

Consolidated SAP Implementation Report



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Caltex Kurnell Port and Berthing Project, Botany Bay, NSW

Sediment Sampling and Analysis Plan Implementation Report

301015-03041 – CS-REP-0011

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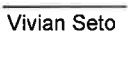
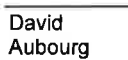
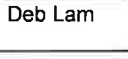
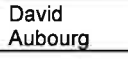
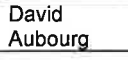
SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

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PROJECT 301015-03041 - CALTEX KURNELL PORT AND BERTHING PROJECT, BOTANY BAY, NSW

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ACRONYMS USED IN THIS REPORT

AAA	Advanced Analytical Australia
AASS	Actual Acid Sulfate Soils
ALS	ALS Laboratory Group
ANC	Acid Neutralising Capacity
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASSMP	Acid Sulfate Soil Management Plan
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CD	Chart Datum
CECR	CSIRO Centre for Environmental Contaminants Research
CRS	Chromium-Reducible Sulfur
CSIRO	Commonwealth Scientific and Industrial Research Organization
DECC	Department of Environment and Climate Change
DEWHA	Department of Environment, Water, Heritage and the Arts
DQO	Data Quality Objectives
SEWPaC	(Department of) Sustainability, Environment, Water, Populations and Communities
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
ESA	Ecotox Services Australasia
ESL	Ecological Screening Level
HIL	Health Investigation Level
GA	Geochemical Assessments Pty Ltd
GPS	Global Positioning System Receiver
HSL	Health Screening Level
ISQG	Interim Sediment Quality Guidelines



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LOR	Limit of Reporting
MDS	McLennan Diving Services
MGA	Map Grid of Australia
NAGD	National Assessment Guidelines for Dredging (Commonwealth of Australia, 2009)
NODGM	National Ocean Disposal Guidelines for Dredged Material (superseded by the NAGD)
NATA	National Association of Testing Authorities
NEPM	National Environmental Protection Measure
OCPs	Organochlorine Pesticides
No Overflowing	See Overflowing
OD	Outside Diameter
OPPs	Organophosphorus Pesticides
Overflowing	During dredging operations water is brought to the surface as well as sediment. As well as the sediment, this water is placed in the split hopper barge. Where there will be no significant adverse impact and to increase productivity, once the barge is full of water and sediment, additional sediment is placed within the barge forcing water to “overflow” the sides of the barge. This continues until the barge is substantially filled with sediment. An alternative operation to this is non-overflow, where once the barge is full of water and sediment, no further material is added and no collected water is allowed to re-enter the water at the dredge location.
PAHs	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulfate Soil
PCBs	Polychlorinated Biphenyls
PSD	Particle Size Distribution
QA/QC	Quality Assurance/Quality Control
RPD	Relative Per Cent Difference
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedures
SPC	Sydney Ports Corporation



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SVOCs	Semi-volatile Organic Compounds
TAA	Titrateable Actual Acidity
TBT	Tributyltin
TOC	Total Organic Carbon
TPHs	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
VOCs	Volatile Organic Compounds



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EXECUTIVE SUMMARY

Introduction

Caltex Refineries (NSW) Pty Ltd (Caltex) maintains a refinery at Kurnell, as well as a port and berthing facility within Botany Bay, Sydney. The port and berthing facility comprises the Kurnell Wharf located to the west of Sutherland Point, a sub-berth and associated turning circle and approaches.

Caltex proposes to dredge a footprint including:

1. the approaches and turning circle (Dredge Area 1);
2. sub-berth (Dredge Area 2); and
3. fixed berths #1 and #2 (Dredge Area 3)

These areas can be seen in **Figure 1** and the total dredge volume is approximately 153,000m³. The purpose of this dredging is to remove material that has accumulated since the previous dredging in 1969 as well as an increase in depth in certain areas. In combination this will allow deeper draft vessels to enter the existing berths.

This consolidated Sampling and Analysis Plan (SAP) Implementation Report presents the findings of four separate sediment investigations undertaken by WorleyParsons between November 2009 and August 2012. The objectives of the sediment investigations have been to:

- ensure an adequate spatial and vertical coverage of the dredge footprint to meet the National Assessment Guidelines for Dredging (NAGD) minimum sampling requirements;
- analyse the dredge material for identified contaminants of potential concern and physical properties;
- compare the geochemical concentrations in sediments against the NAGD; and
- determine the suitability of dredge material for sea disposal from each dredge area.

These investigations represent the overall geochemical and physical assessment of sediments within the proposed dredge footprint, and can be used to determine the potential options for disposal and re-use of this material. A separate report (URS 2013) has been prepared summarising the potential options and has identified that the preferred option is to dispose the majority of the material within the Sydney Offshore Spoil Ground (refer **Figure 2**). Up to 6,000m³ of material is also suitable to be disposed of within Botany Bay, as fill material for a former anchor point and areas subject to pipeline scour (refer **Figure 1**). The outcomes of the sediment investigations and data interpretation presented within this report will support applications for approvals for dredging and ocean disposal from the relevant government agencies (i.e. (Department of) Sustainability, Environment, Water, Populations and Communities – SEWPaC).



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Following project initiation in 2009, 4 separate investigations were undertaken. **Figure 3** contains a plot of the location of the collected samples.

1) 2009 Preliminary Sediment Investigation (Section 1.1.1)

The preliminary investigation was conducted to gain an initial characterisation of the physical properties and concentrations of geochemicals within the dredge footprint. At this stage the final dredge footprint had not been determined and it was expected that additional sampling would be required based on the findings of these investigations.

A SAP was not submitted to the Department of Environmental, Water, Heritage and the Arts (DEWHA) (predecessor to SEWPaC) for approval as the sampling was preliminary only, and sampling needed to fit within tight Caltex schedules.

2) 2010 Supplementary Sediment Investigation (Section 1.1.2)

Following analysis of results from the 2009 investigations, discussions with Sydney Ports Corp (SPC) pilots and a review of updated hydrographic survey data, a supplementary sediment investigation was undertaken. The purpose of this investigation was to characterise physical and geochemical properties within the enlarged dredge area identified by the pilots, as well as assess the bioavailability and toxicity of elevated tributyltin (TBT) concentrations analysed during the 2009 investigations.

A SAP was prepared and submitted to DEWHA for review, with minor requested amendments included (refer **Appendix 1**) prior to sampling being undertaken.

3) 2011 Supplementary Sediment Investigation (Section 1.1.3)

As the overall project developed, further modifications were made to the dredge footprint, requiring additional sampling in order to meet NAGD requirements. In addition it was necessary to identify whether any hydrocarbon contamination was present following an oily water discharge from the refinery in March 2011.

A SAP was prepared and submitted to the SEWPaC for review, with amendments included (refer **Appendix 2**) prior to sampling being undertaken. The SAP also provided details on the methodology and results from the previous investigations.

4) 2012 Supplementary Sediment Investigation (Section 1.1.4)

A vessel manoeuvrability review by SPC's pilots in 2012 recommended a proposed widening of the two fixed berths. This resulted in the identification of additional dredging volumes for fixed berths #1 and #2 (Dredge Area 3), requiring additional sediment sampling and analysis in order to meet NAGD requirements.

A Supplementary SAP was prepared for the additional sediment investigation (refer **Appendix 3**), however due to Caltex's time constraints on the development of the fixed



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berths, the supplementary sediment sampling was completed prior to the approval of the Supplementary SAP by SEWPaC.

Sampling Methodology

In total, 53 locations for sediment samples were selected with the number of samples collected for each dredge area satisfying the minimum sampling requirements stipulated in the NAGD (refer **Table 1**). As recommended by the NAGD, random sampling was used in 2009 and 2012, while a judgemental sampling pattern was used in 2010 and 2011. Judgemental sampling was used as there were specific issues to be addressed, including:

- areas with the greatest sediment accretion;
- areas with elevated levels of TBT; and
- areas not covered in previous sampling.

In 2009, 2010 and 2011, samples were collected using vibrocores to a depth of up to 3.5m. The actual depth depended on the depth of dredging and whether the core reached refusal. In addition, sediment samples were collected by pushing a core to a depth of 0.5m or use of a Petite Ponar grab sampler. Where necessary, additional cores and samples were taken to ensure that sufficient volume of sediment was retrieved for the required analysis. Standard Operating Procedures for the coring, surface sampling and sub-sampling were prepared and are included in **Appendix 6**.

Ambient seawater for use in elutriate analysis and elutriate toxicity testing was collected in a triple-rinsed plastic bucket.

In 2012, cores were collected using a piston push corer or a light weight vibrocorer and driven either to the depth of dredging or refusal. Where necessary, additional cores and samples were taken to ensure that sufficient volume of sediment was retrieved for the required analysis.

For all sampling activities, core logs were taken and information recorded on each sample location (refer **Appendix 5**). In total 99 primary samples and 24 QA/QC samples were collected (refer **Table 2**).

A range of over 50 parameters were analysed depending on the sample location, providing a total of over 2,800 individual analysis results (refer **Table 7**, **Appendix 8** and **Appendix 9**). **Table 4** (in **Section 2.8**) contains a summary of the various tests conducted. In addition:

- **Section 2.2** contains details on sampling and sample processing;
- **Section 2.3** provides additional information on the QA/QC sampling; and
- **Sections 2.4 to 2.7** contain details on the analysis that was undertaken as part of the 4 separate investigations, including NAGD Phase II geochemical analysis, NAGD Phase III TBT elutriate testing and NAGD Phase IV TBT toxicity testing. NAGD Phase III and IV testing was required due to the elevated levels of TBT that was identified within the dredge footprint.



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Physical Characteristics

Section 3.1 contains details on the particle size distribution of samples collected within the dredge footprint. This shows that sediments within the approaches, turning circle and sub-berth (Dredge Areas 1 and 2) are dominated by sand with a mean sand content of 89% and 93% respectively.

Samples from fixed berths #1 and #2 (Dredge Area 3) contain sand (<5% fine fraction) to muddy sand (10-20% fine fraction), usually overlaying peat (a hard, black consolidated material, ~30-50% fine fraction content). Peat was either found at the surface or under a layer of unconsolidated sediment (muddy sand). Due to its hard consolidated nature, the presence of peat often caused core refusal during sampling activities. This is acceptable under the NAGD guidelines due to the fact that contaminants are unlikely to penetrate into consolidated layers. A review of historic borehole logs provided by Caltex (Australian Oil Refinery Limited (1953) Boring Plan AS6201-7 and Plan AA.6653-1) confirmed that peat had been observed within this area previously. As found during the sampling discussed within this report, the historic borehole logs showed peat layers at depths of -10 to -13m Chart Datum (CD). **Figure 5** contains details of the spatial distribution of peat based on the sampling that has been undertaken.

Geochemical Characteristics

The NAGD (Commonwealth of Australia, 2009) requires up to 5 phases of contaminant investigation depending on the findings of previous phases. **Figure E1** summarises these phases.

Geochemical testing on sediment samples from the dredge footprint comprised:

- a suite of heavy metals (silver (Ag), arsenic (As), cadmium (Cd), cobalt (Co), chromium (Cr), copper (Cu), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb), tin (Sb), selenium (Se), vanadium (V), and zinc (Zn));
- polycyclic aromatic hydrocarbons (PAHs);
- total organic carbon (TOC);
- tributyltin (TBT);
- benzene, toluene, ethylbenzene and xylene (BTEX);
- total petroleum hydrocarbons (TPHs) (C₆-C₃₆);
- organochlorine pesticides (OCPs);
- organophosphorus pesticides (OPPs); and
- polychlorinated biphenyls (PCBs).

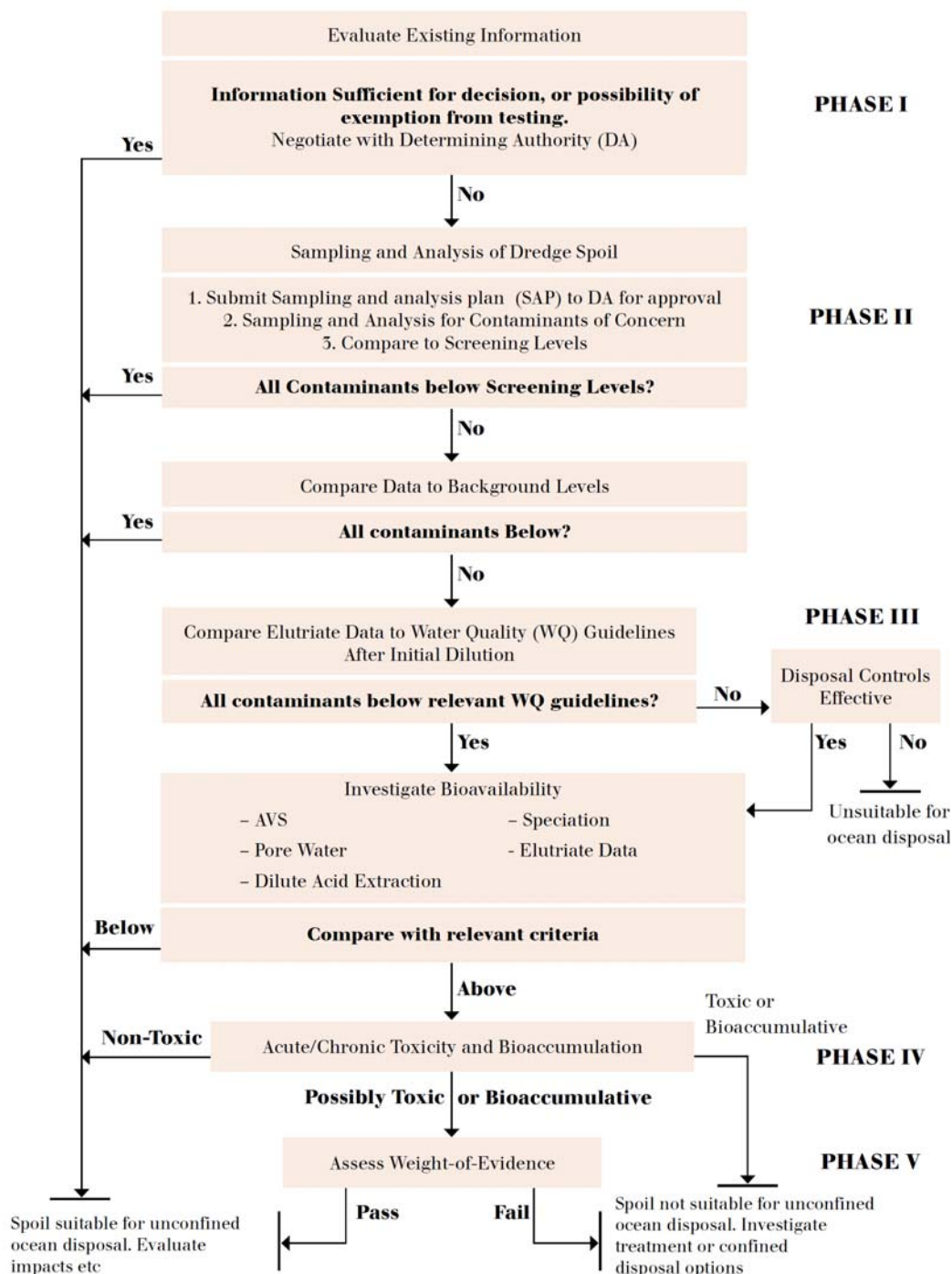


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Figure E1 Assessment of potential contaminants (Figure 3, Commonwealth of Australia, 2009)





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Results from geochemical analysis are presented within **Section 3.2**. Overall the geochemical analysis has identified only one Potential Contaminant of Concern, TBT. The 95% UCL mean¹ for all other contaminants was below the NAGD Screening Level. BTEX, OCPs, OPPs and PCBs were all below the LOR in all samples.

TBT

TBT was found at elevated levels throughout the dredge footprint.

- Within the approaches and turning circle (Dredge Area 1), TBT was present in the majority of samples and exceeded the NAGD TBT Sediment Quality High Value (70 µgSn/kg) in over one quarter of samples. As the 95% UCL of the mean (408 µgSn/kg) exceeded the NAGD TBT Sediment Quality High Value, Phase III testing was required to determine bioavailability of TBT.
- Within the sub berth (Dredge Area 2), TBT was present in the majority of samples and exceeded the NAGD TBT Sediment Quality High Value in approximately one quarter of samples. As the 95% UCL of the mean (314 µgSn/kg) exceeded the NAGD TBT Sediment Quality High Value, Phase III testing was required to determine bioavailability of TBT.
- Out of 39 samples within fixed berths #1 and #2 (Dredge Area 3), TBT was present in the majority of samples but only exceeded the NAGD TBT Screening Level (9 µgSn/kg) in 5 samples and the NAGD TBT Sediment Quality High Value in 1 sample. However the 95% UCL of the mean (25 µgSn/kg) exceeded the NAGD TBT Screening Level, requiring Phase III testing to determine bioavailability of TBT.

While sample locations with elevated concentrations of TBT in whole sediments are found across the dredge footprint, elevated concentrations of TBT (normalised to 1% TOC) are predominantly present in the approaches, turning circle and fixed berths (Dredge Areas 1 and 2) (refer **Figure 12**). A number of samples in the fixed berths (Dredge Area 3) contain elevated TOC contents of more than 10% and up to 40%, resulting in reduced TBT concentrations when normalised to 1% TOC (as specified for comparison to NAGD Screening Levels).

Normalised concentrations of TBT in sediments are generally below the NAGD Screening Level in the northern part of the approaches and turning circle (Dredge Area 1) and in the south eastern area of the turning circle (refer **Figure 12**).

The majority of sediment samples that exceed the NAGD Screening Level are located in the upper 1 m of sediment (refer **Figure 13**) when compared to sediments below 1 m depth (refer **Figure 14**).

¹ A calculated statistical value that exceeds the mean 95% of the time.



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Phase III TBT Testing – Water Column

Phase III elutriate TBT testing was conducted to assess the potential release of sediments into the water column during disposal operations. This testing showed that without allowing for initial dilution, the mean concentration of elutriate TBT exceeded the ANZECC/ARMCANZ (2000) water quality guideline value (6 ng/L). As the raw elutriate results are conservative in nature, the NAGD allows for correction of these raw results by initial dilution modelling. Note that this dilution modelling is separate to that undertaken as part of the EIS submitted by Caltex for this project (URS, 2013a).

Preliminary initial dilution modelling was undertaken using the more conservative NAGD analytical method, considering both disposal within Botany Bay as well as disposal at the Sydney Offshore Spoil Ground. This modelling indicated that TBT would still exceed the water quality guideline value. Following further review of these results it was determined that disposal of contaminated material within Botany Bay would not be pursued further. No further dilution modelling within Botany Bay was undertaken by WorleyParsons from this point.

The more accurate NAGD numerical (STFATE) initial dilution modelling method was then adopted, modelling disposal at the Sydney Offshore Spoil Ground. Modelling was initially undertaken using the physical, geochemical and elutriate properties of sampled sediments collected from the approaches and turning circle (Dredge Area 1), as this contained the highest sampled mean elutriate TBT concentrations of all areas. In addition, modeling assumed the disposal of material from four methods of dredging:

- backhoe loading a split hopper barge with and without overflow; and
- trailer suction hopper dredging with and without overflow.

The different methods of dredging affect the water and sediment content of the material that would be disposed, causing variations in the dilution of the material.

This modelling indicated that after initial dilution, the maximum concentration of TBT at the Sydney Offshore Spoil Ground would range from 4.3×10^{-2} to 8.9×10^{-2} ng/L, substantially below the ANZECC/ARMCANZ (2000) trigger values at the 95% and 99% species protection levels (6 ng/L and 0.4 ng/L respectively).

Following the 2012 supplementary sampling, additional numerical modelling for the disposal at the Sydney Offshore Spoil Ground was undertaken based on the physical, geochemical and elutriate properties of material from the fixed berths (Dredge Area 3). By this stage it was determined that dredging in this area would be undertaken using a backhoe loading a split hopper barge (no overflowing) and therefore only this scenario was modelled for the disposal of material. The results identified that after initial dilution, the maximum concentration of TBT at the Sydney Offshore Spoil Ground would be 2.86×10^{-7} ng/L, again substantially below the ANZECC/ARMCANZ (2000) trigger values for TBT.

Both the worst case condition existing within the approaches and turning circle (Dredge Area 1) and the least contaminated condition within fixed berths #1 and #2 (Dredge Area 3) were modelled for initial dilution during disposal at the Sydney Offshore Spoil Ground. The results of this modelling



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showed that it is unlikely that disposal of the sediments at the Sydney Offshore Spoil Ground will adversely affect water quality during disposal or affect benthic organisms in the water column.

Phase IV TBT Testing – Bioavailability/Toxicity Testing

Due to the sandy nature of the sediments, it was considered inappropriate to undertake Phase III pore water bioavailability testing, and therefore NAGD Phase IV toxicity testing was conducted. Testing was undertaken as recommended by the CSIRO using whole sediment toxicity testing of *Melita plumulosa* and toxicity testing of elutriates for Sydney Rock Oyster (*Saccostrea commercialis*). Toxicity testing found that the test sediments were considered to be non-toxic to the reproduction and survival of the amphipod *Melita plumulosa*, and that there was no detectable toxicity to the bivalve embryos from the elutriate samples tested.

Acid Sulfate Soil Testing

While not required as part of the NAGD, when during early stages of the project onshore disposal was being considered, acid sulfate soil testing was undertaken. Both field screening and detailed laboratory analysis was carried out. The results of these tests indicate that Actual Acid Sulfate Soils (AASS) are present in two of the sixteen selected samples prior to disturbance of the sediments. Both samples were obtained from the fixed berths in Dredge Area 3. Based on this, an Acid Sulfate Soil Management Plan (ASSMP) would be required if the proposed works are expected to result in the oxidation of the dredged material during removal, transportation, reuse or disposal. The requirement for an ASSMP is discussed in further detail within the EIS (URS, 2013a), however for the purposes of the NAGD, no further action is required.

Results of Testing Associated with Oily Water Discharge

Surface samples from the November 2011 sediment investigation reported concentrations of total TPHs and total PAHs within limits previously reported across the dredge footprint in November 2009 and March 2010 sediment investigations. Concentrations of TPHs and total PAHs were below the NAGD Screening Levels for all surface sediment samples tested in the November 2011 investigation. This data indicates that contamination of surface sediments within the dredge footprint resulting from the oily water discharge from the Caltex Refinery in March 2011 was not discernible.

Peat Layer

As previously discussed a hard consolidated peat layer is widely spread within the fixed berths (Dredge Area 3). The peat layer has different properties compared to other surficial sediments sampled within the dredge footprint and therefore additional analysis of the NAGD Phase II results of this material has been conducted. This analysis shows that while some individual levels exceed NAGD Screening Levels, the material is uncontaminated.



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Field observations have shown the peat to be generally highly consolidated and completely dry and flaky inside the core barrel upon recovery from the seabed. This demonstrates a natural origin and the uncontaminated character of the material at depth. While levels of As exceeded NAGD Screening Levels, the non-contaminated nature of the peat is demonstrated by the very low concentrations of all geochemicals that were analysed (i.e. trace metals, TBT, TPHs, OCPs, OPPs, and PCBs). An exception to this is elevated concentrations of TBT in surface samples at VC5E.

VOCs and SVOCs. During the 2010 sampling, to check for contamination peat samples were tested for VOCs and SVOCs. The laboratory data indicated that concentrations of VOCs and SVOCs for these samples were typically below Limit of Reporting (LOR) (refer **Appendix 8**).

TOC. TOC testing of peat samples has shown elevated TOC contents of up to 40%. This contrasts with the lower TOC content in surficial muddy sands overlying the peat and the clean quartzose and well sorted sand, present at depths below 0.5 m in the north-eastern part of fixed berth #1. As discussed below, the increased level of TOC has a strong correlation to the level of As, signifying that the As is a natural component of the peat and not due to contamination.

Arsenic. The geochemical analyses of the peat shows elevated concentrations of As that exceed the NAGD Screening Level of 20 mg/kg (range in peat: 30.6 to 72.9 mg/kg). One of these samples (72.9 mg/kg) also exceeds the NAGD Sediment Quality High Value of 70 mg/kg.

Since the consolidated peat unit represents a different sedimentary unit compared to overlying or adjacent unconsolidated sediments (i.e. sands and muddy sands) and has high levels of As, the ambient baseline level for As using trace element ratios was determined. This was done by normalising to 'non pollutant' elements, such as Al and Fe, as recommended in the NAGD.

Using Aluminium (Al) as a proxy for particle size, (elevated concentrations of Al representing fine-grained particulates), a bivariate plot of the concentrations of aluminium against As in whole sediments has been produced to review the relationship of As to particle size (refer **Figure 9**). This plot shows that high concentrations of Al in fine-grained peat correlate positively with elevated concentrations of As in peat. Although the concentrations of As in peat exceed the NAGD Screening Level concentration of 20 mg/kg, the strongly positive correlation with Al (i.e. grain size) suggests a natural (i.e. non-anthropogenic) and grain size-dependent origin of As within the peat.

Similarly, peat and unconsolidated sediments in the fixed berths (Dredge Area 3) also show strongly positive correlations for bivariate pairs As/Fe (refer **Figure 10**), and As/TOC (refer **Figure 11**).

Therefore, the elevated concentrations of As in the peat are substantially due to the fine-grained nature of the peat material and likely to be of a natural origin. The elevated levels of As do not appear to be due to contamination.

Conclusion

Based on the Phase II, III and IV geochemical testing, it is considered that the sediment is suitable for unconfined disposal within the Sydney Offshore Spoil Ground. The following results were found.



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- Sediments from the dredge footprint showed TBT to be the only contaminant of potential concern. Phase III and IV testing showed that while elevated, the TBT in the dredge sediments are unlikely to adversely affect water quality or benthic organisms within the water column, while toxicity tests indicate that TBT is unlikely to cause chronic toxic effects to benthic organisms.
- The 95% UCL for trace metals and PAHs were below respective NAGD Screening Levels.
- BTEX, OCPs, OPPs, PCBs were all below the LOR in all samples.
- While elevated levels of As were found in peat samples, the 95% mean UCL is less than the NAGD screening levels, and it is believed that the As is of natural origin.
- Within Dredge Area 1, sediments in the northern part of the approaches and in the central and south eastern area of the turning circle contain comparatively low TBT concentrations relative to sediments at other sample locations within the dredge footprint.



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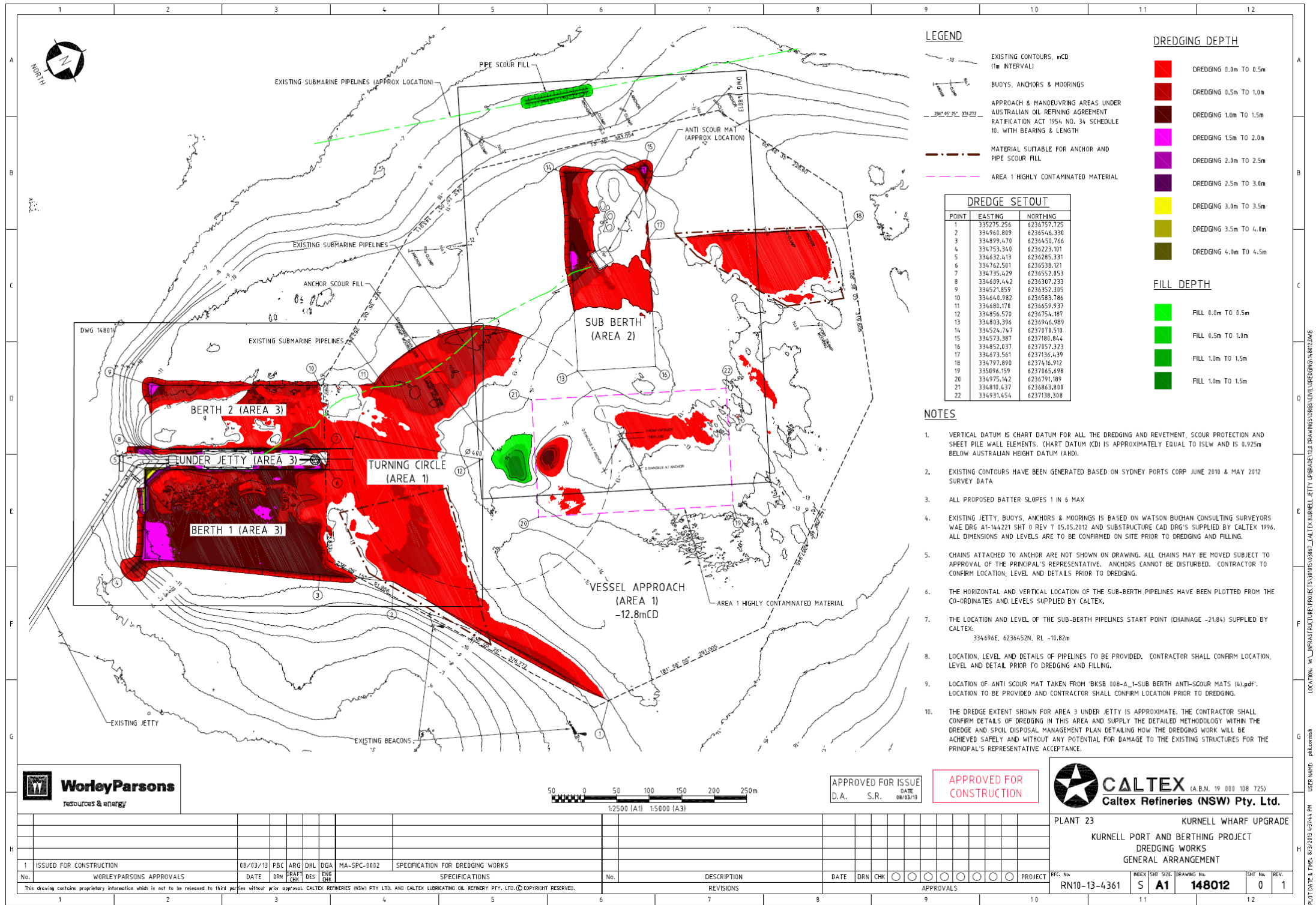


Figure 1. Overall Site Plan and Proposed Dredge Depths in Dredge Footprint.



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1 INTRODUCTION

Caltex Refineries (NSW) Pty Ltd (Caltex) proposes to dredge parts of the seabed associated with its port and berthing facility located in Botany Bay. The areas to be dredged (the dredge footprint) are as follows (refer **Figure 1**):

- approaches and turning circle (Dredge Area 1) (to be dredged to -12.8 m Chart Datum (CD));
- sub-berth (Dredge Area 2) (to be dredged to -14.0 m CD); and
- fixed berths #1 and #2 (Dredge Area 3) (to be dredged to -12.8 m CD).

The estimated dredge volume is approximately 153,000 m³.

Sediment sampling and analysis was undertaken to determine the potential options for disposal or reuse of this material. A separate report summarising the options and identifying the preferred alternatives has been prepared (URS, 2013b) and identified that the preferred option is to dispose the majority of the dredged materials to the Sydney Offshore Spoil Ground (refer **Figure 2**). The alternative options report (URS, 2013b) also recommends disposing up to 6,000 m³ of the 'cleaner' dredged material is proposed to be disposed in Botany Bay. This will be used as fill material for a former anchor point and areas subject to pipeline scour within Botany Bay (refer **Figure 1**).

The evolution and development of the project, including changes in the proposed dredge footprint and dredge material volumes, resulted in four separate sediment investigations being undertaken in Botany Bay in 2009, 2010, 2011 and 2012. The results of these investigations plus the associated physical and geochemical data are included in this Sampling and Analysis Plan (SAP) Implementation Report.

The consolidated findings of this Report supersede the *SAP Implementation Report for Dredge Areas 1, 2 and 3* from June 2012 (WorleyParsons, 2012b) and the *Supplementary SAP Implementation Report for the expanded Dredge Area 3* from November 2012 (WorleyParsons, 2012c).

The purpose of this Report is to outline the methodology and findings of the sediment investigations and to provide an assessment of the suitability of dredge material for ocean disposal under the requirements stipulated in the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009).

While each sediment investigation comprised only a part of the overall assessment, the combined assessment data provides sufficient information for an assessment under the NAGD.



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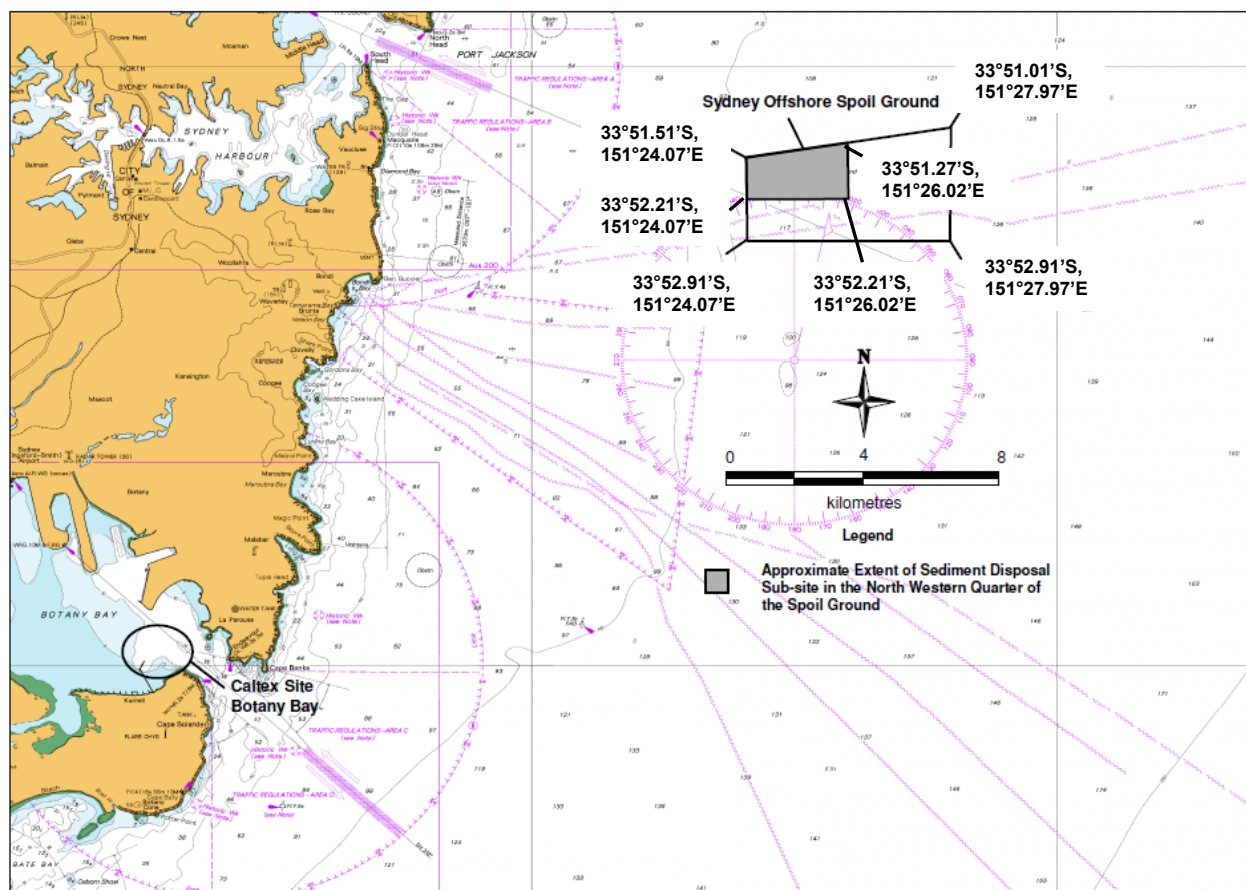


Figure 2. Sydney Offshore Spoil Ground

1.1 History of Sediment Assessments in the Proposed Dredge Areas

The locations where samples were collected on the four separate sediment investigations are shown in **Figure 3**.

The following section describes the basis for each of the separate investigations.

1.1.1 2009 Preliminary Sediment Investigation

Caltex identified the need to dredge three areas within its port and berthing facility to remove sediment that had accumulated since the last dredging campaign undertaken in 1969. These areas were:

- approaches and turning circle (Dredge Area 1);
- sub-berth (Dredge Area 2); and



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- fixed berths #1 and #2 (Dredge Area 3).

The preliminary sediment investigation aimed to characterise the physical properties and the types and concentrations of geochemicals present in the sediments of the dredge footprint. At that stage it was expected that the actual dredge footprint and volumes may change, however preliminary data was required to determine which contaminants may require additional testing once the final dredge footprint was known.

The dredging requirements were determined from the Sydney Ports Corporation's (SPC) 2007 hydrographic survey.

A SAP was not submitted to the then Department of Environmental, Water, Heritage and the Arts (DEWHA) (predecessor to the Department of Sustainability, Environment, Water, Populations and Communities - SEWPaC) for review prior to sampling. This was due to the preliminary nature of the sampling, the overall project schedule at that stage and the requirement to fit in with a suitable opening within Caltex's shipping movements, that arose at short notice.

The preliminary sediment investigation was not intended to comprise a full sediment assessment under the NAGD, but enabled a refinement of the sampling and testing undertaken in subsequent investigations in 2010, 2011 and 2012. Due to its preliminary nature and a subsequent requirement for additional sampling, separate reporting of the analytical results was not undertaken for the 2009 sampling. The 2010 Sampling and Analysis Plan (WorleyParsons, 2010) provided detail on the methodology and results from the 2009 preliminary investigation (refer **Appendix 1**).

1.1.2 2010 Supplementary Sediment Investigation

Subsequent to the 2009 survey, discussions with the SPC pilots, and review of the SPC 2009 hydrographic survey, it was determined that the dredge footprint needed expanding. In addition, results of the 2009 sediment investigations showed elevated concentrations of tributyltin (TBT). As such, further sediment sampling and analysis was required and undertaken as a supplementary sediment investigation in March 2010. The purpose of this investigation was to:

- characterise the geochemical properties of sediment within the expanded areas of the dredge footprint; and
- assess the bioavailability and toxicity of elevated TBT concentrations observed in the 2009 preliminary investigation across the dredge footprint.

A SAP was prepared for this investigation (WorleyParsons, 2010) and submitted to the then DEWHA (predecessor to SEWPaC) for review in February 2010. Following minor requested amendments, the SAP was approved in March 2010 (refer **Appendix 1**).

1.1.3 2011 Supplementary Sediment Investigation

Following the sediment sampling investigation in 2010, Caltex further revised their dredging requirements. Therefore, further sampling and analysis requirements were identified in association with:



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- inclusion of dredging of fixed berths #1 and #2 (Dredge Area 3) adjacent to the Kurnell Wharf and in the turning circle to -12.8 m CD;
- identified accumulation of sediment following a review of the 2011 SPC hydrographic survey;
- meeting the required minimum number of sample locations specified in the NAGD for the increase in dredge volume since the previous sediment sampling and analysis;
- provide a better spatial and vertical coverage of the physical and geochemical characteristics of the sediments within the dredge footprint; and
- identify whether any hydrocarbon contamination was present in the surficial sediments within the dredge footprint following an oily water discharge from the Caltex Refinery in March 2011.

A Supplementary SAP (WorleyParsons, 2011) was prepared for the additional sediment investigation. The Supplementary SAP specified the program of sampling and analysis that would be undertaken in accordance with the NAGD. It also provided details on the methodology and results from the two previous sediment investigations (refer **Appendix 2**).

The Supplementary SAP was submitted to SEWPaC for review in September 2011 and the Supplementary SAP was amended in accordance with the review comments.

The third sediment sampling and analysis investigation was completed in November 2011 in accordance with the Supplementary SAP and SEWPaC comments.

1.1.4 2012 Supplementary Sediment Investigation

In 2012 it was identified that additional dredging would be required for fixed berths #1 and #2 adjacent to the Kurnell Wharf as a result of a vessel manoeuvrability review by SPC's pilots. The additional dredging requirements are a result of a proposed widening of the two fixed berths (Dredge Area 3). Therefore, additional sediment sampling and analysis was required to:

- meet the required minimum number of sample locations specified in the NAGD (due to the increase in dredge volume); and
- provide a better spatial and vertical coverage within the entire enlarged dredge footprint of Dredge Area 3.

A Supplementary SAP (WorleyParsons, 2012) was prepared for the additional sediment investigation (refer **Appendix 3**). The supplementary sediment sampling was completed prior to the approval of the Supplementary SAP by SEWPaC (submitted in August 2012) due to Caltex's urgent time constraints on the development of the fixed berths.

The fourth sediment sampling investigation was completed in August 2012.



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Figure 3. Sediment Sample Locations (2009, 2010, 2011 and 2012 sediment investigations).



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1.2 Project Objectives

Since the first preliminary sediment investigation in 2009, project requirements have changed due to changes in dredge volume and footprint. However, the overall objectives of each of the sediment sampling investigations was to:

- ensure an adequate spatial and vertical coverage of the dredge footprint to meet the NAGD minimum sampling requirements;
- analyse the dredge material for identified contaminants of potential concern and physical properties;
- compare the geochemical concentrations in sediments against the NAGD; and
- determine the suitability of dredge material for sea disposal from each dredge area.

The overall sediment sampling and analysis undertaken in the four sediment investigations is summarised in this Report. The outcomes of the sediment investigations and data interpretation will support applications for approvals for dredging and ocean disposal from the relevant government agencies (i.e. SEWPaC).



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2 METHODOLOGY

2.1 Sediment Sampling Locations

The proposed dredge footprint and volume for each investigation was determined by reviewing the most recent hydrographic survey data available at the time of sampling.

- Sample locations in the initial sampling program (2009) were randomly selected in accordance with NAGD requirements.
- As the dredge design changed, subsequent sediment investigations (2010 and 2011 only) used a judgemental sampling pattern to locate samples based on the following information:
 - o identification of areas with the greatest sediment accretion within the proposed dredge footprint;
 - o identification of areas that had been shown to contain elevated concentrations of TBT in the initial sampling investigation; and
 - o to provide coverage of areas not sampled in previous investigations due to the broadening of the dredge footprint, or recent accumulation of sediment.
- Sample locations in the 2012 sediment investigation were assigned using a random sampling pattern. The supplementary sampling ensured that the entire area of the expanded dredge footprint in Fixed Berths #1 and #2 was covered.

In total, sediment samples were collected at 53 discrete sample locations over the four sampling programs (refer **Table 1**). The number of sample locations for each of the three individual Dredge Areas is adequate to satisfy the minimum sampling requirements stipulated in the NAGD.

The sample locations from all four sediment investigations are shown in **Figure 3**. Coordinates (MGA94, Zone 56) for all sample locations are shown in **Appendix 4**.



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Table 1 Number of Actual and Required Sample Locations Across the Dredge Footprint

Dredge Area	Estimated Dredge Volume (m ³)	Number of Sample Locations	
		Number Locations Sampled	NAGD Minimum Required Sample Locations
Combined Dredge Areas, 1, 2 and 3	153,000	53 (+5 repeat locations)	20
Approaches and Turning Circle (Dredge Area 1)	60,250	19 (+2 repeat locations)	14
Sub-berth (Dredge Area 2)	12,750	7 (+3 repeat locations)	7
Fixed Berths #1 and #2 (Dredge Area 3)	80,000	27	16

Note: Repeat locations were generally resampled for the purpose of assessing TBT for the NAGD Phase III assessment.

2.2 Sediment Sample Collection and Processing

2.2.1 2009, 2010 and 2011 Sediment Investigations

SAMPLE COLLECTION

Vibrocores were collected by McLennan's Diving Services (MDS) aboard the crane barges *Alkira* and *Polaris* under the supervision of a WorleyParsons environmental scientist (refer **Photo 1**). An on-board global positioning system receiver (GPS) was used to position the vessel to within 5 m of each sample location.

Vibrocores were taken to a depth of up to 3.5 m, depending on the depth of dredging required, or until refusal. The equipment used in the sampling of sediments was a Rossfelder™ P3 model vibrocore with 100 mm steel core tubes (refer **Photo 2**). Divers were used to verify the vertical penetration of each vibrocore into the sediments and to assist in sample retention and minimizing core loss. Vibrocores were capped at each end following core retrieval. During vibrocoreing in fixed berth #1, a vibrocore frame (refer **Photo 3**) was used to ensure that the vibrocore tube remained vertical whilst penetrating the hard peat layers that were present at that locality.

Surface samples collected during the first three sediment investigations in 2009, 2010 and 2011 were either collected by MDS divers pushing a core tube to a depth of 0.5 m or by Petite Ponar grab sampler.

Where necessary, two or more cores were taken to ensure that sufficient volume of sediment was retrieved for the required geochemical analyses.

A WorleyParsons senior environmental scientist determined the acceptability of the sediment core following collection. The criteria for acceptance of the core included:



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- no obvious loss of surficial sediment;
- the core must have entered the sediment profile vertically;
- there were no visible disturbances or gaps in the sediment stratigraphy; and
- the core reached the depth of dredging or refusal at rock or dense peat, sand or clay.

Ambient seawater for use in elutriate analysis and elutriate toxicity testing was collected in a triple-rinsed plastic bucket.

SAMPLE PROCESSING

Sediment cores were transported ashore for sample processing by an experienced WorleyParsons scientist. Cores were split longitudinally, photographed and logged. A field log was kept during the preliminary investigation in November 2009 to record sediment characteristics at each sample location. A detailed field log was also kept during the March 2010 and November 2011 investigations to record details of the sediment characteristics in each sample, such as colour, texture, odour, and the time of sampling. Surface samples collected by grab sampler were logged, photographed and subsampled aboard the sampling vessel by a WorleyParsons scientist. Field core and sample logs are provided in **Appendix 5**.

Standard Operating Procedures (SOP) for the coring, surface sampling and sub-sampling are included in **Appendix 6**. For the processing of each sample from each sample location a new set of powder-free nitrile gloves were worn by the sampler. Subsampling was undertaken using stainless steel implements that were cleaned between each sample using Decon® 90, followed by a freshwater rinse.

One subsample was collected from each surface grab. Subsamples were collected from 0.5 m depth intervals from each vibrocore, or once below 0.5m within stratigraphic boundaries (e.g. mud and sand layers).

Samples for geochemical analysis² and possible elutriate testing were homogenised and placed in appropriate sampling containers that were provided by the laboratory³ and with zero headspace. Samples for physical testing and acid sulfate soil (ASS) testing were placed in plastic zip-lock bags. Excess air was expelled from the ASS zip-lock sample bags. Bulk samples for toxicity testing were transferred to plastic zip-lock bags and double-bagged to minimise sample oxidation.

Each sample container was tightly sealed and labelled with a unique identification number. Samples were stored immediately on ice to maintain sample temperatures below 4°C before being shipped under Chain-of-Custody (CoC) protocols to the following analytical and scientific laboratories.

- ALS Laboratory Group⁴ (ALS) for physical and geochemical testing (primary laboratory);

² Excluding subsamples to be tested for acid sulfate soils and volatile organics.

³ Laboratory provided containers comprised solvent rinsed glass jars with Teflon-lined lids.

⁴ Accredited by the National Association of Testing Authorities (NATA).



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- Advanced Analytical Australia (AAA)³ for geochemical testing of split triplicates (secondary laboratory); and
- CSIRO Centre for Environmental Contaminants Research (CECR) for whole sediment toxicity testing.

On receipt of whole sediment samples at CECR, samples were stored under nitrogen until the geochemical analysis was undertaken. Additional sediment was sent to CECR for storage under nitrogen in the event that elutriate toxicity testing was required. Following receipt of samples, CECR was responsible for sample handling and liaison with Ecotox Services Australia (ESA) regarding elutriate toxicity testing.



Photo 1. McLennan's Diving Service crane barge "Alkira".



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Photo 2. Vibrocoreing from the crane barge “Alkira”.



Photo 3. Use of the vibrocore frame.



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2.2.2 2012 Sediment Investigation

SAMPLE COLLECTION

During the 2012 sediment investigation of the fixed berths (Dredge Area 3), sediment cores were collected by Geochemical Assessments Pty Ltd (GA).

GA used a combination of either a custom-fabricated piston push corer with 52 mm outer diameter (OD) steel core tubes or a light weight SDI™ vibrocorer with 52 mm OD steel core tubes. The GA sampling vessel, a purpose-built aluminium trailer boat, was used as a working platform for sediment core sampling and on-board sample processing.

Cores were collected as close as possible to each of the proposed sample locations. A handheld GPS with an accuracy of +/-5 m was used to record each sample location, with a three-point anchoring system deployed at some locations to prevent wind and cross-currents from moving the sampling vessel away from the sampling location.

A log was kept to record the sampling date, time, water depth, sample location coordinates, depth of core penetration and other relevant data for each sample location. Prior to sampling, the vessel was thoroughly inspected and washed down. Any evident sources of contamination were cleaned to avoid accidental contamination of the sediment samples.

Cores were driven to the depth of dredging or refusal in consolidated underlying material. Wherever possible, the piston push corer was used to enable a time-efficient collection of sediment cores to the depth of dredging or core refusal. When piston core refusal occurred in sandy sediment above the depth of dredging, the vibrocore was deployed to obtain a core sample to the depth of dredging or core refusal in consolidated material.

Multiple sediment cores (up to 4 cores) were collected at several sample locations where a short core penetration in consolidated peat (<0.15 m) did not provide sufficient volume of sediment for the required physical and geochemical analyses. In these cases, the material from multiple cores was combined to provide a single composite sample from which a sub-sample was taken.

A WorleyParsons senior environmental scientist determined the acceptability of the sediment core following collection. The criteria for acceptance of the core included:

- no obvious loss of surficial sediment;
- the core must have entered the sediment profile vertically;
- there were no visible disturbances or gaps in the sediment stratigraphy; and
- the core reached the depth of dredging or refusal at rock or dense peat, sand or clay.

SAMPLE PROCESSING

Sample processing was undertaken aboard the sampling vessel immediately following sediment collection. All sample handling was performed to minimise contamination and sample handling errors. The workspace on the sampling vessel was washed down regularly with ambient seawater to clean



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all surfaces and minimise dust contamination. For the processing of each sample from each location, a set of new powder-free nitrile gloves were worn by the sampler. Subsampling was undertaken using stainless steel implements that were decontaminated between each sample using Decon® 90, followed by an ambient seawater rinse.

Piston cores and/or vibrocores were extruded from the core tube and placed on a sampling tray for subsequent logging, photographing and subsampling. Field core and sample logs are provided in **Appendix 5**.

A subsample for geochemical and physical analysis was collected at 0.5 m depth intervals in the top 1.0 m (i.e. 0.0-0.5 m and 0.5-1.0 m), followed by a composite sample from 1.0 m to the end of the core. An additional subsample in each of these horizons was collected and stored appropriately for elutriate testing, if required.

Samples for geochemical analysis and possible elutriate testing were homogenised and placed with zero headspace in appropriate sampling containers that were provided by the analytical laboratory. Samples for physical testing (Particle Size Distributions analysis (PSD)) were placed in 250 ml plastic zip lock bags.

Sample identifiers included the sample location and the depth interval. For example, C1_0.0-0.5 indicates that the sediment sample was collected from sample location C1 over the interval from 0.0 m to 0.5 m. Triplicate samples were labelled with the prefix "T" and suffix A or B (e.g. T01A). QA/QC samples were numbered consecutively (i.e. QC1, QC2, etc.) with the type of the QA/QC sample and the key for the primary sample it relates to recorded on a separate QA/QC identification log sheet that was not revealed to the analytical laboratory.

2.3 Total Number of Samples

In total, 99 primary samples and 24 QA/QC samples were collected during the four sediment investigations (refer **Table 2**).

Field QA/QC samples collected during the four sediment investigations included the following.

- Field triplicates comprising three sediment samples taken at the same location. These give an indication of the small-scale spatial variability of the concentrations of analytes in sediments at a sample location.
- Split duplicates and split triplicates (i.e. a single homogenised sample split into two or more containers) to assess variability associated with subsample handling. The third sample of the split triplicate was sent to a secondary laboratory (AAA) to assess inter-laboratory analytical variability in the geochemical data.
- Field blank samples to assess handling and variability in the concentrations of volatile organic compounds (VOCs) associated with sample transportation (2010 and 2011 sampling), and Method Blank (2012 sampling) to assess potential cross-contamination of samples as part of the subsampling methodology.



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Table 2 Number of Analysed Subsamples

Sample type	Number of Subsamples				Total
	Nov 2009	Mar 2010	Nov 2011	Aug 2012	
Surface cores	12	10	5	-	27
Vibrocores/Piston push cores	21	16	14	21	72
Field Triplicate	-	2 additional samples	2 additional samples	4 additional samples	8
Split Triplicate	-	2 additional samples	2 additional samples	2 additional samples	6
Split Duplicates	3 additional samples	-	-	2 additional samples	5
Field and Method Blank	-	1	1	3	5
Total	36	31	24	32	123

2.4 NAGD Phase II Testing

Geochemical analysis of sediment samples was undertaken by two NATA-accredited laboratories. Primary laboratory services were carried out by ALS whilst AAA provided secondary laboratory services for the analysis of split triplicate samples.

2009 SEDIMENT INVESTIGATION

Geochemical testing on all sediment samples from the dredge footprint comprised:

- a suite of heavy metals (silver (Ag), arsenic (As), cadmium (Cd), cobalt (Co), chromium (Cr), copper (Cu), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb), tin (Sb), selenium (Se), vanadium (V), and zinc (Zn));
- polycyclic aromatic hydrocarbons (PAHs); and
- total organic carbon (TOC).

Fifty per cent of samples were analysed for TBT.

In addition, testing was also undertaken on 20% of samples for:

- benzene, toluene, ethylbenzene and xylene (BTEX);
- total petroleum hydrocarbons (TPHs) (C₆-C₃₆);



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- organochlorine pesticides (OCPs); and
- polychlorinated biphenyls (PCBs).

2010 SEDIMENT INVESTIGATION

Geochemical testing comprised:

- TBT and TOC in all sediment samples;
- 8 of the 10 sample locations
 - o a suite of heavy metals (Ag, As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Se, V, Zn)
 - o PAHs; and
 - o 20% of sample locations for BTEX, TPHs, OCPs and PCBs.

2011 SEDIMENT INVESTIGATION

Geochemical testing comprised:

- TBT and TOC analyses of all sediment samples;
- a suite of heavy metals (Ag, As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Se, V, Zn) analysed in all samples;
- testing of 20% of samples for BTEX, OCPs, organophosphorous pesticides (OPPs) and PCBs and
- testing of five surface samples for PAHs and TPHs in the fixed berths (Dredge Area 3) and in the turning circle (Dredge Area 1), to address the potential for hydrocarbon contamination as a result of oily water from the Caltex Refinery.

During subsampling of two cores from fixed berth #1, a hard, black material and black viscous fluid was observed on splitting of the cores. Due to the location of the samples adjacent to the Kurnell Wharf, and the unknown physical and geochemical characteristics of the material, the samples were also tested for a range of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). Testing on the physical and chemical parameters outlined above was also conducted.

2012 SEDIMENT INVESTIGATION

Sampling of sediments in the expanded dredge footprint of the fixed berths (Dredge Area 3) comprised the following geochemical testing for all sediment samples:

- trace metals (Ag, As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Se, Sb, V, Zn);
- major elements (iron (Fe) and aluminium (Al));
- PAHs;
- TBT; and



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- TOC.

In addition, fifteen (15) sediment samples (including three QA/QC samples) were analysed for TPH (C₁₀-C₃₆) to assess the concentrations and the spatial distribution of TPH in sediments in the fixed berths (Dredge Area 3).

The hierarchical assessment strategy that was used in the successive sediment assessments allowed an elimination of some geochemicals, such as PAHs, BTEX, OCPs, OPPs and PCBs. In particular, the concentrations of BTEX, OCPs, OPPs and PCBs were below the analytical limits of reporting (LOR) in all sediment samples analysed in previous investigations. This outcome, together with the absence of identified local sources of these geochemicals in the vicinity of the dredge footprint, resulted in omitting these geochemicals from sampling in this round of sediment investigations. This conforms with the NAGD requirements.

2.4.1 Geochemical Analysis

The geochemical analytes, analytical methodologies and analytical Limit of Recording (LOR) of the sediment investigations undertaken either meet or exceed the Practical Quantitation Limits (PQLs) stipulated in the NAGD. Values used and NAGD requirements are listed in **Table 3**.



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Table 3 Comparison of laboratory LORs achieved and NAGD PQL requirements.

Analyte	Laboratory LOR	NAGD PQL	Unit	Laboratory Method	NAGD Screening Level
Silver (Ag)	0.1	0.1	mg/kg	USEPA 6020	1
Cadmium (Cd)	0.1	0.1	mg/kg	USEPA 6020	1.5
Selenium (Se)	0.1	0.1	mg/kg	USEPA 6020	--
Cobalt (Co)	0.5	0.5	mg/kg	USEPA 6020	--
Antimony (Sb)	0.5	0.5	mg/kg	USEPA 6020	2
Copper (Cu)	1	1	mg/kg	USEPA 6020	65
Lead (Pb)	1	1	mg/kg	USEPA 6020	50
Zinc (Zn)	1	1	mg/kg	USEPA 6020	200
Chromium (Cr)	1	1	mg/kg	USEPA 6020	80
Nickel (Ni)	1	1	mg/kg	USEPA 6020	21
Arsenic (As)	1	1	mg/kg	USEPA 6020	20
Vanadium (V)	2	2	mg/kg	USEPA 6020	--
Manganese (Mn)	10	10	mg/kg	USEPA 6020	--
Mercury (Hg)	0.01	0.01	mg/kg	APHA 3112 Hg-B	0.15
Iron (Fe)	50	100	mg/kg	USEPA 6010	--
Aluminium (Al)	50	--	mg/kg	USEPA 6010	--
BTEX	0.2	0.2	mg/kg	USEPA SW 846 - 8260B)	N/A
OCPs	0.25-0.5	1	µg/kg	USEPA 3640	0.32-280
OPPs	10	---	µg/kg	USEPA 3640	N/A
PAHs (each individual species)	4-5	5	µg/kg	USEPA 3640/8270	10,000
TPH (C ₆ -C ₉)	0.2	--	mg/kg	USEPA 5030/8260	550
TPH (C ₁₀ -C ₃₆)	3-5/100 total	--	mg/kg	USEPA 3510/8015	550
Total PCBs	5	100	µg/kg	USEPA 3640/3620 USEPA 8081/8082	23
TBT	0.5	1	µg/kg	In-House GC/MS	9
TOC	0.02	0.1	%	In house/Leco	--

Analytical results for organic analytes present above the analytical LOR were normalised to 1% TOC (within limits of 0.2% to 10% TOC). Results for each contaminant of potential concern, for which NAGD Screening Levels exist, and for which the concentration of a contaminant exceeds the analytical LOR in at least one sample, were statistically analysed. Calculations included the mean, standard deviation (SD) and the 95% upper confidence limit (UCL) of the mean concentration for sediments in each Dredge Area. Values have been calculated using the combined analytical dataset from the four sediment investigations.

Where concentrations were below the LOR, a value of half the LOR was used in the statistical analysis of the results. In accordance with the NAGD, the 95% UCL of the mean concentration of a contaminant was determined using either:

- the student-t test method where data was normally distributed; or



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- the standard bootstrap method where the data were not normally distributed.

2.4.2 Physical Testing

Quantitative PSD testing was completed to characterise the physical properties of the proposed dredge material as follows:

- 30% of samples from the preliminary 2009 sediment investigation;
- 0% of samples from the 2010 sediment investigation;
- 50% of samples from the 2011 sediment investigation; and
- 50% of samples from the 2012 sediment investigation

A total of 31 out of 99 samples from the dredge footprint (i.e. 31% of samples) were analysed for PSD, including:

- 22% of samples from the approaches and turning circle (Dredge Area 1);
- 20% of samples from the sub berth (Dredge Area 2); and
- 44% of samples from the fixed berths (Dredge Area 3).

The PSD analyses of sediments, together with field observations and visual estimates of the sediment fine fraction content, are adequate to characterise the texture of the sediments across the dredged footprint.

2.5 NAGD Phase III Elutriate Testing

TBT elutriate testing of sediments under Phase III of the NAGD was undertaken as a result of the 95% UCL of the mean exceeding the NAGD Screening Level for TBT in sediments in each of the three Dredge Areas.

During the preliminary sediment investigation in November 2009 elutriate TBT testing was undertaken on three selected samples, one from each of the three Dredge Areas. Samples selected for elutriate TBT analysis included two samples with normalised TBT concentrations as close as possible to, or slightly higher than, the 95% UCL of the mean TBT concentration obtained from the TBT data of the 2009 sediment investigation (samples VC1B_0-0.6 from Dredge Area 1 and SS3B from Dredge Area 3). The third sample had the highest TBT concentration (SS2D from Dredge Area 2).

Elevated elutriate concentrations of TBT were identified in two of the three samples tested in the November 2009 investigation (within Dredge Areas 1 and 2) (refer **Section 3.2.2**), triggering the need for further testing in accordance with the testing framework provided in the NAGD.



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Advice was subsequently sought from Dr Stuart Simpson (CSIRO) on the most appropriate method of testing the TBT for its bioavailability and toxicity⁵. The testing undertaken in March 2010 was based on the recommendations provided by Dr Simpson (refer **Appendix 7**).

The in-situ bioavailability of TBT could not be undertaken as pore water testing was not considered to be viable given that the results of the sampling investigation indicated that the sediments comprised approximately 90% sand. Dr Simpson advised that the *'extraction of pore water from sandy sediments is not practice and considered unnecessary, given the analytical uncertainties associated with TBT analyses'*. As bioavailability testing could not be undertaken, toxicity testing was therefore required to determine the in-situ effects of TBT contamination at the proposed disposal location, the Sydney Offshore Spoil Ground.

In March 2010, elutriate TBT testing was carried out on ten (10) additional samples in the approaches and swing basin (Dredge Area 1) and sub-berth (Dredge Area 2). Samples with varying TBT concentrations (normalised to 1% TOC) were selected for testing, including samples with TBT concentrations:

- above the NAGD Sediment Quality High Value of 70 µgSn/kg; and
- representative of the 95% UCL of the mean total TBT concentration from the combined 2009 and 2010 data.

One replicate and one seawater sample in the March 2010 sediment investigation was submitted for TBT analysis for QA/QC purposes.

Further elutriate testing was undertaken in the 2011 sediment investigations. Testing for elutriate TBT was carried out on three samples with TBT concentrations close to the 95% UCL of the mean for the combined data set.

As part of the 2012 sediment investigations, elutriate analyses for TBT were carried out on five (5) samples plus one replicate sample and one elutriate seawater blank sample for the fixed berths (Dredge Area 3). This exceeds the minimum analysis criteria set out in the NAGD, in which a minimum of four (4) samples are required for elutriate analyses for dredge volumes of less than 100,000 m³ (dredge volume for the Fixed Berths is approximately 80,000 m³).

None of the sediment samples collected in the fixed berths (Dredge Area 3) during August 2012 exceeded the NAGD Screening Level concentration of TBT (9 µgSn/kg) normalised to 1% TOC. As such, the selection of samples for elutriate analyses was primarily guided by the requirements stipulated in the NAGD to obtain samples that are *'representative of the overall dredged material composition in the dredged area'* and *'representative of all levels of contamination'* (Commonwealth of Australia, 2009, p. 61).

⁵ Dr Simpson is an expert in aquatic geochemistry and sediment toxicology and was a key technical expert in the development of the NAGD.



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Therefore, the five (5) samples (plus one replicate sample) chosen for elutriate analyses of TBT were:

- representative of material to be dredged in the overall fixed berths (Dredge Area 3), including consolidated peat and unconsolidated muddy sand (C5_0.0-0.15 (peat); C14_0.0-0.15 (peat); C2_0.0-0.5 (muddy sand); C15_0.0-0.5 (muddy sand) and C18_0.0-0.5 (muddy sand with fragmented peat); and
- representative of material to be dredged in the fixed berths #1 and #2 (C5_0.0-0.15 (Berth 1); C2_0.0-0.5 (Berth 1); C18_0.0-0.5 (Berth 1); C14_0.0-0.15 (Berth 2) and C15_0.0-0.5 (Berth 2)).

In addition, one (1) replicate sample (QC5 - a split replicate of primary sample C2_0.0-0.5) and one (1) seawater sample (labelled "Elutriate Blank") were submitted for elutriate analyses for QA/QC purposes.

The overall dredge volumes for the dredge footprint is 153,000 m³. The amount and percentage of total dredge volume in each area is:

- the approaches and turning circle (Dredge Area 1) contain 60,250 m³, approximately 39% of dredge material;
- the sub berth (Dredge Area 2) contain 12,750m³, approximately 8%; and
- fixed berths (Dredge Area 3) contain 80,000m³, approximately 52%.

TBT elutriate analysis of ten samples from the approaches and turning circle (Dredge Area 1), three samples from the sub berth (Dredge Area 2) and eight samples from the fixed berths (Dredge Area 3) respectively represent approximately 48%, 14% and 38% of the total number of elutriate samples analysed (i.e. 21 samples). Therefore, the percentages of elutriate samples analysed in the dredge footprint are approximately proportional to the respective dredge volumes each of the Dredge Areas.

2.6 NAGD Phase IV Toxicity Testing

TBT bioavailability testing in pore waters under NAGD Phase III was not undertaken due to the sandy nature of the sediments (see above). Testing therefore progressed to NAGD Phase IV toxicity testing.

In Phase IV testing, the NAGD recommends three different types of toxicity tests, but acknowledges that only a small number of marine sediment toxicity tests are available in Australia. The NAGD states a preference for whole sediment toxicity testing as these are considered to be ecologically more relevant. The NAGD states that toxicity testing of elutriates may be required in some cases.

Advice was sought from Dr Simpson of CSIRO on the most appropriate method for toxicity testing. In accordance with Dr Simpson's recommendations (refer **Appendix 7**), the following two types of toxicity testing were recommended for the sediments collected from the dredge footprint:

- whole sediment toxicity testing for amphipod *Melita* (*Melita plumulosa*); and
- toxicity testing of elutriates for Sydney Rock Oyster (*Saccostrea commercialis*).



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This recommendation by Dr Simpson was submitted as part of a SAP to SEWPac for review in February 2010 and, following minor requested amendments, was approved on 5 March 2010. A summary of the sampling and analysis procedures are provided in the following sections.

2.6.1 Whole Sediment Toxicity Testing

Whole sediment toxicity testing was undertaken during the March 2010 investigation to determine the *in situ* effects of TBT contamination at the Sydney Offshore Spoil Ground after the disposal of dredged material. Typically this would be undertaken through pore water testing. However, extraction of pore water from sandy sediments that are typically present in the three Dredge Areas (refer **Section 3.1**) is not practical and may result in an underestimation of the pore water TBT concentrations.

The toxicity testing of whole sediments that was undertaken assesses chronic effects (reproduction) to *Melita plumulosa*⁶. Whole sediment testing was carried out by the CSIRO CECR. Samples selected for whole sediment toxicity testing included:

- three samples with total normalised TBT concentrations above the NAGD Sediment Quality High value of 70 µgSn/kg and close to or above the 95% UCL of the mean normalised TBT concentration for the combined 2009 and 2010 dataset (VC4B (1.5-2.0), SS4D, and VC4C (0.5-1.0));
- one blind control with a total normalised TBT concentrations below the NAGD Sediment Quality High value of 70µgSn/kg (VC4C (1.0-1.5); and
- one silty laboratory control.

2.6.2 Toxicity Testing of Elutriates

Toxicity testing of elutriates was undertaken during the March 2010 investigation. Elutriate toxicity testing was undertaken by the NATA accredited laboratory ESA. Testing was undertaken in polycarbonate containers that were used to minimise adsorption of TBT to the container walls.

Elutriate toxicity testing comprised a 48-hour larval development test using the Sydney Rock Oyster (*Saccostrea commercialis*) to determine the presence or absence of toxicity⁷. The test involves

⁶ *M. plumulosa* may not inhabit the designated ocean disposal site at the Sydney Offshore Spoil Ground; however the species is native to NSW waters, is exposed to contaminants via both dissolved and dietary exposure routes, and is relatively sensitive to contaminants compared to other native species. Toxicity tests using *M. plumulosa* are more robust than tests using other species present in NSW sediments such as the harpacticoid copepod, *Nitocra spinipes* (S. Simpson, pers.comm., 2009).

⁷ The absence of toxicity would not ensure that other toxic effects from dissolved TBT (e.g. imposex in snails and immune-suppression in bivalves) could not occur. There are no TBT sensitive tests using bivalves or snails, however it is considered that the water quality guidelines would need to be exceeded continuously for such chronic effects to occur (S. Simpson, pers. comm., 2009).



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exposure of developing bivalve embryos to a range of elutriate concentrations (diluted with seawater) from each sample and determination of the number of normally developed and abnormal larvae after 48 hours.

Testing of each sample involved the preparation of 1:4 elutriate, which was serially diluted with seawater to achieve test concentrations of 100%, 50%, 25%, 12.5% and 6.3%. Elutriate samples were also tested for ammonia and sulfide and the seawater sample used to dilute samples was tested concurrently with the samples.

Sediments for use in elutriate toxicity testing were stored by CECR under nitrogen and provided to ESA for testing within 7 weeks of sampling. As for the whole sediment toxicity testing, samples selected for elutriate toxicity testing included:

- three samples with total normalised TBT concentrations above the NAGD Sediment Quality High value of 70 µgSn/kg and close to or above the 95% UCL of the mean normalised TBT concentration for all areas from the combined 2009 and 2010 dataset (VC4B(0.5-1.5), VC4B(1.5-2.0), VC4C(0.5-1.0));
- one blind control with a total normalised TBT concentration below the NAGD Sediment Quality High value of 70 µgSn/kg (SS4G); and
- one silty laboratory control.

2.7 Acid Sulfate Soil Testing

While not required under the NAGD for assessing sediments for sea disposal, acid sulfate soil (ASS) testing was undertaken on all samples during the preliminary sediment investigation in 2009.

Following the results of the field screen testing, 10% of samples were selected for the Chromium-Reducible Sulfur (CRS) suite to confirm the risk of acid-generating material being present in the proposed dredge material. Based on the results, it was considered that there was limited risk of disturbing acid sulfate soils within the dredge footprint and no further testing was undertaken during the supplementary 2010 investigation.

During subsampling of cores from the November 2011 investigation, sediment indicators of potential ASS (PASS) were identified in three cores (i.e. grey to black sediments, presence of shell, sulphurous odour). ASS screen testing and CRS testing were carried out on samples from these three cores.

2.8 Summary of Testing

A summary of the physical, geochemical and toxicity testing, and frequency of testing carried out in the four sediment investigations is contained in **Table 4**.



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Table 4 Summary of Sediment Testing - 2009 to 2012

Analyte	Frequency of Testing			
	Nov 2009	Mar 2010	Nov 2011	Aug 2012
Number of primary samples	33	26	19	21
Moisture content	All samples	All samples	All samples	All samples
Heavy metals (Ag, As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Se, V, and Zn)	All samples	All samples from additional dredge footprint	All samples from additional dredge footprint	All samples
Major elements (Al, Fe)	Nil	Nil	Nil	All samples
PAHs	All samples	8 of 10 samples from Dredge Area 1	Surface samples from Swing Basin and Dredge Area 3	All samples
TBT	50% of samples	All samples	All samples	All samples
TOC	All samples	All samples	All samples	All samples
OCPs	20% of samples	20% of samples from additional dredge footprint	20% of samples from additional dredge footprint	Nil
OPPs	Nil	Nil	20% of samples	Nil
BTEX	20% of samples	20% of samples from additional dredge footprint	20% of samples from additional dredge footprint	Nil
TPHs (C ₆ -C ₃₆)	20% of samples	20% of samples from additional dredge footprint	Surface samples from Swing Basin and Dredge Area 3	50% of samples from peat and muddy sands in Dredge Area 3
PCBs	20% of samples	20% of samples from additional dredge footprint	20% of samples from additional dredge footprint	Nil
ASS field screen test	All samples	Nil	6 samples with sediment indicators of AASS/PASS	Nil
VOCs/SVOCs	Nil	Nil	Selected samples from 2 locations	Nil
Chromium-Reducible Sulfur (CRS) suite	10% of samples (selected follow field screen test)	Nil	6 samples with sediment indicators of AASS/PASS	Nil
Particle size distribution (PSD)	30% of samples	Nil	50% of samples	50% of samples from Dredge Area 3
Elutriate TBT testing	3 samples	10 samples	3 samples	5 samples
Whole sediment toxicity testing	Nil	4 samples	Nil	Nil
Elutriate toxicity testing	Nil	4 samples	Nil	Nil

*normalised to 1% TOC

2.9 Field QA/QC Procedures

Field QA/QC procedures included the following.

- Use of suitably qualified environmental staff and support personnel experienced in sediment sampling, field supervision, sediment sampling and sediment logging.
- The adoption and implementation of a Standard Operating Procedures (SOP) provided in **Appendix 6**.



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- Decontamination/covering of all potentially contaminated surfaces prior to sampling and subsampling.
- Documentation in a field log during sampling and subsampling noting sample locations and any changes, time, date, and sediment characteristics.
- Use of appropriate Personal Protective Equipment (PPE) (i.e. nitrile gloves), appropriate sampling utensils, and decontamination of all sampling equipment between samples using a laboratory-grade detergent (Decon® 90).
- Storage of samples in appropriately pre-treated and labelled sample containers provided by the analytical laboratory (where relevant).
- Following sampling, an immediate storage of samples in cool boxes containing bags of ice to maintain sample temperatures below 4°C until delivery to the analytical laboratory.
- Storage of samples held for potential toxicity testing under nitrogen to extend toxicity testing holding times, allowing for analysis following receipt of geochemical and/or elutriate TBT results.
- Transportation of samples under chain-of-custody (CoC) procedures to the analytical laboratory.
- Submission of:
 - o field triplicates, split duplicates and triplicates, and field blanks for geochemical analyses; and
 - o a split duplicate for elutriate TBT testing.

2.10 Quality Control (Laboratory Analysis)

The primary analytical laboratory used for the geochemical and physicochemical analyses of sediments for the four sediment investigations, ALS, is NATA accredited for the analytical methods used. ALS is experienced in the analysis of marine sediments. The secondary laboratory used for the analysis of inter-laboratory QC samples was AAA, which is also NATA-accredited for the analyses undertaken (except selenium).

Quality control procedures relevant to the assessment of sediment geochemistry include:

- CoC protocol;
- laboratory QC protocols; and
- inter-laboratory analysis.

Laboratory QC procedures were undertaken in accordance with Appendix F of the NAGD to confirm that the analytical data quality was suitable for undertaking an assessment to characterise material proposed for dredging and disposal.



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Laboratory data validation included an assessment of results for laboratory blanks, standards, surrogate spike samples and matrix spikes and duplicate samples. Results were compared to laboratory criteria which are equivalent to the NAGD criteria for the analyses undertaken.



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3 RESULTS OF THE INVESTIGATION

The findings presented in this section are based on the four separate investigations of sediments across the dredge footprint.

3.1 Sediment Physical Characteristics

The physical characteristics of the sampled sediments (i.e. their PSD) are provided in **Table 5** and in **Figure 4**. Field core and sample logs are provided in **Appendix 5**. Results for the laboratory PSD are shown in **Appendix 8**.

Table 5 Summary of Sediment Particle Size Analyses

		Clay ($<2\ \mu\text{m}$) (%)	Silt ($2\text{--}60\ \mu\text{m}$) (%)	Fines ($<75/60\ \mu\text{m}$) (%)	Sand ($75/60\ \mu\text{m}\text{--}2\ \text{mm}$) (%)	Gravel ($>2\ \text{mm}$) (%)	Cobbles ($>6\ \text{cm}$) (%)
Dredge Area 1	No of Samples	3	3	8	8	8	8
	Mean	2.0	0.8	7.5	89.3	3.6	<1
	SD	0.0	0.3	12.0	17.9	6.1	N/A
	Max	2	1	36	99	18	<1
	Minimum	2	<1	1	46	2	<1
Dredge Area 2	No of Samples	4	4	4	4	4	4
	Mean	6	2	8	93	<1	<1
	SD	2.4	0.8	3.5	3.5	N/A	N/A
	Max	9	3	11	96	<1	<1
	Minimum	4	1	4	89	<1	<1
Dredge Area 3	No of Samples	14	14	19	19	19	19
	Mean	7	4	15	76	10	<1
	SD	5	7	12	23	18	N/A
	Max	18	27	47	98	61	<1
	Minimum	1	1	2	21	1	<1

Notes:

1. SD: Standard Deviation;
2. N/A: not applicable;
3. Particle size classification for: Fines $\leq 60\ \mu\text{m}$ for samples dated 2009 and $<75\ \mu\text{m}$ for samples dated 2011 and 2012;
Sand = $0.06\text{--}2\ \text{mm}$ for 2009 samples and $0.075\text{--}2\ \text{mm}$ for 2011/12 samples;
4. Fines ($<75/60\ \mu\text{m}$) includes clay ($<2\ \mu\text{m}$) and silt ($2\text{--}60\ \mu\text{m}$); and
5. Gravel ($>2\ \text{mm}$) includes cobbles ($>6\ \text{cm}$).



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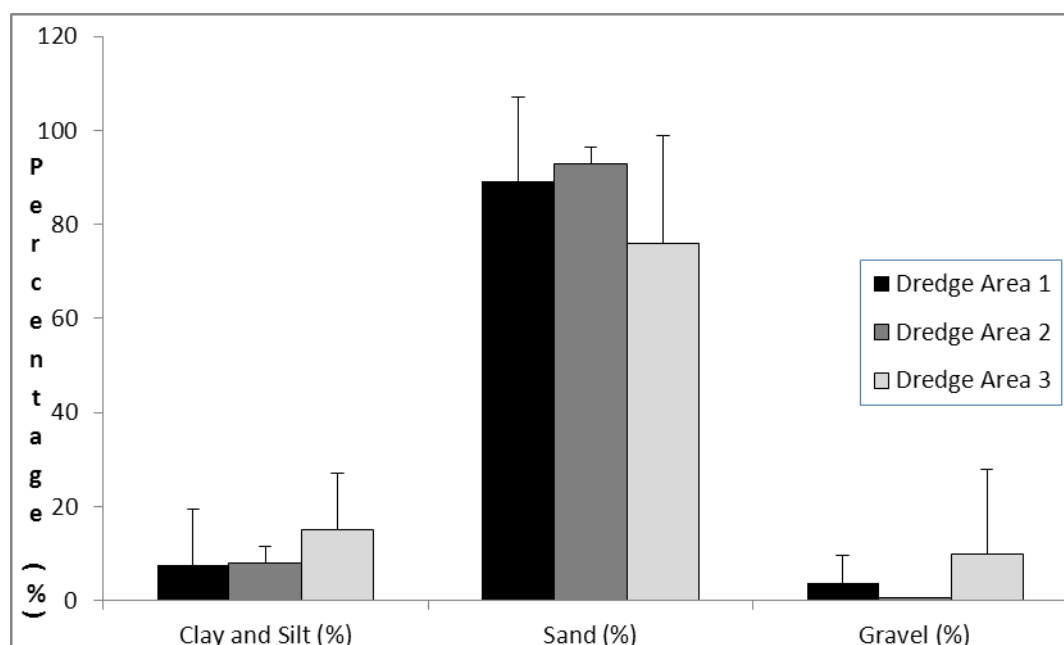


Figure 4. Mean Gravel, Sand and Silt/Clay Contents in Dredge Areas 1, 2 and 3 (Error Bars: +1 Standard Deviations (SD)).

Approaches, Turning Circle and Sub Berth (Dredge Areas 1 and 2)

Sediments within the approaches and turning circle, and sub berth (Dredge Areas 1 and 2) are dominated by sands, with the sediment mean sand content in these two areas being 89% and 93%, respectively.

The mean fines content (<75 µm grain size) in approaches, turning circle and sub berth (Dredge Areas 1 and 2) is about 8%.

Photos 4 and 5 are typical examples of the material observed in samples from the approaches, turning circle and sub berth (Dredge Areas 1 and 2).

Fixed Berths (Dredge Area 3)

Sediments within the fixed berths (Dredge Area 3) comprise a mean sand and gravel content of 76% and 10%, respectively, with a greater proportion of fines compared to the approaches.

Fixed Berth #1

The depth of unconsolidated sediment (muddy sand) in the fixed berth #1 is:

- generally very thin (0.05- 0.1 m) in the central part of the area at locations C3 to C8;
- a layer of muddy sand up to 0.7 m in the south (Locations C1 and C2); and
- a layer of muddy sand of 0.3 m in the north (Locations C9 and C11).



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Muddy sand (~20% fine fraction content) overlies consolidated peat in fixed berth #1 and appears deeper to the east. There is up to 0.9 m of unconsolidated muddy sand grading into fragmented and weathered peat at sample location C18 on the eastern margin of fixed berth #1.

Fixed Berth #2

Unconsolidated sediments in the fixed berth #2 comprise slightly muddy sands (<10-15% fine fraction content) in the upper 0.5 m, generally overlain by consolidated peat (i.e. locations C14, C15). The spatial distribution of consolidated sediments in fixed berth #2 is less well defined compared to fixed berth #1 because of the fewer number of samples collected in this berth.

Photos 6 and 7 exhibit the textural variability of material in the fixed berths (Dredge Area 3).

In addition, **Photos 8, 9 and 10** are typical examples of the material from the fixed berths (Dredge Area 3), varying from unconsolidated sand (<5% fine fraction content), to muddy sand (10-20% mud content), to consolidated very hard and stiff peat (~30-50% fine fraction content).



Photo 4. Silty sand in VC4B (0.5 -1.0 m) from the turning circle (Dredge Area 1).



Photo 5. Sand in surface of SS4A (0.5 - 1.0 m) from the approaches (Dredge Area 1).



Photo 6. Fragmented peat/mud overlying clay in VC5E (0.0 - 1.65 m) from fixed berth #1 (Dredge Area 3).



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Photo 7. Silty sand overlying clay in VC5C (0.0 - 0.5m) from fixed berth #1 (Dredge Area 3).



Photo 8. Unconsolidated soft light brown well sorted quartzose sand (<5% fine fraction and <0.2% TOC content) from C10 in fixed berth #1 (Dredge Area 3).



Photo 9. Unconsolidated soft dark olive-gray to brown muddy sand (20% fine fraction and 1.3% TOC content) from C2 in fixed berth #1 (Dredge Area 3).



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Photo 10. Consolidated very hard and stiff dark brown to black organic-rich flaky peat (dry *in situ*) (47% fine fraction and 19% TOC content) from C8 in fixed berth #1 (Dredge Area 3).

Consolidated Peat in the Fixed Berths (Dredge Area 3)

During the sediment investigation in 2010, a hard, low density, black material with a chalky texture and a pitted surface was observed during subsampling of sediment cores VC5D and VC5E in fixed berth #1 (refer **Figure 3**). This material was identified at or near the surface down to depths of 1.5 m and 0.6 m for each core respectively, which equates to approximately -12.5 m CD. The material was subjected to testing for VOCs/SVOCs to identify the potential for hydrocarbon contamination. Subsequently, the results of visual inspections and geochemical analysis identified that the sediment consisted of decomposing organic matter, or peat-like material. A review of historic borehole logs that were provided by Caltex (Australian Oil Refinery Limited (1953) Boring Plan AS6201-7 and Plan AA.6653- 1)), indicated that peat layers had previously been observed in the vicinity of the berths and approaches of the Kurnell Port and Berthing Facility. The plans identified peat layers at depths of about -10 to -13 m CD in four boreholes located west of the fixed berths (Dredge Area 3) and outside of the proposed dredge footprint.

The presence of the hard, consolidated peat in fixed berth #1 was confirmed by the supplementary sediment sampling in August 2012, which showed peat to be present at all supplementary sample locations in fixed berth #1, except C10 and C12. Peat was found at the surface or below a veneer of unconsolidated sands to muddy sands. This veneer was up to 0.9 m deep (refer **Table 6**). Similarly, consolidated peat was also present in fixed berth #2 at sample locations C14 and C5, either near the surface or below up to 0.5 m of unconsolidated muddy sands. The depth of the consolidated peat layer at each sample location could not be established due to core refusal in this very hard and stiff unit.



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A separate geotechnical investigation of sediments in the fixed berths (Dredge Area 3) was undertaken by Ausbarge Marine Services Pty Ltd in October-November 2012 (Douglas Partners, 2012). Deep cores were collected at twelve borehole locations within and adjacent to the two fixed berths (Dredge Area 3). Peat was identified in six of the twelve boreholes, confirming the lateral and vertical extent of the consolidated peat layer in sediments of the fixed berths identified by WorleyParsons. The lateral distribution and depth to the consolidated peat, either at the surface or underlying unconsolidated sediment, is shown in **Figure 5**.



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Table 6 Field descriptions of peat in Dredge Area 3

Sample Location	Sampling Month	Berth	Core Length	Presence of Peat	Depth to Peat (m)	Depth of Peat layer (m)	Notes
SS3B	Nov-09	1	0.6	no	n/a	n/a (below 0.6 m?)	No peat (based on core photo)
SS3C	Nov-09	1	0.5	no	n/a	n/a (below 0.6 m?)	No peat (based on core photo)
SS3D	Nov-09	1	0.6	no	n/a	n/a (below 0.6 m?)	No peat (based on core photo)
VC3A	Nov-09	2	2.4	no	n/a	n/a	based on core photo (core terminated at 2.4 m)
SS5E	Nov-11	1	0.25	yes	at surface	0 to 0.25 (continuing)	Contained numerous chunks of hard black material up to 4cm in length similar to material found at VC5D and VC5E. Polychaete worms present. Was not possible to retrieve any sample at original coordinates due to hard black surface layer. Seven attempts tried at original location at south end of berth pocket
VC5C	Nov-11	1	1.2	yes	0.4	0.4 to 1.2 (continuing)	Core retrieved following several attempts. First attempts penetrated ~100mm of sand before terminating in hard black material such as found at surface of VC5D.
VC5D	Nov-11	1	3.5	yes	at surface	0.0 to 1.8 m (grading into dark/red/brown clay)	Hard packed black surface with chalky texture. Round pebbly rocks formed from excessive vibration to get core to penetrate.
VC5E	Nov-11	1	1.65	yes	at surface	0.0 to 1.0 m (grading into black mud)	Small (<5cm) broken up pieces of very hard black peat and soft black sandy mud with black viscous fluid.
C1	Aug-12	1	0.55	yes	0.55	0.55 (continuing)	large peat fragments (up to 5 cm) in upper 25 cm, overlying stiff peat layer at 0.55 m
C2	Aug-12	1	0.5 (loss of 0.5-0.7 m)	yes	0.7	0.7 (continuing)	refusal at 0.7-0.8 m (peat at base)
C3	Aug-12	1	0.1	yes	at surface	0 to 0.1 (continuing)	refusal at 0.1 m, very stiff and hard
C4	Aug-12	1	0.1	yes	at surface	0 to 0.1 (continuing)	refusal at 0.1 m, very stiff and hard
C5	Aug-12	1	0.15	yes	at surface	0 to 0.15 (continuing)	less than 2 cm of overlying muddy sand; refusal at 0.15 m, very stiff base
C6	Aug-12	1	0.13	yes	at surface	0-0.13 (continuing)	very hard and stiff, refusal at 0.13 m
C7	Aug-12	1	0.1	yes	at surface	0-0.1 (continuing)	refusal in very hard and stiff peat at 0.1 m depth
C8	Aug-12	1	0.12	yes	at surface	0-0.12 (continuing)	very hard and stiff peat, refusal at 0.12 m
C9	Aug-12	1	0.45	yes	0.3	0.3-0.45 (continuing)	very stiff peat at 0.3 m depth, refusal at 0.45 m
C10	Aug-12	1	2	no	n/a	n/a	No peat
C11	Aug-12	1	0.35	yes	0.3	0.3-0.35 (continuing)	refusal in very stiff peat at 0.35 m depth
C12	Aug-12	1	1.5	no	n/a	n/a	No peat
C18	Aug-12	1	0.9	yes	0.9	0.9 (continuing)	refusal in dark brown stiff peat
VC3B	Nov-09	2	0.9	possibly	0.9 m?	below 0.9 m (if present)	refusal at 0.9 m (no peat at base, hard surface - based on core photo)
SS3A	Nov-09	2	0.6	no	n/a	n/a (below 0.6 m?)	No peat (based on core photo)
VC5B	Nov-11	2	2.2	no	n/a	n/a	No peat
C13	Aug-12	2	0.5	no	n/a		lost bottom 0.5 m of core (0.5-1.0 m segment), no peat
C14	Aug-12	2	0.15	yes	at surface	0-0.15 (continuing)	refusal in dark brown very hard/stiff peat at 0.15 m
C15	Aug-12	2	0.5	yes	at surface	0.0 (continuing); up to 0.5 m of unconsolidated muddy sand	peat at surface in vicinity of core location (actual core location has 0.5 m of unconsolidated muddy sand); patchy distribution of unconsolidated sediments overlying peat at location C15



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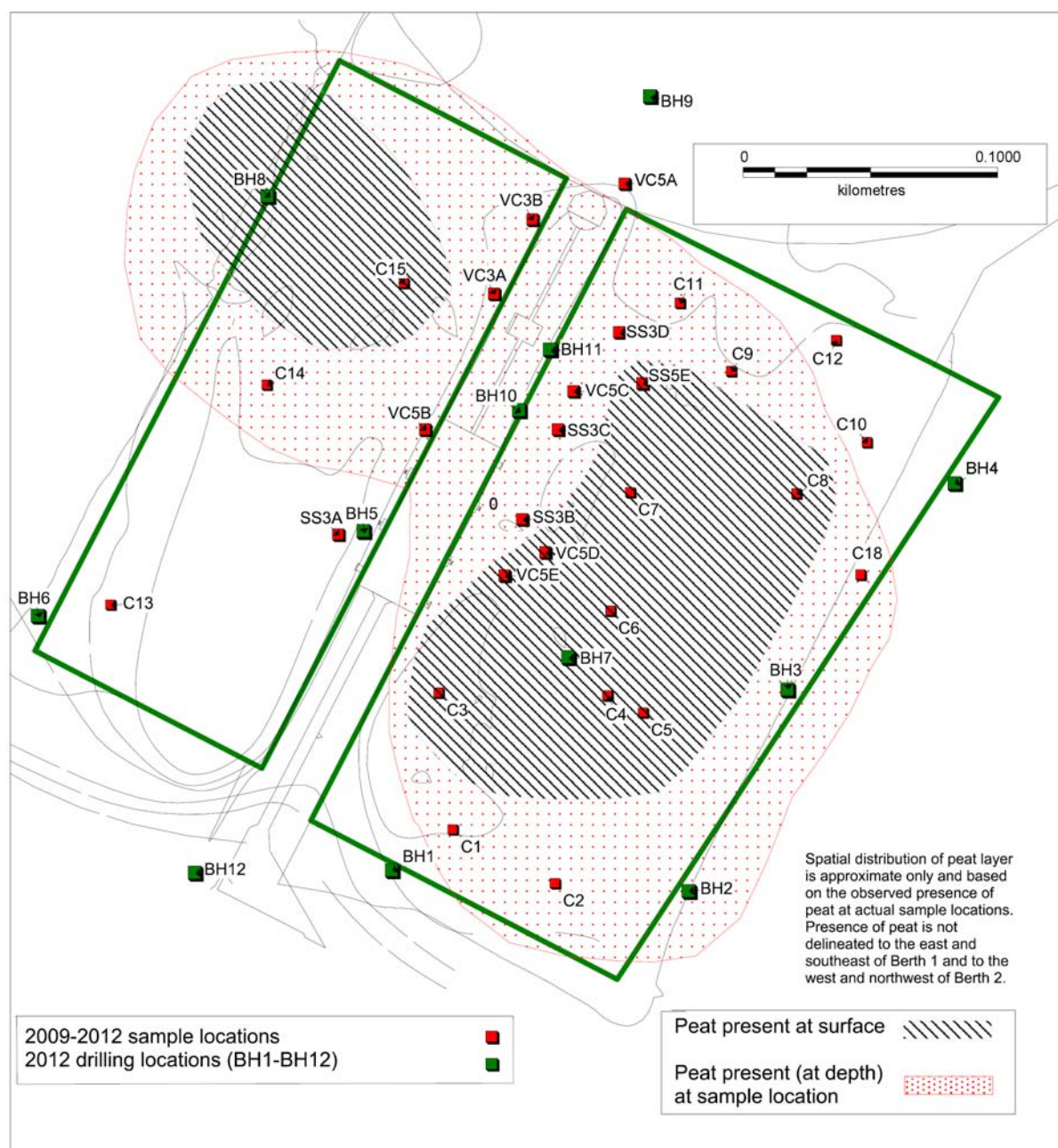


Figure 5. Depth to peat layer in Dredge Area 3.



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3.2 Sediment Geochemical Characteristics

The sediment geochemical results for NAGD Phase II, III and IV assessment are summarised in **Sections 3.2.1 to 3.2.3**. All geochemical analyses are reported on a dry weight basis for whole sediments.

The geochemical laboratory reports are provided in **Appendix 8**.

3.2.1 NAGD Phase II Assessment

This section summarises the results for the Phase II geochemical analyses. **Table 7** contains a summary of results for the geochemical analyses for each Dredge Area. **Figures 6 to 8** provides a graphical summary of the percentage of samples below or exceeding the LOR, NAGD Screening Level and NAGD Sediment Quality High Value in each Dredge Area.

The sediment geochemical results for each individual sample are provided in a summary table in **Appendix 9**.

3.2.1.1 APPROACHES AND TURNING CIRCLE (DREDGE AREA 1)

Table 7 and **Figure 6** contain a summary of the results of sampling for the approaches and turning circle (Dredge Area 1). Key findings are outlined below.

- Trace Metals. Silver and mercury exceeded the NAGD screening levels in 1 sample each (1 and 0.15 mg/kg respectively), however all other samples were below the screening level. All other metals and metalloids were below NAGD screening levels.
- The sum of PAHs was below the NAGD Screening Level in all samples.
- Concentrations of TPHs (normalized to 1% organic carbon) were below the NAGD Screening Level in all samples.
- TBT was present in the majority of samples and ranged from 0.7 µgSn/kg – 3,740 µgSn/kg, once normalised to 1% TOC. Half of the samples were above the NAGD Screening Level of 9 µgSn/kg for TBT, and over half of these samples were also above the NAGD Sediment Quality High Value of 70 µgSn/kg (refer **Section 3.2.1.4** for the spatial and vertical distribution of TBT). The 95% UCL of the mean, 408 µgSn/kg, also exceeded the NAGD Screening Level and Sediment Quality High Value. Based on these results further testing (Phase III) was required to determine the bioavailability of TBT.
- Other Analytes. BTEX, OCPs, OPPs, PCBs were all below the LOR in all samples.



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Table 7 Summary of Results for the Geochemical Analysis for each Dredge Area.

Dredge Area	Analyte	Moisture Content (dried @ 103°C)	TOC	Metals		Trace Metals														BTEX	TPHs					TRHs	Pesticides		PCBs
			Total Organic Carbon	Aluminium	Iron	Antimony	Arsenic	Cadmium	Chromium	Copper	Cobalt	Lead	Manganese	Nickel	Selenium	Silver	Vanadium	Zinc	Mercury	BTEX	C6 - C9 Fraction Normalised	C10 - C14 Fraction Normalised	C15 - C28 Fraction Normalised	C29 - C36 Fraction Normalised	Sum TPHs Normalised	C6-C10 Fraction	OC Pesticides	OP Pesticides	Total PCBs normalised
	Units	%	%	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	µg/kg	µg/kg	µg/kg
LOR		1	0.02	50	50	0.5	1	0.1	1	1	0.5	1	10	1	0.1	0.1	2	1	0.01	0.2	3	3	3	5	3-5	3	0.5-10	0.5	5
NAGD SL		-	-	-	-	2	20	1.5	80	65	-	50	-	21	-	1	-	200	0.15	-	-	-	-	-	550	-	0.32-280		23
NAGD SQ High		-	-	-	-	25	70	10	370	270	-	220	-	52	-	3.7	-	410	1.0	-	-	-	-	-	-	-	-	-	-
APPROACHES and TURNING CIRCLE (DREDGE AREA 1)	Total No. of Samples	36	36	3	3	27	27	27	27	27	27	27	27	27	27	27	27	27	27	6	7	7	7	7	7	3	8	3	8
	Mean	nc	0.27	1920	2400	<0.5	0.9	0.06	1.9	2.4	0.26	2.5	6.8	0.6	0.1	0.1	8.6	7.1	0.04	nc	nc	nc	nc	nc	121	nc	<0.5-10	<0.5	<5
	SD	nc	0.79	1672	1840	nc	0.9	nc	1.6	1.8	0.07	2.4	6.1	0.4	0.1	0.2	20.0	9.6	0.13	nc	nc	nc	nc	nc	115	nc	nc	nc	nc
	95% UCL of the mean	nc	0.48	nc	nc	<0.5	1.2	0.08	2.4	3.0	0.29	3.2	8.8	0.7	0.1	0.2	15.2	10.2	0.08	nc	nc	nc	nc	nc	169	nc	<0.5-10	<0.5	<5
SUB-BERTH (DREDGE AREA 2)	Total No. of Samples	20	20	0	0	13	13	13	13	13	13	13	13	13	13	13	13	13	13	2	2	2	2	2	2	0	2	0	2
	Mean	nc	0.21	nc	nc	<0.5	2.4	0.06	5.5	2.0	0.55	3.3	6.5	1.0	0.28	<0.1	5	11	0.06	nc	nc	nc	nc	nc	nc	nc	<0.5-10	nc	<5
	SD	nc	0.28	nc	nc	nc	4.3	0.02	7.0	1.8	0.79	3.3	4.0	1.0	0.51	nc	6	13	0.15	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	95% UCL of the mean	nc	0.31	nc	nc	<0.5	4.3	0.07	8.7	2.8	0.95	4.7	8.5	1.4	0.50	<0.1	8	17	0.13	nc	nc	nc	nc	nc	nc	nc	<0.5-10	nc	<5
FIXED BERTHS #1 AND #2 (DREDGE AREA 3)	Total No. of Samples	43	43	24	24	34	34	34	34	34	34	34	33	34	34	34	34	34	34	7	4	18	18	18	18	3	8	6	5
	Mean	nc	8.8	3765	7020	0.26	13.8	0.07	9.9	6.1	0.99	8.5	12.5	2.8	0.90	0.08	16	37	0.08	nc	nc	nc	nc	nc	68	nc	<0.5-10	<0.5	<5
	SD	nc	13.0	3089	7783	0.04	19.4	0.05	8.2	7.0	1.00	11.8	11.8	2.6	1.40	0.06	20	80	0.10	nc	nc	nc	nc	nc	37	nc	nc	nc	nc
	95% UCL of the mean	nc	12.10	4757	9544	0.29	19.2	0.09	12.2	8.1	1.28	11.8	16.0	3.6	1.30	0.09	21	60	0.11	nc	nc	nc	nc	nc	83	nc	<0.5-10	<0.5	<5



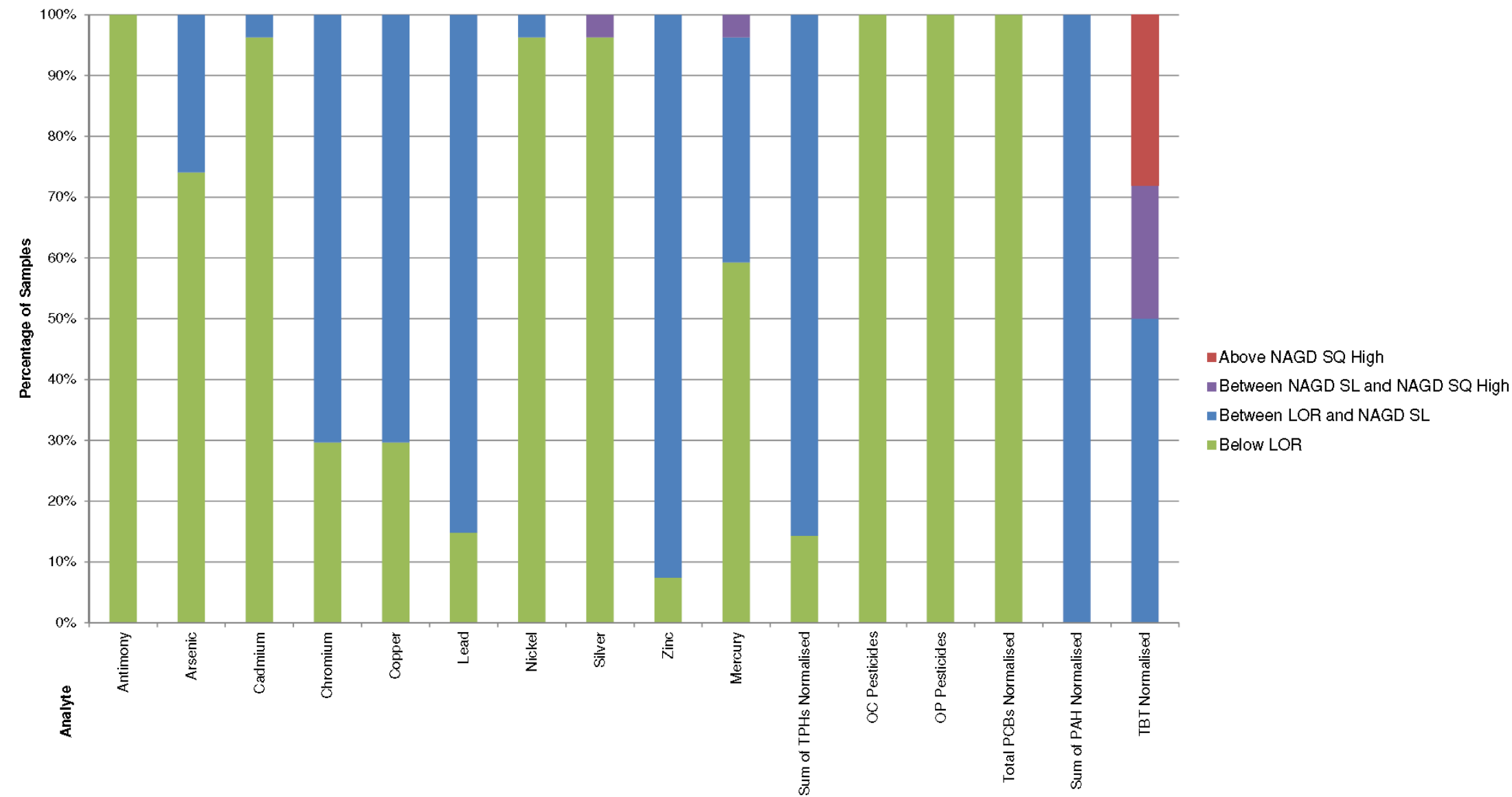
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Table 7 Summary of Results for the Geochemical Analysis for each Dredge Area (continued).

Dredge Area			Analyte	PAHs																				TBT			
				Naphthalene	2-Methylnaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(e)pyrene	Benzo(a)pyrene	Perylene	Benzo(g,h,i)perylene	Dibenz(a,h)anthracene	Indeno(1.2.3.cd)pyrene	Coronene	Sum of PAHs	Sum of PAH normalised	TBT raw	TBT normalised
Units				µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg		µgSn/kg		
LOR				5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4			0.5		
NAGD SL				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10000	-	9		
NAGD SQ High				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50000	-	70		
APPROACHES and TURNING CIRCLE (DREDGE AREA 1)	Total No. of Samples			26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	32	32		
	Mean			nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	296	nc	212	
	SD			nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	456	nc	675	
	95% UCL of the mean			nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	443	nc	408	
SUB-BERTH (DREDGE AREA 2)	Total No. of Samples			13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13		
	Mean			nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	350	nc	174	
	SD			nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	874	nc	307	
	95% UCL of the mean			nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	734	nc	314	
FIXED BERTHS #1 AND #2 (DREDGE AREA 3)	Total No. of Samples			34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	39	39		
	Mean			nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	273	nc	12	
	SD			nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	469	nc	50	
	95% UCL of the mean			nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	405	nc	25	
				Notes: All organics are normalised to 1% TOC (with 0.2 to 10% TOC) Where results are below the analytical limit of Reporting (LOR), half the LOR has been used in the statistical analyses * NAGD Sediment Quality High value = 70 µgSn/kg ; nc = not calculated;																							



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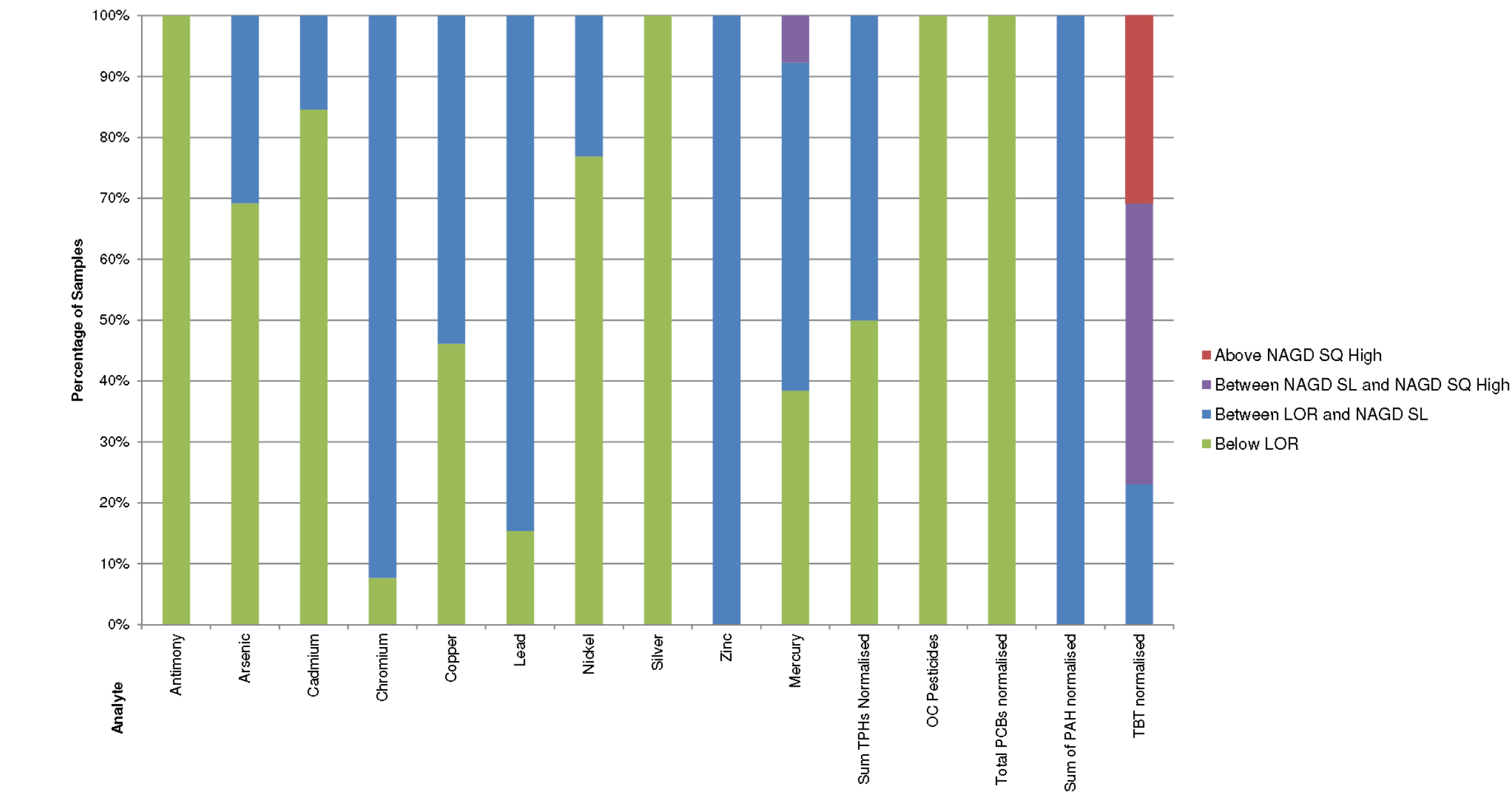


Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µgSn/kg
LOR	0.5	1	0.1	1	1	1	1	0.1	1	0.01	3-5	0.5-10	0.5	5		
NAGD SL	2	20	1.5	80	65	50	21	1	200	0.15	550	0.32-280	23	10000	9	
NAGD SQ High	25	70	10	370	270	220	52	3.7	410	1.0	-	-	-	-	50000	70

Figure 6. Percentage of samples below or exceeding the Limit of Recording (LOR), NAGD Screening Level (SL) and NAGD Sediment Quality (SQ) High in the approaches and turning circle (Dredge Area 1).



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Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg	µgSn/kg
LOR	0.5	1	0.1	1	1	1	1	0.1	1	0.01	3-5	0.5-10	5		
NAGD SL	2	20	1.5	80	65	50	21	1	200	0.15	550	0.32-280	23	10000	9
NAGD SQ High	25	70	10	370	270	220	52	3.7	410	1.0	-	-	-	50000	70

Figure 7. Percentage of samples below or exceeding the Limit of Recording (LOR), NAGD Screening Level (SL) and NAGD Sediment Quality (SQ) High in the sub-berth (Dredge Area 2).



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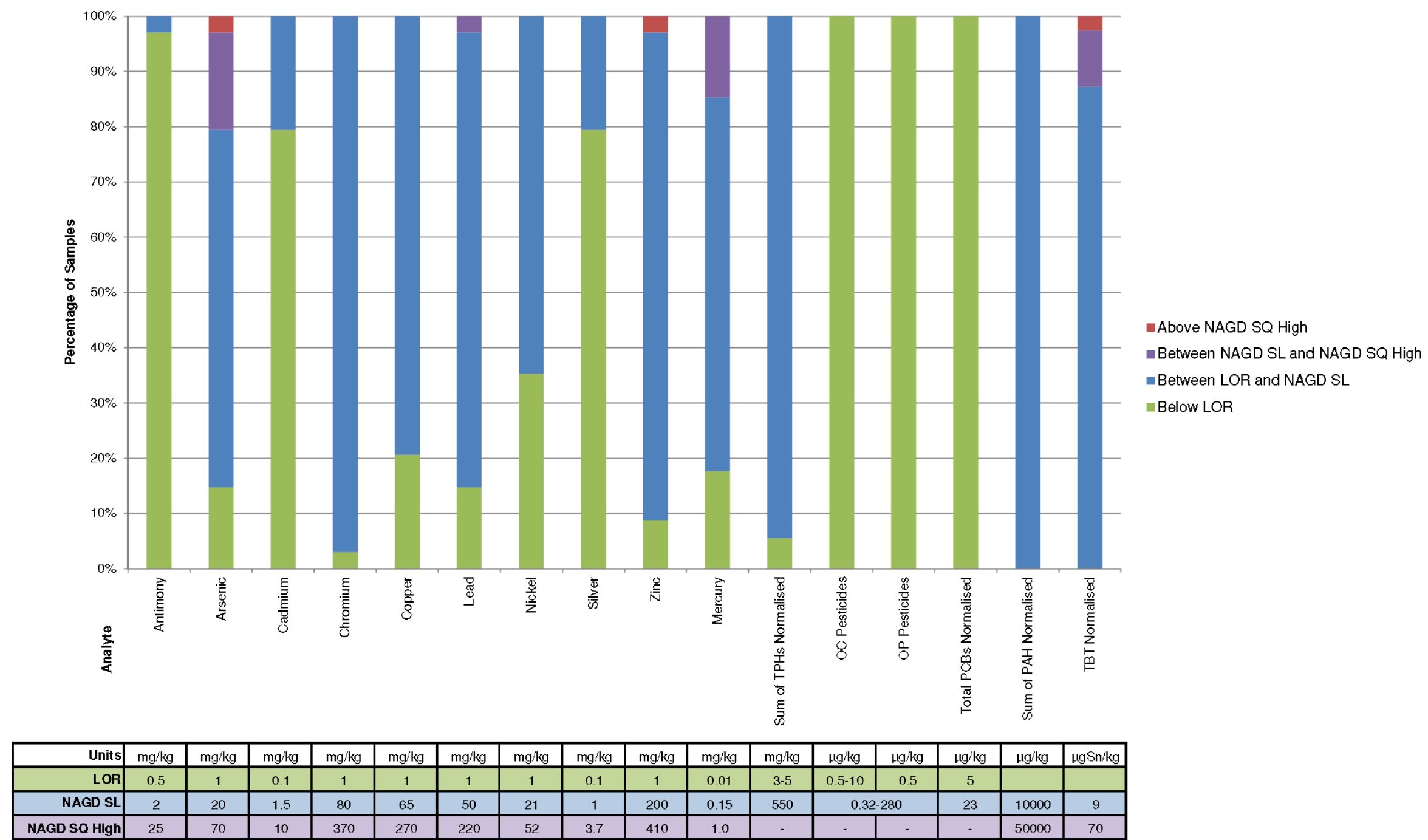


Figure 8. Percentage of Samples below or exceeding the Limit of Recording (LOR), NAGD Screening Level (SL) and NAGD Sediment Quality (SQ) High in the fixed berths (Dredge Area 3).



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3.2.1.2 SUB BERTH (DREDGE AREA 2)

Table 7 and **Figure 7** contain a summary of the results of sampling for the sub-berth (Dredge Area 2). Key findings are outlined below.

- Trace Metals. Mercury exceeded the NAGD Screening Level in one sample (0.55mg/kg), however all other samples were below the screening level. All other metals and metalloids were below NAGD screening levels.
- The sum of PAHs was below the NAGD Screening Level in all samples.
- Concentrations of TPHs (normalized to 1% organic carbon) were below the NAGD Screening Level.
- TBT was present in the majority of samples and ranged from 10 µgSn/kg – 1,040 µgSn/kg, once normalised to 1% TOC, above the NAGD Screening Level of 9 µgSn/kg. Four of these samples were also above the NAGD Sediment Quality High Value of 70 µgSn/kg (refer **Section 3.2.1.4** for the spatial and vertical distribution of TBT). The 95% UCL of the mean, 314 µgSn/kg, also exceeded the NAGD Screening Level and Sediment Quality High Value. Based on these results further testing (Phase III) was required to determine the bioavailability of TBT.
- Other Analytes. BTEX, OCPs, OPPs, PCBs were all below the LOR in all samples.

3.2.1.3 FIXED BERTHS (DREDGE AREA 3)

Table 7 and **Figure 8** contain a summary of the results of sampling for the fixed berths (Dredge Area 3). Key findings are outlined below.

