-Oct-2018 00:00	05-Oct-2018 00:00
Compound	CAS Number	LOR	Unit		ES1829588-001	ES1829588-005	ES1829588-010	ES1829588-012	ES1829588-013
					Result	Result	Result	Result	Result
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		<20	110	<20	40	<20
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		11.6	4.33	8.76	7.51	6.38
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		11.2	24.9	12.7	9.1	8.6
Acenaphthylene	208-96-8	0.5	mg/kg		1.6	1.9	1.1	1.0	<0.8
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.8
Fluorene	86-73-7	0.5	mg/kg		1.9	1.4	1.2	1.1	0.8
Phenanthrene	85-01-8	0.5	mg/kg		6.5	4.8	4.6	4.0	3.1
Anthracene	120-12-7	0.5	mg/kg		2.4	1.5	1.6	1.4	1.2
Fluoranthene	206-44-0	0.5	mg/kg		8.1	4.5	5.5	5.1	3.9
Pyrene	129-00-0	0.5	mg/kg		7.4	5.6	5.0	4.5	3.6
Benz(a)anthracene	56-55-3	0.5	mg/kg		3.8	1.4	2.6	2.1	1.7
Chrysene	218-01-9	0.5	mg/kg		4.1	1.6	2.6	2.2	1.8
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		6.9	2.3	4.3	3.8	2.8
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		2.6	0.8	1.3	1.3	0.9
Benzo(a)pyrene	50-32-8	0.5	mg/kg		5.5	2.0	3.5	3.2	2.3
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		3.0	1.0	1.8	1.6	1.2
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		0.9	<0.5	0.5	0.5	<0.8
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		3.5	1.3	2.2	1.9	1.4
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		69.4	55.0	50.5	42.8	33.3
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		8.1	2.6	5.0	4.6	3.0
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		8.1	2.8	5.0	4.6	3.2
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		8.1	3.1	5.0	4.6	3.5
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		530	570	340	340	230
C29 - C36 Fraction	----	100	mg/kg		400	470	340	310	220
^ C10 - C36 Fraction (sum)	----	50	mg/kg		930	1040	680	650	450
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10