- Lead and zinc exceeded the NAGD Screening Level in one sample each (60.2 mg/kg and 460 mg/kg respectively). The 95% UCL of the mean for both lead and zinc was below the respective NAGD Screening Levels.
- Mercury was above the NAGD Screening Level of 0.15 mg/kg in four samples (0.2 – 0.44 mg/kg). The 95% UCL of the mean was below the NAGD Screening Level.
- Arsenic was above the NAGD Screening Level in seven samples (30.6 – 72.9 mg/kg) and all seven samples had the presence of peat. One of these samples was also above the NAGD Sediment Quality High Value of 70 mg/kg (72.9 mg/kg). The 95% UCL of the mean was below the NAGD Screening Level. The elevated levels are discussed further below where it is shown that the As values are of a natural origin rather than caused by contamination.
- All other metals and metalloids were below respective NAGD Screening Levels in individual samples and at the 95% UCL of the mean.
- The sum of PAHs was below the NAGD Screening Level in all samples.



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- Concentrations of TPHs (normalized to 1% organic carbon) were below the NAGD Screening Level in all samples.
- TBT was present in the majority of samples and ranged from 0.1 µgSn/kg – 312 µgSn/kg, once normalised to 1% TOC. Five samples were above the NAGD Screening Level of 9 µgSn/kg for TBT, and one sample was also above the NAGD Sediment Quality High Value of 70 µgSn/kg (refer **Section 3.2.1.4** for the spatial and vertical distribution of TBT). The 95% UCL of the mean, 25 µgSn/kg, also exceeded the NAGD Screening Level. Based on these results further testing (Phase III) is required to determine the bioavailability of TBT.
- Other Analytes. BTEX, OCPs, OPPs, PCBs were all below the LOR in all samples.

GEOCHEMICAL TESTING OF PEAT

As discussed in **Section 2.4**, sampling discussed within this report has identified a widespread presence of a hard consolidated peat layer within the fixed berths (Dredge Area 3). Peat was found within the majority of sample locations (refer **Table 6**). Its absence in some of the locations may be due to the limited depth of sampling at these locations. This layer was also identified within historical borehole data (Australian Oil Refinery Limited (1953) Boring Plan AS6201-7 and Plan AA.6653- 1). The peat layer has different properties compared to other surficial sediments sampled within the dredge footprint and therefore this section provides more analysis of the NAGD Phase II results of this material. This analysis shows that while some levels exceed NAGD screening levels, the material is uncontaminated.

Field observations have shown the peat to be generally highly consolidated and completely dry and flaky inside the core barrel upon recovery from the seabed. This demonstrates a natural origin and the uncontaminated character of the material at depth. The consolidated nature of the peat suggests that it is a sedimentary unit that is very old (possibly of pre-Holocene/Pleistocene age), supporting the theory that the layer is uncontaminated. While levels of As exceeded NAGD screening levels, the non-contamination is demonstrated by the very low concentrations of all geochemicals that were analysed (i.e. trace metals, TBT, TPHs, OCPs, OPPs, and PCBs). An exception to this is elevated concentrations of TBT in surface samples at VC5E. TBT in this sample was recorded at 102 µgSn/kg, which was reduced to 10.2 µgSn/kg following normalisation to 1% TOC.

VOCs and SVOCs. During the 2010 sampling, peat was identified within cores VC5D and VC5E from fixed berth #1. Due to the location of the samples adjacent to the Caltex Kurnell Wharf, facilities, and the unknown physical and geochemical characteristics of the material, samples were tested for VOCs and SVOCs. The laboratory data indicated that concentrations of VOCs and SVOCs for these samples were typically below LOR (refer **Appendix 8**).

TOC. TOC testing of peat samples has shown elevated TOC contents of up to 39%. This contrasts with the lower TOC content in surficial muddy sands overlying the peat (ranging from <1% to 2% TOC). Clean quartzose and well sorted sand, present at depths below 0.5 m in the north-eastern part of fixed berth #1, contains less than 0.02% TOC.



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Arsenic. The geochemical analyses of the peat shows elevated concentrations of As that exceed the NAGD Screening Level of 20 mg/kg (range in peat: 30.6 to 72.9 mg/kg). One of these samples (72.9 mg/kg) also exceeds the NAGD Sediment Quality High Value of 70 mg/kg.

Since the consolidated peat unit represents a different sedimentary unit compared to overlying or adjacent unconsolidated sediments (i.e. sands and muddy sands) and has high levels of As, it was considered prudent to determine the ambient baseline level for As using trace element ratios. This was done by normalising to 'non pollutant' elements, such as Al and Fe, as recommended in the NAGD.

Aluminium (Al) can be used as a proxy for particle size, with elevated concentrations of Al representing fine-grained particulates within the sediment. Based on this, a bivariate plot of the concentrations of aluminium against As in whole sediments has been produced to review the relationship of As to particle size (refer **Figure 9**). This plot shows that high concentrations of Al in fine-grained peat correlate positively with elevated concentrations of As in peat. Although the concentrations of As in peat exceed the NAGD Screening Level concentration of 20 mg/kg, the strongly positive correlation with Al (i.e. grain size) suggests a natural (i.e. non-anthropogenic) and grain size-dependent origin of As within the peat.

Similar, peat and unconsolidated sediments in the fixed berths (Dredge Area 3) also show strongly positive correlations for bivariate pairs As/Fe (refer **Figure 10**), and As/TOC (refer **Figure 11**). The consolidated peat exhibited substantially higher concentrations of Fe (about 10,000-15,000 mg/kg) and TOC content (about 20-40% TOC) compared to unconsolidated sediments, which generally contained <5,000 mg/kg of Fe and a TOC content of <3%.

Therefore, the elevated concentrations of As in the peat with respect to the NAGD Screening Level are substantially due to the fine-grained nature of the peat material and likely to be of a natural origin.



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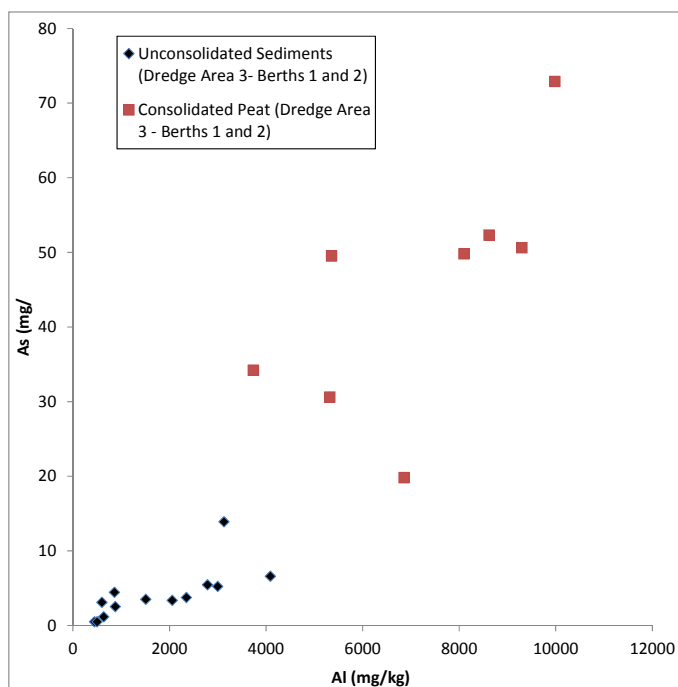


Figure 9. Al vs. As in unconsolidated sediments and in peat in the fixed berths.

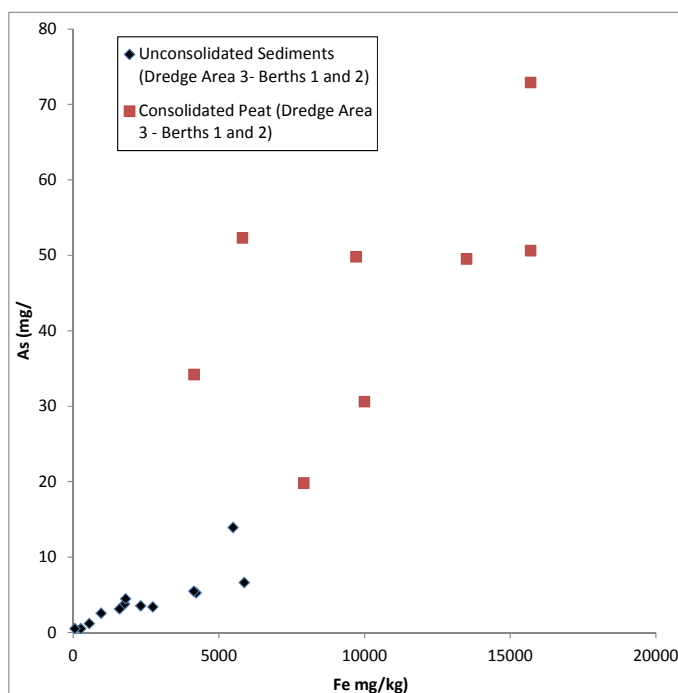


Figure 10. Fe vs. As in unconsolidated sediments and in peat in the fixed berths.



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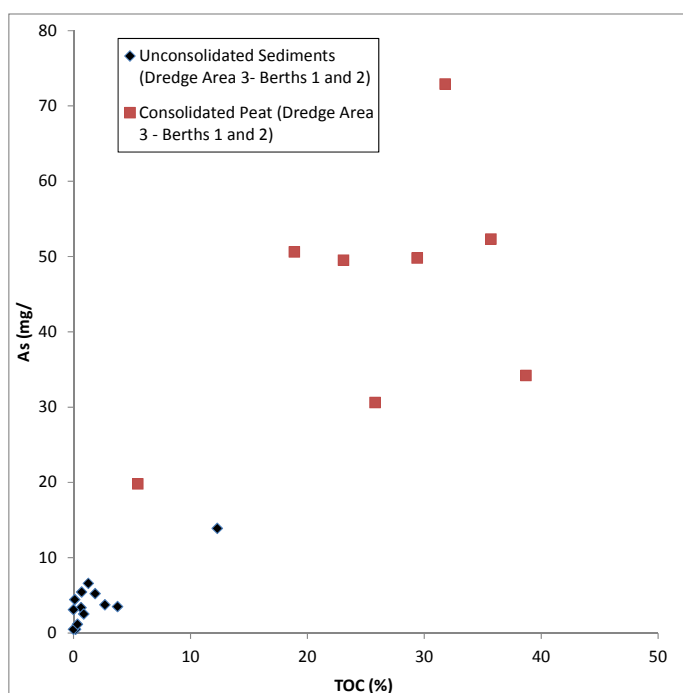


Figure 11. TOC vs. As in unconsolidated sediments and in peat in the fixed berths.

3.2.1.4 SPATIAL AND VERTICAL DISTRIBUTION OF TBT

Sample locations with elevated concentrations of TBT in whole sediments are found across the dredge footprint. However, elevated concentrations of TBT (normalised to 1% TOC) are predominantly present in the approaches, turning circle and fixed berths (Dredge Areas 1 and 2) (refer **Figure 12**). A number of samples in the fixed berths (Dredge Area 3) contain elevated TOC contents of more than 10% and up to 40%. This results in reduced TBT concentrations when normalised to 1% TOC.

Normalised concentrations of TBT in sediments are generally below the NAGD Screening Level in the northern part of the approaches and turning circle (Dredge Area 1) near sample locations SS4A, SS5A and SS5B and in the south eastern area of the turning circle near sample location VC4D and SS4J (refer **Figure 12**).

The majority of sediment samples that exceed the NAGD Screening Level are located in the upper 1 m of sediment (refer **Figure 13**) compared to sediments below 1 m depth (refer **Figure 14**).



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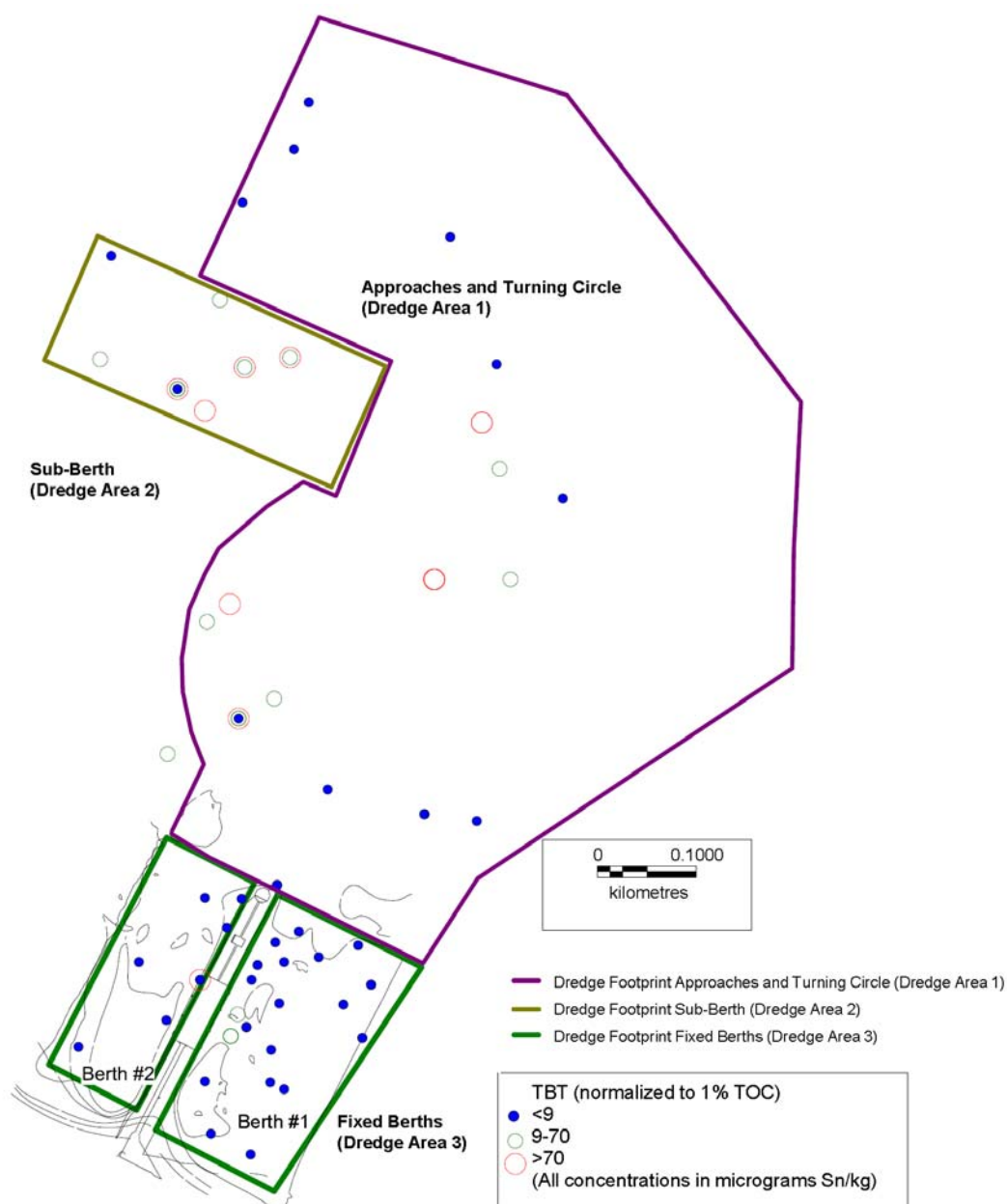


Figure 12. Spatial representation of TBT (normalized to 1% TOC) concentrations in the dredge footprint. Note some TBT samples were taken at multiple depths at the same location.



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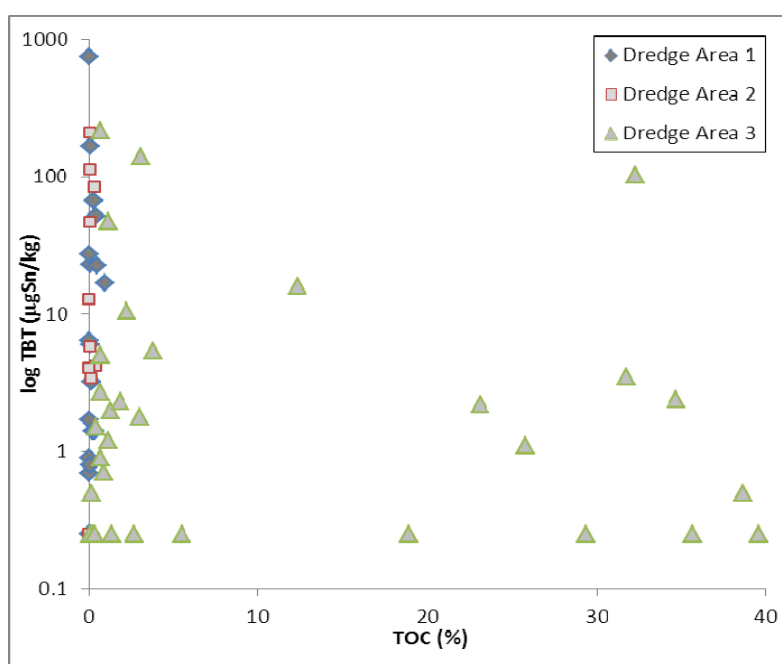


Figure 13. TOC vs log TBT in the upper 1 m of sediments in dredge footprint.

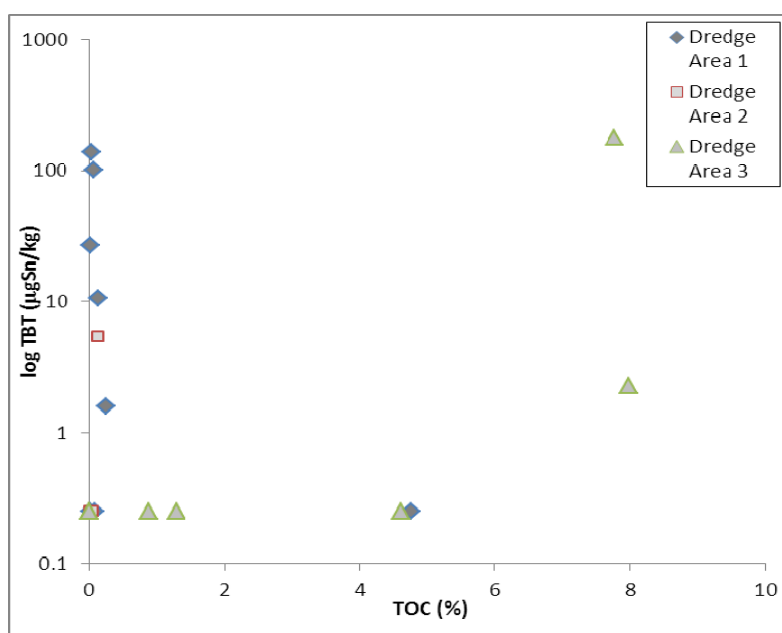


Figure 14. TOC vs log TBT below 1 m depth in sediments in dredge footprint.



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3.2.2 NAGD Phase III Assessment

Elutriate testing was undertaken to assess the potential release of TBT from the sediments into the water column during the disposal of the dredged material at the Sydney Offshore Spoil Ground. Laboratory results for elutriate TBT testing are provided in **Appendix 8** and have been summarised in **Table 8**.

As shown in **Table 8**, the elutriate TBT results indicated that the 95% UCL of the mean concentration of elutriate TBT for the dredge footprint exceed the ANZECC/ARMCANZ (2000) water quality guideline value of 6 ng/L. The elutriate test uses a dilution of 1:4, which greatly overestimates water quality impacts as much greater dilutions would be expected at the spoil ground. Therefore the test data were corrected for the calculated dilution factor after the four-hour mixing period. The results for this correction are presented in the following section.



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Table 8 Elutriate TBT Results for the 2009-2012 Sediment Investigations

Dredge Area		Sediment TBT ⁽¹⁾ (µg/kg)	Elutriate TBT ⁽²⁾ (ng/L)	Dredge Area		Sediment TBT ⁽¹⁾ (µg/kg)	Elutriate TBT ⁽²⁾ (ng/L)
	NAGD SL	9			NAGD SL	9	
	NAGD Sediment Quality High	70			NAGD Sediment Quality High	70	
	ANZECC Water Quality Guideline*		6		ANZECC Water Quality Guideline*		6
Approaches and Turning Circle (Dredge Area 1)	VC1A 0-0.5	---	---	Fixed Berths (Dredge Area 3)	C1_0-0.55	1.6	---
	VC1A 0.5-1.2	---	---		C2_0-0.5	1.6	1.0
	VC1A 1.2-1.6	134	---		C3_0-0.1	0.4	---
	VC1B 0-0.6	115	70		C4_0-0.1	0.0	---
	VC1B 0.6-1.2	---	---		C5_0-0.15	0.2	1.0
	VC1B 1.2-1.7	---	---		C6_0-0.13	0.0	---
	SS1A	30	---		C7_0-0.10	0.1	---
	SS1B	3.5	---		C8_0-0.12	0.03	---
	SS1C	32	---		C9_0-0.45	0.1	---
	SS1D	8.5	---		C10_0-0.50	4.2	---
	SS4A	4	---		C10_0.5-1.0	1.3	---
	SS4E	3740	246		C10_1.0-1.5	1.3	---
	SS4F	129	8		C11_0-0.35	1.4	---
	SS4G	16	14		C12_0-0.5	1.3	---
	SS4H	16	23		C12_0.5-1.0	0.7	---
	SS4I	4.5	---		C12_1-1.5	1.3	---
	SS4J	4	---		C13_0-0.5	0.8	---
	VC4B 0-0.5	136	---		C14_0-0.15	0.1	1.0
	VC4B 0.5-1	840	3338		C15_0-0.5	1.2	1.0
	VC4B 1-1.5	690	4518		C18_0-0.5	1.3	1.0
	VC4B 1.5-2	505	1028		C18_0.5-0.9	0.05	---
	VC4C 0-0.5	49	---		VC3A 0-0.6	7.2	---
	VC4C 0.5-1	231	161		VC3B 0-0.5	3.7	---
	VC4C 1-1.5	53	---		SS3A	2.5	---
	VC4C 1.5-2	6.4	---		SS3B	46	1.0
	VC4D 0-0.5	1.3	---		SS3C	0.2	---
	VC4D 0.5-1	1.3	---		SS3D	1.0	---
	VC4D 1-1.5	1.3	---		SS5E	0.6	---
	VC4D 1.5-2	1.3	---		VC5B (0-0.8)	312	43
	SS5A	1.3	---		VC5B (0.8-1.3)	0.3	---
	SS5B	1.3	---		VC5B (1.3-1.6)	0.2	---
	SS5C	1.3	---		VC5C (0-0.5)	4.8	---
	SS5D	17.4	1.0		VC5C (0.5-1)	0.03	---
	VC5A (0-0.5)	5.8	---		VC5D (0-0.5)	0.2	---
	VC5A (0.5-1)	0.7	---		VC5D (1.8-2.1)	0.3	---
	VC5A (1.5-2)	0.1	---		VC5D (2.1-3.1)	0.1	---
Approaches and Turning Circle (Dredge Area 1)	Mean	212	941	Fixed Berths (Dredge Area 3)	VC5E (0-0.6)	10	---
	95% UCL	408	1884		VC5E (0.6-0.8)	42	1.0
					VC5E (1-1.6)	23	---
Sub-Berth (Dredge Area 2)	VC2A 0-0.1	---	---	Fixed Berths (Dredge Area 3)	Mean	12.1	6.3
	VC2A 1-1.4	---	---		95% UCL	25.0	16.2 ^Y
	VC2A 1.4-2	---	---	Notes:			
	VC2A 2-2.3	---	---	⁽¹⁾ normalised to 1% TOC			
	VC2A 2.3-2.6	27	---	⁽²⁾ corrected for TBT concentration in seawater			
	VC2B 0-0.5	17	---	^Y Calculated using Student's-t Test (assuming Normal distribution)			
	VC2B 0.5-0.9	---	---	Where results are below analytical limit of reporting (LOR), half the LOR has been used in the statistical analyses (<i>italicised</i>)			
	VC2B 0.9-1.5	---	---	"---" indicates no analysis			
	VC2B 1.5-2.2	---	---	*ANZECC water quality guideline for marine waters (95% species protection)			
	SS2A	1.25	---				
	SS2B	10	---				
	SS2C	234	---				
	SS2D	259	8.0				
	SS4B	64	31				
	SS4C	20	---				
	SS4D	1040	7				
	VC4A 0-0.5	565	---				
	VC4A 0.5-1	29	---				
	VC4A 1-1.5	1.25	---				
	VC4A 1.5-2	1.25	---				
Sub-Berth (Dredge Area 2)	Mean	174	15.3				
	95% UCL	314	38 ^Y				



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3.2.2.1 TBT DILUTION CALCULATIONS

The full reports on the dilution modelling for the approaches and turning circle (Dredge Area 1) and the fixed berths (Dredge Area 3) are included in **Appendix 10**. It should be noted that this modelling is separate to the modelling that has been undertaken as part of the Environmental Impact Statement process (URS, 2013a).

The impact of dissolved TBT in the water column at the disposal site was calculated from the elutriate TBT results based on advice provided by Dr Simpson (CSIRO). The stages to the calculation are as follows.

1. Calculate the 95% UCL of the mean elutriate TBT results for the samples.
2. Multiply the 95% UCL of the mean elutriate TBT by 10. This estimated factor takes into account the poor accuracy in detecting dissolved TBT and the likely underestimation in calculating pore water concentrations from elutriate results.
3. Calculate the expected dilutions at the disposal site.
4. Calculate the expected dissolved TBT in waters at the disposal site.

The initial dilution of disposed dredged material in the ocean depends on a number of factors, such as water depth, stratification in the water column, current velocities and current directions. As described in the NAGD, initial dilution can be determined using either of two methods, namely:

- the liquid and suspended particulate phases of the dredged material may be assumed to be evenly distributed after four hours over a column of water bounded on the surface by the release zone and extending to the ocean floor, thermocline or halocline, if one exists, or to a depth of 20 m, whichever is shallower (analytical method); or
- it can be calculated using the US Army Engineers Waterways Research Station STFATE model (numerical method).

During the early stages of the project proposal, preliminary analytical modelling was undertaken to determine if more detailed investigations would be required. It was initially expected that backhoe dredging with overflowing was likely to be the preferred dredging method with disposal taking place from a split hopper barge. Disposal was considered at two possible sites (i.e. the Sydney Offshore Spoil Ground and a spoil ground located within Botany Bay).

The preliminary analytical modelling was undertaken for the above dredging and disposal methods based on combined results from the November 2009 and March 2010 investigations. This modelling indicated that the concentrations of TBT in the water column, after initial mixing of sediment from the dredge footprint, would exceed the ANZECC/ARMCANZ (2000) TBT high reliability trigger value for protection of 95% of species. Following review of the results of the analytical modelling, it was considered that disposal of all dredged sediments within Botany Bay would not be pursued. No further dilution modelling within Botany Bay was undertaken by WorleyParsons from this point.



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The more accurate numerical method (STFATE modelling) was adopted to predict the initial dilution of TBT for disposal operations at the Sydney Offshore Spoil Ground. This is because the analytical method is overly conservative for application in this case, given that the mixing zone is specified to only extend to a water depth of 20 m in the methodology, and the actual water depths at the Sydney Offshore Spoil Ground are approximately 100 m to 130 m.

STFATE dilution modelling was undertaken using the physical, geochemical and elutriate properties of sampled sediments collected from the approaches and turning circle (Dredge Area 1), as this contained the highest sampled mean elutriate TBT concentrations compared to the sub-berth and fixed berths (Dredge Areas 2 and 3). The dilution modelling also incorporated SEWPac's requirements with regards to the representation of the physical properties of the dredge material.

A supplementary investigation was undertaken in 2012 to characterise the expanded areas of the dredge footprint for the fixed berths (Dredge Area 3). Further TBT dilution modelling was undertaken for the fixed berths (Dredge Area 3) as part of the supplementary sediment investigation in 2012.

APPROACHES AND TURNING CIRCLE (DREDGE AREA 1)

Numerical modelling of dilution within the Sydney Offshore Spoil Ground using STFATE was carried out for the disposal of material collected by four methods of dredging in the approaches and turning circle (Dredge Area 1) as follows:

1. backhoe loading a split hopper barge (with overflowing);
2. backhoe loading a split hopper barge (no overflowing);
3. trailer suction hopper dredging (with overflowing); and
4. trailer suction hopper dredging (no overflowing).

The different methods of dredging affect the water and sediment content for the material that would be disposed, causing variations in the dilution of the material.

Following the early stages of the project proposal, the preferred dredging method has been selected as backhoe loading a split hopper barge (with overflowing and no overflowing).

The dilution modelling for the approaches and turning circle (Dredge Area 1) used a 95% UCL elutriate TBT concentration of 3,119 ng/L, which represents the value that is calculated when elutriate TBT data from samples VC4C(0.5-1.0), SS4F, SS4G and SS4H are excluded from the data. At the time of preparation of the dilution model, these four sample locations were included in the data collected for the fixed berths (Dredge Area 3) rather than the approaches and turning circle.

Subsequently the definition of Dredge Areas was altered due to modifications to the dredge footprint and these samples have been transferred to the turning circle. The modified 95% UCL elutriate TBT concentration for the approaches and turning circle (Dredge Area 1) (when including TBT elutriate concentrations for these four samples) was recalculated as 1,884 ng/L. Therefore, the dilution modelling undertaken was more conservative, with the modelled TBT concentration being approximately 1.5 times greater than would be expected based on the most recent definition of areas.



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The results of the numerical modelling were compared to the ANZECC/ARMCANZ (2000) trigger values for TBT at the 95% and 99% levels of species protection, i.e. 6 ng/L and 0.4 ng/L, respectively. The results indicate that after initial mixing over a four-hour period, the maximum concentration of TBT at the Sydney Offshore Spoil Ground for all four dredging scenarios would range from 4.3×10^{-2} to 8.9×10^{-2} ng/L, which is substantially below the ANZECC/ARMCANZ (2000) trigger values at the 95% and 99% species protection levels (refer **Table 9**).

FIXED BERTHS (DREDGE AREA 3)

Dilution modelling was also undertaken using the physical, geochemical and elutriate properties of material from the fixed berths (Dredge Area 3) following the sediment in investigation in August 2012 (refer **Appendix 10**).

The fixed berth (Dredge Area 3) modelling was only for the scenario of backhoe loading a split hopper barge (no overflowing). No overflow is proposed for the fixed berths (Dredge Area 3) due to the presence of peat.

The results of the numerical modelling were compared to the ANZECC/ARMCANZ (2000) trigger values for TBT at the 95% and 99% levels of species protection (i.e. 6 ng/L and 0.4 ng/L, respectively). The results identified that after initial mixing over a four-hour period, the maximum concentration of TBT at the Sydney Offshore Spoil Ground for a backhoe loading a split hopper barge (no overflowing) would be 2.86×10^{-7} ng/L, which is substantially below the ANZECC/ARMCANZ (2000) trigger values at the 95% and 99% species protection levels for TBT (refer **Table 9** and **Appendix 10**).



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Table 9 Summary of Results from Dilution Modelling

Dredge Area	Case	Maximum concentration of TBT in the water column after four hours (ng/L)	Comparison with the 95% and 99% protection level
Area 1	Backhoe loading a split hopper barge (with overflowing)	4.3×10^{-2}	139 times less than the 95% protection level 9.3 times less than 99% protection level
Area 1	Backhoe loading a split hopper barge (no overflowing)	6.2×10^{-2}	97 times less than 95% protection level 6.5 times less than 99% protection level
Area 1	Trailer suction hopper dredging (with overflowing)	5.7×10^{-2}	105 times less than 95% protection level 7.0 times less than 99% protection level
Area 1	Trailer suction hopper dredging (no overflowing)	8.9×10^{-2}	68 times less than 95% protection level 4.5 times less than 99% protection level
Area 3	Backhoe loading a split hopper barge (no overflowing)	2.86×10^{-7}	20979 times less than 95% protection level 1399 times less than 99% protection level

Note: Results for the preferred dredging method is shaded.

SUMMARY

TBT dilution modelling was undertaken for the disposal of material at the Sydney Offshore Spoil Ground from the approaches and turning circle (Dredge Area 1), representing the 'worst case' scenario, and the fixed berths (Dredge Area 3), representing the 'least contaminated' area with respect to TBT. This modelling is considered to adequately represent the disposal of material from the whole dredge footprint, including the sub-berth (Dredge Area 2).

The results of the dilution modelling for the disposal of material at the Sydney Offshore Spoil Ground for the approaches, turning circle and fixed berths (Dredge Area 1 and 3) were substantially less than the ANZECC/ARMCANZ (2000) marine water quality guidelines for TBT (95% protection level of 6 ng/L and at the 99% level of protection of 0.04 ng/L).



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The outcome of the dilution modelling for TBT in dredge sediments shows that it is unlikely that the disposal of the sediments at the Sydney Offshore Spoil Ground will adversely affect water quality during disposal or affect benthic organisms in the water column.

3.2.3 NAGD Phase IV Assessment

3.2.3.1 WHOLE SEDIMENT TOXICITY TESTING

Whole sediment toxicity testing was undertaken by CSIRO under the supervision of Dr Stuart Simpson to assess the survival rates and the number of embryos per female for the amphipod *Melita plumulosa*. The results as summarised in **Table 10**. They conclude that:

- the number of embryos per female in the silty control was within the test acceptability limits of 10-18 embryos per female; and
- there was no statistical significant difference in embryos per female or survival between any of the sediments and the blind control (VC4C 1-1.5m) which contained less than 70 µgSn/kg (normalised to 1% TOC).

Therefore CSIRO concluded the test sediments were considered to be non-toxic to the reproduction and survival of the amphipod *Melita plumulosa*.

A full copy of the laboratory results of the whole sediment toxicity tests are provided in **Appendix 8**.

Table 10 Summary of whole sediment toxicity testing results

Sediment	TBT (normalised to 1% TOC) (µg SN/kg)	Survival (% survival)	% of Control ^a	Embryos per female	% of Control ^a
Silty control	-	90 ± 3 ^b	NA	11 ± 1	NA
VC4C (1-1.5m) (blind control)	53	75 ± 9	100 ± 12	8 ± 1	100 ± 15
VC4B (1.5-2.0m)	690	85 ± 3	113 ± 4	8 ± 1	99 ± 10
SS4D	1040	92 ± 3	122 ± 4	9 ± 1	108 ± 13
VC4C (0.5-1m)	231	78 ± 7	104 ± 10	8 ± 1	101 ± 9

Notes: a. Calculated as a percent of the blind control.
b. Standard error calculated on the five replicate samples.



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3.2.3.2 ELUTRIATE TOXICITY TESTING

Laboratory results of the elutriate toxicity tests are provided in **Appendix 8**. Four samples were tested by Ecotox Services Australia - samples VC4B(0.5-1), VC4B(1.5-2), VC4C(0.5-1) and SS4G. The results indicate 62.8% to 74.4% of larvae were alive and/or normal for various concentrations from 6.3 to 100% within the given time frame. This was compared to 72.8% for the filtered seawater control. The 48-hour EC_{10} and EC_{50} ⁸ values in all four samples tested are $\geq 100\%$ with the exception of the 48-hour EC_{10} for VC4C(0.5-1) which is 82.6%. These results indicate that there was no detectable toxicity to the bivalve embryos from the elutriate samples tested.

The NAGD criteria require an assessment of four sample locations for toxicity testing for a dredge volume of 50,000 to 100,000 m³ (NAGD, Table 7). The testing was undertaken on samples from three locations and one 'blind control' sample, reflecting the smaller sediment volume that was considered to be dredged when the earlier investigation was undertaken in 2010. However, the four toxicity tests that were undertaken, which include the analysis of the blind control sample, have passed the toxicity criteria, suggesting that the available toxicity data are adequate without further testing being required.

3.3 Results of Testing Associated with Oily Water Discharge

Surface samples from the November 2011 sediment investigation reported concentrations of total TPHs and total PAHs within limits previously reported across the dredge footprint for the November 2009 and March 2010 sediment investigations. Concentrations of TPHs and total PAHs were below the NAGD Screening Levels for all surface sediment samples tested in the November 2011 investigation. The data indicate that contamination of surface sediments within the dredge footprint resulting from the oily water discharge from the Caltex Refinery in March 2011 was not discernible.

⁸ EC_{50} is the "half maximal effective concentration" and refers to the concentration of a toxicant which induces a response halfway between the baseline response and maximum response after 48 hours of exposure. Similarly, the EC_{10} value refers to the concentration of a toxicant which induces a response 10% of the range between the baseline and maximum response after 48 hours of exposure.



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4 DISCUSSIONS OF RESULTS

4.1 Suitability of Dredge Material for Sea Disposal

Geochemical analysis of sediments, elutriate testing, dilution modelling, whole sediment toxicity testing and elutriate toxicity testing has been conducted on sampled sediments taken from the dredge footprint. Based on these results, the following recommendations are made regarding the suitability of the dredged material for ocean disposal.

- Sediments from the dredge footprint showed TBT to be the only contaminant of potential concern.
- The 95% UCL for trace metals, total TPHs and total PAHs were below respective NAGD Screening Levels.
- BTEX, OCPs, OPPs, PCBs were all below the LOR in all samples.

TBT

The 95% UCL of the mean TBT concentration exceeded the NAGD Screening Level of 9 µgSn/kg across the dredge footprint and also exceeded the NAGD Sediment Quality High Value of 70 µgSn/kg in the approaches, turning circle and sub berth (Dredge Areas 1 and 2) (refer **Table 7**).

The elutriate TBT results indicated that the 95% UCL of the mean concentration of elutriate TBT for the dredged footprint exceeded the ANZECC/ARMCANZ (2000) water quality guideline value of 6 ng/L.

Numerical dilution modelling was used to correct the test data for the calculated dilution factor after the four-hour mixing period. TBT dilution modelling was undertaken for the disposal of material at the Sydney Offshore Spoil Ground for material from the approaches and turning circle (Dredge Area 1), representing the 'worst case' scenario, and material from the fixed berths (Dredge Area 3), representing the 'least contaminated' dredge area within the footprint with respect to TBT. This modelling is considered to adequately represent the whole dredge footprint, including the Sub-Berth (Dredge Area 2). The results of the dilution modelling at the Sydney Offshore Spoil Ground for the approaches, turning circle and fixed berths (Dredge Areas 1 and 3) were substantially less than the ANZECC/ARMCANZ (2000) marine water quality guidelines for TBT (95% protection level of 6 ng/L and at the 99% level of protection of 0.04 ng/L).

The outcomes of the dilution modelling for TBT in dredge sediments show that it is unlikely that the disposal of the sediments at the Sydney Offshore Spoil Ground will adversely affect water quality in these areas or affect benthic organisms in the water column.

Although the sediments within the dredge footprint contain elevated concentrations of TBT and elutriate TBT, both elutriate and whole sediment toxicity tests indicate that TBT is unlikely to cause



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chronic toxic effects to benthic organisms. The tests used are considered the most sensitive tests that are currently available.

Based on the geochemical and eco-toxicological tests, the sediments in each of the dredge areas are considered to be suitable for unconfined ocean disposal at the designated Sydney Offshore Spoil Ground. The above recommendation is supported by advice sought from Dr Stuart Simpson (CSIRO) in May 2011, prior to the November 2011 investigation, who advised that *'Based on the chemical and eco-toxicological tests, the sediments are generally considered to be suitable for ocean disposal at the designated Sydney Offshore Spoil Ground.'* (refer **Appendix 7**).

4.2 Other Considerations

Uncertainty exists regarding the potential for bioaccumulation of TBT by aquatic organisms that colonise and inhabit the sediments at the Sydney Offshore Spoil Ground. The bioaccumulation of TBT has the potential to lead to imposex in organisms such as gastropods, and immunosuppression in some bivalve species. For such effects to be considered likely to occur a significant abundance of these organism types would need to be present at the Sydney Offshore Spoil Ground, and TBT concentrations within the sedimentary pore waters would need to continuously exceed the water quality guidelines at the disposal site. The likelihood and significance of such effects should be considered in relation to the nature and desired properties of the disposal site.

For any dredging and spoil disposal program, careful consideration should be given to the design and execution of the operations. It would be desirable for materials of perceived lower quality (physical and geochemical) to be deposited beneath materials of higher quality at the disposal site. However, the sequencing of the proposed dredging works needs to tie in to the requirement to continue operating the port and berthing facility whilst the dredging would be taking place. This may require sediments from the dredge footprint to be dredged and disposed of simultaneously or in no particular order. This may cause mixing and homogenising of the sediments in the split hopper barge prior to disposal. Further, a sequential dredging operation would not be necessary considering the results of the geochemical and toxicity assessments.

Within Dredge Area 1, sediments in the northern part of the approaches and in the central and southern parts of the turning circle contain comparatively low TBT concentrations relative to sediments at other sample locations within the dredge footprint.

4.3 Acid Sulfate Soils

While not required under the NAGD, an assessment of acid generating risk was undertaken during the November 2009 and November 2011 sediment investigations. This was undertaken as part of considerations of alternative dredge material disposal options that may involve on land disposal, which would require an assessment of the presence of PASS in dredged material. Results of the acid sulfate soil investigation are provided in **Appendix 8**.

The ASS assessments involved two stages.



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The first stage of testing involved laboratory screen testing of 39 samples collected over the two investigations in 2009 and 2011 to identify the presence and severity of actual acid sulfate soils (AASS) and the likely presence of PASS. The laboratory screening test reported that pH_f prior to oxidation ranged from 4.9 to 9, indicating that no AASS (i.e. $\text{pH}_f \leq 4$) are likely to be present. From the laboratory testing the presence of PASS can be indicated (though not confirmed) through one or more of the following:

- release of hydrogen sulfide (H_2S) during oxidation;
- effervescence and release of heat during oxidation;
- a pH following oxidation (pH_{fox}) < 3.5 ; and
- a drop in pH following oxidation of 1 or more (i.e. $\text{pH}_f - \text{pH}_{\text{fox}} \geq 1$).

Analysis of the results of the field screen indicated that PASS may be present in all samples; particularly for those sampled sediments taken from the approaches, turning circle and fixed berths (Dredge Areas 2 and 3).

Detailed laboratory analysis was carried out using the Chromium-Reducible Sulfur (CRS) suite on sixteen selected samples, including those with the highest drop in pH following oxidation or those with the greatest reaction rate. A summary of results for the selected samples is provided in **Table 11**.

The Titratable Actual Acidity (TAA) results indicate that AASS is present in two of the sixteen selected samples prior to disturbance of the sediments. Both samples were obtained from the fixed berths in Dredge Area 3.

The potential sulfidic acidity of each sample was determined using the CRS test (S_{Cr}), which is a direct measure of reduced inorganic sulfur and therefore allows distinction between inorganic sulfur such as pyrite and sulfur from organic sources. Thirteen of the 16 selected samples reported a potential sulfidic acidity greater than the 'action criteria' specified in the Acid Sulfate Soils Manual guidelines (Stone *et. al*, 1998). These results indicate a high potential for acid generating conditions to develop in the dredge material, following disturbance and oxidation.

Generally, where action criteria are exceeded, an Acid Sulfate Soil Management Plan (ASSMP) is required for the disturbance of these sediments, unless mitigating factors such as sufficient Acid Neutralising Capacity (ANC) are established. Such factors are accounted for by determining the net acidity of each sample using the acid base accounting equation:

Net acidity = potential sulfidic acidity + existing acidity – acid neutralising capacity

The ANC of a soil is the ability of the soil to neutralise any acid that may be produced on oxidation and maintain the pH above 5.5. Organic matter, calcium carbonates (i.e. shell) and magnesium carbonates are common naturally occurring neutralising agents. The effectiveness of these agents varies depending on particle size, coatings on the agent and kinetic factors that affect the rate at which they dissolve and become available. To account for these limitations the ANC is divided by a minimum fineness factor of 1.5.



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As shown in **Table 11**, the net acidity was found to exceed the action criteria provided in the Acid Sulfate Soils Manual in 5 of the 16 selected samples (i.e. samples at depth from sample locations VC2A and VC2B from the sub berth (Dredge Area 2) and sample locations VC5C and VC5B from the fixed berths (Dredge Area 3)). Preliminary liming rates for the neutralisation of the samples with net acidity above the action criteria are also provided in **Table 11** and vary from 7 to 76 kg CaCO₃/t of sediment. The mean liming rate for the dredge footprint are <1 kg CaCO₃/t (for the approaches and turning circle), 4.2 kg CaCO₃/t (for the sub berth) and 21 kg CaCO₃/t of sediment (for the fixed berths).

An ASSMP would be required if the proposed works are expected to result in the oxidation of the dredged material during removal, transportation, reuse or disposal. The requirement for an ASSMP is discussed in further detail within the EIS (URS 2013), however for the purposes of the NAGD, no further action is required. Average liming rates for the neutralisation of the material from each Dredge Area are provided in **Table 11**.



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Table 11 Summary of Acid Sulfate Soil Testing

Area	Date	Core	Depth	Sediment Type	ASS Screen Test				Laboratory Result of Chromium Sulfate Testing																
					pH _r	pH _{pot}	Drop In pH	Reaction Rate	Actual Acidity			Potential Acidity		Acid Neutralising Capacity			Retained Acidity				Acid Base Accounting			Liming Rate	
									pH _{KCl}	TAA	S-TAA	S _{CR}		ANC	a - ANC _{ET}	s - ANC _{ET}	a-S _{HAS}	s-S _{HAS}	S _{KCL}	S _{HCL}	Net Acidity		Liming Rate*	Mean Liming Rate	
												pH Unit	mole H+/t								% S	% S			mole H+/t
1	Nov-09	VC1A	0-0.5	Brown/grey silty sand	8.9	6	2.9	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	
1	Nov-09	VC1A	0.5-1.2	Grey silty sand	9	6.3	2.7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
1	Nov-09	VC1A	1.2-1.6	Grey silty sand	9	6.2	2.8	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
1	Nov-09	VC1B	0-0.6	Brown Sand	9	6.1	2.9	1	9.6	<2	<0.02	0.03	17	2.9	580	0.93	-	-	-	-	<0.02	<10	<1		-
1	Nov-09	VC1B	0.6-1.2	Brown Sand	9	6.2	2.8	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
1	Nov-09	VC1B	1.2-1.7	Brown Sand	8.9	4.2	4.7	2	9.6	<2	<0.02	0.06	40	2.3	449	0.72	-	-	-	-	<0.02	<10	<1		-
1	Nov-09	SS1A	0-0.25	Brown sand	8.6	6.1	2.5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
1	Nov-09	SS1B	0-0.25	Grey sand	8.6	5.9	2.7	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
1	Nov-09	SS1C	0-0.25	Yellow sand	8.5	5.7	2.8	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
1	Nov-09	SS1D	0-0.25	Yellow/ brown sand	8.9	5.8	3.1	1	9.6	<2	<0.02	<0.02	<10	0.61	121	0.19	-	-	-	-	<0.02	<10	<1		-
1	Nov-11	VC5A	0-0.5	Fine to medium grained sand with coarse shell	7.9	6.2	1.7	1	9.6	<2	<0.02	0.02	13	9.1	1820	2.91	-	-	-	-	<0.02	<10	<1		-
2	Nov-09	VC2A	0-1.0	Grey sand	7.1	2	5.1	2												-	-	-	4.2		
2	Nov-09	VC2A	1.0-1.4	Dark brown sand	7.4	1.9	5.5	4	7.2	<2	<0.02	0.22	137	0.35	71	0.11	-	-	-	-	0.15	90		7	-
2	Nov-09	VC2A	1.4-2.0	Dark grey sand interbedded with silt	8.8	6.5	2.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	
2	Nov-09	VC2A	2.0-2.3	Light grey sand	8.9	6.5	2.4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	
2	Nov-09	VC2A	2.3-2.6	Grey sand	8.8	6.5	2.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	
2	Nov-09	VC2B	0-0.5	Grey sand	8.9	6.3	2.6	2	9.6	<2	<0.02	0.07	45	3.6	726	1.16	-	-	-	-	<0.02	<10		<1	-
2	Nov-09	VC2B	0.5-0.9	Dark grey silty sand	8.8	6.5	2.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	
2	Nov-09	VC2B	0.9-1.5	Grey sand	7.7	2.1	5.6	4	5.7	8	<0.02	0.16	102				-	-	-	-	0.18	110		8.6	-
2	Nov-09	VC2B	1.5-2.2	Grey sand	7.8	2	5.8	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	
2	Nov-09	SS2A	0-0.25	Brown sand	8.7	6.1	2.6	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	
2	Nov-09	SS2B	0-0.25	Brown silty sand	8.6	6.3	2.3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	
2	Nov-09	SS2C	0-0.25	Grey sand	8.8	6.3	2.5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	
2	Nov-09	SS2D	0-0.25	Brown sand	8.8	6.1	2.7	2	9.7	<2	<0.02	<0.02	<10	2.4	479	0.77	-	-	-	-	<0.02	<10		<1	-
3	Nov-09	VC3A	0-0.6	Dark grey sand	8.8	6.5	2.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	21
3	Nov-09	VC3A	0.6-1.3	Grey gritty sand	8.9	6.5	2.4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	
3	Nov-09	VC3A	1.3-1.9	Grey gritty sand	8.9	6.6	2.3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
3	Nov-09	VC3A	1.9-2.4	Grey coarse sand and shell	8.9	6.6	2.3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
3	Nov-09	VC3B	0-0.5	Grey sand	8.7	6.3	2.4	2	9.4	<2	<0.02	0.1	60	3.5	691	1.11	-	-	-	-	<0.02	<10	<1	-	
3	Nov-09	VC3B	0.5-0.9	Grey sand	8.7	6.3	2.4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
3	Nov-09	SS3A	0-0.25	Grey gritty sand	8.8	6.4	2.4	2	9.6	<2	<0.02	0.06	37	9.1	1830	2.9	-	-	-	-	<0.02	<10	<1	-	
3	Nov-09	SS3B	0-0.25	Dark brown silty sand	8.4	6.5	1.9	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
3	Nov-09	SS3C	0-0.25	Dark brown silty sand	8.4	6.4	2	3	9	<2	<0.02	0.27	167	16.3	3260	5.2	-	-	-	-	<0.02	<10	<1	-	
3	Nov-09	SS3D	0-0.25	Light grey sand	8.7	6.4	2.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
3	Nov-11	VC5B	0-0.8	Dark grey/ black muddy sand and coarse shell. Strong	8.2	6.1	2.1	2	9.3	<2	<0.02	0.122	76	24.8	4960	7.96	-	-	-	-	<0.02	<10	<1	-	
3	Nov-11	VC5B	0.8-1.3	Dark grey/ black clay. Strong H2S odour	7	1.5	5.5	4	6.5	<2	<0.02	1.86	1160	1.28	256	0.41					1.59	993	75.8	-	
3	Nov-11	VC5B	1.3-1.6	Grey to dark grey sandy clay/ clayey sand	4.9	1.5	3.4	4	4.1	39	0.06	1.25	779				52	0.08	0.2	0.31	1.39	869	66.6	-	
3	Nov-11	VC5C	0-0.5	Dark grey muddy sand interbedded with mud	8.4	6	2.4	3	8.7	<2	<0.02	0.3	187	5.99	1200	1.92	-	-	-	-	<0.02	<10	<1	-	
3	Nov-11	VC5C	0.5-1	Black clay (shale like). Brittle, dry and flaking	7.3	4.9	2.4	3	5.7	50	0.08	0.33	203								0.4	253	19.4	-	
Notes: Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Vigorous; 4 - Very Vigorous BOLD - pH _{pot} (<3.5), drop in pH (≥1) or reaction rate (≥2) indicates PASS Retained acidity not required where pH _{KCL} > 4.5 Acid neutralising capacity not effective where pH _{KCL} <6.5 TAA exceeds ASSMAC "action criteria" i.e. AASS Value exceeds ASSMAC "action criteria", i.e. PASS * Liming rate calculated on the highest net acidity results (i.e. either the acid or sulfur trail) * Liming rate using Ag Lime (ENV = 98%), Safety Factor = 1.5																									



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5 DATA VALIDATION

Tabulated results for field triplicates, split triplicates and duplicates, and field blanks for the data validation for the four sediment investigations are provided in **Appendix 12**.

5.1 Field QA/QC samples

FIELD REPLICATES

A field triplicate sample was collected from location SS4G during the 2010 sediment investigation to identify the variability of the geochemical characteristics in sediments at a particular site. The relative standard deviation (RSD) was calculated for each contaminant (refer **Appendix 12**). The NAGD recommends that field replicates should agree within an RSD of +/-50%, although the guidelines note *'they may not always do so where the sediments are very heterogeneous or greatly differing in grain size'*.

The RSD analysis of the geochemical properties of the field triplicate samples (SSG4, FT1, FT2) shows that the RSD was outside of the recommended +/-50% RSD for Cu, Zn, individual PAHs Fluoranthene and Pyrene and total PAHs. The results for the remaining geochemicals were below the LOR, or within the 50% RSD tolerance level. The concentrations of Cu, Zn, Fluoranthene and Pyrene in these samples were close to the analytical LOR, which is likely to have resulted in a greater analytical variability for these analytes.

One field replicate (SS5A) and one split replicate (SS5D) was submitted to ALS for analysis during the 2011 sediment investigation. ALS was instructed to submit one of the split replicate samples to AAA for inter-laboratory analysis.

Based on a review of the results of the QA/QC samples, it is suspected that a human error in label writing in the field or in label identification in the laboratory may have occurred which has resulted in a mix up of the field and split replicate samples. RSD and RPD analysis of the replicate samples could therefore not be calculated and relied upon, but the raw data are shown in **Appendix 12**. As the remaining samples were labelled with distinguishable identifiers, it is not expected that any error associated with the field and split replicate data has affected the quality of the remaining data or compromise the quality of the overall data set.

Two (2) field triplicate samples were collected from sample locations C2 (C2_0-0.5) and C11 (C11_0-0.35) during the 2012 sediment investigation. The RSD was calculated for each contaminant (refer **Appendix 12**). The RSD analysis was within the recommended +/-50% RSD for all analytes in both field triplicate samples, except for:

- Individual PAH Coronene from sample location C2 (75% RSD), and
- TOC (52% RSD), and Indeno(1.2.3.cd)pyrene (57% RSD) from sample location C11.



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However the concentrations of these two organic PAH compounds were generally low and comprised <5% of the overall sum of the concentrations of all PAHs. Therefore, the exceedances of the data quality objectives (DQO) for Coronene and Indeno(1.2.3.cd)pyrene are unlikely to affect the overall assessment of the concentrations of total PAHs.

SPLIT REPLICATES

Split duplicates were collected at three locations in the 2009 sediment investigation (VC1B, VC2A and VC3B) and a split triplicate sample was collected at one location (SS4J) during the 2010 sediment investigation. The third triplicate sample from SS4J (i.e. sample SST2 Rep 0) was sent to AAA for analysis.

The recommended RPD/RSD DQO limits were exceeded for total PAHs in three of the four split replicate samples collected in 2009 and 2010. Two of the split replicate samples also exceeded the RPD/RSD limits for TBT and split duplicate sample VC3B exceeded the RPD DQO limit for Cr and Pb.

The analysis of split replicate results indicate that the presence of PAHs and TBT within the sediments is inhomogeneous and possibly due to variations in sediment particle size.

A split triplicate sample was collected during the 2011 sediment investigation. As described above, based on a review of the results of the QA/QC samples, it is suspected that a human error in label writing in the field or in label identification in the laboratory may have occurred, resulting in a mix up of the field and split replicate samples obtained in the 2011 sediment investigation. RSD and RPD analysis of the replicate samples could therefore not be calculated and relied upon, but the raw data are shown in **Appendix 12**.

Split triplicates were collected at two (2) sample locations (C6 and C10) in the 2012 sediment investigation. The third of the split triplicate samples were sent to AAA for analysis. The recommended RPD limits (DQO: <35% RPD) were exceeded in one (1) of the two (2) split samples for total PAHs (i.e. split duplicate pair C10_0.0-0.50 and QC6). An inspection of the core log for sample location C10 indicates that the olive grey-green muddy sand grades into sand at 0.3-0.5 m depth. This may indicate that despite a thorough homogenization of the sample (which also included an inter-laboratory duplicate sample QC7), the presence of PAHs within the sediments is inhomogeneous and possibly due to variations in sediment particle size. This could explain the large variability of PAHs in both the split duplicate and the inter-laboratory duplicate (refer **Appendix 12**).

The split samples C10_0.0-0.50 and QC6 from the 2012 sediment investigation also exceeded the DQO of 35% RPD for Cu and Zn. This is also likely to be the result of the inhomogeneous distribution and particle-size-related nature of the concentrations of these two trace metals in sediments at this sample location. This is supported by the field observations and the core log for sample location C10.

In contrast, the recommended RPD limits in the second split duplicate sample pair (C6_0.0-0.13 and QC1) from the 2012 sediment investigation were below 35% RPD for all analytes (i.e. including all PAHs), with the exception of Se (47% RPD), V (41% RPD) and Hg (46% RPD). This suggests a



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substantially lower degree of sample inhomogeneity and a higher analytical data reproducibility in sediments at sample location C6 compared to sample location C10.

Two (2) inter-laboratory split samples were also submitted to AAA, samples QC2 (Primary sample: C10_0.0-0.13) and QC7 (Primary sample: C10_0.0-0.50). The inter-laboratory sample analysis showed that there were exceedances of the DQO (<35% RPD) for the inter-laboratory sample from sample location C10 (i.e. individual PAHs, Zn and Cu) This is likely to be due to the highly variable sediment texture observed in the upper 0.5 m at that location, and with muddy sand grading into sand below about 0.3 m depth. In contrast, the inter-laboratory sample from sample location C6 has shown to provide a substantially better data reproducibility, with RPDs <35% for all analytes, with the exception of Pb (40% RPD), Chrysene (39% RPD), Perylene (59% RPD) and the sum of total PAHs (48% RPD) (refer **Appendix 12**).

SEDIMENT FIELD AND METHOD BLANKS

Field blanks were submitted as part of the QA/QC procedures during the March 2010 and November 2011 investigations to detect cross contamination from volatile substances such as BTEX and light fraction TPHs during sample handling and transportation. The results showed that all analytes were below LOR. Therefore cross-contamination from secondary sources is unlikely in the applied sampling methodology.

Daily method blanks were submitted as part of the QA/QC procedures during the August 2012 sediment investigation to detect cross contamination from trace metals during sample handling and transportation. The results showed that all analytes were at or below the analytical LOR. The RSDs for the three blank samples collected over the three day sampling period were <20% for all analytes that were present above the analytical LOR. The low concentrations of contaminants in the method blank samples in addition to the low variability in the concentrations of contaminants in the method blank samples suggest that cross-contamination from secondary sources is unlikely (refer **Appendix 12**).

ELUTRIATES

A split duplicate sample was submitted for elutriate TBT testing in the 2010 sediment investigation (sample pair SS4G and FT1). The RPD for the elutriate TBT results (as calculated from TBT concentrations prior to applying the TBT correction from the seawater blank sample) were within the +/-35% DQO criteria.

A split duplicate sample was also submitted for elutriate TBT testing in the 2012 sediment investigation (sample pair C2_0.0-0.5 and QC5). The RPD for the elutriate TBT (<LOR) results (RPD: 0.8%) were also within the 35% RSD DQO criteria.

The seawater used in the elutriate tests was tested for background concentrations of TBT. If background concentrations of TBT were detected in the seawater samples, the results of the elutriate testing were corrected for these background concentrations.



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5.2 Geochemical Laboratory QA/QC

Laboratory quality assurance of the analytical data comprised an analysis of laboratory duplicates, method blanks, laboratory control samples and matrix spikes. The results of this quality assurance are shown within the laboratory reports (refer **Appendix 8**).

An assessment of laboratory blank samples reported by ALS and AAA demonstrates concentrations below the LOR for all parameters, indicating an absence of cross-contamination.

LABORATORY DUPLICATES

The precision of analyses performed by the analytical laboratory is determined from the RPD of the analytical data from duplicate analyses. The NAGD recommend that laboratory duplicates do not exceed an RPD of +/-35%. This range was exceeded for Cr in sample VC2A (1.4-2.0) from the 2009 sediment investigation, for total PAHs in two ALS laboratory duplicates (VC4C(0.0-0.5) and SS4F) in the 2010 sediment investigation. As such, the PAH results for samples VC4C(0.0-0.5) and SS4F and the Cr results in sample VC2A (1.4-2.0) are reported as estimates only. The remaining laboratory duplicates from the 2009, 2010 and 2011 sediment investigations conform to the required RPD criteria, indicating that the analytical laboratories (ALS and AAA) have provided an acceptable level of precision for the geochemical data.

The RPD in laboratory duplicates from the 2012 sediment investigation were below 35% for all analytes, with the exception of the following:

- Co and Ni in sample C8_0.0-0.12;
- Se in sample C10_0-0.50;
- Benz(a)anthracene and Sum of PAHs in sample C11_0.0-0.35;
- Co in an anonymous sample; and
- Benz(a)anthracene and Sum of PAHs in an anonymous sample.

The Laboratory QC samples at ALS are randomly picked from a range of samples and an anonymous sample indicates a sample picked from another client batch.

All other RPD results for the samples from the 2012 sediment investigation were below 35%, indicating that the concentrations of Co, Ni, Se and PAHs in sediments at these locations are variable.

MATRIX AND SURROGATE SPIKES

Analyses of surrogate spike samples were undertaken by the analytical laboratory to identify the per cent recovery of spiked organic compounds relative to the concentration of recovery. Surrogate spike samples were within NAGD criteria, with the exception of TBT surrogates for several samples. Within these samples, the high primary sample analyte concentrations required sample dilution to allow analysis. As a result of the dilution the concentration of the surrogates was below the analytical LOR. Therefore these results were not reported.



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Recovery of matrix spikes determines the interference on contaminant recovery from the sediment matrix. The per cent recovery for TBT was not reported due to the requirement for further primary dilution as a result of the high analyte concentrations in the samples. Recovery of OCPs and OPPs, individual Aroclors, and individual PAHs were non-compliant with the NAGD criteria, likely due to sample heterogeneity.

Laboratory control spikes were within recovery limits for all analytes with the exception of Hg in one sample obtained during the 2011 sediment investigation. The recovery limit was only slightly below the recommended limits and was considered to be within range of the laboratory's data quality objectives.

As noted in the laboratory data in **Appendix 8**, elutriation was undertaken three days outside of recommended holding times during the 2010 sediment investigation. This was due to analysis difficulties encountered by the laboratory due to the high sediment TBT concentrations observed. However, the laboratory and CSIRO have advised that this is not expected to adversely impact the analytical results.

Laboratory control spikes were within the recovery limits for all analytes obtained during the 2012 sediment investigation. The assessment of matrix spikes for the 2012 sediment investigation includes the following:

- Coronene in sample C11_0.0-0.35 greater than recovery limit;
- Tripropyltin in sample C12_0.5-1.0 greater than recovery limit;
- Perylene in sample C13_0-0.50 below the recovery limit;
- TBT, 2-Fluorobiphenyl in sample C18_0.0-0.5 greater than recovery limit; and
- 2-Fluorobiphenyl in sample T02A greater than recovery limit.

Matrix spikes for some individual PAHs and TBT were not determined due to sample matrix interference. Some individual PAHs, TBT and Tripropyltin were reported as less than, or exceeding the recommended recovery limits, indicating matrix interference or sample heterogeneity. The following samples were not determined for matrix spikes:

- Individual PAHs in sample C11_0.0-0.35;
- TBT in sample C17_0.0-0.5; and
- Individual PAHs in sample 'Anonymous'.

ELUTRIATE DATA LABORATORY QA/QC

Laboratory duplicates and matrix spikes for analyses of TBT have shown to be within the laboratory's recovery limits for all samples and for TBT. Therefore elutriate data are acceptable for interpretation under the NAGD.



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5.3 Toxicity Laboratory QA/QC

Laboratory QA/QC for toxicity testing included percentage survival of organisms in laboratory control samples, reference toxicants and measurement of water quality criteria for pH, salinity, dissolved oxygen and temperature.

All QA/QC parameters for the whole sediment and elutriate TBT toxicity testing were met.

5.4 Summary

Overall, field and laboratory QA/QC was considered acceptable for the use of the analytical data in the interpretation and in the environmental assessment outlined in this report.



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6 CONCLUSION

The sediment sampling and testing program detailed within this Report comprises a consolidated set of results of the 2009, 2010, 2011 and 2012 sediment investigations across the dredge footprint.

The investigations were undertaken to characterise the physical and geochemical properties of sediment from the dredge footprint within three dredge areas (the approaches and turning circle, the sub berth and the fixed berths). The assessment also included an assessment of the toxicity of TBT.

The four stages of the investigation were carried out in accordance with the NAGD and the relevant SAPs (WorleyParsons, 2010; WorleyParsons, 2011; and WorleyParsons, 2012a).

Results were compared to NAGD requirements. In accordance with these requirements and based on the geochemical and eco-toxicological tests, the sediments within the dredge footprint are considered to be suitable for unconfined ocean disposal at the designated Sydney Offshore Spoil Ground.

The key findings of the investigation are as follows.

- The sampled sediments within the approaches, turning circle and sub berth (Dredge Areas 1 and 2) are dominated by sands (about 90%), with minor amounts of fine fraction. In contrast, sediments within the fixed berths (Dredge Area 3) are dominated by unconsolidated muddy sands and sands in the surficial sediments and consolidated peat. The consolidated peat underlies unconsolidated sediments or is present at the surface in the central area of fixed berth #1 and in the northern part of fixed berth #2. While the average fine fraction content (<75 µm) in sediments in the fixed berths (Dredge Area 3) is 15%, consolidated peat samples contain more than 30% and up to 47% fine fraction content.
- Total organic carbon contents are highly variable between the sands and muddy sands (<3% TOC) and peat (~20-40% TOC).
- Acid sulfate soils testing indicated that the net acidity of some samples exceeded the action criteria provided in the Acid Sulfate Soils Manual (Stone *et. al*, 1998). This has been further discussed within the EIS (URS 2013) and does not need to be addressed under the NAGD.
- Comparison of the geochemical analysis results against the guidelines for ocean disposal (i.e. the Screening Levels provided in Appendix A, Table 2 of the NAGD) indicated:
 - o concentrations of BTEX, light fraction hydrocarbons (C₆-C₉ and C₆-C₁₀), OCPs, OPPs and PCBs were below analytical limits of reporting in all sediment samples tested;
 - o the 95% UCL of the mean concentration of trace metals, total TPHs and total PAHs were below NAGD Screening Levels when calculated for each Dredge Area; and



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- o elevated concentrations of TBT above the NAGD Sediment Quality High Value in sediments in all areas of the dredge footprint triggered further post-NAGD Phase II testing.
- Analytical results for TPHs and PAHs indicate that there appears to be no significant contamination of surface sediments as a result of the oily water discharge in March 2011.
- Geochemical testing of the peat-like material in the fixed berths (Dredge Area 3) shows that the 95% UCL of the mean concentrations of all analytes tested, with the exception of TBT, are below NAGD Screening Levels. While elevated levels of As were found in peat samples, the 95% mean UCL is less than the NAGD screening levels, and it is believed that the As is of natural origin.
- Elutriate testing indicated that elutriate TBT concentrations (excluding calculated dilutions) and the 95% UCL of the mean of elutriate TBT concentrations exceeded the ANZECC/ARMCANZ (2000) water quality guideline value across the dredge footprint.
- Dilution modelling was conducted to assess the ability for the dredged sediments to be disposed at the Sydney Offshore Spoil Ground. The modelling comprised using the numerical method outlined in the NAGD and results of the elutriate testing for the 'worst-case' 95% UCL (located within the approaches and turning circle (i.e. Dredge Area 1)). This modelling indicated that the maximum concentration of TBT in the water at the Sydney Offshore Spoil Ground, following initial mixing for four modelled possible scenarios, would be ≤ 0.089 ng/L. This is substantially below both the 95% species protection level (6 ng/L) and the 99% species protection level (0.4 ng/L).

In addition, dilution modelling for disposal at the Sydney Offshore Spoil Ground using the numerical method and the 95% UCL of elutriate results from the sediments disposed from within the fixed berths (Dredge Area 3) (i.e. backhoe loading a split hopper barge (no overflowing)) was conducted. This indicated that the maximum concentration of TBT in the water at the Sydney Offshore Spoil Ground, following initial mixing over a 4 hour period, would be 2.9×10^{-7} ng/L. This is approximately 20,000 times below the ANZECC/ARMCANZ water quality guideline value for 95% species protection for TBT.

Based on these modelling results, the concentrations of TBT in sediments that would be dredged across the footprint are unlikely to affect water quality adversely during disposal at the Sydney Offshore Spoil Ground.

- Whole sediment toxicity testing indicated that all test sediments were considered to be non-toxic to the reproduction and survival of the amphipod *Melita plumulosa*.
- Elutriate toxicity testing indicated that there was no detectable toxicity to bivalve embryos from the elutriate samples tested.
- Toxicity tests used in the current assessment are considered to be the most sensitive tests that are currently available.



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- Within Dredge Area 1, normalised concentrations of TBT and all other contaminants tested in sediments are below the NAGD Screening Level in the northern part of the approaches and in the south eastern area of the turning circle.
- The field and laboratory QA/QC methodology was acceptable and in accordance with the approved SAPs.



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Appendix 1 SAP (March 2010)



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Caltex Maintenance Dredging Sampling and Analysis Plan

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3 March 2010

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Confidentiality

This document has been prepared for the sole purpose of documenting our tender for consultancy services associated with the Sampling and Analysis Plan

It is expected that this document and its contents, including work scope, methodology and commercial terms will be treated in strict confidence by Caltex Australia Petroleum Pty Ltd and that the contents will be used by Caltex Australia Petroleum Pty Ltd only for the purpose of selecting a consultant for the project.

PROJECT 301015-01887 - CALTEX MAINTENANCE DREDGING

REV	DESCRIPTION	ORIG	REVIEW	WORLEY- PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	_____ O Murray	_____ A Watters	_____ N/A	28-01-10	_____ N/A	
B	Issued for DEWHA review	_____ O Murray	_____ A Watters	_____ A Watters	29-01-10	_____ N/A	N/A
0	Issued for Use	_____ O Murray	_____ A Watters	_____ A Watters	3-03-10	_____ 	N/A
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ACRONYMS and ABBREVIATIONS

Caltex	Caltex Australia Petroleum Pty Ltd
DEWHA	Department of Environment, Water, Heritage and the Arts
EMP	Environmental Management Plan
GHD	GHD Pty Ltd
MDS	McLennan's Diving Service
NAGD	National Assessment Guidelines for Dredging
SAP	Sampling and Analysis Plan
TBT	Tributyltin



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1 INTRODUCTION

Caltex Australia Petroleum Pty Ltd (Caltex) is responsible for the maintenance of their port facilities at Kurnell. The facilities were last dredged in the 1950s and 1960s. Sediment has since accumulated at the wharf and approaches. The build up of sediment on the seabed has reduced the clearance between ship keel and harbour floor. Maintenance dredging of the seabed is required to improve the operational capability of the facility.

Preliminary sediment investigations undertaken in November 2009 indicated that there were elevated concentrations of tributyltin (TBT) in the sediment. In order to assess the suitability of the maintenance dredge material for sea disposal (either within Botany Bay or offshore), additional sediment investigations and analyses are required.

The additional investigations are required to assess the bioavailability and toxicity of the observed TBT. In addition, following the preliminary sediment investigations undertaken in November 2009, Caltex has had further discussions with the Sydney Ports Corporation (SPC) Pilots resulting in a broadening of the proposed dredge area. Sampling within the wider dredge area is required to fully characterise the chemical properties of the maintenance dredge material.

This report outlines the proposed Sampling and Analysis Plan (SAP) for the additional sediment investigations for the maintenance dredge area. The SAP has been prepared in accordance with recommendations outlined in the National Assessment Guidelines for Dredging (DEWHA, 2009). The SAP includes the following elements:

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



2 COMPILATION & REVIEW OF EXISTING DATA

2.1 Site History

The Caltex refinery is located at Kurnell on the southern shore of Botany Bay, just south of the Sydney CBD (refer **Figure 1**). The refinery commenced operations in 1956.

The Caltex Wharf at Kurnell is located to the west of Sutherland Point and north east of Silver Beach (refer **Figure 1**). The wharf is used for the supply of crude oil and distribution of product by ship and pipeline. On the northern side of the wharf, rows of pipelines connect the refinery's tanks to the three berths, the Banksmeadow terminal on the northern side of Botany Bay and, via the Sydney-Newcastle Pipeline, to the Silverwater and Newcastle terminals. In addition, a jet line supplies 50% of the airline fuel needed by Sydney Airport. The wharf also supports the cooling water pump house providing part of the refinery's cooling water.

The wharf was completed in 1956 and extends more than 1km into Botany Bay. The structure is constructed almost entirely of reinforced concrete and comprises over 5000m² of deck area supported by almost 900 piles. The superstructure has two levels: an upper deck for vehicular traffic and a lower, mostly open lattice of beams, supporting the pipework.

Although the wharf structure has basically not changed since its construction, the ship fendering systems have been varied numerous times. Originally catering for ships of up to 30,000 tonnes capacity, an upgrade in 1996 made it possible to berth ships with a capacity of up to 45,000 tonnes.

Following construction of the Caltex Wharf during the 1950s, dredging was undertaken for the berths and approaches. A search of Caltex's records is ongoing but to date, historical survey plans show the last maintenance dredging campaign was undertaken in 1969. Caltex's proposed maintenance dredging program is to restore the berths and approaches to previous historical dredge depths.

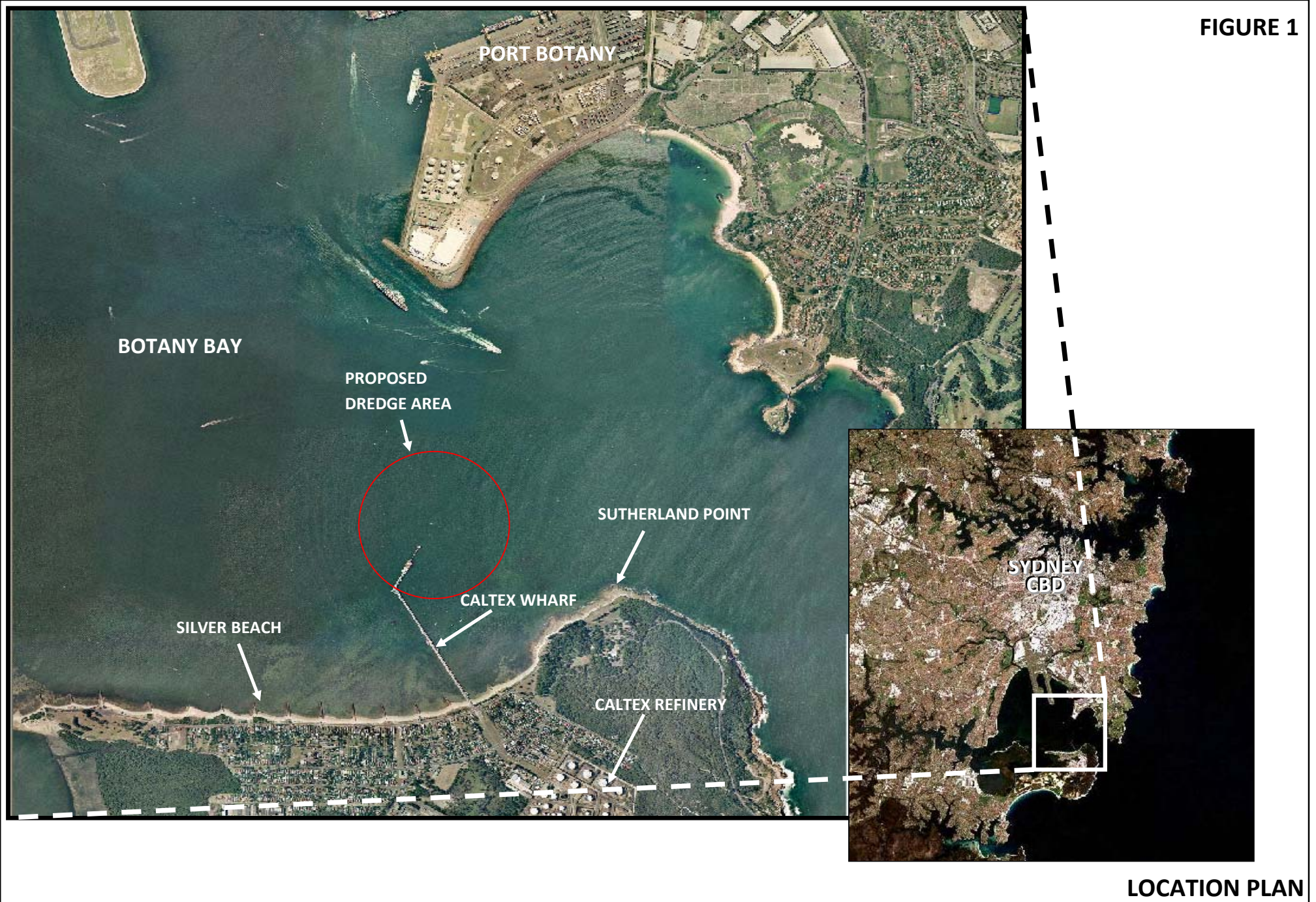
2.2 Existing Sediment Data

Relevant current sediment investigations include:

- vibrocoring investigations by GHD in 2007 and 2008 at locations in the vicinity of the proposed dredging areas (0.5 to 1 km from the dredge areas); and
- sediment quality investigation by WorleyParsons in November 2009 within the proposed dredge areas.

The GHD vibrocoring investigations provided an indication of the likely physical and chemical properties of the maintenance dredge material. The WorleyParsons sediment quality investigation confirmed the physical properties of the sediment and provided sufficient data to characterise the physical and chemical properties of the maintenance dredge material. A summary of each investigation is provided below.

FIGURE 1





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2.2.1 September 2007 and September 2008 GHD Pty Ltd Geotechnical Vibrocore Investigations

GHD conducted two vibrocore investigations in September 2007 and September 2008 approximately 0.5km to 1km to the east/southeast of the dredging areas. This study indicated that the sediment within the proposed dredge areas is likely to comprise mainly sand with some possible zones of silty and shelly sand within the subsurface profile. Stiff/very stiff clay is expected at around 16m below AHD, well below the proposed maximum dredge depth for the maintenance dredging program.

The geochemical testing undertaken for the GHD vibrocore investigations identified that:

- metal concentrations in surface sediments were below ANZECC sediment quality guideline levels;
- tributyltin (TBT) concentrations were reported in sediments below the ANZECC sediment quality guideline levels; and
- no contaminants in water samples taken during vibrocoreing were reported in concentrations exceeding the applicable ANZECC Water Quality Guidelines for Marine Ecosystems.

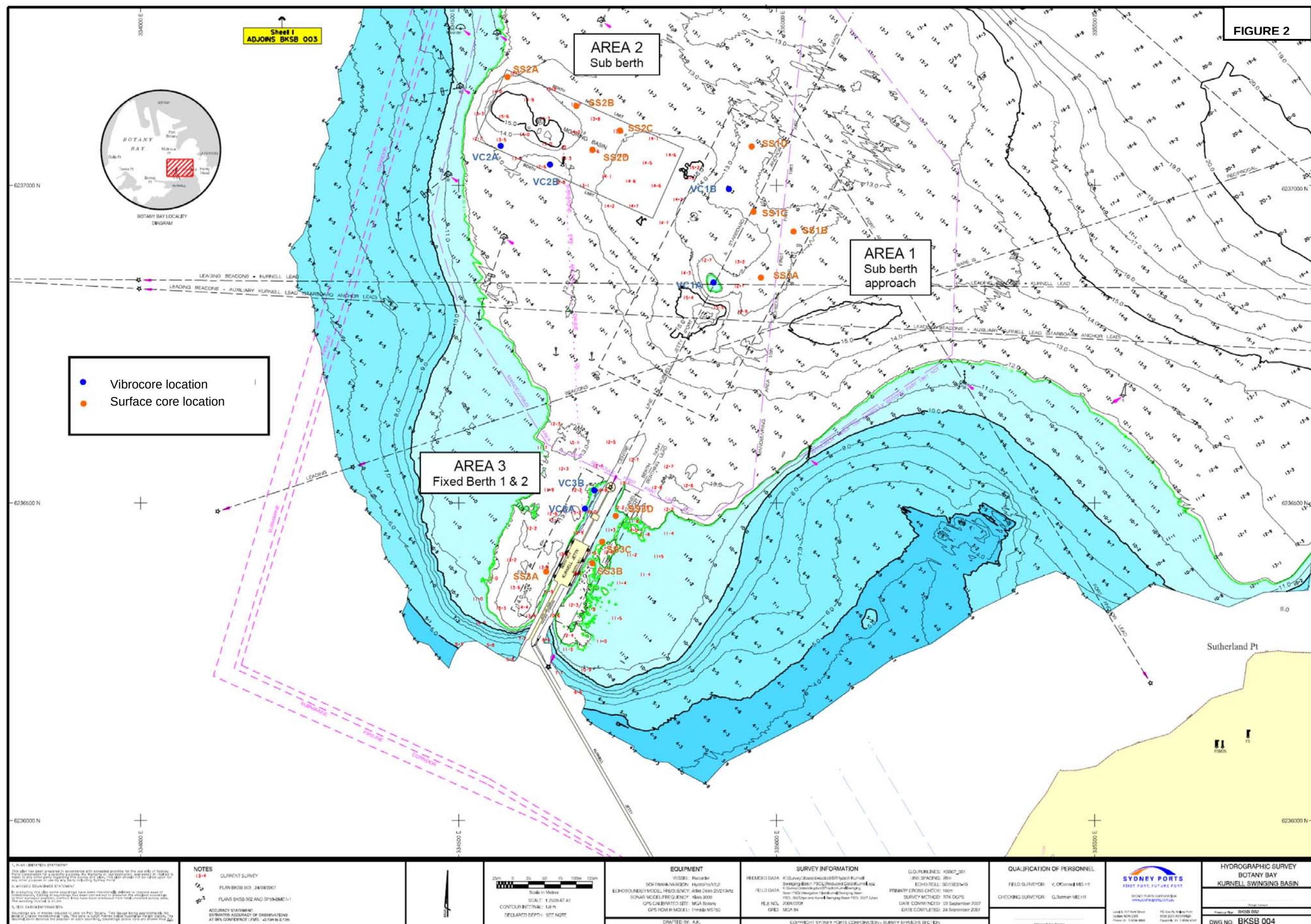
It was suggested by GHD (2009) that the sands within the dredge areas are unlikely to be contaminated. However a thin layer of recently deposited fine materials (clays/silts) may have accumulated in pockets within the dredge areas. Given the long history of shipping activity, these sediments were considered more likely to be contaminated than the underlying deeper strata (GHD, 2009).

2.2.2 November 2009 WorleyParsons Sediment Quality Investigations

WorleyParsons was engaged by Caltex to undertake sediment quality investigations to characterise the proposed maintenance dredged material. The proposed dredge areas comprised the sub-berth, approaches to the sub berth and two fixed berths (refer **Figure 2**). Although the dredge areas are all within an area less than 1 km², in order to assess any potential variation in contamination across the site, the proposed dredge area was divided as follows:

- Area 1 Approaches to the Sub-berth;
- Area 2 Berthing box at the Sub-berth; and
- Area 3 Fixed Berths #1 & #2.

The rationale and main findings of the WorleyParsons sediment quality investigations are described below.





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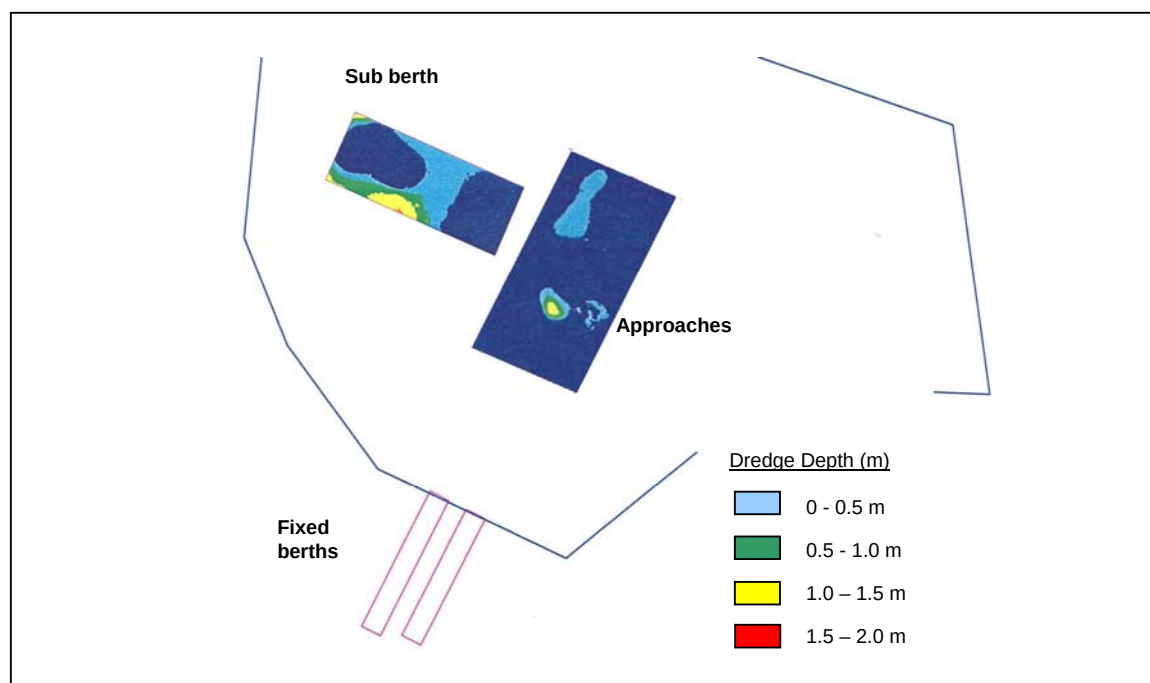
Sampling Methodology

Analysis of the most recent available hydrographic survey (SPC, 2007) was undertaken to identify the required areas, thickness and volume of maintenance dredging. The depth below the sea bed of the proposed maintenance dredging for the majority of the dredge areas was generally in the order of 0.5m with several isolated areas of greater sediment accretion requiring removal of up to 2 m of material. A combination of surface cores and vibrocoreing was therefore undertaken.

As the chemical properties of the sediment from each proposed dredge area were unknown, sampling at 6 locations from each area was undertaken in accordance with the recommended number of sampling locations listed in Table 6 of NAGD (2009). Within each dredge area, 4 surface cores and 2 vibrocores were recovered.

A judgmental sampling program was designed to provide spatial coverage of each dredge area and allow targeted vibrocoreing in the areas of greatest sediment accumulation. **Figure 2** shows the selected sample locations. **Figure 3** shows the results of the hydrographic survey analysis used to select the sample locations and showing the depth of required maintenance dredging and clearly highlighting the areas of greatest sediment accumulation. **Table 1** provides a summary of the number of sample locations.

Figure 3 Areas and depths of maintenance dredging





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Table 1 Summary of number of sample locations

Dredge area	Maintenance Dredge Depth (m CD)	Volume of maintenance dredge material	Number of surface samples	Number of vibrocores	Total number of sample locations
Area 1- Approaches to the Sub-berth;	- 12.8 m CD	1,900 m ³	4	2	6
Area 2 - Berthing box at the Sub-berth	-14 m CD	6,700 m ³	4	2	6
Area 3 - Fixed Berths 1 & 2	-11.6 and 11.4 m CD	<100 m ³	4	2	6

Sub Sampling

Collection of the sediment samples was undertaken by McLennans Diving Service (MDS). An onboard GPS was used to position the sampling vessel at the nominated locations. Divers were used to verify the verticality of each vibrocore, assist in sample retention and recover surface cores.

Sample processing took place at the MDS Factory Unit in Pagewood. The vibrocores and surface cores were split and sub sampling undertaken by a WorleyParsons Environmental Scientist. Samples were recovered approximately every 0.5 m from each vibrocore to the proposed dredge depth. One sample was recovered from each surface core.

Testing

Particle size analysis of samples from 2 locations within each maintenance dredge area was undertaken.

Based on the site history and previous sediment sampling, the contaminants of concern identified for the maintenance dredge material included:

- heavy metals;
- PAHs; and
- TBT.

Samples from all locations were tested for the contaminants of concern and total organic carbon (TOC) (for normalisation of organics results). In addition, 20% of the samples were tested for the following contaminants to confirm that they were not a concern.

- organochlorine (OC) pesticides;
- polychlorinated biphenyl (PCBs);
- BTEX; and
- TPHs.

Main Findings

The results of the sediment testing were compiled and statistical analysis of the pooled data from all maintenance dredging areas undertaken and compared to the NAGD (refer **Table 2**). In summary the results indicated:



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Table 2 Results of November 2009 sediment investigations

Analyte		Antimony	Arsenic	Cadmium	Chromium (VI)	Copper	Lead	Nickel	Silver	Zinc	Mercury	Total PAHs	Tributyltin	PCBs	OC Pesticides	BTEX	TPH C10 - C36 Fraction
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µgSn/kg	µg/kg	µg/kg	mg/kg	mg/kg
LOR		5	5	1	2	5	5	2	0.1	5	0.1	0.5	0.005	0.1	1	2	3
	NAGD Screening Level	2	20	1.5	80	65	50	21	1	200	0.15	10000	9	23	0.32-280	-	550
	NAGD Maximum Level	-	-	-	-	-	-	-	-	-	-	-	80	-	-	-	-
ALL AREAS																	
	mean	0.3	2.2	0.1	4.6	4.3	5.9	1.1	0.1	27.3	0.06	298	51.70	<5.0	<0.5	<0.2	10.3
	SD	0.0	3.4	0.1	6.4	6.7	11.2	1.3	0.2	80.3	0.15	654	80.40	0	0	0	12.2
	95% UCL	na	3.1	0.1	6.4	6.2	9.0	1.4	0.1	49.8	0.11	480	82.44	na	na	na	20.4
AREA 1 - SUB BERTH APPROACH																	
VC1A	0-0.4	0.3	0.5	0.1	1.7	2.8	0.5	0.5	0.1	2.2	0.01	950	134	<5.0	<0.5	<0.2	<3
VC1A	0.4-1.1	0.3	0.5	0.1	0.5	3.3	2.6	0.5	0.1	16.5	0.01	10	--	--	--	--	--
VC1A	1.1-1.6	0.3	0.5	0.1	0.5	4.1	1.6	0.5	0.1	6.1	0.71	10	--	--	--	--	--
VC1B	0-0.6	0.3	0.5	0.4	0.5	3.2	1.2	0.5	1.1	4.7	0.01	110	115	<5.0	<0.5	<0.2	24
VC1B	0.6-1.2	0.3	0.5	0.1	0.5	2.4	1.0	0.5	0.1	2.5	0.01	45	--	--	--	--	--
VC1B	1.2-1.7	0.3	1.7	0.1	1.1	3.7	0.5	0.5	0.1	3.0	0.01	10	--	--	--	--	--
SS1	A	0.3	0.5	0.1	0.5	1.6	1.5	0.5	0.1	2.0	0.01	225	30	--	--	--	--
SS1	B	0.3	0.5	0.1	0.5	2.0	2.2	0.5	0.1	8.0	0.01	1870	34	--	--	--	--
SS1	C	0.3	0.5	0.1	1.2	3.9	1.1	0.5	0.1	2.3	0.01	10	32	--	--	--	--
SS1	D	0.3	0.5	0.1	1.2	3.4	1.0	0.5	0.1	2.1	0.01	395	9	--	--	--	--
	mean	0.3	0.6	0.1	0.8	3.0	1.3	0.5	0.2	4.9	0.08	364	53.74	<5.0	<0.5	<0.2	na
	SD	0.0	0.4	0.1	0.4	0.8	0.7	0.0	0.3	4.5	0.22	605	56.12	0	0	0	na
	95% UCL	na	0.8	0.1	1.1	3.5	1.7	0.5	0.3	7.6	0.20	663	88.59	na	na	na	na
AREA 2 - SUB BERTH																	
VC2A	0-0.3	0.3	1.2	0.1	3.4	3.2	3.1	0.5	0.1	6.9	0.03	25	27	<5.0	<0.5	<0.2	<3
VC2A	0.3-0.6	0.3	0.5	0.1	3.1	2.3	4.2	0.5	0.1	11.0	0.04	25	--	--	--	--	--
VC2A	0.6-1.2	0.3	3.2	0.1	24.4	4.6	10.7	2.3	0.1	49.8	0.55	754	--	--	--	--	--
VC2A	1.2-1.6	0.3	15.0	0.1	14.5	0.5	1.4	2.4	0.1	3.3	0.01	2	--	--	--	--	--
VC2A	1.6-2.6	0.3	0.5	0.1	0.5	0.5	0.5	0.5	0.1	1.4	0.01	10	--	--	--	--	--
VC2B	0-0.5	0.3	0.5	0.1	3.6	3.6	3.9	0.5	0.1	20.7	0.03	45	17	<5.0	<0.5	<0.2	4
VC2B	0.5-0.9	0.3	0.5	0.1	2.6	0.5	1.4	0.5	0.1	3.5	0.02	372	--	--	--	--	--
VC2B	0.9-1.5	0.3	0.5	0.1	2.5	0.5	1.2	0.5	0.1	2.6	0.02	10	--	--	--	--	--
VC2B	1.5-2.2	0.3	0.5	0.1	1.0	0.5	0.5	0.5	0.1	1.7	0.01	30	--	--	--	--	--
SS2	A	0.3	0.5	0.1	1.6	0.5	1.8	0.5	0.1	4.8	0.01	10	3	--	--	--	--
SS2	B	0.3	7.5	0.1	10.8	5.7	9.5	3.2	0.1	21.3	0.08	3167	10	--	--	--	--
SS2	C	0.3	0.5	0.1	1.6	1.2	2.2	0.5	0.1	5.0	0.01	80	234	--	--	--	--
SS2	D	0.3	0.5	0.1	1.8	1.9	2.0	0.5	0.1	6.8	0.01	16	259	--	--	--	--
	mean	0.3	2.4	0.1	5.5	2.0	3.3	1.0	0.1	10.7	0.06	350	91.30	<5.0	<0.5	<0.2	na
	SD	0.0	4.3	0.0	7.0	1.8	3.3	1.0	0.0	13.5	0.15	874	120.61	0	0	0	na
	95% UCL	na	4.5	0.1	8.6	2.7	4.7	1.4	0.1	16.6	0.13	739	165.40	na	na	na	na
AREA 3 - FIXED BERTHS																	
VC3A	0-0.6	0.3	2.0	0.1	5.0	3.1	9.0	1.3	0.1	18.4	0.06	275	7	<5.0	<0.5	<0.2	28
VC3A	0.6-1.3	0.3	2.3	0.1	2.8	1.9	3.4	0.5	0.1	5.8	0.03	45	--	--	--	--	--
VC3A	1.3-1.9	0.3	0.5	0.1	3.0	2.6	9.0	0.5	0.1	30.1	0.04	60	--	--	--	--	--
VC3A	1.9-2.4	0.3	10.1	0.1	2.3	0.5	1.4	0.5	0.1	2.3	0.01	10	--	--	--	--	--
VC3B	0-0.5	0.3	0.5	0.1	2.2	1.3	2.4	0.5	0.1	6.3	0.02	5	4	<5.0	<0.5	<0.2	3
VC3B	0.5-0.9	0.3	0.5	0.1	2.9	2.0	3.4	0.5	0.1	9.0	0.02	23	--	--	--	--	--
SS3	A	0.6	1.7	0.2	7.1	33.2	60.2	2.0	0.1	460.0	0.01	10	3	--	--	--	--
SS3	B	0.3	8.9	0.2	22.8	21.7	25.5	5.7	0.2	95.9	0.2	150	46	--	--	--	--
SS3	C	0.3	5.9	0.1	19.1	15.2	19.9	4.6	0.1	64.2	0.15	1062	0	--	--	--	--
SS3	D	0.3	1.5	0.1	5.3	5.1	4.5	1.0	0.1	19.1	0.03	16	1	--	--	--	--
	mean	0.3	3.4	0.1	7.3	8.7	13.9	1.7	0.1	71.1	0.06	166	10.07	<5.0	<0.5	<0.2	na
	SD	0.1	3.6	0.1	7.4	11.1	18.1	1.9	0.0	139.9	0.07	326	17.67	0	0	0	na
	95% UCL	0.3	5.2	0.1	10.9	14.1	22.8	2.6	0.1	140.5	0.09	328	21.10	na	na	na	na

Notes:

Where results are below LOR, half the LOR has been used in the statistical analyses

na - not applicable to calculate 95%UCL as results below LOR or dataset too small



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- the maintenance dredge material is a grey/brown sand;
- the 95% UCL of the mean concentrations of heavy metals, PAHs and TPHs were below NAGD screening levels;
- BTEX, PCBs and OC pesticide were below laboratory detection (and below NAGD screening levels); and
- the 95% UCL of the mean TBT concentration was above the NAGD screening level.

The statistical analysis was also undertaken for the results from each dredge area. However, similar concentrations of each contaminant were observed for each dredge area. It was considered that the maintenance dredge areas could be considered as one site since the material from each of the three areas had similar concentrations of contaminants.

Due to the elevated concentrations of TBT, in order to further assess the suitability of the maintenance dredge material for sea disposal (within Botany Bay or at sea), elutriate TBT testing of three representative samples was undertaken. The samples selected for elutriate testing included the sample with the highest observed concentration of TBT and samples with TBT concentrations as close as possible to the 95% UCL of the mean TBT concentration (refer **Table 3**).

Table 3 Results of TBT elutriate testing

Sample	Sediment (µg/kg)	Elutriate (ng/L)
	SL = 9	ANZECC = 6
VC1B 0-0.6 (Area 1)	115	70
SS2D (Area 2)	259	8
SS3B (Area 3)	46	<2

The elutriate TBT concentrations for two out of the three selected samples were above the ANZECC water quality guideline for 95% species protection indicating that TBT in the sediments may be bioavailable. TBT may therefore be at concentrations that could cause toxicity.

2.3 Contaminants of Concern for the Further Testing

Based on the results of the November 2009 investigations, TBT has been identified as the contaminant of concern in the areas previously investigated. Advice has been sought from Dr Stuart Simpson of CSIRO regarding appropriate further testing to determine if the maintenance dredge material is suitable for placement within Botany Bay or offshore. In addition, as testing of TBT in the November 2009 investigation was limited to surface samples, testing for TBT with depth will be undertaken to assess any variation with depth.

Section 4 of this SAP sets out in detail the proposed further TBT testing.

As noted in **Section 1**, Caltex has had further discussions with the Sydney Ports Corporation (SPC) Pilots resulting in a broadening of the proposed dredge area. Sampling within the wider dredge area



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is required to fully characterise the chemical properties of the maintenance dredge material. As was undertaken for the November 2009 investigations, samples from all locations within the additional dredge area will be tested for heavy metals, PAHs, TBT and TOC.

In addition, 20% of the samples within the additional dredge area will be tested for the following contaminants to confirm that they are not a concern:

- organochlorine (OC) pesticides;
- polychlorinated biphenyl (PCBs);
- BTEX; and
- TPHs.



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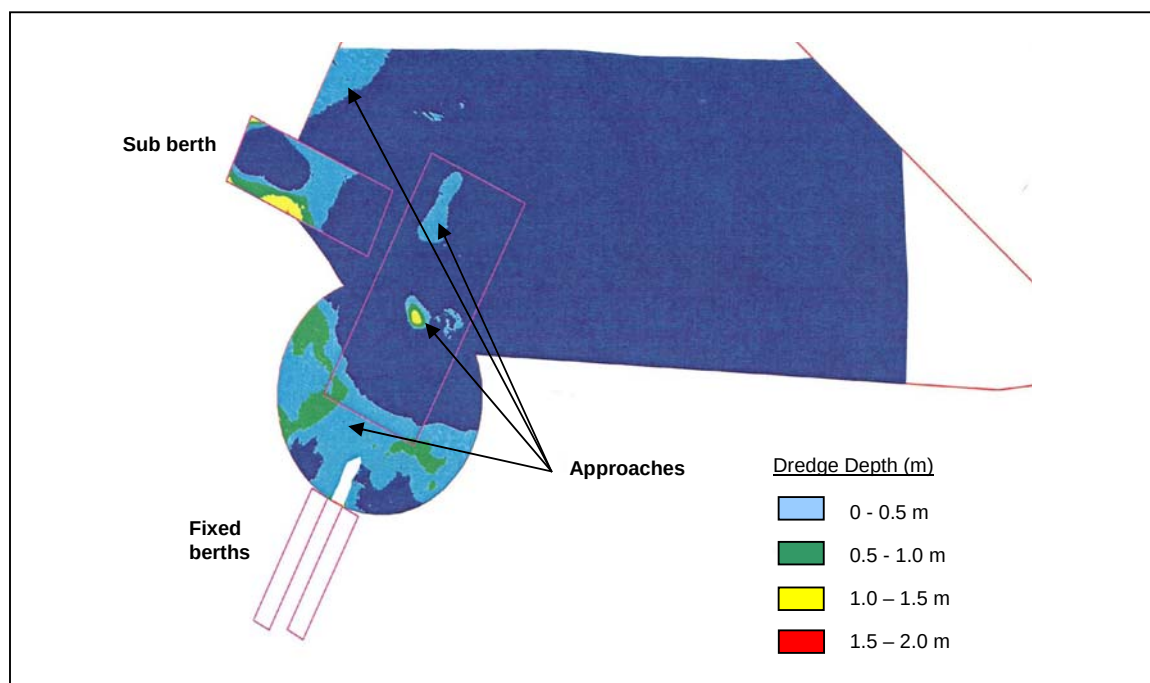
3 DESCRIPTION OF DREDGING PROPOSAL

As described in **Section 2.1**, the material to be dredged as part of the maintenance dredging activities is from the sub-berth, approaches to the sub berth and two fixed berths. Maintenance dredging involves the removal of material from these areas to the following depths:

- approaches to the sub berth -12.8 m CD;
- sub berth -14.0 m CD; and
- fixed berths 1 & 2 -11.6 and 11.4 m CD.

Analysis of the most recent available hydrographic survey (SPC, 2007) was undertaken to identify the required areas, thickness and volume of maintenance dredging. **Figure 4** shows the results of the hydrographic survey analysis showing the depth of required maintenance dredging and clearly highlighting the areas of greatest sediment accumulation. The total volume of proposed maintenance dredge material is 33,800 m³. Please note, negligible (<100 m³) of sediment needs to be removed from the fixed berths.

Figure 4 Areas and depths of maintenance dredging





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4 PROPOSED SEDIMENT SAMPLING AND ANALYSIS

4.1 Objective

The sampling and testing is to be undertaken to determine the suitability of maintenance dredge material with elevated concentrations of TBT from the Caltex Berths and Approaches for sea disposal (either within Botany Bay or offshore). The sampling program is to include an assessment of TBT contamination with depth and has also been designed to provide sediment quality data for the recent increase to the proposed dredge footprint. The investigations are required to provide sufficient information to obtain any subsequent approvals for the maintenance dredging from the relevant government agencies.

4.2 Sample Locations

Samples will be collected from 14 locations within the revised dredge footprint as determined from the hydrographic survey (SPC, 2007). Samples will comprise ten surface cores and four vibrocores. A judgmental sampling pattern has been used to locate samples in areas:

- with the greatest sediment accretion within the proposed dredge footprint;
- which had high TBT concentrations observed in the November 2009 investigation; and
- not covered in the November 2009 preliminary investigation.

Vibrocore sample locations have been chosen to target areas with sediment accumulation more than 1 m above the design dredge levels. The proposed sampling locations are shown in **Figure 5**. The coordinates for each proposed sampling location are included in **Appendix 1**.

An onboard GPS will be used to position the sampling vessel at the nominated sampling locations. The GPS has an accuracy of $\pm 0.1\text{m}$. However, following maneuvering of the vessel into position and recovery of the sample from the sea bed, the positioning of vibrocores is likely to have an accuracy of $\pm 5\text{m}$.

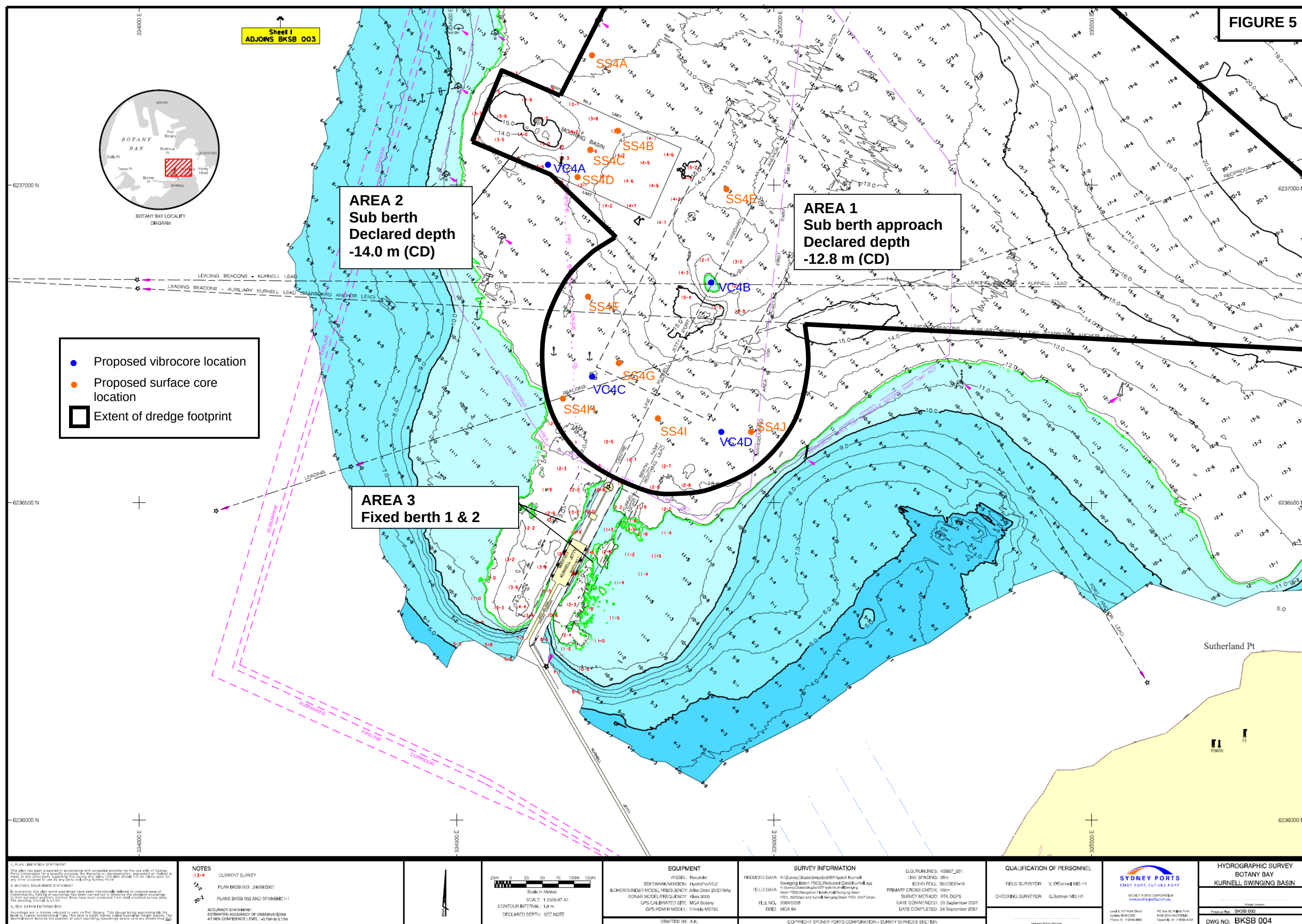
4.3 Sample Collection

Collection of the sediment samples will be undertaken by MDS.

Prior to sampling, the crane barge vessel proposed for use will be thoroughly inspected and washed down. Any evident sources of contamination will be cleaned and covered in plastic to avoid accidental contamination of any samples.

Surface cores to a depth of 0.5m will be recovered by divers. Diver assisted vibrocoreing will be taken using a Rossfelder P3 Vibrocore with 100mm aluminium core tubes. If necessary, core catchers will be used to retain sediment within each core. Vibrocores will be driven to a depth of 2m or refusal. To

FIGURE 5





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recover sufficient volume of sediment for the analyses proposed, it will be necessary to take two vibrocores at each of the proposed vibrocoring locations and two surface cores at the split triplicate location. Sampling dates, time, water depth and depth of core penetration will be recorded. Vibrocores and surface cores will be capped and transported onshore for subsampling.

All surfaces used for sample handling will be covered in plastic sheeting prior to subsampling. Subsampling will be undertaken using nitrile gloves and decontaminated stainless steel equipment.

Cores will be split longitudinally, logged, photographed and subsampled for each half metre depth increment. The following volumes will be retained from each subsample for the different analyses potentially required:

- 150ml for chemical analysis (i.e. TBT and TOC);
- 500ml (i.e. 2 x 250ml) for elutriate TBT analysis;
- 1L sample for sediment toxicity testing; and
- 2L sample for elutriate toxicity testing.

For 20% of the samples from the additional area of the dredge footprint (i.e. three samples), the above volumes will be collected along with an additional 250ml for chemical analysis including heavy metals, PAHs, OC Pesticides, PCB's, BTEX and TPH's.

Samples for chemical analysis and elutriate TBT testing will be homogenised¹ and transferred to glass jars with Teflon lined lids. Bulk samples for toxicity testing will be transferred to plastic zip-lock bags and double-bagged to minimise the chance of oxidation. Each jar/bag will be filled with zero headspace and tightly sealed to avoid loss of sample. Each container will be labelled with a unique identification number and each sample will be recorded on a log sheet.

Sediment will typically adhere to the outside of the sample containers. To avoid cross contamination, after each container is sealed, the outside of each sample container will be washed with seawater.

Two x 20L of seawater from the site will also be collected in plastic drums for elutriate testing.

Standard Operating Procedures (SOP) for the coring, surface sampling and sub sampling are included in **Appendix 2**.

4.4 Estimated Number of Samples

The number of sampling locations for the analyses proposed is based on the recommended number in the NAGD for a dredge volume of <50,000m³ and also based on the requirement to recover samples with representative concentrations of TBT for the proposed elutriate and toxicity testing (refer

¹ All samples for chemical testing and elutriate TBT testing will be homogenised in the field with the exception of the three samples from the additional dredge areas. These samples are to be tested for volatiles. The COC will be marked up to request that the lab homogenize subsamples for non-volatiles on these samples.



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Table 4). Recovery and testing of samples from more locations than recommended in the NAGD is proposed to ensure samples with TBT concentrations representative of the dredge material are recovered and can be used for elutriate and toxicity testing.

Table 4 Proposed Number of Sample Locations for the Dredge Footprint

Volume (m ³)	Number of Sample Locations			Table 7 of the NAGD
	Nov 2009 Investigation	Proposed this SAP	Total	
33,800	18	14	32	10

One subsample will be collected from each of the ten surface cores. Approximately four subsamples will be collected from each of the four vibrocores, i.e. one sample every 0.5m from 2m vibrocores. An estimated 26 subsamples will be collected in total.

In addition, a field triplicate (that is, three samples taken at the same location) will be collected. The triplicate samples will be used to give an indication of the variability in the chemical properties of the sediment at a sample location. As part of QA/QC procedures, it is proposed to submit one split triplicate (i.e. a single homogenised sample split into three containers with the third sample being sent to a second laboratory to assess variation associated with subsample handling) and one field blank.

It is therefore proposed to submit 31 samples comprising subsamples and field QA/QC samples for geochemical analyses as shown in **Table 5**.

Table 5 Proposed Number of Sub-samples

Sample type	Number of Subsamples
Surface cores	10
Vibrocores	16
Triplicate	2 additional samples
Split Triplicate	2 additional samples
Blank	1
Total	31

4.5 Sample Preservation

Samples will be packed in ice in an esky immediately after sampling to maintain the temperature below 4°C. Samples will then be submitted to the analytical laboratory on the same day or the



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following morning. Should overnight storage be required samples for chemical and elutriate analysis will be placed in a freezer. Samples for toxicity testing will not be frozen but will be kept cool (i.e. 4°C) and in the dark.

Samples submitted to laboratories for toxicity testing will be stored under nitrogen prior to commencement of testing.

4.6 Equipment Decontamination Procedure

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

4.7 Sample Shipment

All sample containers will be clearly labelled with unique sample identification numbers. Samples will be transported in an esky in ice to the relevant analytical laboratory nominated for each analyses required. WorleyParsons will coordinate the analysis of the samples.

All samples will be transported under WorleyParsons chain of custody procedures.

4.8 Analysis Schedule

4.8.1 Chemical Analysis

The primary laboratory selected to undertake the chemical testing is the NATA registered ALS Laboratory Group. The third spilt triplicate sample will be submitted to a secondary laboratory, NATA registered Advanced Analytical Australia laboratory group.

Chemical testing will comprise testing for TBT and TOC in all samples. All samples from each vibrocore will be tested for TBT i.e. any variation in TBT contamination with depth will be assessed. A fast turn-around time for the sediment TBT analysis has been negotiated with ALS Laboratory to ensure that subsequent elutriate TBT testing can be commenced within recommended holding times.

Samples located in those areas of the dredge footprint added subsequent to the November 2009 preliminary investigation will also be tested for a suite of heavy metals and PAHs. Twenty percent of all samples collected from the additional dredge area will be tested for the following contaminants to confirm that they are not a concern:

- organochlorine (OC) pesticides;
- polychlorinated biphenyl (PCBs);
- BTEX; and
- TPHs.

The contaminants and the detection limit of the proposed analytical methods are listed in **Table 6**.



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Table 6 Proposed Chemical Analysis of Sediment Samples

Test Parameter	PQL	units	Lab Method	Screening Level
Silver (Ag)	0.1	mg/kg	USEPA 6020	1
Cadmium (Cd)	0.1	mg/kg	USEPA 6020	1.5
Selenium (Se)	0.1	mg/kg	USEPA 6020	--
Cobalt (Co)	0.5	mg/kg	USEPA 6020	--
Antimony (Sb)	0.5	mg/kg	USEPA 6020	2
Copper (Cu)	1	mg/kg	USEPA 6020	65
Lead (Pb)	1	mg/kg	USEPA 6020	50
Zinc (Zn)	1	mg/kg	USEPA 6020	200
Chromium (Cr)	1	mg/kg	USEPA 6020	80
Nickel (Ni)	1	mg/kg	USEPA 6020	21
Arsenic (As)	1	mg/kg	USEPA 6020	20
Vanadium (V)	2	mg/kg	USEPA 6020	--
Manganese (Mn)	10	mg/kg	USEPA 6020	--
Mercury (Hg)	0.01	mg/kg	APHA 3112 Hg-B	0.15
PAHs (each individual species)	4-5 ¹	µg/kg	USEPA 3640/8270	10,000
TPH (C6-C9) / BTEX	0.2	mg/kg	USEPA 5030/8260	550
TPH (C10-C36)	3-5	mg/kg	USEPA 3510/8015	550
Total PCBs	5 ¹	µg/kg	USEPA 3640/3620 USEPA 8081/8082	23
OC pesticides (each individual species)	0.5 ¹	µg/kg	USEPA 3640/3620 USEPA 8081/8082	Various 0.32-280
TBT	0.5	µg/kg	In-House GC/MS	9
TOC	0.02%		In house/Leco	--

Notes

1. The laboratory will strive to reach this PQL but previous sampling and testing indicates that matrix interference may prevent the laboratory reaching this very low detection limit.

The results of the chemical analysis will be pooled with data obtained from the November 2009 preliminary investigation. The 95% UCL of the mean concentration of each contaminant will be calculated and compared to the NAGD screening levels.

4.8.2 Further Elutriate and Toxicity Testing

Following the elevated elutriate TBT results identified in the November 2009 preliminary investigation, advice was sought from Dr Stuart Simpson of CSIRO on the most appropriate method of testing for bioavailability and toxicity of TBT. Dr Simpson is an expert in aquatic geochemistry and sediment toxicology and was a key technical expert in the development of the NAGD. The proposed testing detailed below is based on the recommended design provided by Dr Simpson. A complete copy of his recommendation is included in **Appendix 3**.



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ELUTRIATE TESTING

As indicated in **Section 2.2.2**, elutriate testing was carried out on three samples collected during the November 2009 preliminary investigation, two of which had elutriate TBT concentrations exceeding the ANZECC/ARMCANZ 2000 water quality guidelines. In order to obtain a sufficient dataset to carry out dilution calculations and hence determine if dissolved TBT concentrations in the water column during disposal are bioavailable, elutriate testing is required on additional samples which have a total TBT concentration above the NAGD maximum level (i.e. the ANZECC/ARMCANZ Interim Sediment Quality Guidelines High –value (ISQG High)) of 70 µgSn/kg.

Eight samples will be selected for elutriate TBT testing. Samples selected will have TBT concentrations (normalised to 1% TOC) above the ISQG-High value and preferably representative of, or higher than, the 95% UCL of the mean total TBT concentration. In addition, one replicate and one sea water sample from the site will be submitted for QA/QC purposes. The sample selection process will be fully documented.

The results of the recent sampling investigation indicated that the sediments comprise typically greater than 90% sand. Extraction of pore-water from sandy sediments is not practical and would likely result in an underestimation of the porewater TBT concentrations. As such, porewater testing to determine the in-situ bioavailability of TBT following disposal is not viable. Toxicity testing is therefore required to determine the in-situ effects of TBT contamination at the spoil ground as is discussed in detail below.

The impact of dissolved TBT in the water column at the disposal site will be calculated from the elutriate TBT results based on advice provided by sediment ecotoxicology expert, Dr Stuart Simpson of CSIRO as follows:

1. Calculate the 95% UCL of the mean elutriate TBT results for 11 samples (including the results from the November 2009 preliminary investigation)
2. Multiply the 95% UCL of the mean elutriate TBT by 10. This (arbitrary) factor takes into account the poor accuracy in detecting dissolved TBT⁽²⁾ and the likely underestimation in calculating porewater concentrations from elutriate results⁽³⁾;
3. Calculate the expected dilutions at the disposal site⁽⁴⁾;
4. Calculate the expected dissolved TBT in waters at the disposal site:

² The ‘accuracy’ of dissolved TBT analyses is expected to be 50%, at best and rates of adsorptive losses to collection containers can be significant (Simpson, pers. comm., 2009).

³ For sandy sediments, extraction of porewater is not practical and is considered unnecessary. Elutriate tests are likely to underestimate the concentration in the sediment pore water (Simpson, pers. comm., 2009).

⁴ It is proposed to use the STFATE numerical method as recommended in the NAGD (Commonwealth of Australia, 2009).



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5. Compare the expected dissolved TBT with the ANZECC/ARMCANZ 2000 water quality guideline value to determine if there is potential for TBT to be bioavailable in the water column at the disposal site.

TOXICITY TESTING

Advice on the relevant toxicity tests required to assess the TBT contamination of the dredge material was provided by Dr Stuart Simpson of CSIRO.

Whole Sediment Toxicity Testing

Whole-sediment toxicity testing will be undertaken to determine if there is potential for in-situ toxicity to benthic organisms post-disposal of the dredged material.

Whole-sediment toxicity testing will be undertaken on three samples⁵ with total TBT concentrations above the ISQG-High value of 70 µgSn/kg and preferably above the 95% UCL of the mean TBT concentration. One 'blind control' sediment sample, collected from a nearby location and with a TBT concentration below the ISQG-High value will also be submitted. Additional in-house laboratory controls will also be undertaken.

The whole sediment toxicity testing proposed will test for chronic effects (reproduction) to the epibenthic amphipod, *Melita plumulosa*⁶. The testing will be undertaken by Dr Simpson of CSIRO.

Toxicity Testing of Elutriates (If Required)

Toxicity testing of elutriates will only be required if the expected dissolved TBT concentration at the spoil ground exceeds the ANZECC/ARMCANZ guideline value.

If required, elutriate toxicity testing would be undertaken by the NATA accredited laboratory, Ecotox Services Australasia (ESA).

Toxicity testing of elutriate waters would be undertaken on three samples⁷ with total TBT concentrations above the ISQG-High value of 70 µgSn/kg and preferably above the 95% UCL of the mean TBT concentration. One 'blind control' sediment sample, collected from a nearby location and with a TBT concentration below the ISQG-High value would also be submitted.

⁵ A minimum of three samples is required for dredging volumes up to 50,000m³ as indicated in Table 7 of the NAGD (Commonwealth of Australia, 2009).

⁶ *M. plumulosa* may not inhabit ocean disposal sites, however the species is native to NSW waters, is exposed to contaminants via both dissolved and dietary exposure routes, and is relatively sensitive to contaminants in comparison to other native species. Toxicity tests using *M. plumulosa* are more robust than tests using other species present in NSW sediments such as the harpacticoid copepod, *Nitocra spinipes* (Simpson, pers.comm., 2009).

⁷ A minimum of three samples is required for dredging volumes up to 50,000m³ as indicated in Table 7 of the NAGD (Commonwealth of Australia, 2009).



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Testing would comprise a 48 hour oyster larval development test to determine the presence or absence of toxicity⁸. Testing would involve the preparation of 1:4 elutriate followed by the immediate commencement of toxicity testing. All elutriate toxicity testing would be undertaken in polycarbonate containers to minimise adsorption of TBT to the container walls.

4.8.3 Data Management Procedure

Statistical analysis and tabulation of data will be undertaken following data validation. Data management of the analysis results will be in accordance with the requirements of NAGD. Validation of data will include evaluating the results from laboratory blanks, standard samples, field triplicate samples and split triplicate samples.

4.9 Equipment and Personnel

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

- The crane barge "The Alkira" with onboard GPS (provided by MDS)
- Rossfelder P3 vibrocorer (provided by MDS)
- Commercial dive team (provided by MDS)
- 9m aluminium vibrocore pipes and 0.5m push-core tubes
- core catchers and core caps
- stainless steel bowl and spoons
- nitrile gloves and PPE
- Decon90
- sample containers and zip-lock bags
- eskies and ice
- data forms for recording field measurements and logging samples.

An experienced environmental scientist/environmental engineer from WorleyParsons will coordinate the sampling program. MDS personnel will operate the crane/barge and vibrocorer and undertake all diving operations.

⁸ The absence of toxicity would not ensure that other toxic effects from dissolved TBT (e.g. imposex in snails, and immune-suppression in bivalves) could not occur. There are no TBT sensitive tests using bivalves or snails however it is considered that the water quality guidelines would need to be exceeded continuously for such chronic effects to occur (Simpson, pers. comm., 2009).



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4.10 Health and Safety Precautions

The sampling program will adhere to HSE systems of WorleyParsons, Caltex and MDS.

4.11 Contingency Plan

The sampling program is unlikely to be affected by weather or equipment failure. Sampling may be delayed due to operational requirements of the Caltex berths. In the event of delay, the sampling would be recommenced following the provision of access to the berths and access channel, improvement in the weather or fixing of the equipment.



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5 QA/QC PROCEDURES

5.1 Field QA/QC Procedures

Field QA/QC procedures will include the following:

- Sample Location: "The Alkira's" onboard position fixing system will be used to locate the sampling locations.
- Decontamination of Sampling Equipment: Prior to use, the survey vessel will be thoroughly inspected and washed down. Any evident sources of contamination would be cleaned and covered in plastic to avoid accidental contamination of any samples. All surfaces used for sample handling will also be covered in plastic sheeting prior to subsampling. All sampling equipment that comes into contact with the sediment samples will be decontaminated (using Decon 90) prior to each sampling event.
- Field triplicates: Triplicate samples (comprising three samples taken from one location) will be analysed and used to give an indication of the variability in the chemical properties of the sediment at a sample location.
- Field Documentation: Each sample location will be numbered on a sampling plan in the field logbook. All other observations including weather, time, date of sampling, water depth, and depth of core penetration will be noted in the field logbook. Time, date, core compaction and appearance of the sediments, e.g. texture, colour, odour and the like will also be reported in the field logbook during sub-sampling.
- Cross Contamination: Following sampling, to avoid cross contamination, each sample jar will be washed with sea water to remove sediment adhering to the outside of the sample containers.
- Split triplicates: At one location, a split triplicate sample will be taken with two of the samples submitted to the primary laboratory and the third sample submitted to the secondary laboratory for geochemical analysis. The split triplicate results will be analysed to assess variability in sub-sampling.
- Sample Control: Each sample will have a unique identification number, which will be recorded in the field log book and chain of custody form. A chain of custody form will accompany the sediment samples at all times and will include the analysis method required of each laboratory.

5.2 Laboratory QA/QC Procedures

Laboratory QA/QC procedures for the geochemical and elutriate analyses will include the following:

- Analysis Blanks: One per analytical run or one in every 20 samples, whichever is the smaller.



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



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6 REPORTING

The main findings of the elutriate testing, dilution modelling and the toxicity testing will be documented in a factual report along with the results from the November 2009 preliminary investigation. The report will include:

- a description of the sampling program
- tabulation of all laboratory results and a copy of the original laboratory sheets
- results for organic analytes normalised to 1% total organic carbon
- statistical analysis of the results to calculate the mean, and standard deviation and the 95% upper confidence limit of the mean (95% UCL). The 95% UCL of the mean TBT concentration will be used for selection of samples for elutriate and toxicity testing. The 95%UCL of the mean elutriate TBT concentration will be used in the dilution calculations and determination of dissolved TBT concentrations at the spoil ground
- where values are less than the detection limit, a nominal value of one half of the detection limit will be used in the statistical analysis of the results
- reporting of all QA/QC.



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7 REFERENCES

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

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

GHD (2009) *Caltex Port Facilities, Botany Bay Geotechnical & Geochemical Investigations Desk Study*.



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Appendix 1 Coordinates of Proposed Sample Locations



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Site	Easting	Northing
VC4A	334653	6237038
VC4B	334913	6236845
VC4C	334715	6236704
VC4D	334903	6236607
SS4A	334719	6237227
SS4B	334767	6237070
SS4C	334721	6237060
SS4D	334681	6237016
SS4E	334961	6237004
SS4F	334706	6236820
SS4G	334751	6236724
SS4H	334643	6236668
SS4I	334805	6236632
SS4J	334956	6236600



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Appendix 2 Standard Operating Procedures for Sediment Sampling & Subsampling



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STANDARD OPERATING PROCEDURES FOR SEDIMENT SAMPLING & SUBSAMPLING

1. location of sampling to be confirmed by on-board GPS.
2. the coordinates of the sample location, date, time, weather conditions and water depth should be recorded in the field log book.
3. for coring:
 - a. core deployed and lowered to sea bed
 - b. depth of penetration of the core recorded
 - c. core recovered, capped, and placed on vessel deck
 - d. two cores taken from each location to obtain sufficient volume of sample.
4. for surface cores:
 - a. diver deployed to sea bed
 - b. 0.5m surface core collected and capped
 - c. three surface cores taken the field replicate location
5. steps 1 to 4 repeated at each core/surface core location.
6. surfaces to be covered in plastic sheeting prior to subsampling .
7. cores from each location split, logged and photographed.
8. core compaction calculation and each core subsampled.
9. for each surface 0.5m vibrocore depth increment, sediment from the two vibrocores homogenised into one sample.
10. for each surface core/0.5m vibrocore depth increment, collect:
 - a. one sub-sample for chemical analysis (1x150 ml glass jar)
 - b. one sub-sample for TBT elutriate analysis (2x250ml glass jars)
 - c. 1L sub-sample for sediment toxicity testing
 - d. 2L sub-sample for elutriate toxicity testing.
11. samples homogenised and transferred to the appropriate containers using stainless steel implements.
12. sample containers filled with zero headspace.



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13. each container tightly sealed to avoid loss of sample and labelled with a unique identification number.
14. outside of each sample container washed with sea water to avoid cross contamination.
15. samples to be packed in ice in an esky immediately after sampling to maintain the temperature below 4°C. If overnight storage is required, freeze samples for chemical and elutriate testing. Samples for whole sediment toxicity testing and elutriate toxicity testing to be cooled to 4°C and kept in the dark.
16. all sampling equipment should be decontaminated before the next sampling event by rinsing equipment in water to remove visible sediment, followed by a Decon 90 rinse.



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Appendix 3 CSIRO Recommendations for Elutriate and Toxicity Testing

Our Ref: TBT contamination in proposed maintenance dredging area of Botany Bay –
Caltex-WorleyParsons 221209.doc

Tuesday, 22 December 2009

Attention: Ali Watters and Orla Murray

Background

Caltex propose to undertake maintenance dredging in Botany Bay (Kurnell area) at three shipping berth locations: (i) berth approach, (ii) sub-berth and (iii) fixed berth. Samples collected by vibrocoring and surface sampling have been found to comprise 89-98% sand, generally <0.2% TOC and concentrations of all contaminants were below guidelines except for tributyltin (TBT). Elevated concentrations of TBT were observed for all three areas above the NAGD screening levels. In the three areas the 95% UCLs of the mean TBT concentrations normalised to 1% TOC were calculated to be: (i) Area 1 - 88 µgSn/kg, (ii) Area 2 - 165 µgSn/kg, and (iii) Area 3 - 21 µgSn/kg.

Three samples for which the ISQG-High value was exceeded were subjected to elutriate testing. The elutriate TBT concentrations for two out of the three selected samples were above the ANZECC water quality guideline indicating that TBT in the sediments is bioavailable. The maximum measured elutriate concentration was 70 ng TBT/L, compared to the WQG value of 6 ng/L.

Caltex would like to pursue further testing to determine if the dredge material can be shown to be suitable for ocean disposal or placement within Botany Bay. WorleyParsons have requested that CSIRO advise the types of further testing required.

Recommendations

Based on the information provided, the TBT concentrations are low, but exceed the NAGD / ANZECC Maximum ISQG-High values (TV) for whole-sediment and water (elutriates) – hence prompting further consideration. The major environmental concerns are:

For waters:

- Dissolved TBT released from the sediments during unconfined sea disposal could exceed water quality guidelines (WQG) and cause toxic effects to biota.

Notes:

- the 'accuracy' of dissolved TBT analyses is expected to be 50%, at best (the methods are not considered very robust) and rates of adsorptive losses to collection containers can be significant.
- elutriate tests are likely to underestimate the concentration in the sediment pore water (1:4, sediment:water).
- for sandy sediments, extraction of porewater is not practice and considered unnecessary, given the analytical uncertainties associated with TBT analyses.
- dissolved TBT concentrations from the elutriate tests show exceedances of the WQG-TBT of 6 ng/L.
- significant dilution is expected following disposal and the dissolved TBT and concentrations are very unlikely to remain above the WQG-TBT value for long.

- according to the NAGD, allowable dilution is that which occurs after four hours of mixing so dilution of 100-fold would be conservative, especially for offshore disposal sites on the NSW shelf. It would be surprising if dissolved TBT exceeded WQG four hours after disposal unless TBT elutriates are massively above ANZECC/ARMCANZ WQG. They are not.
- the WQG-TBT is a continuous chronic-effects guideline.

Advice for waters:

- Determine a 95% UCL for dissolved TBT in elutriates for samples that exceed the ISQG-High value (undertake additional sediment sampling and elutriate testing).
 - Multiple the 95% UCL for dissolved TBT in elutriates by 10 (arbitrary) to take into account possible differences to porewater TBT) (a conservative measure)
 - Calculate the expected dilutions based on knowledge of disposal site
 - Calculate the expected dissolved TBT in waters at the disposal site
- The cost of this exercise will be as determined by WorleyParsons.
- If the WQG for TBT is exceeded, then there will be a requirement for toxicity testing.
 - If necessary, confirm the absence of toxicity in elutriate waters prepared from sediments with TBT concentrations >ISQG-High (and preferably >95% UCL of 165 µg/kg 1%TOC)
 - The preferred test would be 48-h oyster larval development (performed by Ecotox services Australasia, ESA). Such tests should be conducted in polycarbonate containers to minimise adsorption of TBT to container walls. ESA laboratory will prepare 1:4 elutriate and commence toxicity test immediately following. Cost per test = \$1850/test. Would suggest testing three TBT-contaminated sediments and one 'blind control' sediment collected from a nearby location for which TBT < TV.

Uncertainty / risks:

- The absence of toxicity would not ensure that other toxic effects from dissolved TBT (e.g. imposex in snails and immuno-suppression in bivalves) could not occur. However, we would expect that the WQG would need to be exceeded continuously for such chronic effects to occur.

For whole sediments:

- At the disposal site, TBT concentrations of deposited sediments may retain, or develop, porewater TBT concentrations that exceed the WQG-TBT and potentially cause toxic effects to benthic invertebrates. There is a need to assess potential effects in these whole sediments, to simulate the post-settlement condition.

Notes:

- the most notable effect of TBT to benthic biota is imposex in snails and immuno-suppression in bivalves. Beyond measuring porewater TBT concentrations (which itself is very challenging), there are no reliable 'laboratory-based' tests for these effects.
- literature indicates that the lowest dissolved TBT concentration that is likely to cause lethality to benthic invertebrates are >100 ng/L (e.g. for the harpacticoid copepod, *T. japonicus*, acute lethality from TBT occurs with LC50 and LC20 values of 0.15 and ~0.05 µg TBT/L). No data exist for tests using Australian species.

Advice for sediments:

- Confirm the absence of toxicity to benthic invertebrates using chronic whole-sediment toxicity tests.
- given uncertainties in testing/unavailability of pore water, and that the ISQG-High (Maximum Level) are being exceeded, this is considered a necessary precaution.
- we recommend that chronic effects (reproduction) to the epibenthic amphipod, *Melita plumulosa* (native to NSW) be assessed. While this species may not inhabit ocean disposal sites, it is relatively sensitive to contaminants and exposed to contaminants via both dissolved and dietary exposure routes. *M. plumulosa* is therefore a useful surrogate for possible toxic effects to other species. Worth noting is that acute lethality from copper to *T. japonicus* occurs at an 96-h LC50 of 1020 µg/L, for *M. plumulosa* the 96-h LC50 is 120 µg/L, i.e. *M. plumulosa* may be more sensitive to contaminants (and TBT) than *T. japonicus*.
- We suggest initially testing three TBT-contaminated sediments that exceed the ISQG-High (Maximum Level) and one 'blind control' sediment collected from a nearby location for which TBT < TV. Additional in-house controls will be undertaken.

- Estimated cost = Full cost for sediment toxicity testing =

Project management and reporting costs

- A report will be prepared that will discuss the results in terms of NAGD / ANZECC and likelihood for ecological effects from maintenance dredging in Botany Bay and unconfined sea disposal of the sediments

- Cost =

- Total estimated total cost of CSIRO components =

Additional notes:

* Assumes dredging will occur as three zones, but the likelihood of effects from TBT will be assessed more broadly

* Information on sediment heterogeneity and depth profiles not available

* The SQGs for TBT were derived from the WQG based on effects on gastropods (imposex) as a sensitive endpoint using equilibrium partitioning. If pore water concentrations exceed the WQG then there are potential ecological effects. Therefore toxicity testing on organisms of unknown sensitivity to TBT may be a little arbitrary. If the WQG values are exceeded there is a potential problem, taking into account uncertainties in TBT analysis, potential losses and the fact that elutriate tests are conservative. To take a counter argument you could reason that the half life of TBT in sediments is about 3 years, although in paint flakes this could be longer. Also probably need to know something about the depth profile in the sediments and sample heterogeneity.

* It may also be argued, that given that the disposal site is dispersive that fine sediments may not be there or would be significantly diluted over a period of years.

* No TBT-sensitive tests using bivalves or snails. Methods are not available for testing for imposex other than via benthic surveys which we don't believe are appropriate. It may be possible to demonstrate that bivalves or snails do not accumulate TBT during 1-2 month exposures. However, it would not be possible to link this information to development of immuno-suppression or imposex.

* another potential chronic whole-sediment toxicity test species is the harpacticoid copepod, *Nitocra spinipes*, which is also present in NSW sediments. Chronic tests are also available using this species, although the methods are currently less robust than the chronic *M. plumulosa* tests.

Regards,



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CALTEX KURNELL PORT AND BERTHING PROJECT, BOTANY BAY, NSW

SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

Appendix 2 Supplementary SAP (November 2011)



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Caltex Dredging

Supplementary Sampling and Analysis Plan

301015-02448 – rp301015-02448oam110913_Supplementary SAP_Rev0.doc

19 Sep 2011

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Confidentiality

This document has been prepared for the sole purpose of documenting our Supplementary Sampling and Analysis Plan.

It is expected that this document and its contents will be treated in strict confidence by Caltex Refineries NSW Pty Ltd.

PROJECT 301015-02448 - CALTEX DREDGING

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	<u> </u> OAM	<u> </u> AW	<u> </u> N/A	13-09-11	<u> </u> N/A	
0	Issued for SEWPaC review	<u> </u> OAM	<u> </u> AW	<u> </u> AW	19-09-11	<u> </u> N/A	
		<u> </u>	<u> </u>	<u> </u>		<u> </u>	
		<u> </u>	<u> </u>	<u> </u>		<u> </u>	



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ACRONYMS and ABBREVIATIONS

AAA	Advanced Analytical Australia
ANZECC/ARMCANZ	Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CD	Chart Datum
CSIRO	Australian Commonwealth Scientific and Research Organization
DEWHA	Department of Environment, Water, Heritage and the Arts
EILs	Ecological Investigation Levels
EPA	Environment Protection Authority
HILs	Health based Investigation Levels
ISQC	Interim Sediment Quality Guidelines
LOR	Limit of Reporting
NAGD	National Assessment Guidelines for Dredging
NATA	National Association of Testing Authorities
NEHF	National Environmental Health Forum
NEPM	National Environmental Protection Measure
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls



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QA/QC	Quality Assurance/ Quality Control
SAP	Sampling and Analysis Plan
SEWPaC	Department of Sustainability, Environment, Water, Populations and Communities
SOP	Standard Operating Procedures
TBT	Tributyltin
TOC	Total organic carbon
TPHs	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
WGS	World Geodetic System



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1 INTRODUCTION

Caltex Refineries (NSW) Pty Ltd (Caltex) is responsible for the maintenance of their port facilities in Botany Bay in association with their refinery at Kurnell.

Caltex has formerly proposed to undertake maintenance dredging of the berths and approaches to remove sediment that has accumulated since the last maintenance dredging campaign undertaken in the 1969. Two recent sediment investigations were undertaken by WorleyParsons in November 2009 and March 2010 in association with the formerly proposed maintenance dredging to determine the suitability of the material for unconfined sea disposal. The testing was undertaken in accordance with the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009) and indicated that the materials were considered to be suitable for ocean disposal at the designated Sydney Offshore Spoil Ground.

Since the completion of the previous investigations, Caltex has modified the project proposal to include capital dredging of the No. 1 and No. 2 Fixed Berths adjacent to the Caltex jetty. In addition, recent hydrographic survey indicates that sediment has accumulated in the approaches and swing circle.

During preparation of this document, it was also identified that a discharge of oily water occurred in Botany Bay from the Caltex Refinery in March 2011 which may have impacted on the proposed dredge footprint.

As such, additional sampling and testing is required to

- meet the required number of samples specified in the NAGD for the change in dredge volume since the previous sampling and testing;
- provide a better spatial and vertical coverage of the proposed dredge areas; and
- identify whether any hydrocarbon contamination is present in the surface sediments of the proposed dredge area following the oily water discharge from the Caltex Refinery.

This report outlines the proposed Supplementary Sampling and Analysis Plan (SAP) and should be considered in conjunction with the most recent SAP prepared for the March 2010 sediment investigation (refer **Appendix 1**) and the Implementation Report prepared for that investigation (refer **Appendix 2**).

The Supplementary SAP has been prepared in accordance with recommendations outlined in the National Assessment Guidelines for Dredging (DEWHA, 2009) and includes the following elements:

- evaluation of the site history and available data
- objectives of the SAP
- map showing the proposed sampling locations



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- estimates of the number of samples including replicates and triplicates
- methods and procedures for sampling
- details of methods for sample handling, preservation, storage and quality control and quality assurance (QC/QA)
- list of analyses required, detection limits and laboratory QC/QA procedures.



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2 COMPILATION & REVIEW OF EXISTING DATA

2.1 Site Location

The Caltex refinery is located at Kurnell on the southern shore of Botany Bay, just south of the Sydney CBD (refer **Figure 1**).

The Caltex jetty extends approximately 800m into Botany Bay to the west of Sutherland Point, terminating in a wharf approximately 300m long. Fixed Berths No. 1 and No. 2 are located either side of the wharf, beyond which lies the approaches (including a swing circle) and the Sub-berth as shown on **Figure 2**.

2.2 Existing Sediment Data

Recent sediment investigations have been undertaken which are relevant to the proposed dredge areas including:

- sediment investigations by GHD in 2007 and 2008 at locations in the vicinity of the proposed dredging areas (0.5 to 1 km from the dredge areas);
- sediment quality investigation by WorleyParsons in November 2009 within the proposed dredge areas; and
- sediment quality investigation by WorleyParsons in March 2010 within the proposed dredge areas.

Preliminary sediment investigations undertaken by WorleyParsons in November 2009 indicated that there were elevated concentrations of tributyltin (TBT) in the sediment. In addition, subsequent discussions with the SPC pilots and review of the SPC (2009) hydrographic survey determined that the required dredge footprint was larger than the footprint investigated in the preliminary investigation.

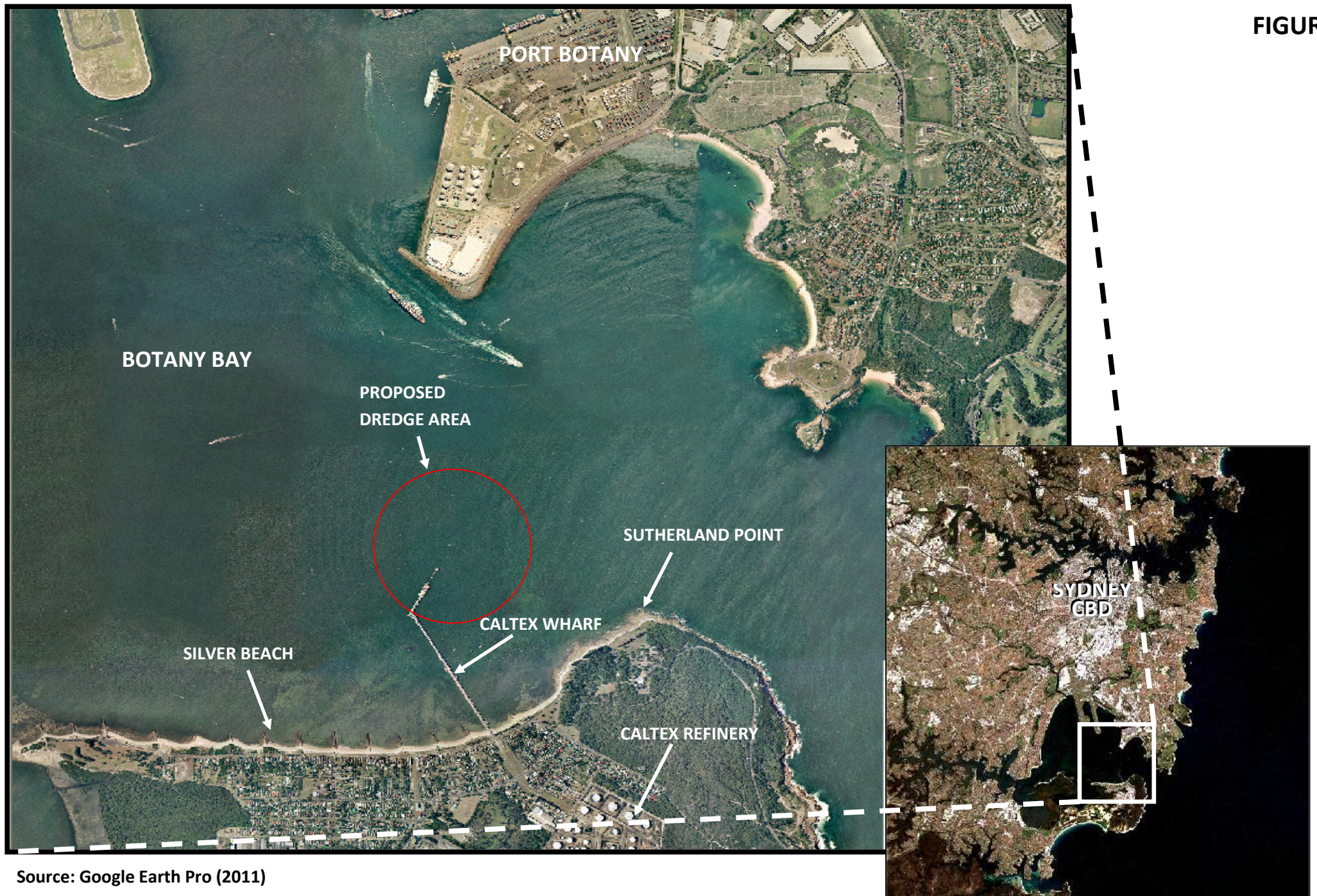
An SAP (refer **Appendix 1**) was prepared for further investigations carried out in March 2010 to:

- characterise the chemical properties of sediment from within the expanded areas of the dredge footprint; and
- assess the bioavailability and toxicity of the observed TBT with depth across the dredge footprint (including elutriate analyses and toxicity testing where required).

The SAP was approved by the Department of Sustainability, Environment, Water, Populations and Communities (then DEWHA) prior to implementation.

The main findings of the SAP Implementation Report (refer **Appendix 2**), which provides results from both the 2009 and 2010 investigation, are described below. The SAP Implementation Report has not yet been reviewed by SEWPaC.

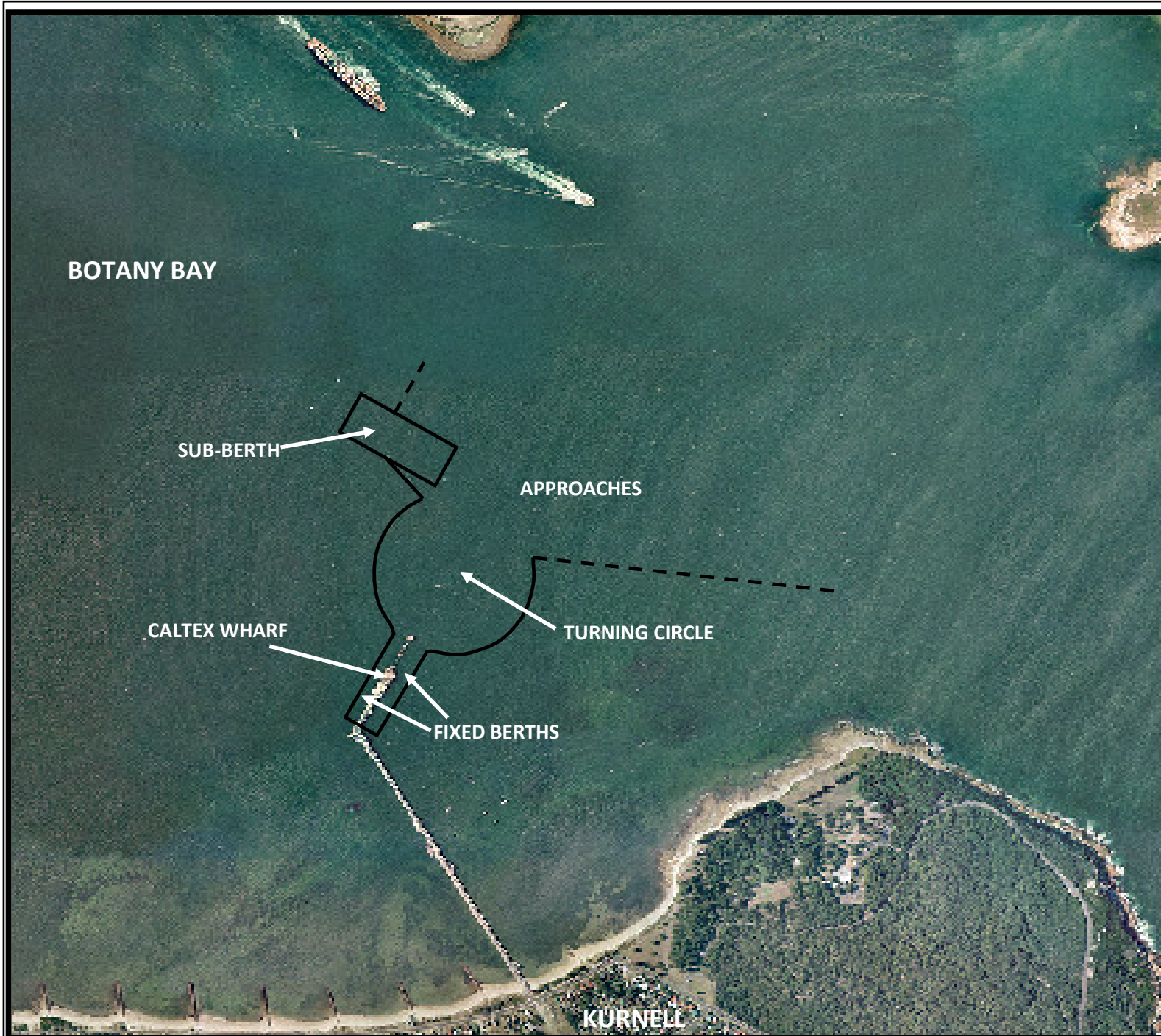
FIGURE 1



Source: Google Earth Pro (2011)

LOCATION PLAN

FIGURE 2



Source: Google Earth Pro (2011)

**LOCATION OF BERTHS
AND APPROACHES**



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It is envisaged that **Appendix 2** would be updated following the implementation of this SAP and would be submitted with the Sea Dumping Permit application should Caltex pursue sea disposal of the dredged material.

Sampling Methodology

Samples comprising both vibrocores and surface samples were collected from the sub-berth and approaches during the investigations undertaken on 3rd and 5th March, 2010. A judgmental sampling pattern was used to position sample locations in areas:

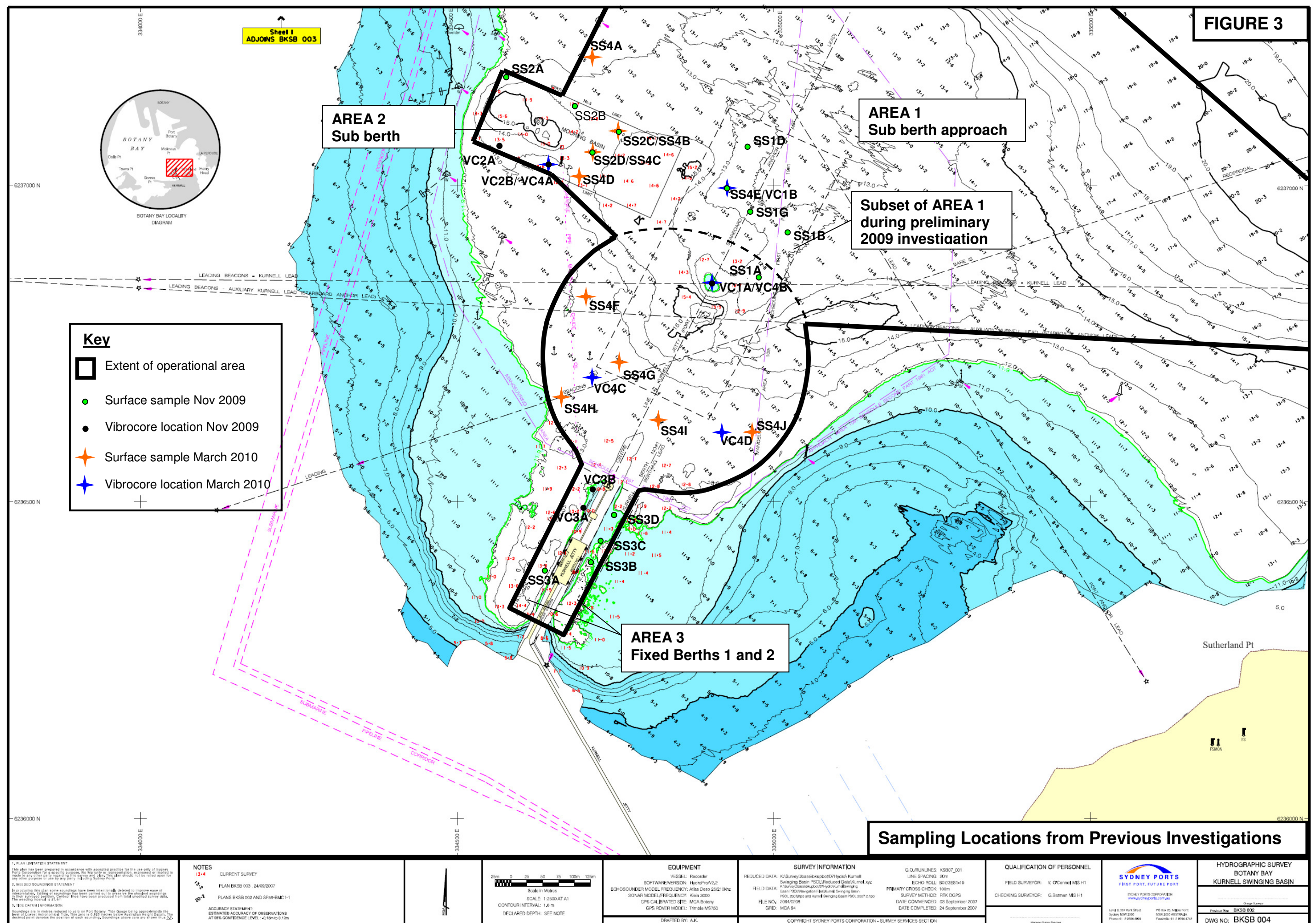
- with the greatest sediment accretion within the proposed dredge footprint (based on review of the hydrographic survey);
- which had high TBT concentrations observed in the preliminary November 2009 investigation (i.e. in order to ensure retrieval of sufficient sample with TBT concentrations representative of the dredge material for use in elutriate and toxicity testing); and
- not covered in the preliminary investigation (i.e. those additional areas of the broadened dredge footprint).

In total, samples were collected from 26 discrete locations for the November 2009 and March 2010 investigations as well as six locations from the 2009 investigation which were resampled during the 2010 investigation to obtain sediment with high TBT concentrations to undertake elutriate and toxicity testing.

Sufficient sediment was collected to allow a range of tests on each sample. Seawater was also collected for elutriate testing purposes.

Standard Operating Procedures (SOP) were used for the coring, surface sampling and sub sampling (refer **Appendix 3**). Samples were recovered approximately every 0.5 m from each vibrocore to the proposed dredge depth. One sample was recovered from each surface core.

Figure 3 shows the selected sample locations.





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Testing

Chemical testing undertaken in March 2010 comprised testing by ALS Environmental for:

- TBT and Total Organic Carbon (TOC) in all samples;
- a suite of heavy metals and Polycyclic Aromatic Hydrocarbons (PAHs) of all samples in the expanded area of the dredge footprint; and
- Benzene, Toluene, Ethyl Benzene and Xylene (BTEX), Total Petroleum Hydrocarbons (TPHs), Organochlorin (OC) Pesticides and Polychlorinated Biphenyls (PCBs) of 20% of samples in the expanded area of the dredge footprint to confirm that these contaminants are not of concern.

Particle size analysis and acid sulfate testing undertaken during the November 2009 investigation was considered sufficient for the expanded dredge footprint.

Advice was sought from Dr Stuart Simpson of CSIRO on the most appropriate method of testing for bioavailability and toxicity of TBT. Dr Simpson is an expert in aquatic geochemistry and sediment toxicology and was a key technical expert in the development of the NAGD. The toxicity tests selected by Dr Simpson are considered to be the most sensitive available currently and it was not recommended that further ecotoxicological tests be undertaken.

Following the statistical analysis of results to determine the 95% Upper Confidence Level (UCL) of the mean concentration of TBT, samples were selected for elutriate and toxicity testing. Dr Simpson recommended that samples be selected based on a TBT concentration (normalised to 1% TOC) greater than the NAGD maximum level of 70µg Sn/kg and as close as possible to, or slightly higher than the 95% UCL of the mean TBT concentration (i.e. 363µg Sn/kg). For toxicity tests, a "blind control" sample was also selected with a TBT concentration below the NAGD maximum level.

Elutriate testing comprised testing of twelve selected samples including one replicate and one seawater blank.

Dilution calculations were undertaken using the results for total sediment TBT concentrations and the elutriate TBT results to determine the potential bioavailability of dissolved TBT concentrations in the water column during sea disposal. Analytical dilution modeling was undertaken assuming dredging would be undertaken using a backhoe dredger with overflowing. Following analysis of the result from the analytical method, numerical modeling using STFATE was undertaken for four scenarios including backhoe dredging and trailer suction hopper dredging, both with and without overflowing.

Whole sediment toxicity testing was undertaken by CSIRO and comprised the 10 day toxicity testing for chronic effects (reproduction) to the epibenthic amphipod *Melita plumulosa* on three selected samples, a blind control and an in-house silty sediment sample.

Toxicity testing of elutriates was undertaken by Ecotox Services Australasia on three selected samples, a one blind control and a seawater blank. The elutriate water and serial dilutions (50%,



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25%, 12.5%, 6.3%) were tested using the 48 hour oyster larval development test using the rock oyster *Saccostrea commercialis* to determine the presence or absence of toxicity.

Main Findings

The results of the sediment testing from both the November 2009 and March 2010 investigations were compiled. A statistical analysis of the pooled data was undertaken and the results compared to the NAGD, relevant reuse and disposal guidelines, and the ANZECC/ ARM CANZ (2000) Marine Water Quality Guidelines (refer **Table 2.1** and **Table 2.2**).

The full report on the findings is provided in **Appendix 2**. A summary of the results relevant to the proposed unconfined sea disposal of the material is provided below:

- the maintenance dredge material comprises grey/brown sands (mean 93%) with minimal amounts of clay (2-9%) and silt (<1-3%).
 - Concentrations of BTEX, OC Pesticides and PCB's were below laboratory detection levels in all samples tested.
 - the 95% UCL of the mean concentration of metals, TPH's and total PAH were below NAGD screening levels when calculated for each area and for all areas combined.
 - elevated concentrations of TBT were observed above the NAGD maximum level triggering the need for further testing including elutriate and toxicity testing.
- the results of the elutriate testing indicated that elutriate TBT concentrations (excluding calculated dilutions) exceeded the ANZECC/ARM CANZ (2000) water quality guideline value.
- dilution modelling for the Sydney Offshore Spoil Ground using the numerical method indicated that for all modelled scenarios, the concentration of TBT in the water following initial mixing would be a maximum of $\leq 0.000035\mu\text{g/L}$, i.e. well below both the 95% protection level ($0.006\mu\text{g/L}$) and the 99% level of protection ($0.0004\mu\text{g/L}$). Therefore, the concentrations of TBT in material from the proposed Caltex maintenance dredge areas are not of concern to water quality during disposal at the Sydney Offshore Spoil Ground.
- results of the whole sediment toxicity testing indicated that all test sediments were considered to be non-toxic to the reproduction and survival of the amphipod *Melita plumulosa*.
- based on the chemical and ecotoxicological tests, the sediments are considered to be suitable for ocean disposal at the designated Sydney Offshore Spoil Ground.
- due to the uncertainty regarding the potential for bioaccumulation of TBT by aquatic organisms that colonise and inhabit the sediments, it would be desirable that the more highly
- TBT contaminated material from Area 1 material (approaches) should be deposited beneath materials of higher quality at the disposal site.



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Table 2.1 Summary of Geochemical Results from the WP November 2009 and March 2010 Sediment Investigation in Comparison to Reuse and Disposal Criteria

		Metals														Organics					
		Antimony	Arsenic	Cadmium	Chromium	Copper	Cobalt	Lead	Manganese	Nickel	Selenium	Silver	Vanadium	Zinc	Mercury	BTEX	Sum TPHs	OC Pesticides	Total PCBs	Sum PAHs	TBT
Units		mg/kg														mg/kg		µg/kg			µg Sn/kg
LOR		0.5	1	0.1	1	1	0.5	1	10	1	0.1	0.1	2	1	0.01	0.2	3-5	0.5	5		0.5
Waste Classification Criteria	CT1 - General solid waste	-	100	20	100	-		100		40		-		-	4	10-1000		-	-	-	-
	CT2 - Restricted solid waste	-	400	80	400	-		400		160		-		-	16	40-4000		-	-	-	-
Site Contamination Criteria	NEPC E - Health based Investigation Level (HILS) parks, recreational open space, playing fields	-	200	40	24%	2000		600		600		-		14000	30	-		20000	20000	40000	-
	NEPC - Ecological Investigation Level (EILS) Interim Urban	-	20	3	400	100		600		60		-		200	1	-		-	-	-	-
Aquatic Ecology	NAGD / ANZECC ISGQ low	2	20	1.5	80	65		50		21		1		200	0.15	-	550	0.32-280	23	10000	9
	NAGD / ANZECC ISGQ max	-	-	-	-	-		-		-		-		-	-	-		-	-	-	70*
ALL AREAS	Mean	<0.5	1.78	<0.1	3.89	3.52	0.42	4.82	7.87	0.52	0.16	0.08	7.50	21	0.05	<0.2	165	<0.5	<5.0	283	206
	Standard Deviation	NA	2.93	0.20	5.49	5.78	0.53	9.52	7.88	1.22	0.31	0.15	15.6	68	0.13	NA	211	NA	NA	579	595
	95% UCL of the mean	<0.5	2.48	<0.1	5.18	4.89	0.55	7.08	9.72	0.81	0.24	0.11	11.2	37	0.08	<LOR	296	<LOR	<LOR	440	353
AREA 1 - SUB BERTH APPROACH	Mean	<0.5	0.76	<0.1	1.61	2.23	<0.5	1.89	6.50	<.01	0.06	0.09	9.43	4.85	0.04	<LOR	254	<0.5	<LOR	295	281
	Standard Deviation	NA	0.49	NA	1.15	1.55	NA	1.10	6.03	NA	0.03	0.21	21	3.76	0.14	<LOR	257	NA	<LOR	472	770
	95% UCL of the mean	<0.5	0.92	<0.1	1.99	2.73	<0.5	2.28	8.61	<0.1	0.07	0.17	16.4	6.07	0.09	<LOR	499	<LOR	<LOR	450	516
AREA 2 - SUB BERTH	Mean	<0.5	2.41	<0.1	5.49	1.96	0.55	3.26	6.54	0.65	0.28	<.01	4.89	10.7	0.06	<LOR	53	<LOR	<LOR	350	174
	Standard Deviation	NA	4.27	NA	6.99	1.80	0.79	3.25	3.95	1.15	0.51	NA	5.99	13.5	0.15	<LOR	14.1	<LOR	<LOR	874	307
	95% UCL of the mean	<0.5	4.27	<0.1	8.57	2.75	0.95	4.69	8.49	1.22	0.51	<0.1	7.53	16.6	0.13	<LOR	116	<LOR	<LOR	732	309
AREA 3 - FIXED BERTHS	Mean	<0.5	3.38	0.09	7.25	8.66	0.65	13.9	12.9	1.49	0.26	0.07	6.26	71	0.06	<LOR	56	<LOR	<LOR	166	10.1
	Standard Deviation	NA	3.58	0.06	7.44	11.09	0.64	18.1	13.0	2.06	0.29	0.05	5.99	140	0.07	<LOR	42	<LOR	<LOR	326	17.7
	95% UCL of the mean	<0.5	5.18	0.12	10.90	14.18	1.02	23	19.3	2.50	0.40	0.10	9.22	140	0.09	<LOR	245	<LOR	<LOR	326	25
Notes: All organics are normalised to 1% TOC (with 0.2 to 10% TOC) Where results are below LOR, half the LOR has been used in the statistical analyses (<i>italicised</i>) NEPC - National Environmental Protection Council (NEPC) (1999) National Environmental Protection (Assessment of Site Contamination) Measure ANZECC ISQG-low - ANZECC/ARMCANZ (2000) Guidelines for Fresh and Marine Water Quality as updated (in draft) by Simpson et al. (2008) * NAGD maximum level = 70 µg Sn/kg whereas ANZECC ISQG-high = 80 µg Sn/kg																					

Table 2.2 Total Sediment and Elutriate TBT results from WP November 2009 and March 2010 Investigations

				Analyte	TBT Normalised	Elutriate TBT ⁽²⁾
				Units	µgSn/kg	ng/L
				LOR	0.5	2
Aquatic Ecology				NAGD / ANZECC ISQG low	9	6
				NAGD / ANZECC ISQG high	70*	
Area 1	Nov-09	16/11/2009	VC1A 1.2-1.6	134		
Area 1	Nov-09	18/11/2009	VC1B 0-0.6	115		70
Area 1	Nov-09	18/11/2009	SS1A	30		
Area 1	Nov-09	18/11/2009	SS1B	3.5		
Area 1	Nov-09	17/11/2009	SS1C	32		
Area 1	Nov-09	17/11/2009	SS1D	8.5		
Area 1	Mar-10	5/05/2010	SS4A	4		
Area 1	Mar-10	5/05/2010	SS4E	3740		246
Area 1	Mar-10	5/05/2010	SS4F	129		8
Area 1	Mar-10	5/05/2010	SS4G	16		14
Area 1	Mar-10	3/05/2010	SS4H	16		23
Area 1	Mar-10	3/05/2010	SS4I	4.5		
Area 1	Mar-10	3/05/2010	SS4J	4		
Area 1	Mar-10	5/05/2010	VC4B 0-0.5	136		
Area 1	Mar-10	5/05/2010	VC4B 0.5-1	840		3338
Area 1	Mar-10	5/05/2010	VC4B 1-1.5	690		4518
Area 1	Mar-10	5/05/2010	VC4B 1.5-2	505		1028
Area 1	Mar-10	3/05/2010	VC4C 0-0.5	49		
Area 1	Mar-10	3/05/2010	VC4C 0.5-1	231		161
Area 1	Mar-10	3/05/2010	VC4C 1-1.5	53		
Area 1	Mar-10	3/05/2010	VC4C 1.5-2	6.4		
Area 1	Mar-10	3/05/2010	VC4D 0-0.5	1.3		
Area 1	Mar-10	3/05/2010	VC4D 0.5-1	1.3		
Area 1	Mar-10	3/05/2010	VC4D 1-1.5	1.3		
Area 1	Mar-10	3/05/2010	VC4D 1.5-2	1.3		
Area 2	Nov-09	16/11/2009	VC2A 2.3-2.6	27		
Area 2	Nov-09	17/11/2009	VC2B 0-0.5	17		
Area 2	Nov-09	17/11/2009	SS2A	1.25		
Area 2	Nov-09	17/11/2009	SS2B	10		
Area 2	Nov-09	17/11/2009	SS2C	234		
Area 2	Nov-09	17/11/2009	SS2D	259		8
Area 2	Mar-10	5/05/2010	SS4B	64		31
Area 2	Mar-10	5/05/2010	SS4C	20		
Area 2	Mar-10	5/05/2010	SS4D	1040		7
Area 2	Mar-10	5/05/2010	VC4A 0-0.5	565		
Area 2	Mar-10	5/05/2010	VC4A 0.5-1	29		
Area 2	Mar-10	5/05/2010	VC4A 1-1.5	1.3		
Area 2	Mar-10	5/05/2010	VC4A 1.5-2	1.3		
Area 3	Nov-09	16/11/2009	VC3A 0-0.6	7.2		
Area 3	Nov-09	16/11/2009	VC3B 0-0.5	3.7		
Area 3	Nov-09	16/11/2009	SS3A	2.5		
Area 3	Nov-09	16/11/2009	SS3B	46		<2
Area 3	Nov-09	16/11/2009	SS3C	0.2		
Area 3	Nov-09	16/11/2009	SS3D	1.0		
ALL AREAS				Mean	206	727
				Standard Deviation	595	1691
				n	44	13
				95% UCL of the mean	353	1369
AREA 1 - APPROACHES				Mean	281	1045
				Standard Deviation	770	1691
				n	25	9
				95% UCL of the mean	516	2093
AREA 2 - SUB BERTH				Mean	174	15.3
				Standard Deviation	307	13.6
				n	13	3
				95% UCL of the mean	309	38
AREA 3 - FIXED BERTHS				Mean	10.1	<2
				Standard Deviation	17.7	-
				n	6	1
				95% UCL of the mean	25	<2

Notes:
 All organics are normalised to 1% TOC (with 0.2 to 10% TOC)
 Where results are below LOR, half the LOR has been used in the statistical analyses (*italicised*)
 ANZECC ISQG-low - ANZECC/ARMCANZ (2000) Guidelines for Fresh and Marine Water Quality as updated (in draft) by Simpson et al. (2008)
 * NAGD maximum level = 70 µgSn/kg whereas ANZECC ISQG-high = 80 µgSn/kg
 Student t-test used to calculate 95%UCL of the mean where insufficient data is available to use the Standard Bootstrap Method



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2.3 Potential Impact from Recent Oil Slick

A sheen of hydrocarbons was identified in Botany Bay on 20th March, 2011. The oily water discharge resulted from heavy localised flooding which caused the failure of the Caltex Refinery's onsite stormwater management system which separates oil from water prior to release.

Caltex immediately contacted the New South Wales Department of Environment, Climate Change & Water (DECCW, now OEH) and Sydney Ports Corporation. The containment strategy used booms to entrain the oil and boats were used to break up the sheen to aid in evaporation of the sheen. Inspectors from the NSW Office of Environment and Heritage inspected the beaches and wetlands around Botany Bay on the day of the release and again the following day. No traces of the hydrocarbons were evident along the shoreline. Whilst it is not expected that the dredge footprint would have been impacted by this discharge, as a precautionary measure, testing of all surface samples (refer **Section 4**) for PAHs and TPHs is recommended.

2.4 Contaminants of Concern for the Further Testing

Based on a review of recent geochemical data for the dredge area and surrounding areas (refer **Section 2.2**), TBT has been identified as a contaminant of concern within the dredge footprint. TBT testing is required in those areas that have recently accumulated sediment within the swing circle and approaches, and at depth within the fixed berths proposed for capital dredging. **Section 4** of this SAP sets out in detail the proposed further TBT testing.

In addition to TBT testing, 20% of samples proposed for collection from the additional dredge areas within the fixed berths, swing circle and approaches would also be tested for a suite of heavy metals.

To address the potential for hydrocarbon contamination as a result of the oily water release from the refinery in March 2011, all surface samples for collection from the additional dredge areas within the fixed berths, swing circle and approaches would be tested for PAHs, TPHs and TOC.

As concentrations of BTEX, OC Pesticides and PCBs from recent samples collected across the dredge footprint were below the laboratory limits of reporting, testing for these analytes is not proposed.



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3 DESCRIPTION OF DREDGING PROPOSAL

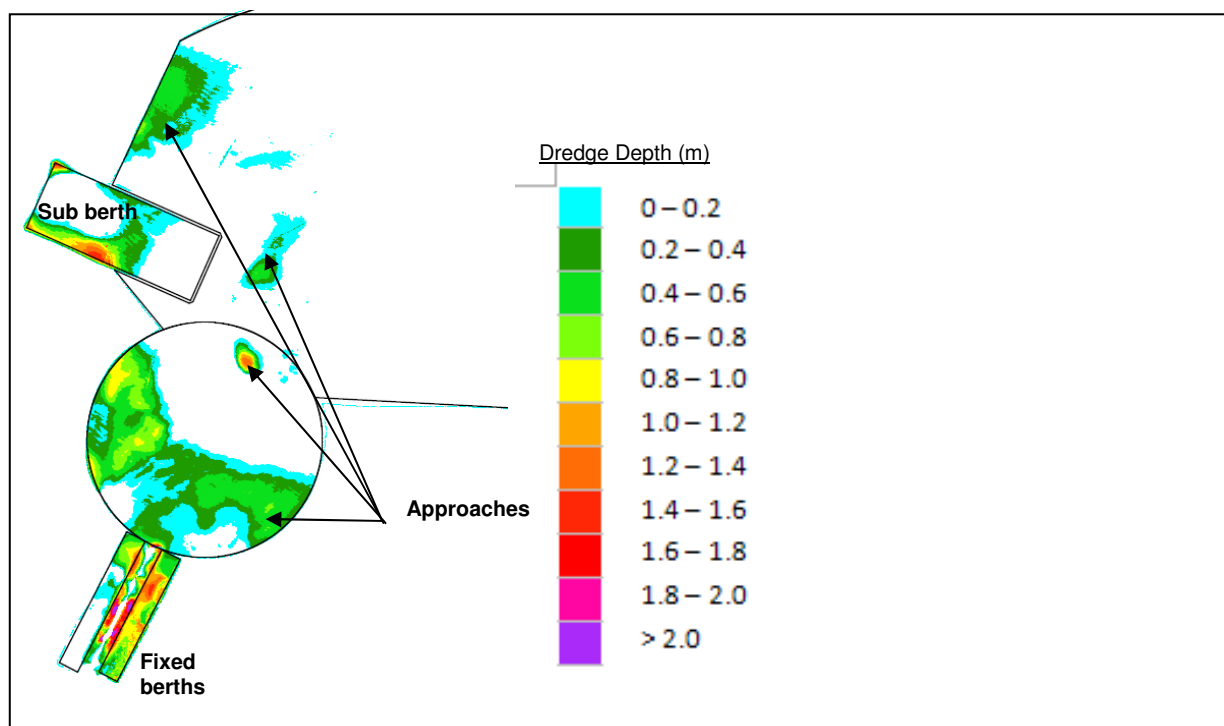
The project proposal comprises maintenance dredging activities of all areas to their declared depths as specified below:

- approaches to the sub berth -12.8 m CD;
- swing circle -12.8m CD;
- sub berth -14.0 m CD; and
- fixed berths 1 & 2 -11.2 and 11.6 m CD respectively.

In addition, capital dredging will be undertaken in the fixed berths, below the declared depths, to a depth of -12.8m CD.

The most recent hydrographic survey (SPC, 2011) made available since the previous sediment investigations, was used to identify the areas, thickness and volume of dredge material. The depth dredging required and the areas of greatest sediment accumulation are shown in **Figure 4**.

Figure 4 Areas and depths of proposed dredging





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The total volume of proposed maintenance dredge material, including an allowance for dredging tolerance, is approximately 90,300 m³.

It is envisaged that dredging would be undertaken using a trailer suction hopper dredge (TSHD) with overflowing through a green valve. However, other options have been considered for the purposes of assessing water quality impacts including backhoe dredging, and dredging without overflowing from the barge.



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4 PROPOSED SEDIMENT SAMPLING AND ANALYSIS

4.1 Objective

The sampling and testing is to be undertaken to provide better spatial and vertical coverage of the dredge areas and to meet the NAGD sampling requirements for the change in dredge volume. The investigations are required to support applications for approvals for dredging and disposal from the relevant government agencies.

4.2 Sample Locations

Samples will be collected from ten locations including one vibrocore and four surface samples collected from the swing circle and approaches, and four vibrocores and one surface sample collected from the fixed berths. A judgmental sampling pattern has been used to locate samples:

- in areas of the of the swing circle and approaches which were not sampled in the previous investigations but are now part of the dredge footprint due to recent sediment accumulation; and
- in the fixed berths, in areas with the greatest sediment depth to dredge design level.

Vibrocore sample locations have been chosen to target areas with sediment accumulation more than 1 m above the design dredge levels. The proposed sampling locations are shown in **Figure 5**. The coordinates for each proposed sampling location are included in **Appendix 4**.

An onboard GPS will be used to position the sampling vessel at the nominated sampling locations. The GPS has an accuracy of ± 0.1 m. However, following maneuvering of the vessel into position and recovery of the sample from the sea bed, the positioning of vibrocores is likely to have an accuracy of ± 5 m.

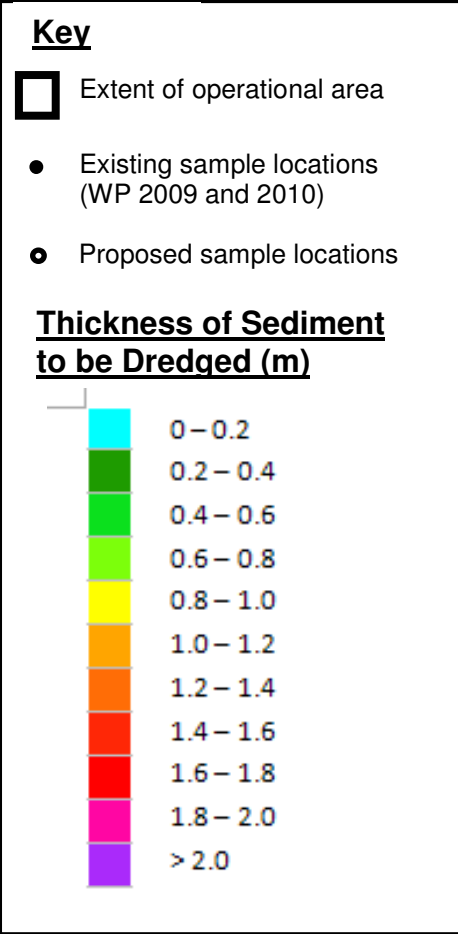
4.3 Sample Collection

Prior to sampling, each vessel proposed for use will be thoroughly inspected and washed down. Any evident sources of contamination will be cleaned and covered in plastic to avoid accidental contamination of any samples.

Collection of the vibrocores will be undertaken by McLennans Diving Service (MDS) using a Rossfelder P3 Vibrocore with 100mm diameter aluminium core tubes and if necessary, core catchers to retain sediment within each core. Vibrocores will be driven to a depth of 2.5m or refusal. Surface samples would be collected by a WorleyParsons environmental scientist using a Ponar grab sampler.

Sampling dates, time, water depth and depth of core penetration will be recorded. Vibrocores will be capped and transported onshore for subsampling. Surface samples will be sub-sampled onboard.

FIGURE 5



Area 2
Sub-berth

Area 1
Approaches and swing
circle

Area 3
Fixed berths

PROPOSED SAMPLING LOCATIONS



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All surfaces used for sample handling will be covered in plastic sheeting prior to subsampling. Subsampling will be undertaken using nitrile gloves and decontaminated stainless steel equipment.

Cores will be split longitudinally, logged, photographed and subsampled for each half metre depth increment. The following volumes will be retained from each subsample, where relevant, for the different analyses potentially required:

- 150ml for analysis of TBT and TOC;
- 250ml for analysis of metals, PAHs and TPHs; and
- 250g for particle size analysis.

Samples for chemical analysis will be homogenised and transferred to glass jars with Teflon lined lids. Samples for particle size analysis will be transferred to a plastic ziplock bag. Each jar/bag will be filled with zero headspace and tightly sealed to avoid loss of sample. Each container will be labelled with a unique identification number and each sample will be recorded on a log sheet.

Sediment will typically adhere to the outside of the sample containers. To avoid cross contamination, after each container is sealed, the outside of each sample container will be washed with seawater.

Standard Operating Procedures (SOP) for the coring, surface sampling and sub sampling are included in **Appendix 3**.

4.4 Estimated Number of Samples

For a total estimated dredge volume (including overdredging) of 90,300m³, the number of sampling locations required as specified in the NAGD, is 17.

The combined dataset from the recent November 2009 and March 2010 investigations comprised sampling from 26 locations, six of which were sampled during both investigations. In order to allow sufficient coverage of the additional proposed dredge areas since these investigations, sampling is proposed at an additional ten locations. This will bring the total number of sampling locations to 36 discrete locations (refer **Table 4.1**) which is considered more than sufficient to satisfy the requirements of the NAGD should the entire dredge footprint be considered as one area, or as individuals areas.

For geochemical analyses, one subsample will be collected from each of the surface cores. From each vibrocore, a sample from the surface 0-0.5m, and one to two samples at depth (in 0.5m increments) would be collected.

In addition, a field triplicate will be collected, that is, three samples taken at the same location (i.e. two additional samples). The triplicate samples will be used to give an indication of the variability in the chemical properties of the sediment at a sample location. As part of QA/QC procedures, it is proposed to submit one split triplicate, i.e. a single homogenised sample split into three containers with the third sample being sent to a second laboratory to assess variation associated with subsample handling (i.e. two additional samples).



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As sediments are not being analysed for volatiles, it is not proposed to submit a field blank.

Particle size analysis will be carried out on an additional four samples at depth within the fixed berths to provide an indication of the physical characteristics of the proposed capital dredge material.

Table 4.1 Proposed Number of Sample Locations for the Dredge Footprint

Area	Total Estimated Volume Including Overdredging (m ³)	Number of Sample Locations			Table 7 of the NAGD
		Nov 2009 and March 2010 Investigation	Proposed this SAP	Total	
All proposed dredge areas (i.e. entire dredge footprint treated as one area)	90,300	26 (+ 6 repeated locations)	10	36 (+6 repeated locations)	17 (i.e. one dredge area)
Fixed Berths No. 1 and No.2	19,800	6	5	11	8
Approaches and Swing Circle	58,450	13 (+ 3 repeated locations)	5	18 (+3 repeated locations)	14
Sub-berth	12,050	7 (+3 repeated locations)	0	7 (+ 3 repeated locations)	7

Notes

1. Some sampling locations from the 2010 investigation were chosen based on locations from the preliminary investigation in 2009 that reported high concentrations of TBT in order to carry out elutriate and toxicity testing.

An estimated 23 subsamples will be collected in total including field QA/QC samples. The sub-sample breakdown is shown in **Table 4.2**.

Table 4.2 Proposed Number of Sub-samples

Sample type	Number of Subsamples
Surface cores	5
Vibrocores	14
Triplicate	2 additional samples
Split Triplicate	2 additional samples
Blank	0
Total	23



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4.5 Sample Preservation

Samples for geochemical analysis will be packed in ice in an esky immediately after sampling to maintain the temperature below 4°C. Samples for physical analysis will be stored at ambient temperatures. Samples will then be submitted to the analytical laboratory on the same day or the following morning.

4.6 Equipment Decontamination Procedure

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

4.7 Sample Shipment

All sample containers will be clearly labelled with unique sample identification numbers. Samples will be transported in an esky in ice to the relevant analytical laboratory nominated for each analyses required. WorleyParsons will coordinate the analysis of the samples.

All samples will be transported under WorleyParsons chain of custody procedures.

4.8 Analysis Schedule

4.8.1 Chemical Analysis

The primary laboratory selected to undertake the chemical testing is the NATA registered ALS Laboratory Group. The third split triplicate sample will be submitted to a secondary laboratory, NATA registered Advanced Analytical Australia (AAA) laboratory group.

Chemical testing will comprise testing for TBT and TOC in all samples.

In addition, four samples at depth within the fixed berths will be tested for PAHs and TPHS, and twenty percent of samples will also be tested for a suite of metals as specified in the NAGD to confirm that they are not of concern.

The contaminants and the detection limit of the proposed analytical methods are listed in **Table 4.3**.

4.8.2 Physical Analysis

Physical testing will comprise determination of the particle size distribution (PSD) by sieve (to 75µm) and reporting of % gravel, sand and fines. Analysis will be undertaken by ALS Laboratory Group.



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Table 4.3 Proposed Chemical Analyses of Sediment Samples

Test Parameter	PQL	units	Lab Method	Screening Level
Silver (Ag)	0.1	mg/kg	USEPA 6020	1
Cadmium (Cd)	0.1	mg/kg	USEPA 6020	1.5
Selenium (Se)	0.1	mg/kg	USEPA 6020	--
Cobalt (Co)	0.5	mg/kg	USEPA 6020	--
Antimony (Sb)	0.5	mg/kg	USEPA 6020	2
Copper (Cu)	1	mg/kg	USEPA 6020	65
Lead (Pb)	1	mg/kg	USEPA 6020	50
Zinc (Zn)	1	mg/kg	USEPA 6020	200
Chromium (Cr)	1	mg/kg	USEPA 6020	80
Nickel (Ni)	1	mg/kg	USEPA 6020	21
Arsenic (As)	1	mg/kg	USEPA 6020	20
Vanadium (V)	2	mg/kg	USEPA 6020	--
Manganese (Mn)	10	mg/kg	USEPA 6020	--
Mercury (Hg)	0.01	mg/kg	APHA 3112 Hg-B	0.15
PAHs (each individual species)	4-5 ¹	µg/kg	USEPA 3640/8270	10,000
TPH (C6-C9)	0.2	mg/kg	USEPA 5030/8260	550
TPH (C10-C36)	3-5	mg/kg	USEPA 3510/8015	550
Total PCBs	5 ¹	µg/kg	USEPA 3640/3620	23
TBT	0.5	µg/kg	USEPA 8081/8082 In-House GC/MS	9
TOC	0.02%		In house/Leco	--

Notes

2. The laboratory will strive to reach this PQL but previous sampling and testing indicates that matrix interference may prevent the laboratory reaching this very low detection limit.

The results of the chemical analysis will be pooled with data obtained from the November 2009 and March 2010 investigations. The 95% UCL of the mean concentration of each contaminant will be calculated and compared to the NAGD screening levels.

4.8.3 Requirements for Additional Testing

Provided that the 95%UCL of the mean normalised TBT concentration, once updated with the results of the proposed TBT testing, is consistent with the results from the previous investigations, it is not expected that further elutriate or toxicity testing would be required.

Elutriate and toxicity testing has previously been undertaken in accordance with the NAGD decision-tree approach for assessing potential contaminants. Results from these investigations are documented in **Appendix 2** and summarised in **Section 2.2**.



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Should the 95%UCL of the mean normalised PAH and TPH concentrations be consistent with the results from the previous investigations, once updated with the additional proposed testing of surface samples, it would be considered that there has been no impact to the proposed dredge footprint following the recent oily water discharge from the refinery.

4.8.4 Data Management Procedure

Statistical analysis and tabulation of data will be undertaken following data validation. Data management of the analysis results will be in accordance with the requirements of NAGD. Validation of data will include evaluating the results from laboratory blanks, standard samples, field triplicate samples and split triplicate samples.

4.9 Equipment

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

- The crane barge the “Alkira” with onboard GPS (provided by MDS)
- The catamaran vessel the “Stewie Griffin” with onboard GPS (provided by WorleyParsons)
- Rossfelder P3 vibrocorer (provided by MDS)
- Commercial dive team (provided by MDS)
- 3m aluminium vibrocore pipes
- core catchers and core caps
- Ponar grab sampler
- trestles and table for use in subsampling;
- tarpaulin/ plastic sheeting;
- measuring tape;
- stainless steel bowl and spoons;
- nitrile gloves and PPE;
- Decon90 (diluted to 5% with deionised water) ;
- sample containers and zip-lock bags;
- permanent markers and other stationary;
- core log photo board;
- eskies and ice;
- camera;



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- data forms for recording field measurements and logging samples; and
- chain of custody forms.

An experienced environmental scientist/environmental engineer from WorleyParsons will coordinate the sampling program and carry out the surface sampling. MDS personnel will operate the crane/barge and vibrocorer and undertake all diving operations.

4.10 Health and Safety Precautions

The sampling program will adhere to HSE systems of WorleyParsons, Caltex and McLennans Diving Service.

4.11 Contingency Plan

The sampling program is unlikely to be affected by weather or equipment failure. Sampling may be delayed due to operational requirements of the Caltex berths. In the event of delay, the sampling would be recommenced following the provision of access to the berths and access channel, improvement in the weather or fixing of the equipment.



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5 QA/QC PROCEDURES

5.1 Field QA/QC Procedures

Field QA/QC procedures will include the following:

- **Sample Location:** The “Alkira’s” onboard position fixing system will be used to locate the sampling locations.
- **Decontamination of Sampling Equipment:** Prior to use, the survey vessel will be thoroughly inspected and washed down. Any evident sources of contamination would be cleaned and covered in plastic to avoid accidental contamination of any samples. All surfaces used for sample handling will also be covered in plastic sheeting prior to subsampling. All sampling equipment that comes into contact with the sediment samples will be decontaminated (using Decon 90) prior to each sampling event.
- **Field triplicates:** Triplicate samples (comprising three samples taken from one location) will be analysed and used to give an indication of the variability in the chemical properties of the sediment at a sample location.
- **Field Documentation:** Each sample location will be numbered on a sampling plan in the field logbook. All other observations including weather, time, date of sampling, water depth, and depth of core penetration will be noted in the field logbook. Time, date, core compaction and appearance of the sediments, e.g. texture, colour, odour and the like will also be reported in the field logbook during sub-sampling.
- **Cross Contamination:** Following sampling, to avoid cross contamination, each sample jar will be washed with water to remove sediment adhering to the outside of the sample containers.
- **Split triplicates:** At one location, a split triplicate sample will be taken with two of the samples submitted to the primary laboratory and the third sample submitted to the secondary laboratory for geochemical analysis. The split triplicate results will be analysed to assess variability in sub-sampling.
- **Sample Control:** Each sample will have a unique identification number, which will be recorded in the field log book and chain of custody form. A chain of custody form will accompany the sediment samples at all times and will include the analysis method required of each laboratory.

5.2 Laboratory QA/QC Procedures

Laboratory QA/QC procedures for the geochemical analyses will include the following:

- **Analysis Blanks:** One per analytical run or one in every 20 samples, whichever is the smaller.



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



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6 REPORTING

The main findings of the proposed sampling and testing investigation will be documented in a factual report along. The report will include:

- a description of the sampling program
- tabulation of all laboratory results and a copy of the original laboratory sheets
- results for organic analytes normalised to 1% total organic carbon
- statistical analysis of the results to calculate the mean, and standard deviation and the 95% upper confidence limit of the mean (95% UCL).
- where values are less than the detection limit, a nominal value of one half of the detection limit will be used in the statistical analysis of the results
- reporting of all QA/QC.



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Appendix 1 WP (2010) Caltex Maintenance Dredging: Sampling and Analysis Plan

Supplied Under Separate Cover (Attached CD)



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Appendix 2 WP (2010) Caltex Maintenance Dredging: Sampling and Analysis Plan Implementation Report

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Appendix 3 Standard Operating Procedures for Sediment Sampling & Subsampling



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STANDARD OPERATING PROCEDURES FOR SEDIMENT SAMPLING AND SUBSAMPLING

1. location of sampling to be confirmed by on-board GPS.
2. the coordinates of the sample location, date, time, weather conditions and water depth should be recorded in the field log book.
3. for coring:
 - a. core deployed and lowered to sea bed
 - b. depth of penetration of the core recorded
 - c. core recovered, capped, and placed on vessel deck
 - d. two cores taken from each location to obtain sufficient volume of sample.
4. for surface grab samples:
 - a. Ponar grab (decontaminated with Decon90) to be deployed and lowered to sea bed
 - b. Jaws of Ponar grab to close upon contact with the sea bed
 - c. Ponar grab recovered and placed on vessel deck for inspection
 - d. Integrity of grab sample assessed for loss of fines
 - e. If grab not considered satisfactory, sample should be discarded and steps a to d repeated
5. steps 1 to 4 repeated at each core/surface core location.
6. surfaces to be covered in plastic sheeting prior to subsampling.
7. cores from each location split, logged and photographed.
8. for cores:
 - a. core compaction calculation and each core subsampled.
 - b. If more than one core was recovered from each location to obtain sufficient sediment for all analyses, the sediment from each core for 0.5m depth increment is to be homogenised into one sample
9. for each surface core/0.5m vibrocore depth increment, collect sufficient sediment for the analyses required, i.e.:
 - a. one sub-sample for TBT and TOC (1x150 ml glass jar)
 - b. one sub-sample for metals, PAHs and TPHs (1x250ml glass jars)
 - c. one sub-sample for PSD (1 x 250g ziplock bag)



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10. samples homogenised and transferred to the appropriate containers using stainless steel implements.
11. sample containers filled with zero headspace.
12. each container tightly sealed to avoid loss of sample and labelled with a unique identification number.
13. outside of each sample container washed with sea water to avoid cross contamination.
14. samples to be packed in ice in an esky immediately after sampling to maintain the temperature below 4°C. If overnight storage is required, freeze samples for chemical testing.
15. all sampling equipment should be decontaminated before the next sampling event by rinsing equipment in water to remove visible sediment, followed by a Decon 90 rinse.



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Appendix 4 Coordinates of Proposed Sample Locations



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Site	Easting	Northing
SS5A	334786	6237329
SS5B	334771	6237281
SS5C	334929	6237192
SS5D	334675	6236807
SS5E	334702	6236351
VC5A	334751	6236535
VC5B	334676	6236439
VC5C	334738	6236457
VC5D	334726	6236392
VC5E	334678	6236371

Note: Coordinates are in MGA.



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SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

Appendix 3 Supplementary SAP (June 2012)



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Botany Bay, Sydney, NSW

Supplementary Sampling and Analysis Plan (Caltex Berths 1 and 2 – Dredge Area 3)

301015-02851 – Supplementary SAP_Rev0.doc

6 August 2012

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Confidentiality

This document has been prepared for the sole purpose of documenting our Supplementary Sampling and Analysis Plan to undertake sediment sampling in Dredge Area 3 (Berths 1 and 2).

It is expected that this document and its contents will be treated in strict confidence by Caltex Refineries NSW Pty Ltd.

PROJECT 301015-02851 – CALTEX SUPPLEMENTARY SAMPLING

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	CM	VS	DA	26-07-12	N/A	
B	Issued for Caltex Review	CM	BT	DA	03-08-12	CH	06-08-12
0	Issued for SEWPaC review	CM	BT	DA	06-08-12		



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ACRONYMS and ABBREVIATIONS

AAA	Advanced Analytical Australia
ANZECC/ARMCANZ	Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CBD	Central Business District
CD	Chart Datum
DEWHA	Department of Environment, Water, Heritage and the Arts
LOR	Limit of Reporting
MGA 94	Map Grid of Australia (1994)
NAGD	National Assessment Guidelines for Dredging
NATA	National Association of Testing Authorities
OCPs	Organochlorine Pesticides
OPPs	Organophosphorus Pesticides
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
QA/QC	Quality Assurance/Quality Control
SAP	Sampling and Analysis Plan
SEWPAC	Department of Sustainability, Environment, Water, Populations and Communities
SPC	Sydney Ports Corporation
TBT	Tributyltin
TOC	Total Organic Carbon
TPHs	Total Petroleum Hydrocarbons
VOCs/SVOCs	Volatile Organic Compounds/Semi Volatile Organic Compounds
UCL	Upper Confidence Limit



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1 INTRODUCTION

Caltex Refineries (NSW) Pty Ltd (Caltex) is responsible for the maintenance of their port facilities in Botany Bay in association with their refinery at Kurnell on the southern side of Botany Bay (Sydney, NSW) as well as port facilities within the bay. The facilities comprise the Caltex Wharf located to the west of Sutherland Point, and associated berths and approaches.

1.1 History of Dredge Area

Three recent sediment investigations were undertaken by WorleyParsons in November 2009, March 2010 and November 2011 to determine the suitability of the dredge material for unconfined sea disposal in association with the formerly proposed maintenance dredging in three separate Dredge Areas:

- Dredge Area 1 - Approaches and Swing Basin (to be dredged to -12.8 m relative to Chart Datum (CD));
- Dredge Area 2: Sub-berth (to be dredged to -14.0 m CD); and
- Dredge Area 3: Fixed Berths 1 and 2 (to be dredged to -12.8 m CD).

The testing was undertaken in accordance with the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009) and indicated that the dredge material in Dredge Areas 1, 2 and 3 was suitable for ocean disposal at the designated Sydney Offshore Spoil Ground (WorleyParsons, 2012) (**Appendix 1**).

A preliminary investigation was undertaken in November 2009 to characterise the physical properties and the types, concentrations and bioavailability of chemicals present in the proposed dredge material. The dredging requirements were determined from the Sydney Ports Corporation (SPC) (2007) hydrographic survey, which was the most recent hydrographic survey available at the time of sampling.

A Sampling and Analysis Plan (SAP) was prepared for the preliminary investigation in accordance with the NAGD. However, due to the need to fit in with Caltex shipping movements at short notice, the SAP was not submitted to the Department of Environmental, Water, Heritage and the Arts (DEWHA) (now the Department of Sustainability, Environment, Water, Populations and Communities - SEWPAC) for review prior to sampling.

The results of the preliminary investigation indicated that elevated concentrations of tributyltin (TBT) were present in some sediments in the areas sampled. In addition, subsequent discussions with the SPC pilots and review of the SPC (2009) hydrographic survey determined that the required dredge footprint was larger than the footprint investigated in the preliminary investigation.



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Therefore, a further investigation was undertaken to:

- Characterise the chemical properties of sediment from within the expanded areas of the dredge footprint; and
- Assess the bioavailability and toxicity of TBT with depth across the dredge footprint.

An SAP (WorleyParsons, 2010) was prepared for the additional investigation and submitted to DEWHA (now SEWPAC) for review in February 2010 and approved on 5 March 2010, following minor requested amendments. Supplementary sediment sampling was undertaken in March 2010 in accordance with the approved SAP. The analytical results indicated that, while elevated concentrations of TBT were observed in elutriates, dilution modelling using the numerical method for material from the combined Dredge Areas 1, 2 and 3 determined that the concentrations of TBT in the dredge material would not be of concern to water quality during disposal at the Sydney Offshore Spoil Ground. In addition, toxicity was not observed by whole sediment or elutriate toxicity testing.

Following the second sediment sampling program in March 2010, it was identified that additional sampling and testing was required in association with the proposal by Caltex to undertake capital dredging in a portion of the dredge footprint to:

- Meet the required minimum number of samples specified in the NAGD, due to the increase in dredge volume since the previous sediment sampling and testing;
- Provide a better spatial and vertical coverage of the three proposed Dredge Areas; and
- Identify whether, following an oily water discharge from the Caltex Refinery in March 2011, any hydrocarbon contamination was present in the surface sediments within the proposed Dredge Areas.

A Supplementary SAP (WorleyParsons, 2011) was prepared for the additional sediment investigation, specifying the program of sampling and testing that would be undertaken in accordance with the NAGD. The Supplementary SAP also provided details on the methodology and results from the two previous investigations. The Supplementary SAP was submitted to SEWPAC for review on 20 September 2011. Comments on the Supplementary SAP were received from SEWPAC on 27 October 2011 and the third sediment sampling and analysis investigation was completed in November 2011 in accordance with the Supplementary SAP (WorleyParsons, 2011) and the review comments that were provided by SEWPAC on 27 October 2011 (**Appendix 1**).

1.2 Purpose and Objectives of SAP

The purpose of this Supplementary Sampling and Analysis Plan (SAP) is to describe and justify the additional sediment sampling and analysis in Dredge Area 3 (Berths 1 and 2). This Supplementary SAP should be considered in association with the SAP Implementation Report for Dredge Areas 1-3 that was prepared following the most recent sediment sampling investigation in November 2011 and



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which includes a summary of the three previous sediment investigations (WorleyParsons, 2012) (**Appendix 1**).

Since the completion of the previous sediment investigations, the latest of which was undertaken in November 2011, Caltex has indicated additional dredging of fixed Berths 1 and 2 adjacent to the Caltex jetty as a result of a proposed berth widening of Berth 1 from 35 m to 138 m and a widening of Berth 2 from 35 m to 103 m. Therefore, additional sediment sampling and testing is required to:

- Meet the required minimum number of samples specified in the NAGD, due to the increase in dredge volume since the previous sediment sampling and testing; and
- Provide a better spatial and vertical coverage within the entire dredge footprint of Dredge Area 3 (Berths 1 and 2).

The supplementary sediment sampling and analysis is to be undertaken to provide spatial and vertical coverage of the expanded dredge area in Berths 1 and 2 (Dredge Area 3) and to meet the NAGD sampling requirements for the increased dredge volume. The supplementary sediment sampling and analysis and the previous sediment investigations of Dredge Areas 1-3 reported in WorleyParsons (2012) (**Appendix 1**) will support applications for approvals for dredging and disposal from the relevant government agencies.

This current Supplementary SAP has been prepared in accordance with the NAGD, and it includes the following elements:

- Objectives of the SAP;
- Evaluation of the site history and available data;
- Map showing the proposed sample locations;
- Estimates of the proposed number of sediment samples, including replicates and triplicates;
- Methods and procedures for sampling;
- Details of methods for sample handling, preservation, storage and quality control and quality assurance (QC/QA); and
- List of chemical analyses, detection limits and laboratory QC/QA procedures.



2 COMPILATION AND REVIEW OF EXISTING DATA

2.1 Site Location (Dredge Area 3 – Berths 1 and 2)

The Caltex refinery is located at Kurnell on the southern shore of Botany Bay, south of the Sydney Central Business District CBD (**Figure 1**). The Caltex jetty extends approximately 800 m into Botany Bay to the west of Sutherland Point, terminating in a wharf approximately 300 m long. Fixed Berths 1 and 2 are located either side of the wharf, beyond which are the approaches (including a Swing Basin) and the Sub-berth.

2.2 Existing Geochemical Data

Recent sediment investigations have been undertaken which are relevant to the proposed dredge area in Berths 1 and 2 (Dredge Area 3) including:

- Sediment investigations by GHD in 2007 and 2008 (GHD, 2009) at locations about 0.5 to 1.0 km from the proposed dredge areas; and
- Sediment investigation within the previously proposed dredge area in Berths 1 and 2 (Dredge Area 3; berth width: 35 m) in November 2009 and November 2011 (no sediment sampling was undertaken in Dredge Area 3 in March 2010) (WorleyParsons, 2012) (**Table 1**).

The main findings of the SAP Implementation Report (WorleyParsons, 2012) (**Appendix 1**) are described below, containing the results from the previous investigations in Dredge Area 3 (Berths 1 and 2). The SAP Implementation Report has not yet been reviewed by SEWPAC.

It is envisaged that **Table 1** would be updated following the implementation of this Supplementary SAP, as part of a Supplementary SAP Implementation Report for Dredge Area 3 (Berths 1 and 2) only. The previous SAP Implementation Report (WorleyParsons, 2012) and the Supplementary SAP Implementation Report would be submitted together to form part of the Sea Dumping Permit application, for Caltex to pursue approval for sea disposal of the dredged material.



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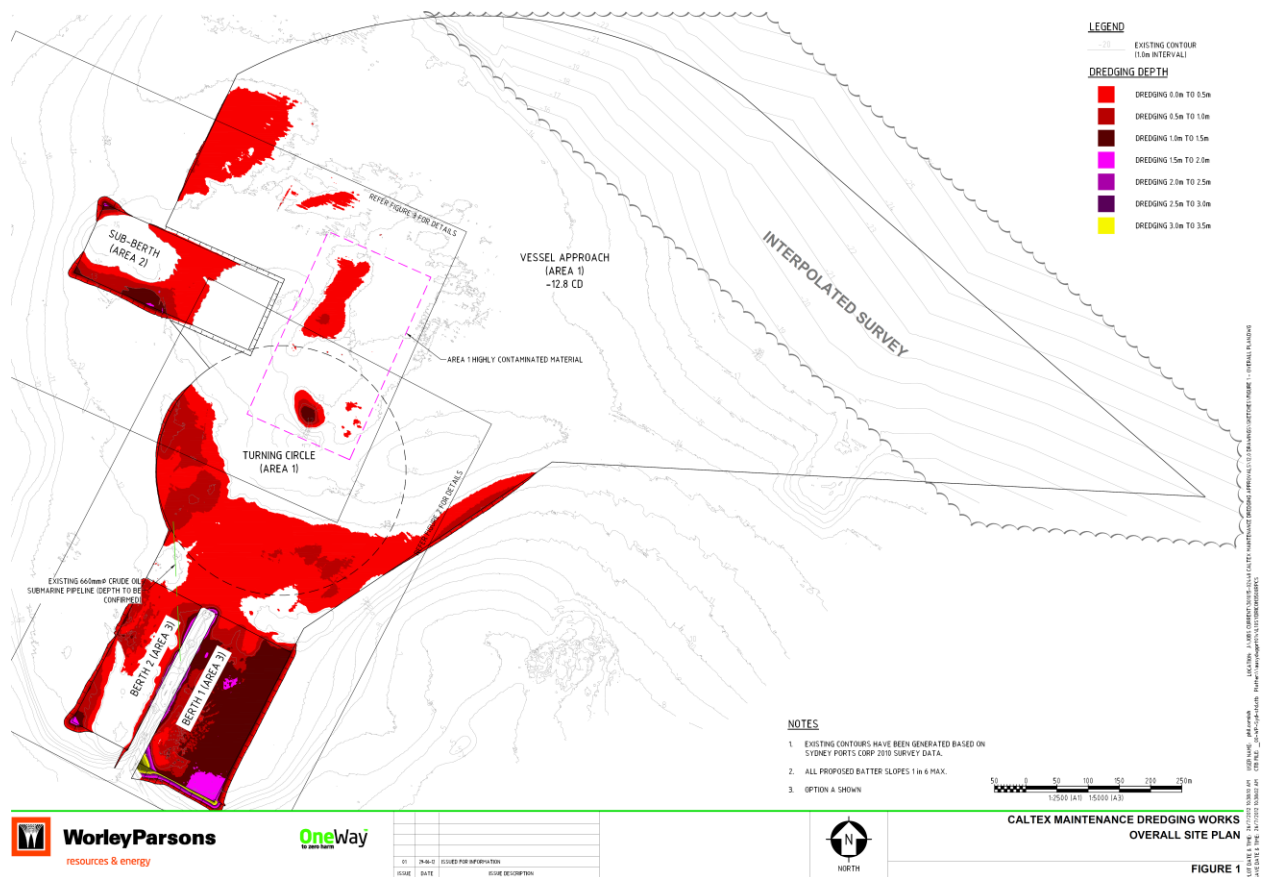


Figure 1. Overall Site Plan.



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- which had high TBT concentrations observed in the preliminary November 2009 investigation (i.e. to ensure retrieval of sufficient sample with TBT concentrations representative of the dredge material for use in elutriate and toxicity testing); and
- not covered in the preliminary investigation (i.e. the additional areas of the broadened dredge footprint).

In total, samples were collected from eleven (11) discrete locations in the November 2009 and November 2011 investigations (i.e. seven (7) sample locations in Berth 1 (SS3B; SS3C; SS3D; SS5E; VC5C; VC5D; VC5E) and four (4) sample locations in Berth 2 (SS3A; VC3A; VC3B; VC5B).

Samples were recovered from vibrocores and surface cores to the proposed depth of dredging at each of the eleven (11) sample locations in Dredge Area 3 (Berths 1 and 2) (refer to Figure 4 in **Appendix 1**) (WorleyParsons, 2012).

2.2.2 Sediment Testing

SEDIMENT PHYSICAL CHARACTERISTICS

Sediments within Dredge Area 3 comprise a mean sand and gravel content of 69% and 16%, respectively, with a greater proportion of fines compared to Dredge Areas 1 and 2 (17% average silt and clay). Several samples from Berths 1 and 2 contained elevated TOC contents of more than 7% up to about 40% (**Table 1**).

During sampling and subsampling of sediment, cores VC5D and VC5E (located in the southern end of Fixed Berth 1 in Dredge Area 3) were found to contain a hard, low density, black material with a chalky texture and a pitted surface. This material was identified at or near the surface to depths of 1.5 m and 0.6 m for each of these two cores, respectively. This equates to approximately -12.5 m below Chart Datum (CD). The material was subjected to testing for Volatile Organic Compounds/Semi Volatile Organic Compounds (VOCs/SVOCs) for consideration of potential hydrocarbon contamination. Subsequently, the results of visual inspections and geochemical analysis identified that the materials consisted of decomposing organic matter, or peat-like material. A review of historic borehole logs that were provided by Caltex (Australian Oil Refinery Limited (1953) Boring Plan AS6201-7 and Plan AA.6653-1), and made available since the preparation of the Supplementary SAP and the completion of the November 2011 investigation, indicated that peat layers had previously been observed in the vicinity of the Caltex berths and approaches. The plans identified peat layers at depths of about -10 to -13 m CD in four boreholes located west of Berths 1 and 2 in Dredge Area 3 and outside of the proposed dredge footprint. The peat layers identified in the most recent investigation were present within this depth range.



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SEDIMENT CHEMICAL CHARACTERISTICS

Chemical testing of sediments from Berths 1 and 2 undertaken in November 2009 and in November 2011 included:

- Inorganic contaminants (trace metals): Silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb), antimony (Sb), selenium (Se), and vanadium (V);
- Organic contaminants: Polycyclic Aromatic Hydrocarbons (PAHs), Tributyltin (TBT), Polychlorinated Biphenyls (PCBs), Organochlorine Pesticides (OCPs), Organophosphorus Pesticides (OPPs), Total Petroleum Hydrocarbons (TPHs), BTEX; and
- Total Organic Carbon (TOC).

Not all of the analytes above were assessed in all sediment samples from Dredge Area 3 (Berths 1 and 2) (**Table 1**), because the above list of analytes represented a screening assessment to determine if these contaminants may represent contaminants of potential concern.

Previous sediment investigations undertaken by WorleyParsons in November 2009 and November 2011 confirmed the presence of elevated concentrations of TBT in sediments in Berths 1 and 2 (as well as in sediments in Dredge Areas 1 and 2), while the concentrations of all other analytes were below the NAGD Screening Levels in all sediment samples. Exceptions were Pb and Zn at location SS3A in Berth 2 and Hg at location SS3B in Berth 1 (**Table 1**). The 95% upper confidence limit (UCL) of the mean concentration was below the NAGD Screening Level for all analytes, except for TBT (normalized to 1% TOC), for which the 95% UCL of the mean concentration (54 µgSn/kg) exceeded the NAGD Screening Level of 9 µgSn/kg.

The concentrations of TBT in whole sediments are generally elevated in sediments throughout the three Dredge Areas, although normalized TBT concentrations that exceed 9 µgSn/kg in sediments in Dredge Area 3 are mostly limited to the central and southern area of Berths 1 and 2.

Sediments in Berth 1 generally contain greater than 1% TOC, resulting in a reduction of TBT concentrations that are normalized to 1% TOC. While normalized TBT concentrations greater than 9 µgSn/kg are predominantly located in sediments in Dredge Areas 1 and 2, sediments at several sample locations in Dredge Area 3 (Berths 1 and 2) also exceed the NAGD screening level of TBT (WorleyParsons, 2012) (**Appendix 1**).

SEDIMENT ELUTRIATE TESTING

Elutriate testing in all three dredge areas comprised testing of sixteen (16) selected sediment samples, as well as one replicate and one seawater blank. Elutriate TBT concentrations were determined in three (3) sediment samples from Dredge Area 3 (Berths 1 and 2) (i.e. samples SS3B and VC5E_0.6-0.8 from Berth 1 (both <0.1 ng/L) and sample VC5B_0.0-0.8 from Berth 2 (43 ng/L)).



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Dilution calculations were undertaken using the results for total sediment TBT concentrations and the elutriate TBT results to determine the potential bioavailability of dissolved TBT concentrations in the water column during sea disposal. The dilution modelling was undertaken using the physical, geochemical and elutriate properties of material from Dredge Area 1 only as a 'worst-case' scenario (**Appendix 1**).

The results of the numerical modelling for the 'worst-case' Dredge Area 1 were compared to the ANZECC/ARMCANZ (2000) trigger values for TBT at the 95% and 99% levels of species protection, i.e. 6 ng/L and 0.4 ng/L, respectively. The results of the numerical modelling indicate that after initial mixing over a four hour period (as allowed for in the NAGD), the maximum concentration of TBT at the Sydney Offshore Spoil Ground for all four dredging scenarios (a. backhoe loading a split hopper barge (with overflowing); b. backhoe loading a split hopper barge (no overflowing); c. trailer suction hopper dredging (with overflowing); d. trailer suction hopper dredging (no overflowing)) for the 'worst-case' Dredge Area 1 sediments would be ≤ 0.089 ng/L, which is substantially below the ANZECC/ARMCANZ (2000) trigger values at the 95% and 99% species protection levels. Based on the outcomes of the dilution modelling the concentrations of TBT in dredged sediments are unlikely to adversely affect water quality during the proposed disposal at the Sydney Offshore Spoil Ground.

A full report on the dilution modelling is included in Appendix 8 of the SAP Implementation Report for Dredge Areas 1-3 (**Appendix 1**).

WHOLE SEDIMENT AND ELUTRIATE TOXICITY TESTING

Following the statistical analysis of analytical results to determine the 95% UCL of the mean concentration of TBT, samples were selected for elutriate and toxicity testing based on a normalised TBT concentration of greater than the NAGD maximum level (70 μ g Sn/kg) and as close as possible to, or slightly higher than the 95% UCL of the mean TBT concentration (WorleyParsons, 2012) (**Appendix 1**).

The mean concentrations of TBT were substantially greater in Dredge Area 1 and Dredge Area 2 compared to Dredge Area 3 (Berths 1 and 2). Therefore whole sediment toxicity testing and elutriate toxicity testing was undertaken in samples from Dredge Areas 1 and 2 only (i.e. samples from locations VC4B and VC4C from Dredge Area 1 and sample SS4D from Dredge Area 2).

Whole-sediment toxicity testing was undertaken to determine if there is potential for *in situ* toxicity to benthic organisms following disposal of the dredged material. The toxicity testing of whole sediments that was undertaken assessed chronic effects (reproduction) to the epibenthic amphipod *Melita plumulosa*. The results indicated that all test sediments were considered to be non-toxic to the reproduction and survival of *M. plumulosa*.

Elutriate toxicity testing comprised a 48 hour larval development test using the rock oyster *Saccostrea commercialis*. Laboratory results of the elutriate toxicity tests indicated that there was no detectable



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toxicity to the bivalve embryos from the elutriate samples tested (WorleyParsons, 2012)
(**Appendix 1**).

2.2.3 Main Findings

Based on the previous chemical and ecotoxicological tests, sediments in Dredge Areas 1, 2 and 3 were considered to be suitable for unconfined ocean disposal at the designated Sydney Offshore Spoil Ground (WorleyParsons, 2012) (**Appendix 1**).



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3 DESCRIPTION OF DREDGING PROPOSAL

Since the completion of the previous sediment sampling and assessments reported in WorleyParsons (2012) (**Appendix 1**), the proposed berth width of fixed Berths 1 and 2 has been increased from 35 m to 138 m and from 35 m to 103 m, respectively, necessitating consideration for supplementary sediment sampling and analysis of dredged sediments in the berth areas exceeding 35 m berth width. Each berth will be dredged to a declared depth of -12.8 m CD. This will require dredging of both capital and maintenance dredge material.

The most recent hydrographic survey (SPC, 2011) was used to identify the areas, thickness and volume of dredge material in the expanded berth areas to a berth width of 138 m (Berth 1) and 103 m (Berth 2). The depth of dredging required and the areas of greatest sediment accumulation are shown in **Figure 2**.

The proposed widening of Berth 1 from 35 m to 138 m would result in an increase in the dredge sediment volume (including overdredging of 0.3 m) from 13,419 m³ to 58,918 m³ (i.e. an additional 45,499 m³). For Berth 2 an increase in width from 35 m to 103 m would result in an increase in dredge volume from 6,342 m³ to 14,505 m³ (i.e. an additional 8,163 m³). Due to this increase in dredge volume, additional sampling and assessment of sediments is required in Berths 1 and 2.



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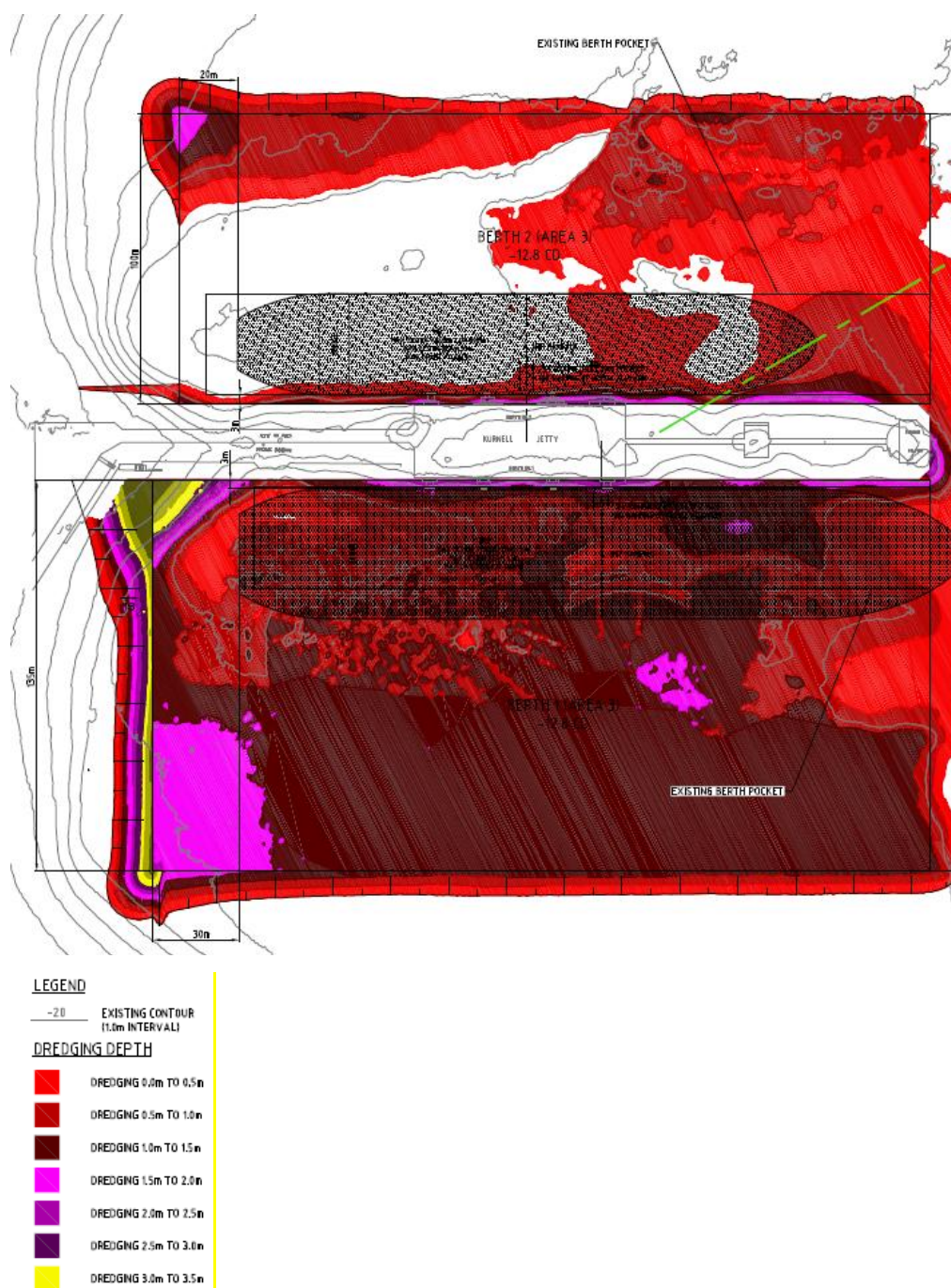


Figure 2. Areas and depths of proposed dredging in Dredge Area 3 (Berths 1 and 2).



4 SUPPLEMENTARY SEDIMENT SAMPLING AND ANALYSIS (DREDGE AREA 3 – BERTHS 1 AND 2)

4.1 Changes in Dredge Volumes in Berths 1 and 2

The proposed berth widening, from 35 m to 138 m for Berth 1 resulted in an increase in dredge material volume of 45,499 m³, the total being 58,918 m³ (including overdredging of 0.3 m). Due to this substantial increase in dredge volume, additional sampling and assessment of sediments is required in Berth 1 to assess the entire berth area. The increase in berth width from 35 m to 103 m in Berth 2 increases the dredge volume by 8,163 m³ to a total dredge volume of 14,505 m³ (including overdredging of 0.3 m), which is also a substantial increase in dredge volume that necessitates supplementary sediment sampling and assessment of sediments in Berth 2.

Therefore supplementary sediment sampling and analysis at fifteen (15) sample locations, covering a dredge volume of up to 75,000 m³ to the depth of dredging at -12.8 m CD (Table 6 of NAGD), will be undertaken in Berths 1 and 2. The additional geochemical data will supplement the existing geochemical data from eleven (11) sample locations in Berths 1 and 2 and exceed the minimum sampling requirements of the NAGD if Berths 1 and 2 are assessed as a single dredge area.

4.2 Rationale for Supplementary Sediment Sampling

For the purpose of the sediment assessment for sea disposal under the NAGD, Berths 1 and 2 are assessed as one single dredge area (Dredge Area 3), with a total dredge volume for both berths of 73,423 m³. This dredge volume requires sediment sampling and analysis at a total of fifteen (15) sample locations according to Table 6 of the NAGD. Previously, sediments from a total of eleven (11) sample locations (seven (7) sample locations in Berth 1 and four (4) sample locations in Berth 2) were sampled and analysed (WorleyParsons, 2012) (**Appendix 1**). Therefore the previous sediment sampling and assessment does not adequately cover the total proposed dredge volume of 73,423 m³. In addition, the expanded dredge footprint to a berth width of up to 138 m (Berth 1) and up to 103 m (Berth 2) has not been assessed by the previous sediment sampling investigations (WorleyParsons, 2012) (**Appendix 1**).

To allow for coverage of the additional proposed dredge area in Berths 1 and 2 to a berth width of 138 m and 103 m, respectively, sampling at an additional fifteen (15) locations (**Table 2**) will bring the total number of sample locations to twenty-six (26) discrete locations, which substantially exceeds the number required under the NAGD when the entire dredge footprint is considered as one dredge area (Dredge Area 3).

Table 2 shows the existing and additional number of sample locations in the expanded Dredge Area 3, following the proposed widening of the berths. Samples will be collected from twelve (12) additional sample locations in Berth 1 (locations C1 to C12) and from three (3) additional sample



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locations in Berth 2 (locations C13 to C15), which is approximately proportional to the respective dredge volumes in Berths 1 and 2 (ratio of about 4:1). Sampling will be undertaken using a piston corer or a vibrocorer, depending on the depth of penetration achieved using the piston corer and the overall coring depth that is required at each sample location.

Unlike in the previous sediment investigations (WorleyParsons, 2012) in which a judgmental sampling pattern was used to assign each sample location, the additional sample locations in Berths 1 and 2 have been assigned using a random sampling pattern that uses a regular grid pattern comprising of 20 m by 20 m squares that overlie the entire dredge area in each berth. Each grid square within the dredge area was numbered (181 grid squares in Berth 1 and 128 grid squares in Berth 2) and the fifteen (15) sample locations were selected using a random number generator. Twelve (12) sample locations were selected in Berth 1 and three (3) sample locations were selected in Berth 2.

Samples will be collected at the centre of each of the selected grid squares or, if the grid square is not entirely located within the dredge area, in the centre of the portion of the grid square that is contained within the dredge area. If sediment sampling cannot be undertaken at a designated sample location (e.g. due to hard or rocky substrate), alternative sample locations have been selected using the same random sample selection procedure. The sample location selection procedure is in accordance with guidance provided on page 61 in the NAGD.

While previously the sample locations in Berths 1 and 2 were chosen to target areas with maximum sediment accumulation above the design dredge levels, the supplementary sampling will ensure that the entire area of the expanded dredge footprint in Berths 1 and 2 is covered.

The proposed sample locations as well as previous sample locations in Berths 1 and 2 are shown in **Figure 3**. The coordinates (in MGA 94 – Zone 56) and the depth of sediment dredging to -12.8 m CD at each sample location is shown in **Table 3**.

Two (2) triplicate sample location will be selected from the fifteen (15) sample locations in Berths 1 and 2.



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Table 2. Number of Supplementary (New) and Previous Sample Locations in Dredge Area 3 (Berths 1 and 2)

Dredge Area	Total Estimated Dredge Volume (including 0.3 m overdredge) (m ³)	Total Number of Sample Locations	Minimum Required Sample Locations (Table 6 NAGD)
Combined Berths 1 and 2			
Previously assessed Dredge Area 3 (width: 35 m; -12.8 m CD) (WorleyParsons, 2012)	19,761	11 previous sample locations	8
Proposed Supplementary Sampling Berth 1 width: 138 m; Berth 2 width: 103 m (-12.8 m CD)	73,423 m ³ (additional 53,662 m ³)	15 new sample locations (12 in Berth 1; 3 in Berth 2)	15
Berth 1			
Previously assessed Berth 1 (width: 35 m; -12.8 m CD)	13,419 m ³	7 previous sample locations	7
Proposed Supplementary Sampling Berth 1 width: 138 m (-12.8 m CD)	58,918 m ³ (additional 45,499 m ³)	12 new sample locations (covering up to 138 m berth width)	14
Berth 2			
Previously assessed Berth 2 (width: 35 m; -12.8 m CD)	6,342 m ³	4 previous sample locations	6*
Proposed Supplementary Sampling Berth 2 width: 103 m (-12.8 m CD)	14,505 m ³ (additional 8,163 m ³)	3 new sample locations (covering up to 103 m berth width)	7*

*NAGD requirement if Berth 2 area was to be assessed as a separate dredge area. This is not the case in the current assessment, with Berths 1 and 2 being assessed as a single dredge area (Dredge Area 3).



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Table 3. Maximum Dredge Depths and Coordinates of Sample Locations in Berths 1 and 2.

Sample Location	Berth No.	Maximum Dredge Depth (m)	Maximum No. of Subsamples	Easting*	Northing*
C1	1	1.0-1.5	3	334687	6236283
C2	1	1.5-2.0	3	334727	6236262
C3	1	0.5-1.0	2	334681	6236336
C4	1	1.0-1.5	3	334747	6236335
C5	1	1.0-1.5	3	334761	6236328
C6	1	1.0-1.5	3	334748	6236368
C7	1	1.5-2.0	3	334756	6236415
C8	1	1.0-1.5	3	334821	6236414
C9	1	1.0-1.5	3	334796	6236462
C10	1	1.0-1.5	3	334849	6236434
C11	1	0.5-1.0	2	334776	6236488
C12	1	1.0-1.5	3	334836	6236474
C13	2	<0.5	1	334553	6236371
C14	2	0.5-1.0	2	334614	6236457
C15	2	<0.5	1	334681	6236522
Total Sample No			38		

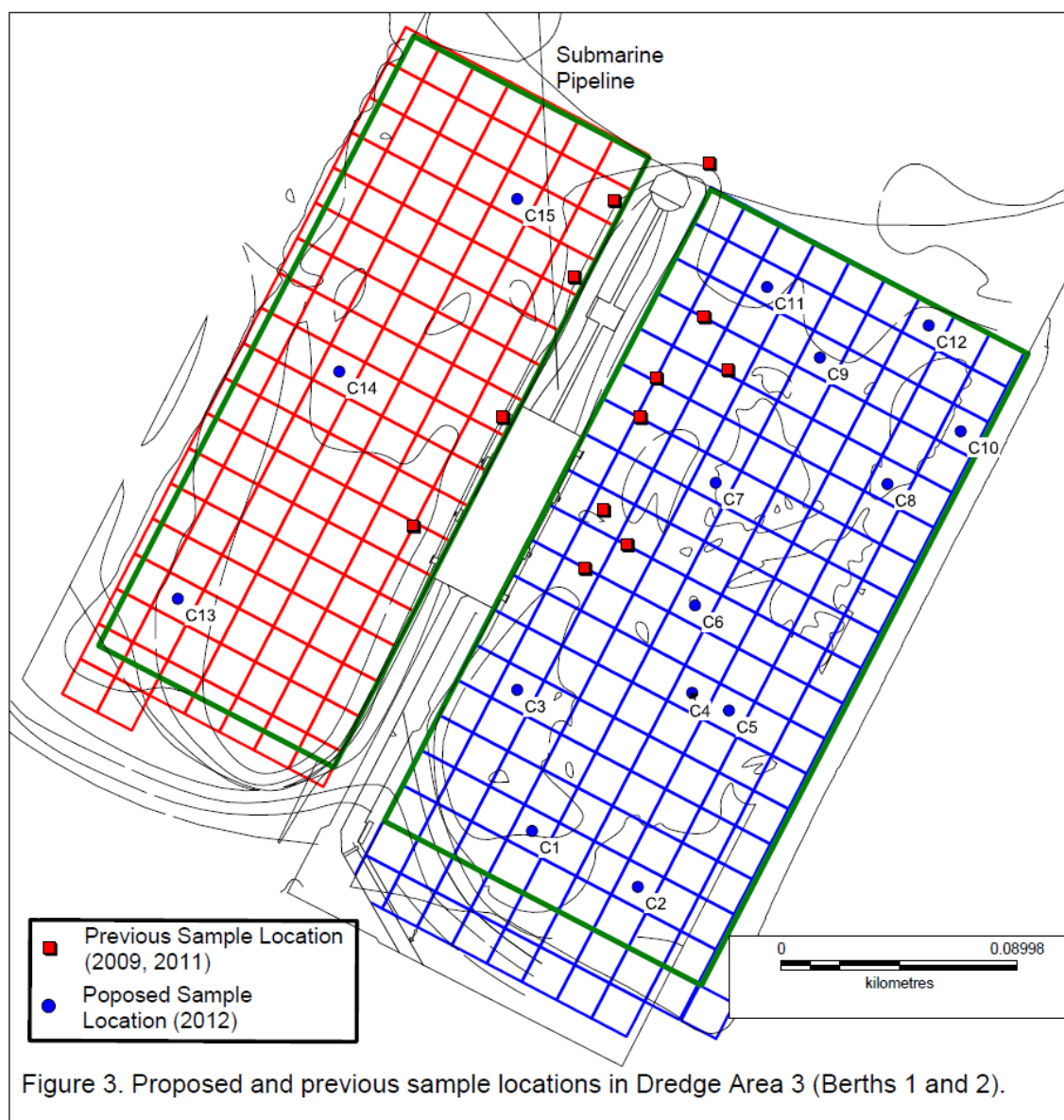
*All coordinates are in MGA94 (Zone 56)



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4.3 Sediment Coring

Geochemical Assessments Pty Ltd (GA) will be engaged to collect sediment cores using a vibrocorer and/or a piston push corer. The GA sampling vessel, a purpose built aluminium hull trailer boat (length: 5 m), will be used as a working platform for sediment core sampling and onboard sample processing.

Cores will be collected as close as possible to the proposed sample locations. A handheld GPS with an accuracy of +/-5 m will be used to record each sample location.

A log will be kept by WorleyParsons to record the sampling date, time, water depth, environmental conditions, sample location coordinates, depth of core penetration and other relevant data for each sample location. Prior to sampling, the vessel will be thoroughly inspected and washed down. Any evident sources of contamination will be cleaned and covered in plastic to avoid accidental contamination of sediment samples.

Sediment cores will be collected using a custom-fabricated piston push corer with 84 mm outer diameter (OD) polycarbonate core tubes, or a light weight vibrocorer with 50 mm or 84 mm OD steel or polycarbonate core tubes. Core catchers may be used to prevent sediment loss from the core barrel during sample retrieval. Cores will be driven to the depth of dredging (up to 2.5 m) or refusal. Wherever possible, the piston corer will be used to enable a time-efficient collection of sediment cores to the depth of dredging. If piston core refusal occurs in sandy sediment above the depth of dredging, the vibrocorer will be deployed to obtain a core sample to the depth of dredging or core refusal in consolidated clay or rock.

Multiple sediment cores will be collected at each sample location as required to provide sufficient volume of sediment for the required geochemical analyses.

A WorleyParsons environmental scientist (Dr Carsten Matthai) would determine the acceptability of the sediment core following collection. The criteria for acceptance of the core will include:

- No obvious loss of surficial sediment;
- The core must have entered the sediment profile vertically;
- There must be no visible disturbance or gaps in the sediment stratigraphy;
- The core must reach the depth of dredging or refusal at rock or dense sand or clay.

Cores at the fifteen (15) designated sample locations will be collected over two days of field sampling, assuming negligible interference from unscheduled shipping activities or severely adverse weather (see **Section 4.12** - Sampling Contingency Plans).



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In addition, field triplicates will be collected at two (2) sample locations, that is, three cores taken at the same sample location and at two separate locations (i.e. four additional cores). The triplicate samples will be used to give an indication of the variability in the chemical properties of the sediment at a sample location. As part of QA/QC procedures there will also be split triplicate samples from one sample location (5% of locations), i.e. a single homogenised sample from each sample interval split into three (3) containers with the third sample being sent to a second laboratory to assess variation associated with subsample handling. This is in accordance with NAGD requirements.

4.4 Sample Processing

All sample handling and processing will be performed to minimise contamination and sample mix-ups. The workspace on the sampling vessel will be washed down regularly with ambient seawater to clean all surfaces and minimize dust contamination of samples. New powder-free nitrile gloves will be worn by the sampler for the processing of each sample from each location. Subsampling will be undertaken using stainless steel implements that will be decontaminated between each sample using Decon90, followed by an ambient seawater rinse.

Piston cores and/or vibrocores will be extruded from the core tube and placed on a sampling tray for subsequent logging, photographing and subsampling.

A subsample will be collected at 0.5 m depth intervals in the top 1.0 m (i.e. 0.0-0.5 m and 0.5-1.0 m), followed by a composite sample from 1.0 m to the end of the core.

Sediment subsamples of entire cores, collected at 0.5 m intervals in the top 1.0 m and from 1.0 m to the end of the core will be collected and stored appropriately for elutriate and bioavailability testing, if required.

Samples for chemical analysis and possible elutriate testing will be homogenised and placed with zero headspace in appropriate sampling containers that are provided by the analytical laboratory. Samples for physical testing (Particle Size Distributions (PSD) analysis) will be placed in plastic ziplock bags.

Sample identifiers will include the sample location and the depth interval. For example, C1_0.0-0.5 indicates that the sediment sample was collected from sample location C1 over the interval from 0.0 m to 0.5 m. Triplicate samples will be labelled with the prefix "T" and suffix A, B, or C (e.g. T01A). QA/QC samples will be numbered consecutively (i.e. QC1, QC2, etc.) with the type of the QA/QC sample and the key for the primary sample it relates to being recorded on a separate QA/QC identification log sheet that will not be revealed to the analytical laboratory.

The following sediment volumes will be retained from each subsample, where relevant, for the different analyses required:



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- One 500 ml, one 250 ml, and one 150 ml glass jar for analysis of metals, PAHs, TPHs, TBT, TOC (all samples) and possible elutriate and bioavailability analysis; and
- One 250 ml ziplock bag for PSD analysis (50% of primary samples only).

4.5 Sample Preservation, Shipment and Analysis

Samples for geochemical analysis will be packed in ice in an esky immediately after sampling to maintain the temperature below 4°C. Samples for physical analysis will be stored at ambient temperatures. Samples will then be submitted to the following NATA-accredited analytical laboratories on the same day, or the following morning, under WorleyParsons Chain-of-Custody (CoC) protocols:

- ALS Laboratory Group (ALS) for primary physical and chemical testing; and
- Advanced Analytical Australia (AAA) for secondary chemical testing of split duplicates (via ALS under CoC protocol).

WorleyParsons will coordinate the analysis of the samples. Samples for possible elutriate and bioavailability analyses will be archived in refrigerated storage by the analytical laboratory. Elutriate and bioavailability analyses (including 20% replicate samples), if required, would be undertaken by ALS.

Given that the analytical holding times for sediment and elutriate samples, as specified in the NAGD, are 14 days or longer for all chemical analytes included in the supplementary sediment investigation, a submission of sediment samples within 24 hours of sampling is not critical, provided the samples are chilled and kept in the dark.

4.6 Analysis Schedule

The primary laboratory selected to undertake the chemical testing is the NATA registered ALS Laboratory Group (ALS). Split triplicate inter-laboratory samples will be submitted to a secondary laboratory, the NATA registered Advanced Analytical Australia (AAA) laboratory. The contaminants and the detection limit of the proposed analytical methods are outlined in the following sections and summarized in **Table 4**.



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Table 4. Chemical Analytes for Supplementary Sediment Sampling

Test Parameter	PQL	units	Lab Method	NAGD Screening Level
Silver (Ag)	0.1	mg/kg	USEPA 6020	1
Cadmium (Cd)	0.1	mg/kg	USEPA 6020	1.5
Selenium (Se)	0.1	mg/kg	USEPA 6020	--
Cobalt (Co)	0.5	mg/kg	USEPA 6020	--
Antimony (Sb)	0.5	mg/kg	USEPA 6020	2
Copper (Cu)	1	mg/kg	USEPA 6020	65
Lead (Pb)	1	mg/kg	USEPA 6020	50
Zinc (Zn)	1	mg/kg	USEPA 6020	200
Chromium (Cr)	1	mg/kg	USEPA 6020	80
Nickel (Ni)	1	mg/kg	USEPA 6020	21
Arsenic (As)	1	mg/kg	USEPA 6020	20
Vanadium (V)	2	mg/kg	USEPA 6020	--
Manganese (Mn)	10	mg/kg	USEPA 6020	--
Mercury (Hg)	0.01	mg/kg	APHA 3112 Hg-B	0.15
PAHs (each individual species)	4-5 ¹	µg/kg	USEPA 3640/8270	10,000
TBT	0.5	µg/kg	In-House GC/MS	9
TOC	0.02%		In house/Leco	--

Notes

1. The laboratory will strive to reach this PQL but previous sampling and testing indicates that matrix interference may prevent the laboratory reaching this very low detection limit.
2. All primary and QA/QC sediment samples will be analysed for all analytes.

4.6.1 Chemical Analysis

TBT has been identified as a contaminant of potential concern based on a review of recent geochemical data for Dredge Area 3 (Berths 1 and 2) (**Section 2.2**) and the surrounding Dredge Areas 1 and 2 (WorleyParsons, 2012) (**Appendix 1**). Therefore TBT is also a contaminant of potential concern for the sampling of sediments in the expanded berth area to a width of 138 m in Berth 1 and up to 103 m in Berth 2. TBT analyses will be undertaken for all sediment samples to be collected in the supplementary sediment sampling program in Dredge Area 3 (Berths 1 and 2), including QA/QC samples.

In addition, there were exceedances of NAGD Screening levels for Hg, Pb and Zn in at least one sediment sample collected previously in Dredge Area 3 (Berths 1 and 2) (**Table 1**). Therefore trace metals (Ag, As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Se, V, Zn) will be included in the analysis of all sediment samples, including QA/QC samples to be collected in the supplementary sampling of sediments in Dredge Area 3 (Berths 1 and 2).



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While the concentrations of PAHs in sediments in Dredge Area 3 (Berths 1 and 2) were below the NAGD Screening Levels in all sediment samples analysed, PAHs were present at concentrations above the analytical limits of reporting (LOR) in all sediment samples that were analysed for PAHs in Berths 1 and 2. Therefore an analysis of PAHs will be undertaken for all sediment samples collected in the expanded dredge area of Berth 1, including QA/QC samples.

In contrast, the concentrations of, BTEX, TPHs, OCPs, OPPs and PCB's in sediment samples collected previously in Berths 1 and 2 were generally low or below the LOR (WorleyParsons, 2012) (**Appendix 1**). Therefore these analytes are not included in the supplementary sediment sampling program outlined in this Supplementary SAP.

Total organic carbon (TOC) contents in all sediment samples will be determined to enable a normalization of the organic contaminant concentrations (i.e. TBT, PAHs) to 1% TOC, in accordance with the guidance provided by the NAGD.

The analytes and their detection limits in the supplementary sediment sampling and analysis program are listed in **Table 4**.

The results of the chemical analysis will be combined with data obtained from the previous sediment sampling and analysis programs (WorleyParsons, 2012). The 95% UCL of the mean concentration of each contaminant will be calculated and compared to the NAGD screening levels to assess the requirement for further testing (i.e. elutriate and bioavailability).

4.6.2 Physical Analysis

Fifty per cent of primary sediment samples (i.e. up to nineteen (19) samples from the fifteen (15) sample locations) obtained in Berths 1 and 2 will be analysed for particle size distributions (PSD) to provide an indication of the physical characteristics of the proposed dredge material in the expanded berth area. Physical testing will comprise a determination of PSD by wet sieving, using geological size fractions (including a 75 µm cut-off to enable comparison with previous PSD data), and a determination of the fine fraction content in accordance with Table 1 of NAGD (hydrometer) to determine clay (<4 µm) and silt (4 to 63 µm) fraction contents. Particle size analyses will be undertaken by the ALS Environmental laboratory in Newcastle.

4.7 Total Number of Supplementary Samples in Dredge Area 3

The number of subsamples per core, from the fifteen (15) sample locations in Dredge Area 1 (Berths 1 and 2) (including two triplicate sample locations), will be up to three (3), with sample intervals of 0.0-0.5 m, 0.5-1.0 m and 1.0 m to the end of the core (less than 2.5 m core length). The maximum number of sediment subsamples, including QA/QC samples, is up to 54 (**Table 5**).

Sediment samples will not be analysed for volatile contaminants (i.e. BTEX) and the field blank sample, which comprises clean sand, will be analysed for trace metals only.



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Table 5. Maximum Number of Sediment Samples in Supplementary Sediment Sampling and Analysis of Dredge Area 3 (Berths 1 and 2)

Sample Type	Number of Subsamples
Dredge Area 3 (Berths 1 and 2): Primary piston push core or vibrocore subsamples (21 core locations with up to 3 subsamples per core)	up to 38
Two Field Triplicates (10% of locations - 2 core locations: 4 additional cores with up to two samples per core)	up to 8
Split Triplicate and Interlaboratory samples (5% of locations – 1 location; up to 2 subsamples x 3 triplicates)	up to 6 (including 2 interlaboratory samples)
Interbatch samples (1 batch only)	Nil
Daily Field Blank (metals analyses only)	2
Total*	up to 54*

*Excludes elutriate and bioavailability sample analyses (to be confirmed following Phase II sediment testing)

4.8 Requirements for Additional Sampling and Testing

The results of the chemical analyses of sediments would be combined with the geochemical data obtained in the previous investigations of Dredge Area 3 (Berths 1 and 2) (WorleyParsons, 2012) (Table 1). The 95% UCL of the mean concentration of each chemical in the combined data for Dredge Area 3 (Berths 1 and 2) would be calculated and compared to the NAGD screening levels.

Elutriate, bioavailability and toxicity testing was previously undertaken in accordance with the NAGD decision-tree approach for assessing potential contaminants. Results from the three previous sediment investigations are documented in the SAP Implementation Report (WorleyParsons, 2012) (Appendix 1).

4.8.1 Elutriate and Bioavailability Testing

Provided that the 95% UCL of the mean concentration of the combined data, is consistent with the results from the previous investigations, it may not be required to undertake further elutriate or bioavailability testing in Dredge Area 3. However, TBT has shown to be a contaminant of potential concern for which elutriate testing was previously required (WorleyParsons, 2012). The results of the combined data for TBT elutriate concentrations from the three previous investigations indicated that the concentration of elutriate TBT exceed the ANZECC/ARMCANZ (2000) water quality guideline value of 6 ng/L.



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It is therefore recommended to obtain additional sediment samples to undertake up to four (4) elutriate and bioavailability analyses (plus one replicate sample analysis) for contaminants of potential concern, if required. Elutriate analysis will be required if the 95% UCL of the mean concentrations of TBT in sediments in Dredge Area 3 exceed the NAGD Screening Level, using the combined data for the previous and the supplementary sediment investigations.

Ambient seawater from Dredge Area 3 for possible use in elutriate analysis will be collected in a triple-rinsed 20 L plastic carboy at the time of sediment sampling.

4.8.2 Toxicity Testing

Whole sediment toxicity testing and elutriate toxicity testing undertaken during the previous sediment investigation (WorleyParsons, 2012) are considered to be the most sensitive tests currently available, and indicated that the sediments in the Dredge Areas were non-toxic. Therefore it is not recommended that further ecotoxicological tests be undertaken in the proposed supplementary sediment investigation.

4.8.3 Acid Sulfate Soil Testing

Acid sulfate soils testing in previous sediment investigations indicated that the net acidity of some samples in Dredge Areas 2 and 3 exceeded the action criteria provided in the Acid Sulfate Soils Manual (ASSM). Previous sediment investigations have identified low net acidity in four sediment samples collected from Dredge Area 1 (WorleyParsons, 2012). If the ASSM action criteria are exceeded, an Acid Sulfate Soil Management Plan (ASSMP) will be required if the proposed works are expected to result in the oxidation of this dredged material during removal, transportation, reuse or disposal. Oxidation will only occur if the material is disposed of on land and for the proposed offshore disposal an ASSMP will therefore not be required. As the proposed disposal method (offshore disposal in the Sydney Offshore Spoil Ground) will not trigger a requirement for an ASSMP, no additional acid sulphate soil testing will be undertaken.

4.8.4 Other NAGD Phase IV Testing

Additional elements of testing that may be required under the NAGD, such bioaccumulation testing (Phase IV in NAGD), have not been included in the proposed sediment sampling and assessment outlined in this Supplementary SAP, as they are subject to the analysis of results from elutriate contaminant concentration testing. Additional testing requirements would be assessed as part of an additional Phase IV sampling and analysis program, if required.

4.8.5 Additional Sampling of Sediments in Dredge Area 1 (Swing Basin)

A northeastward moving of the Swing Basin by about 50 m, additional dredging to the east of the swing basin as part of Caltex' planned berth development, and a resulting readjustment of the



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boundary for Dredge Area 1 resulted in a slight change in the dredge volume from the previously assessed 58,450 m³ to 58,812 m³ (i.e. an additional 362 m³). This does not require additional sampling and assessment of sediments in Dredge Area 1, as previous sampling and assessment was undertaken at nineteen (19) sample locations within Dredge Area 1. This substantially exceeds the minimum sampling requirement for the assessment of the dredge volume for this area (i.e. only 14 sample locations are required for a dredge volume of 58,812 m³).



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4.9 Data Management Procedure

Statistical analysis and tabulation of data will be undertaken following data validation. Data management of the analysis results will be in accordance with the requirements of the NAGD. Validation of data will include evaluating the results from laboratory blanks, standard samples, field triplicate samples and split triplicate samples.

4.10 Equipment List

The following equipment will be required to undertake the supplementary sediment sampling program:

- Handheld differential GPS;
- Sampling vessel (length: 5 m) (owned and operated by Geochemical Assessments);
- Light-weight vibrocorer;
- 50 mm stainless steel core tubes (vibrocoring) and 84 mm polycarbonate core tubes (piston coring), with stainless steel core catcher (if required);
- Tray table for subsampling;
- Stainless steel piston push corer (custom-fabricated);
- Core extrusion devices;
- Core catchers and core caps;
- Digital camera;
- Measuring tape;
- Deck wash;
- Eskies and ice;
- Decontamination equipment (Decon 90, brushes, buckets);
- Laboratory-supplied sample containers and zip-lock bags;
- Sampling trays, stainless steel mixing bowls and subsampling equipment, spoons;
- Permanent markers and other stationary;
- Chain-of-Custody (CoC) forms;



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- Log book and logging sheets; and
- Personal protection equipment (weather protection, hats, nitrile powder-free gloves, steel capped boots, appropriate work clothes).

An experienced environmental scientist, Dr Carsten Matthai, from WorleyParsons will coordinate the sampling program and assist GA in carrying out the sampling. GA personnel will operate the sampling vessel, vibrocorer and piston push corer and undertake the core extraction with the assistance of GA technical staff.

4.11 Health and Safety Precautions

The sampling program will adhere to HSE systems of WorleyParsons, Caltex and Geochemical Assessments and Safe Work Method Statements (SWMS) for the proposed works prepared by GA. Prior to the commencement of fieldwork involving coring, Caltex would provide authorization to undertake the proposed sampling and analysis program to confirm that no underwater services are present at the proposed sample locations.

4.12 Sampling Contingency Plans

4.12.1 Adverse Weather

The proposed sampling would be undertaken in the relatively protected waters of Botany Bay. In the case of predicted severe weather, sampling would be discontinued and rescheduled. The sampling program will be completed over two days, however a longer sampling period may result from inclement weather. WorleyParsons believe that there are no unacceptable OH&S risks to personnel working in rain and they anticipate continue working during calm, wet weather. If adverse weather makes sampling unacceptable due to high winds or waves, the sampling team, coring subcontractor and vessel operator would remain on stand-by.

4.12.2 Equipment Failure

Equipment used on the sampling program is highly specialized but many replacement parts for the vibrocorer and piston push corer would be provided on standby by the subcontractor. Repairs to critical equipment would be undertaken as soon as practicable, although equipment failure would result in a delay to sample collection.

4.12.3 Shipping Operations

Sampling may be delayed due to operational requirements of the Caltex berths, including shipping movements during the period of sampling or during the mobilization period.



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In the event of delays due to the above issues, the sampling would be recommenced following the provision of access to the berths and access channel, improvement in the weather or fixing of the equipment.



5 QA/QC PROCEDURES

5.1 Field QA/QC Procedures

Field QA/QC procedures will include the following:

- **Sample Location:** A handheld GPS position fixing system with an accuracy of +/-5 m will be used to locate each sample location;
- **Decontamination of Sampling Equipment:** Prior to use, the survey vessel will be thoroughly inspected and washed down. Any evident sources of contamination will be cleaned and covered in plastic to avoid accidental contamination of any samples. All surfaces used for sample handling will also be covered in plastic sheeting prior to subsampling. All sampling equipment that may come into contact with the sediment samples will be decontaminated using Decon 90 prior to each sampling event;
- **Field triplicates:** Triplicate samples will be analysed and used to assess the variability in the chemical analytes in the sediment at two (2) sample locations (comprising up to three core subsamples per core taken from two triplicate sample locations – i.e. 2 locations x 3 cores x up to 2 samples = up to 12 samples);
- **Field Documentation:** Each sample location will be numbered on a sampling plan in the field logbook. All other observations including weather, time, date of sampling, water depth, and depth of core penetration will be noted in the field logbook. Time, date, and appearance of the sediments (e.g. texture, colour, odour) will also be reported in the field logbook during sub-sampling;
- **Cross Contamination:** Each sample jar will be washed with seawater following subsampling to remove sediment on the outside of the sample containers and to minimize cross-contamination;
- **Split triplicates:** At one sample location three split triplicate samples will be taken (i.e. up to 2 subsamples x 3 triplicates = up to 6 samples) with two of each of the core subsamples submitted to the primary laboratory, and a third of the core subsamples submitted to the secondary laboratory for geochemical analysis. The split results will be analysed to assess variability in sub-sampling; and
- **Sample Control:** Each sample will have a unique identification number that will be recorded in the field log book, and the Chain-of-Custody (CoC) form. A CoC form will accompany the sediment samples at all times, and will include the analysis required for each sample and each laboratory.



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5.2 Laboratory QA/QC Procedures

Laboratory QA/QC procedures for the geochemical analyses will include the following:

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



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6 REPORTING (SUPPLEMENTARY SAP IMPLEMENTATION REPORT)

The findings of the supplementary sediment sampling and analysis investigation will be in accordance with the Supplementary SAP and documented in a Supplementary SAP Implementation Report, which will include a synthesis of the analytical data obtained for Dredge Area 3 (Berths 1 and 2) from the previous sediment investigations in 2009 and 2011 (WorleyParsons, 2012) (**Appendix 1**) and the supplementary sediment investigation. The SAP Implementation Report will assess sediments to be dredged in the expanded Dredge Area 3 (138 m berth width in Berth 1 and 103 m berth width in Berth 2) against the criteria set out in the NAGD.

The Supplementary SAP Implementation Report will provide a summary of the total sampling and analysis work undertaken in Dredge Area 3, and provide a classification of the suitability of sediments in Dredge Area 3 for offshore disposal under the NAGD. The Report will also detail the sampling and analysis work completed and present an assessment of the results, including the following:

- Summary of the Supplementary SAP, or Supplementary SAP appended to report;
- A description of the sampling carried out, along with the actual sample locations, sample numbers (including replicate and QA samples), completed CoC forms, field logs and descriptions of the sediments;
- A description of any problems encountered or deviations from the procedures set out in the SAP (including justifications for deviations);
- Normalization of results for organic analytes to 1% TOC (within a range of 0.2-10%);
- Comparison of the 95% UCL of mean chemical concentrations of sediment in Dredge Area 3 with NAGD Screening Levels;
- Reporting of all QA/QC data;
- Presentation and review of the results, including QA/QC assessment of field and laboratory data, comparison to data quality objectives and data validation;
- Conclusions as to the acceptability or unacceptability of the dredge material in Dredge Area 3 for open water disposal and/or recommendations as to further work required;
- Classification of sediment in Dredge Area 3 as acceptable (or otherwise) for unconfined ocean disposal, based on the previous and supplementary sediment assessments;
- Assessment of sediment toxicity may be recommended and separately reported, as it is not included in the supplementary sediment assessment, and if sediment is classified unsuitable for unconfined sea disposal, following NAGD Phase III assessments; and



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- Appendices, including all laboratory and field data.



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7 REFERENCES

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Appendix 1 WP (2012) Caltex Dredging. Sediment Sampling And Analysis Plan Implementation Report – Final Report (Dredge Areas 1-3)

Supplied Under Separate Cover (Attached CD)



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Appendix 4 Coordinates of Sample Locations (MGA94, Zone 56)

Dredge Area	Sampling Month	Sampling Date	Site	Easting	Northing	Notes:
Area 1	Nov-09	16/11/2009	VC1A	334913	6236845	
Area 1	Mar-10	5/05/2010	VC4B	334913	6236845	repeat location
Area 1	Nov-09	18/11/2009	VC1B	334961	6237004	
Area 1	Mar-10	5/05/2010	SS4E	334961	6237004	repeat location
Area 1	Nov-09	18/11/2009	SS1A	334990	6236845	
Area 1	Nov-09	18/11/2009	SS1B	335043	6236927	
Area 1	Nov-09	17/11/2009	SS1C	334979	6236957	
Area 1	Nov-09	17/11/2009	SS1D	334976	6237063	
Area 1	Mar-10	5/05/2010	SS4A	334719	6237227	
Area 1	Mar-10	5/05/2010	SS4F	334706	6236820	
Area 1	Mar-10	5/05/2010	SS4G	334751	6236724	
Area 1	Mar-10	3/05/2010	SS4H	334643	6236668	
Area 1	Mar-10	3/05/2010	SS4I	334805	6236632	
Area 1	Mar-10	3/05/2010	SS4J	334956	6236600	
Area 1	Mar-10	3/05/2010	VC4C	334715	6236704	
Area 1	Mar-10	3/05/2010	VC4D	334903	6236607	
Area 1	Nov-11	17/11/2011	VC5A	334754	6236535	
Area 1	Nov-11	17/11/2011	SS5A	334786	6237329	
Area 1	Nov-11	17/11/2011	SS5B	334771	6237281	
Area 1	Nov-11	17/11/2011	SS5C	334929	6237192	
Area 1	Nov-11	17/11/2011	SS5D	334683	6236802	
Area 2	Nov-09	17/11/2009	VC2B	334653	6237038	
Area 2	Mar-10	5/05/2010	VC4A	334653	6237038	repeat location
Area 2	Nov-09	17/11/2009	SS2C	334767	6237070	
Area 2	Mar-10	5/05/2010	SS4B	334767	6237070	repeat location
Area 2	Nov-09	17/11/2009	SS2D	334721	6237060	
Area 2	Mar-10	5/05/2010	SS4C	334721	6237060	repeat location
Area 2	Nov-09	16/11/2009	VC2A	334575	6237068	
Area 2	Nov-09	17/11/2009	SS2A	334586	6237173	
Area 2	Nov-09	17/11/2009	SS2B	334696	6237128	
Area 2	Mar-10	5/05/2010	SS4D	334681	6237016	
Area 3	Nov-09	16/11/2009	VC3A	334703	6236492	
Area 3	Nov-09	16/11/2009	VC3B	334718	6236521	
Area 3	Nov-09	16/11/2009	SS3A	334642	6236398	
Area 3	Nov-09	16/11/2009	SS3B	334714	6236404	
Area 3	Nov-09	16/11/2009	SS3C	334728	6236439	
Area 3	Nov-09	16/11/2009	SS3D	334752	6236477	
Area 3	Nov-11	17/11/2011	SS5E	334761	6236457	
Area 3	Nov-11	17/11/2011	VC5B	334676	6236439	
Area 3	Nov-11	17/11/2011	VC5C	334734	6236454	
Area 3	Nov-11	17/11/2011	VC5D	334723	6236391	
Area 3	Nov-11	17/11/2011	VC5E	334707	6236382	
Area 3	Aug-13	15/08/2011	C1	334687	6236283	
Area 3	Aug-13	15/08/2011	C2	334727	6236262	
Area 3	Aug-13	14/08/2011	C3	334681	6236336	
Area 3	Aug-13	14/08/2011	C4	334747	6236335	
Area 3	Aug-13	14/08/2011	C5	334761	6236328	
Area 3	Aug-13	14/08/2011	C6	334748	6236368	
Area 3	Aug-13	14/08/2011	C7	334756	6236415	
Area 3	Aug-13	15/08/2011	C8	334821	6236414	
Area 3	Aug-13	15/08/2011	C9	334796	6236462	
Area 3	Aug-13	15/08/2011	C10	334849	6236434	
Area 3	Aug-13	16/08/2011	C11	334776	6236488	
Area 3	Aug-13	15/08/2011	C12	334836	6236474	
Area 3	Aug-13	14/08/2011	C13	334553	6236371	
Area 3	Aug-13	16/08/2011	C14	334614	6236457	
Area 3	Aug-13	16/08/2011	C15	334681	6236522	
Area 3	Aug-13	16/08/2011	C18	334840	6236380	

All coordinates in MGA94 (Zone 56)



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SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

Appendix 5 Core Logs

	Area 1- Approaches						Area 2 - Sub berth						Area 3 - Fixed Berths					
Depth (m)	SS1A	SS1B	SS1C	SS1D	VC1A	VC1B	SS2A	SS2B	SS2C	SS2D	VC2B	VC2A	SS3A	SS3B	SS3C	SS3D	VC3B	VC3A
0	Brown sand	Grey sand	Yellow Sand	Yellow/brown sand	Brown/grey silty sand	Brown Sand	Brown sand	Silty brown sand	Grey sand	Brown sand	Grey sand	Grey sand	Gritty grey sand	Dark brown silty sand	Dark brown silty sand	Light grey sand	Grey sand	Dark grey sand
0.1																		
0.2																		
0.3																		
0.4																		
0.5																		
0.6					Grey silty sand						Dark grey silty sand	Grey sand					core refusal	Grey gritty sand
0.4																		
0.8																		
0.9																		
1																		
1.1																		
1.2												Dark brown sand						
1.3																		
1.4																		
1.5																		
1.6																		
1.7					core loss													
1.8						core loss												
1.9																		
2																		
2.1												Light grey sand						Coarse shelly grey sand
2.2																		
2.3																		
2.4																		
2.5																		
2.6												Grey sand						



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VIBROCORE # SS4A

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex berths/ approaches Botany Bay
JOB NUMBER:	301015-02448

DATE COLLECTED:	5/03/2010
DATE LOGGED	
LOGGED BY:	OM
CHECKED BY:	AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 mm	Easting: 334719	Water depth:
Equipment: Diver collected surface core	(ID): 96 mm	Northing: 6237227	Datum: WGS84

[illegible]

VIBROCORE # SS4B
SHEET 1 of 1

DATE COLLECTED:	5/03/2010
DATE LOGGED	
LOGGED BY:	OM
CHECKED BY:	AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 mm	Easting: 334767	Water depth:
Equipment: Diver collected surface core	(ID): 96 mm	Northing: 6237070	Datum: WGS84

[illegible]



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VIBROCORE # SS4C

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex berths/ approaches Botany Bay
JOB NUMBER:	301015-02448

DATE COLLECTED: 5/03/2010

DATE LOGGED

LOGGED BY: OM

CHECKED BY: AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 mm	Easting: 334721	Water depth:
Equipment: Diver collected surface core	(ID): 96 mm	Northing: 6237060	Datum: WGS84

Diver collected surface cores											
Method	Depth below bed level (m)	Geological Unit Classification Symbol	Material Description	% Recovery	Density/Consistency	Sample/ Test		Lab Results			Field Records/Comments
						PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)	
	0.5		Fine to medium grained yellow/ light grey sand. Some small mud balls				TBT, TOC				
	1										
	2										
	3										
	4										



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VIBROCORE # SS4D

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex berths/ approaches Botany Bay
JOB NUMBER:	301015-02448

DATE COLLECTED:	5/03/2010
DATE LOGGED	
LOGGED BY:	OM
CHECKED BY:	AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 mm	Easting: 334681	Water depth:
Equipment: Diver collected surface core	(ID): 96 mm	Northing: 6237016	Datum: WGS84

Geological Unit Classification Symbol													Material Description													% Recovery													Density/ Consistency													Sample/ Test													Lab Results													Field Records/Comments																																										
Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description													% Recovery													Density/ Consistency													Sample/ Test													Lab Results													Field Records/Comments																																																			
Diver collected surface cores	0.5			Fine to medium grained yellow/ light grey sand. Some small mud balls ~ 10cm in diameter																																							PSD													Geochem													% Fines (< 75µm)													% Sand (>75µm)													% Gravel (> 2mm)																									
				Core terminated at 0.5m																																																																																																																				

VIBROCORE # SS4E
SHEET 1 of 1

DATE COLLECTED:	5/03/2010
DATE LOGGED	
LOGGED BY:	OM
CHECKED BY:	AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 mm	Easting: 334961	Water depth:
Equipment: Diver collected surface core	(ID): 96 mm	Northing: 6237004	Datum: WGS84

Geological Data Form - Core Log												
Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)	
Diver collected surface cores	0.5 1 2 3 4			Fine to medium grained yellow sand Core terminated at 0.5m				TBT, TOC				



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VIBROCORE # SS4F

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex berths/ approaches Botany Bay
JOB NUMBER:	301015-02448

DATE COLLECTED:	5/03/2010
DATE LOGGED	
LOGGED BY:	OM
CHECKED BY:	AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 m	Easting: 334706	Water depth:
Equipment: Diver collected surface core	(ID): 96 mm	Northing: 6236820	Datum: WGS84

[illegible]



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VIBROCORE # SS4G

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex berths/ approaches Botany Bay
JOB NUMBER:	301015-02448

DATE COLLECTED:	5/03/2011
DATE LOGGED	
LOGGED BY:	OM
CHECKED BY:	AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 mm	Easting: 334751	Water depth:
Equipment: Diver collected surface core	(ID): 96 mm	Northing: 6236724	Datum: WGS84

Figure 1: Diver collected surface cores													Figure 2: 60 mm coring													Datum: 1988												
Method	Depth below bed level (m)	Geological Unit Classification Symbol	Material Description	% Recovery	Density/Consistency	Sample/ Test		Lab Results				Field Records/Comments																										
						PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)																												
Diver collected surface cores	0.5		Grey sand. Fine to medium grained with some mud balls				TBT, TOC, PAH's, metals					Field Triplicates (SS4GX, Y and Z)																										
			Core terminated at 0.5m																																			



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VIBROCORE # SS4H

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex berths/ approaches Botany Bay
JOB NUMBER:	301015-02448

DATE COLLECTED:	4/03/2010
DATE LOGGED	
LOGGED BY:	OM
CHECKED BY:	AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 mm	Easting: 334643	Water depth:
Equipment: Diver collected surface core	(ID): 96 mm	Northing: 6236668	Datum: WGS84

Figure 1: Diver collected surface cores													Figure 2: Diver collected surface cores													Figure 3: Diver collected surface cores													Figure 4: Diver collected surface cores												
Method	Depth below bed level (m)	Geological Unit Classification Symbol	Material Description	% Recovery	Density/Consistency	Sample/ Test		Lab Results				Field Records/Comments																																							
						PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)																																									
Diver collected surface cores	0.5		Dark grey muddy sand at surface overlying grey to light grey/yellow medium grained sand				TBT, TOC, PAH's, metals																																												
	1		Core terminated at 0.5m																																																
	2																																																		
	3																																																		
	4																																																		



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VIBROCORE # SS4I

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex berths/ approaches Botany Bay
JOB NUMBER:	301015-02448

DATE COLLECTED:
DATE LOGGED
LOGGED BY: OM
CHECKED BY: AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 mm	Easting: 334805	Water depth:
Equipment: Diver collected surface core	(ID): 96 mm	Northing: 6236632	Datum: WGS84

Project Information: [Project Name] [Location] [Date]												
Core Identification: [Core ID] [Depth Range] [Recovery %]												
Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)	
Diver collected surface cores	0.5 1 2 3 4			Grey to light grey sand, medium grained Core terminated at 0.5m				TBT, TOC, PAH's, Metals, OCP's, PCB's, BTEX, TPH's				



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VIBROCORE # SS4J

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex berths/ approaches Botany Bay
JOB NUMBER:	301015-02448

DATE COLLECTED:	4/03/2010
DATE LOGGED	
LOGGED BY:	OM
CHECKED BY:	AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 mm	Easting: 334956	Water depth:
Equipment: Diver collected surface core	(ID): 96 mm	Northing: 6236600	Datum: WGS84

Diver collected surface cores														Diver collected surface cores													
Method	Depth below bed level (m)	Geological Unit	Classification Symbol	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results				Field Records/Comments														
							PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)																
Diver collected surface cores	0.5			Grey/ yellow medium grained sand				TBT, TOC, PAH's, metals						Split triplicates ST1 and ST2 for TBT, TOC, metals and PAHs													
				Core terminated at 0.5m																							



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VIBROCORE # VC4A

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex berths/ approaches Botany Bay
JOB NUMBER:	301015-02448

DATE COLLECTED:	5/03/2010
DATE LOGGED	
LOGGED BY:	OM
CHECKED BY:	AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 mm	Easting: 334653	Water depth:
Equipment: Rossfelder vibrocorer	(ID): 96 mm	Northing: 6237038	Datum: WGS84

[illegible]



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VIBROCORE # VC4B

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex berths/ approaches Botany Bay
JOB NUMBER:	301015-02448

DATE COLLECTED:	5/03/2010
DATE LOGGED	
LOGGED BY:	OM
CHECKED BY:	AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 m	Easting: 334913	Water depth:
Equipment: Rossfelder vibrocorer	(ID): 96 mm	Northing: 6236845	Datum: WGS84

[illegible]



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VIBROCORE # VC4D

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex berths/ approaches Botany Bay
JOB NUMBER:	301015-02448

DATE COLLECTED:	4/03/2010
DATE LOGGED	
LOGGED BY:	OM
CHECKED BY:	AW

Contractor: McLennans Diving Service	Core diameter (OD): 100 mm	Eastings: 334903	Water depth:
Equipment: Rossfelder vibrocorer	(ID): 96 mm	Northings: 6236607	Datum: WGS84

[illegible]

LOG SHEET

Job: Caltex Dredging
Job Number: 301015-02448
Client: Caltex Refineries NSW Pty Ltd

Sample ID	SS5A + SS5X1 + SS5X2
Date	17/11/2011
Time	12:20
ID of Sampler	O. Murray
Type of Sample (triplicate, replicate)	Field triplicate
Water Depth (m)	12.9m
Depth of Sample (m)	0.25m
Coordinates	334786, 6237329
Weather conditions	Overcast with drizzle. Calm water
Sample Description	
Sediment Characteristics (texture, colour, odour, sorting, firmness etc)	Yellow grey sand
Comments (presence of foreign material, organic matter, biota, variability between replicates etc)	
Lab Analysis	PSA, TBT, TOC, OC/OP, PCB, metals, BTEX

LOG SHEET

Job: Caltex Dredging
Job Number: 301015-02448
Client: Caltex Refineries NSW Pty Ltd

Sample ID	SS5B
Date	17/11/2011
Time	13:00
ID of Sampler	O. Murray
Type of Sample (triplicate, replicate)	Sample
Water Depth (m)	~12.5m
Depth of Sample (m)	0.25m
Coordinates	334771, 6237281
Weather conditions	Overcast with drizzle. Calm water
Sample Description	
Sediment Characteristics (texture, colour, odour, sorting, firmness etc)	Yellow grey sand with some balls of mud
Comments (presence of foreign material, organic matter, biota, variability between replicates etc)	
Lab Analysis	TBT, TOC

LOG SHEET

Job: Caltex Dredging
Job Number: 301015-02448
Client: Caltex Refineries NSW Pty Ltd

Sample ID	SS5C
Date	17/11/2011
Time	12:00
ID of Sampler	O. Murray
Type of Sample (triplicate, replicate)	Sample
Water Depth (m)	13.0m
Depth of Sample (m)	0.25m
Coordinates	334929, 6237192
Weather conditions	Overcast with drizzle. Calm water
Sample Description	
Sediment Characteristics (texture, colour, odour, sorting, firmness etc)	Yellow/ grey sand, trace fines
Comments (presence of foreign material, organic matter, biota, variability between replicates etc)	Limited organic debris (wood) and some polychaetes present
Lab Analysis	TBT, TOC, PSA (limited material available for PSA)

LOG SHEET

Job: Caltex Dredging
Job Number: 301015-02448
Client: Caltex Refineries NSW Pty Ltd

Sample ID	SS5D + SS5Y1 + SS5Y2
Date	17/11/2011
Time	10:30
ID of Sampler	O. Murray
Type of Sample (triplicate, replicate)	Split triplicate
Water Depth (m)	12.7m
Depth of Sample (m)	0.25m
Coordinates	334726, 6236392
Weather conditions	Overcast with drizzle. Calm water
Sample Description	
Sediment Characteristics (texture, colour, odour, sorting, firmness etc)	Grey silt/ sand
Comments (presence of foreign material, organic matter, biota, variability between replicates etc)	Some polychaetes present
Lab Analysis	PSA, TBT, TOC, TRH, OC.OP, PCB, PAH, metals, BTEX

LOG SHEET

Job: Caltex Dredging
Job Number: 301015-02448
Client: Caltex Refineries NSW Pty Ltd

Sample ID	SS5E (new location in north end of berth pocket)
Date	17/11/2011
Time	13:30
ID of Sampler	O. Murray
Type of Sample (triplicate, replicate)	Sample
Water Depth (m)	12m
Depth of Sample (m)	0.25m
Coordinates	334736, 6237408
Weather conditions	Overcast with drizzle. Calm water
Sample Description	
Sediment Characteristics (texture, colour, odour, sorting, firmness etc)	Grey sand/ mud
Comments (presence of foreign material, organic matter, biota, variability between replicates etc)	Contained numerous chunks of hard black material up to 4cm in length similar to material found at VC5D and VC5E. Polychaete worms present. Was not possible to retrieve any sample at original coordinates due to hard black surface layer. Seven attempts tried at original location at sth end of berth pocket
Lab Analysis	PSA, TBT, TOC, PAH, TRH

VIBROCORE LOG


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VIBROCORE # VC5A

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex berths/ approaches Botany Bay
JOB NUMBER: 301015-002448

DATE COLLECTED: 18/11/2011, 11:14
DATE LOGGED: 18/11/2011, 14:00
LOGGED BY: OM
CHECKED BY: AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 mm **Easting:** 334676 **Water depth:** 12.7m
Equipment: Rossfelder vibrocorer **(ID):** 96 mm **Northing:** 6236535 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)	
Diver assisted vibrocoring	1			Grey fine to medium grained sand with coarse shell. Large pieces of hard organic matter at 0.8m and 1m.	100% (i.e. Core depth = 2.7m, recovery = 2.7m, loss of 0m)	D	PSD	TBT, TOC, TRH, OC/OP, PCB, PAH, metals, BTEX, VOCs/ SVOCs, ASS				Sandy shelly surface sediments. Vibrocoring frame required.
	1.45			Black clay interbedded with layers of grey sand and soft mud.		VSt - VD - S	PSD	TBT, TOC				
	2			Dark grey fine to medium grained sand.		MD						
	2.7			Core terminated at 2.7m								Depth of dredge design approximately 2m
	3											
	4											

VIBROCORE LOG



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VIBROCORE # VC5B

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex berths/ approaches Botany Bay
JOB NUMBER: 301015-002448

DATE COLLECTED: 18/11/2011, 09:50
DATE LOGGED: 18/11/2011, 15:30
LOGGED BY: OM
CHECKED BY: AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 mm **Easting:** 334676 **Water depth:** 13.2m
Equipment: Rossfelder vibrocorer **(ID):** 96 mm **Northing:** 6236439 **Datum:** WGS84

Figure 1: Sediment Profile (0.0m to 4.0m Depth)													Datum: MSL
Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results				Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (> 75µm)	% Gravel (> 2mm)		
Diver assisted vibrocore	0.8			Dark grey/ black muddy sand and shell (large, coarse mussel shells). Strong H2S odour.	80% (i.e. Core depth = 2.7m, recovery = 2.2m, loss of 0.5m)	MD - VD		TBT, TOC, TRH, PAH, ASS					Sandy silty surface sediments. Vibrocore frame required.
	1			Dark grey/ black clay. Very hard at 0.8-0.9m. Strong H2S odour.		VSt - Hd		TBT, TOC, ASS					
	1.3			Grey to dark grey sandy clay/ clayey sand.		VSt		TBT, TOC, ASS					
	2												Depth of dredge design approximately 2m
	2.2			Core terminated at 2.2m									
	3												
	4												

VIBROCORE LOG



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VIBROCORE # VC5C

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex berths/ approaches Botany Bay
JOB NUMBER: 301015-002448

DATE COLLECTED: 18/11/2011, 12:50
DATE LOGGED: 18/11/2011,
LOGGED BY: OM
CHECKED BY: AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 mm **Easting:** 334734 **Water depth:** 12.8m
Equipment: Rossfelder vibrocorer **(ID):** 96 mm **Northing:** 6236454 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (> 75µm)	% Gravel (> 2mm)	
Diver assisted vibrocore	0.4			Dark grey muddy sand interbedded with mud. Some large shell present.	88% (i.e. Core depth = 1.4m, recovery = 1.2m, loss of 0.2m)	Hd		TBT, TOC, TRH, OC/OP, PCB, PAH, metals, BTEX, ASS				Surface sediments comprised shelly sand Core retrieved following several attempts. First attempts penetrated ~100mm of sand before terminating in black 'rock' such as found at surface on VC5D. Vibrocore frame required.
	1			Black clay (shale like). Brittle, dry and flaking.		Hd	PSD	TBT, TOC, ASS				
	1.2			Core terminated at 1.2m								
	2											Depth of dredge design approximately 1.5m
	3											
	4											

VIBROCORE LOG



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VIBROCORE # VC5D
SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex berths/ approaches Botany Bay
JOB NUMBER: 301015-002448

DATE COLLECTED: 17/11/2011, 11:15
DATE LOGGED 18/11/2011,
LOGGED BY: OM
CHECKED BY: AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 mm **Easting:** 334723 **Water depth:** 12.5m
Equipment: Rossfelder vibrocorer **(ID):** 96 mm **Northing:** 6236391 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results				Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)		
Diver assisted vibrocoring	1			Broken up pieces (up to 0.1m in length) of very hard black peat interspersed with black viscous fluid. Approximately 1L of black viscous fluid leaked out of core when cut open. Strong odour. Some material with fibrous (wood like) appearance. Denser material from 0.6m caused core to bend at ~1m	100% (i.e. Core depth = 2.5m, recovery = 3.5m, loss of 0m, expansion of 140%)	Hd solid with oil		TBT, TOC, VOCs/ SVOCs				Hard packed black surface with chalky texture. Round pebbly rocks formed from excessive vibration to get core to penetrate.	
	1.8												
	2			Dark grey/ brown muddy sand and black viscous fluid.		MD		TBT, TOC, OC/OP, PCB, metals, BTEX, VOCs/ SVOCs				Depth of dredge design approximately 1.5m (or 2.1m down core log if assuming an expansion of 140%)	
	2.1												
	3			Dark red/brown clay.		VSt	PSD	TBT, TOC, TRH, OC/OP, PCB, metals, BTEX, VOCs/ SVOCs, ASS					
				Dark grey clay/ clayey sand.		Vst							
	4			Core terminated at 3.5m									

VIBROCORE LOG



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VIBROCORE # VC5E

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd **DATE COLLECTED:** 17/11/2011, 14:15
PROJECT: Caltex Dredging **DATE LOGGED:** 18/11/2011, 12:00
LOCATION: Caltex berths/ approaches Botany Bay **LOGGED BY:** OM
JOB NUMBER: 301015-002448 **CHECKED BY:** AW

Contractor: McLennans Diving Service **Core diameter (OD):** 100 mm **Easting:** 345636 **Water depth:** 12.5m
Equipment: Rossfelder vibrocorer **(ID):** 96 mm **Northing:** 6236373 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (> 75µm)	% Gravel (> 2mm)	
Diver assisted vibrocore	0.85			Small (<5cm) broken up pieces of very hard black material and soft black sandy mud with black viscous fluid.	100% (i.e. Core depth = 1m, recovery = 165m, loss of 0m; expansion of 165%)	VD	PSD	TBT, TOC, VOCs/ SVOCs				Surface sediments comprised silty sand.
				Large fragments of organic mater (wood like) at 0.4-0.5m.		VS		TBT, TOC				
				Black sandy mud with coarse shell (>1cm). Layer of consolidated shell at 0.8-0.85m.		VD						
				Hard black clay.		S - St	PSD	TBT, TOC, VOCs/ SVOCs				
	1.65			Black mud interbedded with 0.1m layers of black clay at 1.1m and at 1.4m.								Depth of dredge design approximately 1.5m (or 2.5m down core log for an expansion of 165%)
				Core terminated at 1.65m								
	2											
	3											
	4											



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CORE ID: C1

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex Berths 1 and 2 (Dredge Area 3)
JOB NUMBER:	301015-03041

DATE COLLECTED: 15/08/2012 10.40am
DATE LOGGED 15/08/2012 10.50am
LOGGED BY: CM
CHECKED BY:

Contractor: Geochemical Assessments	Core diameter (OD): 50	Easting: 334687	Water depth: 11.9m
Equipment: SDI Lightweight Vibrocorer	(ID): 46	Northing: 6236283	Datum: WGS84

[illegible]

CORE LOG



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CORE ID: C2

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex Berths 1 and 2 (Dredge Area 3)
JOB NUMBER: 301015-03041

DATE COLLECTED: 15/08/2012 8.30am
DATE LOGGED: 15/08/2012 9.25am
LOGGED BY: CM
CHECKED BY:

Contractor: Geochemical Assessments **Core diameter (OD):** 50 **Easting:** 334727 **Water depth:** 11.4m
Equipment: SDI Lightweight Vibrocorer **(ID):** 46 **Northing:** 6236262 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/Consistency	Sample/ Test		Lab Results				Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)		
Vibrocoring	0.5			dark olive gray to brown muddy sand (<10% visual mud content) overlying peat at about 0.7 m depth; increaing mud content with depth in core to about 30% visual mud content core loss of 0.5-0.7 m section	83% (depth: 0.7m; recovery: 0.5m)	S	PSD	metals, PAHs, TBT, TOC				Field Triplicate sample location (T01A and T01B); loss of 50-70 section of primary core C2; penetration of 0.8 m for field triplicate core T01B prior to refusal in hard/stiff peat layer and loss of bottom 0.3 m of core; sampled 0.0-0.5 m depth intervals in all three fielf triplicate cores C2, T01A and T01B; Sample QC5 (replicate elutriate sample)	
	1			Core terminated at 0.7m - core refusal in consolidated peat		VSt							
	1.5												
	2											Depth of dredge design approximately 2.0m	

CORE LOG



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CORE ID: C3

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
 PROJECT: Caltex Dredging
 LOCATION: Caltex Berths 1 and 2 (Dredge Area 3)
 JOB NUMBER: 301015-03041

DATE COLLECTED: 14/08/2012 12.05pm
 DATE LOGGED: 14/08/2012 12.15pm
 LOGGED BY: CM
 CHECKED BY:

Contractor: Geochemical Assessments Core diameter (OD): 50 Easting: 334681 Water depth: 12.3m
 Equipment: Piston push corer (ID): 46 Northing: 6236336 Datum: WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines ($< 75\mu\text{m}$)	% Sand ($> 75\mu\text{m}$)	% Gravel ($> 2\text{mm}$)	
Piston coring	0.5			very stiff dark brown peat, flaky and dry in situ		VSt						required collection of three cores and compositing of upper 0.1 m of sediments to obtain sufficient material for chemical analysis; insufficient sample material for elutriate analysis
		Core terminated at 0.1m - core refusal in consolidated peat	100% (depth: 0.1m; recovery: 0.1m)			metals, PAHs, TBT, TOC						
	1											Depth of dredge design approximately 1.0m

CORE LOG


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CORE ID: C4

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex Berths 1 and 2 (Dredge Area 3)
JOB NUMBER: 301015-03041

DATE COLLECTED: 14/08/2012 1.00pm
DATE LOGGED: 14/08/2012 1.15pm
LOGGED BY: CM
CHECKED BY:

Contractor: Geochemical Assessments **Core diameter (OD):** 50 **Easting:** 334747 **Water depth:** 11.9m
Equipment: Piston push corer **(ID):** 46 **Northing:** 6236335 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)	
				very stiff dark brown peat, flaky and dry in situ; friable when wet; no odour		VSt						required collection of three cores and compositing of upper 0.1 m of sediments to obtain sufficient material for chemical analysis; insufficient sample material for elutriate analysis
Piston coring	0.5 											

CORE LOG



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CORE ID: C5

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex Berths 1 and 2 (Dredge Area 3)
JOB NUMBER: 301015-03041

DATE COLLECTED: 14/08/2012 1.20pm
DATE LOGGED: 14/08/2012 1.35pm
LOGGED BY: CM
CHECKED BY:

Contractor: Geochemical Assessments **Core diameter (OD):** 50 **Easting:** 334761 **Water depth:** 11.9m
Equipment: Piston push corer **(ID):** 46 **Northing:** 6236328 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines ($\leq 75\mu\text{m}$)	% Sand ($\geq 75\mu\text{m}$)	% Gravel ($\geq 2\text{mm}$)	
Piston coring	0.5			very stiff dark brown peat, lumpy and dry in situ, friable when wet; thin veneer of light brown sand ($\leq 1\text{cm}$); no odour	100% (depth: 0.15m; recovery: 0.15m)	VSt	PSD	metals, PAHs, TBT, TOC				required collection of three cores and compositing of upper 0.1 m of sediments to obtain sufficient material for chemical analysis;
				Core terminated at 0.15m - core refusal in consolidated peat								
	1.5											Depth of dredge design approximately 1.5m

CORE LOG


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CORE ID: C6

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex Berths 1 and 2 (Dredge Area 3)
JOB NUMBER: 301015-03041

DATE COLLECTED: 14/08/2012 2.25pm
DATE LOGGED: 14/08/2012 2.40pm
LOGGED BY: CM
CHECKED BY:

Contractor: Geochemical Assessments **Core diameter (OD):** 50 **Easting:** 334748 **Water depth:** 12.1m
Equipment: Piston push corer **(ID):** 46 **Northing:** 6236368 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results				Field Records/Comments
							PSD	Geochem	% Fines ($< 75\mu\text{m}$)	% Sand ($> 75\mu\text{m}$)	% Gravel ($> 2\text{mm}$)		
Piston coring	0.5			very stiff dark brown peat, flaky and dry in situ; friable when wet; organic-rich; no odour	100% (depth: 0.13m; recovery: 0.13m)	VSt						required collection of four cores and compositing of upper 0.13 m of sediments to obtain sufficient material for chemical analysis; insufficient sample material for elutriate analysis; sample QC1 (split triplicate and QC2 (interlaboratory sample)	
				Core terminated at 0.13m - core refusal in consolidated peat				metals, PAHs, TBT, TOC					
	1.5											Depth of dredge design approximately 1.5m	

CORE LOG


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CORE ID: C7

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex Berths 1 and 2 (Dredge Area 3)
JOB NUMBER: 301015-03041

DATE COLLECTED: 14/08/2012 3.30pm
DATE LOGGED: 14/08/2012 3.45pm
LOGGED BY: CM
CHECKED BY:

Contractor: Geochemical Assessments **Core diameter (OD):** 50 **Easting:** 334756 **Water depth:** 12.9m
Equipment: Piston push corer **(ID):** 46 **Northing:** 6236415 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)	
				dark brown to black organic-rich peat; some light olive-gray sand at surface (<1 cm depth)		VSt						required collection of two cores and compositing of upper 0.1 m of sediments to obtain sufficient material for chemical analysis; insufficient sample material for elutriate analysis
Piston coring	0.5			Core terminated at 0.1m - core refusal in consolidated peat	100% (depth: 0.1m; recovery: 0.1m)		PSD	metals, PAHs, TBT, TOC				
	1											
	1.5											
	2											Depth of dredge design approximately 2.0m

CORE LOG



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CORE ID: C8

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
 PROJECT: Caltex Dredging
 LOCATION: Caltex Berths 1 and 2 (Dredge Area 3)
 JOB NUMBER: 301015-03041

DATE COLLECTED: 15/08/2012 2.10pm
 DATE LOGGED: 15/08/2012 2.30pm
 LOGGED BY: CM
 CHECKED BY:

Contractor: Geochemical Assessments Core diameter (OD): 50 Easting: 334821 Water depth: 11.9m
 Equipment: Piston push corer (ID): 46 Northing: 6236414 Datum: WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (> 75µm)	% Gravel (> 2mm)	
				dark brown to black organic-rich peat; no overlying sand, very hard and stiff		VSt						required collection of two cores and compositing of upper 0.1 m of sediments to obtain sufficient material for chemical analysis; insufficient sample material for elutriate analysis
Piston coring	0.5											

CORE LOG



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CORE ID: C9

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex Berths 1 and 2 (Dredge Area 3)
JOB NUMBER: 301015-03041

DATE COLLECTED: 15/08/2012 3.30pm
DATE LOGGED: 15/08/2012 3.45pm
LOGGED BY: CM
CHECKED BY:

Contractor: Geochemical Assessments **Core diameter (OD):** 50 **Easting:** 334796 **Water depth:** 12.3m
Equipment: Piston push corer **(ID):** 46 **Northing:** 6236462 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)	
Piston coring				light brown to olive-gray quartzose sand in upper 30 cm overlying peat at about 30-40cm, very hard and stiff peat at 0.3 m	100% (depth: 0.45m; recovery: 100%)	S-Med	metals, PAHs, TBT, TOC				required collection of two cores and compositing of upper 0.1 m of sediments to obtain sufficient material for chemical analysis;	
	0.5			Core terminated at 0.45m - core refusal in consolidated peat		Vst						
	1											
	1.5										Depth of dredge design approximately 1.5m	



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CORE ID: C10

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex Berths 1 and 2 (Dredge Area 3)
JOB NUMBER:	301015-03041

DATE COLLECTED: 15/08/2012 11.40am
DATE LOGGED 15/08/2012 11.50am
LOGGED BY: CM
CHECKED BY:

Contractor: Geochemical Assessments	Core diameter (OD): 50	Easting: 334849	Water depth: 11.3m
Equipment: SDI Lightweight Vibrocorer	(ID): 46	Northing: 6236434	Datum: WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)	
Vibrocoring	0.5			olive gray-green muddy sand; thin (<2 cm) olive muddy surface layer; muddy sand grades into sand at 30-50 cm depth	100% (depth: 2.00m; recovery: 2.00m)	S	PSD	metals, PAHs, TBT, TOC				C10_0.0-0.5: split triplicate sample (QC6); interlaboratory sample (QC7)
	1			well sorted light brown clean (<1% fine fraction content) quartzose sand		S		metals, PAHs, TBT, TOC				
	1.5			well sorted light brown clean (<1% fine fraction content) quartzose sand		S	PSD	metals, PAHs, TBT, TOC				
	2			Core terminated at 2.00m - core ends in unconsolidated clean quartzose sand								Depth of dredge design approximately 1.5m

CORE LOG


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CORE ID: C11

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex Berths 1 and 2 (Dredge Area 3)
JOB NUMBER: 301015-03041

DATE COLLECTED: 16/08/2012 8.50am
DATE LOGGED: 16/08/2012 9.05am
LOGGED BY: CM
CHECKED BY:

Contractor: Geochemical Assessments **Core diameter (OD):** 50 **Easting:** 334776 **Water depth:** 12.0m
Equipment: Piston push corer **(ID):** 46 **Northing:** 6236488 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/ Consistency	Sample/ Test		Lab Results				Field Records/Comments
							PSD	Geochem	% Fines ($< 75\mu\text{m}$)	% Sand ($> 75\mu\text{m}$)	% Gravel ($> 2\text{mm}$)		
Piston coring				olive gray-green slightly muddy sand overlying dark brown very stiff peat at 0.3 m depth, some shell fragments ($< 10\%$ visual fine fraction content)	100% (depth: 0.35m; recovery: 0.35m)	S-Med		metals, PAHs, TBT, TOC					required collection of two cores and compositing of upper 0.1 m of sediments to obtain sufficient material for chemical analysis; Filed Triplicate core sample location (Cores T02A and T02B - sampled 0.0-0.35 m intervals in all three triplicate cores)
	0.5			Core terminated at 0.35m - core refusal in consolidated peat		VSt							
	1												Depth of dredge design approximately 1.0m
	1.5												



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CORE ID: C14

SHEET 1 of 1

CLIENT:	Caltex Refineries NSW Pty Ltd
PROJECT:	Caltex Dredging
LOCATION:	Caltex Berths 1 and 2 (Dredge Area 3)
JOB NUMBER:	301015-03041

DATE COLLECTED: 16/08/2012 10.20am
DATE LOGGED 16/08/2012 10.35am
LOGGED BY: CM
CHECKED BY:

Contractor: Geochemical Assessments	Core diameter (OD): 50	Easting: 334614	Water depth: 12.8m
Equipment: Piston push corer	(ID): 46	Northing: 6236457	Datum: WGS84

[illegible]

CORE LOG



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CORE ID: C15

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex Berths 1 and 2 (Dredge Area 3)
JOB NUMBER: 301015-03041

DATE COLLECTED: 16/08/2012 11.45am
DATE LOGGED: 16/08/2012 11.55am
LOGGED BY: CM
CHECKED BY:

Contractor: Geochemical Assessments **Core diameter (OD):** 50 **Easting:** 334668 **Water depth:** 12.9m
Equipment: Piston push corer **(ID):** 46 **Northing:** 6236496 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/Consistency	Sample/ Test		Lab Results			Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (> 75µm)	% Gravel (> 2mm)	
Piston coring	0.5			dark olive to gray-green slightly muddy sand; about 20% visual mud content; grading into sandy mud below 30 cm depth; some shell fragments; strong H ₂ S odour;	100% (depth: 0.5m; recovery: 0.5m)	S-Med	PSD	metals, PAHs, TBT, TOC				required repeat coring attempts (three unsuccessful coring attempts in hard peat surface; patchy distribution of unconsolidated sediments at this location, with surface appearance of peat layer common
	1			Core terminated at 0.5m - core refusal in consolidated peat		Vst						Depth of dredge design approximately 0.5m

CORE LOG



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CORE ID: C18

SHEET 1 of 1

CLIENT: Caltex Refineries NSW Pty Ltd
PROJECT: Caltex Dredging
LOCATION: Caltex Berths 1 and 2 (Dredge Area 3)
JOB NUMBER: 301015-03041

DATE COLLECTED: 16/08/2012 9.30am
DATE LOGGED: 16/08/2012 9.45am
LOGGED BY: CM
CHECKED BY:

Contractor: Geochemical Assessments **Core diameter (OD):** 50 **Easting:** 334840 **Water depth:** 12.9m
Equipment: Piston push corer **(ID):** 46 **Northing:** 6236380 **Datum:** WGS84

Method	Depth below bed level (m)	Geological Unit	Classification	Material Description	% Recovery	Density/Consistency	Sample/ Test		Lab Results				Field Records/Comments
							PSD	Geochem	% Fines (< 75µm)	% Sand (>75µm)	% Gravel (> 2mm)		
Piston coring	0.5			dark olive gray-green slightly muddy sand, grading into brown to dark brown fragmented peaty layers at ~0.3-0.5 m depth	100% (depth: 0.9m; recovery: 0.9m)	S	PSD	metals, PAHs, TBT, TOC					
				dark brown peat, organic-rich, fragmented angular blocks, appearing more weathered than at other locations		VSt (fragmented peat)		metals, PAHs, TBT, TOC					
	1			Core terminated at 0.90m - core refusal in consolidated peat									
	1.5												Depth of dredge design approximately 1.5m



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SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

Appendix 6 Standard Operating Procedures



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SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

STANDARD OPERATING PROCEDURES FOR SEDIMENT SAMPLING & SUBSAMPLING

1. location of sampling to be confirmed by on-board GPS.
 2. the coordinates of the sample location, date, time, weather conditions and water depth should be recorded in the field log book.
 3. for coring:
 - a. core deployed and lowered to sea bed
 - b. depth of penetration of the core recorded
 - c. core recovered, capped, and placed on vessel deck
 4. for surface cores:
 - a. diver deployed to sea bed
 - b. 0.5m surface core collected and capped
 - c. three surface cores taken the field replicate location
 5. steps 1 to 4 repeated at each core/surface core location.
 6. surfaces to be covered in plastic sheeting prior to subsampling.
 7. cores from each location split, logged and photographed.
 8. core compaction calculation and each core subsampled.
 9. for each surface 0.5m vibrocore depth increment, sediment from the two vibrocores homogenised into one sample.
 10. for each surface core/0.5m vibrocore depth increment, collect relevant sediment required e.g.:
 - a. one sub-sample for chemical analysis (1-3 x150 ml glass jars)
 - b. one sub-sample for TBT elutriate analysis (2x250ml glass jars)
 - c. one subsample for ASS testing (1x250 ml plastic bag with air extruded)
 - d. one subsamples for PSD testing (1x250 ml plastic bag)
 - e. 1L sub-sample for sediment toxicity testing
 - f. 2L sub-sample for elutriate toxicity testing.
 11. samples homogenised (excluding samples for VOCs testing, ASS testing and toxicity testing) and transferred to the appropriate containers using stainless steel implements.
-



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SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

12. sample containers filled with zero headspace.
 13. each container tightly sealed to avoid loss of sample and labelled with a unique identification number.
 14. outside of each sample container washed with sea water to avoid cross contamination.
 15. samples to be packed in ice in an esky immediately after sampling to maintain the temperature below 4°C. If overnight storage is required, freeze samples for chemical and ASS testing. Samples for whole sediment toxicity testing and elutriate toxicity testing to be cooled to 4°C and kept in the dark.
 16. all sampling equipment should be decontaminated before the next sampling event by rinsing equipment in water to remove visible sediment, followed by a Decon 90 rinse.
-



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SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

Appendix 7 CSIRO Recommendations for Elutriate and Toxicity Testing and Offshore Disposal Option

Our Ref: TBT contamination in proposed maintenance dredging area of Botany Bay –
Caltex-WorleyParsons 221209.doc

Tuesday, 22 December 2009

Attention: Ali Watters and Orla Murray

Background

Caltex propose to undertake maintenance dredging in Botany Bay (Kurnell area) at three shipping berth locations: (i) berth approach, (ii) sub-berth and (iii) fixed berth. Samples collected by vibrocoring and surface sampling have been found to comprise 89-98% sand, generally <0.2% TOC and concentrations of all contaminants were below guidelines except for tributyltin (TBT). Elevated concentrations of TBT were observed for all three areas above the NAGD screening levels. In the three areas the 95% UCLs of the mean TBT concentrations normalised to 1% TOC were calculated to be: (i) Area 1 - 88 µgSn/kg, (ii) Area 2 - 165 µgSn/kg, and (iii) Area 3 - 21 µgSn/kg.

Three samples for which the ISQG-High value was exceeded were subjected to elutriate testing. The elutriate TBT concentrations for two out of the three selected samples were above the ANZECC water quality guideline indicating that TBT in the sediments is bioavailable. The maximum measured elutriate concentration was 70 ng TBT/L, compared to the WQG value of 6 ng/L.

Caltex would like to pursue further testing to determine if the dredge material can be shown to be suitable for ocean disposal or placement within Botany Bay. WorleyParsons have requested that CSIRO advise the types of further testing required.

Recommendations

Based on the information provided, the TBT concentrations are low, but exceed the NAGD / ANZECC Maximum ISQG-High values (TV) for whole-sediment and water (elutriates) – hence prompting further consideration. The major environmental concerns are:

For waters:

- Dissolved TBT released from the sediments during unconfined sea disposal could exceed water quality guidelines (WQG) and cause toxic effects to biota.

Notes:

- the 'accuracy' of dissolved TBT analyses is expected to be 50%, at best (the methods are not considered very robust) and rates of adsorptive losses to collection containers can be significant.
- elutriate tests are likely to underestimate the concentration in the sediment pore water (1:4, sediment:water).
- for sandy sediments, extraction of porewater is not practice and considered unnecessary, given the analytical uncertainties associated with TBT analyses.
- dissolved TBT concentrations from the elutriate tests show exceedances of the WQG-TBT of 6 ng/L.
- significant dilution is expected following disposal and the dissolved TBT and concentrations are very unlikely to remain above the WQG-TBT value for long.

- according to the NAGD, allowable dilution is that which occurs after four hours of mixing so dilution of 100-fold would be conservative, especially for offshore disposal sites on the NSW shelf. It would be surprising if dissolved TBT exceeded WQG four hours after disposal unless TBT elutriates are massively above ANZECC/ARMCANZ WQG. They are not.
- the WQG-TBT is a continuous chronic-effects guideline.

Advice for waters:

- Determine a 95% UCL for dissolved TBT in elutriates for samples that exceed the ISQG-High value (undertake additional sediment sampling and elutriate testing).
 - Multiple the 95% UCL for dissolved TBT in elutriates by 10 (arbitrary) to take into account possible differences to porewater TBT) (a conservative measure)
 - Calculate the expected dilutions based on knowledge of disposal site
 - Calculate the expected dissolved TBT in waters at the disposal site
- The cost of this exercise will be as determined by WorleyParsons.
- If the WQG for TBT is exceeded, then there will be a requirement for toxicity testing.
 - If necessary, confirm the absence of toxicity in elutriate waters prepared from sediments with TBT concentrations >ISQG-High (and preferably >95% UCL of 165 µg/kg 1%TOC)
 - The preferred test would be 48-h oyster larval development (performed by Ecotox services Australasia, ESA). Such tests should be conducted in polycarbonate containers to minimise adsorption of TBT to container walls. ESA laboratory will prepare 1:4 elutriate and commence toxicity test immediately following. Cost per test = \$1850/test. Would suggest testing three TBT-contaminated sediments and one 'blind control' sediment collected from a nearby location for which TBT < TV.

Uncertainty / risks:

- The absence of toxicity would not ensure that other toxic effects from dissolved TBT (e.g. imposex in snails and immuno-suppression in bivalves) could not occur. However, we would expect that the WQG would need to be exceeded continuously for such chronic effects to occur.

For whole sediments:

- At the disposal site, TBT concentrations of deposited sediments may retain, or develop, porewater TBT concentrations that exceed the WQG-TBT and potentially cause toxic effects to benthic invertebrates. There is a need to assess potential effects in these whole sediments, to simulate the post-settlement condition.

Notes:

- the most notable effect of TBT to benthic biota is imposex in snails and immuno-suppression in bivalves. Beyond measuring porewater TBT concentrations (which itself is very challenging), there are no reliable 'laboratory-based' tests for these effects.
- literature indicates that the lowest dissolved TBT concentration that is likely to cause lethality to benthic invertebrates are >100 ng/L (e.g. for the harpacticoid copepod, *T. japonicus*, acute lethality from TBT occurs with LC50 and LC20 values of 0.15 and ~0.05 µg TBT/L). No data exist for tests using Australian species.

Advice for sediments:

- Confirm the absence of toxicity to benthic invertebrates using chronic whole-sediment toxicity tests.
- given uncertainties in testing/unavailability of pore water, and that the ISQG-High (Maximum Level) are being exceeded, this is considered a necessary precaution.
- we recommend that chronic effects (reproduction) to the epibenthic amphipod, *Melita plumulosa* (native to NSW) be assessed. While this species may not inhabit ocean disposal sites, it is relatively sensitive to contaminants and exposed to contaminants via both dissolved and dietary exposure routes. *M. plumulosa* is therefore a useful surrogate for possible toxic effects to other species. Worth noting is that acute lethality from copper to *T. japonicus* occurs at an 96-h LC50 of 1020 µg/L, for *M. plumulosa* the 96-h LC50 is 120 µg/L, i.e. *M. plumulosa* may be more sensitive to contaminants (and TBT) than *T. japonicus*.
- We suggest initially testing three TBT-contaminated sediments that exceed the ISQG-High (Maximum Level) and one 'blind control' sediment collected from a nearby location for which TBT < TV. Additional in-house controls will be undertaken.

- Estimated cost = Full cost for sediment toxicity testing =

Project management and reporting costs

- A report will be prepared that will discuss the results in terms of NAGD / ANZECC and likelihood for ecological effects from maintenance dredging in Botany Bay and unconfined sea disposal of the sediments

- Cost =

- Total estimated total cost of CSIRO components =

Additional notes:

* Assumes dredging will occur as three zones, but the likelihood of effects from TBT will be assessed more broadly

* Information on sediment heterogeneity and depth profiles not available

* The SQGs for TBT were derived from the WQG based on effects on gastropods (imposex) as a sensitive endpoint using equilibrium partitioning. If pore water concentrations exceed the WQG then there are potential ecological effects. Therefore toxicity testing on organisms of unknown sensitivity to TBT may be a little arbitrary. If the WQG values are exceeded there is a potential problem, taking into account uncertainties in TBT analysis, potential losses and the fact that elutriate tests are conservative. To take a counter argument you could reason that the half life of TBT in sediments is about 3 years, although in paint flakes this could be longer. Also probably need to know something about the depth profile in the sediments and sample heterogeneity.

* It may also be argued, that given that the disposal site is dispersive that fine sediments may not be there or would be significantly diluted over a period of years.

* No TBT-sensitive tests using bivalves or snails. Methods are not available for testing for imposex other than via benthic surveys which we don't believe are appropriate. It may be possible to demonstrate that bivalves or snails do not accumulate TBT during 1-2 month exposures. However, it would not be possible to link this information to development of immuno-suppression or imposex.

* another potential chronic whole-sediment toxicity test species is the harpacticoid copepod, *Nitocra spinipes*, which is also present in NSW sediments. Chronic tests are also available using this species, although the methods are currently less robust than the chronic *M. plumulosa* tests.

Regards,



Dr Stuart Simpson
Principal Research Scientist
CSIRO Centre for Environmental Contaminants Research
Stuart.Simpson@csiro.au

Ali Watters and Orla Murray
WorleyParsons
Level 12, 141 Walker Street
North Sydney NSW 2060

30 May, 2011

Dear Ali and Orla,

Assessment of potential ecological effects of TBT contamination from proposed maintenance dredging area of Botany Bay – Caltex

You have requested advice on the potential ecological impacts of maintenance dredging proposed by Caltex in Botany Bay (Kurnell area) at three shipping berth locations: (i) Area 1 - berth approach, (ii) Area 2 - sub-berth, and (iii) Area 3 - fixed berth. Samples collected by vibrocore and surface sampling have been found to comprise 89-98% sand, generally <0.2% TOC and concentrations of all contaminants were below guidelines except for tributyltin (TBT).

To determine if the dredge material is suitable for ocean disposal, a range of testing has been undertaken in accordance with the National Assessment Guidelines for Dredging (NAGD, 2009). This report summarises the outcomes of this testing.

Results

The test results provided show that elevated concentrations of TBT exist within the sediments of all three areas and are above the NAGD (2009) screening level of 9 µg Sn/kg (dry weight, normalised to 1% TOC) and above the ISQG-High value of 80 µg Sn/kg in two of the areas. In the three areas the 95% UCLs of the mean TBT concentrations normalised to 1% TOC were calculated to be: (i) Area 1 - 1200 µg Sn/kg, (ii) Area 2 - 360 µg Sn/kg, and (iii) Area 3 - 57 µg Sn/kg. Overall for the sediment from all areas the 95% UCL of the mean TBT concentration normalised to 1% TOC was calculated to be 360 µg Sn/kg (on an area basis).

For a range of samples for which the ISQG-High value was exceeded, elutriate testing has determined that the elutriate TBT concentrations may exceed the ANZECC/ARMCANZ (2000) water quality guideline value of 6 ng/L. For the three areas the elutriate TBT concentrations (mean±standard deviation) were calculated to be: (i) Area 1 – 1840±1980 ng/L, (ii) Area 2 - 15±14 ng/L, and (iii) Area 3 - 41±67 ng/L. The high variability in the results was expected due to the large range of sediment properties. Overall for the sediment from all areas the elutriate TBT concentration (mean±standard deviation) was calculated to be 730±1470 ng/L (on an area basis).

Toxicity tests were undertaken on elutriates prepared from three sediment samples exhibiting elutriate TBT concentrations of 160, 1030 and 3340 ng/L. These were 48-h larval development tests using the rock oyster *Saccostrea commercialis*, and no toxicity was exhibited for any of the samples.

Whole-sediment toxicity tests were also undertaken on three sediment samples with concentrations of 230, 505 and 1040 µg Sn/kg. These were 10-day chronic amphipod

reproduction toxicity test using the amphipod *Melita plumulosa*, and no toxicity was exhibited for any of the samples.

Assessment in relation to NAGD

The sediments from Area 1 had TBT concentrations that greatly exceed the ISQG-High value of 80 µg Sn/kg and elutriate waters had TBT concentrations >300 times the water quality guideline value of 6 ng/L. Using numerical dilution modelling (undertaken by WorleyParsons), it was calculated that the maximum concentration of TBT in the water at the Sydney Offshore Spoil Ground following initial mixing would be 0.000035 µg/L. Continuous exceedence of the WQG in the marine waters at the offshore spoil ground is therefore unlikely.

It is understood that disposal within Botany Bay is no longer being considered, however the likely dilution would be much less than at the Sydney Offshore Spoil Ground. On this basis, there remains potential for dissolved TBT concentrations to exceed WQG at a disposal site within Botany Bay.

Although the sediments have high concentrations of TBT, the elutriate and whole-sediment toxicity tests indicate that TBT is unlikely to cause chronic toxic effects to benthic organisms. The tests used are considered to be the most sensitive available currently and it is not recommended that further ecotoxicological tests be undertaken.

Uncertainty exists regarding the potential for bioaccumulation of TBT by aquatic organisms that colonise and inhabit the sediments at either disposal site selected. The bioaccumulation of TBT has the potential to lead to imposex in organisms such as gastropods and immuno-suppression in some bivalve species. For such effects to be considered possible, firstly, a significant abundance of these organism types would need to be present at the disposal site, and secondly, TBT concentrations within the sediment porewaters would need to continuously exceed the water quality guideline value at the disposal site. The likelihood and significance of such effects should be considered in relation to the nature and desired properties of the disposal site.

Based on the chemical and ecotoxicological tests, the sediments are generally considered to be suitable for ocean disposal at the designated Sydney Offshore Spoil Ground. The sediments from Area 2 and 3 may also be suitable for disposal within Botany Bay, however, this should be considered in relation to the nature and desired attributes of the disposal site.

Finally, for any dredging and spoil disposal program, careful consideration should be given to design and execution of the operations. It would be desirable that materials of perceived lower quality (physical and chemical) should be deposited beneath materials of higher quality at the disposal site.

Regards,



Dr Stuart Simpson
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Appendix 8 Laboratory Results (2009-2012 Sediment Investigations)



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SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

PARTICLE SIZE DISTRIBUTION RESULTS



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917542	Page	: 1 of 3
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 17-NOV-2009
C-O-C number	: ----	Issue Date	: 26-NOV-2009
Sampler	: NH	No. of samples received	: 6
Site	: ----	No. of samples analysed	: 4
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

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accordance with NATA
accreditation requirements.

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Dianne Blane		Newcastle

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

A Campbell Brothers Limited Company



General Comments

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

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

LOR = Limit of reporting

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



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				VC2A 1.4-2.0	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6	----
				17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]	----
Compound	CAS Number	LOR	Unit	ES0917542-003	ES0917542-004	ES0917542-005	ES0917542-006	----
EA150: Particle Sizing								
+75µm	----	1	%	90	95	98	94	----
+150µm	----	1	%	84	88	98	88	----
+300µm	----	1	%	50	41	74	46	----
+425µm	----	1	%	12	9	32	19	----
+600µm	----	1	%	<1	1	10	10	----
+1180µm	----	1	%	<1	<1	1	5	----
+2.36mm	----	1	%	<1	<1	<1	2	----
+4.75mm	----	1	%	<1	<1	<1	<1	----
+9.5mm	----	1	%	<1	<1	<1	<1	----
+19.0mm	----	1	%	<1	<1	<1	<1	----
+37.5mm	----	1	%	<1	<1	<1	<1	----
+75.0mm	----	1	%	<1	<1	<1	<1	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	7	4	2	5	----
Silt (2-60 µm)	----	1	%	3	2	<1	<1	----
Sand (0.06-2.00 mm)	----	1	%	90	94	98	93	----
Gravel (>2mm)	----	1	%	<1	<1	<1	2	----
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	----



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917660	Page	: 1 of 3
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 18-NOV-2009
C-O-C number	: ----	Issue Date	: 01-DEC-2009
Sampler	: NH	No. of samples received	: 3
Site	: ----	No. of samples analysed	: 3
Quote number	: SY/503/09		

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

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- General Comments
- Analytical Results



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Signatories

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Signatories

Position

Accreditation Category

Dianne Blane

Newcastle

Environmental Division Sydney

Part of the **ALS Laboratory Group**

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Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

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General Comments

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

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

LOR = Limit of reporting

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



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Sub-Matrix: SOIL				Client sample ID		VC3B_0-0.5	VC2B_0-0.5	VC2B_0.5-0.9	----	----
				Client sampling date / time		17-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	----	----
Compound	CAS Number	LOR	Unit	ES0917660-001	ES0917660-002	ES0917660-003	----	----		
EA150: Particle Sizing										
+75µm	----	1	%	95	96	89	----	----		
+150µm	----	1	%	90	94	83	----	----		
+300µm	----	1	%	39	51	44	----	----		
+425µm	----	1	%	9	13	15	----	----		
+600µm	----	1	%	2	2	5	----	----		
+1180µm	----	1	%	1	1	1	----	----		
+2.36mm	----	1	%	<1	1	<1	----	----		
+4.75mm	----	1	%	<1	<1	<1	----	----		
+9.5mm	----	1	%	<1	<1	<1	----	----		
+19.0mm	----	1	%	<1	<1	<1	----	----		
+37.5mm	----	1	%	<1	<1	<1	----	----		
+75.0mm	----	1	%	<1	<1	<1	----	----		
EA150: Soil Classification based on Particle Size										
Clay (<2 µm)	----	1	%	4	4	9	----	----		
Silt (2-60 µm)	----	1	%	2	1	2	----	----		
Sand (0.06-2.00 mm)	----	1	%	94	95	89	----	----		
Gravel (>2mm)	----	1	%	<1	<1	<1	----	----		
Cobbles (>6cm)	----	1	%	<1	<1	<1	----	----		



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917542	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 17-NOV-2009
C-O-C number	: ----	Issue Date	: 26-NOV-2009
Sampler	: NH	No. of samples received	: 6
Order number	: ----	No. of samples analysed	: 4
Quote number	: SY/503/09		

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

This Quality Control Report contains the following information:

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



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ISO/IEC 17025.

Signatories

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Signatories	Position	Accreditation Category
Dianne Blane		Newcastle

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

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

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

								No Limit
--	--	--	--	--	--	--	--	----------

- No Laboratory Duplicate (DUP) Results are required to be reported.



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

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

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**



Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917660	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 18-NOV-2009
C-O-C number	: ----	Issue Date	: 01-DEC-2009
Sampler	: NH	No. of samples received	: 3
Order number	: ----	No. of samples analysed	: 3
Quote number	: SY/503/09		

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Dianne Blane		Newcastle

Environmental Division Sydney

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									No Limit
--	--	--	--	--	--	--	--	--	----------

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- **No Matrix Spike (MS) Results are required to be reported.**

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

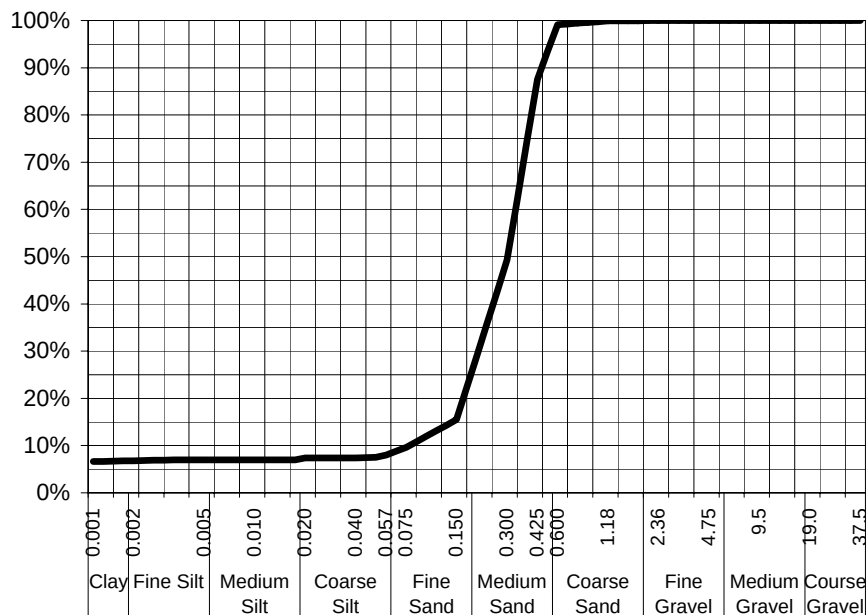
ALS Environmental

Newcastle, NSW



CLIENT: Ali Watters **DATE REPORTED:** 26-Nov-2009
COMPANY: Worley Parsons - Infrastructure MWE **DATE RECEIVED:** 17-Nov-2009
ADDRESS: Level 10/141 Walker Street **REPORT NO:** ES0917542-003 / PSD
North Sydney, NSW, Australia 2060
PROJECT: Caltex Maintenance Dredging **SAMPLE ID:** VC2A 1.4-2.0

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	99%
0.425	88%
0.300	49%
0.150	16%
0.075	10%
Particle Size (microns)	
57	8%
40	7%
20	7%
10	7%
5	7%
4	7%
1	7%

Samples analysed as received.

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand & fines

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density 2.65 Assumed

NATA Accreditation: 825 **Site:** Newcastle

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Analysed: 20-Nov-09

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

D Blane

Dianne Blane
Senior Analyst
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

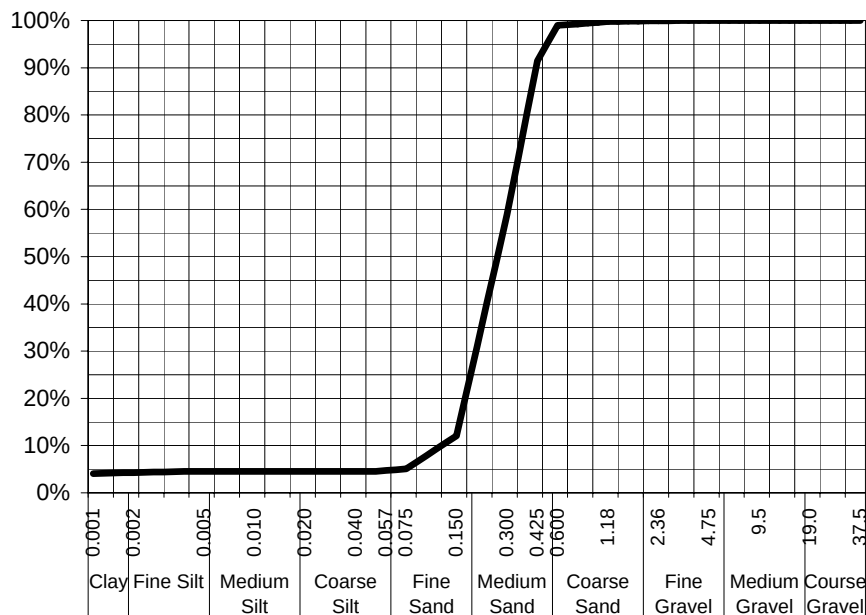
ALS Environmental

Newcastle, NSW



CLIENT: Ali Watters **DATE REPORTED:** 26-Nov-2009
COMPANY: Worley Parsons - Infrastructure MWE **DATE RECEIVED:** 17-Nov-2009
ADDRESS: Level 10/141 Walker Street **REPORT NO:** ES0917542-004 / PSD
North Sydney, NSW, Australia 2060
PROJECT: Caltex Maintenance Dredging **SAMPLE ID:** VC2A 2.3-2.6

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	99%
0.425	91%
0.300	59%
0.150	12%
0.075	5%
Particle Size (microns)	
57	5%
40	5%
20	5%
10	5%
5	5%
4	5%
1	4%

Samples analysed as received.

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand & fines

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density 2.65 Assumed

NATA Accreditation: 825 **Site:** Newcastle

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Analysed: 20-Nov-09

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

D Blane

Dianne Blane
Senior Analyst
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

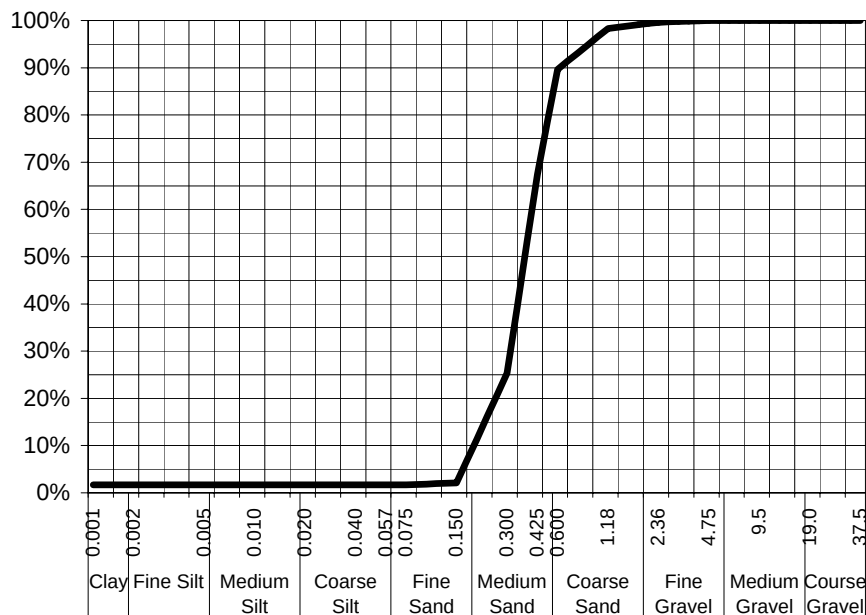
ALS Environmental

Newcastle, NSW



CLIENT: Ali Watters **DATE REPORTED:** 26-Nov-2009
COMPANY: Worley Parsons - Infrastructure MWE **DATE RECEIVED:** 17-Nov-2009
ADDRESS: Level 10/141 Walker Street **REPORT NO:** ES0917542-005 / PSD
North Sydney, NSW, Australia 2060
PROJECT: Caltex Maintenance Dredging **SAMPLE ID:** VC1A 1.2-1.6

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	98%
0.600	90%
0.425	67%
0.300	25%
0.150	2%
0.075	2%
Particle Size (microns)	
57	2%
40	2%
20	2%
10	2%
5	2%
4	2%
1	2%

Samples analysed as received.

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density 2.65 Assumed

NATA Accreditation: 825 Site: Newcastle

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Analysed: 20-Nov-09

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

D Blane

Dianne Blane
Senior Analyst
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

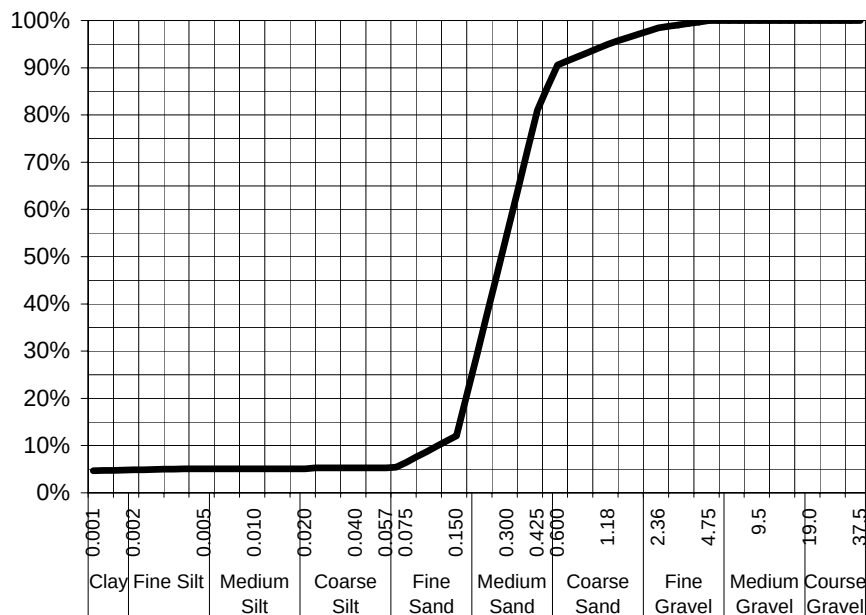
ALS Environmental

Newcastle, NSW



CLIENT: Ali Watters **DATE REPORTED:** 26-Nov-2009
COMPANY: Worley Parsons - Infrastructure MWE **DATE RECEIVED:** 17-Nov-2009
ADDRESS: Level 10/141 Walker Street **REPORT NO:** ES0917542-006 / PSD
North Sydney, NSW, Australia 2060
PROJECT: Caltex Maintenance Dredging **SAMPLE ID:** VC3A 0-0.6

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	98%
1.18	95%
0.600	91%
0.425	81%
0.300	55%
0.150	12%
0.075	6%
Particle Size (microns)	
57	5%
40	5%
20	5%
10	5%
5	5%
4	5%
1	5%

Samples analysed as received.

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand, shell & vegetation

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density 2.65 Assumed

NATA Accreditation: 825 **Site:** Newcastle

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Analysed: 20-Nov-09

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

D Blane

Dianne Blane
Senior Analyst
Authorised Signatory

Certificate of Analysis

ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW



CLIENT: Ali Watters

DATE REPORTED: 1-Dec-2009

COMPANY: Worley Parsons - Infrastructure
MWE

DATE RECEIVED: 18-Nov-2009

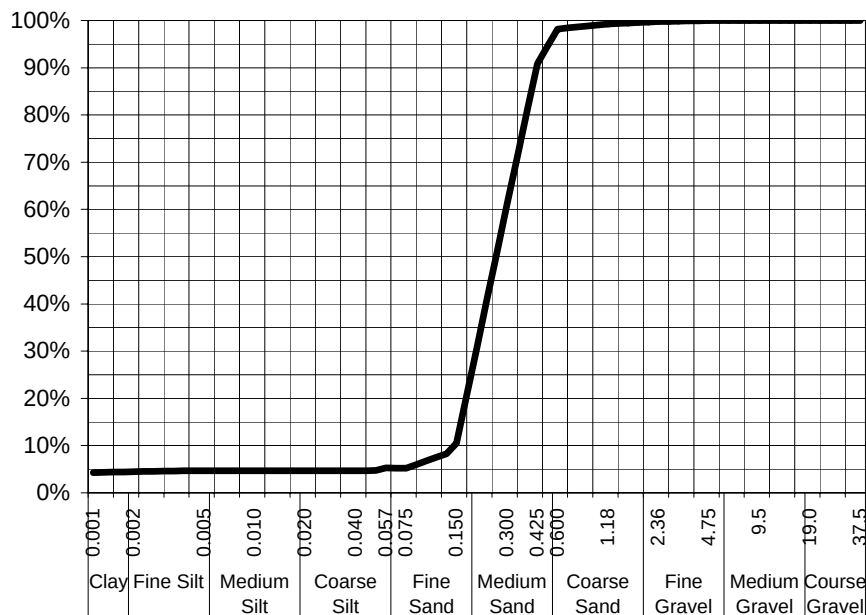
ADDRESS: Level 10/141 Walker Street
North Sydney, NSW, Australia
2060

REPORT NO: ES0917660-001 / PSD

PROJECT: Caltex Maintenance Dredging

SAMPLE ID: VC3B_0-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	98%
0.425	91%
0.300	61%
0.150	11%
0.075	5%
Particle Size (microns)	
57	5%
40	5%
20	5%
10	5%
5	5%
4	5%
1	4%

Samples analysed as received.

Sample Comments:

Analysed: 26-Nov-09

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Sand & fines

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density 2.65 Assumed

NATA Accreditation: 825 **Site:** Newcastle

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ALS Environmental

Newcastle, NSW



CLIENT: Ali Watters

DATE REPORTED: 1-Dec-2009

COMPANY: Worley Parsons - Infrastructure
MWE

DATE RECEIVED: 18-Nov-2009

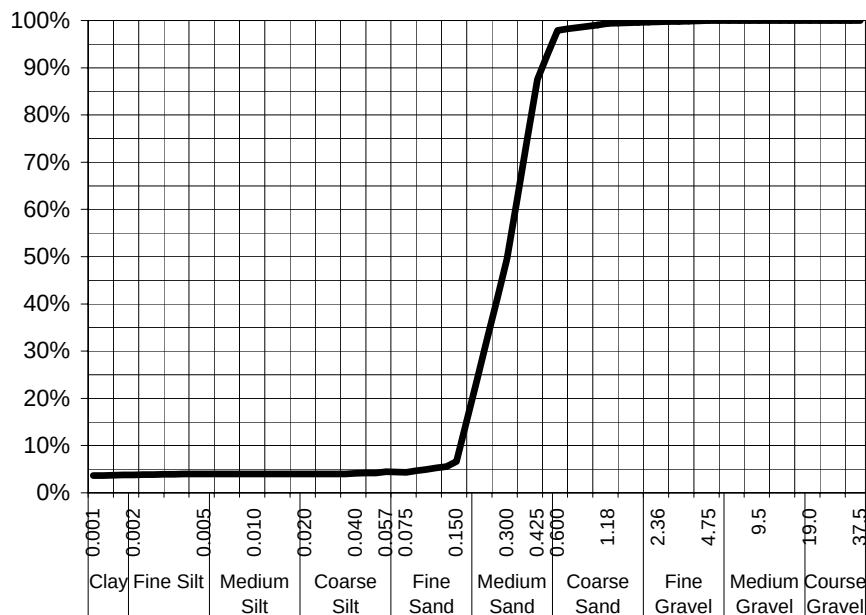
ADDRESS: Level 10/141 Walker Street
North Sydney, NSW, Australia
2060

REPORT NO: ES0917660-002 / PSD

PROJECT: Caltex Maintenance Dredging

SAMPLE ID: VC2B_0-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	98%
0.425	88%
0.300	50%
0.150	7%
0.075	4%
Particle Size (microns)	
57	4%
40	4%
20	4%
10	4%
5	4%
4	4%
1	4%

Samples analysed as received.

Sample Comments:

Analysed: 26-Nov-09

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Sand & fines

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density 2.65 Assumed

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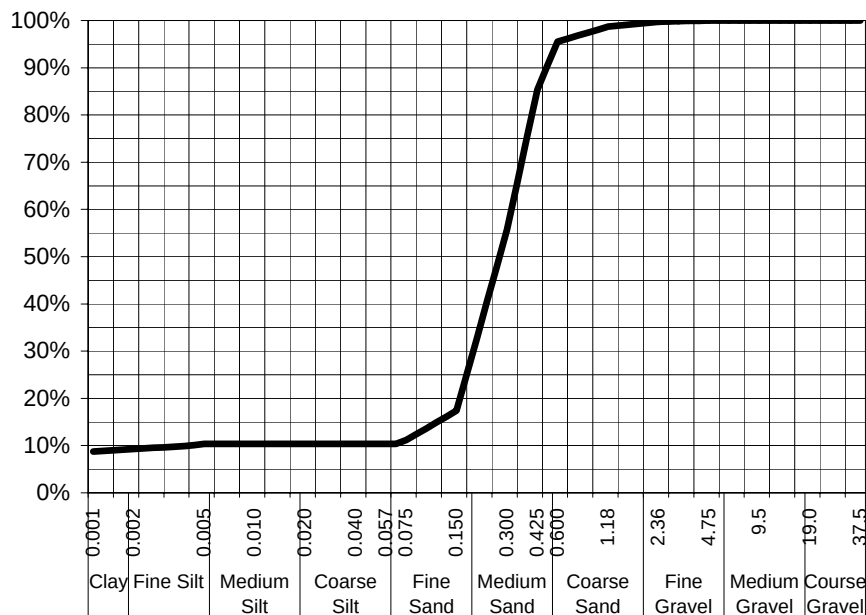
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pH 02 4968 9433
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Newcastle, NSW



CLIENT: Ali Watters **DATE REPORTED:** 1-Dec-2009
COMPANY: Worley Parsons - Infrastructure MWE **DATE RECEIVED:** 18-Nov-2009
ADDRESS: Level 10/141 Walker Street **REPORT NO:** ES0917660-003 / PSD
North Sydney, NSW, Australia 2060
PROJECT: Caltex Maintenance Dredging **SAMPLE ID:** VC2B_0.5-0.9

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	96%
0.425	85%
0.300	56%
0.150	17%
0.075	11%
Particle Size (microns)	
57	10%
40	10%
20	10%
10	10%
5	10%
4	10%
1	9%

Samples analysed as received.

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand & fines

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density 2.65 Assumed

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Analysed: 26-Nov-09

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

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CLIENT: Ali Watters

DATE REPORTED: 1-Dec-2009

COMPANY: Worley Parsons - Infrastructure
MWE

DATE RECEIVED: 19-Nov-2009

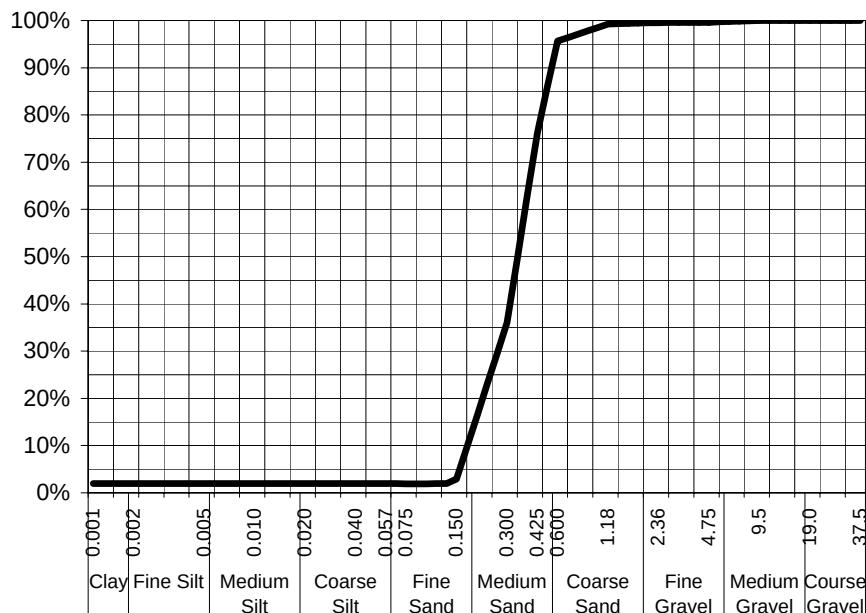
ADDRESS: Level 10/141 Walker Street
North Sydney, NSW, Australia
2060

REPORT NO: ES0917732-001 / PSD

PROJECT: Caltex Maintenance Dredging

SAMPLE ID: VC1A1 0-0.6

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	96%
0.425	76%
0.300	36%
0.150	3%
0.075	2%
Particle Size (microns)	
57	2%
40	2%
20	2%
10	2%
5	2%
4	2%
1	2%

Samples analysed as received.

Sample Comments:

Analysed: 25-Nov-09

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Sand

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density 2.65 Assumed

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CLIENT: Ali Watters

DATE REPORTED: 1-Dec-2009

COMPANY: Worley Parsons - Infrastructure
MWE

DATE RECEIVED: 19-Nov-2009

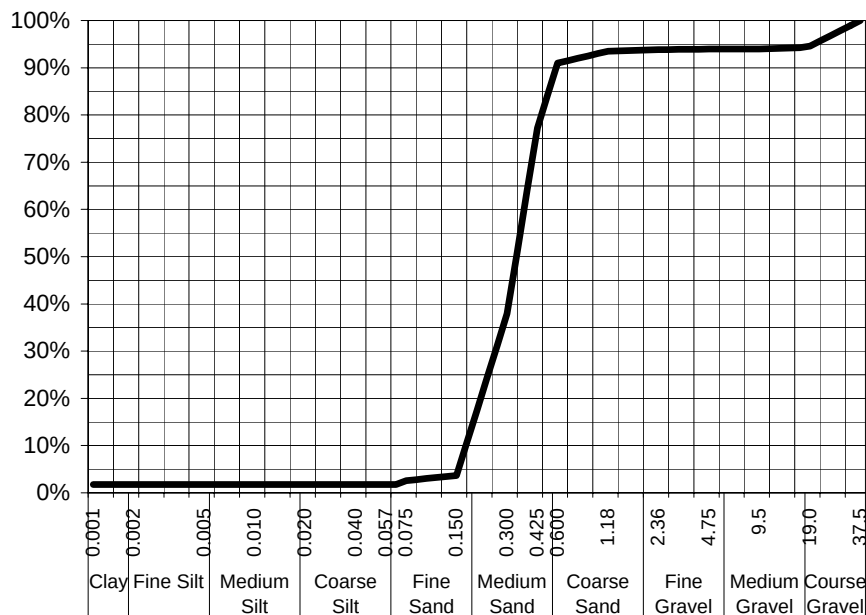
ADDRESS: Level 10/141 Walker Street
North Sydney, NSW, Australia
2060

REPORT NO: ES0917732-002 / PSD

PROJECT: Caltex Maintenance Dredging

SAMPLE ID: VC1A1 0.6-1.2

Particle Size Distribution



Particle Size (mm)	Percent Passing
37.5	100%
19.0	95%
9.5	94%
4.75	94%
2.36	94%
1.18	93%
0.600	91%
0.425	77%
0.300	38%
0.150	4%
0.075	3%
Particle Size (microns)	
57	2%
40	2%
20	2%
10	2%
5	2%
4	2%
1	2%

Samples analysed as received.

Sample Comments:

Analysed: 25-Nov-09

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: Sand

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Hydrometer Type ASTM E100

Soil Particle Density 2.65 Assumed

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DATE RECEIVED: 18-Nov-2011

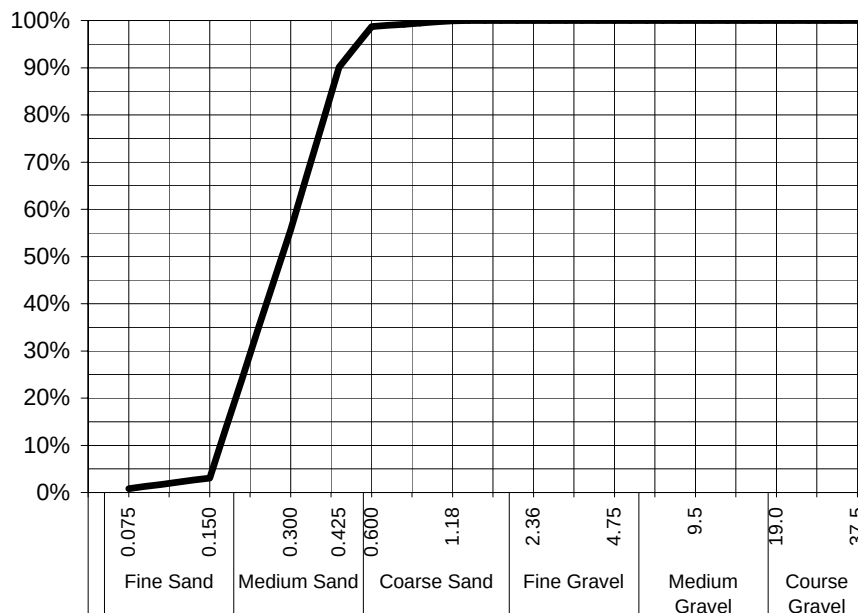
ADDRESS: Level 10/141 Walker Street
North Sydney, NSW, Australia
2060

REPORT NO: ES1125458-001 / PSD

PROJECT: Caltex

SAMPLE ID: SS5A

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	99%
0.425	90%
0.300	56%
0.150	3%
0.075	1%

Samples analysed as received.

* Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.
Typical sediment SPD values used for calculations

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand

Test Method: AS1289.3.6.1

Median Particle Size (mm)	0.225
---------------------------	-------

Analysed: 25-Nov-11

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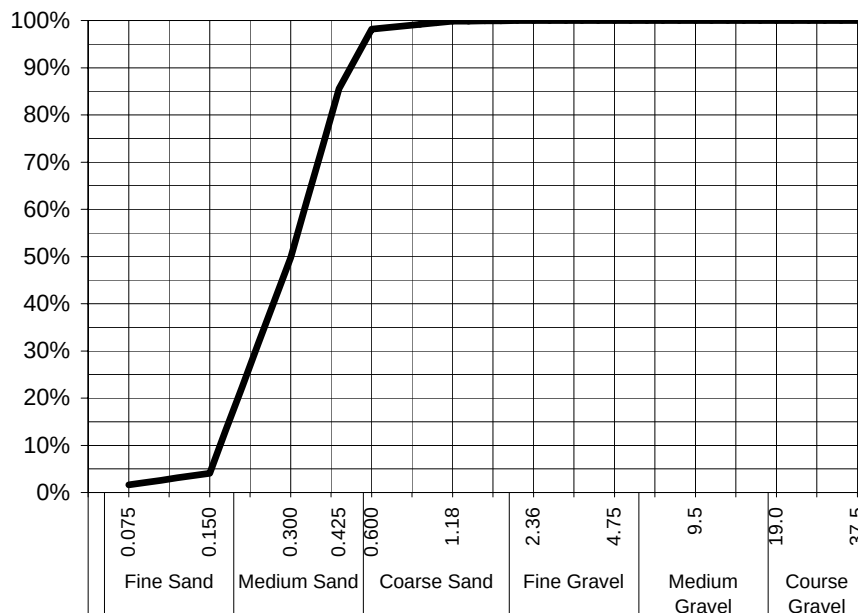
ADDRESS: Level 10/141 Walker Street
North Sydney, NSW, Australia
2060

REPORT NO: ES1125458-005 / PSD

PROJECT: Caltex

SAMPLE ID: SS5C

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	98%
0.425	86%
0.300	50%
0.150	4%
0.075	2%

Samples analysed as received.

* Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.
Typical sediment SPD values used for calculations

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand

Test Method: AS1289.3.6.1

Median Particle Size (mm)	0.300
---------------------------	-------

Analysed: 25-Nov-11

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COMPANY: Worley Parsons - Infrastructure
MWE

DATE RECEIVED: 18-Nov-2011

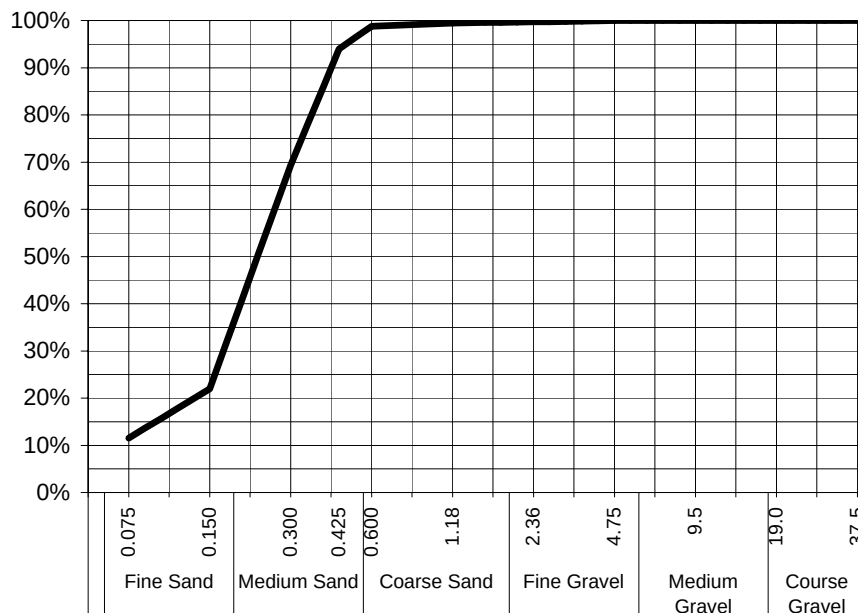
ADDRESS: Level 10/141 Walker Street
North Sydney, NSW, Australia
2060

REPORT NO: ES1125458-006 / PSD

PROJECT: Caltex

SAMPLE ID: SS5D

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	99%
0.425	94%
0.300	69%
0.150	22%
0.075	12%

Samples analysed as received.

* Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.
Typical sediment SPD values used for calculations

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand and fines

Test Method: AS1289.3.6.1

Median Particle Size (mm)	0.150
---------------------------	-------

Analysed: 25-Nov-11

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MWE

DATE RECEIVED: 18-Nov-2011

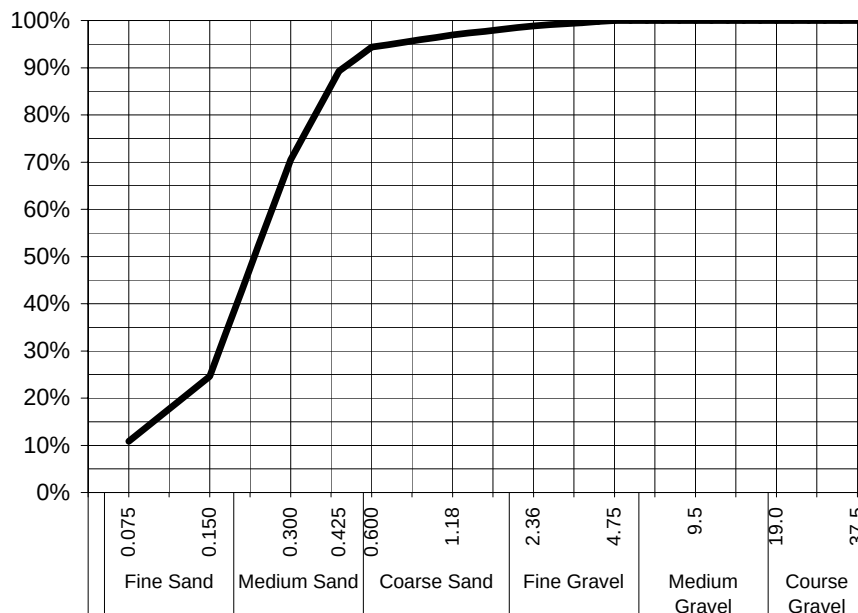
ADDRESS: Level 10/141 Walker Street
North Sydney, NSW, Australia
2060

REPORT NO: ES1125458-009 / PSD

PROJECT: Caltex

SAMPLE ID: SS5E

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	99%
1.18	97%
0.600	94%
0.425	89%
0.300	70%
0.150	25%
0.075	11%

Samples analysed as received.

* Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.
Typical sediment SPD values used for calculations

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand and fines

Test Method: AS1289.3.6.1

Median Particle Size (mm)	0.150
---------------------------	-------

Analysed: 25-Nov-11

Limit of Reporting: 1%

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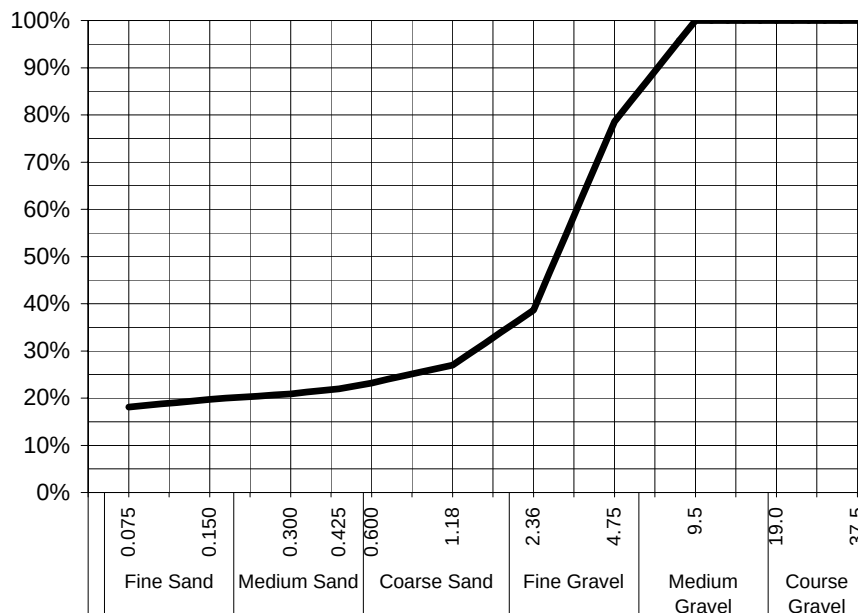
ALS Environmental

Newcastle, NSW



CLIENT: Orla Murray **DATE REPORTED:** 28-Nov-2011
COMPANY: Worley Parsons - Infrastructure **DATE RECEIVED:** 18-Nov-2011
ADDRESS: Level 10/141 Walker Street **REPORT NO:** ES1125458-020 / PSD
North Sydney, NSW, Australia
2060
PROJECT: Caltex **SAMPLE ID:** VC5C 0.5-1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	79%
2.36	39%
1.18	27%
0.600	23%
0.425	22%
0.300	21%
0.150	20%
0.075	18%

Samples analysed as received.

* Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.
Typical sediment SPD values used for calculations

Sample Comments:

Loss on Pretreatment NA

Sample Description: Gravel, coarse sand and fines

Test Method: AS1289.3.6.1

Median Particle Size (mm)	2.360
---------------------------	-------

Analysed: 25-Nov-11

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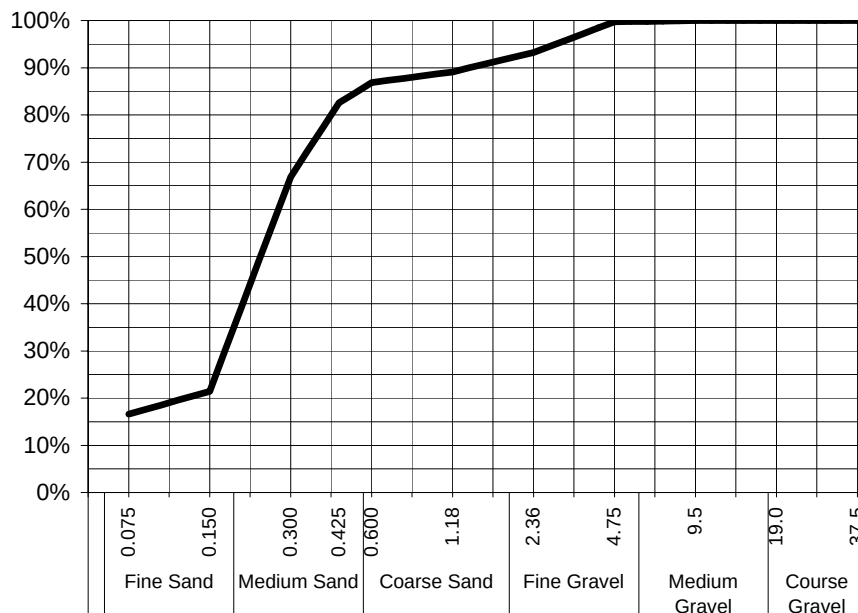
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COMPANY: Worley Parsons - Infrastructure **DATE RECEIVED:** 18-Nov-2011
ADDRESS: Level 10/141 Walker Street **REPORT NO:** ES1125458-026 / PSD
North Sydney, NSW, Australia
2060
PROJECT: Caltex **SAMPLE ID:** VCSD_2.1-3.1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	93%
1.18	89%
0.600	87%
0.425	83%
0.300	67%
0.150	21%
0.075	17%

Samples analysed as received.

* Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.
Typical sediment SPD values used for calculations

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand and fines

Test Method: AS1289.3.6.1

Median Particle Size (mm)	0.150
---------------------------	-------

Analysed: 25-Nov-11

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CLIENT: Orla Murray

DATE REPORTED: 28-Nov-2011

COMPANY: Worley Parsons - Infrastructure
MWE

DATE RECEIVED: 18-Nov-2011

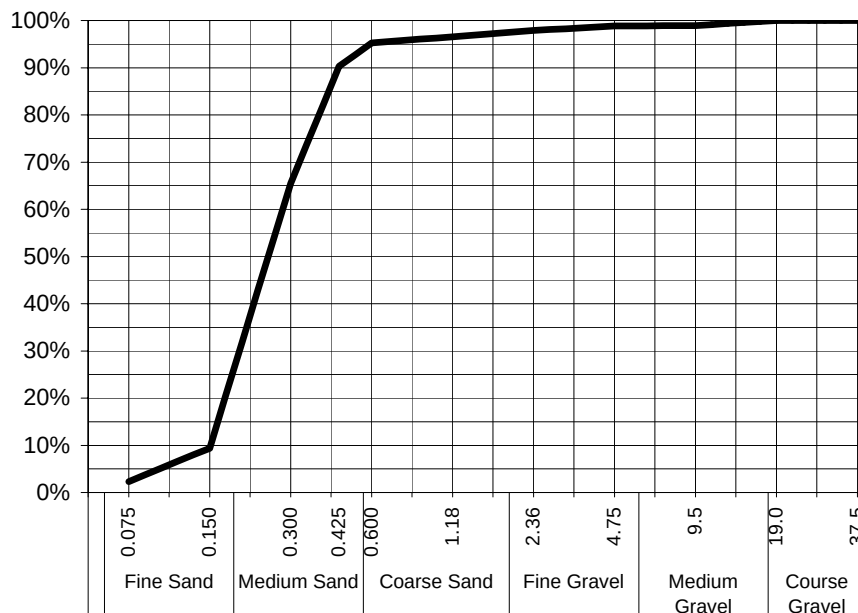
ADDRESS: Level 10/141 Walker Street
North Sydney, NSW, Australia
2060

REPORT NO: ES1125458-028 / PSD

PROJECT: Caltex

SAMPLE ID: VCSA(0-0.5)

Particle Size Distribution



Particle Size (mm)	Percent Passing
0.075	2%
0.150	9%
0.300	65%
0.425	90%
0.600	95%
1.18	97%
2.36	98%
4.75	99%
9.5	99%
19.0	100%
37.5	100%

Samples analysed as received.

* Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.
Typical sediment SPD values used for calculations

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand

Test Method: AS1289.3.6.1

Median Particle Size (mm)	0.150
---------------------------	-------

Analysed: 25-Nov-11

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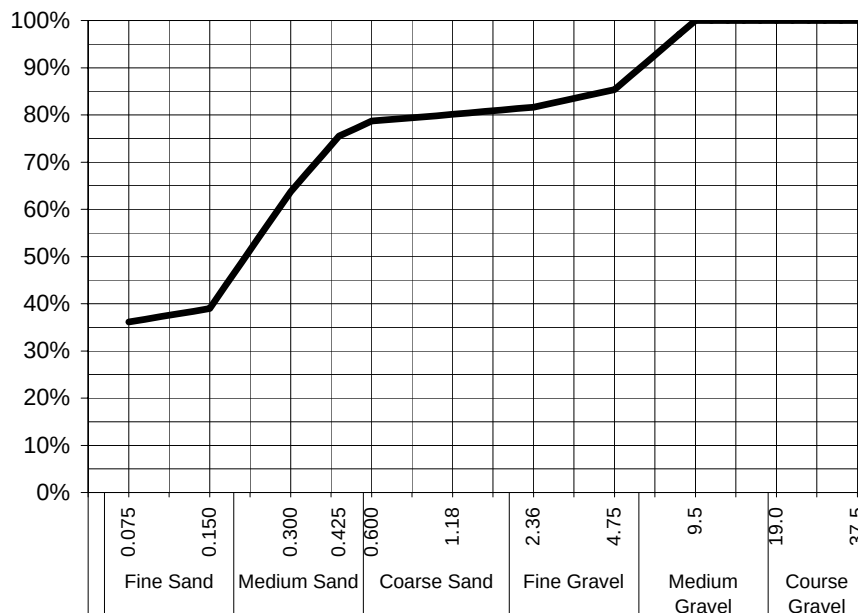
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Newcastle, NSW



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COMPANY: Worley Parsons - Infrastructure **DATE RECEIVED:** 18-Nov-2011
ADDRESS: Level 10/141 Walker Street **REPORT NO:** ES1125458-030 / PSD
North Sydney, NSW, Australia
2060
PROJECT: Caltex **SAMPLE ID:** VCSA1.5-2

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	85%
2.36	82%
1.18	80%
0.600	79%
0.425	76%
0.300	64%
0.150	39%
0.075	36%

Samples analysed as received.

* Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.
Typical sediment SPD values used for calculations

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand, fines and gravel

Test Method: AS1289.3.6.1

Median Particle Size (mm)	0.150
---------------------------	-------

Analysed: 25-Nov-11

Limit of Reporting: 1%

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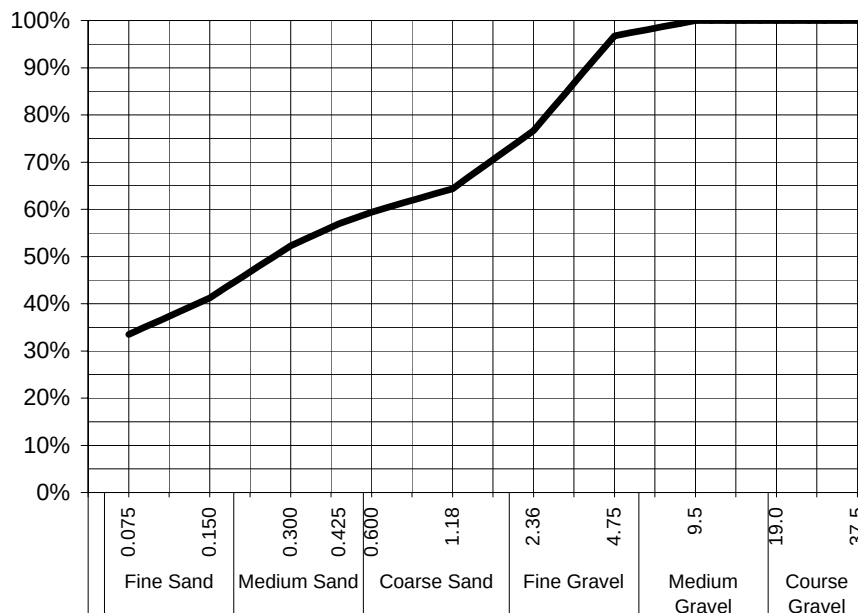
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CLIENT: Orla Murray **DATE REPORTED:** 28-Nov-2011
COMPANY: Worley Parsons - Infrastructure **DATE RECEIVED:** 18-Nov-2011
ADDRESS: Level 10/141 Walker Street **REPORT NO:** ES1125458-036 / PSD
North Sydney, NSW, Australia
2060
PROJECT: Caltex **SAMPLE ID:** VCSE 0-0.6

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	97%
2.36	77%
1.18	64%
0.600	59%
0.425	57%
0.300	52%
0.150	41%
0.075	33%

Samples analysed as received.

* Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.
Typical sediment SPD values used for calculations

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand, fines and gravel

Test Method: AS1289.3.6.1

Median Particle Size (mm)	0.150
---------------------------	-------

Analysed: 25-Nov-11

Limit of Reporting: 1%

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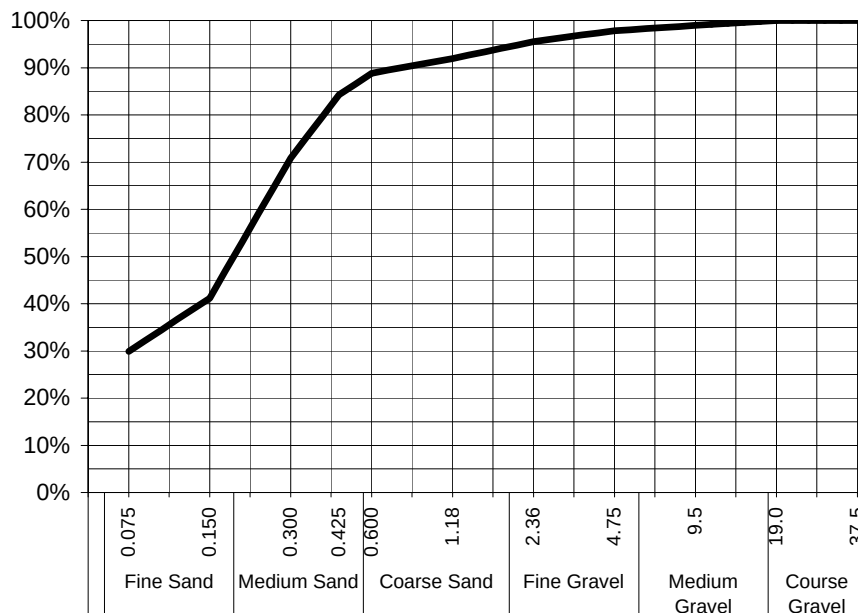
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COMPANY: Worley Parsons - Infrastructure MWE **DATE RECEIVED:** 18-Nov-2011
ADDRESS: Level 10/141 Walker Street **REPORT NO:** ES1125458-037 / PSD
North Sydney, NSW, Australia 2060
PROJECT: Caltex **SAMPLE ID:** VCSE 1-1.6

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	99%
4.75	98%
2.36	96%
1.18	92%
0.600	89%
0.425	84%
0.300	71%
0.150	41%
0.075	30%

Samples analysed as received.

* Insufficient sample provided for Soil Particle Density analysis according to AS 1289.3.5.1—2006.
Typical sediment SPD values used for calculations

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand and fines

Test Method: AS1289.3.6.1

Median Particle Size (mm)	0.150
---------------------------	-------

Analysed: 25-Nov-11

Limit of Reporting: 1%

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Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES1219873	Page	: 1 of 4
Client	: CALTEX REFINERIES(NSW) PTY LTD	Laboratory	: Environmental Division Sydney
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Address	: 2 SOLANDER ST KURNELL NSW, AUSTRALIA 2231	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
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Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: 301015-03041	Date Samples Received	: 15-AUG-2012
C-O-C number	: ----	Issue Date	: 22-AUG-2012
Sampler	: CM	No. of samples received	: 12
Site	: ----	No. of samples analysed	: 9
Quote number	: SY/389/12 V2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
		Newcastle



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.

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

LOR = Limit of reporting

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



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				C13_0.0-0.5	C5_0.0-0.15	C7_0.0-0.10	C2_0.0-0.5	C1_0-0.55
				14-AUG-2012 15:00	14-AUG-2012 15:00	14-AUG-2012 15:00	15-AUG-2012 15:00	15-AUG-2012 15:00
Compound	CAS Number	LOR	Unit	ES1219873-001	ES1219873-002	ES1219873-003	ES1219873-004	ES1219873-005
EA150: Particle Sizing								
+75µm	----	1	%	94	97	93	79	82
+150µm	----	1	%	82	94	89	64	76
+300µm	----	1	%	23	86	80	34	55
+425µm	----	1	%	5	77	71	12	42
+600µm	----	1	%	1	72	60	3	37
+1180µm	----	1	%	<1	66	32	1	33
+2.36mm	----	1	%	<1	54	2	<1	21
+4.75mm	----	1	%	<1	38	<1	<1	8
+9.5mm	----	1	%	<1	34	<1	<1	4
+19.0mm	----	1	%	<1	34	<1	<1	4
+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	%	5	3	7	15	9
Silt (2-60 µm)	----	1	%	1	<1	<1	6	8
Sand (0.06-2.00 mm)	----	1	%	94	43	91	79	62
Gravel (>2mm)	----	1	%	<1	54	2	<1	21
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				C10_0-0.50	C10_1.0-1.5	C12_0.5-1.0	C8_0.0-0.12	----
				15-AUG-2012 15:00	15-AUG-2012 15:00	15-AUG-2012 15:00	15-AUG-2012 15:00	----
Compound	CAS Number	LOR	Unit	ES1219873-006	ES1219873-007	ES1219873-008	ES1219873-009	----
EA150: Particle Sizing								
+75µm	----	1	%	89	98	95	53	----
+150µm	----	1	%	81	98	92	49	----
+300µm	----	1	%	40	62	57	37	----
+425µm	----	1	%	12	18	18	26	----
+600µm	----	1	%	3	2	3	21	----
+1180µm	----	1	%	<1	<1	<1	18	----
+2.36mm	----	1	%	<1	<1	<1	12	----
+4.75mm	----	1	%	<1	<1	<1	2	----
+9.5mm	----	1	%	<1	<1	<1	<1	----
+19.0mm	----	1	%	<1	<1	<1	<1	----
+37.5mm	----	1	%	<1	<1	<1	<1	----
+75.0mm	----	1	%	<1	<1	<1	<1	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	7	1	3	18	----
Silt (2-60 µm)	----	1	%	4	1	2	27	----
Sand (0.06-2.00 mm)	----	1	%	89	98	95	43	----
Gravel (>2mm)	----	1	%	<1	<1	<1	12	----
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	----

Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES1219873	Page	: 1 of 4
Client	: CALTEX REFINERIES(NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR SIMON CAPLES	Contact	: Client Services
Address	: 2 SOLANDER ST KURNELL NSW, AUSTRALIA 2231	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scaples@caltex.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 15-AUG-2012
Sampler	: CM	Issue Date	: 22-AUG-2012
Order number	: 301015-03041		
Quote number	: SY/389/12 V2	No. of samples received	: 12
		No. of samples analysed	: 9

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories

Position

Accreditation Category

Newcastle



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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

- **No Laboratory Duplicate (DUP) Results are required to be reported.**



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

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

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**

Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

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

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES1219873	Page	: 1 of 5
Client	: CALTEX REFINERIES(NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR SIMON CAPLES	Contact	: Client Services
Address	: 2 SOLANDER ST KURNELL NSW, AUSTRALIA 2231	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scaples@caltex.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 15-AUG-2012
C-O-C number	: ----	Issue Date	: 22-AUG-2012
Sampler	: CM	No. of samples received	: 12
Order number	: 301015-03041	No. of samples analysed	: 9
Quote number	: SY/389/12 V2		

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

This Interpretive Quality Control Report contains the following information:

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



Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing								
Snap Lock Bag (EA150H) C13_0.0-0.5, C7_0.0-0.10	C5_0.0-0.15,	14-AUG-2012	---	10-FEB-2013	----	21-AUG-2012	10-FEB-2013	✓
Snap Lock Bag (EA150H) C2_0.0-0.5, C10_0-0.50, C12_0.5-1.0,	C1_0-0.55, C10_1.0-1.5, C8_0.0-0.12	15-AUG-2012	---	11-FEB-2013	----	21-AUG-2012	11-FEB-2013	✓
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H) C13_0.0-0.5, C7_0.0-0.10	C5_0.0-0.15,	14-AUG-2012	---	10-FEB-2013	----	21-AUG-2012	10-FEB-2013	✓
Snap Lock Bag (EA150H) C2_0.0-0.5, C10_0-0.50, C12_0.5-1.0,	C1_0-0.55, C10_1.0-1.5, C8_0.0-0.12	15-AUG-2012	---	11-FEB-2013	----	21-AUG-2012	11-FEB-2013	✓

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



CHAIN OF CUSTODY

ALS Laboratory:
please tick →

DAELADE 21 Burma Road Peoria SA 5055
Ph: 08 8359 0800 E: adelaide@alsglobal.com
CURRIEBANE 32 Strand Street Stirling QLD 4053
Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
CUGLAIDSTONE 46 Callionville Drive Clinton QLD 4680
Ph: 07 7471 4600 E: gisborne@alsglobal.com

CMACKAY 78 Harbour Road Mackay QLD 4740
Ph: 07 4944 0177 E: mackay@alsglobal.com
CMELBOURNE 2-4 Westall Road Spotswood VIC 3171
Ph: 03 9549 9600 E: samples.melbourne@alsglobal.com
CMUDGEE 27 Sydney Road Mudgee NSW 2850
Ph: 02 6372 6735 E: mudgee@alsglobal.com

CNEWCASTLE 5 Ross Gum Road Waratah NSW 2304
Ph: 02 4868 9433 E: samples.newcastle@alsglobal.com
CNEWCASTLE 413 Geary Place North Nowra NSW 2541
Ph: 02 4423 2063 E: nowra@alsglobal.com
CNEWCASTLE 10 Hod Way Mudgee NSW 2850
Ph: 02 6372 6735 E: mudgee@alsglobal.com

CSYDNEY 277 380 Woodpark Road Smithfield NSW 2164
Ph: 02 8764 5555 E: samples.sydney@alsglobal.com
CUTOWNVILLE 14-15 Deena Court Belah QLD 4818
Ph: 07 4796 0800 E: townsville@alsglobal.com
CNEWCASTLE 89 Kenny Street Wollongong NSW 2500
Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: CALTEX

OFFICE: via WorleyParsons Office (141 Walker St, North Sydney NSW 2060)
PROJECT: Caltex Dredging

ORDER NUMBER: 301015-03041

PROJECT MANAGER: Ben Taylor

SAMPLER: Carsten Matthai

COC emailed to ALS? (YES / NO) No

EDD FORMAT (or default):

Email Reports to: Carsten.Matthai@WorleyParsons.com and Deborah.Lam@WorleyParsons.com

Email Invoice to (will default to PM if no other addresses are listed): CHalm@caltex.com.au

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS:

(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

ALS QUOTE NO.: SY389/12 V2

3 DAY TAT REQUIRED

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

COC: 1 2 3 4 5 6 7

OF: 1 2 3 4 5 6 7

RELINQUISHED BY:

Carsten Matthai

DATE/TIME: 15-8-12

4-30pm

RECEIVED BY:

Frankie Arg

DATE/TIME: 15-8-12

1800

RELINQUISHED BY:

DATE/TIME:

DATE/TIME:

DATE/TIME:

FOR LABORATORY USE ONLY: (Circle)

Custody Seal intact? Yes No N/A
Free ice / frozen/bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

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 (filtered bottle required).

Additional Information

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (to codes below)	(refer TOTAL CONTAINERS	ALS (SYDNEY)				ALS (NEWCASTLE)		HOLD for potential elutriate testing	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
						Super Ultratrace PAHs (EP132-SD)	Trace Metals (Suite SD-3) -Ag, As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Se, V, Zn	HCL Extractable Metals (SD-4)	TOC (LECO) (EP003)	TBT (EP090)	Particle Size (Hydrometer) (EA150-H)		
4	C2-00-0.5	15-8-12	Sediment	Various	4 jars 1 bag	✓	✓		✓	✓	✓	✓	Hold all primary samples for possible elutriate analysis and weak acid digestion and analysis
5	C1-0-0.55	15-8-12	Sediment	Various	4 jars 1 bag	✓	✓		✓	✓	✓	✓	
6	C10-0-0.50	15-8-12	Sediment	Various	4 jars 1 bag	✓	✓		✓	✓	✓	✓	
	C10-0.5-1.0	15-8-12	Sediment	Various	4 jars 1 bag	✓	✓		✓	✓	✓	✓	
7	C10-1.0-1.5	15-8-12	Sediment	Various	4 jars 1 bag	✓	✓		✓	✓	✓	✓	
	QC6	15-8-12	Sediment	Various	2 jars	✓	✓		✓	✓			
	QC4	15-8-12	Sediment	Various	1 jar	✓	✓		✓	✓			
	QC5	15-8-12	Sediment	Various	2 jars							✓	
	T01A	15-8-12	Sediment	Various	4 jars	✓	✓		✓	✓		✓	
	T01B	15-8-12	Sediment	Various	4 jars	✓	✓		✓	✓		✓	SEAWATER TO BE PLACED ON HOLD FOR

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
I = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulfate 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.

Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order : ES1219873

Client	: CALTEX REFINERIES(NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR CARSTEN MATTHAI	Contact	: Client Services
Address	: 141 Walker st North Sydney NSW 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: carsten.matthai@WorleyParsons.com	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX DREDGING	Page	: 1 of 3
Order number	: 301015-03041	Quote number	: ES2012CALREFNSW0182 (SY/389/12 V2)
C-O-C number	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
Sampler	: CM		

Dates

Date Samples Received	: 15-AUG-2012	Issue Date	: 17-AUG-2012 12:25
Client Requested Due Date	: 23-AUG-2012	Scheduled Reporting Date	: 23-AUG-2012

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 3.3'C - Ice present
No. of coolers/boxes	: 3 HARD	No. of samples received	: 12
Security Seal	: Not intact.	No. of samples analysed	: 9

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
- **Samples received in appropriately pretreated and preserved containers.**
- **PSD analysis will be conducted by ALS Newcastle.**
- **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.**
- **Sample C14_0.0-0.12 received extra and placed on hold, Please confirm.**
- **Sample #8 id is C12_0.5-1.0 on the jar, but received labelled as C12_1.0-1.5, Please confirm which is the correct ID.**
- **THIS BATCH IS FOR PSD AND SPLIT INTO ES1219839.**
- 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 (14 days), Solid (60 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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 to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - EA150H Particle Size Analysis by Hydrometer
ES1219873-001	14-AUG-2012 15:00	C13_0.0-0.5		✓
ES1219873-002	14-AUG-2012 15:00	C5_0.0-0.15		✓
ES1219873-003	14-AUG-2012 15:00	C7_0.0-0.10		✓
ES1219873-004	15-AUG-2012 15:00	C2_0.0-0.5		✓
ES1219873-005	15-AUG-2012 15:00	C1_0-0.55		✓
ES1219873-006	15-AUG-2012 15:00	C10_0-0.50		✓
ES1219873-007	15-AUG-2012 15:00	C10_1.0-1.5		✓
ES1219873-008	15-AUG-2012 15:00	C12_0.5-1.0		✓
ES1219873-009	15-AUG-2012 15:00	C8_0.0-0.12		✓
ES1219873-010	14-AUG-2012 15:00	C3_0.0-0.1	✓	
ES1219873-011	14-AUG-2012 15:00	C4_0.0-0.1	✓	
ES1219873-012	14-AUG-2012 15:00	C14_0.0-0.12	✓	

Proactive Holding Time Report

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



Requested Deliverables

MR CARSTEN MATTHAI

- *AU Certificate of Analysis - NATA (COA)	Email	carsten.matthai@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	carsten.matthai@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	carsten.matthai@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	carsten.matthai@WorleyParsons.com
- Attachment - Report (SUBCO)	Email	carsten.matthai@WorleyParsons.com
- Chain of Custody (CoC) (COC)	Email	carsten.matthai@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	carsten.matthai@WorleyParsons.com

MR SIMON CAPLES

- *AU Certificate of Analysis - NATA (COA)	Email	scaples@caltex.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	scaples@caltex.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	scaples@caltex.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	scaples@caltex.com.au
- A4 - AU Tax Invoice (INV)	Email	scaples@caltex.com.au
- Attachment - Report (SUBCO)	Email	scaples@caltex.com.au
- Chain of Custody (CoC) (COC)	Email	scaples@caltex.com.au
- EDI Format - ENMRG (ENMRG)	Email	scaples@caltex.com.au

MS CHRISTINA HALIM

- A4 - AU Tax Invoice (INV)	Email	CHalim@caltex.com.au
-------------------------------	-------	----------------------

MS DEBORAH LAM

- *AU Certificate of Analysis - NATA (COA)	Email	deborah.lam@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	deborah.lam@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	deborah.lam@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	deborah.lam@WorleyParsons.com
- Attachment - Report (SUBCO)	Email	deborah.lam@WorleyParsons.com
- Chain of Custody (CoC) (COC)	Email	deborah.lam@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	deborah.lam@WorleyParsons.com

Certificate of Analysis

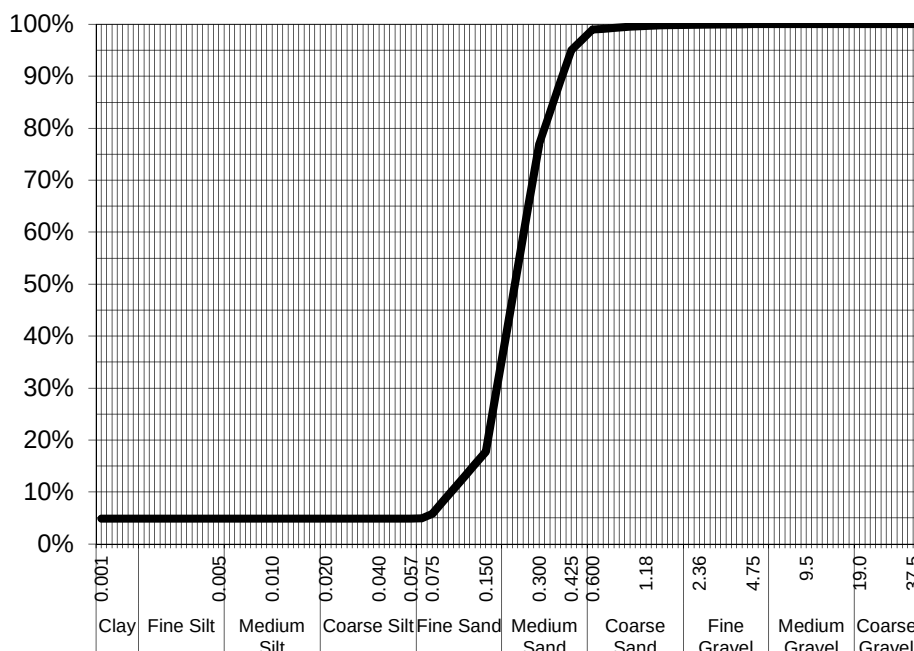
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-001 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C13_0.0-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	99%
0.425	95%
0.300	77%
0.150	18%
0.075	6%
Particle Size (microns)	
57	5%
40	5%
20	5%
10	5%
5	5%
4	5%
1	5%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm) 0.150

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

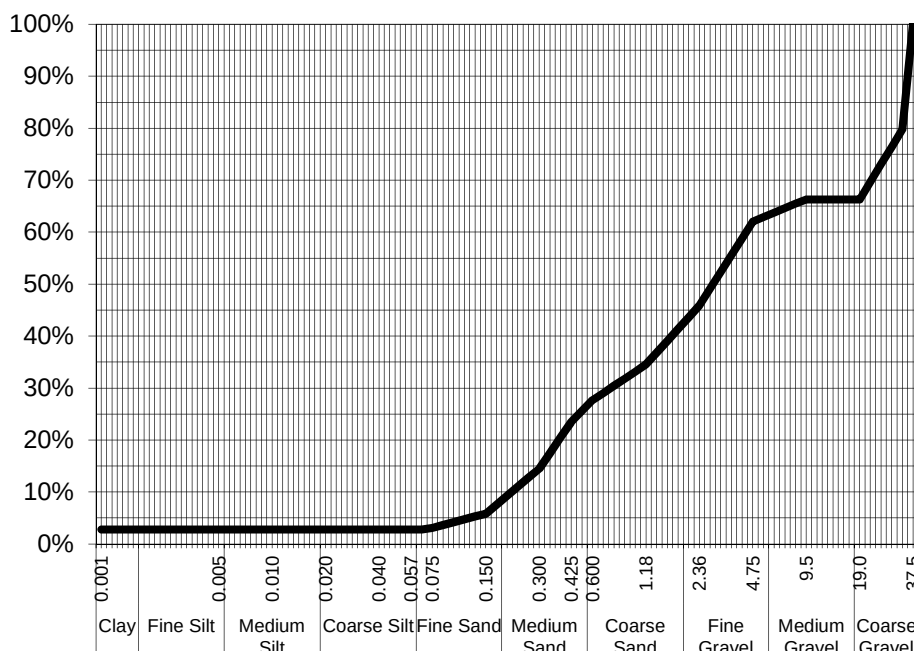
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-002 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C5_0.0-0.15

Particle Size Distribution



Particle Size (mm)	Percent Passing
37.5	100%
19.0	66%
9.5	66%
4.75	62%
2.36	46%
1.18	35%
0.600	28%
0.425	23%
0.300	14%
0.150	6%
0.075	3%
Particle Size (microns)	
57	3%
40	3%
20	3%
10	3%
5	3%
4	3%
1	3%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Gravel and sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm)	2.360
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Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

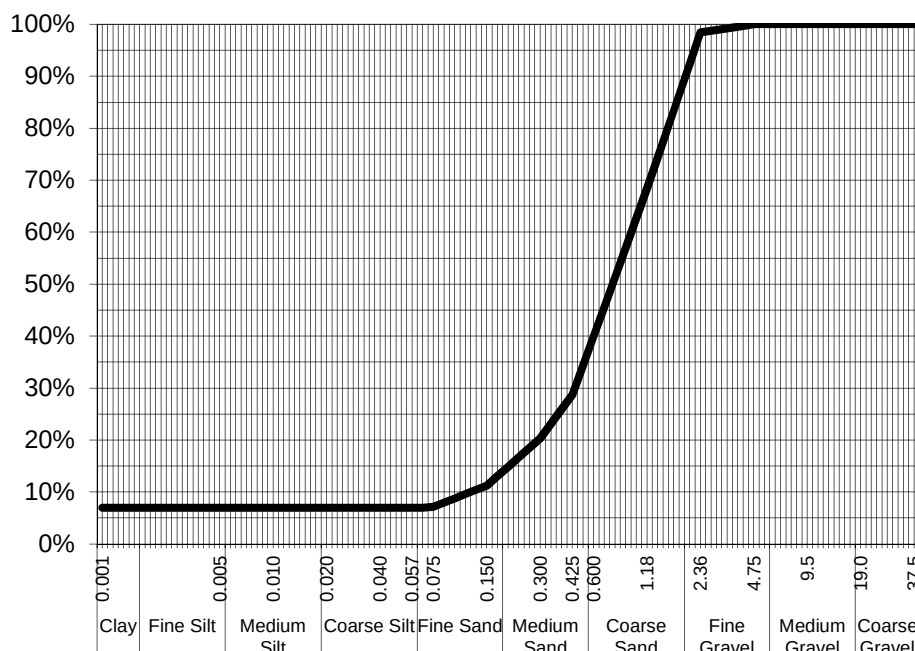
ALS Laboratory Group Pty Ltd
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Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-003 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C7_0.0-0.10

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	98%
1.18	68%
0.600	40%
0.425	29%
0.300	20%
0.150	11%
0.075	7%
Particle Size (microns)	
57	7%
40	7%
20	7%
10	7%
5	7%
4	7%
1	7%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm) 0.600

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

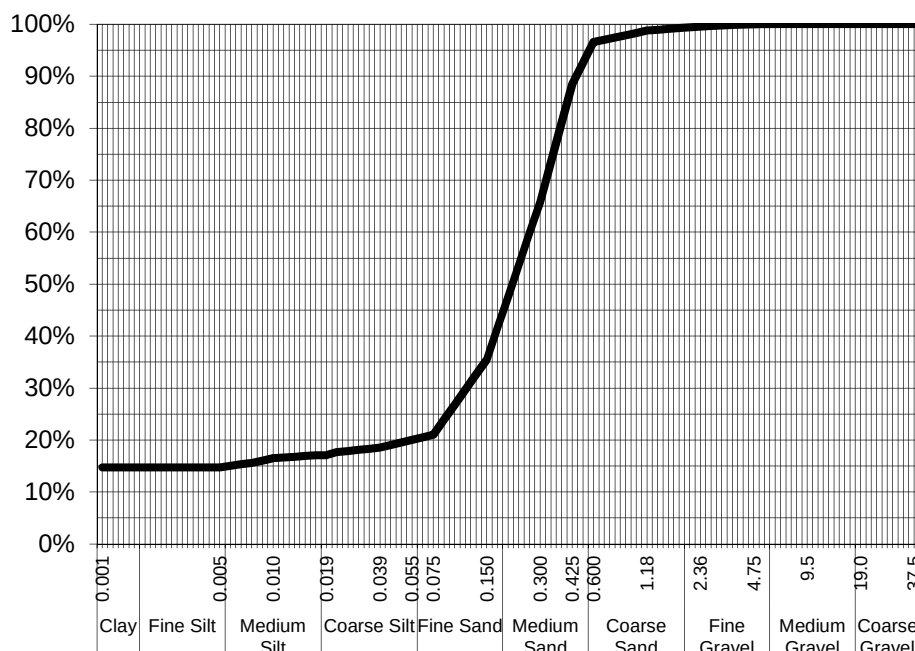
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pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-004 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C2_0.0-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	97%
0.425	88%
0.300	66%
0.150	35%
0.075	21%
Particle Size (microns)	
55	20%
39	19%
19	17%
10	16%
5	15%
3	15%
1	15%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand and clay

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

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Median Particle Size (mm)	0.150
---------------------------	-------

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

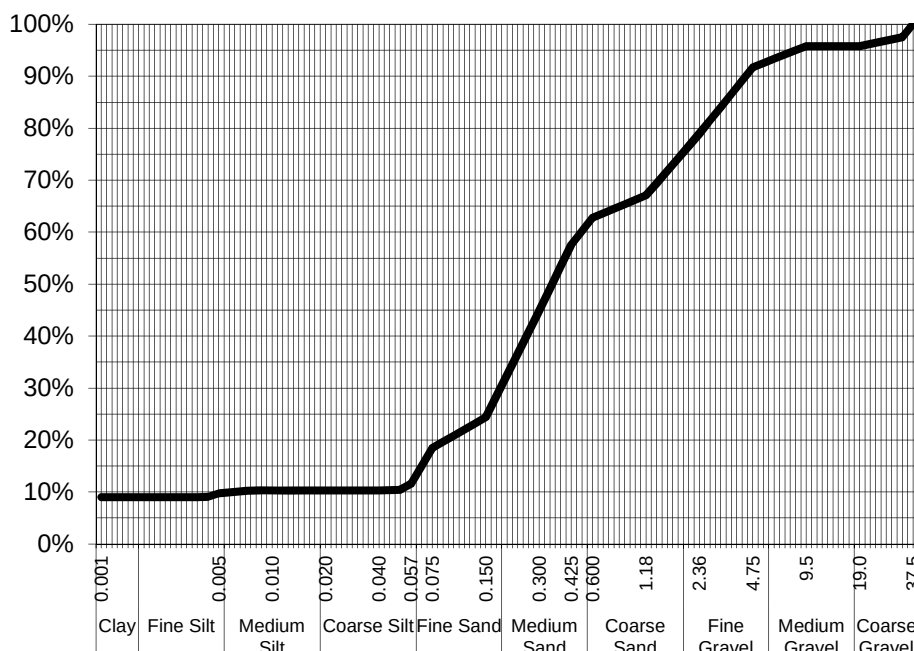
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5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-005 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C1_0-0.55

Particle Size Distribution



Particle Size (mm)	Percent Passing
37.5	100%
19.0	96%
9.5	96%
4.75	92%
2.36	79%
1.18	67%
0.600	63%
0.425	58%
0.300	45%
0.150	24%
0.075	18%
Particle Size (microns)	
57	12%
40	10%
20	10%
10	10%
5	10%
4	9%
1	9%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand, gravel and silty clay

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

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Median Particle Size (mm)	0.300
---------------------------	-------

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

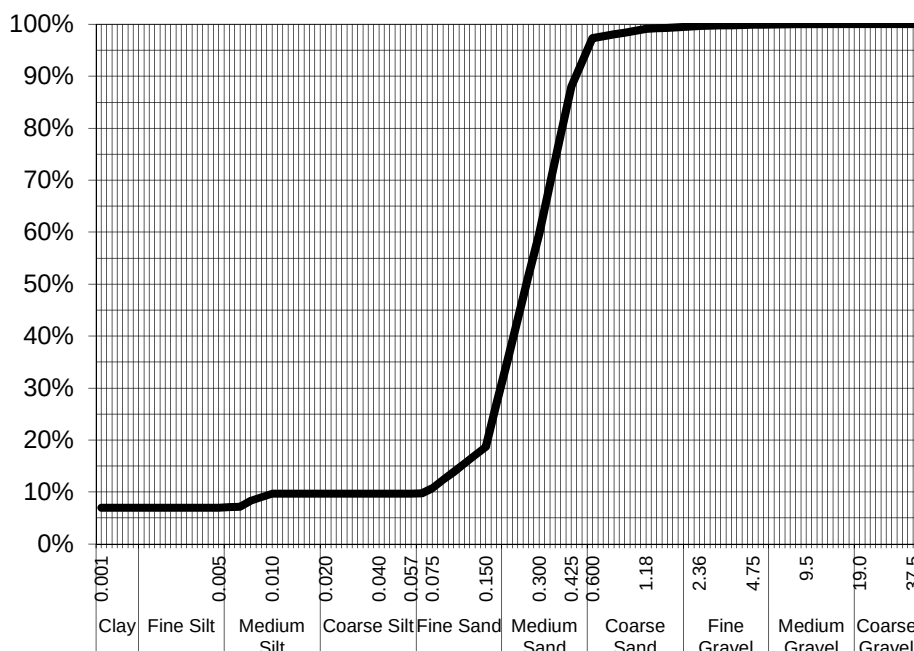
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-006 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C10_0-0.50

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	97%
0.425	88%
0.300	60%
0.150	19%
0.075	11%
Particle Size (microns)	
57	10%
40	10%
20	10%
10	10%
5	7%
4	7%
1	7%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

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Median Particle Size (mm) 0.150

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

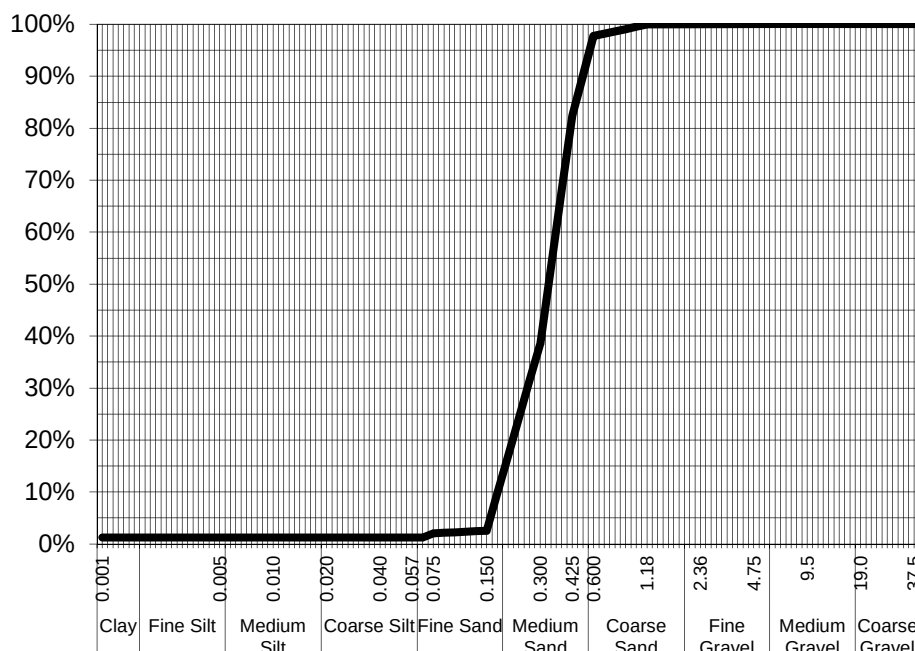
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-007 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C10_1.0-1.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	98%
0.425	82%
0.300	38%
0.150	3%
0.075	2%
Particle Size (microns)	
57	1%
40	1%
20	1%
10	1%
5	1%
4	1%
1	1%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

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Median Particle Size (mm)	0.300
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Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

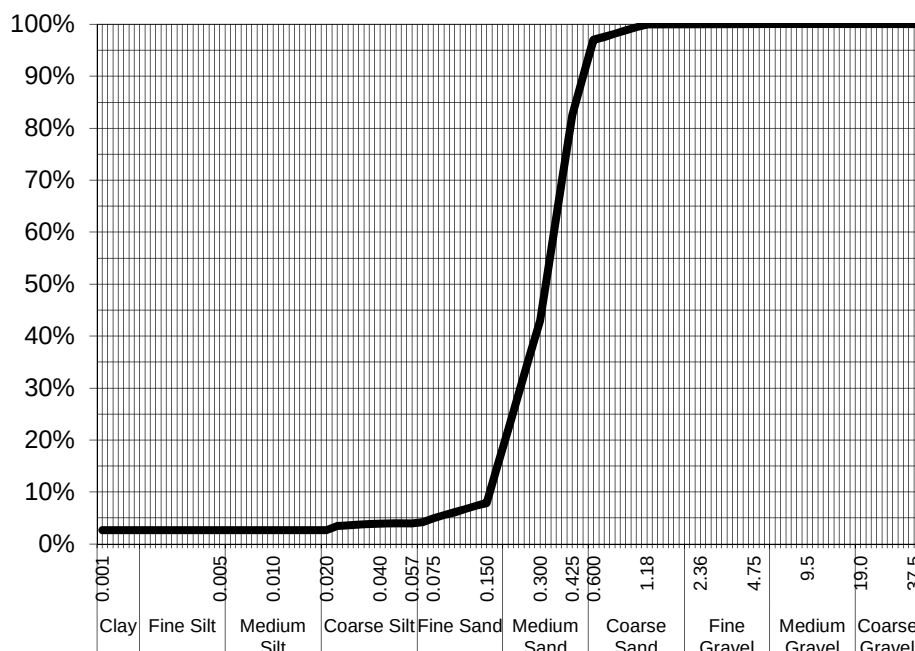
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-008 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C12_0.5-1.0

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	97%
0.425	83%
0.300	43%
0.150	8%
0.075	5%
Particle Size (microns)	
57	4%
40	4%
20	3%
10	3%
5	3%
4	3%
1	3%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm) 0.300

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

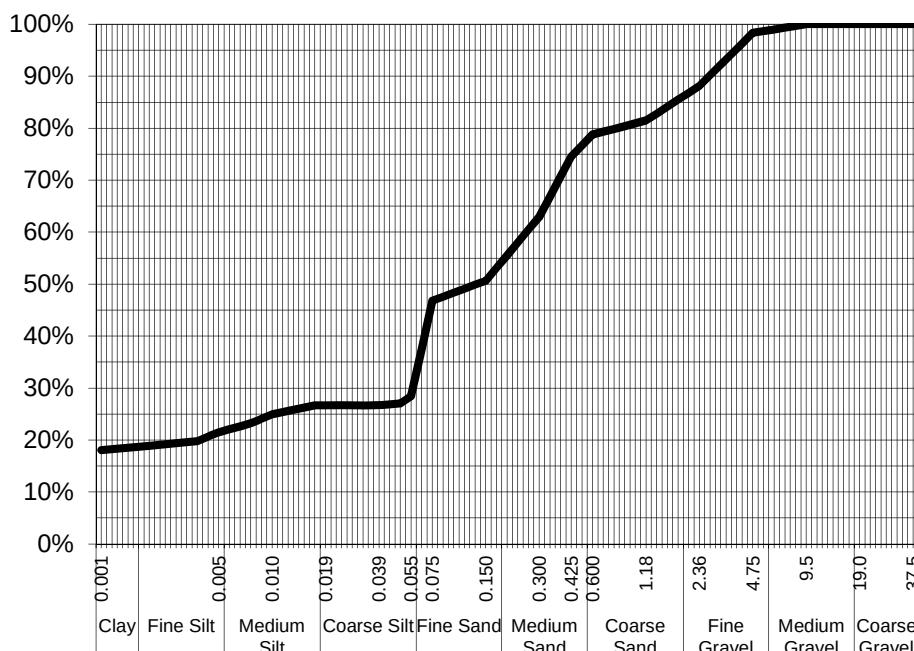
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-009 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C8_0.0-0.12

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	98%
2.36	88%
1.18	81%
0.600	79%
0.425	75%
0.300	63%
0.150	51%
0.075	47%
Particle Size (microns)	
55	28%
39	27%
19	27%
10	25%
5	21%
3	20%
1	18%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Silty clay, sand and gravel

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm)	0.113
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Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

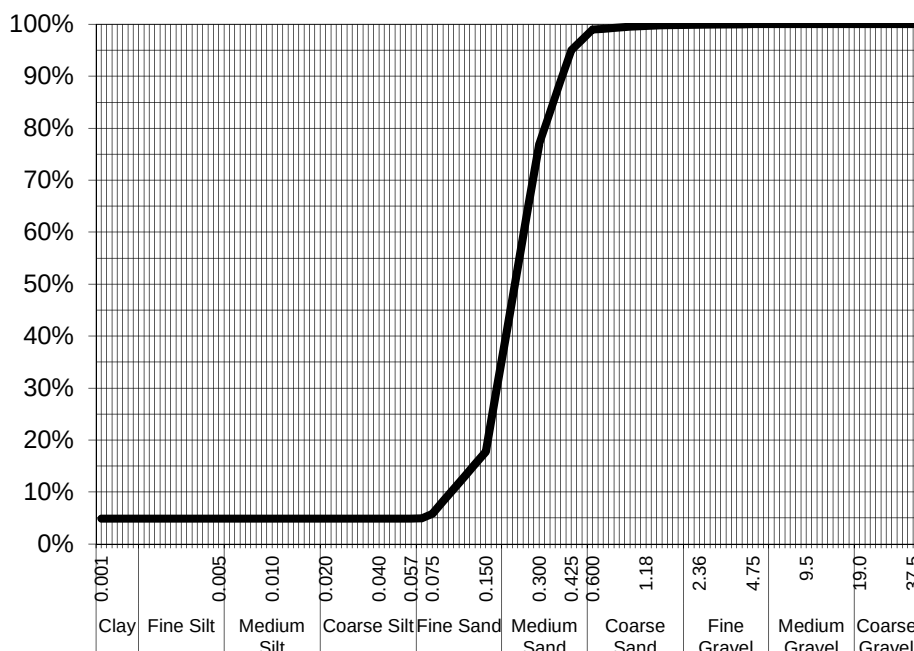
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-001 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C13_0.0-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	99%
0.425	95%
0.300	77%
0.150	18%
0.075	6%
Particle Size (microns)	
57	5%
40	5%
20	5%
10	5%
5	5%
4	5%
1	5%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm)	0.150
---------------------------	-------

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

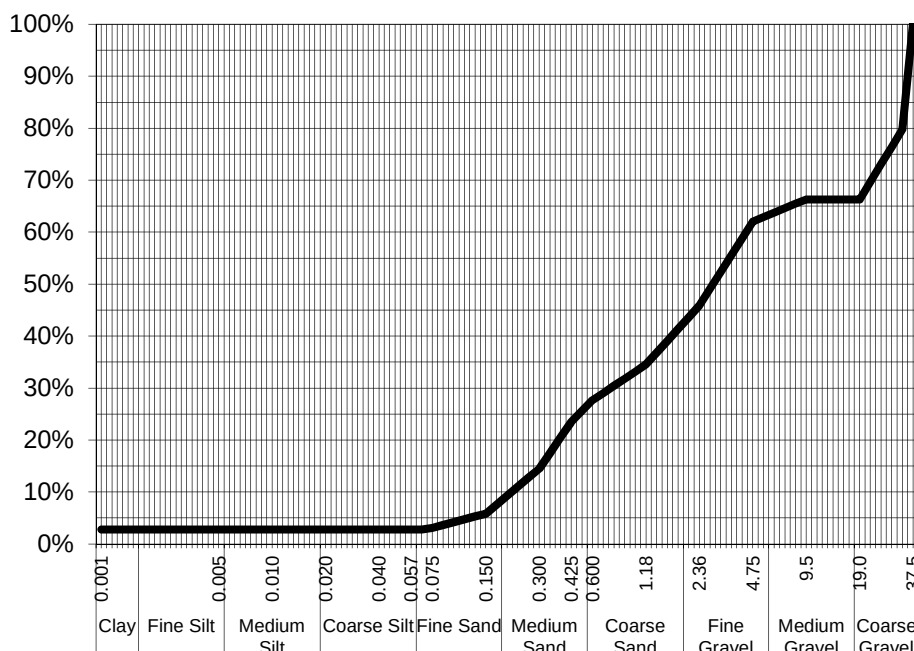
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Warabrook, NSW 2304
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samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-002 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C5_0.0-0.15

Particle Size Distribution



Particle Size (mm)	Percent Passing
37.5	100%
19.0	66%
9.5	66%
4.75	62%
2.36	46%
1.18	35%
0.600	28%
0.425	23%
0.300	14%
0.150	6%
0.075	3%
Particle Size (microns)	
57	3%
40	3%
20	3%
10	3%
5	3%
4	3%
1	3%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Gravel and sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm) 2.360

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

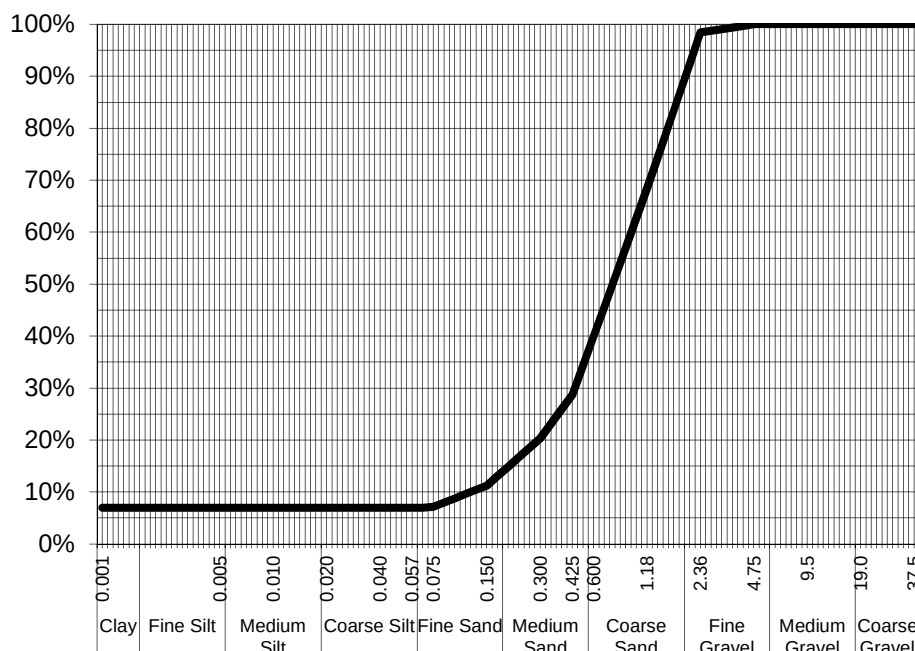
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pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-003 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C7_0.0-0.10

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	98%
1.18	68%
0.600	40%
0.425	29%
0.300	20%
0.150	11%
0.075	7%
Particle Size (microns)	
57	7%
40	7%
20	7%
10	7%
5	7%
4	7%
1	7%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm)	0.600
---------------------------	-------

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

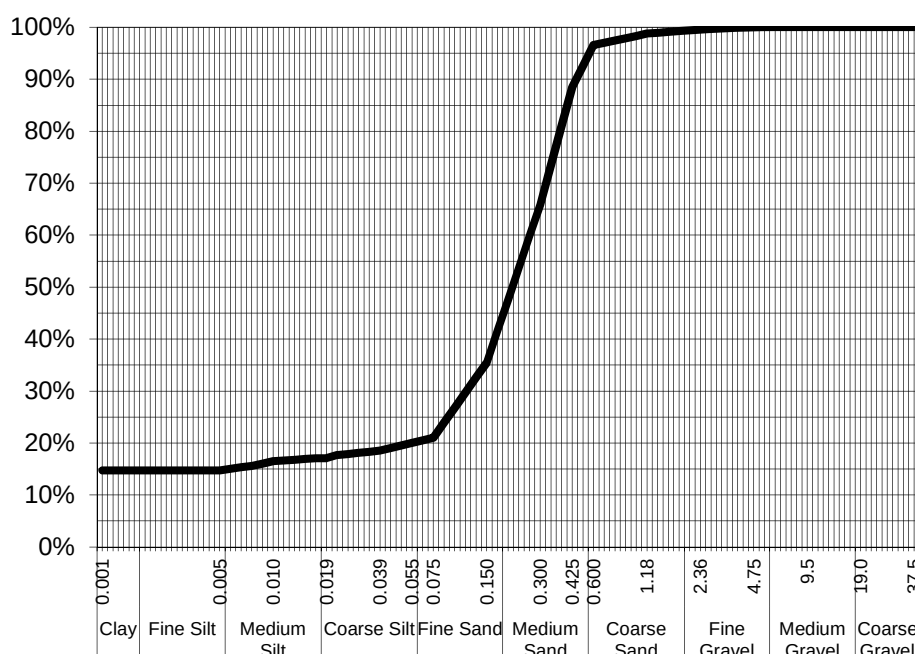
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-004 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C2_0.0-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	97%
0.425	88%
0.300	66%
0.150	35%
0.075	21%
Particle Size (microns)	
55	20%
39	19%
19	17%
10	16%
5	15%
3	15%
1	15%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand and clay

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm)	0.150
---------------------------	-------

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

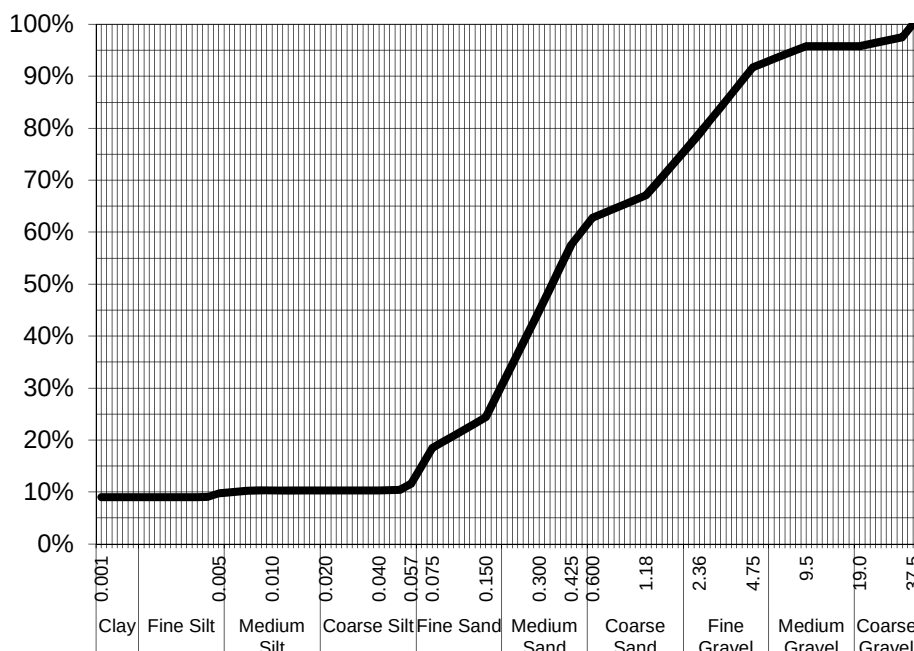
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-005 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C1_0-0.55

Particle Size Distribution



Particle Size (mm)	Percent Passing
37.5	100%
19.0	96%
9.5	96%
4.75	92%
2.36	79%
1.18	67%
0.600	63%
0.425	58%
0.300	45%
0.150	24%
0.075	18%
Particle Size (microns)	
57	12%
40	10%
20	10%
10	10%
5	10%
4	9%
1	9%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand, gravel and silty clay

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm) 0.300

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

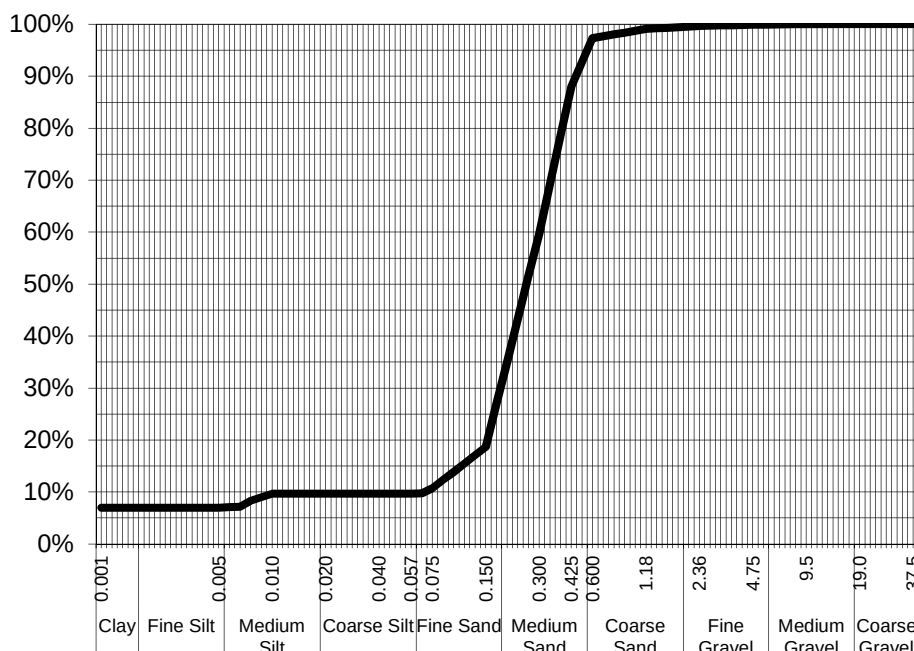
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-006 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C10_0-0.50

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	97%
0.425	88%
0.300	60%
0.150	19%
0.075	11%
Particle Size (microns)	
57	10%
40	10%
20	10%
10	10%
5	7%
4	7%
1	7%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm)	0.150
---------------------------	-------

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

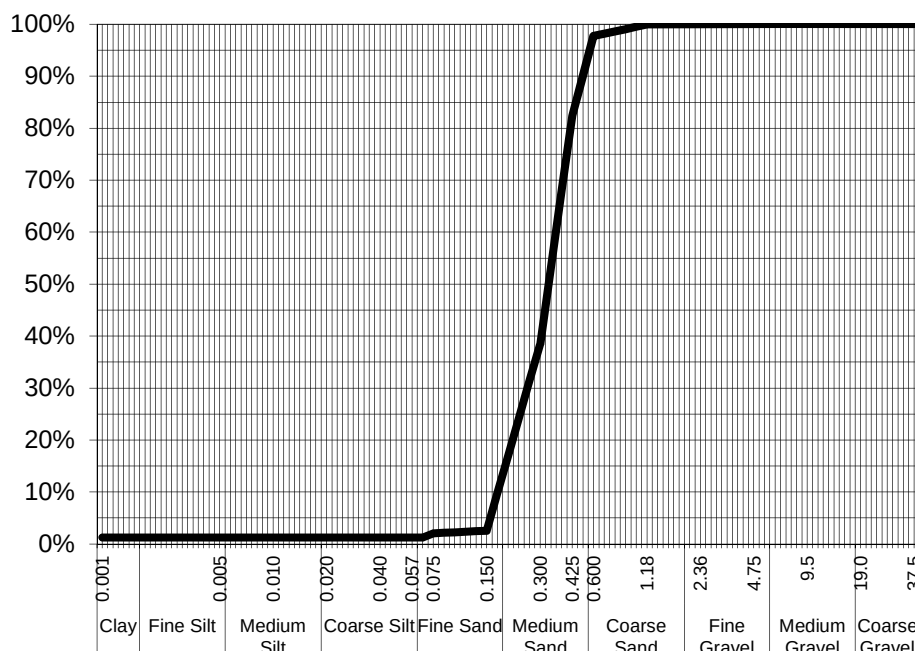
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-007 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C10_1.0-1.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	98%
0.425	82%
0.300	38%
0.150	3%
0.075	2%
Particle Size (microns)	
57	1%
40	1%
20	1%
10	1%
5	1%
4	1%
1	1%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm)	0.300
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Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

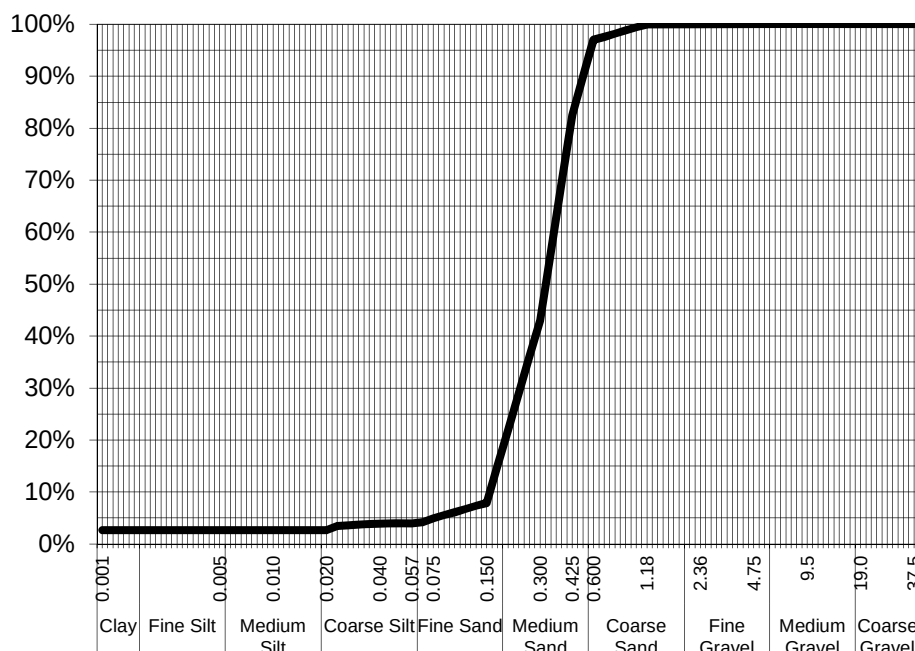
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-008 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C12_0.5-1.0

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	100%
0.600	97%
0.425	83%
0.300	43%
0.150	8%
0.075	5%
Particle Size (microns)	
57	4%
40	4%
20	3%
10	3%
5	3%
4	3%
1	3%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm) 0.300

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

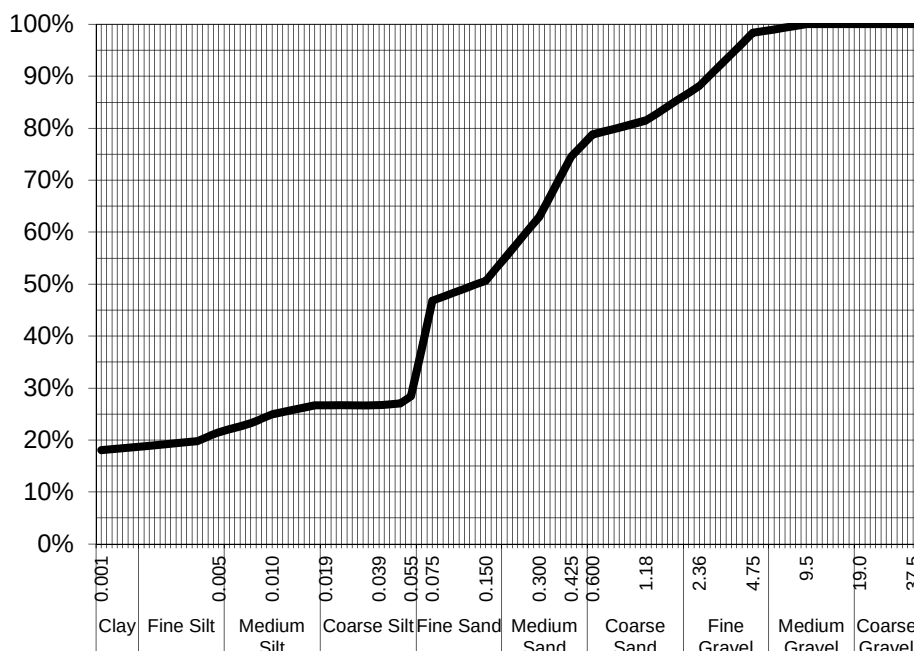
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Carsten Matthai **DATE REPORTED:** 22-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 15-Aug-2012
ADDRESS: 141 Walker St **REPORT NO:** ES1219873-009 / PSD
North Sydney, NSW 2060
PROJECT: Caltex Dredging **SAMPLE ID:** C8_0.0-0.12

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	98%
2.36	88%
1.18	81%
0.600	79%
0.425	75%
0.300	63%
0.150	51%
0.075	47%
Particle Size (microns)	
55	28%
39	27%
19	27%
10	25%
5	21%
3	20%
1	18%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Silty clay, sand and gravel

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm)	0.113
---------------------------	-------

Analysed: 20-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES1220010	Page	: 1 of 3
Client	: CALTEX REFINERIES(NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR SIMON CAPLES	Contact	: Client Services
Address	: 2 SOLANDER ST KURNELL NSW, AUSTRALIA 2231	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scaples@caltex.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: 301015-03041	Date Samples Received	: 16-AUG-2012
C-O-C number	: ----	Issue Date	: 23-AUG-2012
Sampler	: CM	No. of samples received	: 3
Site	: ----	No. of samples analysed	: 3
Quote number	: SY/389/12 V2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
		Newcastle



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.

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

LOR = Limit of reporting

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



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				C18_0.0-0.5	C14_0.0-0.15	C15_0.0-0.5	----	----
				[16-AUG-2012]	[16-AUG-2012]	[16-AUG-2012]	----	----
Compound	CAS Number	LOR	Unit	ES1220010-001	ES1220010-002	ES1220010-003	----	----
EA150: Particle Sizing								
+75µm	----	1	%	88	90	86	----	----
+150µm	----	1	%	78	85	81	----	----
+300µm	----	1	%	43	67	44	----	----
+425µm	----	1	%	16	50	16	----	----
+600µm	----	1	%	3	40	5	----	----
+1180µm	----	1	%	<1	26	3	----	----
+2.36mm	----	1	%	<1	4	2	----	----
+4.75mm	----	1	%	<1	<1	1	----	----
+9.5mm	----	1	%	<1	<1	<1	----	----
+19.0mm	----	1	%	<1	<1	<1	----	----
+37.5mm	----	1	%	<1	<1	<1	----	----
+75.0mm	----	1	%	<1	<1	<1	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	10	5	11	----	----
Silt (2-60 µm)	----	1	%	1	2	1	----	----
Sand (0.06-2.00 mm)	----	1	%	89	89	86	----	----
Gravel (>2mm)	----	1	%	<1	4	2	----	----
Cobbles (>6cm)	----	1	%	<1	<1	<1	----	----

Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES1220010	Page	: 1 of 4
Client	: CALTEX REFINERIES(NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR SIMON CAPLES	Contact	: Client Services
Address	: 2 SOLANDER ST KURNELL NSW, AUSTRALIA 2231	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scaples@caltex.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 16-AUG-2012
C-O-C number	: ----	Issue Date	: 23-AUG-2012
Sampler	: CM	No. of samples received	: 3
Order number	: 301015-03041	No. of samples analysed	: 3
Quote number	: SY/389/12 V2		

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories

Position

Accreditation Category

Newcastle



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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

- **No Laboratory Duplicate (DUP) Results are required to be reported.**



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

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

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**

Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

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

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES1220010	Page	: 1 of 5
Client	: CALTEX REFINERIES(NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR SIMON CAPLES	Contact	: Client Services
Address	: 2 SOLANDER ST KURNELL NSW, AUSTRALIA 2231	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scaples@caltex.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 16-AUG-2012
Sampler	: CM	Issue Date	: 23-AUG-2012
Order number	: 301015-03041		
Quote number	: SY/389/12 V2	No. of samples received	: 3
		No. of samples analysed	: 3

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

This Interpretive Quality Control Report contains the following information:

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



Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA150: Particle Sizing								
Snap Lock Bag (EA150H) C18_0.0-0.5, C15_0.0-0.5	C14_0.0-0.15,	16-AUG-2012	---	12-FEB-2013	----	22-AUG-2012	12-FEB-2013	✓
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H) C18_0.0-0.5, C15_0.0-0.5	C14_0.0-0.15,	16-AUG-2012	---	12-FEB-2013	----	22-AUG-2012	12-FEB-2013	✓



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Particle Size Analysis (Sieving)	EA150	SOIL	Particle Size Analysis by Sieving according to AS1289.3.6.1 - 1995
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order : **ES1220010**

Client : **CALTEX REFINERIES(NSW) PTY LTD**
 Contact : **MR CARSTEN MATTHAI**
 Address : **141 Walker st**
North Sydney NSW 2060

E-mail : **carsten.matthai@WorleyParsons.co**
m

Telephone : ----
 Facsimile : ----

Project : **CALTEX DREDGING**
 Order number : **301015-03041**
 C-O-C number : ----

Site : ----
 Sampler : **CM**

Laboratory : **Environmental Division Sydney**
 Contact : **Client Services**
 Address : **277-289 Woodpark Road Smithfield**
NSW Australia 2164

E-mail : **sydney@alsglobal.com**

Telephone : **+61-2-8784 8555**
 Facsimile : **+61-2-8784 8500**

Page : **1 of 2**

Quote number : **ES2012CALREFNSW0182 (SY/389/12**
V2)

QC Level : **NEPM 1999 Schedule B(3) and ALS**
QCS3 requirement

Dates

Date Samples Received : **16-AUG-2012**
 Client Requested Due Date : **24-AUG-2012**

Issue Date : **20-AUG-2012 09:30**
 Scheduled Reporting Date : **24-AUG-2012**

Delivery Details

Mode of Delivery : **Carrier**
 No. of coolers/boxes : **3 HARD**
 Security Seal : **Not intact.**

Temperature : **4.5'C - Ice present**
 No. of samples received : **3**
 No. of samples analysed : **3**

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
- **Samples received in appropriately pretreated and preserved containers.**
- **PSD analysis will be conducted by ALS Newcastle.**
- **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.**
- **THIS BATCH IS FOR PSD AND SPLIT INTO ES1220011.**
- 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 (14 days), Solid (60 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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 to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA150H Particle Size Analysis by Hydrometer
ES1220010-001	[16-AUG-2012]	C18_0.0-0.5	✓
ES1220010-002	[16-AUG-2012]	C14_0.0-0.15	✓
ES1220010-003	[16-AUG-2012]	C15_0.0-0.5	✓

Proactive Holding Time Report

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

Requested Deliverables

MR CARSTEN MATTHAI

- *AU Certificate of Analysis - NATA (COA)	Email	carsten.matthai@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	carsten.matthai@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	carsten.matthai@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	carsten.matthai@WorleyParsons.com
- Attachment - Report (SUBCO)	Email	carsten.matthai@WorleyParsons.com
- Chain of Custody (CoC) (COC)	Email	carsten.matthai@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	carsten.matthai@WorleyParsons.com

MR SIMON CAPLES

- *AU Certificate of Analysis - NATA (COA)	Email	scaples@caltex.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	scaples@caltex.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	scaples@caltex.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	scaples@caltex.com.au
- A4 - AU Tax Invoice (INV)	Email	scaples@caltex.com.au
- Attachment - Report (SUBCO)	Email	scaples@caltex.com.au
- Chain of Custody (CoC) (COC)	Email	scaples@caltex.com.au
- EDI Format - ENMRG (ENMRG)	Email	scaples@caltex.com.au

MS CHRISTINA HALIM

- A4 - AU Tax Invoice (INV)	Email	CHalim@caltex.com.au
-------------------------------	-------	----------------------

MS DEBORAH LAM

- *AU Certificate of Analysis - NATA (COA)	Email	deborah.lam@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	deborah.lam@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	deborah.lam@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	deborah.lam@WorleyParsons.com
- Attachment - Report (SUBCO)	Email	deborah.lam@WorleyParsons.com
- Chain of Custody (CoC) (COC)	Email	deborah.lam@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	deborah.lam@WorleyParsons.com

Certificate of Analysis

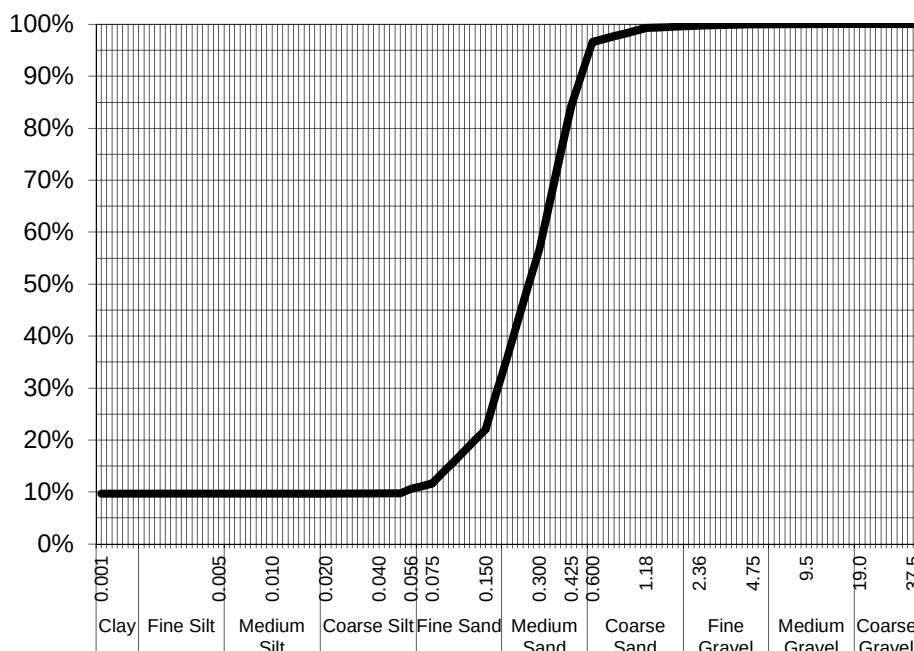
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Simon Caples **DATE REPORTED:** 23-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 16-Aug-2012
ADDRESS: 2 Solander St **REPORT NO:** ES1220010-001 / PSD
Kurnell, NSW, Australia 2231
PROJECT: Caltex Dredging **SAMPLE ID:** C18_0.0-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	100%
1.18	99%
0.600	97%
0.425	84%
0.300	57%
0.150	22%
0.075	12%
Particle Size (microns)	
56	11%
40	10%
20	10%
10	10%
5	10%
4	10%
1	10%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand and clay

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm)	0.225
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Analysed: 21-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

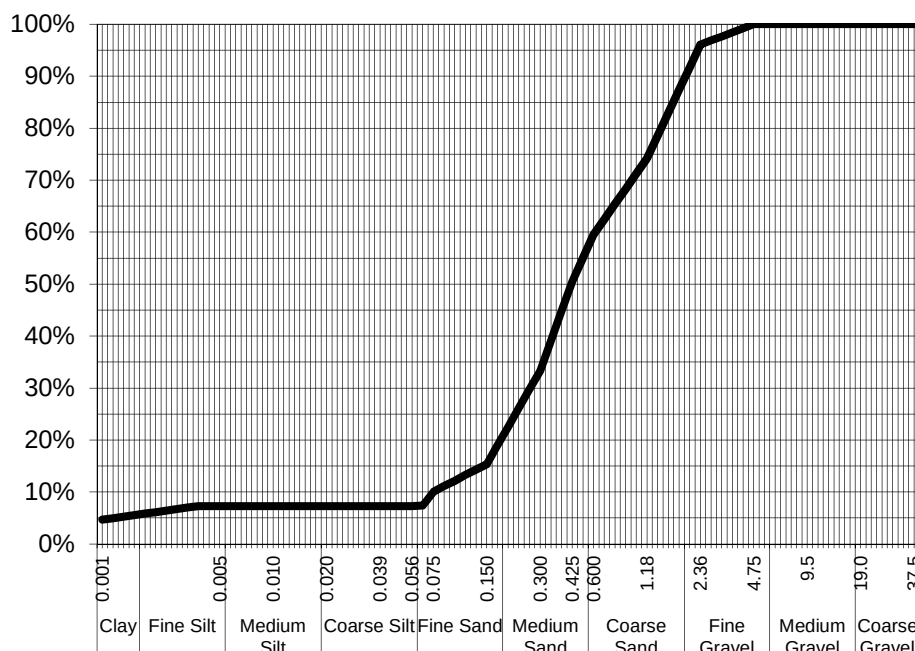
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Simon Caples **DATE REPORTED:** 23-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 16-Aug-2012
ADDRESS: 2 Solander St **REPORT NO:** ES1220010-002 / PSD
Kurnell, NSW, Australia 2231
PROJECT: Caltex Dredging **SAMPLE ID:** C14_0.0-0.15

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	100%
2.36	96%
1.18	74%
0.600	60%
0.425	50%
0.300	33%
0.150	15%
0.075	10%
Particle Size (microns)	
56	7%
39	7%
20	7%
10	7%
5	7%
4	7%
1	5%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Sand

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm) 0.363

Analysed: 21-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory

Certificate of Analysis

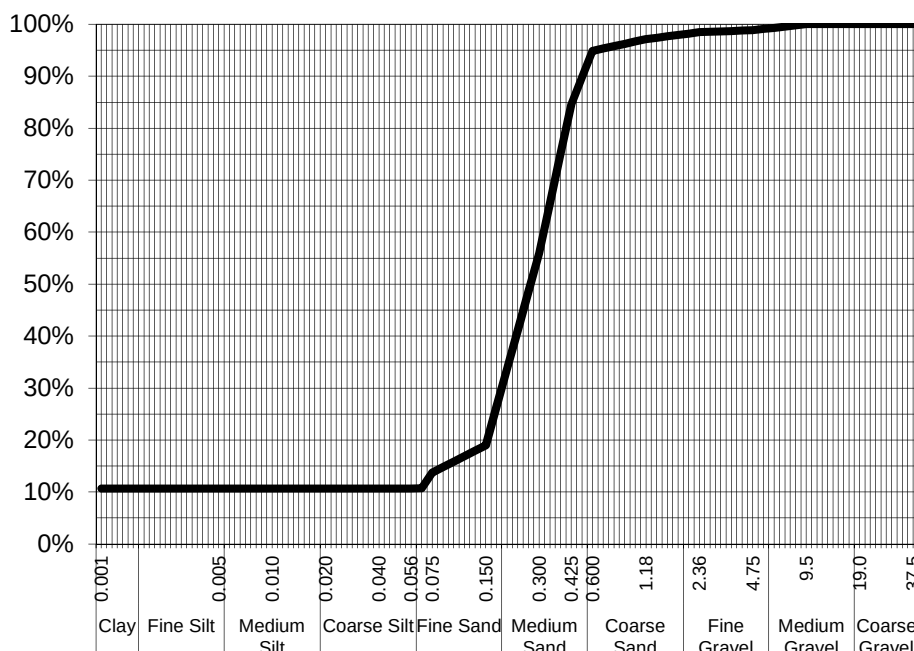
ALS Laboratory Group Pty Ltd
5 Rosegum Road
Warabrook, NSW 2304
pH 02 4968 9433
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Simon Caples **DATE REPORTED:** 23-Aug-2012
COMPANY: Caltex Refineries(NSW) Pty Ltd **DATE RECEIVED:** 16-Aug-2012
ADDRESS: 2 Solander St **REPORT NO:** ES1220010-003 / PSD
Kurnell, NSW, Australia 2231
PROJECT: Caltex Dredging **SAMPLE ID:** C15_0.0-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.5	100%
4.75	99%
2.36	98%
1.18	97%
0.600	95%
0.425	85%
0.300	56%
0.150	19%
0.075	14%
Particle Size (microns)	
56	11%
40	11%
20	11%
10	11%
5	11%
4	11%
1	11%

Samples analysed as received.

Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results

Sample Comments:

Loss on Pretreatment NA

Sample Description: Medium fine sand and clay

Test Method: AS1289.3.6.1/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.65 g/cm³

NATA Accreditation: 825 Site: Newcastle
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Median Particle Size (mm)	0.225
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Analysed: 21-Aug-12

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Hamish Murray
Laboratory Supervisor, Newcastle
Authorised Signatory



WorleyParsons

resources & energy

EcoNomics™

CALTEX REFINERIES NSW

CALTEX KURNELL PORT AND BERTHING PROJECT, BOTANY BAY, NSW

SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

ACID SULFATE SOIL LABORATORY RESULTS

Maggie Kahi

From: Nathan King
Sent: Wednesday, 9 December 2009 12:54 PM
To: Maggie Kahi; Matthew Goodwin
Subject: FW: further testing - ES0917731, ES0917543, ES0917657

From: Frank Ferraro
Sent: Wednesday, 9 December 2009 11:33 AM
To: Samples Brisbane; Nathan King
Cc: Jacob Waugh
Subject: FW: further testing - ES0917731, ES0917543, ES0917657

Hi Nathan,

Can you please re-batch the samples below as per client request? All samples are in Brisbane.

Regards

Frank

From: Watters, Ali (Sydney) [mailto:Ali.STONE@WorleyParsons.com]
Sent: Wednesday, 9 December 2009 12:12 PM
To: Samples Sydney
Cc: Jacob Waugh; Charlie Pierce; Hannaford, Nick (Sydney)
Subject: further testing - ES0917731, ES0917543, ES0917657

Could you please arrange the following further ASS testing -

ALS Method - EA033 Chromium Suite - Complete

- 1 VC1A1 (0-0.6) ES0917731-005
- 2 VC1A1 (1.2-1.7) ES0917731-007
- 3 VC2A (1.0-1.4) ES0917543-004
- 4 VC2B (0-0.5) ES0917657-008
- 5 VC2B (0.9-1.5) ES0917657-010
- 6 VC3B (0-0.5) ES0917657-005
- 7 SS1D ES0917657-015
- 8 SS2D ES0917657-012
- 9 SS3A ES0917657-004
- 10 SS3C ES0917657-001

Thanks

Ali

Ali Watters
Principal Environmental Engineer
Coastal and Marine
WorleyParsons

Tel: +61 2 8456 7264 (direct)
Fax: +61 2 8923 6877



11/12/2009

Street address
Level 12
141 Walker Street
North Sydney NSW 2060

Postal address
PO Box 1812
North Sydney NSW 2059

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Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: EB0919644	Page	: 1 of 4
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MR NICK HANNAFORD	Contact	: Tim Kilmister
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: Nicholas.Hannaford@WorleyParsons.com	E-mail	: Services.Brisbane@alsenviro.com
Telephone	: +61 02 8456 7374	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 8923 6877	Facsimile	: +61-7-3243 7218
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 09-DEC-2009
C-O-C number	: ----	Issue Date	: 21-DEC-2009
Sampler	: NICK HANNAFORD	No. of samples received	: 10
Site	: ----	No. of samples analysed	: 10
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Inorganics

Environmental Division Brisbane

Part of the **ALS Laboratory Group**

32 Shand Street Stafford QLD Australia 4053

Tel. +61-7-3243 7222 Fax. +61-7-3243 7218 www.alsglobal.com

A Campbell Brothers Limited Company



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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- **Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO₃) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m³ in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m³'.**
- **Retained Acidity not required because pH KCl greater than or equal to 4.5**



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				VC1A1 (0-0.6)	VC1A1 (1.2-1.7)	VC2A (1.0-1.4)	VC2B (0-0.5)	VC2B (0.9-1.5)
				18-NOV-2009 15:00	18-NOV-2009 15:00	17-DEC-2009 11:00	18-NOV-2009 15:00	18-NOV-2009 15:00
Compound	CAS Number	LOR	Unit	EB0919644-001	EB0919644-002	EB0919644-003	EB0919644-004	EB0919644-005
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	9.6	9.6	7.2	9.6	5.7
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	8
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.02	% S	0.03	0.06	0.22	0.07	0.16
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	17	40	137	45	102
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	2.90	2.25	0.35	3.64	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	580	449	71	726	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.93	0.72	0.11	1.16	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.14	<0.02	0.18
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	90	<10	111
Liming Rate	----	1	kg CaCO3/t	<1	<1	7	<1	8



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				VC3B (0-0.5)	SS1D	SS2D	SS3A	SS3C
				18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00
Compound	CAS Number	LOR	Unit	EB0919644-006	EB0919644-007	EB0919644-008	EB0919644-009	EB0919644-010
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	9.4	9.6	9.7	9.6	9.0
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.02	% S	0.10	<0.02	<0.02	0.06	0.27
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	60	<10	<10	37	167
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	3.46	0.61	2.40	9.14	16.3
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	691	121	479	1830	3260
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	1.11	0.19	0.77	2.93	5.22
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	<1



Environmental Division

QUALITY CONTROL REPORT

Work Order	: EB0919644	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MR NICK HANNAFORD	Contact	: Tim Kilmister
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: Nicholas.Hannaford@WorleyParsons.com	E-mail	: Services.Brisbane@alsenviro.com
Telephone	: +61 02 8456 7374	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 8923 6877	Facsimile	: +61-7-3243 7218
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 09-DEC-2009
C-O-C number	: ----	Issue Date	: 21-DEC-2009
Sampler	: NICK HANNAFORD	No. of samples received	: 10
Order number	: ----	No. of samples analysed	: 10
Quote number	: SY/503/09		

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Inorganics

Environmental Division Brisbane

Part of the **ALS Laboratory Group**

32 Shand Street Stafford QLD Australia 4053

Tel. +61-7-3243 7222 Fax. +61-7-3243 7218 www.alsglobal.com

A Campbell Brothers Limited Company



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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA033-A: Actual Acidity (QC Lot: 1198174)									
EB0919465-001	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	7	6	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	6.0	6.0	0.0	0% - 20%
EB0919644-005	VC2B (0.9-1.5)	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	8	6	26.1	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.7	5.9	3.4	0% - 20%
EA033-B: Potential Acidity (QC Lot: 1198174)									
EB0919465-001	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.02	% S	<0.02	<0.02	0.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EB0919644-005	VC2B (0.9-1.5)	EA033: Chromium Reducible Sulfur (22B)	----	0.02	% S	0.16	0.17	0.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	102	105	2.4	0% - 50%



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

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

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EA033-A: Actual Acidity (QCLot: 1198174)								
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	----	----	----	----
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 1198174)								
EA033: Chromium Reducible Sulfur (22B)	----	0.02	% S	<0.02	----	----	----	----
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 1198174)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	----	----	----	----
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----



Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: EB0919644	Page	: 1 of 6
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MR NICK HANNAFORD	Contact	: Tim Kilmister
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: Nicholas.Hannaford@WorleyParsons.com	E-mail	: Services.Brisbane@alsenviro.com
Telephone	: +61 02 8456 7374	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 8923 6877	Facsimile	: +61-7-3243 7218
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 09-DEC-2009
C-O-C number	: ----	Issue Date	: 21-DEC-2009
Sampler	: NICK HANNAFORD		
Order number	: ----	No. of samples received	: 10
Quote number	: SY/503/09	No. of samples analysed	: 10

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

This Interpretive Quality Control Report contains the following information:

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

Environmental Division Brisbane

Part of the **ALS Laboratory Group**

32 Shand Street Stafford QLD Australia 4053

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A Campbell Brothers Limited Company



Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-A: Actual Acidity							
80* dried soil VC2A (1.0-1.4)	17-DEC-2009	17-DEC-2009	17-DEC-2010	✓	19-DEC-2009	17-MAR-2010	✓
80* dried soil VC1A1 (0-0.6), VC2B (0-0.5), VC3B (0-0.5), SS2D, SS3C	18-NOV-2009	17-DEC-2009	18-NOV-2010	✓	19-DEC-2009	17-MAR-2010	✓
EA033-B: Potential Acidity							
80* dried soil VC2A (1.0-1.4)	17-DEC-2009	17-DEC-2009	17-DEC-2010	✓	19-DEC-2009	17-MAR-2010	✓
80* dried soil VC1A1 (0-0.6), VC2B (0-0.5), VC3B (0-0.5), SS2D, SS3C	18-NOV-2009	17-DEC-2009	18-NOV-2010	✓	19-DEC-2009	17-MAR-2010	✓
EA033-C: Acid Neutralising Capacity							
80* dried soil VC2A (1.0-1.4)	17-DEC-2009	17-DEC-2009	17-DEC-2010	✓	19-DEC-2009	17-MAR-2010	✓
80* dried soil VC1A1 (0-0.6), VC2B (0-0.5), VC3B (0-0.5), SS2D, SS3C	18-NOV-2009	17-DEC-2009	18-NOV-2010	✓	19-DEC-2009	17-MAR-2010	✓



Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-D: Retained Acidity								
80* dried soil VC2A (1.0-1.4)		17-DEC-2009	17-DEC-2009	17-DEC-2010	✓	19-DEC-2009	17-MAR-2010	✓
80* dried soil VC1A1 (0-0.6), VC2B (0-0.5), VC3B (0-0.5), SS2D, SS3C		18-NOV-2009	17-DEC-2009	18-NOV-2010	✓	19-DEC-2009	17-MAR-2010	✓
VC1A1 (1.2-1.7), VC2B (0.9-1.5), SS1D, SS3A,								
EA033-E: Acid Base Accounting								
80* dried soil VC2A (1.0-1.4)		17-DEC-2009	17-DEC-2009	17-DEC-2010	✓	19-DEC-2009	17-MAR-2010	✓
80* dried soil VC1A1 (0-0.6), VC2B (0-0.5), VC3B (0-0.5), SS2D, SS3C		18-NOV-2009	17-DEC-2009	18-NOV-2010	✓	19-DEC-2009	17-MAR-2010	✓
VC1A1 (1.2-1.7), VC2B (0.9-1.5), SS1D, SS3A,								



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	2	16	12.5	10.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	16	6.3	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)
Comprehensive Report

Work Order : **EB0919644**

Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MR NICK HANNAFORD	Contact	: Tim Kilmister
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: Nicholas.Hannaford@WorleyParsons. com	E-mail	: Services.Brisbane@alsenviro.com
Telephone	: +61 02 8456 7374	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 8923 6877	Facsimile	: +61-7-3243 7218
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----	Quote number	: ES2009WORPAR0232 (SY/503/09)
C-O-C number	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
Sampler	: NICK HANNAFORD		

Dates

Date Samples Received	: 09-DEC-2009	Issue Date	: 11-DEC-2009 12:52
Client Requested Due Date	: 22-DEC-2009	Scheduled Reporting Date	: 22-DEC-2009

Delivery Details

Mode of Delivery	: Samples on hand	Temperature	: AMBIENT
No. of coolers/boxes	: RE-BATCH	No. of samples received	: 10
Security Seal	: Intact.	No. of samples analysed	: 10

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **Sample(s) have been received within recommended holding times.**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Maggie Kahi.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA033 Chromium Suite for Acid Sulphate Soils
EB0919644-001	18-NOV-2009 15:00	VC1A1 (0-0.6)	✓
EB0919644-002	18-NOV-2009 15:00	VC1A1 (1.2-1.7)	✓
EB0919644-003	17-DEC-2009 11:00	VC2A (1.0-1.4)	✓
EB0919644-004	18-NOV-2009 15:00	VC2B (0-0.5)	✓
EB0919644-005	18-NOV-2009 15:00	VC2B (0.9-1.5)	✓
EB0919644-006	18-NOV-2009 15:00	VC3B (0-0.5)	✓
EB0919644-007	18-NOV-2009 15:00	SS1D	✓
EB0919644-008	18-NOV-2009 15:00	SS2D	✓
EB0919644-009	18-NOV-2009 15:00	SS3A	✓
EB0919644-010	18-NOV-2009 15:00	SS3C	✓

Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParsons.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - XTab (XTAB)	Email	Nicholas.Hannaford@WorleyParsons.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com
- EDI Format - XTab (XTAB)	Email	ali.watters@worleyparsons.com

CLIENT: WORPAR					SAMPLER:					 ALS Laboratory Group									
ADDRESS / OFFICE:					MOBILE:														
PROJECT MANAGER (PM):					PHONE:														
PROJECT ID: ES112545R					EMAIL REPORT TO:														
SITE:					P.O. NO.:					EMAIL INVOICE TO: (if different to report)									
RESULTS REQUIRED (Date):					QUOTE NO.:					ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)									
FOR LABORATORY USE ONLY COOLER SEAL (circle appropriate) Intact: ☒ Yes ☐ No ☐ N/A SAMPLE TEMPERATURE CHILLED: ☐ Yes ☐ No					COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:					Notes: e.g. Highly contaminated samples e.g. "High PAHs expected". e.g. "High ORs etc." please give Sample #1 to Chris to Rlp Work Order EB1126260 Telephone : + 61-7-3243 7222									
SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION					CF Suite									
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles													
1	VC5C 0.5-1 Rlp	18/11																	
2	VC5B 0.8-1.3 Rlp	18/11																	
3	VC5B 1.3-1.6 Rlp	18/11																	
RELINQUISHED BY:					RECEIVED BY					METHOD OF SHIPMENT									
Name:		Date:			Name: C. Bryant		Date: 6-12-11			Con' Note No:									
Of:		Time:			Of: ALS		Time: 1341												
Name:		Date:			Name:		Date:			Transport Co:									
Of:		Time:			Of:		Time:												
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; V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.																			

CERTIFICATE OF ANALYSIS

Work Order	: EB1126260	Page	: 1 of 3
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: Caltex	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: 301015-02448	Date Samples Received	: 06-DEC-2011
C-O-C number	: ----	Issue Date	: 13-DEC-2011
Sampler	: O. MURRAY	No. of samples received	: 3
Site	: ----	No. of samples analysed	: 3
Quote number	: EN/034/11		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils



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.

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

- **ASS: EA033 (CRS Suite):** Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO_3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m³ in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m³'.



Analytical Results

Sub-Matrix: **SOIL**

Client sample ID

Client sampling date / time

				VC5C 0.5-1	VC5B 0.8-1.3	VC5B 1.3-1.6	----	----
				18-NOV-2011 15:00	18-NOV-2011 15:00	18-NOV-2011 15:00	----	----
Compound	CAS Number	LOR	Unit	EB1126260-001	EB1126260-002	EB1126260-003	----	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.7	6.5	4.1	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	50	<2	38	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.08	<0.02	0.06	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.325	1.86	1.25	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	203	1160	779	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	----	1.28	----	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	----	256	----	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	----	0.41	----	----	----
EA033-D: Retained Acidity								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	----	----	0.20	----	----
HCl Extractable Sulfur (20Be)	----	0.02	% S	----	----	0.31	----	----
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	----	----	0.11	----	----
acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t	----	----	52	----	----
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	----	----	0.08	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	----	----
Net Acidity (sulfur units)	----	0.02	% S	0.40	1.59	1.39	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	253	993	869	----	----
Liming Rate	----	1	kg CaCO3/t	19	74	65	----	----

QUALITY CONTROL REPORT

Work Order	: EB1126260	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: Caltex	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 06-DEC-2011
Sampler	: O. MURRAY	Issue Date	: 13-DEC-2011
Order number	: 301015-02448		
Quote number	: EN/034/11	No. of samples received	: 3
		No. of samples analysed	: 3

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils



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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA033-A: Actual Acidity (QC Lot: 2084548)									
EB1126093-001	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	10	10	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.7	5.6	1.8	0% - 20%
EA033-B: Potential Acidity (QC Lot: 2084548)									
EB1126093-001	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.083	0.084	1.9	0% - 50%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	52	53	0.0	No Limit



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

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

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			LCS	Low	High
EA033-A: Actual Acidity (QCLot: 2084548)								
EA033: pH KCl (23A)	----	0.1	pH Unit	----	4.5 pH Unit	97.8	93	120
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	30 mole H+ / t	99.6	93	120
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 2084548)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	.28 % S	86.3	80	120
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 2084548)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	101	89	111
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----
EA033-D: Retained Acidity (QCLot: 2084548)								
EA033: Net Acid Soluble Sulfur (20Je)	----	0.02	% S	<0.02	----	----	----	----
EA033: acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.02	.038 % S	92.6	90	110
EA033: HCl Extractable Sulfur (20Be)	----	0.02	% S	<0.02	.06 % S	106	93	120



Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: EB1126260	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: Caltex	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 06-DEC-2011
C-O-C number	: ----	Issue Date	: 13-DEC-2011
Sampler	: O. MURRAY	No. of samples received	: 3
Order number	: 301015-02448	No. of samples analysed	: 3
Quote number	: EN/034/11		

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

This Interpretive Quality Control Report contains the following information:

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



Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA033-E: Acid Base Accounting								
80* dried soil (EA033) VC5C 0.5-1, VC5B 1.3-1.6	VC5B 0.8-1.3,	18-NOV-2011	12-DEC-2011	17-NOV-2012	✓	12-DEC-2011	11-MAR-2012	✓
EA033-C: Acid Neutralising Capacity								
80* dried soil (EA033) VC5C 0.5-1, VC5B 1.3-1.6	VC5B 0.8-1.3,	18-NOV-2011	12-DEC-2011	17-NOV-2012	✓	12-DEC-2011	11-MAR-2012	✓
EA033-A: Actual Acidity								
80* dried soil (EA033) VC5C 0.5-1, VC5B 1.3-1.6	VC5B 0.8-1.3,	18-NOV-2011	12-DEC-2011	17-NOV-2012	✓	12-DEC-2011	11-MAR-2012	✓
EA033-B: Potential Acidity								
80* dried soil (EA033) VC5C 0.5-1, VC5B 1.3-1.6	VC5B 0.8-1.3,	18-NOV-2011	12-DEC-2011	17-NOV-2012	✓	12-DEC-2011	11-MAR-2012	✓
EA033-D: Retained Acidity								
80* dried soil (EA033) VC5C 0.5-1, VC5B 1.3-1.6	VC5B 0.8-1.3,	18-NOV-2011	12-DEC-2011	17-NOV-2012	✓	12-DEC-2011	11-MAR-2012	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL** Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	1	10	10.0	10.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	1	10	10.0	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	10	10.0	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: EB1126260		
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: Caltex	Page	: 1 of 2
Order number	: 301015-02448	Quote number	: EM2011WORPAR0266 (EN/034/11)
C-O-C number	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
Sampler	: O. MURRAY		

Dates

Date Samples Received	: 06-DEC-2011	Issue Date	: 08-DEC-2011 22:22
Client Requested Due Date	: 16-DEC-2011	Scheduled Reporting Date	: 16-DEC-2011

Delivery Details

Mode of Delivery	: Samples on hand	Temperature	: AMBIENT
No. of coolers/boxes	: REBATCH	No. of samples received	: 3
Security Seal	: N/A	No. of samples analysed	: 3

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
- **Samples received in appropriately pretreated and preserved containers.**
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

[illegible]



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: EB1201570	Page	: 1 of 3
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: CALTEX	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: 301015-02448	Date Samples Received	: 18-JAN-2012
C-O-C number	: ----	Issue Date	: 24-JAN-2012
Sampler	: ----	No. of samples received	: 3
Site	: ----	No. of samples analysed	: 3
Quote number	: EN/034/11		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

Environmental Division Brisbane
Part of the **ALS Laboratory Group**

32 Shand Street Stafford QLD Australia 4053
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A Campbell Brothers Limited Company



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.

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

- **ASS: EA033 (CRS Suite):** Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO_3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m³ in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m³'.
- **ASS: EA033 (CRS Suite):** Retained Acidity not required because pH KCl greater than or equal to 4.5



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				VCSC 0-0.5	VCSA 0-0.5	VCSB 0-0.8	----	----
				18-NOV-2011 15:00	18-NOV-2011 15:00	18-NOV-2011 15:00	----	----
Compound	CAS Number	LOR	Unit	EB1201570-001	EB1201570-002	EB1201570-003	----	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	8.7	9.6	9.3	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.300	0.020	0.122	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	187	13	76	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	5.99	9.10	24.8	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	1200	1820	4960	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	1.92	2.91	7.96	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	----	----
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	----	----
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	----	----



Environmental Division

QUALITY CONTROL REPORT

Work Order	: EB1201570	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ---	Facsimile	: +61 7 3243 7218
Project	: CALTEX	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ---	Date Samples Received	: 18-JAN-2012
C-O-C number	: ---	Issue Date	: 24-JAN-2012
Sampler	: ---	No. of samples received	: 3
Order number	: 301015-02448	No. of samples analysed	: 3
Quote number	: EN/034/11		

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in
accordance with NATA
accreditation requirements.

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

Environmental Division Brisbane

Part of the **ALS Laboratory Group**

32 Shand Street Stafford QLD Australia 4053

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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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA033-A: Actual Acidity (QC Lot: 2137223)									
EB1201415-001	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	8.6	8.7	1.2	0% - 20%
EB1201570-003	VCSB 0-0.8	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	9.3	9.4	1.1	0% - 20%
EA033-B: Potential Acidity (QC Lot: 2137223)									
EB1201415-001	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.543	0.554	2.0	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	339	346	2.0	0% - 20%
EB1201570-003	VCSB 0-0.8	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.122	0.127	3.5	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	76	79	3.5	No Limit
EA033-C: Acid Neutralising Capacity (QC Lot: 2137223)									
EB1201415-001	Anonymous	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	1.74	1.69	3.2	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.56	0.54	3.2	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	348	337	3.2	0% - 20%
EB1201570-003	VCSB 0-0.8	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	24.8	24.8	0.3	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	7.96	7.93	0.3	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	4960	4950	0.3	0% - 20%



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

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

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EA033-A: Actual Acidity (QCLot: 2137223)								
EA033: pH KCl (23A)	----	0.1	pH Unit	----	4.5 pH Unit	102	93	120
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	30 mole H+ / t	103	93	120
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 2137223)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	.28 % S	85.4	80	120
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 2137223)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	107	89	111
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----



Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: EB1201570	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: MS ORLA MURRAY	Contact	: Customer Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: orla.murray@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: CALTEX	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-JAN-2012
Sampler	: ----	Issue Date	: 24-JAN-2012
Order number	: 301015-02448		
Quote number	: EN/034/11	No. of samples received	: 3
		No. of samples analysed	: 3

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

This Interpretive Quality Control Report contains the following information:

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

Environmental Division Brisbane

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA033-A: Actual Acidity								
80* dried soil VCSC 0-0.5, VCSB 0-0.8	VCSC 0-0.5, VCSB 0-0.8	18-NOV-2011	23-JAN-2012	17-NOV-2012	✓	24-JAN-2012	22-APR-2012	✓
EA033-B: Potential Acidity								
80* dried soil VCSC 0-0.5, VCSB 0-0.8	VCSC 0-0.5, VCSB 0-0.8	18-NOV-2011	23-JAN-2012	17-NOV-2012	✓	24-JAN-2012	22-APR-2012	✓
EA033-C: Acid Neutralising Capacity								
80* dried soil VCSC 0-0.5, VCSB 0-0.8	VCSC 0-0.5, VCSB 0-0.8	18-NOV-2011	23-JAN-2012	17-NOV-2012	✓	24-JAN-2012	22-APR-2012	✓
EA033-D: Retained Acidity								
80* dried soil VCSC 0-0.5, VCSB 0-0.8	VCSC 0-0.5, VCSB 0-0.8	18-NOV-2011	23-JAN-2012	17-NOV-2012	✓	24-JAN-2012	22-APR-2012	✓
EA033-E: Acid Base Accounting								
80* dried soil VCSC 0-0.5, VCSB 0-0.8	VCSC 0-0.5, VCSB 0-0.8	18-NOV-2011	23-JAN-2012	17-NOV-2012	✓	24-JAN-2012	22-APR-2012	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL** Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	2	12	16.7	10.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	1	12	8.3	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	12	8.3	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.

[illegible]



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CALTEX KURNELL PORT AND BERTHING PROJECT, BOTANY BAY, NSW

SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

GEOCHEMISTRY LABORATORY RESULTS



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0917541	Page	: 1 of 6
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
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Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 17-NOV-2009
C-O-C number	: ----	Issue Date	: 27-NOV-2009
Sampler	: NH	No. of samples received	: 23
Order number	: ----	No. of samples analysed	: 13
Quote number	: SY/503/09		

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

This Interpretive Quality Control Report contains the following information:

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

Environmental Division Sydney

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA055: Moisture Content								
Soil Glass Jar - Unpreserved VC1A 0-0.5, VC2A 0-1.0, VC2A 1.0-1.4, VC2A 2.0-2.3, VC1A 1.2-1.6, VC3A 0.6-1.3, VC3A 1.9-2.4	VC1A 0.5-1.2, VC2A 0-1.0 DUP, VC2A 1.4-2.0, VC2A 2.3-2.6, VC3A 0-0.6, VC3A 1.3-1.9,	17-NOV-2009	----	----	----	19-NOV-2009	24-NOV-2009	✓
EG020-SD: Total Metals in Sediments by ICPMS								
Soil Glass Jar - Unpreserved VC1A 0-0.5, VC2A 0-1.0, VC2A 1.0-1.4, VC2A 2.0-2.3, VC1A 1.2-1.6, VC3A 0.6-1.3, VC3A 1.9-2.4	VC1A 0.5-1.2, VC2A 0-1.0 DUP, VC2A 1.4-2.0, VC2A 2.3-2.6, VC3A 0-0.6, VC3A 1.3-1.9,	17-NOV-2009	18-NOV-2009	15-DEC-2009	✓	19-NOV-2009	16-MAY-2010	✓
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved VC1A 0-0.5, VC2A 0-1.0, VC2A 1.0-1.4, VC2A 2.0-2.3, VC1A 1.2-1.6, VC3A 0.6-1.3, VC3A 1.9-2.4	VC1A 0.5-1.2, VC2A 0-1.0 DUP, VC2A 1.4-2.0, VC2A 2.3-2.6, VC3A 0-0.6, VC3A 1.3-1.9,	17-NOV-2009	18-NOV-2009	15-DEC-2009	✓	19-NOV-2009	15-DEC-2009	✓



Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
Soil Glass Jar - Unpreserved VC2A 2.3-2.6, VC3A 0-0.6	VC1A 1.2-1.6,	17-NOV-2009	18-NOV-2009	01-DEC-2009	✓	19-NOV-2009	28-DEC-2009	✓
Soil Glass Jar - Unpreserved VC2A 2.3-2.6, VC3A 0-0.6	VC1A 1.2-1.6,	17-NOV-2009	20-NOV-2009	01-DEC-2009	✓	23-NOV-2009	01-DEC-2009	✓
EP080-SD: BTEX								
Soil Glass Jar - Unpreserved VC2A 2.3-2.6, VC3A 0-0.6	VC1A 1.2-1.6,	17-NOV-2009	20-NOV-2009	01-DEC-2009	✓	23-NOV-2009	01-DEC-2009	✓
EP131A: Organochlorine Pesticides								
Soil Glass Jar - Unpreserved VC2A 2.3-2.6, VC3A 0-0.6	VC1A 1.2-1.6,	17-NOV-2009	19-NOV-2009	01-DEC-2009	✓	24-NOV-2009	29-DEC-2009	✓
EP131B: Polychlorinated Biphenyls (as Aroclors)								
Soil Glass Jar - Unpreserved VC2A 2.3-2.6, VC3A 0-0.6	VC1A 1.2-1.6,	17-NOV-2009	19-NOV-2009	01-DEC-2009	✓	24-NOV-2009	29-DEC-2009	✓
EP132B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved VC1A 0-0.5, VC2A 0-1.0, VC2A 1.0-1.4, VC2A 2.0-2.3, VC1A 1.2-1.6, VC3A 0.6-1.3, VC3A 1.9-2.4	VC1A 0.5-1.2, VC2A 0-1.0 DUP, VC2A 1.4-2.0, VC2A 2.3-2.6, VC3A 0-0.6, VC3A 1.3-1.9,	17-NOV-2009	18-NOV-2009	01-DEC-2009	✓	20-NOV-2009	28-DEC-2009	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	6	57	10.5	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	16.7	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	2	13	15.4	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	6	16.7	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	2	16	12.5	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	2	18	11.1	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	3	33.3	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	5	20.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	16.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	13	7.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	6	16.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	16	6.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	18	5.6	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	3	33.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	5	20.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	16.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	13	7.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	6	16.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	16	6.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	18	5.6	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	3	33.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	5	20.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	16.7	5.0	✓	ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	13	7.7	5.0	✓	ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	6	16.7	5.0	✓	ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	16	6.3	5.0	✓	ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	18	5.6	5.0	✓	ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	3	33.3	5.0	✓	ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	5	20.0	5.0	✓	ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (1999) Schedule B(3) (Method 102)
Total Metals in Sediments by ICPMS	EG020-SD	SOIL	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. Analyte list and LORs per NODG.
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3)
TPH - Semivolatile Fraction	EP071-SD	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 504)
TPH Volatiles/BTEX in Sediments	EP080-SD	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 501)
Organochlorine Pesticides (Ultra-trace)	EP131A	SOIL	USEPA Method 3640 (GPC cleanup), 3620 (Florisil), 8081/8082 (GC/uECD/uECD) This technique is compliant with NEPM (1999) Schedule B(3) (Method 504)
PCB's (Ultra-trace)	EP131B	SOIL	USEPA Method 3640 (GPC cleanup), 3620 (Florisil), 8081/8082 (GC/uECD/uECD) This technique is compliant with NEPM (1999) Schedule B(3) (Method 504)
PAHs in Sediments by GCMS(SIM)	EP132B-SD	SOIL	8270 GCMS Capillary column, SIM mode using large volume programmed temperature vaporisation injection.
Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	USEPA 200.2 Mod. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (1999) Schedule B(3) (Method 202)
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids/ Sample Cleanup	ORG17A-UTP	SOIL	In-house, Mechanical agitation (tumbler). 20g of sample, Na ₂ SO ₄ and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. Samples are extracted, concentrated (by KD) and exchanged into an appropriate solvent for GPC and florisil cleanup as required.
Tumbler Extraction of Solids for LVI (Non-concentrating)	ORG17D	SOIL	In house: 10g of sample, Na ₂ SO ₄ and surrogate are extracted with 50mL 1:1 DCM/Acetone by end over end tumbling. An aliquot is concentrated by nitrogen blowdown to a reduced volume for analysis if required.



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EG020-SD: Total Metals in Sediments by ICPMS	ES0917541-006	VC2A 1.4-2.0	Chromium	7440-47-3	29.5 %	0-20%	RPD exceeds LOR based limits

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917541	Page	: 1 of 11
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 17-NOV-2009
C-O-C number	: ----	Issue Date	: 27-NOV-2009
Sampler	: NH	No. of samples received	: 23
Order number	: ----	No. of samples analysed	: 13
Quote number	: SY/503/09		

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

This Quality Control Report contains the following information:

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



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Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Celine Conceicao	Spectroscopist	Inorganics
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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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 1168181)									
EB0918142-001	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	30.9	30.4	1.9	0% - 20%
EP0906633-009	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	27.5	27.2	1.0	0% - 20%
EA055: Moisture Content (QC Lot: 1168182)									
ES0917541-005	VC2A 1.0-1.4	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	15.4	16.8	8.9	0% - 50%
ES0917612-005	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	13.1	12.0	8.9	0% - 50%
EA055: Moisture Content (QC Lot: 1168642)									
ES0917541-008	VC2A 2.3-2.6	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	21.3	21.4	0.5	0% - 20%
ES0917644-004	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	13.8	12.6	9.5	0% - 50%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 1166950)									
ES0917498-001	Anonymous	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	0.1	<0.1	0.0	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	0.8	0.6	34.0	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	0.6	0.4	28.1	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	6.5	5.6	15.1	0% - 50%
		EG020-SD: Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	0.0	No Limit
		EG020-SD: Chromium	7440-47-3	1.0	mg/kg	65.8	56.0	16.0	0% - 20%
		EG020-SD: Copper	7440-50-8	1.0	mg/kg	102	87.3	15.2	0% - 20%
		EG020-SD: Lead	7439-92-1	1.0	mg/kg	163	142	13.9	0% - 20%
		EG020-SD: Nickel	7440-02-0	1.0	mg/kg	10.5	8.5	21.4	No Limit
		EG020-SD: Zinc	7440-66-6	1.0	mg/kg	346	301	14.0	0% - 20%
		EG020-SD: Arsenic	7440-38-2	1.00	mg/kg	16.2	14.4	12.0	0% - 50%
		EG020-SD: Manganese	7439-96-5	10	mg/kg	99	161	47.5	0% - 50%
		EG020-SD: Vanadium	7440-62-2	2.0	mg/kg	37.7	33.2	12.7	0% - 50%
		EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	0.1	0.2	0.0	No Limit
ES0917541-006	VC2A 1.4-2.0	EG020-SD: Selenium	7782-49-2	0.1	mg/kg	0.3	0.6	68.1	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	0.2	0.0	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	0.7	1.4	60.6	No Limit
		EG020-SD: Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	0.0	No Limit
		EG020-SD: Chromium	7440-47-3	1.0	mg/kg	24.4	32.9	# 29.5	0% - 20%
		EG020-SD: Copper	7440-50-8	1.0	mg/kg	4.6	9.0	64.0	No Limit
		EG020-SD: Lead	7439-92-1	1.0	mg/kg	10.7	17.1	45.9	0% - 50%
		EG020-SD: Nickel	7440-02-0	1.0	mg/kg	2.3	4.2	59.9	No Limit
		EG020-SD: Zinc	7440-66-6	1.0	mg/kg	49.8	49.4	0.8	0% - 20%
		EG020-SD: Arsenic	7440-38-2	1.00	mg/kg	3.21	9.25	96.9	No Limit
		EG020-SD: Manganese	7439-96-5	10	mg/kg	12	21	58.2	No Limit
		EG020-SD: Vanadium	7440-62-2	2.0	mg/kg	6.2	11.2	57.3	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1166949)									
ES0917498-001	Anonymous	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	1.91	1.99	4.3	0% - 20%
ES0917541-006	VC2A 1.4-2.0	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.55	0.47	16.8	0% - 20%
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1166947)									
ES0917541-001	VC1A 0-0.5	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	<5	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1169136)									
ES0917541-008	VC2A 2.3-2.6	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD: BTEX (QC Lot: 1169136)									
ES0917541-008	VC2A 2.3-2.6	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: ortho-Xylene	106-42-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP131A: Organochlorine Pesticides (QC Lot: 1168438)									
ES0917541-008	VC2A 2.3-2.6	EP131A: Aldrin	309-00-2	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-BHC	319-84-6	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-BHC	319-85-7	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: delta-BHC	319-86-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4,4'-DDD	72-54-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4,4'-DDE	72-55-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4,4'-DDT	50-29-3	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: DDT (total)	----	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Dieldrin	60-57-1	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-Endosulfan	959-98-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-Endosulfan	33213-65-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan sulfate	1031-07-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan (sum)	115-29-7	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin	72-20-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin aldehyde	7421-93-4	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin ketone	53494-70-5	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor	76-44-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor epoxide	1024-57-3	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: gamma-BHC	58-89-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Methoxychlor	72-43-5	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: cis-Chlordane	5103-71-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: trans-Chlordane	5103-74-2	0.50	µg/kg	<0.50	<0.50	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP131A: Organochlorine Pesticides (QC Lot: 1168438) - continued									
ES0917541-008	VC2A 2.3-2.6	EP131A: Total Chlordane (sum)	----	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
EP131B: Polychlorinated Biphenyls (as Aroclors) (QC Lot: 1168439)									
ES0917541-008	VC2A 2.3-2.6	EP131B: Total Polychlorinated biphenyls	----	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1016	12974-11-2	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1221	11104-28-2	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1232	11141-16-5	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1242	53469-21-9	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1248	12672-29-6	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1254	11097-69-1	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1260	11096-82-5	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1166946)									
ES0917541-001	VC1A 0-0.5	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.0	No Limit
ES0917541-011	VC3A 0.6-1.3	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	5	0.0	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	5	28.6	No Limit

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 Work Order : ES0917541
 Client : WORLEY PARSONS - INFRASTRUCTURE MWE
 Project : CALTEX MAINTENANCE DREDGING



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1166946) - continued									
ES0917541-011	VC3A 0.6-1.3	EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	4	0.0	No Limit
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Dibenzo(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	9	21	81.8	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	9	7	24.9	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.0	No Limit



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

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

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1166950)								
EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	----	----	----	----
EG020-SD: Arsenic	7440-38-2	1.0	mg/kg	<1.00	13.1 mg/kg	99.2	70	130
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	2.76 mg/kg	95.7	70	130
EG020-SD: Chromium	7440-47-3	1.0	mg/kg	<1.0	60.9 mg/kg	97.9	70	130
EG020-SD: Copper	7440-50-8	1.0	mg/kg	<1.0	54.7 mg/kg	93.6	70	130
EG020-SD: Cobalt	7440-48-4	10	mg/kg	<10.0	24.5 mg/kg	104	70	130
EG020-SD: Lead	7439-92-1	1.0	mg/kg	<1.0	54.8 mg/kg	95.3	70	130
EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	136 mg/kg	90.6	70	130
EG020-SD: Nickel	7440-02-0	1.0	mg/kg	<1.0	55.2 mg/kg	95.0	70	130
EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	5.6 mg/kg	96.8	70	130
EG020-SD: Vanadium	7440-62-2	2	mg/kg	<2.0	34 mg/kg	91.3	70	130
EG020-SD: Zinc	7440-66-6	1.0	mg/kg	<1.0	104 mg/kg	96.9	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1166949)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.090 mg/kg	104	74.2	126
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1166947)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	5 mg/kg	88.0	75.2	116
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	5 mg/kg	93.0	75.3	113
EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	5 mg/kg	111	72.6	117
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1169136)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	26 mg/kg	114	68.4	128
EP080-SD: BTEX (QCLot: 1169136)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	120	67.5	125
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	1 mg/kg	87.6	69	122
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	1 mg/kg	104	65.3	126
EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	2.0 mg/kg	81.8	66.5	124
	106-42-3							
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	1 mg/kg	116	66.7	123
EP131A: Organochlorine Pesticides (QCLot: 1168438)								
EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	5 µg/kg	110	31.7	140
EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	5 µg/kg	124	24.5	150
EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	5 µg/kg	110	36.9	139
EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	5 µg/kg	111	38.2	137
EP131A: 4,4'-DDD	72-54-8	0.5	µg/kg	<0.50	5 µg/kg	128	42.5	141



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
Method: Compound	CAS Number	LOR	Unit	Result				
EP131A: Organochlorine Pesticides (QCLot: 1168438) - continued								
EP131A: 4,4'-DDE	72-55-9	0.5	µg/kg	<0.50	5 µg/kg	65.9	34.8	140
EP131A: 4,4'-DDT	50-29-3	0.5	µg/kg	<0.50	5 µg/kg	94.8	38	143
EP131A: DDT (total)	----	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	5 µg/kg	111	43.2	134
EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	5 µg/kg	99.5	23.7	139
EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	5 µg/kg	105	35.8	138
EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	5 µg/kg	90.6	7.45	158
EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	5 µg/kg	95.2	21.6	162
EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	5 µg/kg	88.3	19.3	131
EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	5 µg/kg	100	17.9	141
EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	5 µg/kg	124	31	153
EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	5 µg/kg	108	34.3	138
EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	5 µg/kg	98.0	18.6	146
EP131A: gamma-BHC	58-89-9	0.5	µg/kg	<0.50	5 µg/kg	118	30.7	145
EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	5 µg/kg	95.7	15	157
EP131A: cis-Chlordane	5103-71-9	0.5	µg/kg	<0.50	5 µg/kg	138	22.3	145
EP131A: trans-Chlordane	5103-74-2	0.5	µg/kg	<0.50	5 µg/kg	107	42.4	139
EP131A: Total Chlordane (sum)	----	0.5	µg/kg	<0.50	----	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 1168439)								
EP131B: Total Polychlorinated biphenyls	----	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1016	12974-11-2	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1221	11104-28-2	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1232	11141-16-5	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1242	53469-21-9	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1248	12672-29-6	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1254	11097-69-1	5	µg/kg	<5.0	50 µg/kg	112	61.3	121
EP131B: Aroclor 1260	11096-82-5	5	µg/kg	<5.0	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1166946)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	91.6	----	----
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	93.2	----	----
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	86.2	----	----
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	109	----	----
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	93.1	----	----
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	88.8	----	----
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	86.7	----	----
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	87.3	----	----
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	87.5	----	----
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	86.3	----	----

Page : 9 of 11
 Work Order : ES0917541
 Client : WORLEY PARSONS - INFRASTRUCTURE MWE
 Project : CALTEX MAINTENANCE DREDGING



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1166946) - continued								
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	86.6	----	----
EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	25 µg/kg	99.2	----	----
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	78.3	----	----
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	75.3	----	----
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	84.5	----	----
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	53.2	----	----
EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	85.0	----	----
EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	86.9	----	----
EP132B-SD: Indeno(1,2,3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	79.2	----	----
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	71.0	----	----
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----



Matrix Spike (MS) Report

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

Sub-Matrix: SOIL

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number		MS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1166950)							
ES0917498-001	Anonymous	EG020-SD: Arsenic	7440-38-2	50 mg/kg	94.9	70	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	97.0	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	85.8	70	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	81.9	70	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	77.8	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	96.0	70	130
		EG020-SD: Zinc	7440-66-6	250 mg/kg	75.4	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1166949)							
ES0917498-001	Anonymous	EG035T-LL: Mercury	7439-97-6	0.50 mg/kg	117	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1166947)							
ES0917541-001	VC1A 0-0.5	EP071-SD: C10 - C14 Fraction	----	19.75 mg/kg	86.3	70	130
		EP071-SD: C15 - C28 Fraction	----	87.25 mg/kg	89.8	70	130
		EP071-SD: C29 - C36 Fraction	----	60 mg/kg	108	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1169136)							
ES0917541-008	VC2A 2.3-2.6	EP080-SD: C6 - C9 Fraction	----	26 mg/kg	106	70	130
EP080-SD: BTEX (QCLot: 1169136)							
ES0917541-008	VC2A 2.3-2.6	EP080-SD: Benzene	71-43-2	2.5 mg/kg	76.8	70	130
		EP080-SD: Toluene	108-88-3	2.5 mg/kg	95.6	70	130
		EP080-SD: Ethylbenzene	100-41-4	2.5 mg/kg	72.9	70	130
		EP080-SD: meta- & para-Xylene	108-38-3	2.5 mg/kg	77.8	70	130
			106-42-3				
	EP080-SD: ortho-Xylene	95-47-6	2.5 mg/kg	74.3	70	130	
EP131A: Organochlorine Pesticides (QCLot: 1168438)							
ES0917541-008	VC2A 2.3-2.6	EP131A: Aldrin	309-00-2	5 µg/kg	90.9	31.7	140
		EP131A: alpha-BHC	319-84-6	5 µg/kg	82.6	24.5	150
		EP131A: beta-BHC	319-85-7	5 µg/kg	88.2	36.9	139
		EP131A: delta-BHC	319-86-8	5 µg/kg	84.0	38.2	137
		EP131A: 4,4`-DDD	72-54-8	5 µg/kg	130	42.5	141
		EP131A: 4,4`-DDE	72-55-9	5 µg/kg	64.4	34.8	140
		EP131A: 4,4`-DDT	50-29-3	5 µg/kg	116	38	143
		EP131A: Dieldrin	60-57-1	5 µg/kg	88.9	43.2	134
		EP131A: alpha-Endosulfan	959-98-8	5 µg/kg	79.8	23.7	139
		EP131A: beta-Endosulfan	33213-65-9	5 µg/kg	94.4	35.8	138
		EP131A: Endosulfan sulfate	1031-07-8	5 µg/kg	108	7.45	158



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number		MS	Low	High
EP131A: Organochlorine Pesticides (QCLot: 1168438) - continued							
ES0917541-008	VC2A 2.3-2.6	EP131A: Endrin	72-20-8	5 µg/kg	73.1	21.6	162
		EP131A: Endrin aldehyde	7421-93-4	5 µg/kg	61.7	19.3	131
		EP131A: Endrin ketone	53494-70-5	5 µg/kg	101	17.9	141
		EP131A: Heptachlor	76-44-8	5 µg/kg	82.5	31	153
		EP131A: Heptachlor epoxide	1024-57-3	5 µg/kg	79.2	34.3	138
		EP131A: Hexachlorobenzene (HCB)	118-74-1	5 µg/kg	67.3	18.6	146
		EP131A: gamma-BHC	58-89-9	5 µg/kg	89.3	30.7	145
		EP131A: Methoxychlor	72-43-5	5 µg/kg	104	15	157
		EP131A: cis-Chlordane	5103-71-9	5 µg/kg	117	22.3	145
		EP131A: trans-Chlordane	5103-74-2	5 µg/kg	84.1	42.4	139
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 1168439)							
ES0917541-008	VC2A 2.3-2.6	EP131B: Aroclor 1254	11097-69-1	50 µg/kg	65.8	61.3	121
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1166946)							
ES0917541-001	VC1A 0-0.5	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	78.5	70	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	84.7	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	89.6	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	105	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	95.5	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	97.6	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	89.0	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	113	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	108	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	114	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	96.5	70	130
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	25 µg/kg	116	70	130
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	81.5	70	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	82.0	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	102	70	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	74.9	70	130
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	25 µg/kg	114	70	130
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	25 µg/kg	112	70	130
		EP132B-SD: Indeno(1,2,3.cd)pyrene	193-39-5	25 µg/kg	110	70	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	86.4	70	130



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)
Comprehensive Report

Work Order : **ES0917541**

Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 3
Order number	: ----	Quote number	: ES2009WORPAR0232 (SY/503/09)
C-O-C number	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
Sampler	: NH		

Dates

Date Samples Received	: 17-NOV-2009	Issue Date	: 19-NOV-2009 14:47
Client Requested Due Date	: 27-NOV-2009	Scheduled Reporting Date	: 27-NOV-2009

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 4.6'C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 23
Security Seal	: Intact.	No. of samples analysed	: 13

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.
- OC/PCB/TPH/BTEX CANCELLED FOR SAMPLES 1 & 3 AS PER Nick Hannaford ON 19/11/09
- **Samples received in appropriately pretreated and preserved containers.**
- **Sample(s) have been received within recommended holding times.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- **Sample UC3b 0.5-0.9, UC3b 0-0.5 and UC3b 0-0.5x not received by ALS Sydney and this applies to batch ES0917542, ES0917543 and ES0917544.**
- **This batch is split into ES0917542 for PSD, ES0917543 for Ph FOX and ES0917544 for TBT and TOC.**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EG020-SD Total Metals in Sediments by ICPMS (NODG)	SOIL - EG035T-LL Total Mercury by FIMS - Low Level	SOIL - EP071 - SD TPH ultra trace in sediments	SOIL - EP080-SD TPH(V)/BTEX in Sediments	SOIL - EP131A OC Pesticides (Ultratrace)	SOIL - EP131B PCB's (Ultratrace)
ES0917541-001	17-NOV-2009 10:00	VC1A 0-0.5		✓	✓	✓				
ES0917541-002	17-NOV-2009 10:00	VC1A 0.5-1.2		✓	✓	✓				
ES0917541-003	17-NOV-2009 10:00	VC2A 0-1.0		✓	✓	✓				
ES0917541-004	17-NOV-2009 10:00	VC2A 0-1.0 DUP		✓	✓	✓				
ES0917541-005	17-NOV-2009 10:00	VC2A 1.0-1.4		✓	✓	✓				
ES0917541-006	17-NOV-2009 10:00	VC2A 1.4-2.0		✓	✓	✓				
ES0917541-007	17-NOV-2009 10:00	VC2A 2.0-2.3		✓	✓	✓				
ES0917541-008	[17-NOV-2009]	VC2A 2.3-2.6		✓	✓	✓	✓	✓	✓	✓
ES0917541-009	[17-NOV-2009]	VC1A 1.2-1.6		✓	✓	✓	✓	✓	✓	✓
ES0917541-010	[17-NOV-2009]	VC3A 0-0.6		✓	✓	✓	✓	✓	✓	✓
ES0917541-011	[17-NOV-2009]	VC3A 0.6-1.3		✓	✓	✓				
ES0917541-012	[17-NOV-2009]	VC3A 1.3-1.9		✓	✓	✓				
ES0917541-013	[17-NOV-2009]	VC3A 1.9-2.4		✓	✓	✓				
ES0917541-014	17-NOV-2009 10:00	VC1A 0-0.5X	✓							
ES0917541-015	17-NOV-2009 10:00	VC1A 0.5-1.2Y	✓							
ES0917541-016	17-NOV-2009 10:00	VC2A 0-1.0X	✓							
ES0917541-017	17-NOV-2009 10:00	VC2A 1.0-1.4Y	✓							
ES0917541-018	17-NOV-2009 10:00	VC2A 1.4-2.0Z	✓							
ES0917541-019	[17-NOV-2009]	VC2A 3-2.6X	✓							
ES0917541-020	[17-NOV-2009]	VC1A 1.2-1.6Z	✓							
ES0917541-021	[17-NOV-2009]	VC3A 0-0.6X	✓							
ES0917541-022	[17-NOV-2009]	VC3A 0.6-1.3Y	✓							
ES0917541-023	[17-NOV-2009]	VC3A 1.3-1.9Z	✓							



Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EP132B-SD Ultra-trace PAHs in Sediments
ES0917541-001	17-NOV-2009 10:00	VC1A 0-0.5	✓
ES0917541-002	17-NOV-2009 10:00	VC1A 0.5-1.2	✓
ES0917541-003	17-NOV-2009 10:00	VC2A 0-1.0	✓
ES0917541-004	17-NOV-2009 10:00	VC2A 0-1.0 DUP	✓
ES0917541-005	17-NOV-2009 10:00	VC2A 1.0-1.4	✓
ES0917541-006	17-NOV-2009 10:00	VC2A 1.4-2.0	✓
ES0917541-007	17-NOV-2009 10:00	VC2A 2.0-2.3	✓
ES0917541-008	[17-NOV-2009]	VC2A 2.3-2.6	✓
ES0917541-009	[17-NOV-2009]	VC1A 1.2-1.6	✓
ES0917541-010	[17-NOV-2009]	VC3A 0-0.6	✓
ES0917541-011	[17-NOV-2009]	VC3A 0.6-1.3	✓
ES0917541-012	[17-NOV-2009]	VC3A 1.3-1.9	✓
ES0917541-013	[17-NOV-2009]	VC3A 1.9-2.4	✓

Requested Deliverables

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com



ALS Laboratory: **please tick** →

WORKLEY PARSONS
OFFICE: N. SYDNEY
PROJECT: CALTEX MAINTENANCE DRAGGING
ORDER NUMBER:
PROJECT MANAGER: AL WATERS
SAMPLER: AICK HAMMARD
COC emailed to ALS? (YES / NO)
Email Reports to (will default to PM if no other addresses are listed):
Email Invoice to (will default to PM if no other addresses are listed):
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

CLIENT: WORKLEY PARSONS
OFFICE: N. SYDNEY
PROJECT: CALTEX MAINTENANCE DRAGGING
ORDER NUMBER:
PROJECT MANAGER: AL WATERS
SAMPLER: AICK HAMMARD
COC emailed to ALS? (YES / NO)
Email Reports to (will default to PM if no other addresses are listed):
Email Invoice to (will default to PM if no other addresses are listed):
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact?
Free Ice / Frozen Ice Bricks present
Random Sample Temperature on
Other comment:

Environmental Division
Sydney
Work Order
ES0917541
Telephone: +61-2-8784 8555

RECEIVED BY:
DATE/TIME:

Subcon / Forward Lab / Split WO
Lab / Analysis: Sydney
Organised By / Date: TBT + TOC : ES0917544
Relinquished By / Date: PSD : ES0917541
Connote / Courier: PH Fox : ES0917543
WO No: ES0917541
Attach By PO / Internal Sheet:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EO020SD (trace metals)	EO035L (Mercury)	EP12SD (PAHs)	EP004 (TOC)	EP060 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (CG-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry bag label)	EA0003 (pH & pHfox)	EA033 (chromium)	(TCO) (date)	Additional Information
14	VCIA 0-0.5	17/11 am	s	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	STORE remaining sample - will select following review of results
15	VCIA 0-0.5X	17/11 am	s	Glass bottle/bags	2	HOLD												STORE	STORE	
16	VCIA 0.5-1.2	17/11 am	s	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
17	VCIA 0.5-1.2	17/11 am	s	Glass bottle/bags	2	HOLD												STORE	STORE	
18	VC2A 0-1.0	17/11 am	s	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	
19	VC2A 0-1.0 DUP	17/11 am	s	Glass bottle/bags	1	✓	✓	✓	✓									STORE	STORE	
20	VC2A 0-1.0 X	17/11 am	s	Glass bottle/bags	2	HOLD												STORE	STORE	
21	VC2A 1.0-1.4	17/11 am	s	Glass bottle/bags	3	✓	✓	✓	✓							✓	✓	STORE	STORE	
22	VC2A 1.0-1.4Y	17/11 am	s	Glass bottle/bags	2	HOLD												STORE	STORE	
23	VC2A 1.4-2.0	17/11 am	s	Glass bottle/bags	4	✓	✓	✓	✓						✓	✓	✓	STORE	STORE	
24	VC2A 1.4-2.0Z	17/11 am	s	Glass bottle/bags	2	HOLD												STORE	STORE	
25	VC2A 2.0-2.3	17/11 am	s	Glass bottle/bags	3	✓	✓	✓	✓						✓	✓	✓	STORE	STORE	
26	VC2A 2.3-2.6	17/11 pm	s	Glass bottle/bags	4													STORE	STORE	
27	VC2A 2.3-2.6x	17/11 pm	s	Glass bottle/bags	2	HOLD												STORE	STORE	
28	VCIA 1.2-1.6	17/11 pm	s	Glass bottle/bags	4													STORE	STORE	
29	VCIA 1.2-1.62	17/11 pm	s	Glass bottle/bags	2	HOLD												STORE	STORE	
30			s	Glass bottle/bags														STORE	STORE	



CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: Worley Parsons	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE: N. 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: Caltex maintenance & redye	ALS QUOTE NO.:	Free ice/frozen ice bricks present upon receipt? ☒ Yes ☐ No N/A
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle)	Random Sample Temperature on Receipt:
PROJECT MANAGER: Al. Watters	CONTACT PH: 0422763337	Other comment:
SAMPLER: Nick Hennel	SAMPLER MOBILE: 0403365423	RECEIVED BY: 5078 Stepho ASSS Pty. DATE/TIME: 17/11/19 17:20
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	RELINQUISHED BY: DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):		
Email Invoice to (will default to PM if no other addresses are listed):		

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY		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).													Additional Information		
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <i>(refer to codes below)</i>	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/L-able)	EA0003 (pH & pHfox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.	
10	UC3a 0-0.6		S	Glass bottle/bags	4	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE		
21	UC3a 0-0.6x		S	Glass bottle/bags	2	Hold													STORE	STORE	
11	UC3a 0.6-1.3		S	Glass bottle/bags	3	/	/	/	/								/	STORE	STORE		
22	UC3a 0.6-1.3 ₁		S	Glass bottle/bags	2	Hold													STORE	STORE	
12	UC3a 1.3-1.9 ₁		S	Glass bottle/bags	3	/	/	/	/								/	STORE	STORE		
23	UC3a 1.3-1.9 ₂		S	Glass bottle/bags	2	Hold													STORE	STORE	
13	UC3a 1.9-2.4		S	Glass bottle/bags	3	/	/	/	/								/	STORE	STORE		
Not received	SS3a UC3b 0.5-0.9		S	Glass bottle/bags	3	/	/	/	/								/	STORE	STORE		
	SS3a UC3b 0-0.5		S	Glass bottle/bags	2	/	/	/	/								/	STORE	STORE		
	SS3b UC3b 0-0.5x		S	Glass bottle/bags	2	Hold													STORE	STORE	
	SS3b		S	Glass bottle/bags														STORE	STORE		
TOTAL						30	30	30	30	18	6	6	6	6	6	30	30	?	?		

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.

ES0917541**Uma Nagendiram**

From: Charlie Pierce
Sent: Thursday, 19 November 2009 11:41 AM
To: Uma Nagendiram; Peter Donaghy; Frank Ferraro; Edwandy Fadjar; Alex Rossi
Cc: Jacob Waugh
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Dear Everyone,

The client has requested that we no longer test sample 001 and sample ⁰⁰³002 for the tests shown below. Please stop these tests immediately. If testing has been completed, please let me know.

Dear Frank

Can you confirm that:

VC3B0.5-0.9

VC3B0-0.5

VC3B0-0.5x

Were not received?

Kind Regards

Charlie Pierce

Laboratory Manager - Sydney

ALS Laboratory Group

Environmental Division

Sydney, Australia

Phone: + 61 2 8784 8555

Fax: + 61 2 8784 8500

Mobile: +61 0466309729

www.alsglobal.com



From: Hannaford, Nick (Sydney) [mailto:Nicholas.Hannaford@WorleyParsons.com]

Sent: Thursday, 19 November 2009 11:20 AM

To: Charlie Pierce

Cc: Watters, Ali (Sydney)

Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Hi Charlie,

Please see the following amendments to the attached SRN below.

Lab ID	Our ID	Change
ES0917541-001 #1	VC1A 0-0.5	No longer require the following tests: EP090 (TBT) ← ES0917541 #1 + #3 EP131A (OC Pesticides) ✓ EP131B (PCBs) ✓ EP080-UT (TPH(C6-C9)/BTEX) ✓ ES0917541 #1 + #3 EP071SD (TPH C10-C36) ✓ EA150-H (Particle Sizing) ← ES0917542 (#1) + #2
		No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides)

19/11/2009

ES0917541-003	VC2A 0-1.0	EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)
---------------	------------	---

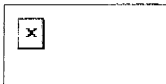
I also note that on the second copy of the COD form that you sent Ali it is stated that the following samples were not received:

VC3B0.5-0.9
VC3B0-0.5
VC3B0-0.5x

However on the first copy of the CoC these are given a lab ID. These samples are also missing from the SRN. Please advise.

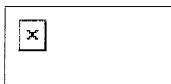
Regards,

Nick Hannaford
Environmental Scientist
WorleyParsons
Tel: +61 2 8456 7357
Fax: +62 2 8923 6877
WorleyParsons Services Pty Ltd
Level 11, 141 Walker St
Nth Sydney NSW 2060
WorleyParsons | www.worleyparsons.com



From: Watters, Ali (Sydney)
Sent: Wednesday, November 18, 2009 2:47 PM
To: Hannaford, Nick (Sydney)
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE
Workorder : ES0917541

FYI



From: ALSE Sydney Aus [<mailto:alse.sydney.als@als.com.au>]
Sent: Wednesday, 18 November 2009 2:39 PM
To: Watters, Ali (Sydney)
Subject: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE
Workorder : ES0917541

This e-mail has been automatically generated.

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If the reader of this message is not the intended recipient,

19/11/2009



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917541	Page	: 1 of 10
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 17-NOV-2009
C-O-C number	: ----	Issue Date	: 27-NOV-2009
Sampler	: NH	No. of samples received	: 23
Site	: ----	No. of samples analysed	: 13
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Celine Conceicao	Spectroscopist	Inorganics
Edwandy Fadjar	Senior Organic Chemist	Organics
Hoa Nguyen	Inorganic Chemist	Inorganics

Environmental Division Sydney

Part of the **ALS Laboratory Group**

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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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- **EG020T: Poor precision was obtained for Chromium on sample ES0917541 #6 due to sample heterogeneity. Results have been confirmed by re-extraction and reanalysis.**
- **EP071-SD: The result for sample VC3A 0-0.6 was confirmed by re-extraction and re-analysis.**



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	VC1A 0-0.5	VC1A 0.5-1.2	VC2A 0-1.0	VC2A 0-1.0 DUP	VC2A 1.0-1.4
				17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00
				ES0917541-001	ES0917541-002	ES0917541-003	ES0917541-004	ES0917541-005
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	18.3	19.9	17.1	16.9	15.4
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1.00	mg/kg	<1.00	<1.00	<1.00	<1.00	15.0
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	0.1
Chromium	7440-47-3	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	14.5
Copper	7440-50-8	1.0	mg/kg	4.1	3.3	<1.0	<1.0	<1.0
Cobalt	7440-48-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	3.1
Lead	7439-92-1	1.0	mg/kg	1.6	2.6	<1.0	<1.0	1.4
Manganese	7439-96-5	10	mg/kg	<10	<10	<10	<10	<10
Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	2.4
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	1.9
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	22.8
Zinc	7440-66-6	1.0	mg/kg	6.1	16.5	1.4	1.4	3.3
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.71	<0.01	<0.01	<0.01	<0.01
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	<5	<5	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	<4	<4	<4	<4	<4
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	<4	<4
Fluoranthene	206-44-0	4	µg/kg	<4	<4	<4	<4	<4
Pyrene	129-00-0	4	µg/kg	<4	<4	<4	<4	<4
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	<4	<4
Chrysene	218-01-9	4	µg/kg	<4	<4	<4	<4	<4
Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	<4	<4	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	<4	<4	<4
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	<4	<4	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	<4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	<4	<4
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				VC1A 0-0.5	VC1A 0.5-1.2	VC2A 0-1.0	VC2A 0-1.0 DUP	VC2A 1.0-1.4
				17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00
Compound	CAS Number	LOR	Unit	ES0917541-001	ES0917541-002	ES0917541-003	ES0917541-004	ES0917541-005
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
^ Sum of PAHs	----	4	µg/kg	<4	<4	<4	<4	<4
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	86.1	76.0	73.7	87.4	101
Anthracene-d10	1719-06-8	0.1	%	89.8	94.7	95.6	97.5	89.8
4-Terphenyl-d14	1718-51-0	0.1	%	85.2	89.3	98.2	99.1	76.5



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Sub-Matrix: SOIL				Client sample ID	VC2A 1.4-2.0	VC2A 2.0-2.3	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6
				Client sampling date / time	17-NOV-2009 10:00	17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]
Compound	CAS Number	LOR	Unit	ES0917541-006	ES0917541-007	ES0917541-008	ES0917541-009	ES0917541-010	
EA055: Moisture Content									
^ Moisture Content (dried @ 103°C)	----	1.0	%	25.6	23.4	21.3	20.4	24.0	
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	
Arsenic	7440-38-2	1.00	mg/kg	3.21	<1.00	1.18	<1.00	1.98	
Cadmium	7440-43-9	0.1	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	
Chromium	7440-47-3	1.0	mg/kg	24.4	3.1	3.4	1.7	5.0	
Copper	7440-50-8	1.0	mg/kg	4.6	2.3	3.2	2.8	3.1	
Cobalt	7440-48-4	0.5	mg/kg	0.7	<0.5	<0.5	<0.5	<0.5	
Lead	7439-92-1	1.0	mg/kg	10.7	4.2	3.1	<1.0	9.0	
Manganese	7439-96-5	10	mg/kg	12	<10	<10	34	<10	
Nickel	7440-02-0	1.0	mg/kg	2.3	<1.0	<1.0	<1.0	1.3	
Selenium	7782-49-2	0.1	mg/kg	0.3	<0.1	<0.1	<0.1	0.2	
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	
Vanadium	7440-62-2	2.0	mg/kg	6.2	3.0	2.6	<2.0	6.4	
Zinc	7440-66-6	1.0	mg/kg	49.8	11.0	6.9	2.2	18.4	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg	0.55	0.04	0.03	<0.01	0.06	
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg	----	----	<3	<3	<3	
C10 - C14 Fraction	----	3	mg/kg	----	----	<3	<3	<3	
C15 - C28 Fraction	----	3	mg/kg	----	----	<3	<3	13	
C29 - C36 Fraction	----	5	mg/kg	----	----	<5	<5	15	
^ C10 - C36 Fraction (sum)	----	3	mg/kg	----	----	----	----	28	
C10 - C36 Fraction (sum)	----	3	mg/kg	----	----	<3	<3	----	
EP080-SD: BTEX									
Benzene	71-43-2	0.2	mg/kg	----	----	<0.2	<0.2	<0.2	
Toluene	108-88-3	0.2	mg/kg	----	----	<0.2	<0.2	<0.2	
Ethylbenzene	100-41-4	0.2	mg/kg	----	----	<0.2	<0.2	<0.2	
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	----	----	<0.2	<0.2	<0.2	
ortho-Xylene	95-47-6	0.2	mg/kg	----	----	<0.2	<0.2	<0.2	
EP131A: Organochlorine Pesticides									
Aldrin	309-00-2	0.50	µg/kg	----	----	<0.50	<0.50	<0.50	
alpha-BHC	319-84-6	0.50	µg/kg	----	----	<0.50	<0.50	<0.50	
beta-BHC	319-85-7	0.50	µg/kg	----	----	<0.50	<0.50	<0.50	
delta-BHC	319-86-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50	
4,4'-DDD	72-54-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50	
4,4'-DDE	72-55-9	0.50	µg/kg	----	----	<0.50	<0.50	<0.50	



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	VC2A 1.4-2.0	VC2A 2.0-2.3	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6
				17-NOV-2009 10:00	17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]
				ES0917541-006	ES0917541-007	ES0917541-008	ES0917541-009	ES0917541-010
EP131A: Organochlorine Pesticides - Continued								
4,4'-DDT	50-29-3	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
^ DDT (total)	----	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Dieldrin	60-57-1	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
^ Endosulfan (sum)	115-29-7	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Endrin	72-20-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Heptachlor	76-44-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Heptachlor epoxide	1024-57-3	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
gamma-BHC	58-89-9	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Methoxychlor	72-43-5	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
cis-Chlordane	5103-71-9	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
trans-Chlordane	5103-74-2	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
^ Total Chlordane (sum)	----	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
Oxychlordane	27304-13-8	0.50	µg/kg	----	----	<0.50	<0.50	<0.50
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1016	12974-11-2	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1221	11104-28-2	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1232	11141-16-5	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1242	53469-21-9	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1248	12672-29-6	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1254	11097-69-1	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
Aroclor 1260	11096-82-5	5.0	µg/kg	----	----	<5.0	<5.0	<5.0
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	5	5	<5	16
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	10	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	10	4
Fluorene	86-73-7	4	µg/kg	4	<4	<4	7	<4
Phenanthrene	85-01-8	4	µg/kg	42	<4	<4	29	14
Anthracene	120-12-7	4	µg/kg	9	<4	<4	4	<4
Fluoranthene	206-44-0	4	µg/kg	65	<4	<4	29	21
Pyrene	129-00-0	4	µg/kg	61	<4	<4	23	22



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	VC2A 1.4-2.0	VC2A 2.0-2.3	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6
				17-NOV-2009 10:00	17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]
				ES0917541-006	ES0917541-007	ES0917541-008	ES0917541-009	ES0917541-010
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Benz(a)anthracene	56-55-3	4	µg/kg	39	<4	<4	14	14
Chrysene	218-01-9	4	µg/kg	31	<4	<4	14	12
Benzo(b)fluoranthene	205-99-2	4	µg/kg	44	<4	<4	15	16
Benzo(k)fluoranthene	207-08-9	4	µg/kg	19	<4	<4	6	7
Benzo(e)pyrene	192-97-2	4	µg/kg	17	<4	<4	8	9
Benzo(a)pyrene	50-32-8	4	µg/kg	40	<4	<4	12	15
Perylene	198-55-0	4	µg/kg	8	<4	<4	<4	7
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	29	<4	<4	10	13
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	12	<4	<4	<4	<4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	23	<4	<4	9	12
Coronene	191-07-1	5	µg/kg	7	<5	<5	<5	7
^ Sum of PAHs	----	4	µg/kg	460	5	5	190	190
EP080-SD: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	----	----	91.3	109	102
Toluene-D8	2037-26-5	0.1	%	----	----	107	110	106
4-Bromofluorobenzene	460-00-4	0.1	%	----	----	95.5	104	103
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	----	72.9	42.4	46.6
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	72.9	42.2	45.1
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	75.3	72.7	108	82.9	105
Anthracene-d10	1719-06-8	0.1	%	82.9	80.1	87.2	87.5	85.1
4-Terphenyl-d14	1718-51-0	0.1	%	81.0	83.2	84.9	86.0	81.4



Analytical Results

Sub-Matrix: **SOIL**

Client sample ID

Client sampling date / time

Sub-Matrix: SOIL				Client sample ID	VC3A 0.6-1.3	VC3A 1.3-1.9	VC3A 1.9-2.4	----	----
				Client sampling date / time	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]	----	----
Compound	CAS Number	LOR	Unit	ES0917541-011	ES0917541-012	ES0917541-013	----	----	----
EA055: Moisture Content									
^ Moisture Content (dried @ 103°C)	----	1.0	%	22.6	21.6	22.2	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	----	----	----
Arsenic	7440-38-2	1.00	mg/kg	2.34	<1.00	10.1	----	----	----
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	----	----	----
Chromium	7440-47-3	1.0	mg/kg	2.8	3.0	2.3	----	----	----
Copper	7440-50-8	1.0	mg/kg	1.9	2.6	<1.0	----	----	----
Cobalt	7440-48-4	0.5	mg/kg	<0.5	<0.5	<0.5	----	----	----
Lead	7439-92-1	1.0	mg/kg	3.4	9.0	1.4	----	----	----
Manganese	7439-96-5	10	mg/kg	<10	<10	<10	----	----	----
Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	<1.0	----	----	----
Selenium	7782-49-2	0.1	mg/kg	0.1	<0.1	0.2	----	----	----
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	----	----	----
Vanadium	7440-62-2	2.0	mg/kg	2.5	2.1	3.9	----	----	----
Zinc	7440-66-6	1.0	mg/kg	5.8	30.1	2.3	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg	0.03	0.04	<0.01	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg	9	5	<5	----	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	----	----	----
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	----	----	----
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	----	----	----
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	----	----	----
Phenanthrene	85-01-8	4	µg/kg	<4	<4	<4	----	----	----
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	----	----	----
Fluoranthene	206-44-0	4	µg/kg	<4	4	<4	----	----	----
Pyrene	129-00-0	4	µg/kg	<4	5	<4	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	----	----	----
Chrysene	218-01-9	4	µg/kg	<4	<4	<4	----	----	----
Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	<4	<4	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	<4	----	----	----
Perylene	198-55-0	4	µg/kg	<4	<4	<4	----	----	----
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	<4	----	----	----
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	----	----	----
Coronene	191-07-1	5	µg/kg	<5	<5	<5	----	----	----



Analytical Results

Sub-Matrix: SOIL				Client sample ID	VC3A 0.6-1.3	VC3A 1.3-1.9	VC3A 1.9-2.4	----	----
				Client sampling date / time	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]	----	----
Compound	CAS Number	LOR	Unit		ES0917541-011	ES0917541-012	ES0917541-013	----	----
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Sum of PAHs		----	4	µg/kg	9	15	<4	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		79.9	112	83.1	----	----
Anthracene-d10	1719-06-8	0.1	%		86.6	83.0	85.9	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		83.1	80.2	83.3	----	----



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080-SD: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	74.7	127
Toluene-D8	2037-26-5	74.8	129
4-Bromofluorobenzene	460-00-4	75.3	127
EP131S: OC Pesticide Surrogate			
Dibromo-DDE	21655-73-2	10	136
EP131T: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	10	164
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	30	115
Anthracene-d10	1719-06-8	27	133
4-Terphenyl-d14	1718-51-0	18	137

Hi All,

The following changes have been made to the below batches as per the client request.

NEWCASTLE PSD BATCH

ES0917542 – Cancelled analysis on samples **1 and 2** in this batch

BRISBANE TBT AND TOC BATCH

ES0917544 – Cancelled TBT on samples **1 and 3**. **TOC is still needed for these samples.**

SYDNEY BATCH

ES0917541 – Cancelled UT OC/PCB as well as Low Level TPH and BTEX on samples **1 and 3**. **This means metals, mercury and Sediment PAH's still need to continue on these samples.**

Jacob Waugh

Production Co-ordinator

ALS Laboratory Group

Environmental Division

Sydney, Australia

Phone: +61 2 8784 8555

Fax: +61 2 8784 8500

www.alsglobal.com

From: Charlie Pierce

Sent: Thursday, 19 November 2009 11:41 AM

To: Uma Nagendiram; Peter Donaghy; Frank Ferraro; Edwandy Fadjar; Alex Rossi

Cc: Jacob Waugh

Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Dear Everyone,

The client has requested that we no longer test sample 001 and sample 002 for the tests shown below. Please stop these tests immediately. If testing has been completed, please let me know.

Dear Frank

Can you confirm that:

VC3B0.5-0.9

VC3B0-0.5

VC3B0-0.5x

Were not received?

Kind Regards

Charlie Pierce

Laboratory Manager - Sydney

ALS Laboratory Group

Environmental Division

Sydney, Australia

Phone: + 61 2 8784 8555

Fax: + 61 2 8784 8500

Mobile: +61 0466309729

www.alsglobal.com

From: Hannaford, Nick (Sydney) [mailto:Nicholas.Hannaford@WorleyParsons.com]

Sent: Thursday, 19 November 2009 11:20 AM

To: Charlie Pierce

Cc: Watters, Ali (Sydney)

Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Hi Charlie,

Please see the following amendments to the attached SRN below.

19/11/2009

Lab ID	Our ID	Change
ES0917541-001	VC1A 0-0.5	No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides) EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)
ES0917541-003	VC2A 0-1.0	No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides) EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)

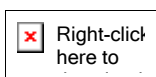
I also note that on the second copy of the COD form that you sent Ali it is stated that the following samples were not received:

VC3B0.5-0.9
VC3B0-0.5
VC3B0-0.5x

However on the first copy of the CoC these are given a lab ID. These samples are also missing from the SRN. Please advise.

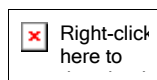
Regards,

Nick Hannaford
Environmental Scientist
WorleyParsons
Tel: +61 2 8456 7357
Fax: +62 2 8923 6877
WorleyParsons Services Pty Ltd
Level 11, 141 Walker St
Nth Sydney NSW 2060
WorleyParsons | www.worleyparsons.com



From: Watters, Ali (Sydney)
Sent: Wednesday, November 18, 2009 2:47 PM
To: Hannaford, Nick (Sydney)
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

FYI



From: ALSE Sydney Aus [<mailto:alse.sydney.als@als.com.au>]
Sent: Wednesday, 18 November 2009 2:39 PM
To: Watters, Ali (Sydney)
Subject: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

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Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0917542	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 17-NOV-2009
C-O-C number	: ----	Issue Date	: 26-NOV-2009
Sampler	: NH	No. of samples received	: 6
Order number	: ----	No. of samples analysed	: 4
Quote number	: SY/503/09		

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

This Interpretive Quality Control Report contains the following information:

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

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Part of the **ALS Laboratory Group**

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA150: Particle Sizing									
Snap Lock Bag VC2A 1.4-2.0, VC1A 1.2-1.6,		VC2A 2.3-2.6, VC3A 0-0.6	17-NOV-2009	---	---	----	24-NOV-2009	16-MAY-2010	✔
EA150: Soil Classification based on Particle Size									
Snap Lock Bag VC2A 1.4-2.0, VC1A 1.2-1.6,		VC2A 2.3-2.6, VC3A 0-0.6	17-NOV-2009	---	---	----	24-NOV-2009	16-MAY-2010	✔



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Reaular	Actual	Expected	Evaluation	



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Particle Size Analysis (Sieving)	EA150	SOIL	Particle Size Analysis by Sieving according to AS1289.3.6.1 - 1995
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



CHAIN OF CUSTODY

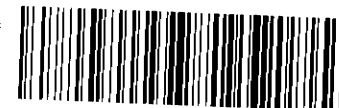
ALS Laboratory, please tick →

Environmental Division
Sydney

Work Order

ES0917542

CLIENT: WORLEY PARSONS	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	FOR LABORATORY USE ONLY Custody Seal Intact? ☒
OFFICE: N. STONEY	ALS QUOTE NO.: 57/503/09	Free ice / frozen ice bricks present up to: ☒
PROJECT: CATCO MAINTENANCE DREGGING	CONTACT PH: 0422 763 386	Random Sample Temperature on Recv: ☒
ORDER NUMBER:	SAMPLER MOBILE: 0402365428	Other comment:
PROJECT MANAGER: AL WATTERS	RELINQUISHED BY:	RECEIVED BY: <i>Sydney</i>
SAMPLER: ALICE HANNAFORD	DATE/TIME: 17/11/19 17:20	RELINQUISHED BY:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):		
Email Invoice to (will default to PM if no other addresses are listed):		
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:		



Telephone : +61-2-8784 8555

Yes	No	N/A
Yes	No	N/A
RECEIVED BY:		
DATE/TIME:		

Subcon / Forward Lab / Split WO
Lab / Analysis: ALS Newcastle
Organised By / Date: 17/11/19 PSD only
Relinquished By / Date: 17/11/19
Connote / Courier: ALS SYD BATCH ONLY: ES0917541
WO No: ES0917542
Attach By PO / Internal Sheet:

ALS USE ONLY		SAMPLE DETAILS		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 (filtered bottle required)														Additional Information	
		MATRIX: Solid(S) Water(W)																	



CHAIN OF CUSTODY

ALS Laboratory please tick →

CLIENT: <u>Woley Parsons</u>		TURNAROUND REQUIREMENTS : ☐ Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):		FOR LABORATORY USE ONLY (Circle) Custody Seal Intact? ☒ Yes ☐ No ☐ N/A	
OFFICE: <u>N Sydney</u>		ALS QUOTE NO.:		COC SEQUENCE NUMBER (Circle) COC: <u>0</u> 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	
PROJECT: <u>Cable maintenance & safety</u>				Free ice / frozen ice bricks present upon receipt? ☒ Yes ☐ No ☐ N/A	
ORDER NUMBER:				Random Sample Temperature on Receipt:	
PROJECT MANAGER: <u>Al Watters</u>		CONTACT PH: <u>0422763337</u>		Other comment:	
SAMPLER: <u>Nick Hamilton</u>		SAMPLER MOBILE: <u>0402365428</u>		RECEIVED BY: <u>Steph ASS</u> DATE/TIME: <u>17/11/19 17:20</u>	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):		RECEIVED BY:	
Email Reports to (will default to PM if no other addresses are listed):		DATE/TIME:		DATE/TIME:	
Email Invoice to (will default to PM if no other addresses are listed):				DATE/TIME:	

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	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)														Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C8) / BTEX)	EP071SD (TPH C10-C16)	EA150-H (Particle sizing)	EN020PR (dry Bag/Lab)	EA0003 (pH & phfox)	EA033 (chromium)	(TCLP/Eutrate)	Comments on likely contaminant levels, dilutions or samples requiring specific QC analysis etc.
6	UC3a0-06		S	Glass bottle/bags	4	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
	UC3a006x		S	Glass bottle/bags	2	Hold												STORE	STORE	
	UC3a06-13		S	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
	UC3a06-13y		S	Glass bottle/bags	2	Hold												STORE	STORE	
	UC3a13-191		S	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
	UC3a13-192		S	Glass bottle/bags	2	Hold												STORE	STORE	
	UC3a19-24		S	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
7	UC3b0-05-09		S	Glass bottle/bags	2	Hold												STORE	STORE	
	UC3b0-05		S	Glass bottle/bags	2	Hold												STORE	STORE	
	UC3b0-05x		S	Glass bottle/bags	2	Hold												STORE	STORE	
	SS6a		S	Glass bottle/bags														STORE	STORE	
						30	30	30	30	18	6	6	6	6	6	30	30	?	?	

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 Bisulfate 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 Solids; B = Unpreserved Bag.



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917542	Page	: 1 of 3
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 17-NOV-2009
C-O-C number	: ----	Issue Date	: 26-NOV-2009
Sampler	: NH	No. of samples received	: 6
Site	: ----	No. of samples analysed	: 4
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in
accordance with NATA
accreditation requirements.

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Dianne Blane		Newcastle

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

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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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

LOR = Limit of reporting

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



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				VC2A 1.4-2.0	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6	----
				17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]	----
Compound	CAS Number	LOR	Unit	ES0917542-003	ES0917542-004	ES0917542-005	ES0917542-006	----
EA150: Particle Sizing								
+75µm	----	1	%	90	95	98	94	----
+150µm	----	1	%	84	88	98	88	----
+300µm	----	1	%	50	41	74	46	----
+425µm	----	1	%	12	9	32	19	----
+600µm	----	1	%	<1	1	10	10	----
+1180µm	----	1	%	<1	<1	1	5	----
+2.36mm	----	1	%	<1	<1	<1	2	----
+4.75mm	----	1	%	<1	<1	<1	<1	----
+9.5mm	----	1	%	<1	<1	<1	<1	----
+19.0mm	----	1	%	<1	<1	<1	<1	----
+37.5mm	----	1	%	<1	<1	<1	<1	----
+75.0mm	----	1	%	<1	<1	<1	<1	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	7	4	2	5	----
Silt (2-60 µm)	----	1	%	3	2	<1	<1	----
Sand (0.06-2.00 mm)	----	1	%	90	94	98	93	----
Gravel (>2mm)	----	1	%	<1	<1	<1	2	----
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	----

Hi All,

The following changes have been made to the below batches as per the client request.

NEWCASTLE PSD BATCH

ES0917542 – Cancelled analysis on samples **1 and 2** in this batch

BRISBANE TBT AND TOC BATCH

ES0917544 – Cancelled TBT on samples **1 and 3**. **TOC is still needed for these samples.**

SYDNEY BATCH

ES0917541 – Cancelled UT OC/PCB as well as Low Level TPH and BTEX on samples **1 and 3**. **This means metals, mercury and Sediment PAH's still need to continue on these samples.**

Jacob Waugh

Production Co-ordinator

ALS Laboratory Group

Environmental Division

Sydney, Australia

Phone: +61 2 8784 8555

Fax: +61 2 8784 8500

www.alsglobal.com

From: Charlie Pierce

Sent: Thursday, 19 November 2009 11:41 AM

To: Uma Nagendiram; Peter Donaghy; Frank Ferraro; Edwandy Fadjar; Alex Rossi

Cc: Jacob Waugh

Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Dear Everyone,

The client has requested that we no longer test sample 001 and sample 002 for the tests shown below. Please stop these tests immediately. If testing has been completed, please let me know.

Dear Frank

Can you confirm that:

VC3B0.5-0.9

VC3B0-0.5

VC3B0-0.5x

Were not received?

Kind Regards

Charlie Pierce

Laboratory Manager - Sydney

ALS Laboratory Group

Environmental Division

Sydney, Australia

Phone: + 61 2 8784 8555

Fax: + 61 2 8784 8500

Mobile: +61 0466309729

www.alsglobal.com

From: Hannaford, Nick (Sydney) [mailto:Nicholas.Hannaford@WorleyParsons.com]

Sent: Thursday, 19 November 2009 11:20 AM

To: Charlie Pierce

Cc: Watters, Ali (Sydney)

Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Hi Charlie,

Please see the following amendments to the attached SRN below.

19/11/2009

Lab ID	Our ID	Change
ES0917541-001	VC1A 0-0.5	No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides) EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)
ES0917541-003	VC2A 0-1.0	No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides) EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)

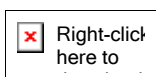
I also note that on the second copy of the COD form that you sent Ali it is stated that the following samples were not received:

VC3B0.5-0.9
VC3B0-0.5
VC3B0-0.5x

However on the first copy of the CoC these are given a lab ID. These samples are also missing from the SRN. Please advise.

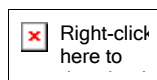
Regards,

Nick Hannaford
Environmental Scientist
WorleyParsons
Tel: +61 2 8456 7357
Fax: +62 2 8923 6877
WorleyParsons Services Pty Ltd
Level 11, 141 Walker St
Nth Sydney NSW 2060
WorleyParsons | www.worleyparsons.com



From: Watters, Ali (Sydney)
Sent: Wednesday, November 18, 2009 2:47 PM
To: Hannaford, Nick (Sydney)
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

FYI



From: ALSE Sydney Aus [<mailto:alse.sydney.als@als.com.au>]
Sent: Wednesday, 18 November 2009 2:39 PM
To: Watters, Ali (Sydney)
Subject: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

This e-mail has been automatically generated.

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Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917542	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 17-NOV-2009
C-O-C number	: ----	Issue Date	: 26-NOV-2009
Sampler	: NH	No. of samples received	: 6
Order number	: ----	No. of samples analysed	: 4
Quote number	: SY/503/09		

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Dianne Blane		Newcastle

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

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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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

		----					No Limit
--	--	------	--	--	--	--	----------

- No Laboratory Duplicate (DUP) Results are required to be reported.



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

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

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**



Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)
Comprehensive Report

Work Order : **ES0917542**

Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----	Quote number	: ES2009WORPAR0223 (EN/034/09)
C-O-C number	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
Sampler	: NH		

Dates

Date Samples Received	: 17-NOV-2009	Issue Date	: 20-NOV-2009 17:53
Client Requested Due Date	: 27-NOV-2009	Scheduled Reporting Date	: 27-NOV-2009

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 4.6'C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 6
Security Seal	: Intact.	No. of samples analysed	: 4

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.
- Particle Size cancelled for Samples 1 & 2 as per Nick Hannaford on 19/11/09
- **Samples received in appropriately pretreated and preserved containers.**
- **PSD analysis will be conducted by ALS Newcastle.**
- **Sample(s) have been received within recommended holding times.**
- **This batch for PSD only and split from ES0917541**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - EA150H Particle Sizing by Hydrometer
ES0917542-001	17-NOV-2009 10:00	VC1A 0-0.5	✓	
ES0917542-002	17-NOV-2009 10:00	VC2A 0-1.0	✓	
ES0917542-003	17-NOV-2009 10:00	VC2A 1.4-2.0		✓
ES0917542-004	[17-NOV-2009]	VC2A 2.3-2.6		✓
ES0917542-005	[17-NOV-2009]	VC1A 1.2-1.6		✓
ES0917542-006	[17-NOV-2009]	VC3A 0-0.6		✓

Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParsons.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParsons.com
- Trigger - Subcontract Report (SUBCO)	Email	Nicholas.Hannaford@WorleyParsons.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com
- Trigger - Subcontract Report (SUBCO)	Email	ali.watters@worleyparsons.com



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)
Comprehensive Report

Work Order : **ES0917543**

Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----	Quote number	: ES2009WORPAR0223 (EN/034/09)
C-O-C number	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
Sampler	: NH		

Dates

Date Samples Received	: 17-NOV-2009	Issue Date	: 19-NOV-2009 12:03
Client Requested Due Date	: 23-NOV-2009	Scheduled Reporting Date	: 23-NOV-2009

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 4.6'C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 12
Security Seal	: Intact.	No. of samples analysed	: 12

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **PH FOX analysis will be conducted by ALS Brisbane**
- **Sample(s) have been received within recommended holding times.**
- **This batch for PHFOX only and split from ES0917541**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA003 pH field/fox
ES0917543-001	17-NOV-2009 10:00	VC1A 0-0.5	✓
ES0917543-002	17-NOV-2009 10:00	VC1A 0.5-1.2	✓
ES0917543-003	17-NOV-2009 10:00	VC2A 0-1.0	✓
ES0917543-004	17-NOV-2009 10:00	VC2A 1.0-1.4	✓
ES0917543-005	17-NOV-2009 10:00	VC2A 1.4-2.0	✓
ES0917543-006	17-NOV-2009 10:00	VC2A 2.0-2.3	✓
ES0917543-007	[17-NOV-2009]	VC2A 2.3-2.6	✓
ES0917543-008	[17-NOV-2009]	VC1A 1.2-1.6	✓
ES0917543-009	[17-NOV-2009]	VC3A 0-0.6	✓
ES0917543-010	[17-NOV-2009]	VC3A 0.6-1.3	✓
ES0917543-011	[17-NOV-2009]	VC3A 1.3-1.9	✓
ES0917543-012	[17-NOV-2009]	VC3A 1.9-2.4	✓

Requested Deliverables

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com



CHAIN OF CUSTODY

ALS Laboratory, please tick →

CLIENT: <u>WILEY PARSONS</u>		TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):		FOR LABORATORY USE ONLY	
OFFICE: <u>N SYDNEY</u>		Standard TAT may be longer for some tests e.g. Ultra Trace Organics ☐ Non Standard or urgent TAT (List due date):		Custody Seal Intact?	
PROJECT: <u>CALTEX MARITIME DREDGING</u>		ALS QUOTE NO.: <u>57/503/09</u>		Free ice / frozen ice bricks present:	
ORDER NUMBER:				Random Sample Temperature on F	
PROJECT MANAGER: <u>NU WATTERS</u>		CONTACT PH: <u>0422 763 386</u>		Other comment:	
SAMPLER: <u>WILL HANNAFORD</u>		SAMPLER MOBILE: <u>0402365428</u>		RECEIVED BY: <u>3088 Nephew Alex Sydney</u>	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):		DATE/TIME: <u>17/11/19 17:20</u>	
Email Reports to (will default to PM if no other addresses are listed):		RELINQUISHED BY:		DATE/TIME:	
Email Invoice to (will default to PM if no other addresses are listed):					
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:					

Subcon / Forward Lab / Split WO
Lab / Analysis: ALS Brisbane
Organised By / Date: PH Fox only
Relinquished By / Date: 17/11/19
Connote / Courier: WO No: ES0917543
Attach By PO / Internal Sheet:

Environmental Division
Sydney

Work Order

ES0917543

Telephone: + 61-2-8784 8555

RECEIVED BY:

DATE/TIME:

ALS USE ONLY		SAMPLE DETAILS MATRIX: Solid(S) Water(W)		ANALYSIS REQUIRED including SUITES (NB, Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).										Additional Information										
		Organised By / Date: PH fox only. Relinquished By / Date: 17/11/19 Connote / Courier: WO No: ES09175243 Attach By PO / Internal Sheet:										ALS SYD BATCH ONLY: ES09175241 PSD: ES09175242 TOC+TBT: ES09175244												
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP000 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP000-UT (TPH C6-C9) / BTEX	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pHf & pHfox)	EA033 (chromium)	(TOC/Eutrogate)		Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.			
1	VC1A 0-0.5	12/11 am	s	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	STORE remaining sample - will select following review of results			
	VC1A 0-0.5X	17/11 am	s	Glass bottle/bags	2	HOLD										✓	✓	STORE	STORE					
2	VC1A 0.5-1.2	17/11 am	s	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	STORE	STORE				
	VC1A 0.5-1.27	17/11 am	s	Glass bottle/bags	2	HOLD										-	-	-	-	✓	✓	STORE	STORE	
3			s	Glass bottle/bags															STORE	STORE				
	VC2A 0-1.0	17/11 am	s	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE				
	VC2A 0-1.0 DUP	17/11 am	s	Glass bottle/bags	1	✓	✓	✓	✓	-	-	-	-	-	-	-	-	-	STORE	STORE				
4	VC2A 0-1.0 X	17/11 am	s	Glass bottle/bags	2	HOLD										-	-	-	-	-	-	STORE	STORE	
	VC2A 1.0-1.4	17/11 am	s	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	-	WATER	✓	✓	STORE	STORE				
	VC2A 1.0-1.47	17/11 am	s	Glass bottle/bags	2	HOLD										-	-	-	-	-	-	STORE	STORE	
5	VC2A 1.4-2.0	17/11 am	s	Glass bottle/bags	4	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	✓	STORE	STORE				
	VC2A 1.4-2.0 Z	17/11 am	s	Glass bottle/bags	2	HOLD										-	-	-	-	-	-	STORE	STORE	
6	VC2A 2.0-2.3	17/11 am	s	Glass bottle/bags	3	✓	✓	✓	✓	-	-	-	-	-	-	WATER	✓	✓	STORE	STORE				
	VC2A 2.3-2.6	17/11 am	s	Glass bottle/bags	4	-	-	-	-	-	-	-	-	-	-	-	-	-	STORE	STORE				
7	VC2A 2.3-2.6 x	17/11 am	s	Glass bottle/bags	2	HOLD										-	-	-	-	-	-	STORE	STORE	
			s	Glass bottle/bags															STORE	STORE				
	VC1A 1.2-1.6	17/11 am	s	Glass bottle/bags	4	-	-	-	-	-	-	-	-	-	-	-	-	-	STORE	STORE				
8	VC1A 1.2-1.62	17/11 am	s	Glass bottle/bags	2	HOLD										-	-	-	-	-	-	STORE	STORE	
			s	Glass bottle/bags															STORE	STORE				



CHAIN OF CUSTODY

ALS Laboratory please tick →

CLIENT: <u>Worley Parsons</u>	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	FOR LABORATORY USE ONLY (Circle) Custody Seal Intact? ☒ Yes ☐ No ☐ N/A	
OFFICE: <u>N Sydney</u>	☐ Non Standard or urgent TAT (List due date):	Free ice / frozen ice bricks present upon receipt? ☒ Yes ☐ No ☐ N/A	
PROJECT: <u>Caltex maintenance & ecology</u>	ALS QUOTE NO.:	Random Sample Temperature on Receipt: <u>4.6 °C</u>	
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle) COC: <u>1</u> 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Other comment:	
PROJECT MANAGER: <u>AL Watters</u>	CONTACT PH: <u>0422763381</u>	RECEIVED BY: <u>Steph</u> DATE/TIME: <u>17/11/19 17:20</u>	
SAMPLER: <u>Nick Henderson</u>	SAMPLER MOBILE: <u>0402365423</u>	RECEIVED BY:	
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME:	
Email Reports to (will default to PM if no other addresses are listed):		DATE/TIME:	
Email Invoice to (will default to PM if no other addresses are listed):		DATE/TIME:	

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	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).														Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP125SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP111A (OC Pesticides)	EP11B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C16)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pH & pHfox)	EA033 (chromium)	(TCLPE/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
9	UC3a0-06		S	Glass bottle/bags	4	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
	UC3a0-06x		S	Glass bottle/bags	2	Hold												STORE	STORE	
10	UC3a06-13		S	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
	UC3a06-13x		S	Glass bottle/bags	2	Hold												STORE	STORE	
11	UC3a13-19		S	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
	UC3a13-19x		S	Glass bottle/bags	2	Hold												STORE	STORE	
12	UC3a19-24		S	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
	UC3b0-05-09		S	Glass bottle/bags	3	Hold												STORE	STORE	
	UC3b0-05x		S	Glass bottle/bags	2	Hold												STORE	STORE	
	UC3b0-05x		S	Glass bottle/bags	2	Hold												STORE	STORE	
	UC3b0-05x		S	Glass bottle/bags	2	Hold												STORE	STORE	
						30	30	30	30	18	6	6	6	6	6	30	30	?	?	

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.



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917543	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 17-NOV-2009
C-O-C number	: ----	Issue Date	: 23-NOV-2009
Sampler	: NH	No. of samples received	: 12
Site	: ----	No. of samples analysed	: 12
Quote number	: EN/034/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Inorganics

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

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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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- Analysis conducted by ALS Brisbane, NATA Site No. 818.
- pH FOX Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Vigorous; 4 - Very Vigorous



Analytical Results

Sub-Matrix: SOIL

				Client sample ID	VC1A 0-0.5	VC1A 0.5-1.2	VC2A 0-1.0	VC2A 1.0-1.4	VC2A 1.4-2.0
				Client sampling date / time	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00
Compound	CAS Number	LOR	Unit		ES0917543-001	ES0917543-002	ES0917543-003	ES0917543-004	ES0917543-005
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		8.9	9.0	7.1	7.4	8.8
pH (Fox)	----	0.1	pH Unit		6.0	6.3	2.0	1.9	6.5
Reaction Rate	----	1	Reaction Uni		2	2	2	4	2



Analytical Results

Sub-Matrix: SOIL

				Client sample ID	VC2A 2.0-2.3	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6	VC3A 0.6-1.3
				Client sampling date / time	17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]
Compound	CAS Number	LOR	Unit		ES0917543-006	ES0917543-007	ES0917543-008	ES0917543-009	ES0917543-010
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		8.9	8.8	9.0	8.8	8.9
pH (Fox)	----	0.1	pH Unit		6.5	6.5	6.2	6.5	6.5
Reaction Rate	----	1	Reaction Uni		2	2	2	2	2



Analytical Results

Sub-Matrix: SOIL				Client sample ID	VC3A 1.3-1.9	VC3A 1.9-2.4	----	----	----
				Client sampling date / time	[17-NOV-2009]	[17-NOV-2009]	----	----	----
Compound	CAS Number	LOR	Unit		ES0917543-011	ES0917543-012	----	----	----
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		8.9	8.9	----	----	----
pH (Fox)	----	0.1	pH Unit		6.6	6.6	----	----	----
Reaction Rate	----	1	Reaction Uni		1	1	----	----	----



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917543	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 23-NOV-2009
Order number	: ----		
Quote number	: EN/034/09	No. of samples received	: 12
		No. of samples analysed	: 12

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in
accordance with NATA
accreditation requirements.

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Inorganics

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

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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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA003 :pH (field/fox) (QC Lot: 1168129)									
ES0917543-001	VC1A 0-0.5	EA003: Reaction Rate	----	1	--	2	2	0.0	No Limit
		EA003: pH (F)	----	0.1	pH Unit	8.9	9.0	1.1	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	6.0	6.0	0.0	0% - 20%
ES0917543-010	VC3A 0.6-1.3	EA003: Reaction Rate	----	1	--	2	2	0.0	No Limit
		EA003: pH (F)	----	0.1	pH Unit	8.9	9.0	1.1	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	6.5	6.5	0.0	0% - 20%



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

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

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**



Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0917543	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 23-NOV-2009
Order number	: ----		
Quote number	: EN/034/09	No. of samples received	: 12
		No. of samples analysed	: 12

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

This Interpretive Quality Control Report contains the following information:

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

Environmental Division Sydney

Part of the **ALS Laboratory Group**

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA003 :pH (field/fox)								
Snap Lock Bag - frozen		17-NOV-2009	----	----	----	23-NOV-2009	17-NOV-2010	✔
VC1A 0-0.5,	VC1A 0.5-1.2,							
VC2A 0-1.0,	VC2A 1.0-1.4,							
VC2A 1.4-2.0,	VC2A 2.0-2.3,							
VC2A 2.3-2.6,	VC1A 1.2-1.6,							
VC3A 0-0.6,	VC3A 0.6-1.3,							
VC3A 1.3-1.9,	VC3A 1.9-2.4							



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
pH field/fox	EA003	2	12	16.7	10.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH field/fox	EA003	SOIL	Ahern et al 1998 - determined on a 1:5 soil/water extract designed to simulate field measured pH and pH after the extract has been oxidised with peroxide.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0917544	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 27-NOV-2009
Order number	: ----		
Quote number	: EN/034/09	No. of samples received	: 13
		No. of samples analysed	: 13

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

This Interpretive Quality Control Report contains the following information:

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



Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA055: Moisture Content								
Soil Glass Jar - Unpreserved VC2A 2.3-2.6, VC3A 0-0.6	VC1A 1.2-1.6,	17-NOV-2009	----	----	----	23-NOV-2009	24-NOV-2009	✓
EP005: Total Organic Carbon (TOC)								
Pulp Bag VC1A 0-0.5, VC2A 0-1.0, VC2A 1.0-1.4, VC2A 2.0-2.3, VC1A 1.2-1.6, VC3A 0.6-1.3, VC3A 1.9-2.4	VC1A 0.5-1.2, VC2A 0-1.0 DUP, VC2A 1.4-2.0, VC2A 2.3-2.6, VC3A 0-0.6, VC3A 1.3-1.9,	17-NOV-2009	20-NOV-2009	15-DEC-2009	✓	23-NOV-2009	15-DEC-2009	✓
EP090: Organotin Compounds								
Soil Glass Jar - Unpreserved VC2A 2.3-2.6, VC3A 0-0.6	VC1A 1.2-1.6,	17-NOV-2009	23-NOV-2009	01-DEC-2009	✓	25-NOV-2009	02-JAN-2010	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	2	11	18.2	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organotin Analysis	EP090	2	18	11.1	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	2	13	15.4	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Organotin Analysis	EP090	1	18	5.6	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	13	7.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organotin Analysis	EP090	1	18	5.6	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	13	7.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Organotin Analysis	EP090	1	18	5.6	5.0	✓	ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (1999) Schedule B(3) (Method 102)
Total Organic Carbon	EP005	SOIL	In-house. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO ₂) is automatically measured by infra-red detector.
Organotin Analysis	EP090	SOIL	(USEPA SW 846 - 8270D) Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quantified against an established calibration curve.
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Organotin Sample Preparation	ORG35	SOIL	In house. 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP090: Organotin Compounds	ES0917544-008	VC2A 2.3-2.6	Tributyltin	56573-85-4	Not Determined	----	Matrix spike recovery not determined due to sample matrix interference.

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

Regular Sample Surrogates

Sub-Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP090S: Organotin Surrogate	ES0917544-009	VC1A 1.2-1.6	Tripropyltin	----	Not Determined	----	Surrogate recovery not determined due to (target or non-target) matrix interferences

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



CHAIN OF CUSTODY

ALS Laboratory please tick →

Environmental Division

Sydney

Work Order

ES0917544

CLIENT: <u>WORLEY PARSONS</u>	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):	FOR LABORATORY USE:
OFFICE: <u>N. SYDNEY</u>	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	Custody Seal Intact? ☒
PROJECT: <u>CALTEX MAINTENANCE DREAGING</u>	ALS QUOTE NO.: <u>59/503/09</u>	Free Ice / Frozen ice bricks: ☒
ORDER NUMBER:		Random Sample Temperature: ☐
PROJECT MANAGER: <u>AL WATTERS</u>	CONTACT PH: <u>0422 763 386</u>	Other comment:
SAMPLER: <u>ALICE HAMMART</u>	SAMPLER MOBILE: <u>0402365428</u>	RECEIVED BY: <u>30/8/2019</u>
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME: <u>17/11/19 17:20</u>
Email Reports to (will default to PM if no other addresses are listed):	RELINQUISHED BY:	RELINQUISHED BY:
Email Invoice to (will default to PM if no other addresses are listed):		DATE/TIME:
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:		



Telephone : +61-2-8784 8555

Yes	No	N/A
Yes	No	N/A
4-6°C		
RECEIVED BY:		
DATE/TIME:		

Subcon / Forward Lab / Split WO
Lab / Analysis: ALS B.R. 8/2019
Organised By / Date: 17/11/19
Relinquished By / Date: 17/11/19
Connote / Courier: ALS SYD BATCH ONLY: ES0917541
WO No: ES0917544
Attach By PO / Internal Sheet:

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 (acid filtered bottle required).

WO No: ES0917544 Attach By PO / Internal Sheet:																				PH Fox: ES0917543		Comments on likely contaminant levels, dilutions, or samples requiring specific GC analysis etc.
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG030L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP080 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C16)	EA150-H (Particle sizing)	EN020PR (dry/Bag/L abel)	EA003 (pH & pHfox)	EA033 (chromium)	(TCS/Eluate)			
1	VCIA 0-0.5	17/11 am	s	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE	STORE remaining sample - will select following review of results	
	VCIA 0-0.5X	17/11 am	s	Glass bottle/bags	2	HOLD														STORE		STORE
2	VCIA 0.5-1.2	17/11 am	s	Glass bottle/bags	3	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	STORE	STORE		
	VCIA 0.5-1.2X	17/11 am	s	Glass bottle/bags	2	HOLD														STORE	STORE	
			s	Glass bottle/bags															STORE	STORE		
3	VC2A 0-1.0	17/11 am	s	Glass bottle/bags	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	STORE	STORE		
4	VC2A 0-1.0 DUP	17/11 am	s	Glass bottle/bags	1	✓	✓	✓	✓	✓	-	-	-	-	-	-	-	-	STORE	STORE		
	VC2A 0-1.0X	17/11 am	s	Glass bottle/bags	2	HOLD														STORE	STORE	
5	VC2A 1.0-1.4	17/11 am	s	Glass bottle/bags	3	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	STORE	STORE		
	VC2A 1.0-1.4X	17/11 am	s	Glass bottle/bags	2	HOLD														STORE	STORE	
6	VC2A 1.4-2.0	17/11 am	s	Glass bottle/bags	4	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	STORE	STORE		
	VC2A 1.4-2.0X	17/11 am	s	Glass bottle/bags	2	HOLD														STORE	STORE	
7	VC2A 2.0-2.3	17/11 am	s	Glass bottle/bags	3	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	STORE	STORE		
8	VC2A 2.3-2.6	17/11 pm	s	Glass bottle/bags	4	-	-	-	-	-	-	-	-	-	-	-	-	-	STORE	STORE		
	VC2A 2.3-2.6X	17/11 pm	s	Glass bottle/bags	2	HOLD														STORE	STORE	
			s	Glass bottle/bags															STORE	STORE		
9	VCIA 12-1.6	17/11 pm	s	Glass bottle/bags	4	-	-	-	-	-	-	-	-	-	-	-	-	-	STORE	STORE		
	VCIA 12-1.62	17/11 pm	s	Glass bottle/bags	2	HOLD														STORE	STORE	
			s	Glass bottle/bags															STORE	STORE		



CHAIN OF CUSTODY

ALS Laboratory please tick →

CLIENT: <u>Worley Parsons</u>	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	FOR LABORATORY USE ONLY (Circle) Custody Seal Intact? ☒ Yes ☐ No ☐ N/A
OFFICE: <u>N Sydney</u>	☐ Non Standard or urgent TAT (List due date):	Free Ice / Frozen ice bricks present upon receipt? ☒ Yes ☐ No ☐ N/A
PROJECT: <u>Culter maintenance & edging</u>	ALS QUOTE NO.:	Random Sample Temperature on Receipt: <u>4.6 °C</u>
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle) COC: <u>1</u> 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Other comment:
PROJECT MANAGER: <u>Al Watters</u>	CONTACT PH: <u>0422763331</u>	
SAMPLER: <u>Nick Hennaio</u>	SAMPLER MOBILE: <u>0402365423</u>	RECEIVED BY: <u>Stephano Hennaio</u> DATE/TIME: <u>17/11/19 17:20</u>
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	RECEIVED BY: DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):		
Email Invoice to (will default to PM if no other addresses are listed):		
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:		

ALS USE ONLY		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).														Additional Information	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <i>(refer to codes below)</i>	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pH & pHox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.		
10	UC3a0-06		S	Glass bottle/bags	4	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE			
	UC3a0-06x		S	Glass bottle/bags	2	Hold														STORE	STORE	
11	UC3a06-13		S	Glass bottle/bags	3	/	/	/	/								/	/	STORE	STORE		
	UC3a06-13 ₁		S	Glass bottle/bags	2	Hold														STORE	STORE	
12	UC3a13-19 ₁		S	Glass bottle/bags	3	/	/	/	/								/	/	STORE	STORE		
	UC3a13-19 ₂		S	Glass bottle/bags	2	Hold														STORE	STORE	
13	UC3a19-24		S	Glass bottle/bags	3	/	/	/	/								/	/	STORE	STORE		
14	UC3a UC3b0-05-09		S	Glass bottle/bags	3	Hold														STORE	STORE	
15	UC3a UC3b0-05		S	Glass bottle/bags	2	Hold														STORE	STORE	
	UC3a UC3b0-05 _x		S	Glass bottle/bags	2	Hold														STORE	STORE	
	UC3a		S	Glass bottle/bags																STORE	STORE	
						30	30	30	30	18	6	6	6	6	6	30	30	?	?			

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.



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917544	Page	: 1 of 6
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 17-NOV-2009
C-O-C number	: ----	Issue Date	: 27-NOV-2009
Sampler	: NH	No. of samples received	: 13
Site	: ----	No. of samples analysed	: 13
Quote number	: EN/034/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Matt Frost	Organic Instrument Chemist	Inorganics
Matt Frost	Organic Instrument Chemist	Organics
Stephen Hislop	Senior Inorganic Chemist	Stafford Minerals - AY

Environmental Division Sydney

Part of the **ALS Laboratory Group**

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A Campbell Brothers Limited Company



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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- **TBT: Matrix spike recovery not determined due to sample heterogeneity.**
- **TBT: Sample VC1A 1.2-1.6 required dilution due to the presence of high level contaminants. LOR values have been adjusted accordingly. Surrogate recovery not determined.**



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				VC1A 0-0.5	VC1A 0.5-1.2	VC2A 0-1.0	VC2A 0-1.0 DUP	VC2A 1.0-1.4
				17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00	17-NOV-2009 10:00
Compound	CAS Number	LOR	Unit	ES0917544-001	ES0917544-002	ES0917544-003	ES0917544-004	ES0917544-005
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	0.02	%	0.07	0.08	<0.02	<0.02	1.13

Page : 4 of 6
 Work Order : ES0917544
 Client : WORLEY PARSONS - INFRASTRUCTURE MWE
 Project : CALTEX MAINTENANCE DREDGING



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				VC2A 1.4-2.0	VC2A 2.0-2.3	VC2A 2.3-2.6	VC1A 1.2-1.6	VC3A 0-0.6
				17-NOV-2009 10:00	17-NOV-2009 10:00	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]
Compound	CAS Number	LOR	Unit	ES0917544-006	ES0917544-007	ES0917544-008	ES0917544-009	ES0917544-010
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	----	----	20.1	17.5	27.9
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	0.02	%	0.61	0.12	0.14	0.03	0.69
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	----	----	5.4	26.8	5.0
EP090S: Organotin Surrogate								
Tripopyltin	----	0.1	%	----	----	100	Not Determined	88.2



Analytical Results

Sub-Matrix: SOIL				Client sample ID	VC3A 0.6-1.3	VC3A 1.3-1.9	VC3A 1.9-2.4	----	----
				Client sampling date / time	[17-NOV-2009]	[17-NOV-2009]	[17-NOV-2009]	----	----
Compound	CAS Number	LOR	Unit		ES0917544-011	ES0917544-012	ES0917544-013	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	0.02	%		0.19	0.25	0.14	----	----



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP090S: Organotin Surrogate			
Tripropyltin	----	34	108

Hi All,

The following changes have been made to the below batches as per the client request.

NEWCASTLE PSD BATCH

ES0917542 – Cancelled analysis on samples **1 and 2** in this batch

BRISBANE TBT AND TOC BATCH

ES0917544 – Cancelled TBT on samples **1 and 3**. **TOC is still needed for these samples.**

SYDNEY BATCH

ES0917541 – Cancelled UT OC/PCB as well as Low Level TPH and BTEX on samples **1 and 3**. **This means metals, mercury and Sediment PAH's still need to continue on these samples.**

Jacob Waugh

Production Co-ordinator

ALS Laboratory Group

Environmental Division

Sydney, Australia

Phone: +61 2 8784 8555

Fax: +61 2 8784 8500

www.alsglobal.com

From: Charlie Pierce

Sent: Thursday, 19 November 2009 11:41 AM

To: Uma Nagendiram; Peter Donaghy; Frank Ferraro; Edwandy Fadjar; Alex Rossi

Cc: Jacob Waugh

Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Dear Everyone,

The client has requested that we no longer test sample 001 and sample 002 for the tests shown below. Please stop these tests immediately. If testing has been completed, please let me know.

Dear Frank

Can you confirm that:

VC3B0.5-0.9

VC3B0-0.5

VC3B0-0.5x

Were not received?

Kind Regards

Charlie Pierce

Laboratory Manager - Sydney

ALS Laboratory Group

Environmental Division

Sydney, Australia

Phone: + 61 2 8784 8555

Fax: + 61 2 8784 8500

Mobile: +61 0466309729

www.alsglobal.com

From: Hannaford, Nick (Sydney) [mailto:Nicholas.Hannaford@WorleyParsons.com]

Sent: Thursday, 19 November 2009 11:20 AM

To: Charlie Pierce

Cc: Watters, Ali (Sydney)

Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

Hi Charlie,

Please see the following amendments to the attached SRN below.

19/11/2009

Lab ID	Our ID	Change
ES0917541-001	VC1A 0-0.5	No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides) EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)
ES0917541-003	VC2A 0-1.0	No longer require the following tests: EP090 (TBT) EP131A (OC Pesticides) EP131B (PCBs) EP080-UT (TPH(C6-C9)/BTEX) EP071SD (TPH C10-C36) EA150-H (Particle Sizing)

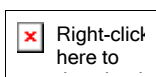
I also note that on the second copy of the COD form that you sent Ali it is stated that the following samples were not received:

VC3B0.5-0.9
VC3B0-0.5
VC3B0-0.5x

However on the first copy of the CoC these are given a lab ID. These samples are also missing from the SRN. Please advise.

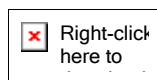
Regards,

Nick Hannaford
Environmental Scientist
WorleyParsons
Tel: +61 2 8456 7357
Fax: +62 2 8923 6877
WorleyParsons Services Pty Ltd
Level 11, 141 Walker St
Nth Sydney NSW 2060
WorleyParsons | www.worleyparsons.com



From: Watters, Ali (Sydney)
Sent: Wednesday, November 18, 2009 2:47 PM
To: Hannaford, Nick (Sydney)
Subject: FW: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

FYI



From: ALSE Sydney Aus [<mailto:alse.sydney.als@als.com.au>]
Sent: Wednesday, 18 November 2009 2:39 PM
To: Watters, Ali (Sydney)
Subject: Your Reference : CALTEX MAINTENANCE DREDGING. COC/COC/COC/COC/SRN for ALSE Workorder : ES0917541

This e-mail has been automatically generated.

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Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917544	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 17-NOV-2009
Sampler	: NH	Issue Date	: 27-NOV-2009
Order number	: ----		
Quote number	: EN/034/09	No. of samples received	: 13
		No. of samples analysed	: 13

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Matt Frost	Organic Instrument Chemist	Inorganics
Matt Frost	Organic Instrument Chemist	Organics
Stephen Hislop	Senior Inorganic Chemist	Stafford Minerals - AY

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

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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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 1171420)									
ES0917544-008	VC2A 2.3-2.6	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	20.1	20.0	0.0	0% - 20%
ES0917655-005	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	18.6	19.0	2.2	0% - 50%
EP005: Total Organic Carbon (TOC) (QC Lot: 1169775)									
ES0917544-001	VC1A 0-0.5	EP005: Total Organic Carbon	----	0.02	%	0.07	0.07	0.0	No Limit
ES0917544-011	VC3A 0.6-1.3	EP005: Total Organic Carbon	----	0.02	%	0.19	0.18	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 1170808)									
EB0918340-003	Anonymous	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	1.9	1.4	33.6	No Limit
ES0917604-075	Anonymous	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	1.9	1.4	26.4	No Limit



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

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

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EP005: Total Organic Carbon (TOC) (QCLot: 1169775)								
EP005: Total Organic Carbon	----	0.02	%	<0.02	100 %	101	70	130
EP090: Organotin Compounds (QCLot: 1170808)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	105	24.1	129



Matrix Spike (MS) Report

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

Sub-Matrix: SOIL

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
					MS	Low	High
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
EP090: Organotin Compounds (QCLot: 1170808)							
ES0917544-008	VC2A 2.3-2.6	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	# Not Determined	20	130



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)
Comprehensive Report

Work Order : **ES0917544**

Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----	Quote number	: ES2009WORPAR0223 (EN/034/09)
C-O-C number	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
Sampler	: NH		

Dates

Date Samples Received	: 17-NOV-2009	Issue Date	: 20-NOV-2009 10:56
Client Requested Due Date	: 27-NOV-2009	Scheduled Reporting Date	: 27-NOV-2009

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 4.6'C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 13
Security Seal	: Intact.	No. of samples analysed	: 13

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.
- TBT cancelled for Samples 1 & 3 as per Nick Hannaford on 19/11/09
- **Samples received in appropriately pretreated and preserved containers.**
- **TBT AND TOC analysis will be conducted by ALS Brisbane**
- **Sample(s) have been received within recommended holding times.**
- **Sample id UC3b0.5-0.9 and UC3b 0-0.5 were not received.**
- **This batch for TBT & TOC only and split from ES0917541**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EP005 (solids) Total Organic Carbon (TOC) soils	SOIL - EA055-103 Moisture Content	SOIL - EP090 (solids) Organotins
ES0917544-001	17-NOV-2009 10:00	VC1A 0-0.5	✓		
ES0917544-002	17-NOV-2009 10:00	VC1A 0.5-1.2	✓		
ES0917544-003	17-NOV-2009 10:00	VC2A 0-1.0	✓		
ES0917544-004	17-NOV-2009 10:00	VC2A 0-1.0 DUP	✓		
ES0917544-005	17-NOV-2009 10:00	VC2A 1.0-1.4	✓		
ES0917544-006	17-NOV-2009 10:00	VC2A 1.4-2.0	✓		
ES0917544-007	17-NOV-2009 10:00	VC2A 2.0-2.3	✓		
ES0917544-008	[17-NOV-2009]	VC2A 2.3-2.6	✓	✓	✓
ES0917544-009	[17-NOV-2009]	VC1A 1.2-1.6	✓	✓	✓
ES0917544-010	[17-NOV-2009]	VC3A 0-0.6	✓	✓	✓
ES0917544-011	[17-NOV-2009]	VC3A 0.6-1.3	✓		
ES0917544-012	[17-NOV-2009]	VC3A 1.3-1.9	✓		
ES0917544-013	[17-NOV-2009]	VC3A 1.9-2.4	✓		

Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParsons.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParsons.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order : **ES0917649**

Client : **WORLEY PARSONS -
INFRASTRUCTURE MWE**

Contact : Ms ALI WATTERS
Address : Level 10/141 Walker Street
NORTH SYDNEY NSW, AUSTRALIA
2060

E-mail : ali.watters@worleyparsons.com
Telephone : +61 02 8907 2131
Facsimile : ----

Project : CALTEX MAINTENANCE DREDGING
Order number : ----
C-O-C number : ----
Site : ----
Sampler : NH

Laboratory : Environmental Division Sydney

Contact : Charlie Pierce
Address : 277-289 Woodpark Road Smithfield
NSW Australia 2164

E-mail : charlie.pierce@alsenviro.com
Telephone : +61-2-8784 8555
Facsimile : +61-2-8784 8500

Page : 1 of 3

Quote number : ES2009WORPAR0232 (SY/503/09)

QC Level : NEPM 1999 Schedule B(3) and ALS
QCS3 requirement

Dates

Date Samples Received : 18-NOV-2009
Client Requested Due Date : 30-NOV-2009

Issue Date : 19-NOV-2009 14:34
Scheduled Reporting Date : **30-NOV-2009**

Delivery Details

Mode of Delivery : Carrier
No. of coolers/boxes : 1 HARD
Security Seal : Not intact.

Temperature : 0.6'C - Ice present
No. of samples received : 27
No. of samples analysed : 15

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **Sample(s) have been received within recommended holding times.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- **This batch split into ES0917655 for TBT/TOC, ES0971657 for PHF/PHFOX , ES0917660 for PARTICAL SIZE analysis.**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EG020-SD Total Metals in Sediments by ICPMS (NODG)	SOIL - EG035T-LL Total Mercury by FIMS - Low Level	SOIL - EP071 - SD TPH ultra trace in sediments	SOIL - EP080-SD TPH(V)/BTEX in Sediments	SOIL - EP131A OC Pesticides (Ultratrace)	SOIL - EP131B PCB's (Ultratrace)
ES0917649-001	17-NOV-2009 15:00	SS3C		✓	✓	✓				
ES0917649-002	17-NOV-2009 15:00	SS3D		✓	✓	✓				
ES0917649-003	17-NOV-2009 15:00	SS3B		✓	✓	✓				
ES0917649-004	17-NOV-2009 15:00	SS3A		✓	✓	✓				
ES0917649-005	17-NOV-2009 15:00	VC3B0-0.5		✓	✓	✓	✓	✓	✓	✓
ES0917649-006	17-NOV-2009 15:00	VC3B0-0.5X		✓	✓	✓				
ES0917649-007	17-NOV-2009 15:00	VC3B0.5-0.9		✓	✓	✓				
ES0917649-008	18-NOV-2009 15:00	VC2B0-0.5		✓	✓	✓	✓	✓	✓	✓
ES0917649-009	18-NOV-2009 15:00	VC2B0.5-0.9		✓	✓	✓				
ES0917649-010	18-NOV-2009 15:00	VC2B0.9-1.5		✓	✓	✓				
ES0917649-011	18-NOV-2009 15:00	VC2B1.5-2.2		✓	✓	✓				
ES0917649-012	18-NOV-2009 15:00	SS2D		✓	✓	✓				
ES0917649-013	18-NOV-2009 15:00	SS1C		✓	✓	✓				
ES0917649-014	18-NOV-2009 15:00	SS2A		✓	✓	✓				
ES0917649-015	18-NOV-2009 15:00	SS1D		✓	✓	✓				
ES0917649-016	17-NOV-2009 15:00	SS3CX	✓							
ES0917649-017	17-NOV-2009 15:00	SS3DX	✓							
ES0917649-018	17-NOV-2009 15:00	SS3BX	✓							
ES0917649-019	17-NOV-2009 15:00	SS3AX	✓							
ES0917649-020	18-NOV-2009 15:00	VC2B0-0.5X	✓							
ES0917649-021	18-NOV-2009 15:00	VC2B0.5-0.9X	✓							
ES0917649-022	18-NOV-2009 15:00	VC2B0.9-1.5X	✓							
ES0917649-023	18-NOV-2009 15:00	VC2B1.5-2.2X	✓							
ES0917649-024	18-NOV-2009 15:00	SS2DX	✓							
ES0917649-025	18-NOV-2009 15:00	SS1CX	✓							
ES0917649-026	18-NOV-2009 15:00	SS2AX	✓							
ES0917649-027	18-NOV-2009 15:00	SS1DX	✓							



Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EP132B-SD Ultra-trace PAHs in Sediments
ES0917649-001	17-NOV-2009 15:00	SS3C	✓
ES0917649-002	17-NOV-2009 15:00	SS3D	✓
ES0917649-003	17-NOV-2009 15:00	SS3B	✓
ES0917649-004	17-NOV-2009 15:00	SS3A	✓
ES0917649-005	17-NOV-2009 15:00	VC3B0-0.5	✓
ES0917649-006	17-NOV-2009 15:00	VC3B0-0.5X	✓
ES0917649-007	17-NOV-2009 15:00	VC3B0.5-0.9	✓
ES0917649-008	18-NOV-2009 15:00	VC2B0-0.5	✓
ES0917649-009	18-NOV-2009 15:00	VC2B0.5-0.9	✓
ES0917649-010	18-NOV-2009 15:00	VC2B0.9-1.5	✓
ES0917649-011	18-NOV-2009 15:00	VC2B1.5-2.2	✓
ES0917649-012	18-NOV-2009 15:00	SS2D	✓
ES0917649-013	18-NOV-2009 15:00	SS1C	✓
ES0917649-014	18-NOV-2009 15:00	SS2A	✓
ES0917649-015	18-NOV-2009 15:00	SS1D	✓

Requested Deliverables

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com



CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: <u>Worley Parsons</u>	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):	FOR LABORATORY USE ONLY (Cir) Custody Seal intact?
OFFICE: <u>North Sydney</u>	ALS QUOTE NO.:	Free ice / frozen ice bricks present upon receipt?
PROJECT: <u>Calder maintenance already</u>	COC SEQUENCE NUMBER (Circle) COC: <u>2</u> 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt:
ORDER NUMBER:	RECEIVED BY: <u>Frank ALS</u>	RELINQUISHED BY:
PROJECT MANAGER: <u>Ali Williams</u>	CONTACT PH: <u>0427 763 386</u>	DATE/TIME: <u>18/11/09 5:15pm</u>
SAMPLER: <u>Nick Hannon</u>	SAMPLER MOBILE: <u>0402365428</u>	DATE/TIME:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	
Email Reports to (will default to PM if no other addresses are listed):		
Email Invoice to (will default to PM if no other addresses are listed):		

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Environmental Division
Sydney

Work Order

ES0917649



Telephone: +61-2-8784 8555

Yes	No	N/A
Yes	No	N/A

0-6 °C

RECEIVED BY:

DATE/TIME:

ALS USE ONLY		SAMPLE DETAILS MATRIX: Solid(S) Water(W)		CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (see www.als.com.au for more information))												Additional Information		
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP080 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pH & pffox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	SS3c		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	STORE remaining sample - will select following review of results
16	SS3cx		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
2	SS3d		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
17	SS3dx		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
3	SS3b		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
18	SS3bx		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
4	SS3a		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
19	SS3ax		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
5	UC3b0-0.5		s	Glass bottle/bags	4	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
6	UC3b0-0.5x		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
7	UC3b0.5-0.9		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
8	UC2B0-0.5		s	Glass bottle/bags	4	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
20	UC2B0-0.5x		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
9	UC2B0.5-0.9		s	Glass bottle/bags	4	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
21	UC2B0.5-0.9x		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
10	UC2B0.9-1.5		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
22	UC2B0.9-1.5x		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
11	UC2B 1.5-2.2		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	
23	UC2B 1.5-2.2x		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	



CHAIN OF CUSTODY

ALS Laboratory, please tick →

CLIENT: <u>Workflows</u>	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	FOR LABORATORY USE ONLY (Circle)	
OFFICE: <u>NHS Spire</u>	☐ Non Standard or urgent TAT (List due date):	Custody Seal intact?	Yes No N/A
PROJECT: <u>Cater maintenance dredging</u>	ALS QUOTE NO.:	Free ice / frozen ice bricks present upon receipt?	Yes No N/A
ORDER NUMBER:		Random Sample Temperature on Receipt:	°C
PROJECT MANAGER: <u>Al. Walter</u>	CONTACT PH: <u>0422 763 336</u>	Other comment:	
SAMPLER: <u>Nick Flannery</u>	SAMPLER MOBILE: <u>040 2365423</u>	RECEIVED BY: <u>Frank - ALS</u>	RECEIVED BY:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME: <u>18/11/09 5:15pm</u>	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):			
Email Invoice to (will default to PM if no other addresses are listed):			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	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 (fold filtered bottle required).														Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP080 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH C6-C9) / BTEX	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bagl. label)	EA0003 (pH & phlox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
12	SS2D	18/11/09 am	S	Glass bottle/bags	3	/	/	/	/	/						/	/	STORE	STORE	
(24)	SS2Dx	18/11/09 am	S	Glass bottle/bags	2	Hold														
13	SS1C	18/11/09 am	S	Glass bottle/bags	3	/	/	/	/	/						/	/	STORE	STORE	
(25)	SS1Cx	18/11/09 am	S	Glass bottle/bags	2	Hold														
14	SS2A	18/11/09 am	S	Glass bottle/bags	3	/	/	/	/	/						/	/	STORE	STORE	
(26)	SS2Ax	18/11/09 am	S	Glass bottle/bags	2	Hold														
15	SS1D	18/11/09 am	S	Glass bottle/bags	3	/	/	/	/	/						/	/	STORE	STORE	
(27)	SS1Dx	18/11/09 am	S	Glass bottle/bags	2	Hold														
			S	Glass bottle/bags														STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
TOTAL						30	30	30	30	18	6	6	6	6	6	30	30	?	?	

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.



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917649	Page	: 1 of 11
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 18-NOV-2009
C-O-C number	: ----	Issue Date	: 27-NOV-2009
Sampler	: NH	No. of samples received	: 27
Site	: ----	No. of samples analysed	: 15
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Celine Conceicao	Spectroscopist	Inorganics
Edwandy Fadjar	Senior Organic Chemist	Organics
Hoa Nguyen	Inorganic Chemist	Inorganics

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

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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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

LOR = Limit of reporting

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



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	SS3C	SS3D	SS3B	SS3A	VC3B0-0.5
				17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00
				ES0917649-001	ES0917649-002	ES0917649-003	ES0917649-004	ES0917649-005
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	40.0	22.0	47.4	24.7	19.1
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	0.56	<0.50
Arsenic	7440-38-2	1.00	mg/kg	5.85	1.50	8.85	1.70	<1.00
Cadmium	7440-43-9	0.1	mg/kg	0.1	<0.1	0.2	0.2	<0.1
Chromium	7440-47-3	1.0	mg/kg	19.1	5.3	22.8	7.1	2.2
Copper	7440-50-8	1.0	mg/kg	15.2	5.1	21.7	33.2	1.3
Cobalt	7440-48-4	0.5	mg/kg	1.4	<0.5	1.8	1.5	<0.5
Lead	7439-92-1	1.0	mg/kg	19.9	4.5	25.5	60.2	2.4
Manganese	7439-96-5	10	mg/kg	33	12	40	14	<10
Nickel	7440-02-0	1.0	mg/kg	4.6	1.0	5.7	2.0	<1.0
Selenium	7782-49-2	0.1	mg/kg	0.5	0.2	1.0	0.2	<0.1
Silver	7440-22-4	0.1	mg/kg	0.1	<0.1	0.2	<0.1	<0.1
Vanadium	7440-62-2	2.0	mg/kg	15.2	3.8	19.3	3.6	2.5
Zinc	7440-66-6	1.0	mg/kg	64.2	19.1	95.9	460	6.3
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.15	0.03	0.20	0.01	0.02
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	----	----	----	----	<3
C10 - C14 Fraction	----	3	mg/kg	----	----	----	----	<3
C15 - C28 Fraction	----	3	mg/kg	----	----	----	----	3
C29 - C36 Fraction	----	5	mg/kg	----	----	----	----	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg	----	----	----	----	3
EP080-SD: BTEX								
Benzene	71-43-2	0.2	mg/kg	----	----	----	----	<0.2
Toluene	108-88-3	0.2	mg/kg	----	----	----	----	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	----	----	----	----	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	----	----	----	----	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	----	----	----	----	<0.2
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.50	µg/kg	----	----	----	----	<0.50
alpha-BHC	319-84-6	0.50	µg/kg	----	----	----	----	<0.50
beta-BHC	319-85-7	0.50	µg/kg	----	----	----	----	<0.50
delta-BHC	319-86-8	0.50	µg/kg	----	----	----	----	<0.50
4,4'-DDD	72-54-8	0.50	µg/kg	----	----	----	----	<0.50
4,4'-DDE	72-55-9	0.50	µg/kg	----	----	----	----	<0.50
4,4'-DDT	50-29-3	0.50	µg/kg	----	----	----	----	<0.50



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	SS3C	SS3D	SS3B	SS3A	VC3B0-0.5
				17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00
				ES0917649-001	ES0917649-002	ES0917649-003	ES0917649-004	ES0917649-005
EP131A: Organochlorine Pesticides - Continued								
^ DDT (total)	----	0.50	µg/kg	----	----	----	----	<0.50
Dieldrin	60-57-1	0.50	µg/kg	----	----	----	----	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg	----	----	----	----	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg	----	----	----	----	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg	----	----	----	----	<0.50
^ Endosulfan (sum)	115-29-7	0.50	µg/kg	----	----	----	----	<0.50
Endrin	72-20-8	0.50	µg/kg	----	----	----	----	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg	----	----	----	----	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg	----	----	----	----	<0.50
Heptachlor	76-44-8	0.50	µg/kg	----	----	----	----	<0.50
Heptachlor epoxide	1024-57-3	0.50	µg/kg	----	----	----	----	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	----	----	----	----	<0.50
gamma-BHC	58-89-9	0.50	µg/kg	----	----	----	----	<0.50
Methoxychlor	72-43-5	0.50	µg/kg	----	----	----	----	<0.50
cis-Chlordane	5103-71-9	0.50	µg/kg	----	----	----	----	<0.50
trans-Chlordane	5103-74-2	0.50	µg/kg	----	----	----	----	<0.50
^ Total Chlordane (sum)	----	0.50	µg/kg	----	----	----	----	<0.50
Oxychlordane	27304-13-8	0.50	µg/kg	----	----	----	----	<0.50
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1016	12974-11-2	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1221	11104-28-2	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1232	11141-16-5	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1242	53469-21-9	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1248	12672-29-6	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1254	11097-69-1	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1260	11096-82-5	5.0	µg/kg	----	----	----	----	<5.0
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	5	39	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	13	<5	7	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	15	<4	12	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	7	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	45	<4	33	<4	<4
Anthracene	120-12-7	4	µg/kg	10	<4	9	<4	<4
Fluoranthene	206-44-0	4	µg/kg	108	4	54	<4	<4
Pyrene	129-00-0	4	µg/kg	158	4	50	<4	<4
Benz(a)anthracene	56-55-3	4	µg/kg	93	<4	28	<4	<4



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	SS3C	SS3D	SS3B	SS3A	VC3B0-0.5
				17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00
				ES0917649-001	ES0917649-002	ES0917649-003	ES0917649-004	ES0917649-005
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	4	µg/kg	107	<4	25	<4	<4
Benzo(b)fluoranthene	205-99-2	4	µg/kg	169	4	42	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg	44	<4	13	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg	94	<4	21	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	192	<4	34	<4	<4
Perylene	198-55-0	4	µg/kg	36	<4	16	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	124	<4	31	<4	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	27	<4	6	<4	<4
Indeno(1,2,3,cd)pyrene	193-39-5	4	µg/kg	119	<4	27	<4	<4
Coronene	191-07-1	5	µg/kg	20	<5	13	<5	<5
^ Sum of PAHs	----	4	µg/kg	1380	18	462	<4	<4
EP080-SD: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	----	----	----	----	108
Toluene-D8	2037-26-5	0.1	%	----	----	----	----	104
4-Bromofluorobenzene	460-00-4	0.1	%	----	----	----	----	112
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	----	----	----	58.3
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	----	----	55.3
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	80.7	100	90.0	88.6	116
Anthracene-d10	1719-06-8	0.1	%	88.8	80.4	93.3	89.6	88.3
4-Terphenyl-d14	1718-51-0	0.1	%	85.6	77.8	96.4	86.9	82.1



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Sub-Matrix: SOIL				Client sample ID	VC3B0-0.5X	VC3B0.5-0.9	VC2B0-0.5	VC2B0.5-0.9	VC2B0.9-1.5
				Client sampling date / time	17-NOV-2009 15:00	17-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00
Compound	CAS Number	LOR	Unit	ES0917649-006	ES0917649-007	ES0917649-008	ES0917649-009	ES0917649-010	
EA055: Moisture Content									
^ Moisture Content (dried @ 103°C)	----	1.0	%	23.2	23.9	15.8	19.4	19.3	
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	
Arsenic	7440-38-2	1.00	mg/kg	1.02	<1.00	<1.00	<1.00	<1.00	
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	
Chromium	7440-47-3	1.0	mg/kg	3.2	2.9	3.6	2.6	2.5	
Copper	7440-50-8	1.0	mg/kg	1.7	2.0	3.6	<1.0	<1.0	
Cobalt	7440-48-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	
Lead	7439-92-1	1.0	mg/kg	3.6	3.4	3.9	1.4	1.2	
Manganese	7439-96-5	10	mg/kg	<10	<10	<10	<10	<10	
Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	
Selenium	7782-49-2	0.1	mg/kg	<0.1	0.1	<0.1	0.2	0.3	
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	
Vanadium	7440-62-2	2.0	mg/kg	3.4	3.3	3.3	2.2	2.9	
Zinc	7440-66-6	1.0	mg/kg	9.0	9.0	20.7	3.5	2.6	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg	0.02	0.02	0.03	0.02	0.02	
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg	----	----	<3	----	----	
C10 - C14 Fraction	----	3	mg/kg	----	----	<3	----	----	
C15 - C28 Fraction	----	3	mg/kg	----	----	4	----	----	
C29 - C36 Fraction	----	5	mg/kg	----	----	<5	----	----	
^ C10 - C36 Fraction (sum)	----	3	mg/kg	----	----	4	----	----	
EP080-SD: BTEX									
Benzene	71-43-2	0.2	mg/kg	----	----	<0.2	----	----	
Toluene	108-88-3	0.2	mg/kg	----	----	<0.2	----	----	
Ethylbenzene	100-41-4	0.2	mg/kg	----	----	<0.2	----	----	
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	----	----	<0.2	----	----	
ortho-Xylene	95-47-6	0.2	mg/kg	----	----	<0.2	----	----	
EP131A: Organochlorine Pesticides									
Aldrin	309-00-2	0.50	µg/kg	----	----	<0.50	----	----	
alpha-BHC	319-84-6	0.50	µg/kg	----	----	<0.50	----	----	
beta-BHC	319-85-7	0.50	µg/kg	----	----	<0.50	----	----	
delta-BHC	319-86-8	0.50	µg/kg	----	----	<0.50	----	----	
4,4'-DDD	72-54-8	0.50	µg/kg	----	----	<0.50	----	----	
4,4'-DDE	72-55-9	0.50	µg/kg	----	----	<0.50	----	----	
4,4'-DDT	50-29-3	0.50	µg/kg	----	----	<0.50	----	----	



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	VC3B0-0.5X	VC3B0.5-0.9	VC2B0-0.5	VC2B0.5-0.9	VC2B0.9-1.5
				17-NOV-2009 15:00	17-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00
				ES0917649-006	ES0917649-007	ES0917649-008	ES0917649-009	ES0917649-010
EP131A: Organochlorine Pesticides - Continued								
^ DDT (total)	----	0.50	µg/kg	----	----	<0.50	----	----
Dieldrin	60-57-1	0.50	µg/kg	----	----	<0.50	----	----
alpha-Endosulfan	959-98-8	0.50	µg/kg	----	----	<0.50	----	----
beta-Endosulfan	33213-65-9	0.50	µg/kg	----	----	<0.50	----	----
Endosulfan sulfate	1031-07-8	0.50	µg/kg	----	----	<0.50	----	----
^ Endosulfan (sum)	115-29-7	0.50	µg/kg	----	----	<0.50	----	----
Endrin	72-20-8	0.50	µg/kg	----	----	<0.50	----	----
Endrin aldehyde	7421-93-4	0.50	µg/kg	----	----	<0.50	----	----
Endrin ketone	53494-70-5	0.50	µg/kg	----	----	<0.50	----	----
Heptachlor	76-44-8	0.50	µg/kg	----	----	<0.50	----	----
Heptachlor epoxide	1024-57-3	0.50	µg/kg	----	----	<0.50	----	----
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	----	----	<0.50	----	----
gamma-BHC	58-89-9	0.50	µg/kg	----	----	<0.50	----	----
Methoxychlor	72-43-5	0.50	µg/kg	----	----	<0.50	----	----
cis-Chlordane	5103-71-9	0.50	µg/kg	----	----	<0.50	----	----
trans-Chlordane	5103-74-2	0.50	µg/kg	----	----	<0.50	----	----
^ Total Chlordane (sum)	----	0.50	µg/kg	----	----	<0.50	----	----
Oxychlordane	27304-13-8	0.50	µg/kg	----	----	<0.50	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	----	----	<5.0	----	----
Aroclor 1016	12974-11-2	5.0	µg/kg	----	----	<5.0	----	----
Aroclor 1221	11104-28-2	5.0	µg/kg	----	----	<5.0	----	----
Aroclor 1232	11141-16-5	5.0	µg/kg	----	----	<5.0	----	----
Aroclor 1242	53469-21-9	5.0	µg/kg	----	----	<5.0	----	----
Aroclor 1248	12672-29-6	5.0	µg/kg	----	----	<5.0	----	----
Aroclor 1254	11097-69-1	5.0	µg/kg	----	----	<5.0	----	----
Aroclor 1260	11096-82-5	5.0	µg/kg	----	----	<5.0	----	----
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	6	5	9	20	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	7	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	<4	<4	<4	17	<4
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	5	<4
Fluoranthene	206-44-0	4	µg/kg	<4	<4	<4	23	<4
Pyrene	129-00-0	4	µg/kg	<4	<4	<4	23	<4
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	17	<4



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	VC3B0-0.5X	VC3B0.5-0.9	VC2B0-0.5	VC2B0.5-0.9	VC2B0.9-1.5
				17-NOV-2009 15:00	17-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00
				ES0917649-006	ES0917649-007	ES0917649-008	ES0917649-009	ES0917649-010
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	4	µg/kg	<4	<4	<4	14	<4
Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	<4	<4	20	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	8	<4
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	11	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	<4	20	<4
Perylene	198-55-0	4	µg/kg	<4	<4	<4	5	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	<4	14	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	<4
Indeno(1,2,3,cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	12	<4
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5
^ Sum of PAHs	----	4	µg/kg	6	5	9	216	<4
EP080-SD: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	----	----	108	----	----
Toluene-D8	2037-26-5	0.1	%	----	----	112	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	----	----	110	----	----
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	----	65.3	----	----
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	65.3	----	----
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	119	102	120	123	86.9
Anthracene-d10	1719-06-8	0.1	%	89.6	92.9	94.7	89.6	89.2
4-Terphenyl-d14	1718-51-0	0.1	%	85.1	83.0	84.3	97.6	90.5



Analytical Results

Sub-Matrix: **SOIL**

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	VC2B1.5-2.2	SS2D	SS1C	SS2A	SS1D
				18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00
				ES0917649-011	ES0917649-012	ES0917649-013	ES0917649-014	ES0917649-015
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	21.4	21.7	20.9	21.8	19.8
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1.00	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	1.0	1.8	1.2	1.6	1.2
Copper	7440-50-8	1.0	mg/kg	<1.0	1.9	3.9	<1.0	3.4
Cobalt	7440-48-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Lead	7439-92-1	1.0	mg/kg	<1.0	2.0	1.1	1.8	1.0
Manganese	7439-96-5	10	mg/kg	<10	<10	12	<10	<10
Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2.0	mg/kg	<2.0	2.8	<2.0	2.6	<2.0
Zinc	7440-66-6	1.0	mg/kg	1.7	6.8	2.3	4.8	2.1
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	6	5	<5	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	<4	<4
Phenanthrene	85-01-8	4	µg/kg	<4	<4	<4	<4	11
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	<4	<4
Fluoranthene	206-44-0	4	µg/kg	<4	<4	<4	<4	15
Pyrene	129-00-0	4	µg/kg	<4	<4	<4	<4	12
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	<4	<4	9
Chrysene	218-01-9	4	µg/kg	<4	<4	<4	<4	6
Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	<4	<4	<4	9
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	<4	5
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	<4	<4	7
Perylene	198-55-0	4	µg/kg	<4	<4	<4	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	<4	<4	5
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	<4	<4
Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	<4	<4
Coronene	191-07-1	5	µg/kg	<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: SOIL

				Client sample ID				
				Client sampling date / time	VC2B1.5-2.2	SS2D	SS1C	SS2A
					18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00
Compound	CAS Number	LOR	Unit		ES0917649-011	ES0917649-012	ES0917649-013	ES0917649-014
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
^ Sum of PAHs	----	4	µg/kg		6	5	<4	<4
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%		89.2	87.1	114	90.1
Anthracene-d10	1719-06-8	0.1	%		93.6	91.6	97.9	100
4-Terphenyl-d14	1718-51-0	0.1	%		80.4	91.8	83.8	99.5



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080-SD: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	74.7	127
Toluene-D8	2037-26-5	74.8	129
4-Bromofluorobenzene	460-00-4	75.3	127
EP131S: OC Pesticide Surrogate			
Dibromo-DDE	21655-73-2	10	136
EP131T: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	10	164
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	30	115
Anthracene-d10	1719-06-8	27	133
4-Terphenyl-d14	1718-51-0	18	137



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917649	Page	: 1 of 11
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 18-NOV-2009
C-O-C number	: ----	Issue Date	: 27-NOV-2009
Sampler	: NH	No. of samples received	: 27
Order number	: ----	No. of samples analysed	: 15
Quote number	: SY/503/09		

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Celine Conceicao	Spectroscopist	Inorganics
Edwandy Fadjjar	Senior Organic Chemist	Organics
Hoa Nguyen	Inorganic Chemist	Inorganics

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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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 1168643)									
ES0917644-015	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	16.0	16.5	3.5	0% - 50%
ES0917649-006	VC3B0-0.5X	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	23.2	21.8	6.0	0% - 20%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 1169247)									
ES0917649-001	SS3C	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	0.1	0.1	0.0	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	0.5	0.6	0.0	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	0.1	0.1	0.0	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	1.4	1.4	0.0	No Limit
		EG020-SD: Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	0.0	No Limit
		EG020-SD: Chromium	7440-47-3	1.0	mg/kg	19.1	19.2	0.0	0% - 50%
		EG020-SD: Copper	7440-50-8	1.0	mg/kg	15.2	16.4	7.4	0% - 50%
		EG020-SD: Lead	7439-92-1	1.0	mg/kg	19.9	21.6	8.0	0% - 20%
		EG020-SD: Nickel	7440-02-0	1.0	mg/kg	4.6	5.1	8.7	No Limit
		EG020-SD: Zinc	7440-66-6	1.0	mg/kg	64.2	68.8	7.1	0% - 20%
		EG020-SD: Arsenic	7440-38-2	1.00	mg/kg	5.85	6.46	9.8	No Limit
		EG020-SD: Manganese	7439-96-5	10	mg/kg	33	35	6.0	No Limit
		EG020-SD: Vanadium	7440-62-2	2.0	mg/kg	15.2	15.6	2.3	No Limit
ES0917649-011	VC2B1.5-2.2	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EG020-SD: Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	0.0	No Limit
		EG020-SD: Chromium	7440-47-3	1.0	mg/kg	1.0	<1.0	0.0	No Limit
		EG020-SD: Copper	7440-50-8	1.0	mg/kg	<1.0	<1.0	0.0	No Limit
		EG020-SD: Lead	7439-92-1	1.0	mg/kg	<1.0	<1.0	0.0	No Limit
		EG020-SD: Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	0.0	No Limit
		EG020-SD: Zinc	7440-66-6	1.0	mg/kg	1.7	1.8	0.0	No Limit
		EG020-SD: Arsenic	7440-38-2	1.00	mg/kg	<1.00	<1.00	0.0	No Limit
		EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	<10	0.0	No Limit
		EG020-SD: Vanadium	7440-62-2	2.0	mg/kg	<2.0	<2.0	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1169246)									
ES0917649-001	SS3C	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.15	0.16	0.0	0% - 50%
ES0917649-011	VC2B1.5-2.2	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1168443)									
ES0917649-005	VC3B0-0.5	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	3	<3	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1168443) - continued									
ES0917649-005	VC3B0-0.5	EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	<5	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1169136)									
ES0917541-008	Anonymous	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD: BTEX (QC Lot: 1169136)									
ES0917541-008	Anonymous	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
			106-42-3						
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP131A: Organochlorine Pesticides (QC Lot: 1168438)									
ES0917541-008	Anonymous	EP131A: Aldrin	309-00-2	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-BHC	319-84-6	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-BHC	319-85-7	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: delta-BHC	319-86-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4,4'-DDD	72-54-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4,4'-DDE	72-55-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4,4'-DDT	50-29-3	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: DDT (total)	----	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Dieldrin	60-57-1	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-Endosulfan	959-98-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-Endosulfan	33213-65-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan sulfate	1031-07-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan (sum)	115-29-7	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin	72-20-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin aldehyde	7421-93-4	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin ketone	53494-70-5	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor	76-44-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor epoxide	1024-57-3	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: gamma-BHC	58-89-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Methoxychlor	72-43-5	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: cis-Chlordane	5103-71-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: trans-Chlordane	5103-74-2	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
				EP131A: Total Chlordane (sum)	----	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
EP131B: Polychlorinated Biphenyls (as Aroclors) (QC Lot: 1168439)									
ES0917541-008	Anonymous	EP131B: Total Polychlorinated biphenyls	----	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1016	12974-11-2	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1221	11104-28-2	5.0	µg/kg	<5.0	<5.0	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP131B: Polychlorinated Biphenyls (as Aroclors) (QC Lot: 1168439) - continued									
ES0917541-008	Anonymous	EP131B: Aroclor 1232	11141-16-5	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1242	53469-21-9	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1248	12672-29-6	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1254	11097-69-1	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1260	11096-82-5	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1168442)									
ES0917649-005	VC3B0-0.5	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Dibenzo(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.0	No Limit
ES0917649-011	VC2B1.5-2.2	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1168442) - continued									
ES0917649-011	VC2B1.5-2.2	EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Indeno(1,2,3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	6	<4	47.5	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	6	<5	26.0	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.0	No Limit



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

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

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1169247)								
EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	----	----	----	----
EG020-SD: Arsenic	7440-38-2	1.0	mg/kg	<1.00	13.1 mg/kg	111	70	130
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	2.76 mg/kg	102	70	130
EG020-SD: Chromium	7440-47-3	1.0	mg/kg	<1.0	60.9 mg/kg	114	70	130
EG020-SD: Copper	7440-50-8	1.0	mg/kg	<1.0	54.7 mg/kg	99.9	70	130
EG020-SD: Cobalt	7440-48-4	10	mg/kg	<10.0	24.5 mg/kg	102	70	130
EG020-SD: Lead	7439-92-1	1.0	mg/kg	<1.0	54.8 mg/kg	85.6	70	130
EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	136 mg/kg	105	70	130
EG020-SD: Nickel	7440-02-0	1.0	mg/kg	<1.0	55.2 mg/kg	107	70	130
EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	5.6 mg/kg	89.3	70	130
EG020-SD: Vanadium	7440-62-2	2	mg/kg	<2.0	34 mg/kg	104	70	130
EG020-SD: Zinc	7440-66-6	1.0	mg/kg	<1.0	104 mg/kg	106	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1169246)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.090 mg/kg	93.3	74.2	126
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1168443)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	5 mg/kg	93.0	75.2	116
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	5 mg/kg	96.0	75.3	113
EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	5 mg/kg	105	72.6	117
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1169136)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	26 mg/kg	114	68.4	128
EP080-SD: BTEX (QCLot: 1169136)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	120	67.5	125
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	1 mg/kg	87.6	69	122
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	1 mg/kg	104	65.3	126
EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	2.0 mg/kg	81.8	66.5	124
	106-42-3							
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	1 mg/kg	116	66.7	123
EP131A: Organochlorine Pesticides (QCLot: 1168438)								
EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	5 µg/kg	110	31.7	140
EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	5 µg/kg	124	24.5	150
EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	5 µg/kg	110	36.9	139
EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	5 µg/kg	111	38.2	137
EP131A: 4,4'-DDD	72-54-8	0.5	µg/kg	<0.50	5 µg/kg	128	42.5	141



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
Method: Compound	CAS Number	LOR	Unit	Result				
EP131A: Organochlorine Pesticides (QCLot: 1168438) - continued								
EP131A: 4,4'-DDE	72-55-9	0.5	µg/kg	<0.50	5 µg/kg	65.9	34.8	140
EP131A: 4,4'-DDT	50-29-3	0.5	µg/kg	<0.50	5 µg/kg	94.8	38	143
EP131A: DDT (total)	----	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	5 µg/kg	111	43.2	134
EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	5 µg/kg	99.5	23.7	139
EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	5 µg/kg	105	35.8	138
EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	5 µg/kg	90.6	7.45	158
EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	5 µg/kg	95.2	21.6	162
EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	5 µg/kg	88.3	19.3	131
EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	5 µg/kg	100	17.9	141
EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	5 µg/kg	124	31	153
EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	5 µg/kg	108	34.3	138
EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	5 µg/kg	98.0	18.6	146
EP131A: gamma-BHC	58-89-9	0.5	µg/kg	<0.50	5 µg/kg	118	30.7	145
EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	5 µg/kg	95.7	15	157
EP131A: cis-Chlordane	5103-71-9	0.5	µg/kg	<0.50	5 µg/kg	138	22.3	145
EP131A: trans-Chlordane	5103-74-2	0.5	µg/kg	<0.50	5 µg/kg	107	42.4	139
EP131A: Total Chlordane (sum)	----	0.5	µg/kg	<0.50	----	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 1168439)								
EP131B: Total Polychlorinated biphenyls	----	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1016	12974-11-2	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1221	11104-28-2	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1232	11141-16-5	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1242	53469-21-9	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1248	12672-29-6	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1254	11097-69-1	5	µg/kg	<5.0	50 µg/kg	112	61.3	121
EP131B: Aroclor 1260	11096-82-5	5	µg/kg	<5.0	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1168442)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	87.0	----	----
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	91.0	----	----
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	100	----	----
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	105	----	----
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	107	----	----
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	101	----	----
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	94.4	----	----
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	108	----	----
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	108	----	----
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	101	----	----



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)		Recovery Limits (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1168442) - continued								
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	94.9	----	----
EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	25 µg/kg	91.5	----	----
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	96.7	----	----
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	78.8	----	----
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	96.2	----	----
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	67.4	----	----
EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	96.0	----	----
EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	96.7	----	----
EP132B-SD: Indeno(1,2,3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	97.2	----	----
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	51.2	----	----
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----



Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
					MS	Low	High
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1169247)							
ES0917649-002	SS3D	EG020-SD: Arsenic	7440-38-2	50 mg/kg	105	70	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	104	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	110	70	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	92.7	70	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	83.4	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	104	70	130
		EG020-SD: Zinc	7440-66-6	250 mg/kg	96.2	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1169246)							
ES0917649-001	SS3C	EG035T-LL: Mercury	7439-97-6	0.50 mg/kg	96.7	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1168443)							
ES0917649-005	VC3B0-0.5	EP071-SD: C10 - C14 Fraction	----	19.75 mg/kg	82.5	70	130
		EP071-SD: C15 - C28 Fraction	----	87.25 mg/kg	76.4	70	130
		EP071-SD: C29 - C36 Fraction	----	60 mg/kg	84.8	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1169136)							
ES0917541-008	Anonymous	EP080-SD: C6 - C9 Fraction	----	26 mg/kg	106	70	130
EP080-SD: BTEX (QCLot: 1169136)							
ES0917541-008	Anonymous	EP080-SD: Benzene	71-43-2	2.5 mg/kg	76.8	70	130
		EP080-SD: Toluene	108-88-3	2.5 mg/kg	95.6	70	130
		EP080-SD: Ethylbenzene	100-41-4	2.5 mg/kg	72.9	70	130
		EP080-SD: meta- & para-Xylene	108-38-3	2.5 mg/kg	77.8	70	130
			106-42-3				
EP080-SD: ortho-Xylene	95-47-6	2.5 mg/kg	74.3	70	130		
EP131A: Organochlorine Pesticides (QCLot: 1168438)							
ES0917541-008	Anonymous	EP131A: Aldrin	309-00-2	5 µg/kg	90.9	31.7	140
		EP131A: alpha-BHC	319-84-6	5 µg/kg	82.6	24.5	150
		EP131A: beta-BHC	319-85-7	5 µg/kg	88.2	36.9	139
		EP131A: delta-BHC	319-86-8	5 µg/kg	84.0	38.2	137
		EP131A: 4,4`-DDD	72-54-8	5 µg/kg	130	42.5	141
		EP131A: 4,4`-DDE	72-55-9	5 µg/kg	64.4	34.8	140
		EP131A: 4,4`-DDT	50-29-3	5 µg/kg	116	38	143
		EP131A: Dieldrin	60-57-1	5 µg/kg	88.9	43.2	134
		EP131A: alpha-Endosulfan	959-98-8	5 µg/kg	79.8	23.7	139
		EP131A: beta-Endosulfan	33213-65-9	5 µg/kg	94.4	35.8	138
		EP131A: Endosulfan sulfate	1031-07-8	5 µg/kg	108	7.45	158



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
					MS	Low	High
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
EP131A: Organochlorine Pesticides (QCLot: 1168438) - continued							
ES0917541-008	Anonymous	EP131A: Endrin	72-20-8	5 µg/kg	73.1	21.6	162
		EP131A: Endrin aldehyde	7421-93-4	5 µg/kg	61.7	19.3	131
		EP131A: Endrin ketone	53494-70-5	5 µg/kg	101	17.9	141
		EP131A: Heptachlor	76-44-8	5 µg/kg	82.5	31	153
		EP131A: Heptachlor epoxide	1024-57-3	5 µg/kg	79.2	34.3	138
		EP131A: Hexachlorobenzene (HCB)	118-74-1	5 µg/kg	67.3	18.6	146
		EP131A: gamma-BHC	58-89-9	5 µg/kg	89.3	30.7	145
		EP131A: Methoxychlor	72-43-5	5 µg/kg	104	15	157
		EP131A: cis-Chlordane	5103-71-9	5 µg/kg	117	22.3	145
		EP131A: trans-Chlordane	5103-74-2	5 µg/kg	84.1	42.4	139
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 1168439)							
ES0917541-008	Anonymous	EP131B: Aroclor 1254	11097-69-1	50 µg/kg	65.8	61.3	121
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1168442)							
ES0917649-005	VC3B0-0.5	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	# 62.9	70	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	76.7	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	86.6	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	102	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	# 68.4	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	98.4	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	91.9	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	98.6	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	96.8	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	96.0	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	90.7	70	130
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	25 µg/kg	91.6	70	130
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	91.0	70	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	74.6	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	101	70	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	72.4	70	130
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	25 µg/kg	96.6	70	130
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	25 µg/kg	98.4	70	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	102	70	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	90.9	70	130



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0917649	Page	: 1 of 7
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-NOV-2009
Sampler	: NH	Issue Date	: 27-NOV-2009
Order number	: ----		
Quote number	: SY/503/09	No. of samples received	: 27
		No. of samples analysed	: 15

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

This Interpretive Quality Control Report contains the following information:

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

Environmental Division Sydney

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA055: Moisture Content								
Soil Glass Jar - Unpreserved SS3C, SS3B, VC3B0-0.5, VC3B0.5-0.9	SS3D, SS3A, VC3B0-0.5X,	17-NOV-2009	----	----	----	19-NOV-2009	24-NOV-2009	✓
Soil Glass Jar - Unpreserved VC2B0-0.5, VC2B0.9-1.5, SS2D, SS2A,	VC2B0.5-0.9, VC2B1.5-2.2, SS1C, SS1D	18-NOV-2009	----	----	----	19-NOV-2009	25-NOV-2009	✓
EG020-SD: Total Metals in Sediments by ICPMS								
Soil Glass Jar - Unpreserved SS3C, SS3B, VC3B0-0.5, VC3B0.5-0.9	SS3D, SS3A, VC3B0-0.5X,	17-NOV-2009	20-NOV-2009	15-DEC-2009	✓	20-NOV-2009	16-MAY-2010	✓
Soil Glass Jar - Unpreserved VC2B0-0.5, VC2B0.9-1.5, SS2D, SS2A,	VC2B0.5-0.9, VC2B1.5-2.2, SS1C, SS1D	18-NOV-2009	20-NOV-2009	16-DEC-2009	✓	20-NOV-2009	17-MAY-2010	✓



Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved SS3C, SS3B, VC3B0-0.5, VC3B0.5-0.9	SS3D, SS3A, VC3B0-0.5X,	17-NOV-2009	20-NOV-2009	15-DEC-2009	✓	27-NOV-2009	15-DEC-2009	✓
Soil Glass Jar - Unpreserved VC2B0-0.5, VC2B0.9-1.5, SS2D, SS2A,	VC2B0.5-0.9, VC2B1.5-2.2, SS1C, SS1D	18-NOV-2009	20-NOV-2009	16-DEC-2009	✓	27-NOV-2009	16-DEC-2009	✓
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
Soil Glass Jar - Unpreserved VC3B0-0.5		17-NOV-2009	---	01-DEC-2009	----	20-NOV-2009	01-DEC-2009	✓
Soil Glass Jar - Unpreserved VC3B0-0.5		17-NOV-2009	20-NOV-2009	01-DEC-2009	✓	23-NOV-2009	01-DEC-2009	✓
Soil Glass Jar - Unpreserved VC2B0-0.5		18-NOV-2009	---	02-DEC-2009	----	20-NOV-2009	02-DEC-2009	✓
Soil Glass Jar - Unpreserved VC2B0-0.5		18-NOV-2009	20-NOV-2009	02-DEC-2009	✓	23-NOV-2009	02-DEC-2009	✓
EP080-SD: BTEX								
Soil Glass Jar - Unpreserved VC3B0-0.5		17-NOV-2009	20-NOV-2009	01-DEC-2009	✓	23-NOV-2009	01-DEC-2009	✓
Soil Glass Jar - Unpreserved VC2B0-0.5		18-NOV-2009	20-NOV-2009	02-DEC-2009	✓	23-NOV-2009	02-DEC-2009	✓
EP131A: Organochlorine Pesticides								
Soil Glass Jar - Unpreserved VC3B0-0.5		17-NOV-2009	19-NOV-2009	01-DEC-2009	✓	24-NOV-2009	29-DEC-2009	✓
Soil Glass Jar - Unpreserved VC2B0-0.5		18-NOV-2009	19-NOV-2009	02-DEC-2009	✓	24-NOV-2009	29-DEC-2009	✓
EP131B: Polychlorinated Biphenyls (as Aroclors)								
Soil Glass Jar - Unpreserved VC3B0-0.5		17-NOV-2009	19-NOV-2009	01-DEC-2009	✓	24-NOV-2009	29-DEC-2009	✓
Soil Glass Jar - Unpreserved VC2B0-0.5		18-NOV-2009	19-NOV-2009	02-DEC-2009	✓	24-NOV-2009	29-DEC-2009	✓



Matrix: SOIL

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP132B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved SS3C, SS3B, VC3B0-0.5, VC3B0.5-0.9	SS3D, SS3A, VC3B0-0.5X,	17-NOV-2009	---	01-DEC-2009	----	23-NOV-2009	01-DEC-2009	✔
Soil Glass Jar - Unpreserved VC2B0-0.5, VC2B0.9-1.5, SS2D, SS2A,	VC2B0.5-0.9, VC2B1.5-2.2, SS1C, SS1D	18-NOV-2009	---	02-DEC-2009	----	23-NOV-2009	02-DEC-2009	✔



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	16.7	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	2	15	13.3	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	6	16.7	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	2	15	13.3	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	2	15	13.3	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	2	50.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	5	20.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	16.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	15	6.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	6	16.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	15	6.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	15	6.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	2	50.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	5	20.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	16.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	15	6.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	6	16.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	15	6.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	15	6.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	2	50.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	5	20.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	16.7	5.0	✓	ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	15	6.7	5.0	✓	ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	6	16.7	5.0	✓	ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	15	6.7	5.0	✓	ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	15	6.7	5.0	✓	ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	2	50.0	5.0	✓	ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	5	20.0	5.0	✓	ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (1999) Schedule B(3) (Method 102)
Total Metals in Sediments by ICPMS	EG020-SD	SOIL	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. Analyte list and LORs per NODG.
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3)
TPH - Semivolatile Fraction	EP071-SD	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 504)
TPH Volatiles/BTEX in Sediments	EP080-SD	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 501)
Organochlorine Pesticides (Ultra-trace)	EP131A	SOIL	USEPA Method 3640 (GPC cleanup), 3620 (Florisil), 8081/8082 (GC/uECD/uECD) This technique is compliant with NEPM (1999) Schedule B(3) (Method 504)
PCB's (Ultra-trace)	EP131B	SOIL	USEPA Method 3640 (GPC cleanup), 3620 (Florisil), 8081/8082 (GC/uECD/uECD) This technique is compliant with NEPM (1999) Schedule B(3) (Method 504)
PAHs in Sediments by GCMS(SIM)	EP132B-SD	SOIL	8270 GCMS Capillary column, SIM mode using large volume programmed temperature vaporisation injection.
Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	USEPA 200.2 Mod. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (1999) Schedule B(3) (Method 202)
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids/ Sample Cleanup	ORG17A-UTP	SOIL	In-house, Mechanical agitation (tumbler). 20g of sample, Na ₂ SO ₄ and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. Samples are extracted, concentrated (by KD) and exchanged into an appropriate solvent for GPC and florisil cleanup as required.
Tumbler Extraction of Solids for LVI (Non-concentrating)	ORG17D	SOIL	In house: 10g of sample, Na ₂ SO ₄ and surrogate are extracted with 50mL 1:1 DCM/Acetone by end over end tumbling. An aliquot is concentrated by nitrogen blowdown to a reduced volume for analysis if required.



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP132B: Polynuclear Aromatic Hydrocarbons	ES0917649-005	VC3B0-0.5	Naphthalene	91-20-3	62.9 %	70-130%	Recovery less than lower data quality objective
EP132B: Polynuclear Aromatic Hydrocarbons	ES0917649-005	VC3B0-0.5	Fluorene	86-73-7	68.4 %	70-130%	Recovery less than lower data quality objective

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

Regular Sample Surrogates

Sub-Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP132T: Base/Neutral Extractable Surrogates	ES0917649-006	VC3B0-0.5X	2-Fluorobiphenyl	321-60-8	119 %	30-115 %	Recovery greater than upper data quality objective
EP132T: Base/Neutral Extractable Surrogates	ES0917649-008	VC2B0-0.5	2-Fluorobiphenyl	321-60-8	120 %	30-115 %	Recovery greater than upper data quality objective
EP132T: Base/Neutral Extractable Surrogates	ES0917649-005	VC3B0-0.5	2-Fluorobiphenyl	321-60-8	116 %	30-115 %	Recovery greater than upper data quality objective
EP132T: Base/Neutral Extractable Surrogates	ES0917649-009	VC2B0.5-0.9	2-Fluorobiphenyl	321-60-8	123 %	30-115 %	Recovery greater than upper data quality objective

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)
Comprehensive Report

Work Order : **ES0917655**

Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----		
C-O-C number	: ----	Quote number	: ES2009WORPAR0223 (EN/034/09)
Site	: ----		
Sampler	: NH	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 18-NOV-2009	Issue Date	: 20-NOV-2009 12:33
Client Requested Due Date	: 30-NOV-2009	Scheduled Reporting Date	: 30-NOV-2009

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 0.6'C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 15
Security Seal	: Not intact.	No. of samples analysed	: 15

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.
- TBT added to samples 1-4 on 20/11/09 as per Nick Hannaford
- **Samples received in appropriately pretreated and preserved containers.**
- **TBT and TOC analysis will be conducted by ALS Brisbane.**
- **Sample(s) have been received within recommended holding times.**
- **This batch is for TBT and TOC only split from ES0917649.**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EP005 (solids) Total Organic Carbon (TOC) soils	SOIL - EA055-103 Moisture Content	SOIL - EP090 (solids) Organotins
ES0917655-001	17-NOV-2009 15:00	SS3C	✓	✓	✓
ES0917655-002	17-NOV-2009 15:00	SS3D	✓	✓	✓
ES0917655-003	17-NOV-2009 15:00	SS3B	✓	✓	✓
ES0917655-004	17-NOV-2009 15:00	SS3A	✓	✓	✓
ES0917655-005	17-NOV-2009 15:00	VC3B_0-0.5	✓	✓	✓
ES0917655-006	17-NOV-2009 15:00	VC3B_0-0.5X	✓		
ES0917655-007	17-NOV-2009 15:00	VC3B_0.5-0.9	✓		
ES0917655-008	18-NOV-2009 15:00	VC2B_0-0.5	✓	✓	✓
ES0917655-009	18-NOV-2009 15:00	VC2B_0.5-0.9	✓		
ES0917655-010	18-NOV-2009 15:00	VC2B_0.9-1.5	✓		
ES0917655-011	18-NOV-2009 15:00	VC2B_1.5-2.2	✓		
ES0917655-012	18-NOV-2009 15:00	SS2D	✓	✓	✓
ES0917655-013	18-NOV-2009 15:00	SS1C	✓	✓	✓
ES0917655-014	18-NOV-2009 15:00	SS2A	✓	✓	✓
ES0917655-015	18-NOV-2009 15:00	SS1D	✓	✓	✓

Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParsons.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParsons.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com



CHAIN OF CUSTODY

ALS Laboratory please tick →

TBT / TOC

CLIENT: <u>Wolfe Bros</u>	TURNAROUND REQUIREMENTS : ☐ Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)		FOR LABORATORY USE ONLY (Circle) Custody Seal Intact? ☒	
OFFICE: <u>North Sydney</u>	☐ Non Standard or urgent TAT (List due date):		Free Ice / Frozen ice bricks present upon receipt? ☒	
PROJECT: <u>Callan maintenance</u>	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC <u>1</u> 2 3 4 5 6 7	Random Sample Temperature on Receipt: OF: 1 2 3 4 5 6 7	
ORDER NUMBER:	PROJECT MANAGER: <u>Ali Williams</u>	CONTACT PH: <u>0427 763 386</u>	Other comment:	
SAMPLER: <u>Nick Hamilton</u>	SAMPLER MOBILE: <u>0402365438</u>	RELINQUISHED BY:	RECEIVED BY: <u>Frank AS</u>	RELINQUISHED BY:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME:	DATE/TIME: <u>18/11/09 5:15pm</u>	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):				
Email Invoice to (will default to PM if no other addresses are listed):				

Environmental Division
Sydney

Work Order

ES0917655

Yes ☒ No ☐
Yes ☒ No ☐
0.6 °C

RECEIVED BY:

DATE/TIME:



Telephone : +61-2-8784 8555

Additional Information

ALS USE ONLY		SAMPLE DETAILS MATRIX: Solid(S) Water(W)		CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB: Suite Codes must be listed Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (filtered))														Telephone : +61-2-8784 8555		Additional Information	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG036L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH C6-C9) / BTEX	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pH & pHox)	EA033 (chromium)	(TCLP/Eutricite)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.			
1	SS3c		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE	STORE remaining sample - will select following review of results			
	SS3cx		s	Glass bottle/bags	2	Hold	/	/	/	/	CONTRACT	/	/	/	/	/	/	STORE	STORE				
2	SS3d		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
	SS3dx		s	Glass bottle/bags	2	Hold	/	/	/	/	ALS Brisbane	/	/	/	/	/	/	STORE	STORE				
3	SS3b		s	Glass bottle/bags	3	/	/	/	/	/	19/11/09	/	/	/	/	/	/	STORE	STORE				
	SS3bx		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
4	SS3a		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
	SS3ax		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
5	UC3b0-05		s	Glass bottle/bags	4	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
6	UC3b0-05x		s	Glass bottle/bags	2	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
7	UC3b0-05-09		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
8	UC2B0-05		s	Glass bottle/bags	4	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
	UC2B0-05x		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
9	UC2B05-09		s	Glass bottle/bags	4	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
	UC2B05-09x		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
10	UC2B09-15		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
	UC2B09-15x		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
11	UC2B15-22		s	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
	UC2B15-22x		s	Glass bottle/bags	2	Hold	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				



CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: <u>Wendy Jones</u>	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)		FOR LABORATORY USE ONLY (Circle)	
OFFICE: <u>NYS</u>	☐ Non Standard or urgent TAT (List due date):		Custody Seal intact?	Yes No N/A
PROJECT: <u>Calla maintenance bagging</u>	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt?	Yes No N/A
ORDER NUMBER:		COC: <u>13</u> 2 3 4 5 6 7	Random Sample Temperature on Receipt:	°C
PROJECT MANAGER: <u>Al. Walker</u>	CONTACT PH: <u>0422 263 336</u>	OF: 1 2 3 4 5 6 7	Other comment:	
SAMPLER: <u>Nick Hamilton</u>	SAMPLER MOBILE: <u>0422 263 423</u>	RELINQUISHED BY:	RECEIVED BY: <u>Frank - ALS</u>	RELINQUISHED BY:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME:	DATE/TIME: <u>18/11/09 5:15pm</u>	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):				
Email Invoice to (will default to PM if no other addresses are listed):				
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:				

ALS USE ONLY		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).														Additional Information					
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <i>(refer to codes below)</i>	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pH & pHox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.					
12	SS20	18/11/09 am	S	Glass bottle/bags	3	-	-	-	-	-						-	-	STORE	STORE						
	SS20a	18/11/09 am	S	Glass bottle/bags	2	Hold													-	-	STORE	STORE			
13	SS1C	18/11/09 am	S	Glass bottle/bags	3	-	-	-	-	-							-	-	STORE	STORE					
	SS1C	18/11/09 am	S	Glass bottle/bags	2	Hold														-	-	STORE	STORE		
14	SS2a	18/11/09 am	S	Glass bottle/bags	3	-	-	-	-	-							-	-	STORE	STORE					
	SS2a	18/11/09 am	S	Glass bottle/bags	2	Hold															-	-	STORE	STORE	
15	SS1D	18/11/09 am	S	Glass bottle/bags	3	-	-	-	-	-							-	-	STORE	STORE					
	SS1D	18/11/09 am	S	Glass bottle/bags	2	Hold															-	-	STORE	STORE	
			S	Glass bottle/bags															STORE	STORE					
			S	Glass bottle/bags															STORE	STORE					
			S	Glass bottle/bags															STORE	STORE					
						30	30	30	30	18	6	6	6	6	6	30	30	?	?						

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 Solids; B = Unpreserved Bag.



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917655	Page	: 1 of 7
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 18-NOV-2009
C-O-C number	: ----	Issue Date	: 03-DEC-2009
Sampler	: NH	No. of samples received	: 15
Site	: ----	No. of samples analysed	: 15
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Cass Sealby	Senior Chemist - Acid Sulphate Soils	Inorganics
Cass Sealby	Senior Chemist - Acid Sulphate Soils	Stafford Minerals - AY
Matt Frost	Organic Instrument Chemist	Inorganics
Matt Frost	Organic Instrument Chemist	Organics

Environmental Division Sydney
Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164
Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

A Campbell Brothers Limited Company



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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- TBT: Samples SS2D and SS3B required dilution due to the presence of high level contaminants. LOR values have been adjusted accordingly. Surrogate recovery is not determined.



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				SS3C	SS3D	SS3B	SS3A	VC3B_0-0.5
				17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00
Compound	CAS Number	LOR	Unit	ES0917655-001	ES0917655-002	ES0917655-003	ES0917655-004	ES0917655-005
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	43.2	21.1	42.0	25.6	18.6
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	0.02	%	1.30	1.16	3.08	0.14	0.41
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.2	141	0.5	1.5
EP090S: Organotin Surrogate								
Tripopyltin	----	0.1	%	106	99.6	Not Determined	77.4	82.7



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				VC3B_0-0.5X	VC3B_0.5-0.9	VC2B_0-0.5	VC2B_0.5-0.9	VC2B_0.9-1.5
				17-NOV-2009 15:00	17-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00
Compound	CAS Number	LOR	Unit	ES0917655-006	ES0917655-007	ES0917655-008	ES0917655-009	ES0917655-010
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	----	----	18.9	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	0.02	%	0.30	0.22	0.14	0.58	0.19
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	----	----	3.4	----	----
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	----	----	71.2	----	----



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				VC2B_1.5-2.2	SS2D	SS1C	SS2A	SS1D
				18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00
Compound	CAS Number	LOR	Unit	ES0917655-011	ES0917655-012	ES0917655-013	ES0917655-014	ES0917655-015
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	----	19.0	17.9	17.4	17.2
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	0.02	%	<0.02	0.32	<0.02	0.03	<0.02
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	----	82.9	6.4	<0.5	1.7
EP090S: Organotin Surrogate								
Tripopyltin	----	0.1	%	----	Not Determined	46.7	111	50.0



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP090S: Organotin Surrogate			
Tripropyltin	----	34	108



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917655	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 18-NOV-2009
C-O-C number	: ----	Issue Date	: 03-DEC-2009
Sampler	: NH	No. of samples received	: 15
Order number	: ----	No. of samples analysed	: 15
Quote number	: SY/503/09		

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Cass Sealby	Senior Chemist - Acid Sulphate Soils	Inorganics
Cass Sealby	Senior Chemist - Acid Sulphate Soils	Stafford Minerals - AY
Matt Frost	Organic Instrument Chemist	Inorganics
Matt Frost	Organic Instrument Chemist	Organics



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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 1171420)									
ES0917544-008	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	20.1	20.0	0.0	0% - 20%
ES0917655-005	VC3B_0-0.5	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	18.6	19.0	2.2	0% - 50%
EA055: Moisture Content (QC Lot: 1172931)									
ES0917655-008	VC2B_0-0.5	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	18.9	17.9	5.1	0% - 50%
ES0917729-003	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	24.0	26.7	10.4	0% - 20%
EP005: Total Organic Carbon (TOC) (QC Lot: 1172946)									
ES0917655-001	SS3C	EP005: Total Organic Carbon	----	0.02	%	1.30	1.35	3.6	0% - 20%
ES0917655-011	VC2B_1.5-2.2	EP005: Total Organic Carbon	----	0.02	%	<0.02	<0.02	0.0	No Limit
EP090: Organotin Compounds (QC Lot: 1172492)									
EP0906633-001	Anonymous	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit
ES0917655-002	SS3D	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	1.2	1.8	36.9	No Limit



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

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

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			Low	High
EP005: Total Organic Carbon (TOC) (QCLot: 1172946)								
EP005: Total Organic Carbon	----	0.02	%	<0.02	100 %	98.9	70	130
EP090: Organotin Compounds (QCLot: 1172492)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5 ----	---- 1.25 µgSn/kg	---- 97.2	---- 24.1	---- 129



Matrix Spike (MS) Report

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

Sub-Matrix: SOIL

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
					MS	Low	High
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
EP090: Organotin Compounds (QCLot: 1172492)							
EP0906633-002	Anonymous	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	70.0	20	130



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0917655	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-NOV-2009
Sampler	: NH	Issue Date	: 03-DEC-2009
Order number	: ----		
Quote number	: SY/503/09	No. of samples received	: 15
		No. of samples analysed	: 15

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

This Interpretive Quality Control Report contains the following information:

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

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

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A Campbell Brothers Limited Company



Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA055: Moisture Content								
Soil Glass Jar - Unpreserved SS3C, SS3B, VC3B_0-0.5	SS3D, SS3A,	17-NOV-2009	----	----	----	23-NOV-2009	24-NOV-2009	✓
Soil Glass Jar - Unpreserved VC2B_0-0.5, SS1C, SS1D	SS2D, SS2A,	18-NOV-2009	----	----	----	24-NOV-2009	25-NOV-2009	✓
EP005: Total Organic Carbon (TOC)								
Pulp Bag SS3C, SS3B, VC3B_0-0.5, VC3B_0.5-0.9	SS3D, SS3A, VC3B_0-0.5X,	17-NOV-2009	24-NOV-2009	15-DEC-2009	✓	25-NOV-2009	15-DEC-2009	✓
Pulp Bag VC2B_0-0.5, VC2B_0.9-1.5, SS2D, SS2A,	VC2B_0.5-0.9, VC2B_1.5-2.2, SS1C, SS1D	18-NOV-2009	24-NOV-2009	16-DEC-2009	✓	25-NOV-2009	16-DEC-2009	✓
EP090: Organotin Compounds								
Soil Glass Jar - Unpreserved SS3C, SS3B, VC3B_0-0.5	SS3D, SS3A,	17-NOV-2009	24-NOV-2009	01-DEC-2009	✓	26-NOV-2009	03-JAN-2010	✓
Soil Glass Jar - Unpreserved VC2B_0-0.5, SS1C, SS1D	SS2D, SS2A,	18-NOV-2009	24-NOV-2009	02-DEC-2009	✓	26-NOV-2009	03-JAN-2010	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	4	22	18.2	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organotin Analysis	EP090	2	14	14.3	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	2	15	13.3	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Organotin Analysis	EP090	1	14	7.1	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	15	6.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organotin Analysis	EP090	1	14	7.1	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	15	6.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Organotin Analysis	EP090	1	14	7.1	5.0	✓	ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (1999) Schedule B(3) (Method 102)
Total Organic Carbon	EP005	SOIL	In-house. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO ₂) is automatically measured by infra-red detector.
Organotin Analysis	EP090	SOIL	(USEPA SW 846 - 8270D) Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quantified against an established calibration curve.
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Organotin Sample Preparation	ORG35	SOIL	In house. 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

Sub-Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP090S: Organotin Surrogate	ES0917655-003	SS3B	Tripopyltin	----	Not Determined	----	Surrogate recovery not determined due to (target or non-target) matrix interferences
EP090S: Organotin Surrogate	ES0917655-012	SS2D	Tripopyltin	----	Not Determined	----	Surrogate recovery not determined due to (target or non-target) matrix interferences

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)
Comprehensive Report

Work Order : **ES0917657**

Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----	Quote number	: ES2009WORPAR0223 (EN/034/09)
C-O-C number	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
Sampler	: NH		

Dates

Date Samples Received	: 18-NOV-2009	Issue Date	: 20-NOV-2009 12:35
Client Requested Due Date	: 23-NOV-2009	Scheduled Reporting Date	: 23-NOV-2009

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 0.6 - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 14
Security Seal	: Not intact.	No. of samples analysed	: 14

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **PH FOX analysis will be conducted by ALS Brisbane**
- **Sample(s) have been received within recommended holding times.**
- **Sample id VC3b0-0.5 was not received a bag for PH Fox analysis.**
- **This batch for PH Fox only and split from ES0917649**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA003 pH field/fox
ES0917657-001	17-NOV-2009 15:00	SS3C	✓
ES0917657-002	17-NOV-2009 15:00	SS3D	✓
ES0917657-003	17-NOV-2009 15:00	SS3B	✓
ES0917657-004	17-NOV-2009 15:00	SS3A	✓
ES0917657-005	17-NOV-2009 15:00	VC3B_0-0.5	✓
ES0917657-007	17-NOV-2009 15:00	VC3B_0.5-0.9	✓
ES0917657-008	18-NOV-2009 15:00	VC2B_0-0.5	✓
ES0917657-009	18-NOV-2009 15:00	VC2B_0.5-0.9	✓
ES0917657-010	18-NOV-2009 15:00	VC2B_0.9-1.5	✓
ES0917657-011	18-NOV-2009 15:00	VC2B_1.5-2.2	✓
ES0917657-012	18-NOV-2009 10:00	SS2D	✓
ES0917657-013	18-NOV-2009 10:00	SS1C	✓
ES0917657-014	18-NOV-2009 10:00	SS2A	✓
ES0917657-015	18-NOV-2009 10:00	SS1D	✓

Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParsons.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParsons.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com



CHAIN OF CUSTODY

ALS Laboratory please tick →

pHE / pHfox only

Environmental Division
Sydney

Work Order

ES0917657

Yes	No	N/A
Yes	No	N/A
0.6	C	

CLIENT: <u>Wolke Bros</u>	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE: <u>North Sydney</u>	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact?
PROJECT: <u>Collect maintenance samples</u>	ALS QUOTE NO.:	Free ice / frozen ice bricks present upon receipt
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle)	Random Sample Temperature on Receipt:
PROJECT MANAGER: <u>Ali Williams</u>	CONTACT PH: <u>0427 763 386</u>	GF: 1 2 3 4 5 6 7
SAMPLER: <u>Nick Hamilton</u>	SAMPLER MOBILE: <u>010365738</u>	Other comment:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	RECEIVED BY: <u>Frank AS</u>
Email Reports to (will default to PM if no other addresses are listed):	DATE/TIME:	DATE/TIME: <u>18/11/09 5:15pm</u>
Email Invoice to (will default to PM if no other addresses are listed):		RELINQUISHED BY:



Telephone : + 61-2-8784 8555

RECEIVED BY:

DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	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).															Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH C6-C9) / BTEX	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pH & pHfox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.	
1	SS3c		S	Glass bottle/bags	3	/	/	/	/	/	CONTRACT WORK								STORE	STORE	STORE remaining sample - will select following review of results
	SS3cx		S	Glass bottle/bags	2	/	/	/	/	/	WD:								STORE	STORE	
2	SS3d		S	Glass bottle/bags	3	/	/	/	/	/	LAB: ALS Brisbane								STORE	STORE	
	SS3dx		S	Glass bottle/bags	2	/	/	/	/	/	DATE: 19/11/05								STORE	STORE	
3	SS3b		S	Glass bottle/bags	3	/	/	/	/	/	DATE:								STORE	STORE	
	SS3bx		S	Glass bottle/bags	2	/	/	/	/	/	SPLIT:								STORE	STORE	
4	SS3a		S	Glass bottle/bags	3	/	/	/	/	/						/	/	STORE	STORE		
	SS3ax		S	Glass bottle/bags	2	/	/	/	/	/						/	/	STORE	STORE		
5	UC3b0-05		S	Glass bottle/bags	4	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE		
6	UC3b0-05x		S	Glass bottle/bags	2	/	/	/	/	/						/	/	STORE	STORE		
7	UC3b0-05-09		S	Glass bottle/bags	3	/	/	/	/	/							/	STORE	STORE		
8	UC2B0-05		S	Glass bottle/bags	64	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE		
	UC2B0-05x		S	Glass bottle/bags	2	/	/	/	/	/									STORE	STORE	
9	UC2B05-09		S	Glass bottle/bags	4	/	/	/	/	/	* removed *								STORE	STORE	
	UC2B05-09x		S	Glass bottle/bags	2	/	/	/	/	/									STORE	STORE	
10	UC2B09-15		S	Glass bottle/bags	3	/	/	/	/	/							/	STORE	STORE		
	UC2B09-15x		S	Glass bottle/bags	2	/	/	/	/	/									STORE	STORE	
11	UC2B15-22		S	Glass bottle/bags	3	/	/	/	/	/							/	STORE	STORE		
	UC2B15-22x		S	Glass bottle/bags	2	/	/	/	/	/									STORE	STORE	



CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: <u>Wodehouse</u>	TURNAROUND REQUIREMENTS : ☐ 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	
OFFICE: <u>N/Spry</u>	ALQ QUOTE NO.:		Free ice / frozen ice bricks present upon receipt? Yes No N/A	
PROJECT: <u>Calla maintenance</u>	COC SEQUENCE NUMBER (Circle) COC: <u>10</u> 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7		Random Sample Temperature on Receipt: °C	
ORDER NUMBER:	PROJECT MANAGER: <u>Al. Weller</u>		RECEIVED BY: <u>Frank - ALS</u>	
SAMPLER: <u>Nick Hamford</u>	SAMPLER MOBILE: <u>0422 763 336</u>	RELINQUISHED BY:	RECEIVED BY:	RECEIVED BY:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default): <u>0422 763 336</u>	DATE/TIME:	DATE/TIME:	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):	DATE/TIME:		DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed):	DATE/TIME:		DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	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).														Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP060 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP060-LUT (TPH (CS-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Labe)	EA0003 (pH & pffox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
12	SS2D	18/10/09 am	S	Glass bottle/bags	3	/	/	/	/	/						/	/	STORE	STORE	
	SS2Dx	18/10/09 am	S	Glass bottle/bags	2	Hold														
13	SS1C	18/10/09 am	S	Glass bottle/bags	3	/	/	/	/	/						/	/	STORE	STORE	
	SS1Cx	18/10/09 am	S	Glass bottle/bags	2	Hold														
14	SS2a	18/10/09 am	S	Glass bottle/bags	3	/	/	/	/	/						/	/	STORE	STORE	
	SS2ax	18/10/09 am	S	Glass bottle/bags	2	Hold														
15	SS1D	18/10/09 am	S	Glass bottle/bags	3	/	/	/	/	/						/	/	STORE	STORE	
	SS1Dx	18/10/09 am	S	Glass bottle/bags	2	Hold														
			S	Glass bottle/bags														STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
			S	Glass bottle/bags														STORE	STORE	
						30	30	30	30	18	6	6	6	6	6	30	30	7	7	

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; S = Unpreserved Bag.



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917657	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 18-NOV-2009
C-O-C number	: ----	Issue Date	: 23-NOV-2009
Sampler	: NH	No. of samples received	: 14
Site	: ----	No. of samples analysed	: 14
Quote number	: EN/034/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Inorganics

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

A Campbell Brothers Limited Company



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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- Analysis conducted by ALS Brisbane, NATA Site No. 818.
- pH FOX Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Vigorous; 4 - Very Vigorous



Analytical Results

Sub-Matrix: SOIL

				Client sample ID	SS3C	SS3D	SS3B	SS3A	VC3B_0-0.5
				Client sampling date / time	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00	17-NOV-2009 15:00
Compound	CAS Number	LOR	Unit		ES0917657-001	ES0917657-002	ES0917657-003	ES0917657-004	ES0917657-005
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		8.4	8.7	8.4	8.8	8.7
pH (Fox)	----	0.1	pH Unit		6.4	6.4	6.5	6.4	6.3
Reaction Rate	----	1	Reaction Uni		3	2	3	2	2



Analytical Results

Sub-Matrix: SOIL

				Client sample ID	VC3B_0.5-0.9	VC2B_0-0.5	VC2B_0.5-0.9	VC2B_0.9-1.5	VC2B_1.5-2.2
				Client sampling date / time	17-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00
Compound	CAS Number	LOR	Unit		ES0917657-007	ES0917657-008	ES0917657-009	ES0917657-010	ES0917657-011
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		8.7	8.9	8.8	7.7	7.8
pH (Fox)	----	0.1	pH Unit		6.3	6.3	6.5	2.1	2.0
Reaction Rate	----	1	Reaction Uni		2	2	2	4	2



Analytical Results

Sub-Matrix: SOIL

				Client sample ID	SS2D	SS1C	SS2A	SS1D	
				Client sampling date / time	18-NOV-2009 10:00	18-NOV-2009 10:00	18-NOV-2009 10:00	18-NOV-2009 10:00	----
Compound	CAS Number	LOR	Unit		ES0917657-012	ES0917657-013	ES0917657-014	ES0917657-015	----
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		8.8	8.5	8.7	8.9	----
pH (Fox)	----	0.1	pH Unit		6.1	5.7	6.1	5.8	----
Reaction Rate	----	1	Reaction Uni		2	1	1	1	----



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917657	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 18-NOV-2009
C-O-C number	: ----	Issue Date	: 23-NOV-2009
Sampler	: NH	No. of samples received	: 14
Order number	: ----	No. of samples analysed	: 14
Quote number	: EN/034/09		

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Kim McCabe	Senior Inorganic Chemist	Inorganics

Environmental Division Sydney

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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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA003 :pH (field/fox) (QC Lot: 1170769)									
ES0917657-001	SS3C	EA003: Reaction Rate	----	1	--	3	3	0.0	No Limit
		EA003: pH (F)	----	0.1	pH Unit	8.4	8.4	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	6.4	6.4	0.0	0% - 20%
ES0917657-011	VC2B_1.5-2.2	EA003: Reaction Rate	----	1	--	2	2	0.0	No Limit
		EA003: pH (F)	----	0.1	pH Unit	7.8	7.9	1.3	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	2.0	2.0	0.0	0% - 20%



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

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

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**



Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0917657	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-NOV-2009
Sampler	: NH	Issue Date	: 23-NOV-2009
Order number	: ----		
Quote number	: EN/034/09	No. of samples received	: 14
		No. of samples analysed	: 14

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

This Interpretive Quality Control Report contains the following information:

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

Environmental Division Sydney

Part of the **ALS Laboratory Group**

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA003 :pH (field/fox)								
Snap Lock Bag - frozen		17-NOV-2009	---	----	---	23-NOV-2009	17-NOV-2010	✔
SS3C,	SS3D,							
SS3B,	SS3A,							
VC3B_0-0.5,	VC3B_0.5-0.9							
Snap Lock Bag - frozen		18-NOV-2009	----	----	----	23-NOV-2009	18-NOV-2010	✔
VC2B_0-0.5,	VC2B_0.5-0.9,							
VC2B_0.9-1.5,	VC2B_1.5-2.2,							
SS2D,	SS1C,							
SS2A,	SS1D							



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
pH field/fox	EA003	2	14	14.3	10.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH field/fox	EA003	SOIL	Ahern et al 1998 - determined on a 1:5 soil/water extract designed to simulate field measured pH and pH after the extract has been oxidised with peroxide.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)
Comprehensive Report

Work Order : **ES0917660**

Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----		
C-O-C number	: ----	Quote number	: ES2009WORPAR0223 (EN/034/09)
Site	: ----		
Sampler	: NH	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 18-NOV-2009	Issue Date	: 26-NOV-2009 14:17
Client Requested Due Date	: 30-NOV-2009	Scheduled Reporting Date	: 30-NOV-2009

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 0.6'C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 3
Security Seal	: Not intact.	No. of samples analysed	: 3

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **PSD analysis will be conducted by ALS Newcastle.**
- **Sample(s) have been received within recommended holding times.**
- **This batch for PSD only and split from ES0917649**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA150H Particle Size Analysis by Hydrometer
ES0917660-001	17-NOV-2009 15:00	VC3B_0-0.5	✓
ES0917660-002	18-NOV-2009 15:00	VC2B_0-0.5	✓
ES0917660-003	18-NOV-2009 15:00	VC2B_0.5-0.9	✓

Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParsons.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParsons.com
- Trigger - Subcontract Report (SUBCO)	Email	Nicholas.Hannaford@WorleyParsons.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com
- Trigger - Subcontract Report (SUBCO)	Email	ali.watters@worleyparsons.com



CHAIN OF CUSTODY

ALS Laboratory please tick →

PSD only

CLIENT: <u>Wolfe Bros</u>	TURNAROUND REQUIREMENTS : ☐ Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)		FOR LABORATORY USE ONLY (Circle) Custody Seal Intact? ☒	
OFFICE: <u>North Sydney</u>	☐ Non Standard or urgent TAT (List due date):		Free ice / frozen ice bricks present upon receipt: ☒	
PROJECT: <u>Callen maintenance</u>	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: <u>1</u> 2 3 4 5 6 7 GF: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt:	
ORDER NUMBER:			Other comment:	
PROJECT MANAGER: <u>Al Williams</u>	CONTACT PH: <u>0427 763 386</u>	RECEIVED BY: <u>Frank ALS</u>	RECEIVED DATE/TIME: <u>18/10/09 5:15pm</u>	
SAMPLER: <u>Nick Hamilton</u>	SAMPLER MOBILE: <u>040365723</u>	RELINQUISHED BY:	RELINQUISHED DATE/TIME:	
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):			
Email Reports to (will default to PM if no other addresses are listed):				
Email Invoice to (will default to PM if no other addresses are listed):				
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:				

Environmental Division
Sydney
Work Order

ES0917660



Telephone : +61-2-8784 8555

Yes	No	N/A
☒	☐	☐
0-6	C	

RECEIVED BY:

ALS USE ONLY		SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB, Suite Codes must be I Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (Ile															Additional Information		
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP080 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pH & pHfox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.				
	SS3c		S	Glass bottle/bags	3	/	/	/	/	CONTRACT WORK										/	/	STORE	STORE	STORE remaining sample - will select following review of results
	SS3cx		S	Glass bottle/bags	2	/	/	/	/	WO:										/	/	STORE	STORE	
	SS3d		S	Glass bottle/bags	3	/	/	/	/	LAB: ALS Newcastle										/	/	STORE	STORE	
	SS3dx		S	Glass bottle/bags	2	/	/	/	/	DATE: 19/11/09										/	/	STORE	STORE	
	SS3b		S	Glass bottle/bags	3	/	/	/	/	SPLIT:										/	/	STORE	STORE	
	SS3bx		S	Glass bottle/bags	2	/	/	/	/	.....										/	/	STORE	STORE	
	SS3a		S	Glass bottle/bags	3	/	/	/	/	.....										/	/	STORE	STORE	
	SS3ax		S	Glass bottle/bags	2	/	/	/	/	.....										/	/	STORE	STORE	
1	UC3b0-05		S	Glass bottle/bags	4	/	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
	UC3b0-05x		S	Glass bottle/bags	2	/	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
	UC3b0-0509		S	Glass bottle/bags	3	/	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
2	UC2B0-05		S	Glass bottle/bags	64	/	/	/	/	/	/	/	/	/	/	/	/	/	STORE	STORE				
	UC2B0-05x		S	Glass bottle/bags	2	/	/	/	/	.....										/	/	STORE	STORE	
3	UC2B05-09		S	Glass bottle/bags	4	/	/	/	/	.....										/	/	STORE	STORE	
	UC2B05-09x		S	Glass bottle/bags	2	/	/	/	/	.....										/	/	STORE	STORE	
	UC2B09-15		S	Glass bottle/bags	3	/	/	/	/	.....										/	/	STORE	STORE	
	UC2B09-15x		S	Glass bottle/bags	2	/	/	/	/	.....										/	/	STORE	STORE	
	UC2B15-22		S	Glass bottle/bags	3	/	/	/	/	.....										/	/	STORE	STORE	
	UC2B15-22x		S	Glass bottle/bags	2	/	/	/	/	.....										/	/	STORE	STORE	



CHAIN OF CUSTODY

ALS Laboratory please tick →

CLIENT: <u>Waterloo</u>	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	FOR LABORATORY USE ONLY (Circle) Custody Seal Intact? Yes No N/A	
OFFICE: <u>N/Spry</u>	☐ Non Standard or urgent TAT (List due date):	Free ice / frozen ice bricks present upon receipt? Yes No N/A	
PROJECT: <u>Water treatment</u>	ALS QUOTE NO.:	CDC SEQUENCE NUMBER (Circle) COC: <u>1</u> 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
ORDER NUMBER:		Other comment:	
PROJECT MANAGER: <u>AL</u>	CONTACT PH: <u>04 22 76 3 336</u>		
SAMPLER: <u>Nick Hamilton</u>	SAMPLER MOBILE: <u>021 235 423</u>	RECEIVED BY: <u>Frank - ALS</u>	RECEIVED BY:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME: <u>18/11/09 5:15pm</u>	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):			
Email Invoice to (will default to PM if no other addresses are listed):			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	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).														Additional Information		
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <i>(refer to codes below)</i>	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH C6-C9) / BTEX	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pH & pHox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.		
	SS2D	18/11/09 am	S	Glass bottle/bags	3	-	-	-	-	-							-	-	STORE	STORE		
	SS2Dx	18/11/09 am	S	Glass bottle/bags	2	Hold														STORE	STORE	
	SS1C	18/11/09 am	S	Glass bottle/bags	3	-	-	-	-	-							-	-	STORE	STORE		
	SS1Cx	18/11/09 am	S	Glass bottle/bags	2	Hold														STORE	STORE	
	SS2a	18/11/09 am	S	Glass bottle/bags	3	-	-	-	-	-							-	-	STORE	STORE		
	SS2ax	18/11/09 am	S	Glass bottle/bags	2	Hold														STORE	STORE	
	SS1D	18/11/09 am	S	Glass bottle/bags	3	-	-	-	-	-							-	-	STORE	STORE		
	SS1Dx	18/11/09 am	S	Glass bottle/bags	2	Hold														STORE	STORE	
			S	Glass bottle/bags															STORE	STORE		
			S	Glass bottle/bags															STORE	STORE		
			S	Glass bottle/bags															STORE	STORE		
						30	30	30	30	18	6	6	6	6	6	30	30	?	?			

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.



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917660	Page	: 1 of 3
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 18-NOV-2009
C-O-C number	: ----	Issue Date	: 01-DEC-2009
Sampler	: NH	No. of samples received	: 3
Site	: ----	No. of samples analysed	: 3
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in
accordance with NATA
accreditation requirements.

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories

Position

Accreditation Category

Dianne Blane

Newcastle

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

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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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

LOR = Limit of reporting

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



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Sub-Matrix: SOIL				Client sample ID	VC3B_0-0.5	VC2B_0-0.5	VC2B_0.5-0.9	----	----
				Client sampling date / time	17-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	----	----
Compound	CAS Number	LOR	Unit	ES0917660-001	ES0917660-002	ES0917660-003	----	----	
EA150: Particle Sizing									
+75µm	----	1	%	95	96	89	----	----	
+150µm	----	1	%	90	94	83	----	----	
+300µm	----	1	%	39	51	44	----	----	
+425µm	----	1	%	9	13	15	----	----	
+600µm	----	1	%	2	2	5	----	----	
+1180µm	----	1	%	1	1	1	----	----	
+2.36mm	----	1	%	<1	1	<1	----	----	
+4.75mm	----	1	%	<1	<1	<1	----	----	
+9.5mm	----	1	%	<1	<1	<1	----	----	
+19.0mm	----	1	%	<1	<1	<1	----	----	
+37.5mm	----	1	%	<1	<1	<1	----	----	
+75.0mm	----	1	%	<1	<1	<1	----	----	
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%	4	4	9	----	----	
Silt (2-60 µm)	----	1	%	2	1	2	----	----	
Sand (0.06-2.00 mm)	----	1	%	94	95	89	----	----	
Gravel (>2mm)	----	1	%	<1	<1	<1	----	----	
Cobbles (>6cm)	----	1	%	<1	<1	<1	----	----	



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917660	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 18-NOV-2009
C-O-C number	: ----	Issue Date	: 01-DEC-2009
Sampler	: NH	No. of samples received	: 3
Order number	: ----	No. of samples analysed	: 3
Quote number	: SY/503/09		

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in
accordance with NATA
accreditation requirements.

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Dianne Blane		Newcastle

Environmental Division Sydney

Part of the **ALS Laboratory Group**

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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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

			----						No Limit
--	--	--	------	--	--	--	--	--	----------

- No Laboratory Duplicate (DUP) Results are required to be reported.



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

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

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**



Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0917660	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-NOV-2009
Sampler	: NH	Issue Date	: 01-DEC-2009
Order number	: ----		
Quote number	: SY/503/09	No. of samples received	: 3
		No. of samples analysed	: 3

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

This Interpretive Quality Control Report contains the following information:

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

Environmental Division Sydney

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing							
Snap Lock Bag VC3B_0-0.5	17-NOV-2009	---	---	----	30-NOV-2009	16-MAY-2010	✔
Snap Lock Bag VC2B_0-0.5, VC2B_0.5-0.9	18-NOV-2009	---	---	----	30-NOV-2009	17-MAY-2010	✔
EA150: Soil Classification based on Particle Size							
Snap Lock Bag VC3B_0-0.5	17-NOV-2009	---	---	----	30-NOV-2009	16-MAY-2010	✔
Snap Lock Bag VC2B_0-0.5, VC2B_0.5-0.9	18-NOV-2009	---	---	----	30-NOV-2009	17-MAY-2010	✔



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Particle Size Analysis (Sieving)	EA150	SOIL	Particle Size Analysis by Sieving according to AS1289.3.6.1 - 1995
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)
Comprehensive Report

Work Order : **ES0917728**

Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 3
Order number	: ----		
C-O-C number	: ----	Quote number	: ES2009WORPAR0232 (SY/503/09)
Site	: ----		
Sampler	: NH	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 19-NOV-2009	Issue Date	: 20-NOV-2009 18:20
Client Requested Due Date	: 01-DEC-2009	Scheduled Reporting Date	: 01-DEC-2009

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 1.4' C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 15
Security Seal	: Not intact.	No. of samples analysed	: 8

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **Sample(s) have been received within recommended holding times.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- **This batch split into ES0917729 for TBT/TOC, ES0917731 for PHFOX, ES0917732 for PSD**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EG020-SD Total Metals in Sediments by ICPMS (NODG)	SOIL - EG035T-LL Total Mercury by FIMS - Low Level	SOIL - EP071 - SD TPH ultra trace in sediments	SOIL - EP080-SD TPH(V)/BTEX in Sediments	SOIL - EP131A OC Pesticides (Ultratrace)	SOIL - EP131B PCB's (Ultratrace)
ES0917728-001	18-NOV-2009 10:00	SS1a		✓	✓	✓				
ES0917728-002	18-NOV-2009 10:00	SS1B		✓	✓	✓				
ES0917728-003	18-NOV-2009 10:00	SS2B		✓	✓	✓				
ES0917728-004	18-NOV-2009 10:00	SS2C		✓	✓	✓				
ES0917728-005	18-NOV-2009 15:00	VC1A1 0-0.6		✓	✓	✓	✓	✓	✓	✓
ES0917728-006	18-NOV-2009 15:00	VC1A1 0.6-1.2		✓	✓	✓				
ES0917728-007	18-NOV-2009 15:00	VC1A1 0.6-1.2DUP		✓	✓	✓				
ES0917728-008	18-NOV-2009 15:00	VC1A1 1.2-1.7		✓	✓	✓				
ES0917728-009	18-NOV-2009 15:00	SS1ax	✓							
ES0917728-010	18-NOV-2009 15:00	SS1Bx	✓							
ES0917728-011	18-NOV-2009 15:00	SS2Bx	✓							
ES0917728-012	18-NOV-2009 15:00	SS2Cx	✓							
ES0917728-013	18-NOV-2009 15:00	VC1A1 0-0.6x	✓							
ES0917728-014	18-NOV-2009 15:00	VC1A1 0.6-1.2x	✓							
ES0917728-015	18-NOV-2009 15:00	VC1A1 1.2-1.7x	✓							

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EP132B-SD Ultra-trace PAHs in Sediments
ES0917728-001	18-NOV-2009 10:00	SS1a	✓
ES0917728-002	18-NOV-2009 10:00	SS1B	✓
ES0917728-003	18-NOV-2009 10:00	SS2B	✓
ES0917728-004	18-NOV-2009 10:00	SS2C	✓
ES0917728-005	18-NOV-2009 15:00	VC1A1 0-0.6	✓
ES0917728-006	18-NOV-2009 15:00	VC1A1 0.6-1.2	✓
ES0917728-007	18-NOV-2009 15:00	VC1A1 0.6-1.2DUP	✓
ES0917728-008	18-NOV-2009 15:00	VC1A1 1.2-1.7	✓



Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParsons.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParsons.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com



CHAIN OF CUSTODY

ALS Laboratory: please tick →

Environmental Division
Sydney

Work Order

ES0917728

CLIENT: <u>Worley Parsons</u>	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):	FOR LABORATORY USE ONLY (Circle) Custody Seal Intact? ☒ Free ice frozen boxes present upon receipt
OFFICE: <u>NRA Sydney</u>	ALS QUOTE NO.: <u>0022 765 386</u>	COC SEQUENCE NUMBER (Circle) COC: <u>1</u> 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7
PROJECT: <u>Cattaraugus dredging</u>	RELINQUISHED BY: <u>Frank ALS</u>	RECEIVED BY: <u>19/11/09 4pm</u>
ORDER NUMBER:	CONTACT PH: <u>022 765 386</u>	RELINQUISHED BY:
PROJECT MANAGER: <u>Ali Walters</u>	SAMPLER MOBILE: <u>060 236 5428</u>	DATE/TIME:
SAMPLER: <u>Nick Hannaford</u>	EDD FORMAT (or default):	DATE/TIME:
COC emailed to ALS? (YES / NO)		
Email Reports to (will default to PM if no other addresses are listed):		
Email Invoice to (will default to PM if no other addresses are listed):		



Telephone: +61-2-8784 8555

Yes ☒ No ☐ N/A
Yes ☒ No ☐ N/A
°C
RECEIVED BY:
DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:																						
ALS USE ONLY		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).														Additional information		
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP000 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP000-UT (TPH C6-C9) / BTEX	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Labe)	EA0003 (pH & pHfox)	EA003 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.		
1	SS1a	18/11/09 am	S	Glass bottle/bags	3	/	/	/	/	/	CONTRACT WORK						/	/	/	STORE	STORE	
9	SS1ax	18/11/09 am	S	Glass bottle/bags	2	Hold	/	/	/	/	WO: ES0917728						/	/	/	STORE	STORE	
2	SS1B	18/11/09 am	S	Glass bottle/bags	3	/	/	/	/	/	ALS Brisbane / Newcastle						/	/	/	STORE	STORE	
10	SS1Bx	18/11/09 am	S	Glass bottle/bags	2	Hold	/	/	/	/	LAB: ES0917728						/	/	/	STORE	STORE	
3	SS2B	18/11/09 am	S	Glass bottle/bags	3	/	/	/	/	/	DATE: 19/11/09						/	/	/	STORE	STORE	
11	SS2Bx	18/11/09 am	S	Glass bottle/bags	2	Hold	/	/	/	/	SPLIT: 18/11/09 ES0917729						/	/	/	STORE	STORE	
4	SS2C	18/11/09 am	S	Glass bottle/bags	3	/	/	/	/	/	PHE/pHfox: 09/11/09						/	/	/	STORE	STORE	
12	SS2Cx	18/11/09 am	S	Glass bottle/bags	2	Hold	/	/	/	/	PSD: 09/11/09						/	/	/	STORE	STORE	
5	UC1A10-0.6	18/11/09 pm	S	Glass bottle/bags	4	/	/	/	/	Yes	Yes	Yes	Yes	Yes	/	/	/	/	/	STORE	STORE	
13	UC1A10-0.6x	18/11/09 pm	S	Glass bottle/bags	2	Hold	/	/	/	/							/	/	/	STORE	STORE	
6	UC1A10-0.6-2	18/11/09 pm	S	Glass bottle/bags	4	/	/	/	/	No	No	No	No	No	/	/	/	/	/	STORE	STORE	
TOTAL						30	30	30	30	18	6	6	6	6	6	6	30	30	?	?		

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 Bisulfate 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 Solids; B = Unpreserved Bag.

ASS bag for SS2C received as SS2C_x but please assume it's SS2C as per Nick. 20/11/09



CHAIN OF CUSTODY

ALS Laboratory please tick →

CLIENT: <u>Worley Parsons</u>	TURNAROUND REQUIREMENTS: ☐ 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: <u>Nm Sydney</u>	Standard TAT may be longer for some tests e.g. Ultra Trace Organics	
PROJECT: <u>Celtic maintenance dredging</u>	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: <u>1</u> 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7
ORDER NUMBER:		
PROJECT MANAGER: <u>Ali Walker</u>	CONTACT PH: <u>0422765386</u>	
SAMPLER: <u>Nick Henderson</u>	SAMPLER MOBILE: <u>0418670577</u>	RECEIVED BY: <u>Frank ALC</u> DATE/TIME: <u>19/11/09 4pm</u>
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	RELINQUISHED BY: DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):		RECEIVED BY: DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed):		

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

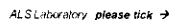
ALS USE ONLY		SAMPLE DETAILS MATRIX: Solid(S) Water(W)		CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required)														Additional Information	
LAB ID		SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry bag/L label)	EA0003 (pH & pifox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
14	14	UC1A106-1.2	18/11/09 pm	S	Glass bottle/bags	2	Hold												STORE	STORE	
	7	UC1A106-1.2DP	18/11/09 pm	S	Glass bottle/bags	1	-	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA	STORE	STORE	
	8	UC1A1P2-1.7	18/11/09 pm	S	Glass bottle/bags	3	-	-	-	-							-	-	STORE	STORE	
15	15	UC1A112-1.7	18/11/09 pm	S	Glass bottle/bags	2	Hold												STORE	STORE	
16	16	SS1A	18/11/09 pm	S	Glass bottle/bags	3	-	-	-	-	-						-	-	STORE	STORE	← All samples from here do are double of the first 8 samples listed they can be as per Nick 20/11/2009
17	17	SS1A x	18/11/09 pm	S	Glass bottle/bags	2	Hold										-	-	STORE	STORE	
18	18	SS1B	18/11/09 pm	S	Glass bottle/bags	3	-	-	-	-	-						-	-	STORE	STORE	
19	19	SS1B v	18/11/09 pm	S	Glass bottle/bags	2	Hold												STORE	STORE	
20	20	SS2B	18/11/09 pm	S	Glass bottle/bags	3	-										-	-	STORE	STORE	
21	21	SS2B x	18/11/09 pm	S	Glass bottle/bags	2	Hold												STORE	STORE	
22	22	SS2C	18/11/09 pm	S	Glass bottle/bags	3	-										-	-	STORE	STORE	
TOTAL							30	30	30	30	18	6	6	6	6	6	30	30	7	7	

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 Solids; B = Unpreserved Bag.

only analysis required on #7 is EQ020SP, EQ035L, EP132SD & TOC. As per Nick 20/11/2009.



COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:
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ALS USE ONLY	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).													Additional Information		
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EQ020SD (trace metals)	EQ035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dryBagLabel)	EA0003 (pH & pHfox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.	
23	SS2C x	13/11/09 pm	S	Glass bottle/bags	2	Hold													STORE	STORE	
			S	Glass bottle/bags															STORE	STORE	
			S	Glass bottle/bags															STORE	STORE	
			S	Glass bottle/bags															STORE	STORE	
			S	Glass bottle/bags															STORE	STORE	
			S	Glass bottle/bags															STORE	STORE	
			S	Glass bottle/bags															STORE	STORE	
			S	Glass bottle/bags															STORE	STORE	
			S	Glass bottle/bags															STORE	STORE	
			S	Glass bottle/bags															STORE	STORE	
			S	Glass bottle/bags															STORE	STORE	
TOTAL						30	30	30	30	18	6	6	6	6	6		30	30	?	?	

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 Solis; B = Unpreserved Bag.



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917728	Page	: 1 of 9
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 19-NOV-2009
C-O-C number	: ----	Issue Date	: 01-DEC-2009
Sampler	: NH	No. of samples received	: 15
Site	: ----	No. of samples analysed	: 8
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

This document is issued in
accordance with NATA
accreditation requirements.

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Celine Conceicao	Spectroscopist	Inorganics
Edwandy Fadjar	Senior Organic Chemist	Organics
Hoa Nguyen	Inorganic Chemist	Inorganics
Pabi Subba	Senior Organic Chemist (Semi-Volatile)	Organics

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

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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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

LOR = Limit of reporting

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



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	SS1a	SS1B	SS2B	SS2C	VC1A1 0-0.6
				18-NOV-2009 10:00	18-NOV-2009 10:00	18-NOV-2009 10:00	18-NOV-2009 10:00	18-NOV-2009 15:00
				ES0917728-001	ES0917728-002	ES0917728-003	ES0917728-004	ES0917728-005
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	20.2	21.8	38.1	20.1	23.5
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1.00	mg/kg	<1.00	<1.00	7.46	<1.00	<1.00
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	0.4
Chromium	7440-47-3	1.0	mg/kg	<1.0	<1.0	10.8	1.6	<1.0
Copper	7440-50-8	1.0	mg/kg	1.6	2.0	5.7	1.2	3.2
Cobalt	7440-48-4	0.5	mg/kg	<0.5	<0.5	0.9	<0.5	<0.5
Lead	7439-92-1	1.0	mg/kg	1.5	2.2	9.5	2.2	1.2
Manganese	7439-96-5	10	mg/kg	<10	<10	18	<10	<10
Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	3.2	<1.0	<1.0
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.6	<0.1	<0.1
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	1.1
Vanadium	7440-62-2	2.0	mg/kg	<2.0	<2.0	11.1	2.1	<2.0
Zinc	7440-66-6	1.0	mg/kg	2.0	8.0	21.3	5.0	4.7
EG035T: Total Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.08	0.01	<0.01
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	----	----	----	----	<3
C10 - C14 Fraction	----	3	mg/kg	----	----	----	----	<3
C15 - C28 Fraction	----	3	mg/kg	----	----	----	----	12
C29 - C36 Fraction	----	5	mg/kg	----	----	----	----	12
^ C10 - C36 Fraction (sum)	----	3	mg/kg	----	----	----	----	24
EP080-SD: BTEX								
Benzene	71-43-2	0.2	mg/kg	----	----	----	----	<0.2
Toluene	108-88-3	0.2	mg/kg	----	----	----	----	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	----	----	----	----	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	----	----	----	----	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	----	----	----	----	<0.2
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.50	µg/kg	----	----	----	----	<0.50
alpha-BHC	319-84-6	0.50	µg/kg	----	----	----	----	<0.50
beta-BHC	319-85-7	0.50	µg/kg	----	----	----	----	<0.50
delta-BHC	319-86-8	0.50	µg/kg	----	----	----	----	<0.50
4,4'-DDD	72-54-8	0.50	µg/kg	----	----	----	----	<0.50
4,4'-DDE	72-55-9	0.50	µg/kg	----	----	----	----	<0.50
4,4'-DDT	50-29-3	0.50	µg/kg	----	----	----	----	<0.50



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	SS1a	SS1B	SS2B	SS2C	VC1A1 0-0.6
				18-NOV-2009 10:00	18-NOV-2009 10:00	18-NOV-2009 10:00	18-NOV-2009 10:00	18-NOV-2009 15:00
				ES0917728-001	ES0917728-002	ES0917728-003	ES0917728-004	ES0917728-005
EP131A: Organochlorine Pesticides - Continued								
^ DDT (total)	----	0.50	µg/kg	----	----	----	----	<0.50
Dieldrin	60-57-1	0.50	µg/kg	----	----	----	----	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg	----	----	----	----	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg	----	----	----	----	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg	----	----	----	----	<0.50
^ Endosulfan (sum)	115-29-7	0.50	µg/kg	----	----	----	----	<0.50
Endrin	72-20-8	0.50	µg/kg	----	----	----	----	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg	----	----	----	----	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg	----	----	----	----	<0.50
Heptachlor	76-44-8	0.50	µg/kg	----	----	----	----	<0.50
Heptachlor epoxide	1024-57-3	0.50	µg/kg	----	----	----	----	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	----	----	----	----	<0.50
gamma-BHC	58-89-9	0.50	µg/kg	----	----	----	----	<0.50
Methoxychlor	72-43-5	0.50	µg/kg	----	----	----	----	<0.50
cis-Chlordane	5103-71-9	0.50	µg/kg	----	----	----	----	<0.50
trans-Chlordane	5103-74-2	0.50	µg/kg	----	----	----	----	<0.50
^ Total Chlordane (sum)	----	0.50	µg/kg	----	----	----	----	<0.50
Oxychlordane	27304-13-8	0.50	µg/kg	----	----	----	----	<0.50
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1016	12974-11-2	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1221	11104-28-2	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1232	11141-16-5	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1242	53469-21-9	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1248	12672-29-6	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1254	11097-69-1	5.0	µg/kg	----	----	----	----	<5.0
Aroclor 1260	11096-82-5	5.0	µg/kg	----	----	----	----	<5.0
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	<5	6	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	5	<5	<5
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	10	<4	<4
Acenaphthene	83-32-9	4	µg/kg	<4	22	17	<4	<4
Fluorene	86-73-7	4	µg/kg	<4	12	30	<4	<4
Phenanthrene	85-01-8	4	µg/kg	<4	32	169	<4	<4
Anthracene	120-12-7	4	µg/kg	<4	8	62	<4	<4
Fluoranthene	206-44-0	4	µg/kg	6	63	237	6	6
Pyrene	129-00-0	4	µg/kg	7	49	179	6	6
Benz(a)anthracene	56-55-3	4	µg/kg	<4	25	97	<4	<4



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	SS1a	SS1B	SS2B	SS2C	VC1A1 0-0.6
				18-NOV-2009 10:00	18-NOV-2009 10:00	18-NOV-2009 10:00	18-NOV-2009 10:00	18-NOV-2009 15:00
				ES0917728-001	ES0917728-002	ES0917728-003	ES0917728-004	ES0917728-005
EP132B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	4	µg/kg	<4	24	94	<4	<4
Benzo(b)fluoranthene	205-99-2	4	µg/kg	6	30	95	4	6
Benzo(k)fluoranthene	207-08-9	4	µg/kg	5	16	50	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg	5	16	43	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg	7	24	89	<4	4
Perylene	198-55-0	4	µg/kg	<4	8	21	<4	<4
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	5	17	47	<4	<4
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	8	14	<4	<4
Indeno(1,2,3,cd)pyrene	193-39-5	4	µg/kg	4	15	45	<4	<4
Coronene	191-07-1	5	µg/kg	<5	7	20	<5	<5
^ Sum of PAHs	----	4	µg/kg	45	374	1330	16	22
EP080-SD: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	----	----	----	----	104
Toluene-D8	2037-26-5	0.1	%	----	----	----	----	103
4-Bromofluorobenzene	460-00-4	0.1	%	----	----	----	----	96.2
EP131S: OC Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	----	----	----	69.6
EP131T: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	----	----	65.4
EP132T: Base/Neutral Extractable Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	94.9	107	111	119	107
Anthracene-d10	1719-06-8	0.1	%	91.9	89.2	94.5	94.3	104
4-Terphenyl-d14	1718-51-0	0.1	%	87.9	86.9	85.5	89.5	95.0



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Sub-Matrix: SOIL				Client sample ID	VC1A1 0.6-1.2	VC1A1 0.6-1.2DUP	VC1A1 1.2-1.7	----	----
				Client sampling date / time	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	----	----
Compound	CAS Number	LOR	Unit	ES0917728-006	ES0917728-007	ES0917728-008	----	----	----
EA055: Moisture Content									
^ Moisture Content (dried @ 103°C)	----	1.0	%	18.9	18.3	22.9	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	<0.50	----	----	----
Arsenic	7440-38-2	1.00	mg/kg	<1.00	<1.00	1.70	----	----	----
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	----	----	----
Chromium	7440-47-3	1.0	mg/kg	<1.0	<1.0	1.1	----	----	----
Copper	7440-50-8	1.0	mg/kg	2.4	2.4	3.7	----	----	----
Cobalt	7440-48-4	0.5	mg/kg	<0.5	<0.5	<0.5	----	----	----
Lead	7439-92-1	1.0	mg/kg	1.0	<1.0	<1.0	----	----	----
Manganese	7439-96-5	10	mg/kg	<10	<10	<10	----	----	----
Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	<1.0	----	----	----
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	----	----	----
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	----	----	----
Vanadium	7440-62-2	2.0	mg/kg	<2.0	<2.0	<2.0	----	----	----
Zinc	7440-66-6	1.0	mg/kg	2.5	2.6	3.0	----	----	----
EG035T: Total Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	<0.01	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg	<5	<5	<5	----	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	<5	----	----	----
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	<4	----	----	----
Acenaphthene	83-32-9	4	µg/kg	<4	<4	<4	----	----	----
Fluorene	86-73-7	4	µg/kg	<4	<4	<4	----	----	----
Phenanthrene	85-01-8	4	µg/kg	<4	5	<4	----	----	----
Anthracene	120-12-7	4	µg/kg	<4	<4	<4	----	----	----
Fluoranthene	206-44-0	4	µg/kg	4	8	<4	----	----	----
Pyrene	129-00-0	4	µg/kg	4	7	<4	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg	<4	5	<4	----	----	----
Chrysene	218-01-9	4	µg/kg	<4	5	<4	----	----	----
Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	5	<4	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	<4	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	<4	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	5	<4	----	----	----
Perylene	198-55-0	4	µg/kg	<4	<4	<4	----	----	----
Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	4	<4	----	----	----
Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	<4	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	<4	----	----	----
Coronene	191-07-1	5	µg/kg	<5	<5	<5	----	----	----



Analytical Results

Sub-Matrix: SOIL				Client sample ID	VC1A1 0.6-1.2	VC1A1 0.6-1.2DUP	VC1A1 1.2-1.7	----	----
				Client sampling date / time	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	----	----
Compound	CAS Number	LOR	Unit		ES0917728-006	ES0917728-007	ES0917728-008	----	----
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Sum of PAHs		----	4	µg/kg	9	44	<4	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		103	79.4	114	----	----
Anthracene-d10	1719-06-8	0.1	%		103	103	96.3	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		95.1	99.4	91.4	----	----



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080-SD: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	74.7	127
Toluene-D8	2037-26-5	74.8	129
4-Bromofluorobenzene	460-00-4	75.3	127
EP131S: OC Pesticide Surrogate			
Dibromo-DDE	21655-73-2	10	136
EP131T: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	10	164
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	30	115
Anthracene-d10	1719-06-8	27	133
4-Terphenyl-d14	1718-51-0	18	137



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917728	Page	: 1 of 10
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 19-NOV-2009
C-O-C number	: ----	Issue Date	: 01-DEC-2009
Sampler	: NH	No. of samples received	: 15
Order number	: ----	No. of samples analysed	: 8
Quote number	: SY/503/09		

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Celine Conceicao	Spectroscopist	Inorganics
Edwandy Fadjjar	Senior Organic Chemist	Organics
Hoa Nguyen	Inorganic Chemist	Inorganics
Pabi Subba	Senior Organic Chemist (Semi-Volatile)	Organics



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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 1170098)									
ES0917724-041	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	11.8	11.3	4.6	0% - 50%
ES0917793-001	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	17.9	19.3	7.7	0% - 50%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 1172083)									
ES0917728-001	SS1a	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EG020-SD: Antimony	7440-36-0	0.50	mg/kg	<0.50	<0.50	0.0	No Limit
		EG020-SD: Chromium	7440-47-3	1.0	mg/kg	<1.0	<1.0	0.0	No Limit
		EG020-SD: Copper	7440-50-8	1.0	mg/kg	1.6	1.4	13.7	No Limit
		EG020-SD: Lead	7439-92-1	1.0	mg/kg	1.5	<1.0	41.4	No Limit
		EG020-SD: Nickel	7440-02-0	1.0	mg/kg	<1.0	<1.0	0.0	No Limit
		EG020-SD: Zinc	7440-66-6	1.0	mg/kg	2.0	2.3	11.6	No Limit
		EG020-SD: Arsenic	7440-38-2	1.00	mg/kg	<1.00	<1.00	0.0	No Limit
		EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	<10	0.0	No Limit
		EG020-SD: Vanadium	7440-62-2	2.0	mg/kg	<2.0	<2.0	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1172082)									
ES0917728-001	SS1a	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1174800)									
ES0917728-005	VC1A1 0-0.6	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	12	10	9.5	No Limit
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	12	10	20.4	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 1175145)									
ES0917728-005	VC1A1 0-0.6	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD: BTEX (QC Lot: 1175145)									
ES0917728-005	VC1A1 0-0.6	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		106-42-3							
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit		
EP131A: Organochlorine Pesticides (QC Lot: 1171557)									
ES0917728-005	VC1A1 0-0.6	EP131A: Aldrin	309-00-2	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-BHC	319-84-6	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-BHC	319-85-7	0.50	µg/kg	<0.50	<0.50	0.0	No Limit



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP131A: Organochlorine Pesticides (QC Lot: 1171557) - continued									
ES0917728-005	VC1A1 0-0.6	EP131A: delta-BHC	319-86-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4,4'-DDD	72-54-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4,4'-DDE	72-55-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: 4,4'-DDT	50-29-3	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: DDT (total)	----	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Dieldrin	60-57-1	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: alpha-Endosulfan	959-98-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: beta-Endosulfan	33213-65-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan sulfate	1031-07-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endosulfan (sum)	115-29-7	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin	72-20-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin aldehyde	7421-93-4	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Endrin ketone	53494-70-5	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor	76-44-8	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Heptachlor epoxide	1024-57-3	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: gamma-BHC	58-89-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Methoxychlor	72-43-5	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: cis-Chlordane	5103-71-9	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: trans-Chlordane	5103-74-2	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
		EP131A: Total Chlordane (sum)	----	0.50	µg/kg	<0.50	<0.50	0.0	No Limit
EP131B: Polychlorinated Biphenyls (as Aroclors) (QC Lot: 1171556)									
ES0917728-005	VC1A1 0-0.6	EP131B: Total Polychlorinated biphenyls	----	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1016	12974-11-2	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1221	11104-28-2	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1232	11141-16-5	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1242	53469-21-9	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1248	12672-29-6	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1254	11097-69-1	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
		EP131B: Aroclor 1260	11096-82-5	5.0	µg/kg	<5.0	<5.0	0.0	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1174799)									
ES0917728-005	VC1A1 0-0.6	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	6	5	0.0	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	6	5	19.4	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.0	No Limit

Page : 5 of 10
 Work Order : ES0917728
 Client : WORLEY PARSONS - INFRASTRUCTURE MWE
 Project : CALTEX MAINTENANCE DREDGING



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1174799) - continued									
ES0917728-005	VC1A1 0-0.6	EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	6	<4	32.3	No Limit
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	4	<4	0.0	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Indeno(1,2,3-cd)pyrene	193-39-5	4	µg/kg	<4	<4	0.0	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	22	10	75.8	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.0	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.0	No Limit



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

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

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1172083)								
EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	----	----	----	----
EG020-SD: Arsenic	7440-38-2	1.0	mg/kg	<1.00	13.1 mg/kg	92.0	70	130
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	2.76 mg/kg	91.2	70	130
EG020-SD: Chromium	7440-47-3	1.0	mg/kg	<1.0	60.9 mg/kg	82.1	70	130
EG020-SD: Copper	7440-50-8	1.0	mg/kg	<1.0	54.7 mg/kg	86.6	70	130
EG020-SD: Cobalt	7440-48-4	10	mg/kg	<10.0	24.5 mg/kg	86.4	70	130
EG020-SD: Lead	7439-92-1	1.0	mg/kg	<1.0	54.8 mg/kg	86.0	70	130
EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	136 mg/kg	81.5	70	130
EG020-SD: Nickel	7440-02-0	1.0	mg/kg	<1.0	55.2 mg/kg	86.2	70	130
EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	5.6 mg/kg	95.3	70	130
EG020-SD: Vanadium	7440-62-2	2	mg/kg	<2.0	34 mg/kg	85.4	70	130
EG020-SD: Zinc	7440-66-6	1.0	mg/kg	<1.0	104 mg/kg	87.1	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1172082)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.046 mg/kg	101	74.2	126
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1174800)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	5 mg/kg	99.0	75.2	116
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	5 mg/kg	84.0	75.3	113
EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	5 mg/kg	92.0	72.6	117
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1175145)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	26 mg/kg	88.0	68.4	128
EP080-SD: BTEX (QCLot: 1175145)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	105	67.5	125
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	1 mg/kg	88.6	69	122
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	1 mg/kg	100	65.3	126
EP080-SD: meta- & para-Xylene	108-38-3	0.2	mg/kg	<0.2	2 mg/kg	99.8	66.5	124
	106-42-3							
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	1 mg/kg	105	66.7	123
EP131A: Organochlorine Pesticides (QCLot: 1171557)								
EP131A: Aldrin	309-00-2	0.5	µg/kg	<0.50	5 µg/kg	88.7	31.7	140
EP131A: alpha-BHC	319-84-6	0.5	µg/kg	<0.50	5 µg/kg	93.2	24.5	150
EP131A: beta-BHC	319-85-7	0.5	µg/kg	<0.50	5 µg/kg	84.7	36.9	139
EP131A: delta-BHC	319-86-8	0.5	µg/kg	<0.50	5 µg/kg	95.9	38.2	137
EP131A: 4,4'-DDD	72-54-8	0.5	µg/kg	<0.50	5 µg/kg	106	42.5	141



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
Method: Compound	CAS Number	LOR	Unit	Result				
EP131A: Organochlorine Pesticides (QCLot: 1171557) - continued								
EP131A: 4,4'-DDE	72-55-9	0.5	µg/kg	<0.50	5 µg/kg	72.4	34.8	140
EP131A: 4,4'-DDT	50-29-3	0.5	µg/kg	<0.50	5 µg/kg	93.3	38	143
EP131A: DDT (total)	----	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Dieldrin	60-57-1	0.5	µg/kg	<0.50	5 µg/kg	96.2	43.2	134
EP131A: alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	5 µg/kg	86.0	23.7	139
EP131A: beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	5 µg/kg	67.6	35.8	138
EP131A: Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	5 µg/kg	90.6	7.45	158
EP131A: Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	----	----	----	----
EP131A: Endrin	72-20-8	0.5	µg/kg	<0.50	5 µg/kg	91.2	21.6	162
EP131A: Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	5 µg/kg	69.0	19.3	131
EP131A: Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	5 µg/kg	85.7	17.9	141
EP131A: Heptachlor	76-44-8	0.5	µg/kg	<0.50	5 µg/kg	88.4	31	153
EP131A: Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	5 µg/kg	88.4	34.3	138
EP131A: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	5 µg/kg	76.8	18.6	146
EP131A: gamma-BHC	58-89-9	0.5	µg/kg	<0.50	5 µg/kg	88.7	30.7	145
EP131A: Methoxychlor	72-43-5	0.5	µg/kg	<0.50	5 µg/kg	91.4	15	157
EP131A: cis-Chlordane	5103-71-9	0.5	µg/kg	<0.50	5 µg/kg	95.1	22.3	145
EP131A: trans-Chlordane	5103-74-2	0.5	µg/kg	<0.50	5 µg/kg	85.1	42.4	139
EP131A: Total Chlordane (sum)	----	0.5	µg/kg	<0.50	----	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 1171556)								
EP131B: Total Polychlorinated biphenyls	----	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1016	12974-11-2	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1221	11104-28-2	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1232	11141-16-5	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1242	53469-21-9	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1248	12672-29-6	5	µg/kg	<5.0	----	----	----	----
EP131B: Aroclor 1254	11097-69-1	5	µg/kg	<5.0	50 µg/kg	84.0	61.3	121
EP131B: Aroclor 1260	11096-82-5	5	µg/kg	<5.0	----	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1174799)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	97.7	----	----
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	25 µg/kg	96.2	----	----
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	84.5	----	----
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	106	----	----
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	89.5	----	----
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	89.6	----	----
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	88.7	----	----
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	90.2	----	----
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	89.9	----	----
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	75.4	----	----

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 Work Order : ES0917728
 Client : WORLEY PARSONS - INFRASTRUCTURE MWE
 Project : CALTEX MAINTENANCE DREDGING



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1174799) - continued								
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	77.5	----	----
EP132B-SD: Benzo(b)fluoranthene	205-99-2	4	µg/kg	<4	25 µg/kg	87.8	----	----
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	76.9	----	----
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	25 µg/kg	64.6	----	----
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	79.4	----	----
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	25 µg/kg	58.5	----	----
EP132B-SD: Benzo(g,h,i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	86.6	----	----
EP132B-SD: Dibenz(a,h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	93.4	----	----
EP132B-SD: Indeno(1,2,3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	82.4	----	----
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	25 µg/kg	50.0	----	----
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----



Matrix Spike (MS) Report

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

Sub-Matrix: SOIL

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
					MS	Low	High
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 1172083)							
ES0917728-002	SS1B	EG020-SD: Arsenic	7440-38-2	50 mg/kg	92.7	70	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	96.4	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	87.0	70	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	87.3	70	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	84.0	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	90.2	70	130
		EG020-SD: Zinc	7440-66-6	250 mg/kg	87.3	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1172082)							
ES0917728-001	SS1a	EG035T-LL: Mercury	7439-97-6	0.50 mg/kg	120	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1174800)							
ES0917728-005	VC1A1 0-0.6	EP071-SD: C10 - C14 Fraction	----	19.75 mg/kg	82.0	70	130
		EP071-SD: C15 - C28 Fraction	----	87.25 mg/kg	78.6	70	130
		EP071-SD: C29 - C36 Fraction	----	60 mg/kg	96.3	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 1175145)							
ES0917728-005	VC1A1 0-0.6	EP080-SD: C6 - C9 Fraction	----	26 mg/kg	119	70	130
EP080-SD: BTEX (QCLot: 1175145)							
ES0917728-005	VC1A1 0-0.6	EP080-SD: Benzene	71-43-2	2.5 mg/kg	83.7	70	130
		EP080-SD: Toluene	108-88-3	2.5 mg/kg	84.6	70	130
		EP080-SD: Ethylbenzene	100-41-4	2.5 mg/kg	87.6	70	130
		EP080-SD: meta- & para-Xylene	108-38-3	2.5 mg/kg	90.2	70	130
			106-42-3				
EP080-SD: ortho-Xylene	95-47-6	2.5 mg/kg	91.1	70	130		
EP131A: Organochlorine Pesticides (QCLot: 1171557)							
ES0917728-005	VC1A1 0-0.6	EP131A: Aldrin	309-00-2	5 µg/kg	55.0	31.7	140
		EP131A: alpha-BHC	319-84-6	5 µg/kg	55.1	24.5	150
		EP131A: beta-BHC	319-85-7	5 µg/kg	58.7	36.9	139
		EP131A: delta-BHC	319-86-8	5 µg/kg	67.4	38.2	137
		EP131A: 4,4`-DDD	72-54-8	5 µg/kg	82.9	42.5	141
		EP131A: 4,4`-DDE	72-55-9	5 µg/kg	55.5	34.8	140
		EP131A: 4,4`-DDT	50-29-3	5 µg/kg	73.3	38	143
		EP131A: Dieldrin	60-57-1	5 µg/kg	72.7	43.2	134
		EP131A: alpha-Endosulfan	959-98-8	5 µg/kg	63.9	23.7	139
		EP131A: beta-Endosulfan	33213-65-9	5 µg/kg	52.3	35.8	138
		EP131A: Endosulfan sulfate	1031-07-8	5 µg/kg	71.2	7.45	158

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 Work Order : ES0917728
 Client : WORLEY PARSONS - INFRASTRUCTURE MWE
 Project : CALTEX MAINTENANCE DREDGING



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
					MS	Low	High
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
EP131A: Organochlorine Pesticides (QCLot: 1171557) - continued							
ES0917728-005	VC1A1 0-0.6	EP131A: Endrin	72-20-8	5 µg/kg	53.3	21.6	162
		EP131A: Endrin aldehyde	7421-93-4	5 µg/kg	53.9	19.3	131
		EP131A: Endrin ketone	53494-70-5	5 µg/kg	80.1	17.9	141
		EP131A: Heptachlor	76-44-8	5 µg/kg	64.6	31	153
		EP131A: Heptachlor epoxide	1024-57-3	5 µg/kg	57.9	34.3	138
		EP131A: Hexachlorobenzene (HCB)	118-74-1	5 µg/kg	44.7	18.6	146
		EP131A: gamma-BHC	58-89-9	5 µg/kg	56.9	30.7	145
		EP131A: Methoxychlor	72-43-5	5 µg/kg	76.9	15	157
		EP131A: cis-Chlordane	5103-71-9	5 µg/kg	86.6	22.3	145
		EP131A: trans-Chlordane	5103-74-2	5 µg/kg	61.9	42.4	139
EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 1171556)							
ES0917728-005	VC1A1 0-0.6	EP131B: Aroclor 1254	11097-69-1	50 µg/kg	62.0	61.3	121
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 1174799)							
ES0917728-005	VC1A1 0-0.6	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	78.7	70	130
		EP132B-SD: 2-Methylnaphthalene	91-57-6	25 µg/kg	108	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	89.8	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	94.1	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	100	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	80.3	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	87.9	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	81.8	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	81.5	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	74.4	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	74.9	70	130
		EP132B-SD: Benzo(b)fluoranthene	205-99-2	25 µg/kg	71.0	70	130
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	73.6	70	130
		EP132B-SD: Benzo(e)pyrene	192-97-2	25 µg/kg	70.8	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	75.0	70	130
		EP132B-SD: Perylene	198-55-0	25 µg/kg	# 64.9	70	130
		EP132B-SD: Benzo(g,h,i)perylene	191-24-2	25 µg/kg	75.0	70	130
		EP132B-SD: Dibenzo(a,h)anthracene	53-70-3	25 µg/kg	85.2	70	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	81.7	70	130
		EP132B-SD: Coronene	191-07-1	25 µg/kg	72.8	70	130



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0917728	Page	: 1 of 6
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
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Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 19-NOV-2009
Sampler	: NH	Issue Date	: 01-DEC-2009
Order number	: ----		
Quote number	: SY/503/09	No. of samples received	: 15
		No. of samples analysed	: 8

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

This Interpretive Quality Control Report contains the following information:

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

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA055: Moisture Content								
Soil Glass Jar - Unpreserved SS1a, SS2B, VC1A1 0-0.6, VC1A1 0.6-1.2DUP,	SS1B, SS2C, VC1A1 0.6-1.2, VC1A1 1.2-1.7	18-NOV-2009	----	----	----	20-NOV-2009	25-NOV-2009	✓
EG020-SD: Total Metals in Sediments by ICPMS								
Soil Glass Jar - Unpreserved SS1a, SS2B, VC1A1 0-0.6, VC1A1 0.6-1.2DUP,	SS1B, SS2C, VC1A1 0.6-1.2, VC1A1 1.2-1.7	18-NOV-2009	24-NOV-2009	16-DEC-2009	✓	24-NOV-2009	17-MAY-2010	✓
EG035T: Total Mercury by FIMS								
Soil Glass Jar - Unpreserved SS1a, SS2B, VC1A1 0-0.6, VC1A1 0.6-1.2DUP,	SS1B, SS2C, VC1A1 0.6-1.2, VC1A1 1.2-1.7	18-NOV-2009	24-NOV-2009	16-DEC-2009	✓	27-NOV-2009	16-DEC-2009	✓
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
Soil Glass Jar - Unpreserved VC1A1 0-0.6		18-NOV-2009	25-NOV-2009	02-DEC-2009	✓	26-NOV-2009	04-JAN-2010	✓
Soil Glass Jar - Unpreserved VC1A1 0-0.6		18-NOV-2009	26-NOV-2009	02-DEC-2009	✓	26-NOV-2009	02-DEC-2009	✓
EP080-SD: BTEX								
Soil Glass Jar - Unpreserved VC1A1 0-0.6		18-NOV-2009	26-NOV-2009	02-DEC-2009	✓	26-NOV-2009	02-DEC-2009	✓
EP131A: Organochlorine Pesticides								
Soil Glass Jar - Unpreserved VC1A1 0-0.6		18-NOV-2009	23-NOV-2009	02-DEC-2009	✓	26-NOV-2009	02-JAN-2010	✓

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 Work Order : ES0917728
 Client : WORLEY PARSONS - INFRASTRUCTURE MWE
 Project : CALTEX MAINTENANCE DREDGING



Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP131B: Polychlorinated Biphenyls (as Aroclors)								
Soil Glass Jar - Unpreserved VC1A1 0-0.6		18-NOV-2009	23-NOV-2009	02-DEC-2009	✔	26-NOV-2009	02-JAN-2010	✔
EP132B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved		18-NOV-2009	25-NOV-2009	02-DEC-2009	✔	27-NOV-2009	04-JAN-2010	✔
SS1a,	SS1B,							
SS2B,	SS2C,							
VC1A1 0-0.6,	VC1A1 0.6-1.2,							
VC1A1 0.6-1.2DUP,	VC1A1 1.2-1.7							



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	2	11	18.2	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	16.7	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	8	12.5	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	2	50.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	8	12.5	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	8	12.5	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	1	100.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	1	100.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	16.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	8	12.5	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	2	50.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	8	12.5	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	8	12.5	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	1	100.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	1	100.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	16.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	8	12.5	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	2	50.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	8	12.5	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	8	12.5	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	1	100.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	1	100.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Organochlorine Pesticides (Ultra-trace)	EP131A	1	6	16.7	5.0	✓	ALS QCS3 requirement
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	8	12.5	5.0	✓	ALS QCS3 requirement
PCB's (Ultra-trace)	EP131B	1	2	50.0	5.0	✓	ALS QCS3 requirement
Total Mercury by FIMS (Low Level)	EG035T-LL	1	8	12.5	5.0	✓	ALS QCS3 requirement
Total Metals in Sediments by ICPMS	EG020-SD	1	8	12.5	5.0	✓	ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071-SD	1	1	100.0	5.0	✓	ALS QCS3 requirement
TPH Volatiles/BTEX in Sediments	EP080-SD	1	1	100.0	5.0	✓	ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (1999) Schedule B(3) (Method 102)
Total Metals in Sediments by ICPMS	EG020-SD	SOIL	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. Analyte list and LORs per NODG.
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3)
TPH - Semivolatile Fraction	EP071-SD	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 504)
TPH Volatiles/BTEX in Sediments	EP080-SD	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 501)
Organochlorine Pesticides (Ultra-trace)	EP131A	SOIL	USEPA Method 3640 (GPC cleanup), 3620 (Florisil), 8081/8082 (GC/uECD/uECD) This technique is compliant with NEPM (1999) Schedule B(3) (Method 504)
PCB's (Ultra-trace)	EP131B	SOIL	USEPA Method 3640 (GPC cleanup), 3620 (Florisil), 8081/8082 (GC/uECD/uECD) This technique is compliant with NEPM (1999) Schedule B(3) (Method 504)
PAHs in Sediments by GCMS(SIM)	EP132B-SD	SOIL	8270 GCMS Capillary column, SIM mode using large volume programmed temperature vaporisation injection.
Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	USEPA 200.2 Mod. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (1999) Schedule B(3) (Method 202)
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids/ Sample Cleanup	ORG17A-UTP	SOIL	In-house, Mechanical agitation (tumbler). 20g of sample, Na ₂ SO ₄ and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. Samples are extracted, concentrated (by KD) and exchanged into an appropriate solvent for GPC and florisil cleanup as required.
Tumbler Extraction of Solids for LVI (Non-concentrating)	ORG17D	SOIL	In house: 10g of sample, Na ₂ SO ₄ and surrogate are extracted with 50mL 1:1 DCM/Acetone by end over end tumbling. An aliquot is concentrated by nitrogen blowdown to a reduced volume for analysis if required.



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP132B: Polynuclear Aromatic Hydrocarbons	ES0917728-005	VC1A1 0-0.6	Perylene	198-55-0	64.9 %	70-130%	Recovery less than lower data quality objective

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

Regular Sample Surrogates

Sub-Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP132T: Base/Neutral Extractable Surrogates	ES0917728-004	SS2C	2-Fluorobiphenyl	321-60-8	119 %	30-115 %	Recovery greater than upper data quality objective

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)
Comprehensive Report

Work Order : **ES0917729**

Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----	Quote number	: ES2009WORPAR0232 (SY/503/09)
C-O-C number	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
Sampler	: NH		

Dates

Date Samples Received	: 19-NOV-2009	Issue Date	: 24-NOV-2009 15:10
Client Requested Due Date	: 02-DEC-2009	Scheduled Reporting Date	: 02-DEC-2009

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 1.4'C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 8
Security Seal	: Not intact.	No. of samples analysed	: 8

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.
- TBT and TOC analysis to be conducted by ALS Brisbane.
- **Samples received in appropriately pretreated and preserved containers.**
- **Sample(s) have been received within recommended holding times.**
- **This work order for TBT/TOC only and split from ES0917728.**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EP005 (solids) Total Organic Carbon (TOC) soils	SOIL - EA055-103 Moisture Content	SOIL - EP090 (solids) Organotins
ES0917729-001	18-NOV-2009 15:00	SS1a	✓	✓	✓
ES0917729-002	18-NOV-2009 15:00	SS1B	✓	✓	✓
ES0917729-003	18-NOV-2009 15:00	SS2B	✓	✓	✓
ES0917729-004	18-NOV-2009 15:00	SS2C	✓	✓	✓
ES0917729-005	18-NOV-2009 15:00	VC1A1 0-0.6	✓	✓	✓
ES0917729-006	18-NOV-2009 15:00	VC1A1 0.6-1.2	✓		
ES0917729-007	18-NOV-2009 15:00	VC1A1 0.6-1.2 DUP	✓		
ES0917729-008	18-NOV-2009 15:00	VC1A1 1.2-1.7	✓		

Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParson s.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParson s.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParson s.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParson s.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParson s.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParson s.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com



CHAIN OF CUSTODY

ALS Laboratory please tick →

TBT/TDC only

Environmental Division
Sydney

Work Order

ES0917729



Telephone : +61-2-8784 8555

Yes ☒ No ☐ N/A
Yes ☒ No ☐ N/A
°C

RECEIVED BY:

DATE/TIME:

CLIENT: <i>City of Sydney</i>	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? ☒
OFFICE: <i>City of Sydney</i>	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: <i>2</i> 3 4 5 6 7	Free ice frozen samples present upon receipt: ☒
PROJECT: <i>City of Sydney</i>		OF: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt:
ORDER NUMBER:			Other comment:
PROJECT MANAGER: <i>H. Walker</i>	CONTACT PH: <i>0422 765 386</i>		
SAMPLER: <i>Det. Walker</i>	SAMPLER MOBILE: <i>062367428</i>	RELINQUISHED BY:	RECEIVED BY: <i>Frank ALS</i>
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME:	DATE/TIME: <i>19/11/09 4pm</i>
Email Reports to (will default to PM if no other addresses are listed):			
Email Invoice to (will default to PM if no other addresses are listed):			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY		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).														Additional Information			
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP090-UT (TPH C6-C9) / BTEX	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA003 (pH & pHfox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.			
1	SS1a	18/10/09 am	S	Glass bottle/bags	3	/	/	/	/	/	CONTRACT WORK										STORE	STORE	
	SS1a	18/10/09 am	S	Glass bottle/bags	2	Hold	/	/	/	/	WO: ES0917729										STORE	STORE	
2	SS1B	18/10/09 am	S	Glass bottle/bags	3	/	/	/	/	/	LAB: ALS Brisbane										STORE	STORE	
	SS1B	18/10/09 am	S	Glass bottle/bags	2	Hold	/	/	/	/	DATE: 19/11/09										STORE	STORE	
3	SS2B	18/10/09 am	S	Glass bottle/bags	3	/	/	/	/	/	SPLIT: from ES0917729										STORE	STORE	
	SS2B	18/10/09 am	S	Glass bottle/bags	2	Hold	/	/	/	/											STORE	STORE	
4	SS2C	18/10/09 am	S	Glass bottle/bags	3	/	/	/	/	/											STORE	STORE	
	SS2C	18/10/09 am	S	Glass bottle/bags	2	Hold	/	/	/	/											STORE	STORE	
5	VC1A10-06	18/10/09 pm	S	Glass bottle/bags	4	/	/	/	/	Yes	Yes	Yes	Yes	Yes	/	/	/	/	STORE	STORE			
	VC1A10-06	18/10/09 pm	S	Glass bottle/bags	2	Hold	/	/	/	/											STORE	STORE	
6	VC1A10-06	18/10/09 pm	S	Glass bottle/bags	4	/	/	/	/	Yes	Yes	Yes	Yes	Yes	/	/	/	/	STORE	STORE			
						30	30	30	30	18	6	6	6	6	6	30	30	?	?				

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 →

CLIENT: <u>Wolke Farms</u>	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):	FOR LABORATORY USE ONLY (Circle)			
OFFICE: <u>NH 3/1/09</u>	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	Custody Seal Intact?	Yes	No	N/A
PROJECT: <u>Callie Whitehouse Lodge</u>	ALS QUOTE NO.:	Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
ORDER NUMBER:		Random Sample Temperature on Receipt:	°C		
PROJECT MANAGER: <u>Al Williams</u>	CONTACT PH: <u>0422 763 886</u>	COC SEQUENCE NUMBER (Circle)			
SAMPLER: <u>Nick Hamilton</u>	SAMPLER MOBILE: <u>0416 670 577</u>	COC: <u>2</u>			
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	OF: 1 2 3 4 5 6 7			
Email Reports to (will default to PM if no other addresses are listed):	DATE/TIME:	RECEIVED BY: <u>Frank ALC</u>			
Email Invoice to (will default to PM if no other addresses are listed):		DATE/TIME: <u>19/11/09 4pm</u>			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	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)														Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Labe)	EA0003 (pH & pH/ox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	UC1A106-12	18/11/09 pm	S	Glass bottle/bags	2	Hold														
7	UC1A106-12D	18/11/09 pm	S	Glass bottle/bags	1															
8	UC1A102-17	18/11/09 pm	S	Glass bottle/bags	3															
	UC1A112-7K	18/11/09 pm	S	Glass bottle/bags	2	Hold														
X	SS1A	18/11/09 pm	S	Glass bottle/bags	3															
	SS1A	18/11/09 pm	S	Glass bottle/bags	2	Hold														
X	SS1B	18/11/09 pm	S	Glass bottle/bags	3															
	SS1B	18/11/09 pm	S	Glass bottle/bags	2	Hold														
X	SS2B	18/11/09 pm	S	Glass bottle/bags	2															
	SS2B	18/11/09 pm	S	Glass bottle/bags	2	Hold														
X	SS2C	18/11/09 pm	S	Glass bottle/bags	3															
	SS2C	18/11/09 pm	S	Glass bottle/bags	3															

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.



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917729	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 19-NOV-2009
C-O-C number	: ----	Issue Date	: 04-DEC-2009
Sampler	: NH	No. of samples received	: 8
Site	: ----	No. of samples analysed	: 8
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Cass Sealby	Senior Chemist - Acid Sulphate Soils	Inorganics
Cass Sealby	Senior Chemist - Acid Sulphate Soils	Stafford Minerals - AY
Matt Frost	Organic Instrument Chemist	Organics

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

A Campbell Brothers Limited Company



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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- TBT: Sample shows poor duplicate results due to sample heterogeneity. Confirmed by re-extraction and re-analysis.
- TBT: Sample shows poor matrix spike recovery due to matrix interference. Confirmed by re-extraction and re-analysis.
- TBT: Samples SS2C and VC1A1 0-0.6 required dilution due to the presence of high level contaminants. Surrogate recovery not determined.

Page : 3 of 5
 Work Order : ES0917729
 Client : WORLEY PARSONS - INFRASTRUCTURE MWE
 Project : CALTEX MAINTENANCE DREDGING



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				SS1a	SS1B	SS2B	SS2C	VC1A1 0-0.6
				18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00
Compound	CAS Number	LOR	Unit	ES0917729-001	ES0917729-002	ES0917729-003	ES0917729-004	ES0917729-005
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)	----	1.0	%	16.7	17.7	24.0	19.7	18.6
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	0.02	%	0.08	0.03	0.42	0.09	0.10
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	6.0	6.9	4.2	46.7	22.9
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	75.5	100	58.9	Not Determined	Not Determined



Analytical Results

Sub-Matrix: SOIL				Client sample ID	VC1A1 0.6-1.2	VC1A1 0.6-1.2 DUP	VC1A1 1.2-1.7	----	----
				Client sampling date / time	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	----	----
Compound	CAS Number	LOR	Unit		ES0917729-006	ES0917729-007	ES0917729-008	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	0.02	%		0.06	0.13	0.03	----	----



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP090S: Organotin Surrogate			
Tripopyltin	----	34	108



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917729	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 19-NOV-2009
C-O-C number	: ----	Issue Date	: 04-DEC-2009
Sampler	: NH	No. of samples received	: 8
Order number	: ----	No. of samples analysed	: 8
Quote number	: SY/503/09		

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Cass Sealby	Senior Chemist - Acid Sulphate Soils	Inorganics
Cass Sealby	Senior Chemist - Acid Sulphate Soils	Stafford Minerals - AY
Matt Frost	Organic Instrument Chemist	Organics

Environmental Division Sydney

Part of the **ALS Laboratory Group**

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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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 1172931)									
ES0917655-008	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	18.9	17.9	5.1	0% - 50%
ES0917729-003	SS2B	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	24.0	26.7	10.4	0% - 20%
EP005: Total Organic Carbon (TOC) (QC Lot: 1175364)									
ES0917729-001	SS1a	EP005: Total Organic Carbon	----	0.02	%	0.08	0.09	13.1	No Limit
EP090: Organotin Compounds (QC Lot: 1174086)									
EB0918409-001	Anonymous	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	73.6	47.1	# 44.0	0% - 20%
EP0906670-012	Anonymous	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.0	No Limit



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

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

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EP005: Total Organic Carbon (TOC) (QCLot: 1175364)								
EP005: Total Organic Carbon	----	0.02	%	<0.02	100 %	100	70	130
EP090: Organotin Compounds (QCLot: 1174086)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	----	----	----	----
				----	1.25 µgSn/kg	91.7	24.1	129



Matrix Spike (MS) Report

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

Sub-Matrix: SOIL

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
					MS	Low	High
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
EP090: Organotin Compounds (QCLot: 1174086)							
EB0918409-002	Anonymous	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	# Not Determined	20	130



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0917729	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 19-NOV-2009
Sampler	: NH	Issue Date	: 04-DEC-2009
Order number	: ----		
Quote number	: SY/503/09	No. of samples received	: 8
		No. of samples analysed	: 8

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

This Interpretive Quality Control Report contains the following information:

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

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content								
Soil Glass Jar - Unpreserved		18-NOV-2009	----	----	----	24-NOV-2009	25-NOV-2009	✔
SS1a,	SS1B,							
SS2B,	SS2C,							
VC1A1 0-0.6								
EP005: Total Organic Carbon (TOC)								
Pulp Bag		18-NOV-2009	26-NOV-2009	---	----	26-NOV-2009	16-DEC-2009	✔
SS1a,	SS1B,							
SS2B,	SS2C,							
VC1A1 0-0.6,	VC1A1 0.6-1.2,							
VC1A1 0.6-1.2 DUP,	VC1A1 1.2-1.7							
EP090: Organotin Compounds								
Soil Glass Jar - Unpreserved		18-NOV-2009	26-NOV-2009	02-DEC-2009	✔	02-DEC-2009	05-JAN-2010	✔
SS1a,	SS1B,							
SS2B,	SS2C,							
VC1A1 0-0.6								



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	2	11	18.2	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Organotin Analysis	EP090	2	17	11.8	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	8	12.5	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Organotin Analysis	EP090	1	17	5.9	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	8	12.5	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organotin Analysis	EP090	1	17	5.9	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	8	12.5	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Organotin Analysis	EP090	1	17	5.9	5.0	✓	ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (1999) Schedule B(3) (Method 102)
Total Organic Carbon	EP005	SOIL	In-house. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO ₂) is automatically measured by infra-red detector.
Organotin Analysis	EP090	SOIL	(USEPA SW 846 - 8270D) Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quantified against an established calibration curve.
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Organotin Sample Preparation	ORG35	SOIL	In house. 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EP090: Organotin Compounds	EB0918409-001	Anonymous	Tributyltin	56573-85-4	44.0 %	0-20%	RPD exceeds LOR based limits
Matrix Spike (MS) Recoveries							
EP090: Organotin Compounds	EB0918409-002	Anonymous	Tributyltin	56573-85-4	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

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

Regular Sample Surrogates

Sub-Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP090S: Organotin Surrogate	ES0917729-004	SS2C	Tripopyltin	----	Not Determined	----	Surrogate recovery not determined due to (target or non-target) matrix interferences
EP090S: Organotin Surrogate	ES0917729-005	VC1A1 0-0.6	Tripopyltin	----	Not Determined	----	Surrogate recovery not determined due to (target or non-target) matrix interferences

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



ALS Laboratory: please tick →

pH 6 / pH 6.5 only

Environmental Division
Sydney
Work Order
ES0917731

Yes No
Yes No
°C



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 Unpreserved, AP = Airfreight Unpreserved Plastic
V = VOA Val HCl Preserved; VB = VOA Val Sodium Bisulphate Preserved; VS = VOA Val Sulfuric Preserved; AV = Airfreight Unpreserved Val 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 = Specialized Bag for Acid Sulphate Solids; B = Unpreserved Bag



CHAIN OF CUSTODY

ALS Laboratory please tick →

CLIENT: <u>Worley Parsons</u>	TURNAROUND REQUIREMENTS: ☐ 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: <u>NM Sydney</u>	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	
PROJECT: <u>Cellar maintenance dredging</u>	ALS QUOTE NO.:	
ORDER NUMBER:		
PROJECT MANAGER: <u>Jim Walters</u>	CONTACT PH: <u>0422 765 386</u>	
SAMPLER: <u>Nick Hammett</u>	SAMPLER MOBILE: <u>0418670577</u>	
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	
Email Reports to (will default to PM if no other addresses are listed):		
Email Invoice to (will default to PM if no other addresses are listed):		

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY		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 (filtered bottle required)														Additional Information	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EG020SD (trace metals)	EG035L (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C16)	EA150-H (Particle sizing)	EN020PR (dryBagLabel)	EA0003 (pH & pH/ox)	EA033 (chromium)	(TCLP/Elutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.		
	UC1A106-12	18/11/09 pm	S	Glass bottle/bags	2	Hold													STORE	STORE		
	UC1A106-12DUS	18/11/09 pm	S	Glass bottle/bags	1															STORE	STORE	
	UC1A112-17	18/11/09 pm	S	Glass bottle/bags	3															STORE	STORE	
	UC1A112-7	18/11/09 pm	S	Glass bottle/bags	2	Hold														STORE	STORE	
	SS1A	18/11/09 pm	S	Glass bottle/bags	3															STORE	STORE	
	SS1A x	18/11/09 pm	S	Glass bottle/bags	2	Hold														STORE	STORE	
	SS1B	18/11/09 pm	S	Glass bottle/bags	3															STORE	STORE	
	SS1B v	18/11/09 pm	S	Glass bottle/bags	2	Hold														STORE	STORE	
	SS2B	18/11/09 pm	S	Glass bottle/bags	2															STORE	STORE	
	SS2B x	18/11/09 pm	S	Glass bottle/bags	2	Hold														STORE	STORE	
	SS2C	18/11/09 pm	S	Glass bottle/bags	3															STORE	STORE	
TOTAL						30	30	30	30	18	6	6	6	6	6	30	30	?	?			

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.



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917731	Page	: 1 of 4
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: SY 503 09 - Caltex Sediment Analysis	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 19-NOV-2009
C-O-C number	: ----	Issue Date	: 26-NOV-2009
Sampler	: NH	No. of samples received	: 7
Site	: ----	No. of samples analysed	: 7
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in
accordance with NATA
accreditation requirements.

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Inorganics

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General Comments

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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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- Analysis conducted by ALS Brisbane, NATA Site No. 818.
- pH FOX Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Vigorous; 4 - Very Vigorous



Analytical Results

Sub-Matrix: SOIL

				Client sample ID	SS1a	SS1B	SS2B	SS2C	VC1A1 0-0.6
				Client sampling date / time	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00	18-NOV-2009 15:00
Compound	CAS Number	LOR	Unit		ES0917731-001	ES0917731-002	ES0917731-003	ES0917731-004	ES0917731-005
EA003 :pH (field)									
pH (F)	----	0.1	pH Unit		8.6	8.6	8.6	8.8	9.0
pH (Fox)	----	0.1	pH Unit		6.1	5.9	6.3	6.3	6.1
Reaction Rate	----	1	Reaction Uni		1	1	1	1	1



Analytical Results

Sub-Matrix: SOIL

				Client sample ID	VC1A1 0.6-1.2	VC1A1 1.2-1.7			
				Client sampling date / time	18-NOV-2009 15:00	18-NOV-2009 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES0917731-006	ES0917731-007	----	----	----
EA003 :pH (field)									
pH (F)	----	0.1	pH Unit		9.0	8.9	----	----	----
pH (Fox)	----	0.1	pH Unit		6.2	4.2	----	----	----
Reaction Rate	----	1	Reaction Uni		1	2	----	----	----



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917731	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: SY 503 09 - Caltex Sediment Analysis	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 19-NOV-2009
C-O-C number	: ----	Issue Date	: 26-NOV-2009
Sampler	: NH	No. of samples received	: 7
Order number	: ----	No. of samples analysed	: 7
Quote number	: SY/503/09		

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- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Inorganics

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

A Campbell Brothers Limited Company



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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA003 :pH (field/fox) (QC Lot: 1175242)									
EB0918486-001	Anonymous	EA003: Reaction Rate	----	1	--	1	1	0.0	No Limit
		EA003: pH (F)	----	0.1	pH Unit	8.0	7.7	3.8	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	3.1	2.9	6.7	0% - 20%
ES0917731-001	SS1a	EA003: Reaction Rate	----	1	--	1	1	0.0	No Limit
		EA003: pH (F)	----	0.1	pH Unit	8.6	8.8	2.3	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	6.1	6.2	1.6	0% - 20%



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

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

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**



Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0917731	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: SY 503 09 - Caltex Sediment Analysis	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 19-NOV-2009
Sampler	: NH	Issue Date	: 26-NOV-2009
Order number	: ----		
Quote number	: SY/503/09	No. of samples received	: 7
		No. of samples analysed	: 7

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

This Interpretive Quality Control Report contains the following information:

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

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA003 :pH (field)								
Snap Lock Bag - frozen		18-NOV-2009	----	----	----	26-NOV-2009	18-NOV-2010	✔
SS1a,	SS1B,							
SS2B,	SS2C,							
VC1A1 0-0.6,	VC1A1 0.6-1.2,							
VC1A1 1.2-1.7								



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
pH field/fox	EA003	2	11	18.2	10.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
pH field/fox	EA003	SOIL	Ahern et al 1998 - determined on a 1:5 soil/water extract designed to simulate field measured pH and pH after the extract has been oxidised with peroxide.

<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)
Comprehensive Report

Work Order : **ES0917731**

Client : **WORLEY PARSONS -
INFRASTRUCTURE MWE**

Contact : Ms ALI WATTERS
Address : Level 10/141 Walker Street
NORTH SYDNEY NSW, AUSTRALIA
2060

E-mail : ali.watters@worleyparsons.com
Telephone : +61 02 8907 2131
Facsimile : ----

Project : SY 503 09 - Caltex Sediment Analysis
Order number : ----
C-O-C number : ----
Site : ----
Sampler : NH

Laboratory : Environmental Division Sydney

Contact : Charlie Pierce
Address : 277-289 Woodpark Road Smithfield
NSW Australia 2164

E-mail : charlie.pierce@alsenviro.com
Telephone : +61-2-8784 8555
Facsimile : +61-2-8784 8500

Page : 1 of 2

Quote number : ES2009WORPAR0232 (SY/503/09)

QC Level : NEPM 1999 Schedule B(3) and ALS
QCS3 requirement

Dates

Date Samples Received : 19-NOV-2009
Client Requested Due Date : 26-NOV-2009

Issue Date : 24-NOV-2009 15:12
Scheduled Reporting Date : **26-NOV-2009**

Delivery Details

Mode of Delivery : Carrier
No. of coolers/boxes : 1 HARD
Security Seal : Intact.

Temperature : 1.4' C - Ice present
No. of samples received : 7
No. of samples analysed : 7

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.
- pH Field/Fox analysis to be conducted by ALS Brisbane.
- **Samples received in appropriately pretreated and preserved containers.**
- **Sample(s) have been received within recommended holding times.**
- **This work order for pH Field & pH Fox only and split from ES0917728.**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA003 pH field/fox
ES0917731-001	18-NOV-2009 15:00	SS1a	✓
ES0917731-002	18-NOV-2009 15:00	SS1B	✓
ES0917731-003	18-NOV-2009 15:00	SS2B	✓
ES0917731-004	18-NOV-2009 15:00	SS2C	✓
ES0917731-005	18-NOV-2009 15:00	VC1A1 0-0.6	✓
ES0917731-006	18-NOV-2009 15:00	VC1A1 0.6-1.2	✓
ES0917731-007	18-NOV-2009 15:00	VC1A1 1.2-1.7	✓

Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParson s.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParson s.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParson s.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParson s.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParson s.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParson s.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com



Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)
Comprehensive Report

Work Order : **ES0917732**

Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	Page	: 1 of 2
Order number	: ----		
C-O-C number	: ----	Quote number	: ES2009WORPAR0232 (SY/503/09)
Site	: ----		
Sampler	: NH	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 19-NOV-2009	Issue Date	: 23-NOV-2009 12:17
Client Requested Due Date	: 01-DEC-2009	Scheduled Reporting Date	: 01-DEC-2009

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 1.4' C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 2
Security Seal	: Intact.	No. of samples analysed	: 2

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **Particle Size analysis will be conducted by ALS Newcastle.**
- **Sample(s) have been received within recommended holding times.**
- **This work order for PSD only and split from ES0917728.**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Jacob Waugh.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA150H Particle Size Analysis by Hydrometer
ES0917732-001	18-NOV-2009 15:00	VC1A1 0-0.6	✓
ES0917732-002	18-NOV-2009 15:00	VC1A1 0.6-1.2	✓

Requested Deliverables

MR NICK HANNAFORD

- *AU Certificate of Analysis - NATA (COA)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Nicholas.Hannaford@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Nicholas.Hannaford@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	Nicholas.Hannaford@WorleyParsons.com
- Default - Chain of Custody (COC)	Email	Nicholas.Hannaford@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	Nicholas.Hannaford@WorleyParsons.com
- Trigger - Subcontract Report (SUBCO)	Email	Nicholas.Hannaford@WorleyParsons.com

Ms ALI WATTERS

- *AU Certificate of Analysis - NATA (COA)	Email	ali.watters@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ali.watters@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ali.watters@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	ali.watters@worleyparsons.com
- A4 - AU Tax Invoice (INV)	Email	ali.watters@worleyparsons.com
- Default - Chain of Custody (COC)	Email	ali.watters@worleyparsons.com
- EDI Format - ENMRG (ENMRG)	Email	ali.watters@worleyparsons.com
- Trigger - Subcontract Report (SUBCO)	Email	ali.watters@worleyparsons.com



CHAIN OF CUSTODY

ALS Laboratory please tick →

PSD only

Environmental Division
Sydney

Work Order

ES0917732

Yes	No	N/A
Yes	No	N/A
°C		

CLIENT: <u>Woolley Parsons</u>	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	FOR LABORATORY USE ONLY (C) Custody Seal Intact? ☒ Free ice / frozen boxes present upon receipt
OFFICE: <u>New Sydney</u>	☐ Non Standard or urgent TAT (List due date):	COC SEQUENCE NUMBER (Circle) COC: <u>7</u> 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7
PROJECT: <u>Coltarmintenned development</u>	ALS QUOTE NO.:	Random Sample Temperature on Receipt
ORDER NUMBER:		Other comment:
PROJECT MANAGER: <u>AC Woolley</u>	CONTACT PH: <u>0122 765 380</u>	
SAMPLER: <u>Nick Hammett</u>	SAMPLER MOBILE: <u>062367828</u>	RECEIVED BY: <u>Frank ALS</u>
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME: <u>19/11/09 4pm</u>
Email Reports to (will default to PM if no other addresses are listed):		
Email Invoice to (will default to PM if no other addresses are listed):		



Telephone : +61-2-8784 8555

RECEIVED BY:
DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	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).														Additional Information			
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <i>(refer to codes below)</i>	TOTAL BOTTLES	EG02SD (trace metals)	EG03SL (Mercury)	EP13SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (Particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pH & pHfox)	EA033 (chromium)	(TCLP/Eutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.			
	SS1a	18/11/09 am	S	Glass bottle/bags	3	/	/	/	/	/	CONTRACT WORK										STORE	STORE	
	SS1ax	18/11/09 am	S	Glass bottle/bags	2	Hold					WO: ES0917732										STORE	STORE	
	SS1B	18/11/09 am	S	Glass bottle/bags	3	/	/	/	/	/	LAB: ALS Newcastle										STORE	STORE	
	SS1Bx	18/11/09 am	S	Glass bottle/bags	2	Hold					DATE: 19/11/09										STORE	STORE	
	SS2B	18/11/09 am	S	Glass bottle/bags	3	/	/	/	/	/	SPLIT: from ES0917728										STORE	STORE	
	SS2Bx	18/11/09 am	S	Glass bottle/bags	2	Hold															STORE	STORE	
	SS2C	18/11/09 am	S	Glass bottle/bags	3	/	/	/	/	/											STORE	STORE	
	SS2Cx	18/11/09 am	S	Glass bottle/bags	2	Hold															STORE	STORE	
1	VC1A10-06	18/11/09 pm	S	Glass bottle/bags	4	-	-	-	-	Yes	Yes	Yes	Yes	Yes	-	-	-	-	STORE	STORE			
	VC1A10-06x	18/11/09 pm	S	Glass bottle/bags	2	Hold															STORE	STORE	
2	VC1A10-06-12	18/11/09 pm	S	Glass bottle/bags	4	-	-	-	-	Yes	Yes	Yes	Yes	Yes	-	-	-	-	STORE	STORE			
						30	30	30	30	18	6	6	6	6	6	30	30	?	?				

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 →

CLIENT: <i>Worley Parsons</i>	TURNAROUND REQUIREMENTS: ☐ 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: <i>Worley Parsons</i>	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: <i>1</i> 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	
PROJECT: <i>Collier mudstone dredges</i>	ORDER NUMBER:	RECEIVED BY: <i>Frank ALC</i> DATE/TIME: <i>19/11/09 4pm</i>	RECEIVED BY: DATE/TIME:
PROJECT MANAGER: <i>Ali Watters</i>	CONTACT PH: <i>0422 765 386</i>	RELINQUISHED BY:	RECEIVED BY:
SAMPLER: <i>Nick Hannigan</i>	SAMPLER MOBILE: <i>0418 670 377</i>	DATE/TIME:	DATE/TIME:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed):			
Email Invoice to (will default to PM if no other addresses are listed):			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:																					
ALS USE ONLY		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 (fold filtered bottle required)													Additional Information		
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <i>(refer to codes below)</i>	TOTAL BOTTLES	EG020SD (trace metals)	EG03SL (Mercury)	EP132SD (PAHs)	EP004 (TOC)	EP090 (TBT)	EP131A (OC Pesticides)	EP131B (PCBs)	EP080-UT (TPH (C6-C9) / BTEX)	EP071SD (TPH C10-C36)	EA150-H (particle sizing)	EN020PR (dry/Bag/Label)	EA0003 (pH & pHfox)	EA033 (chromium)	(TCLP/Eutriate)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.	
	UC1A106-12	18/11/09 AM	S	Glass bottle/bags	2	Hold													STORE	STORE	
	UC1A106-12DUP	18/11/09 pm	S	Glass bottle/bags	1	-	-	-	-	CLW	CLW	CLW	CLW	CLW	CLW	CLW	CLW		STORE	STORE	
	UC1A102-17	18/11/09 pm	S	Glass bottle/bags	3	-	-	-	-								-	-	STORE	STORE	
	UC1A112-72	18/11/09 pm	S	Glass bottle/bags	2	Hold													STORE	STORE	
	SS1A	18/11/09 pm	S	Glass bottle/bags	3	-	-	-	-	-							-	-	STORE	STORE	
	SS1AX	18/11/09 pm	S	Glass bottle/bags	2	Hold													STORE	STORE	
	SS1B	18/11/09 pm	S	Glass bottle/bags	3	-	-	-	-	-							-	-	STORE	STORE	
	SS1Bv	18/11/09 pm	S	Glass bottle/bags	2	Hold													STORE	STORE	
	SS2B	18/11/09 pm	S	Glass bottle/bags	3	-	-	-	-	-							-	-	STORE	STORE	
	SS2Bx	18/11/09 pm	S	Glass bottle/bags	2	Hold													STORE	STORE	
	SS2C	18/11/09 pm	S	Glass bottle/bags	3	-	-	-	-	-							-	-	STORE	STORE	
TOTAL						30	30	30	30	18	6	6	6	6	6	30	30	?	?		

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 Solids; B = Unpreserved Bag.



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0917732	Page	: 1 of 3
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 19-NOV-2009
C-O-C number	: ----	Issue Date	: 01-DEC-2009
Sampler	: NH	No. of samples received	: 2
Site	: ----	No. of samples analysed	: 2
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in
accordance with NATA
accreditation requirements.

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories

Position

Accreditation Category

Dianne Blane

Newcastle

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

Tel. +61-2-8784 8555 Fax. +61-2-8784 8500 www.alsglobal.com

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When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

LOR = Limit of reporting

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



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				VC1A1 0-0.6	VC1A1 0.6-1.2			
				18-NOV-2009 15:00	18-NOV-2009 15:00			
Compound	CAS Number	LOR	Unit	ES0917732-001	ES0917732-002			
EA150: Particle Sizing								
+75µm	----	1	%	98	97	----	----	----
+150µm	----	1	%	97	96	----	----	----
+300µm	----	1	%	64	62	----	----	----
+425µm	----	1	%	24	22	----	----	----
+600µm	----	1	%	4	9	----	----	----
+1180µm	----	1	%	1	6	----	----	----
+2.36mm	----	1	%	<1	6	----	----	----
+4.75mm	----	1	%	<1	6	----	----	----
+9.5mm	----	1	%	<1	6	----	----	----
+19.0mm	----	1	%	<1	5	----	----	----
+37.5mm	----	1	%	<1	<1	----	----	----
+75.0mm	----	1	%	<1	<1	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	2	2	----	----	----
Silt (2-60 µm)	----	1	%	1	1	----	----	----
Sand (0.06-2.00 mm)	----	1	%	97	91	----	----	----
Gravel (>2mm)	----	1	%	<1	6	----	----	----
Cobbles (>6cm)	----	1	%	<1	<1	----	----	----



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0917732	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 19-NOV-2009
C-O-C number	: ----	Issue Date	: 01-DEC-2009
Sampler	: NH	No. of samples received	: 2
Order number	: ----	No. of samples analysed	: 2
Quote number	: SY/503/09		

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

This Quality Control Report contains the following information:

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



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Signatories

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Signatories	Position	Accreditation Category
Dianne Blane		Newcastle

Environmental Division Sydney

Part of the **ALS Laboratory Group**

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

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

		----						No Limit
--	--	------	--	--	--	--	--	----------

- No Laboratory Duplicate (DUP) Results are required to be reported.



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

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

- **No Method Blank (MB) or Laboratory Control Spike (SCS) Results are required to be reported.**



Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0917732	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 19-NOV-2009
Sampler	: NH	Issue Date	: 01-DEC-2009
Order number	: ----		
Quote number	: SY/503/09	No. of samples received	: 2
		No. of samples analysed	: 2

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

This Interpretive Quality Control Report contains the following information:

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

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing								
Snap Lock Bag VC1A1 0-0.6, VC1A1 0.6-1.2		18-NOV-2009	---	---	----	30-NOV-2009	17-MAY-2010	✔
EA150: Soil Classification based on Particle Size								
Snap Lock Bag VC1A1 0-0.6, VC1A1 0.6-1.2		18-NOV-2009	---	---	----	30-NOV-2009	17-MAY-2010	✔



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix:

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Reaular	Actual	Expected	Evaluation	



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Particle Size Analysis (Sieving)	EA150	SOIL	Particle Size Analysis by Sieving according to AS1289.3.6.1 - 1995
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.



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CALTEX KURNELL PORT AND BERTHING PROJECT, BOTANY BAY, NSW

SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

ELUTRIATE LABORATORY RESULTS

Frank 3/12/9 2pm

Frank Ferraro

From: Watters, Ali (Sydney) [Ali.STONE@WorleyParsons.com]
Sent: Thursday, 3 December 2009 1:15 PM
To: Jacob Waugh
Cc: Samples Sydney; Hannaford, Nick (Sydney)
Subject: RE: ES0917655 ES0917729 results pending.

Jacob

Thank you for the preliminary results.

We wish to proceed with TBT elutriate testing of the following currently being kept on hold by ALS:

1
2
3

- ES0917728-013 (VC1A1 0-0.6X)
- ES0917649-018 (SS3BX)
- ES0917649-024 (SS2DX)

Could you please undertake the following analysis:

ALS method - EN68, Preparation of elutriates from marine sediment - TBT ALS method - EP090, Organo Tins (TBT)

Could you also please ensure the sea water sample (W1) used for the elutriate test is tested for TBT.

4

Thanks

Ali

-----Original Message-----

From: Jacob Waugh [mailto:Jacob.Waugh@als.com.au]
Sent: Thursday, 3 December 2009 12:06 PM
To: Hannaford, Nick (Sydney)
Cc: Watters, Ali (Sydney)
Subject: RE: ES0917655 ES0917729 results pending.

Hi Nick,

Sorry for the delay. ES0917655 has now been released this morning so you should have results for this one. If for some reason the emails haven't made it to your inbox yet let me know and I can forward straight away.

ES0917729 has been delayed has been delayed by the TBT results. I just checked our system and I can see that results for all samples are in, however they have not been authorised by the chemist. I have attached a prelim excel sheet for this batch that may help you make decisions on which samples need elutriate TBT however do remember that the results could potentially change if the chemist has any concerns with the results.

Ali,

As discussed once you know the sediments that you want re-batched for Elutriate TBT please email them (with the relevant ALS work order numbers) to myself and samples.sydney@alsenviro.com so we can get it started for you. As mentioned we do now have the sea water your sampler just dropped off.

Jacob Waugh
Production Co-ordinator
ALS Laboratory Group
Environmental Division
Sydney, Australia
Phone: +61 2 8784 8555
Fax: +61 2 8784 8500
www.alsglobal.com

Environmental Division
Sydney
Work Order

ES0918462



Telephone : +61-2-8784 8555

Subcon / Forward Lab / Split WO
Lab / Analysis: _____
Organised By / Date: _____
Relinquished By / Date: _____
Connote / Courier: _____
WO No: _____
Attach By PO / Internal Sheet: _____

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ **Sydney:** 277 Woodpark Rd, Smithfield NSW 2176
 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
☐ **Newcastle:** 5 Rosegum Rd, Warabrook NSW 2304
 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com

☐ **Brisbane:** 32 Shand St, Stafford QLD 4053
 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
☐ **Townsville:** 14-15 Desma Ct, Bohle QLD 4818
 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com

☐ **Melbourne:** 2-4 Westall Rd, Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com

☐ **Adelaide:** 2-1 Burma Rd, Pooraka SA 5095
Ph: 08 8359 0890 E: adelaide@alsenviro.com

☐ **Perth:** 10 Hod Way, Malaga WA 6090
Ph: 08 9209 7655 E: samples.perth@alsenviro.com

☐ **Launceston:** 27 Wellington St, Launceston TAS 7250
Ph: 03 6331 2158 E: launceston@alsenviro.com

[illegible]



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES0918462	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: REBATCH OF ES0917728	Date Samples Received	: 03-DEC-2009
C-O-C number	: ----	Issue Date	: 15-DEC-2009
Sampler	: NH	No. of samples received	: 4
Site	: ----	No. of samples analysed	: 4
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

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Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Matt Frost	Organic Instrument Chemist	Organics
Nanthini Coilparampil	Senior Inorganic Chemist	Inorganics

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

Page : 3 of 5
 Work Order : ES0918462
 Client : WORLEY PARSONS - INFRASTRUCTURE MWE
 Project : CALTEX MAINTENANCE DREDGING



Analytical Results

Sub-Matrix: **ELUTRIATE**

Client sample ID

Client sampling date / time

				VC1A1 0-0.6X	SS3BX	SS2DX	W1	----
				04-DEC-2009 12:00	04-DEC-2009 12:00	04-DEC-2009 12:00	18-NOV-2009 11:00	----
Compound	CAS Number	LOR	Unit	ES0918462-001	ES0918462-002	ES0918462-003	ES0918462-004	----
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	----	----	----	<2	----
Tributyltin	56573-85-4	2	ngSn/L	70	<2	8	----	----
EP090S: Organotin Surrogate								
Tripopyltin	----	0.1	%	----	----	----	44.6	----
Tripopyltin	----	0.1	%	59.4	52.5	96.5	----	----



Analytical Results

Sub-Matrix: SOIL

				Client sample ID				
				Client sampling date / time	VC1A1 0-0.6X	SS3BX	SS2DX	W1
					18-NOV-2009 15:00	17-NOV-2009 15:00	18-NOV-2009 15:00	03-DEC-2009 15:00
Compound	CAS Number	LOR	Unit		ES0918462-001	ES0918462-002	ES0918462-003	ES0918462-004
EN68: Seawater Elutriate Testing Procedure								
Seawater Sampling Date	----	0.1	-		----	----	----	18/11/09
Seawater Sampling Date	----	0.1	-		18/11/09	18/11/09	18/11/09	----



Surrogate Control Limits

Sub-Matrix: ELUTRIATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP090S: Organotin Surrogate			
Tripropyltin	----	10	108



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES0918462	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
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Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
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Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 03-DEC-2009
C-O-C number	: ----	Issue Date	: 15-DEC-2009
Sampler	: NH	No. of samples received	: 4
Order number	: REBATCH OF ES0917728	No. of samples analysed	: 4
Quote number	: SY/503/09		

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This Quality Control Report contains the following information:

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



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Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Matt Frost	Organic Instrument Chemist	Organics
Nanthini Coilparampil	Senior Inorganic Chemist	Inorganics

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LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

			----						No Limit
--	--	--	------	--	--	--	--	--	----------

- No Laboratory Duplicate (DUP) Results are required to be reported.



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

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

Sub-Matrix: WATER

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			LCS	Low	High
EP090: Organotin Compounds (Soluble) (QCLot: 1189227)								
EP090S: Tributyltin	56573-85-4	2	ngSn/L	----	147 ngSn/L	72.0	29	100
				<2	----	----	----	----



Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES0918462	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: Ms ALI WATTERS	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ali.watters@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: +61 02 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 03-DEC-2009
Sampler	: NH	Issue Date	: 15-DEC-2009
Order number	: REBATCH OF ES0917728		
Quote number	: SY/503/09	No. of samples received	: 4
		No. of samples analysed	: 4

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

This Interpretive Quality Control Report contains the following information:

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

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EN68: Seawater Elutriate Testing Procedure							
LabSplit: Leach for organics and other tests SS3BX	17-NOV-2009	---	---	----	04-DEC-2009	01-DEC-2009	✘
LabSplit: Leach for organics and other tests VC1A1 0-0.6X, SS2DX	18-NOV-2009	---	---	----	04-DEC-2009	02-DEC-2009	✘
EP090: Organotin Compounds (Soluble)							
Amber Glass Bottle - Unpreserved VC1A1 0-0.6X, SS3BX, SS2DX	04-DEC-2009	11-DEC-2009	11-DEC-2009	✔	14-DEC-2009	23-JAN-2010	✔

Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EN68: Seawater Elutriate Testing Procedure							
LabSplit: Leach for organics and other tests W1	03-DEC-2009	---	---	----	04-DEC-2009	17-DEC-2009	✔
EP090: Organotin Compounds (Soluble)							
Amber Glass Bottle - Unpreserved W1	18-NOV-2009	11-DEC-2009	25-NOV-2009	✖	14-DEC-2009	23-JAN-2010	✔



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Control Samples (LCS)							
Organotin Compounds (Soluble)	EP090S	2	6	33.3	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organotin Compounds (Soluble)	EP090S	2	6	33.3	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Organotin Compounds (Soluble)	EP090S	SOIL	USEPA SW 846 - 8270D Sample extracts are analysed by GC/MS coupled with high volume injection and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Organotin Compounds (Soluble)	EP090S	WATER	USEPA SW 846 - 8270D Sample extracts are analysed by GC/MS coupled with high volume injection and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Preparation Methods	Method	Matrix	Method Descriptions
Seawater Elutriate Testing Procedure	* EN68a	SOIL	USEPA Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Guide, 1991, EPA-503/8-91/001, USEPA and US Army Corps of Engineers. ANZECC Interim Ocean Disposal Guidelines, December, 1998 This Procedure outlines the preparation of leachate designed to simulate release of contaminants from sediment during the disposal of dredged material. Release can occur by physical processes or a variety of chemical changes such as oxidation of metal sulphides and release of contaminants adsorbed to particles or organic matter.
Organotin Sample Preparation	ORG34	SOIL	In-house. A specified volume of sample is spiked with surrogate, acidified and vacuum filtered. Reagents and solvent are added and the mixture tumbled. The butyltin compounds is derivatisated, extracted and the substitution reaction completed. The extract is transferred to a separatory funnel and further extracted two times with petroleum ether. The resultant extracts are combined and concentrated for analysis.
Seawater Elutriate Testing Procedure	* EN68a	WATER	USEPA Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Guide, 1991, EPA-503/8-91/001, USEPA and US Army Corps of Engineers. ANZECC Interim Ocean Disposal Guidelines, December, 1998 This Procedure outlines the preparation of leachate designed to simulate release of contaminants from sediment during the disposal of dredged material. Release can occur by physical processes or a variety of chemical changes such as oxidation of metal sulphides and release of contaminants adsorbed to particles or organic matter.
Organotin Sample Preparation	ORG34	WATER	In-house. A specified volume of sample is spiked with surrogate, acidified and vacuum filtered. Reagents and solvent are added and the mixture tumbled. The butyltin compounds is derivatisated, extracted and the substitution reaction completed. The extract is transferred to a separatory funnel and further extracted two times with petroleum ether. The resultant extracts are combined and concentrated for analysis.



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EN68: Seawater Elutriate Testing Procedure						
LabSplit: Leach for organics and other tests SS3BX	----	----	----	04-DEC-2009	01-DEC-2009	3
LabSplit: Leach for organics and other tests VC1A1 0-0.6X, SS2DX	----	----	----	04-DEC-2009	02-DEC-2009	2

Matrix: **WATER**

Method	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EP090: Organotin Compounds (Soluble)						
Amber Glass Bottle - Unpreserved W1	11-DEC-2009	25-NOV-2009	16	----	----	----

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.

Fadi Soro

Handwritten:
Fadi
19/3/10
6:15pm

From: Jacob Waugh
Sent: Friday, 19 March 2010 4:40 PM
To: Samples Sydney; Fadi Soro
Cc: Frank Ferraro; Charlie Pierce
Subject: FW: Work Order ES1004273

Hi Fadi,
 Please re-batch as per the below request. Please make sure the sea-water is re-batched also.

Charlie,
 Because Frank is on an earlier shift now can you please send re-batch requests to samples.sydney so Frank or Fadi can action them?

Jacob Waugh
 Production Co-ordinator
ALS Laboratory Group
Environmental Division
 Sydney, Australia
 Phone: +61 2 8784 8555
 Fax: +61 2 8784 8500
www.alsglobal.com

Environmental Division

Sydney

Work Order

ES1005242

Telephone : +61-2-8784 8555

From: Charlie Pierce
Sent: Friday, 19 March 2010 4:33 PM
To: Jacob Waugh; Uma Nagendiram; Frank Ferraro
Subject: FW: Work Order ES1004273

Dear Frank

Please rebatch this for elutriate testing, testing will commence first thing Monday morning.

Kind Regards

Charlie Pierce
 Laboratory Manager - Sydney
ALS Laboratory Group
Environmental Division
 Sydney, Australia
 Phone: + 61 2 8784 8555
 Fax: + 61 2 8784 8500
www.alsglobal.com

ES1005242

Telephone : + 61-2-8784 8555

From: Murray, Orla (Sydney) [mailto:Orla.Murray@v.als.com.au]
Sent: Friday, 19 March 2010 3:28 PM
To: Charlie Pierce
Subject: RE: Work Order ES1004273

Thanks Charlie.

Can you please arrange for the immediate elutriation and testing for elutriate TBT (as per quote SY/503/09 V3) for the following samples:

Sample ID	ALS sample ID
VC4B (0.5-1m) ①	ES1004214-003 5399-401
VC4B (1-1.5m) ②	ES1004214-004
VC4B (1.5-2m) ③	ES1004214-005

19/03/2010



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES1005242	Page	: 1 of 10
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: MS ORLA MURRAY	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: orla.murray@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING -REBATCH OF ES1004273	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: 301015-018871/04-REB	Date Samples Received	: 19-MAR-2010
C-O-C number	: REBATCH	Issue Date	: 31-MAR-2010
Sampler	: OM	No. of samples received	: 11
Site	: ----	No. of samples analysed	: 11
Quote number	: SY/503/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

This document is issued in
accordance with NATA
accreditation requirements.

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Matt Frost	Organic Instrument Chemist	Organics
Wisam.Marassa	Metals Coordinator	Inorganics

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

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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 date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

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

- **EN68 was tumbled outside of holding time due to sample received too late**
- **EN68: This analysis in accordance with National Ocean Disposal Guidelines, Commonwealth of Australia, 2002 - (modified). Results reported are those determined on a 1:4 sediment/seawater elutriate without blank correction.**



Analytical Results

Sub-Matrix: ELUTRIATE

Client sample ID

Client sampling date / time

				VC4B(0.5-1M)	VC4B(1-1.5M)	VC4B(1.5-2M)	SS4E	SS4B
				22-MAR-2010 12:00	22-MAR-2010 12:00	22-MAR-2010 12:00	22-MAR-2010 12:00	22-MAR-2010 12:00
Compound	CAS Number	LOR	Unit	ES1005242-001	ES1005242-002	ES1005242-003	ES1005242-004	ES1005242-005
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	3350	4530	1040	258	43
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	96.6	92.7	91.8	91.5	101



Analytical Results

Sub-Matrix: ELUTRIATE

Client sample ID

Client sampling date / time

				SS4D	VC4C(0.5-1M)	SS4F	SS4G	FT1
				22-MAR-2010 12:00	22-MAR-2010 12:00	22-MAR-2010 12:00	22-MAR-2010 12:00	22-MAR-2010 12:00
Compound	CAS Number	LOR	Unit	ES1005242-006	ES1005242-007	ES1005242-008	ES1005242-009	ES1005242-010
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	19	173	20	26	35
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	85.3	88.2	96.7	99.7	99.7



Analytical Results

Sub-Matrix: ELUTRIATE

Client sample ID

Client sampling date / time

				SITE WATER	----	----	----	----
				22-MAR-2010 12:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1005242-011	----	----	----	----
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	12	----	----	----	----
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	85.0	----	----	----	----



Analytical Results

Sub-Matrix: SOIL				Client sample ID	VC4B(0.5-1M)	VC4B(1-1.5M)	VC4B(1.5-2M)	SS4E	SS4B
				Client sampling date / time	05-MAR-2010 15:00	05-MAR-2010 15:00	05-MAR-2010 15:00	05-MAR-2010 15:00	05-MAR-2010 15:00
Compound	CAS Number	LOR	Unit		ES1005242-001	ES1005242-002	ES1005242-003	ES1005242-004	ES1005242-005
EN68: Seawater Elutriate Testing Procedure									
Seawater Sampling Date	----	0.1	-		05/03/10	05/03/10	05/03/10	05/03/10	05/03/10



Analytical Results

Sub-Matrix: SOIL				Client sample ID	SS4D	VC4C(0.5-1M)	SS4F	SS4G	FT1
				Client sampling date / time	05-MAR-2010 15:00	05-MAR-2010 15:00	05-MAR-2010 15:00	05-MAR-2010 15:00	05-MAR-2010 15:00
Compound	CAS Number	LOR	Unit		ES1005242-006	ES1005242-007	ES1005242-008	ES1005242-009	ES1005242-010
EN68: Seawater Elutriate Testing Procedure									
Seawater Sampling Date	----	0.1	-		05/03/10	05/03/10	05/03/10	05/03/10	05/03/10



Analytical Results

Sub-Matrix: SOIL				Client sample ID	SITE WATER	----	----	----	----
				Client sampling date / time	05-MAR-2010 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1005242-011	----	----	----	----
EN68: Seawater Elutriate Testing Procedure									
Seawater Sampling Date	----	0.1	-		05/03/10	----	----	----	----



Surrogate Control Limits

Sub-Matrix: ELUTRIATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP090S: Organotin Surrogate			
Tripropyltin	----	10	108



Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES1005242	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: MS ORLA MURRAY	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: orla.murray@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ---	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING -REBATCH OF ES1004273	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ---	Date Samples Received	: 19-MAR-2010
C-O-C number	: REBATCH	Issue Date	: 31-MAR-2010
Sampler	: OM		
Order number	: 301015-018871/04-REB		
Quote number	: SY/503/09	No. of samples received	: 11
		No. of samples analysed	: 11

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Matt Frost	Organic Instrument Chemist	Organics
Wisam.Marassa	Metals Coordinator	Inorganics



General Comments

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

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

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

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

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

			----						No Limit
--	--	--	------	--	--	--	--	--	----------

- No Laboratory Duplicate (DUP) Results are required to be reported.



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

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

Sub-Matrix: WATER

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			Result	LCS	Low	High
EP090: Organotin Compounds (Soluble) (QCLot: 1289228)								
EP090S: Tributyltin	56573-85-4	2	ngSn/L	----	147 ngSn/L	86.4	29	100
				<2	----	----	----	----



Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) Results are required to be reported.**



Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES1005242	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: MS ORLA MURRAY	Contact	: Charlie Pierce
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: orla.murray@worleyparsons.com	E-mail	: charlie.pierce@alsenviro.com
Telephone	: 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX MAINTENANCE DREDGING -REBATCH OF ES1004273	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: REBATCH	Date Samples Received	: 19-MAR-2010
Sampler	: OM	Issue Date	: 31-MAR-2010
Order number	: 301015-018871/04-REB		
Quote number	: SY/503/09	No. of samples received	: 11
		No. of samples analysed	: 11

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

This Interpretive Quality Control Report contains the following information:

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

Environmental Division Sydney

Part of the **ALS Laboratory Group**

277-289 Woodpark Road Smithfield NSW Australia 2164

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Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EN68: Seawater Elutriate Testing Procedure								
LabSplit: Leach for organics and other tests		05-MAR-2010	---	---	----	22-MAR-2010	19-MAR-2010	✘
VC4B(0.5-1M),	VC4B(1-1.5M),							
VC4B(1.5-2M),	SS4E,							
SS4B,	SS4D,							
VC4C(0.5-1M),	SS4F,							
SS4G,	FT1,							
SITE WATER								
EP090: Organotin Compounds (Soluble)								
Amber Glass Bottle - Unpreserved		22-MAR-2010	26-MAR-2010	29-MAR-2010	✔	30-MAR-2010	05-MAY-2010	✔
VC4B(0.5-1M),	VC4B(1-1.5M),							
VC4B(1.5-2M),	SS4E,							
SS4B,	SS4D,							
VC4C(0.5-1M),	SS4F,							
SS4G,	FT1,							
SITE WATER								



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Control Samples (LCS)							
Organotin Compounds (Soluble)	EP090S	1	1	100.0	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organotin Compounds (Soluble)	EP090S	1	1	100.0	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Organotin Compounds (Soluble)	EP090S	SOIL	USEPA SW 846 - 8270D Sample extracts are analysed by GC/MS coupled with high volume injection and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Preparation Methods	Method	Matrix	Method Descriptions
Seawater Elutriate Testing Procedure	* EN68a	SOIL	USEPA Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Guide, 1991, EPA-503/8-91/001, USEPA and US Army Corps of Engineers. ANZECC Interim Ocean Disposal Guidelines, December, 1998 This Procedure outlines the preparation of leachate designed to simulate release of contaminants from sediment during the disposal of dredged material. Release can occur by physical processes or a variety of chemical changes such as oxidation of metal sulphides and release of contaminants adsorbed to particles or organic matter.
Organotin Sample Preparation	ORG34	SOIL	In-house. A specified volume of sample is spiked with surrogate, acidified and vacuum filtered. Reagents and solvent are added and the mixture tumbled. The butyltin compounds is derivatisated, extracted and the substitution reaction completed. The extract is transferred to a separatory funnel and further extracted two times with petroleum ether. The resultant extracts are combined and concentrated for analysis.



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

Matrix: **SOIL**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EN68: Seawater Elutriate Testing Procedure							
LabSplit: Leach for organics and other tests							
VC4B(0.5-1M),	VC4B(1-1.5M),	----	----	----	22-MAR-2010	19-MAR-2010	3
VC4B(1.5-2M),	SS4E,						
SS4B,	SS4D,						
VC4C(0.5-1M),	SS4F,						
SS4G,	FT1,						
SITE WATER							

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.

Fadi SoroFadi
30/11/11

From: Glenyss Weeks
Sent: Wednesday, 30 November 2011 2:10 PM
To: Fadi Soro
Cc: Nanthini Coilparampil; Wisam Marassa; Wael Saleh
Subject: ReBatch ES1125458 FW: Schedule elutriate testing asap today please
Importance: High

Fadi,

Can you please rebatch the following samples? (including the site water to be used for the elutriation)

WP Sample ID	ALS Sample ID
① SS5D	ES1125458006
② VCSE 0.6-0.8	ES1125458027
③ VCSB 0-0.8	ES1125458031
④ Site water provided with the samples	#25

5280-282, 289-291

Wael- Please log these in for TBT on the elutriate.

Nanthini- can we do the elutriation by the end of this week? I will talk to the client about giving us such short notice for these. I believe this may be the case for Orla's entire project, which will make it impossible for us to meet all holding times.

Thank you,
Glenyss

From: Murray, Orla (Sydney) [mailto:Orla.Murray@WorleyParsons.com]
Sent: Wednesday, 30 November 2011 2:02 PM
To: Glenyss Weeks
Subject: Schedule elutriate testing asap today please
Importance: High

Thanks Glenyss.

Three things.

Can you please arrange for elutriate TBT testing to be undertaken on the following three samples and the site water blank. These will need to be elutriated asap as the holding time for SS5D is up today and tomorrow for the other two samples:

WP Sample ID	ALS Sample ID
SS5D	ES1125458006
VCSE 0.6-0.8	ES1125458027
VCSB 0-0.8	ES1125458031
Site water provided	

Subcon / Forward Lab / Split WO
 Lab / Analysis: ALS Botswana / TBT
 Organised By / Date: _____
 Relinquished By / Date: _____
 Connote / Courier: _____
 WO No: _____
 Attach By PO / Internal Sheet: _____

Telephone : + 61-2-8784 8555

**ES1126468**

Environmental Division
Sydney
Work Order

Fadi SoroFadi
30/11/11

From: Glenyss Weeks
Sent: Wednesday, 30 November 2011 2:10 PM
To: Fadi Soro
Cc: Nanthini Coilparampil; Wisam Marassa; Wael Saleh
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④ Site water provided with the samples	#25

5280-282, 289-291

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WP Sample ID	ALS Sample ID
SS5D	ES1125458006
VCSE 0.6-0.8	ES1125458027
VCSB 0-0.8	ES1125458031
Site water provided	

Subcon / Forward Lab / Split WO
 Lab / Analysis: ALS Botswana / TBT
 Organised By / Date: _____
 Relinquished By / Date: _____
 Connote / Courier: _____
 WO No: _____
 Attach By PO / Internal Sheet: _____

Telephone : + 61-2-8784 8555

**ES1126468**

Environmental Division
Sydney
Work Order

CERTIFICATE OF ANALYSIS

Work Order	: ES1126468	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: MS ORLA MURRAY	Contact	: Client Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: orla.murray@worleyparsons.com	E-mail	: sydney@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ---	Facsimile	: +61-2-8784 8500
Project	: CALTEX	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: REBATCH OF ES1125458	Date Samples Received	: 30-NOV-2011
C-O-C number	: ---	Issue Date	: 12-DEC-2011
Sampler	: OM	No. of samples received	: 4
Site	: ---	No. of samples analysed	: 4
Quote number	: EN/034/11		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Andrew Matheson	Senior Organic Instrument Chemist	Brisbane Organics
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics



General Comments

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

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

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

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

- **EN68: This analysis in accordance with National Ocean Disposal Guidelines, Commonwealth of Australia, 2002 - (modified). Results reported are those determined on a 1:4 sediment/seawater elutriate without blank correction.**



Analytical Results

Sub-Matrix: ELUTRIATE

Client sample ID

Client sampling date / time

				SS5D	VCSE_0.6-0.8	VCSB 0-0.8	SITE WATER	----
				02-DEC-2011 12:00	02-DEC-2011 12:00	02-DEC-2011 12:00	02-DEC-2011 12:00	----
Compound	CAS Number	LOR	Unit	ES1126468-001	ES1126468-002	ES1126468-003	ES1126468-004	----
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	<2	<2	43	<2	----
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	114	89.8	115	106	----



Analytical Results

Sub-Matrix: SOIL

				Client sample ID	SS5D	VCSE_0.6-0.8	VCSB 0-0.8	SITE WATER	----
				Client sampling date / time	17-NOV-2011 15:00	18-NOV-2011 15:00	18-NOV-2011 15:00	18-NOV-2011 15:00	----
Compound	CAS Number	LOR	Unit		ES1126468-001	ES1126468-002	ES1126468-003	ES1126468-004	----
EN68: Seawater Elutriate Testing Procedure									
Seawater Sampling Date	----	0.1	-		02/12/2011	02/12/2011	02/12/2011	02/12/2011	----



Surrogate Control Limits

Sub-Matrix: ELUTRIATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP090S: Organotin Surrogate			
Tripropyltin	----	24	116

QUALITY CONTROL REPORT

Work Order	: ES1126468	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: MS ORLA MURRAY	Contact	: Client Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: orla.murray@worleyparsons.com	E-mail	: sydney@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 30-NOV-2011
Sampler	: OM	Issue Date	: 12-DEC-2011
Order number	: REBATCH OF ES1125458		
Quote number	: EN/034/11	No. of samples received	: 4
		No. of samples analysed	: 4

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Andrew Matheson	Senior Organic Instrument Chemist	Brisbane Organics
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics



General Comments

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

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

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

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

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: WATER

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP090: Organotin Compounds (Soluble) (QC Lot: 2077350)									
EB1125958-001	Anonymous	EP090S: Tributyltin	56573-85-4	2	ngSn/L	<2	<2	0.0	No Limit



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

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

Sub-Matrix: WATER

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			Result	LCS	Low	High
EP090: Organotin Compounds (Soluble) (QCLot: 2077350)								
EP090S: Tributyltin	56573-85-4	2	ngSn/L	<2	147 ngSn/L	90.7	29	115



Matrix Spike (MS) Report

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

Sub-Matrix: WATER

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
					MS	Low	High
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
EP090: Organotin Compounds (Soluble) (QCLot: 2077350)							
EB1125958-002	Anonymous	EP090S: Tributyltin	56573-85-4	147 ngSn/L	102	20	130

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES1126468	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Sydney
Contact	: MS ORLA MURRAY	Contact	: Client Services
Address	: Level 10/141 Walker Street NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: orla.murray@worleyparsons.com	E-mail	: sydney@alsglobal.com
Telephone	: 8907 2131	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 30-NOV-2011
Sampler	: OM	Issue Date	: 12-DEC-2011
Order number	: REBATCH OF ES1125458		
Quote number	: EN/034/11	No. of samples received	: 4
		No. of samples analysed	: 4

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

This Interpretive Quality Control Report contains the following information:

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



Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EN68: Seawater Elutriate Testing Procedure									
LabSplit: Leach for organics and other tests (EN68a) SS5D		17-NOV-2011	---	01-DEC-2011	----	02-DEC-2011	01-DEC-2011	✖	
LabSplit: Leach for organics and other tests (EN68a) VCSE_0.6-0.8, SITE WATER		18-NOV-2011	---	02-DEC-2011	----	02-DEC-2011	02-DEC-2011	✔	
EP090: Organotin Compounds (Soluble)									
Amber Glass Bottle - Unpreserved (EP090S) SS5D, VCSE 0-0.8,		VCSE_0.6-0.8, SITE WATER	02-DEC-2011	07-DEC-2011	09-DEC-2011	✔	07-DEC-2011	16-JAN-2012	✔



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Organotin Compounds (Soluble)	EP090S	1	7	14.3	10.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Organotin Compounds (Soluble)	EP090S	1	7	14.3	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organotin Compounds (Soluble)	EP090S	1	7	14.3	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Organotin Compounds (Soluble)	EP090S	1	7	14.3	5.0	✔	ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Organotin Compounds (Soluble)	EP090S	SOIL	USEPA SW 846 - 8270D Sample extracts are analysed by GC/MS coupled with high volume injection and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Preparation Methods	Method	Matrix	Method Descriptions
Seawater Elutriate Testing Procedure	* EN68a	SOIL	USEPA Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Guide, 1991, EPA-503/8-91/001, USEPA and US Army Corps of Engineers. ANZECC Interim Ocean Disposal Guidelines, December, 1998 This Procedure outlines the preparation of leachate designed to simulate release of contaminants from sediment during the disposal of dredged material. Release can occur by physical processes or a variety of chemical changes such as oxidation of metal sulphides and release of contaminants adsorbed to particles or organic matter.
Organotin Sample Preparation	ORG34	SOIL	In-house. A specified volume of sample is spiked with surrogate, acidified and vacuum filtered. Reagents and solvent are added and the mixture tumbled. The butyltin compounds is derivatisated, extracted and the substitution reaction completed. The extract is transferred to a separatory funnel and further extracted two times with petroleum ether. The resultant extracts are combined and concentrated for analysis.



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

Matrix: SOIL

Method	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EN68: Seawater Elutriate Testing Procedure						
LabSplit: Leach for organics and other tests SS5D	----	----	----	02-DEC-2011	01-DEC-2011	1

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.

Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: ES1220556		
Amendment	: 3		
Client	: CALTEX REFINERIES(NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR SIMON CAPLES	Contact	: Client Services
Address	: 2 SOLANDER ST KURNELL NSW, AUSTRALIA 2231	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scaples@caltex.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX DREDGING REBATCH OF ES1219839 ES1220011	Page	: 1 of 3
Order number	: 301015-03041		
C-O-C number	: ----	Quote number	: ES2012CALREFNSW0182 (SY/389/12 V2)
Site	: ----		
Sampler	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 23-AUG-2012	Issue Date	: 15-NOV-2012 15:59
Client Requested Due Date	: 16-NOV-2012	Scheduled Reporting Date	: 16-NOV-2012

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 4.1'C - Ice present
No. of coolers/boxes	: REBATCH	No. of samples received	: 7
Security Seal	: Intact.	No. of samples analysed	: 7

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
- **Samples received in appropriately pretreated and preserved containers.**
- **TBT analysis will be conducted by ALS Brisbane**
- **Breaches in recommended extraction / analysis holding times may occur. Please refer to the 'Proactive Holding Time Report' below for further details. Please contact ALS if further information is required.**
- **This is a rebatch of ES1219839 & ES1220011**
- 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 (14 days), Solid (60 days) from date of completion of work order.



Sample Container(s)/Preservation Non-Compliances

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

- No sample container / preservation non-compliance exist.

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 to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EP090S Organotins
ES1220556-001	14-AUG-2012 15:00	C5_0.0-0.15	✓	
	28-AUG-2012 12:00	C5_0.0-0.15		✓
ES1220556-002	15-AUG-2012 15:00	C2_0.0-0.5	✓	
	28-AUG-2012 12:00	C2_0.0-0.5		✓
ES1220556-003	15-AUG-2012 15:00	QC5	✓	
	28-AUG-2012 12:00	QC5		✓
ES1220556-004	28-AUG-2012 12:00	ELUTRIATE BLANK		✓
ES1220556-005	16-AUG-2012 15:00	C14_0.0-0.15	✓	
	28-AUG-2012 12:00	C14_0.0-0.15		✓
ES1220556-006	16-AUG-2012 15:00	C15_0.0-0.5	✓	
	28-AUG-2012 12:00	C15_0.0-0.5		✓
ES1220556-007	16-AUG-2012 15:00	C18_0.0-0.5	✓	
	28-AUG-2012 12:00	C18_0.0-0.5		✓

Proactive Holding Time Report

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



Requested Deliverables

MR CARSTEN MATTHAI

- *AU Certificate of Analysis - NATA (COA)	Email	carsten.matthai@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	carsten.matthai@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	carsten.matthai@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental Abridged (SRN Abridged)	Email	carsten.matthai@WorleyParsons.com
- Chain of Custody (CoC) (COC)	Email	carsten.matthai@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	carsten.matthai@WorleyParsons.com

MR SIMON CAPLES

- *AU Certificate of Analysis - NATA (COA)	Email	scaples@caltex.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	scaples@caltex.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	scaples@caltex.com.au
- A4 - AU Sample Receipt Notification - Environmental Abridged (SRN Abridged)	Email	scaples@caltex.com.au
- A4 - AU Tax Invoice (INV)	Email	scaples@caltex.com.au
- Chain of Custody (CoC) (COC)	Email	scaples@caltex.com.au
- EDI Format - ENMRG (ENMRG)	Email	scaples@caltex.com.au

MS CHRISTINA HALIM

- A4 - AU Tax Invoice (INV)	Email	CHalim@caltex.com.au
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MS DEBORAH LAM

- *AU Certificate of Analysis - NATA (COA)	Email	deborah.lam@WorleyParsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	deborah.lam@WorleyParsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	deborah.lam@WorleyParsons.com
- A4 - AU Sample Receipt Notification - Environmental Abridged (SRN Abridged)	Email	deborah.lam@WorleyParsons.com
- Chain of Custody (CoC) (COC)	Email	deborah.lam@WorleyParsons.com
- EDI Format - ENMRG (ENMRG)	Email	deborah.lam@WorleyParsons.com

Client - Matrix:	ELUTRIATE	Sample Type:	REG
Workgroup:	ES1220556	ALS Sample number:	ES1220556001
Project name/nun	CALTEX DREDGING REBATCH OF E	Sample date:	28/08/2012
		Client sample ID (Primary):	C5_0.0-0.15
		Client sample ID (Secondary):	
		Sample Site:	
		Purchase Order:	301015-03041

Analyte grouping/ CAS Number	Units	LOR
------------------------------	-------	-----

EP090: Organotin Compounds (Soluble)			
Tributyltin	56573-85-4 ngSn/L	2	<2
EP090S: Organotin Surrogate			
Tripopyltin	%	0.1	67.7

Client - Matrix:	SEAWATER	Sample Type:	
Workgroup:	ES1220556	ALS Sample number:	
Project name/nun	CALTEX DREDGING REBATCH OF E	Sample date:	
		Client sample ID (Primary):	
		Client sample ID (Secondary):	
		Sample Site:	
		Purchase Order:	

Analyte grouping/ CAS Number	Units	LOR
------------------------------	-------	-----

Client - Matrix:	SOIL	Sample Type:	REG
Workgroup:	ES1220556	ALS Sample number:	ES1220556001
Project name/nun	CALTEX DREDGING REBATCH OF E	Sample date:	14/08/2012
		Client sample ID (Primary):	C5_0.0-0.15
		Client sample ID (Secondary):	
		Sample Site:	
		Purchase Order:	301015-03041

Analyte grouping/ CAS Number	Units	LOR
------------------------------	-------	-----

EA055: Moisture Content			
Moisture Content (dried @ 10 °C)		1	60.8
EN68: Seawater Elutriate Testing Procedure			
Seawater Sampling Date	-	0.1	27/08/2012

QC - Matrix: SOIL
Workgroup: ES1220556

Sample Type: DUP
ALS Sample number: 2927697-004
Sample date: 15/08/2012

Analyte grouping/ CAS Number Units LOR

EA055: Moisture Content
Moisture Content (dried @ 105 °C) 1 27.2

QC - Matrix: WATER
Workgroup: ES1220556

Sample Type: MB
ALS Sample number: 2926967-001
Sample date: 28/08/2012

Analyte grouping/ CAS Number Units LOR

EP090: Organotin Compounds (Soluble)
Tributyltin 56573-85-4 ngSn/L 2 <2

EP090S: Organotin Surrogate
Tripropyltin % 0.1 59.2

REG	REG	REG	REG	REG	REG
ES1220556002	ES1220556003	ES1220556004	ES1220556005	ES1220556006	ES1220556007
28/08/2012	28/08/2012	28/08/2012	28/08/2012	28/08/2012	28/08/2012
C2_0.0-0.5	QC5	ELUTRIATE BLAN	C14_0.0-0.15	C15_0.0-0.5	C18_0.0-0.5

301015-03041	301015-03041	301015-03041	301015-03041	301015-03041	301015-03041
--------------	--------------	--------------	--------------	--------------	--------------

<2	<2	<2	<2	<2	<2
71.8	64.5	75.2	47.9	67.8	65.2

REG	REG	REG	REG	REG	REG
ES1220556002	ES1220556003	ES1220556004	ES1220556005	ES1220556006	ES1220556007
15/08/2012	15/08/2012	15/08/2012	16/08/2012	16/08/2012	16/08/2012
C2_0.0-0.5	QC5	ELUTRIATE BLAN	C14_0.0-0.15	C15_0.0-0.5	C18_0.0-0.5

301015-03041	301015-03041	301015-03041	301015-03041	301015-03041	301015-03041
--------------	--------------	--------------	--------------	--------------	--------------

27.4	26.9	56.8	28.6	23.4
------	------	------	------	------

27/08/2012	27/08/2012	27/08/2012	27/08/2012	27/08/2012	27/08/2012
------------	------------	------------	------------	------------	------------

LCS	DUP	MS
2926967-002	2926967-004	2926967-006
28/08/2012	14/08/2012	15/08/2012

88.5 <2		92.1
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66.7	69.4	57.4
------	------	------

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES1220556	Page	: 1 of 7
Amendment	: 3		
Client	: CALTEX REFINERIES(NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR SIMON CAPLES	Contact	: Client Services
Address	: 2 SOLANDER ST KURNELL NSW, AUSTRALIA 2231	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scaples@caltex.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX DREDGING REBATCH OF ES1219839 ES1220011	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: 301015-03041		
C-O-C number	: ----	Date Samples Received	: 23-AUG-2012
Sampler	: ----	Issue Date	: 15-NOV-2012
Site	: ----		
Quote number	: SY/389/12 V2	No. of samples received	: 7
		No. of samples analysed	: 7

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Evie.Sidarta	Inorganic Chemist	Sydney Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics



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.

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

- **Moisture not done ES1220556#3 due to insufficient sample.**
- **EG093: Positive results for sample ES1220556 # 004 confirmed.**
- **EN68: This analysis in accordance with National Ocean Disposal Guidelines, Commonwealth of Australia, 2002 - (modified). Results reported are those determined on a 1:4 sediment/seawater elutriate without blank correction.**
- **This report has been amended and re-released to remove the reporting of additional analytical data.**
- **This report has been amended to allow the re-distribution of the SRN without incorrectly reported holding time breaches on all elutriate samples.**



Analytical Results

Sub-Matrix: ELUTRIATE

Client sample ID

Client sampling date / time

				C5_0.0-0.15	C2_0.0-0.5	QC5	ELUTRIATE BLANK	C14_0.0-0.15
				28-AUG-2012 12:00	28-AUG-2012 12:00	28-AUG-2012 12:00	28-AUG-2012 12:00	28-AUG-2012 12:00
Compound	CAS Number	LOR	Unit	ES1220556-001	ES1220556-002	ES1220556-003	ES1220556-004	ES1220556-005
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	<2	<2	<2	<2	<2
EP090S: Organotin Surrogate								
Tripropyltin	----	0.1	%	67.7	71.8	64.5	75.2	47.9



Analytical Results

Sub-Matrix: ELUTRIATE

Client sample ID

Client sampling date / time

				C15_0.0-0.5	C18_0.0-0.5			
				28-AUG-2012 12:00	28-AUG-2012 12:00			
Compound	CAS Number	LOR	Unit	ES1220556-006	ES1220556-007			
EP090: Organotin Compounds (Soluble)								
Tributyltin	56573-85-4	2	ngSn/L	<2	<2			
EP090S: Organotin Surrogate								
Tripropyltin		0.1	%	67.8	65.2			



Analytical Results

Sub-Matrix: SOIL				Client sample ID	C5_0.0-0.15	C2_0.0-0.5	QC5	ELUTRIATE BLANK	C14_0.0-0.15
				Client sampling date / time	14-AUG-2012 15:00	15-AUG-2012 15:00	15-AUG-2012 15:00	15-AUG-2012 15:00	16-AUG-2012 15:00
Compound	CAS Number	LOR	Unit		ES1220556-001	ES1220556-002	ES1220556-003	ES1220556-004	ES1220556-005
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1.0	%		----	----	26.9	----	----
Moisture Content (dried @ 103°C)	----	1.0	%		60.8	27.4	----	----	56.8
EN68: Seawater Elutriate Testing Procedure									
Seawater Sampling Date	----	0.1	-		27/08/12	27/08/12	27/08/12	27/08/12	27/08/12



Analytical Results

Sub-Matrix: SOIL

				Client sample ID				
				Client sampling date / time				
Compound	CAS Number	LOR	Unit					
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%					
EN68: Seawater Elutriate Testing Procedure								
Seawater Sampling Date	----	0.1	-					



Surrogate Control Limits

Sub-Matrix: ELUTRIATE		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP090S: Organotin Surrogate			
Tripropyltin	----	24	116

Environmental Division

QUALITY CONTROL REPORT

Work Order	: ES1220556	Page	: 1 of 4
Amendment	: 3		
Client	: CALTEX REFINERIES(NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR SIMON CAPLES	Contact	: Client Services
Address	: 2 SOLANDER ST KURNELL NSW, AUSTRALIA 2231	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scaples@caltex.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX DREDGING REBATCH OF ES1219839 ES1220011	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 23-AUG-2012
Sampler	: ----	Issue Date	: 15-NOV-2012
Order number	: 301015-03041		
Quote number	: SY/389/12 V2	No. of samples received	: 7
		No. of samples analysed	: 7

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

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

Signatories	Position	Accreditation Category
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Evie Sidarta	Inorganic Chemist	Sydney Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics



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.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 2470708)									
ES1220556-003	QC5	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	26.9	27.2	1.3	0% - 20%
Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP090: Organotin Compounds (Soluble) (QC Lot: 2470025)									
ES1220556-001	C5_0.0-0.15	EP090S: Tributyltin	56573-85-4	2	ngSn/L	<2	<2	0.0	No Limit



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

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

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			LCS	Low	High
EP090: Organotin Compounds (Soluble) (QCLot: 2470025)								
EP090S: Tributyltin	56573-85-4	2	ngSn/L	<2	147 ngSn/L	88.5	24	120

Matrix Spike (MS) Report

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

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number		MS	Low	High
EP090: Organotin Compounds (Soluble) (QCLot: 2470025)							
ES1220556-002	C2_0.0-0.5	EP090S: Tributyltin	56573-85-4	147 ngSn/L	92.1	20	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

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

Sub-Matrix: WATER				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report					
				Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number		MS	MSD	Low	High	Value Control Limit
EP090: Organotin Compounds (Soluble) (QCLot: 2470025)									
ES1220556-002	C2_0.0-0.5	EP090S: Tributyltin	56573-85-4	147 ngSn/L	92.1	----	20	130	----

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES1220556	Page	: 1 of 5
Amendment	: 3		
Client	: CALTEX REFINERIES(NSW) PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR SIMON CAPLES	Contact	: Client Services
Address	: 2 SOLANDER ST KURNELL NSW, AUSTRALIA 2231	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scaples@caltex.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: CALTEX DREDGING REBATCH OF ES1219839 ES1220011	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 23-AUG-2012
Sampler	: ----	Issue Date	: 15-NOV-2012
Order number	: 301015-03041		
Quote number	: SY/389/12 V2	No. of samples received	: 7
		No. of samples analysed	: 7

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

This Interpretive Quality Control Report contains the following information:

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



Analysis Holding Time Compliance

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

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

Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content								
Soil Glass Jar - Unpreserved (EA055-103) C5_0.0-0.15		14-AUG-2012	----	----	----	28-AUG-2012	28-AUG-2012	✓
Soil Glass Jar - Unpreserved (EA055-103) C2_0.0-0.5, QC5		15-AUG-2012	----	----	----	28-AUG-2012	29-AUG-2012	✓
Soil Glass Jar - Unpreserved (EA055-103) C14_0.0-0.15, C18_0.0-0.5		16-AUG-2012	----	----	----	28-AUG-2012	30-AUG-2012	✓
EN68: Seawater Elutriate Testing Procedure								
LabSplit: Leach for organics and other tests (EN68a) C5_0.0-0.15		14-AUG-2012	---	28-AUG-2012	----	28-AUG-2012	28-AUG-2012	✓
LabSplit: Leach for organics and other tests (EN68a) C2_0.0-0.5, QC5, ELUTRIATE BLANK		15-AUG-2012	---	29-AUG-2012	----	28-AUG-2012	29-AUG-2012	✓
LabSplit: Leach for organics and other tests (EN68a) C14_0.0-0.15, C18_0.0-0.5		16-AUG-2012	---	30-AUG-2012	----	28-AUG-2012	30-AUG-2012	✓
EP090: Organotin Compounds (Soluble)								
Amber Glass Bottle - Unpreserved (EP090S) C5_0.0-0.15, QC5, C14_0.0-0.15, C18_0.0-0.5		28-AUG-2012	28-AUG-2012	04-SEP-2012	✓	28-AUG-2012	07-OCT-2012	✓
C2_0.0-0.5, ELUTRIATE BLANK, C15_0.0-0.5,								



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	1	6	16.7	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Organotin Compounds (Soluble)	EP090S	1	7	14.3	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Organotin Compounds (Soluble)	EP090S	1	7	14.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Organotin Compounds (Soluble)	EP090S	1	7	14.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Organotin Compounds (Soluble)	EP090S	1	7	14.3	5.0	✓	ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2010 Draft) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
1M HCl Extractable Metals	EG005-SDH	SOIL	APHA 21st ed., 3120; USEPA SW 846 - 6010. Metals are determined via ICPAES following weak acid extraction. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (1999) Schedule B(3). LORs per NAGD.
1M HCl Extractable Metals by ICPMS	EG020-SDH	SOIL	APHA 21st ed., 3125; USEPA SW846 - 6020. Metals are determined via ICPMS following weak acid extraction. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. Analyte list and LORs per NAGD.
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	SOIL	APHA 21st ed., 3125; USEPA SW846 - 6020 Samples are 0.45 um filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	SOIL	APHA 21st ed., 3125; USEPA SW846 - 6020 Samples are 0.45 um filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Organotin Compounds (Soluble)	EP090S	SOIL	USEPA SW 846 - 8270D Sample extracts are analysed by GC/MS coupled with high volume injection and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals - ORC	EN25-ORC	SOIL	Modified USEPA SW846-3005. This is an Ultrapure Nitric acid digestion procedure used to prepare surface and ground water samples for analysis by ORC- ICPMS. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Seawater Elutriate Testing Procedure	* EN68a	SOIL	USEPA Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Guide, 1991, EPA-503/8-91/001, USEPA and US Army Corps of Engineers. ANZECC Interim Ocean Disposal Guidelines, December, 1998 This Procedure outlines the preparation of leachate designed to simulate release of contaminants from sediment during the disposal of dredged material. Release can occur by physical processes or a variety of chemical changes such as oxidation of metal sulphides and release of contaminants adsorbed to particles or organic matter.
1M HCl Extraction for Metals in Sediments (1 hour)	EN71	SOIL	In house, Allen (1993) Mod. 1g of sample is leached at room temperature for 1 hour in 10% hydrochloric acid. The resultant extract is filtered and bulked for analysis of extracted metals.
Organotin Sample Preparation	ORG34	SOIL	In-house. A specified volume of sample is spiked with surrogate, acidified and vacuum filtered. Reagents and solvent are added and the mixture tumbled. The butyltin compounds is derivatisated, extracted and the substitution reaction completed. The extract is transferred to a separatory funnel and further extracted two times with petroleum ether. The resultant extracts are combined and concentrated for analysis.



Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

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

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

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

- No Quality Control Sample Frequency Outliers exist.

Due - wed (Loren)

290812

Loren Schiavon

Received by

From: Matthai, Carsten (Sydney) <Carsten.Matthai@WorleyParsons.com>
Sent: Thursday, 23 August 2012 4:07 PM
To: Loren Schiavon
Cc: Taylor, Ben (Sydney)
Subject: RE: Results ES1219839
Attachments: image001.jpg

Carsten
23/8 17:40

Hi Loren,

I would like to order the analysis of **elutriate and bioavailability analyses**, as per NAGD requirements for a total of six samples (including one replicate sample) plus one elutriate blank sample (i.e. the seawater blank submitted in the large carboy). The analyses are required for As, TBT and Se, with Se reported on a separate CoA.

The samples to be analysed using a fast TAT, and for which there should be sufficient material for elutriate analyses, are as follows (**please confirm sufficient sample availability for the analyses and the approximate reporting date, preferably within 5 business days**):

Batch ES1219839: Sample IDs: C5_0.0-0.15; C2_0.0-0.5; QC5; Elutriate Blank (4 samples) — tray S610-612

Batch ES1220011: Sample IDs: C14_0.0-0.15; C15_0.0-0.5; C18_0.0-0.5 (3 samples) — tray S618-619

The above seven samples should be analysed for bioavailability (i.e. 1 M HCl extracts) for As and Se and for elutriates (TBT, As and Se) (Note: Se to be reported on a different CoA).

Invoicing should be directly to Simon Caples at Caltex. — CALREFNSW.

Please confirm the above at your earliest convenience. Many thanks to you and your team who are doing a fantastic job on this project (and you can quote me on that to Geoff Anderson).

Regards,

Carsten

Carsten Matthai, BSc(Hons), PhD

Environmental Scientist

Ports and Marine Terminals, Coastal and Ocean Engineering

WorleyParsons

Tel: +61 2 89236798 (direct)

Mob: +61 4 1133 1112

Fax: +61 2 8923 6877

Level 12, 141 Walker St., North Sydney, NSW, 2060

PO Box 1812 North Sydney NSW 2059

From: Loren Schiavon [mailto:loren.schiavon@alsglobal.com]

Sent: Wednesday, 22 August 2012 10:44 AM

To: Matthai, Carsten (Sydney)

Subject: RE: Results ES1219839

Hi Carsten,

I have asked sample receipt to find the samples you mentioned to prepare them for elutriate analysis

The minimum volume we have for these samples is approximately 50g

Substn / Forward Lab / Split WO
Lab / Analysis: ALS Brisbane/
Organised By / Date: TBT on
Relinquished By / Date: elutriate
Connote / Courier: _____
WO No: _____
Attach By PO / Internal Sheet: _____

Loren Schiavon

From: Matthai, Carsten (Sydney) <Carsten.Matthai@WorleyParsons.com>
Sent: Thursday, 23 August 2012 4:07 PM
To: Loren Schiavon
Cc: Taylor, Ben (Sydney)
Subject: RE: Results ES1219839
Attachments: image001.jpg

Received by
Raswithe
23/8 17:00

Hi Loren,

I would like to order the analysis of elutriate and bioavailability analyses, as per NAGD requirements for a total of six samples (including one replicate sample) plus one elutriate blank sample (i.e. the seawater blank submitted in the large carboy). The analyses are required for As, TBT and Se, with Se reported on a separate CoA.

The samples to be analysed using a fast TAT, and for which there should be sufficient material for elutriate analyses, are as follows (please confirm sufficient sample availability for the analyses and the approximate reporting date, preferably within 5 business days):

Batch ES1219839: Sample IDs: C5_0.0-0.15, C2_0.0-0.5, QC5, Elutriate Blank (4 samples) — tray S610-612
Batch ES1220011: Sample IDs: C14_0.0-0.15, C15_0.0-0.5, C18_0.0-0.5 (3 samples) — tray S618-619

The above seven samples should be analysed for bioavailability (i.e. 1 M HCl extracts) for As and Se and for elutriates (TBT, As and Se) (Note: Se to be reported on a different CoA).

Invoicing should be directly to Simon Caples at Caltex.

Please confirm the above at your earliest convenience. Many thanks to you and your team who are doing a fantastic job on this project (and you can quote me on that to Geoff Anderson).

Regards,
Carsten
Carsten Matthai, BSc(Hons), PhD
Environmental Scientist
Ports and Marine Terminals, Coastal and Ocean Engineering
WorleyParsons
Tel: +61 2 89236798 (direct)
Mob: +61 4 1133 1112
Fax: +61 2 8923 6877
Level 12, 141 Walker St., North Sydney, NSW, 2060
PO Box 1812 North Sydney NSW 2059

Ignore this comment.
Se can be reported in the
same batch as discussed between
Loren & the client J.L.

From: Loren Schiavon [mailto:loren.schiavon@alsglobal.com]
Sent: Wednesday, 22 August 2012 10:44 AM
To: Matthai, Carsten (Sydney)
Subject: RE: Results ES1219839

Hi Carsten,

I have asked sample receipt to find the samples you mentioned to prepare them for elutriate analysis.

The minimum volume we have for these samples is approximately 50g.



CHAIN OF CUSTODY

ALS Laboratory:
please tick →

ADLAIDE 21 Burns Road Pokara SA 5095

Ph: 05 8359 0590 E: adelaide@alsglobal.com

BRISBANE 32 Strand Street Stafford QLD 4053

Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Calamansah Drive Clinton QLD 4680

Ph: 07 1471 5993 E: gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740

Ph: 07 4944 0177 E: mackay@alsglobal.com

MELBOURNE 24 Westall Road Springvale VIC 3171

Ph: 03 8549 0600 E: samples.melbourne@alsglobal.com

MURDOCH 27 Sydney Road Mudgee NSW 2850

Ph: 02 6372 8735 E: mudgee.mel@alsglobal.com

NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304

Ph: 02 4968 0433 E: samples.newcastle@alsglobal.com

NOOWRA 4/13 Geary Place North Nowra NSW 2541

Ph: 024423 2063 E: nowra@alsglobal.com

PERTH 10 Head Way Malaga WA 6000

Ph: 08 9209 7855 E: samples.perth@alsglobal.com

SYDNEY 277-288 Woodpark Road Smithfield NSW 2164

Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Orama Court Bohra QLD 4818

Ph: 07 4796 0600 E: samples.townsville@alsglobal.com

WELLINGTON 88 Kaitake Street Mairangi Bay Auckland 06100

Ph: 06 4206 3126 E: j.parker@alsglobal.com

CLIENT: CALTEX

OFFICE: WorleyParsons Office (141 Walker ST, North Sydney NSW 2060)

PROJECT: Caltex Dredging

ORDER NUMBER: 301015-03041

PROJECT MANAGER: Ben Taylor

SAMPLER: Carsten Matthai

CO emailed to ALS? (YES / NO) No

Email Reports to: Carsten.Matthai@WorleyParsons.com and Deborah.Lam@WorleyParsons.com

Email Invoice to (will default to PM if no other addresses are listed): CHallim@caltex.com.au

TURNAROUND REQUIREMENTS:

(Standard TAT may be longer for some tests
e.g. Ultra Trace Organics)

ALS QUOTE NO.: SY/389/12 V2

3 DAY TAT REQUIRED

☒ Non-Standard or urgent TAT (List due date):

DOC SEQUENCE NUMBER (Circle)

DOC: 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
Preserve (frozen) bags present upon receipt? Yes No N/A
Random Sample Temperature on Receipt? Yes No N/A
Other comments:

CONTACT PH: 0402 406624

SAMPLER MOBILE: 0411 331112

EDD FORMAT (or default):

RELINQUISHED BY: Carsten Matthai

DATE/TIME: 15/8/12 4:30pm

RECEIVED BY: Frankus

DATE/TIME: 15-8-12 1800

RELINQUISHED BY:

DATE/TIME:

RECEIVED BY:

DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (to codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED including SURTES (NB. Suite Codes must be listed to attract suite price Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered to required).							
						ALS SYDNEY				ALS (Newcastle)			
						Super Ultra trace PAHS (EP132-SD)	Trace Metals (Suite SD-3) -Ag, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, Se, V, Zn	HCL Extractable Metals (SD-4)	TOC (LECO) (EP003)	TBT (EP090)	Particle Size (Hydrometer) (EA150-H)	HOLD for potential elutriate testing	
1	C13_00-0.5	14/8/12	Sediment	Various	4 jars 1 bag	✓	✓		✓	✓	✓	✓	Hold all primary samples for possible elutriate analysis and weak acid extraction and analysis
2	C3_00-0.1	"	Sediment	Various	2 jars	✓	✓		✓	✓	✓	✓	
3	C4_00-0.1	"	Sediment	Various	2 jars	✓	✓		✓	✓	✓	✓	
4	C5_00-0.15	"	Sediment	Various	4 jars 1 bag	✓	✓		✓	✓	✓	✓	Small volume in PSD bag and one "hold" jar for elutriate
5	C6_00-0.13	"	Sediment	Various	2 jars	✓	✓		✓	✓	✓	✓	
6	C7_00-0.10	"	Sediment	Various	2 jars 1 bag	✓	✓		✓	✓	✓	✓	
7	QC1	"	Sediment	Various	2 jars	✓	✓		✓	✓	✓	✓	
8	QC3	"	Sediment	Various	1 jar		✓						PSD
TOTAL						22							

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORG = Nitric Preserved ORC; SH = Sodium Hydroxide Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Amber Glass 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 Specimen bottles; 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.

Attach By PO / Internal Sheet:



CHAIN OF CUSTODY

ALS Laboratory
08 9559 1000

ADELAIDE 21 Duma Road, Pooraka SA 5095
Ph: 08 8359 0900 E: adelaide@alsglobal.com
BRISBANE 32 Shend Street, Stafford QLD 4053
Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 46 Caledon Drive, Clinton QLD 4680
Ph: 07 7471 5600 E: gladstone@alsglobal.com

DMACKAY 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 9500 E: samples.melbourne@alsglobal.com
DMLDGE 27 Sydney Road, Mudgee NSW 2850
Ph: 02 6372 6735 E: mudgee@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 2083 E: nowra@alsglobal.com
PERTH 10 Hod Way, Malaga WA 6090
Ph: 08 9209 7655 E: samples.perth@alsglobal.com

SYDNEY 277-289 Woodpark Road, Smithfield NSW 2164
Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
TOWNSVILLE 14-15 Duma Court, Bohle QLD 2818
Ph: 07 4796 0800 E: townsville.environmental@alsglobal.com
WOLLONGONG 89 Kenny Street, Wollongong NSW 2500
Ph: 02 4225 3125 E: port Kembla@alsglobal.com

CLIENT: CALTEX

OFFICE: Wily WorleyParsons Office (141 Walker ST, North Sydney NSW 2080)

PROJECT: Caltex Dredging

ORDER NUMBER: 301015-03041

PROJECT MANAGER: Ben Taylor

SAMPLER: Carsten Matthai

COC emailed to ALS? (YES / NO)

No

EDD FORMAT (or default):

Email Reports to: Carsten.Matthai@WorleyParsons.com and Deborah.Lam@WorleyParsons.com

Email Invoice to (will default to PM if no other addresses are listed): CHallm@caltex.com.au

TURNAROUND REQUIREMENTS:
(Standard TAT may be longer for some tests
e.g., Ultra Trace Organics)

ALS QUOTE NO.: SY389/12 V2

3 DAY TAT REQUIRED

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

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7

OP: 1 2 3 4 5 6 7

RELINQUISHED BY:

Carsten Matthai

DATE/TIME: 15-8-12
4:30pm

RECEIVED BY:

Frankie MS

DATE/TIME: 15-8-12 1300

RELINQUISHED BY:

RECEIVED BY:

DATE/TIME:

DATE/TIME:

FOR LABORATORY USE ONLY (Circle)

Custody Seal intact?	YCD	No	N/A
Freeze/ice frozen ice bricks present upon receipt?	YCD	No	N/A
Random Sample Temperature on Receipt			
Other comment			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (to codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (filtered bottle required).							Additional Information
						ALS Sydney	ALS Newcastle	ALS Melbourne	ALS Perth	ALS Brisbane	ALS Adelaide	ALS Wollongong	
						Super Ultratrace PAHS (EP132-SD)	Trace Metals (Suite SD-3) Ag, As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Se, V, Zn	HCL Extractable Metals (SD-4)	TOC (LECO) (EP003)	TBT (EP080)	Particle Size (Hydrometer) (EA150-H)	HOLD for potential elutriate testing	
9	C2-0.0-0.5	15-8-12	Sediment	Various	4 jars	✓	✓		✓	✓	✓	✓	
10	C1-0-0.55	15-8-12	Sediment	Various	4 jars	✓	✓		✓	✓	✓	✓	Hold all primary samples for possible elutriate analysis and weak acid extraction and analysis
11	C10-0-0.50	15-8-12	Sediment	Various	4 jars	✓	✓		✓	✓	✓	✓	
12	C10-0.5-1.0	15-8-12	Sediment	Various	4 jars	✓	✓		✓	✓	✓	✓	
13	C10-1.0-1.5	15-8-12	Sediment	Various	4 jars	✓	✓		✓	✓	✓	✓	
14	QC6	15-8-12	Sediment	Various	2 jars	✓	✓		✓	✓	✓	✓	
15	QC4	15-8-12	Sediment	Various	1 jar		✓						
16	QC5	15-8-12	Sediment	Various	2 jars								
17	T01A	15-8-12	Sediment	Various	4 jars	✓	✓		✓	✓		✓	
18	T01B	15-8-12	Sediment	Various	4 jars	✓	✓		✓	✓		✓	SEAWATER TO BE PLACED ON HOLD FOR POSSIBLE ELUTRIATE ANALYSIS
TOTAL						37							

Water Containers: Codes: N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Ca Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulfate 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 Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.



CHAIN OF CUSTODY

ALG Laboratory
Please tick →

ADELAIDE 21 Burnside Road Pooraka SA 5095
Ph: 08 4358 0880 E: adelaide@alglobal.com
BRISBANE 32 Shand Street Stafford QLD 4053
Ph: 07 3243 7222 E: samples.brisbane@alglobal.com
GLADSTONE 46 Callamondah Drive Clinton QLD 4680
Ph: 07 7471 5800 E: gladstone@alglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740
Ph: 07 4944 0177 E: mackay@alglobal.com
MELBOURNE 2-4 Westall Road Springvale VIC 3171
Ph: 03 8549 9800 E: samples.melbourne@alglobal.com
MUDGEE 27 Sydney Road Mudgee NSW 2850
Ph: 02 6372 8735 E: mudgee.mal@alglobal.com

NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304
Ph: 02 4968 9433 E: samples.newcastle@alglobal.com
NOWRA 4113 Geary Place North Nowra NSW 2541
Ph: 024423 2063 E: nowra@alglobal.com
PERTH 10 Hed Way Malaga WA 6060
Ph: 08 9203 7655 E: samples.perth@alglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164
Ph: 02 8784 0555 E: samples.sydney@alglobal.com
TOWNSVILLE 14-15 Deasma Court Bona QLD 4818
Ph: 07 4796 0800 E: townsville.environmental@alglobal.com
WOLLONGONG 99 Kenny Street Wollongong NSW 2503
Ph: 02 4225 3125 E: portkembala@alglobal.com

CLIENT: CALTEX

TURNAROUND REQUIREMENTS:

3 DAY TAT REQUIRED

(Standard TAT may be longer for some tests e.g., Ultra Trace Organics)

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

OFFICE: c/o WorleyParsons Office (141 Walker ST, North Sydney NSW 2060)

PROJECT: Caltex/Dredging

ALS QUOTE NO.: SY/389/12 V2

ORDER NUMBER: 301015-03041

PROJECT MANAGER: Ben Taylor

CONTACT PH: 0402 406624

SAMPLER: Carsten Matthal

SAMPLER MOBILE: 0411 331112

COC emailed to ALS? (YES / NO)

No

EDD FORMAT (or default):

Email Reports to: Carsten.Matthal@WorleyParsons.com and Deborah.Lam@WorleyParsons.com

Email Invoice to (will default to PM if no other addresses are listed): CHallm@caltex.com.au

RELINQUISHED BY:

Carsten Matthal

DATE/TIME:

15-8-12 4:30pm

RECEIVED BY:

FRANNE MS

DATE/TIME:

15-8-12 1800

FOR LABORATORY USE ONLY (Circle)

Custody Seal intact?	Yes	No	NA
Free ice / frozen ice bricks present upon receipt?	Yes	No	NA
Random Sample Temperature on Receipt:	C		
Other comment:			

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).							Additional Information	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <i>(to codes below)</i>	(refer)	TOTAL CONTAINERS	ALS SYDNEY		ALS NEWCASTLE		ALS			
							Super Ultratrace PAHS (EP132-SD)	Trace Metals (Suite SD-3) Ag, As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Se, Zn	HCL Extractable Metals (SD-4)	TOC (LECO) (EP003)	TBT (EP030)	Particle Size (Hydrometer) (EA150-1)	HOLD for potential elutriate testing	Comments on likely contaminant levels, dilutions or samples requiring specific QC analysis etc.
19	C12-0.0-0.5	15-8-12	Sediment	Various		4 jars	✓	✓		✓	✓		✓	
20	C12-0.5-1.0	"	Sediment	Various		4 jars 1 bag	✓	✓		✓	✓	✓	✓	Hold as primary samples for possible elutriate testing 15% and weak acid extraction and analysis
21	C12-1.0-1.5	"	Sediment	Various		4 jars	✓	✓		✓	✓		✓	
22	C8-0.0-0.12	"	Sediment	Various		2 jars 1 bag	✓	✓		✓	✓	✓	✓	may be the natural background level?
23	C9-0.0-0.45	"	Sediment	Various		4 jars	✓	✓		✓	✓		✓	
			Sediment	Various										
			Sediment	Various										
			Sediment	Various										
			Sediment	Various										
24	Elutriate blank	15-8-12	Water			20L (X1) continue							✓	
TOTAL						21 (incl. 20L container)								

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (0.1N)
V = VOA Vial (100 mL)

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; APS = Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Disulphate 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 = Formic Acid Preserved Plastic; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.



WorleyParsons

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CALTEX REFINERIES NSW

CALTEX KURNELL PORT AND BERTHING PROJECT, BOTANY BAY, NSW

SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

WHOLE SEDIMENT TOXICITY LABORATORY RESULTS

Chronic Amphipod Reproduction Test Report CAR008

Client: Worley Parsons, Ali Watters
Project: Caltex Dredged Sediments
Test Performed: 10-day chronic amphipod reproduction toxicity test using the amphipod *Melita plumulosa*

Sampled:	4-5/03/2010	Test Initiated:	26/03/2010
Arrived:	4-5/03/2010		
CSIRO Sample No.	Sample Name	Sample Description	
E10008	VC4B (1.5-2m)	Very coarse sandy sediment (505 µg Sn/kg, norm 1%TOC)	
E10016	SS4D	Very coarse sandy sediment (1040 µg Sn/kg, norm 1%TOC)	
E10021	VC4C (0.5-1m)	Very coarse sandy sediment (231 µg Sn/kg, norm 1%TOC)	
E10022	VC4C (1-1.5m)	Very coarse sandy sediment (blind control) (<70 µg Sn/kg, norm 1%TOC blind control)	

Test Method: This test measures the survival and number of amphipod (*Melita plumulosa*) embryos in the second brood following exposure to undiluted test sediments over a 10 day period. Sediments were homogenised immediately prior to being added to test vials (40 g sediment per 250 ml vial, 5 replicates per sediment). Filtered seawater (30 ‰) was added, and each beaker was incubated at 21°C with aeration overnight to allow sediments to settle. The following day, overlying water was replaced, five gravid females (gravid for <24 h) and 7 males were randomly assigned to each beaker. Amphipods used in the tests were isolated from laboratory cultures. The test sediments were renewed after 5 days by gently sieving away the adults and placing them into a new sub-sample of the same test sediment that had been equilibrated overnight. This allows for the removal of juveniles from the first brood which is typically less affected by contaminants in the test sediment. On day 10 the number of embryos per female are counted by microscopy and expressed as a percentage of the blind control (VC4C 1-1.5m). The sediment was also checked (by sieving the sediment through 180 µm mesh) for juvenile amphipods that had escaped the marsupium during the latter stages of the test. Physio-chemical parameter (temperature, pH, salinity and dissolved oxygen) were measured throughout the test. A silty control was also tested for quality assurance purposes. All treatments were fed at a rate of 1 mg sera micron® fish food/amphipod twice a week. Statistical significance between treatments was calculated using ToxCalc Version 5.0.23 (Tidepool Software)

Results: The number of embryos per female in the silty control was within the test acceptability limits of 10-18 embryos per female. There was no statistical significant difference ($p=0.05$) in embryos per female or survival between any of the sediments and the blind control (VC4C 1-1.5 m) which contained $<70 \mu\text{g}$ Sn/kg (normalised to 1% TOC). Therefore all the test sediments were considered to be non-toxic to the reproduction and survival of the amphipod.

Sediment	Survival (% survival)	% of Control^a	Embryos per female	% of Control^a
Silty control	90 ± 3^b	NA	11 ± 1	NA
VC4C (1-1.5m) blind control	75 ± 9	100 ± 12	8 ± 1	100 ± 15
VC4B (1.5-2m)	85 ± 3	113 ± 4	8 ± 1	99 ± 10
SS4D	92 ± 3	122 ± 4	9 ± 1	108 ± 13
VC4C (0.5-1m)	78 ± 7	104 ± 10	8 ± 1	101 ± 9

^a Calculated as a percent of the blind control.

^b Standard error calculated on the five replicate samples.

Quality Assurance/Quality Control: Criteria	Range	Criterion Met?
$\geq 80\%$ survival in silty control	$90 \pm 3\%$	Yes
10-18 embryos per female produced in silty control	11 ± 1	Yes
pH of overlying water in test beakers	8.0 ± 0.2	Yes
Salinity of overlying water in test beakers	$30 \pm 2\text{‰}$	Yes
Dissolved oxygen in overlying water in test beakers	$>80\%$	Yes
Temperature of overlying water in test beakers	$21 \pm 1^\circ\text{C}$	Yes

Test carried out by: David Spadaro and Ian Hamilton
 Test supervised by: Stuart Simpson (ph: 02 9710 6807)

Test report prepared by: David Spadaro (ph: 02 9710 6801)

Date: 13/04/2010



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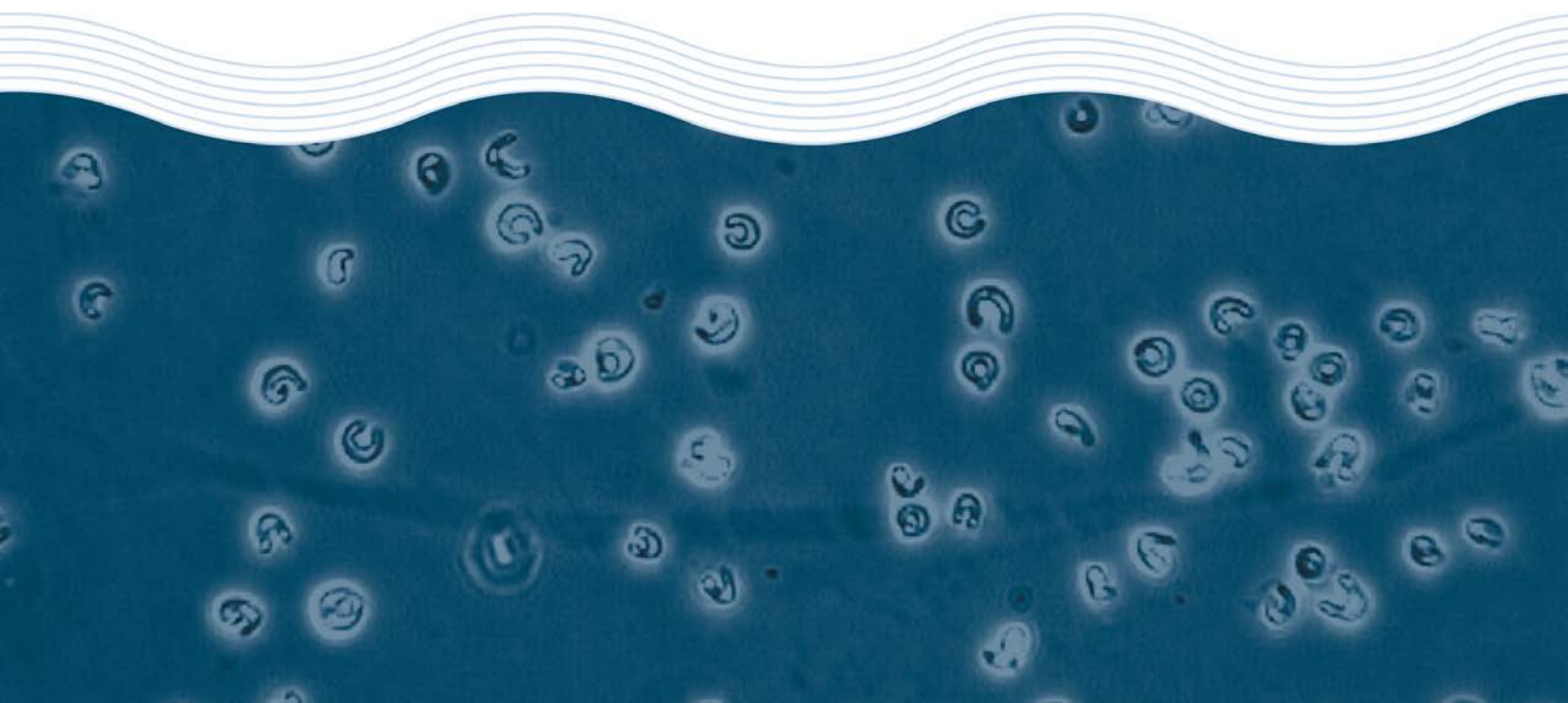
SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

ELUTRIATE TOXICITY TESTING LABORATORY RESULTS

Toxicity Assessment of Four Sediment Elutriates

**CSIRO Centre for Environmental
Contaminants Research**

April 2010



Toxicity Assessment of Four Sediment Elutriates

**CSIRO Centre for Environmental
Contaminants Research**

April 2010

Toxicity Test Report: TR0588/1

(page 1 of 3)

This document is issued in accordance with NATA's accreditation requirements

Client:	CSIRO Centre for Environmental Contaminants and Research Locked Mail Bag 2007 Kirrawee NSW 2232	ESA Job #:	PR0588
Attention:	David Spadaro	Date Sampled:	5 March 2010
Client Ref:	Not Supplied	Date Received:	17 April 2010
		Sampled By:	Client
		ESA Quote #:	PL0588_q01

Lab ID No.:	Sample Name:	Sample Description:
4128	VC4B (0.5-1M), whole sediments	Sediment sample received chilled in apparent good condition.
4129	VC4B (1.5-2M), whole sediments	Sediment sample received chilled in apparent good condition.
4130	VC4C (0.5-1M), whole sediments	Sediment sample received chilled in apparent good condition.
4131	SS4G, whole sediments	Sediment sample received chilled in apparent good condition.

Test Performed:	48-hr larval development test using the rock oyster <i>Saccostrea commercialis</i>
Test Protocol:	ESA SOP 106 (ESA 2009), based on APHA (1998) and Krassoi (1995)
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Test was performed in polycarbonate vials instead of glass tissue vials as requested.
Comments on Solution Preparation:	Sediment elutriates were prepared according to USEPA (1991). One hundred millilitres of sediment was mixed with 400 mL filtered seawater (FSW). The mixture was stirred vigorously for 30 min with a magnetic stirrer. At 10 min intervals, the mixture was also stirred manually to ensure thorough mixing of the sediment and solution. The mixture was allowed to settle for 1 h before the supernatant was carefully siphoned off without disturbing the sediment. Total ammonia and sulphide concentrations for all of the prepared elutriates were below the detection limits of 2.0mg/L and 0.10mg/L, respectively. The sediment elutriates were serially diluted with FSW to achieve the test concentrations. A FSW control was tested concurrently with the samples.
Source of Test Organisms:	Farm-reared, Wallis Lakes, NSW.
Test Initiated:	22 April 2010 at 2000h

Toxicity Test Report: TR0588/1

(page 2 of 3)

Sample 4128: VC4B (0.5-1M)		Sample 4129: VC4B (1.5-2M)		Sample 4130: VC4C (0.5-1M)	
Concentration (%)	% Alive/Normal larvae (Mean ± SD)	Concentration (%)	% Alive/Normal larvae (Mean ± SD)	Concentration (%)	% Alive/Normal larvae (Mean ± SD)
FSW Control	72.8 ± 4.2	FSW Control	72.8 ± 4.2	FSW Control	72.8 ± 4.2
6.3	72.8 ± 3.8	6.3	72.8 ± 5.8	6.3	67.2 ± 5.6
12.5	68.3 ± 9.0	12.5	68.3 ± 5.6	12.5	71.1 ± 7.9
25	69.4 ± 6.1	25	67.2 ± 4.9	25	68.3 ± 4.9
50	71.7 ± 4.6	50	70.6 ± 7.3	50	68.3 ± 2.1
100	74.4 ± 5.6	100	72.2 ± 5.3	100	62.8 ± 9.5
48-hr EC10 = >100%		48-hr EC10 = >100%		48-hr EC10 = 82.6% *	
48-hr EC50 = >100%		48-hr EC50 = >100%		48-hr EC50 = >100%	
NOEC = 100%		NOEC = 100%		NOEC = 100%	
LOEC = >100%		LOEC = >100%		LOEC = >100%	

* 95% confidence limits are not available

Sample 4131: SS4G		Vacant	Vacant
Concentration (%)	% Alive/Normal larvae (Mean ± SD)		
FSW Control	72.8 ± 4.2		
6.3	72.2 ± 5.9		
12.5	68.3 ± 9.3		
25	65.0 ± 4.9		
50	70.0 ± 9.0		
100	68.3 ± 5.8		
48-hr EC10 = >100%			
48-hr EC50 = >100%			
NOEC = 100%			
LOEC = >100%			

QA/QC Parameter	Criterion	This Test	Criterion met?
FSW Control mean % survival	>70%	81.1%	Yes
FSW Control mean % normal	>70%	89.7%	Yes
Reference Toxicant within cusum chart limits	18.9-27.3µg Cu/L	20.1µg Cu/L	Yes

Test Report Authorised by:



Dr Rick Krassoi, Director on 3 May 2010

Toxicity Test Report: TR0588/1

(page 3 of 3)

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

APHA (1998) Standard Methods for the Examination of Water and Wastewater. 20th Ed. American Public Health Association, American Water Works Association and the Water Environment Federation, Washington, DC.

ESA (2009) SOP 106 – *Bivalve Larval Development Test*. Issue No. 7. Ecotox Services Australasia, Sydney, NSW.

Krassoi, R (1995) Salinity adjustment of effluents for use with marine bioassays: effects on the larvae of the doughboy scallop *Chlamys asperrimus* and the Sydney rock oyster *Saccostrea commercialis*. *Australasian Journal of Ecotoxicology*, 1: 143-148.

USEPA (1991) Evaluation of Dredged Material Proposed for Ocean Disposal. Testing Manual. United States Environmental Protection Agency. Office of Marine and Estuarine Protection. EPA-503/8-91/001.

Chain-of-Custody Documentation

Sample Receipt Notification



Attention : David Spadaro

Client : CSIRO
Locked Mail Bag 2007
Kirrawee NSW 2232

Email : david.spadaro@csiro.au
Telephone : 9710 6807
Facsimile : 9710 6800

Date : 20/04/2010

Re : Receipt of Sediment Samples

Pages : 2

ESA Project : PR0588

☒ For Review

☐ Additional Documentation Required - Please Respond

Sample Delivery Details

Completed Chain of Custody accompanied samples: YES

Samples received in apparent good condition and correctly bottled: YES

Security seals on sample bottles and esky intact: YES

Date samples received : 17/04/2010

Time samples received : 10:00

No. of samples received : 4

Sample matrix : sediment

Sample temperature : chilled

Comments : Includes VC4B (0.5-1m) whole sediment (ESA ID# 4128), VC4B (1.5-2m) whole sediment (ESA ID# 4129), VC4C (0.5-1m) whole sediment (ESA ID# 4130), SS4G whole sediment (ESA ID# 4131)

Contact Details

Customer Services Officer : Tina Micevska

Telephone : 61 2 9420 9481

Facsimile : 61 2 9420 9484

Email : tmicevska@ecotox.com.au

Please contact customer services officer for all queries or issues regarding samples

Note that the chain-of-custody provides definitive information on the tests to be performed

Ecotox Services Australia

ABN 45 094 714 904

Unit 27, 2 Chaplin Drive

Lane Cove NSW 2066 Australia

Phone : 61 2 9420 9481

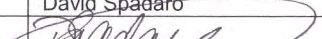
Fax : 61 2 9420 9484

Email : info@ecotox.com.au



CHAIN OF CUSTODY

		Collection		Water Physico-chemical Parameters						Analyses Required					Additional Information	
CSIRO ID (E__)	Sample Description / Sample No	Date	Time	Cond.	Salinity	pH	D.O.	Temp	Other (specify)	48-h oyster larval development (elutriates)						
(CSIRO Use only)		dd/mm/y	hh:m m (24h)	mS	‰		mg/L or % sat.	°C								
E10006	VC4B(0.5-1M), whole sediments	5/03/10		NA	NA	NA	NA	NA		X						- Prepare 1:4 elutriate and commence toxicity test. - If possible, conduct in polycarbonate test vessels
E10008	VC4B(1.5-2M), whole sediments	5/03/10		NA	NA	NA	NA	NA		X						
E10021	VC4C(0.5-1M), whole sediments	5/03/10		NA	NA	NA	NA	NA		X						
E10019	SS4G, whole sediments	5/03/10		NA	NA	NA	NA	NA		X						

				Method of Shipment, Date					
Forwarded by:	David Spadaro					Received By:	Tina Mariska		
Signature						Signature			
For:	CSIRO	Date:	16/04/2010	Toll courier, ref number: 093152		For:	ESA	Date:	17/4/10 @ 10:00

				Method of Shipment, Date					
Collected By:					Received By:				
Signature:					Signature				
For:		Date:			For:		Date:		

Statistical Printouts for the Rock Oyster Larval Development Tests

Bivalve Larval Development Test-Proportion Alive/Normal

Start Date: 22/04/2010 20:00 Test ID: PR0588/01 Sample ID: VC4B (0.5-1.0M)
 End Date: 24/04/2010 20:00 Lab ID: 4128 Sample Type: SEL-Sediment elutriate
 Sample Date: Protocol: ESA 106 Test Species: SR-Saccostrea commercialis
 Comments:

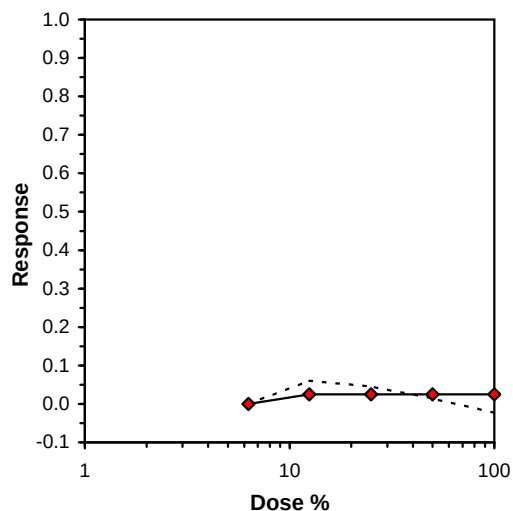
Conc-%	1	2	3	4
FSW Control	0.7556	0.7333	0.7556	0.6667
6.3	0.7333	0.6889	0.7111	0.7778
12.5	0.7333	0.6889	0.5556	0.7556
25	0.6222	0.7333	0.7556	0.6667
50	0.7111	0.6667	0.7778	0.7111
100	0.8000	0.7556	0.6667	0.7556

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%	N				Mean	N-Mean
FSW Control	0.7278	1.0000	1.0227	0.9553	1.0536	4.546	4				0.7278	1.0000
6.3	0.7278	1.0000	1.0226	0.9791	1.0799	4.217	4	0.001	2.410	0.1080	0.7278	1.0000
12.5	0.6833	0.9389	0.9755	0.8411	1.0536	9.719	4	1.053	2.410	0.1080	0.7097	0.9752
25	0.6944	0.9542	0.9865	0.9089	1.0536	6.735	4	0.808	2.410	0.1080	0.7097	0.9752
50	0.7167	0.9847	1.0105	0.9553	1.0799	5.099	4	0.272	2.410	0.1080	0.7097	0.9752
100	0.7444	1.0229	1.0424	0.9553	1.1071	6.074	4	-0.441	2.410	0.1080	0.7097	0.9752

Auxiliary Tests					Statistic		Critical		Skew		Kurt	
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)					0.952806		0.916		-0.61881		-0.1363	
Bartlett's Test indicates equal variances (p = 0.79)					2.396966		15.08627					
Hypothesis Test (1-tail, 0.05)			NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test			100	>100		1	0.100604	0.138101	0.002493	0.004015	0.685698	5, 18
Treatments vs FSW Control												

Log-Logit Interpolation (200 Resamples)

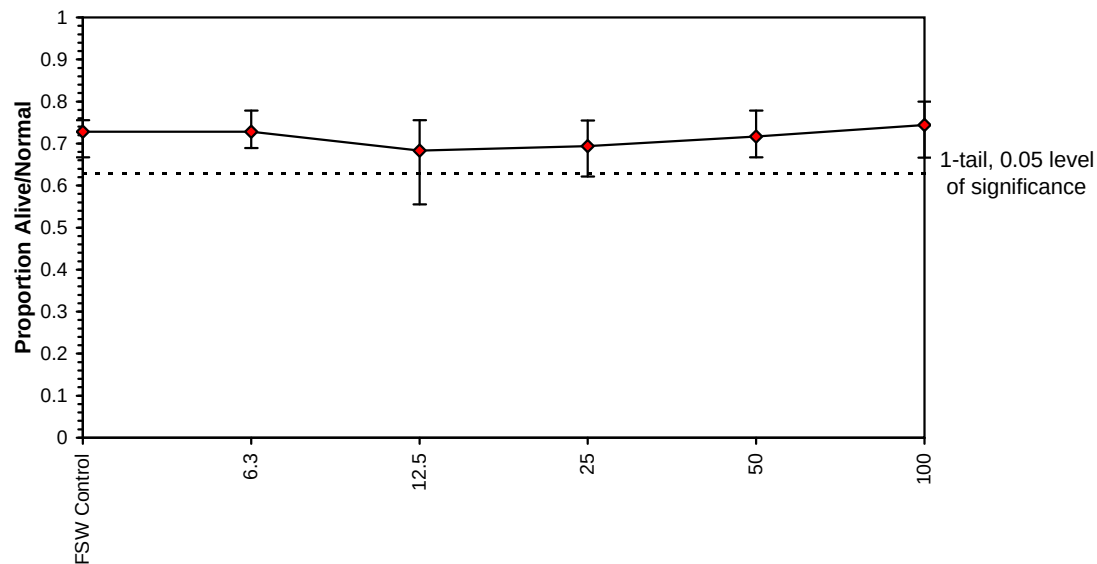
Point	%	SD	95% CL(Exp)	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Bivalve Larval Development Test-Proportion Alive/Normal

Start Date:	22/04/2010 20:00	Test ID:	PR0588/01	Sample ID:	VC4B (0.5-1.0M)
End Date:	24/04/2010 20:00	Lab ID:	4128	Sample Type:	SEL-Sediment elutriate
Sample Date:		Protocol:	ESA 106	Test Species:	SR-Saccostrea commercialis
Comments:					

Dose-Response Plot



Bivalve Larval Development Test-Proportion Alive/Normal

Start Date:	22/04/2010 20:00	Test ID:	PR0588/01	Sample ID:	VC4B (0.5-1.0M)
End Date:	24/04/2010 20:00	Lab ID:	4128	Sample Type:	SEL-Sediment elutriate
Sample Date:		Protocol:	ESA 106	Test Species:	SR-Saccostrea commercialis
Comments:					

		Auxiliary Data Summary					
Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
FSW Control	% Alive / Normal	72.78	66.67	75.56	4.21	2.82	4
6.3		72.78	68.89	77.78	3.80	2.68	4
12.5		68.33	55.56	75.56	8.96	4.38	4
25		69.44	62.22	75.56	6.12	3.56	4
50		71.67	66.67	77.78	4.58	2.99	4
100		74.44	66.67	80.00	5.59	3.18	4
FSW Control	pH	8.20	8.20	8.20	0.00	0.00	1
6.3		8.20	8.20	8.20	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.10	8.10	8.10	0.00	0.00	1
100		8.00	8.00	8.00	0.00	0.00	1
FSW Control	Salinity ppt	35.10	35.10	35.10	0.00	0.00	1
6.3		35.00	35.00	35.00	0.00	0.00	1
12.5		35.30	35.30	35.30	0.00	0.00	1
25		35.40	35.40	35.40	0.00	0.00	1
50		35.50	35.50	35.50	0.00	0.00	1
100		35.60	35.60	35.60	0.00	0.00	1
FSW Control	DO %	100.00	100.00	100.00	0.00	0.00	1
6.3		96.70	96.70	96.70	0.00	0.00	1
12.5		96.40	96.40	96.40	0.00	0.00	1
25		96.40	96.40	96.40	0.00	0.00	1
50		96.40	96.40	96.40	0.00	0.00	1
100		96.00	96.00	96.00	0.00	0.00	1

Bivalve Larval Development Test-Proportion Alive/Normal

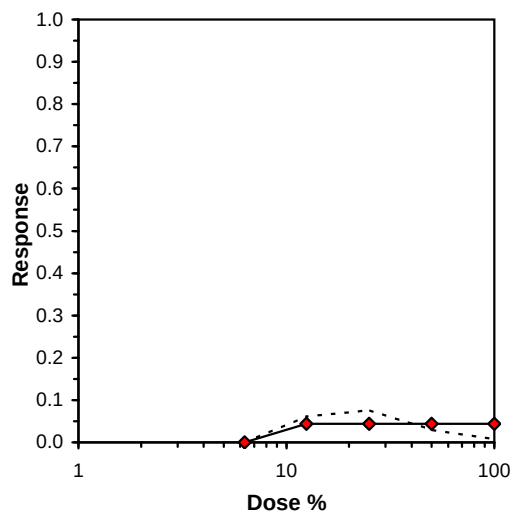
Start Date: 22/04/2010 20:00 Test ID: PR0588/02 Sample ID: VC4B (1.5-2M)
 End Date: 24/04/2010 20:00 Lab ID: 4129 Sample Type: SEL-Sediment elutriate
 Sample Date: Protocol: ESA 106 Test Species: SR-Saccostrea commercialis
 Comments:

Conc-%	1	2	3	4
FSW Control	0.7556	0.7333	0.7556	0.6667
6.3	0.6667	0.7778	0.7778	0.6889
12.5	0.6222	0.6667	0.7556	0.6889
25	0.6444	0.7333	0.6222	0.6889
50	0.7778	0.6667	0.7556	0.6222
100	0.7556	0.7778	0.6889	0.6667

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%	N				Mean	N-Mean
FSW Control	0.7278	1.0000	1.0227	0.9553	1.0536	4.546	4				0.7278	1.0000
6.3	0.7278	1.0000	1.0236	0.9553	1.0799	6.428	4	-0.020	2.410	0.1055	0.7278	1.0000
12.5	0.6833	0.9389	0.9742	0.9089	1.0536	6.204	4	1.107	2.410	0.1055	0.6958	0.9561
25	0.6722	0.9237	0.9620	0.9089	1.0282	5.499	4	1.387	2.410	0.1055	0.6958	0.9561
50	0.7056	0.9695	0.9994	0.9089	1.0799	8.080	4	0.531	2.410	0.1055	0.6958	0.9561
100	0.7222	0.9924	1.0170	0.9553	1.0799	5.829	4	0.130	2.410	0.1055	0.6958	0.9561

Auxiliary Tests					Statistic		Critical		Skew		Kurt	
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)					0.9223		0.916		-0.02921		-1.48612	
Bartlett's Test indicates equal variances (p = 0.97)					0.966229		15.08627					
Hypothesis Test (1-tail, 0.05)		NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df	
Dunnett's Test		100	>100		1	0.09817	0.13476	0.002772	0.003829	0.614197	5, 18	
Treatments vs FSW Control												

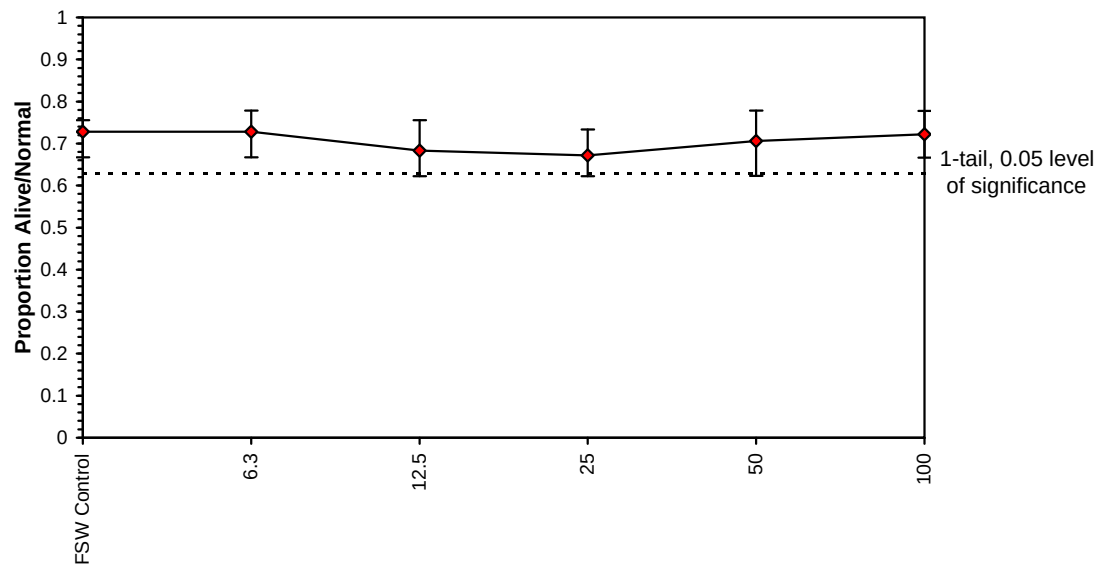
Log-Logit Interpolation (200 Resamples)				
Point	%	SD	95% CL(Exp)	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Bivalve Larval Development Test-Proportion Alive/Normal

Start Date:	22/04/2010 20:00	Test ID:	PR0588/02	Sample ID:	VC4B (1.5-2M)
End Date:	24/04/2010 20:00	Lab ID:	4129	Sample Type:	SEL-Sediment elutriate
Sample Date:		Protocol:	ESA 106	Test Species:	SR-Saccostrea commercialis
Comments:					

Dose-Response Plot



Bivalve Larval Development Test-Proportion Alive/Normal

Start Date:	22/04/2010 20:00	Test ID:	PR0588/02	Sample ID:	VC4B (1.5-2M)
End Date:	24/04/2010 20:00	Lab ID:	4129	Sample Type:	SEL-Sediment elutriate
Sample Date:		Protocol:	ESA 106	Test Species:	SR-Saccostrea commercialis
Comments:					

		Auxiliary Data Summary					
Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
FWS Control	% Alive / Normal	72.78	66.67	75.56	4.21	2.82	4
6.3		72.78	66.67	77.78	5.84	3.32	4
12.5		68.33	62.22	75.56	5.56	3.45	4
25		67.22	62.22	73.33	4.93	3.30	4
50		70.56	62.22	77.78	7.34	3.84	4
100		72.22	66.67	77.78	5.29	3.18	4
FWS Control	pH	8.20	8.20	8.20	0.00	0.00	1
6.3		8.20	8.20	8.20	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.10	8.10	8.10	0.00	0.00	1
100		8.00	8.00	8.00	0.00	0.00	1
FWS Control	Salinity ppt	35.10	35.10	35.10	0.00	0.00	1
6.3		35.10	35.10	35.10	0.00	0.00	1
12.5		35.30	35.30	35.30	0.00	0.00	1
25		35.40	35.40	35.40	0.00	0.00	1
50		35.60	35.60	35.60	0.00	0.00	1
100		35.00	35.00	35.00	0.00	0.00	1
FWS Control	DO %	100.00	100.00	100.00	0.00	0.00	1
6.3		96.80	96.80	96.80	0.00	0.00	1
12.5		96.60	96.60	96.60	0.00	0.00	1
25		96.80	96.80	96.80	0.00	0.00	1
50		96.10	96.10	96.10	0.00	0.00	1
100		95.00	95.00	95.00	0.00	0.00	1

Bivalve Larval Development Test-Proportion Alive/Normal

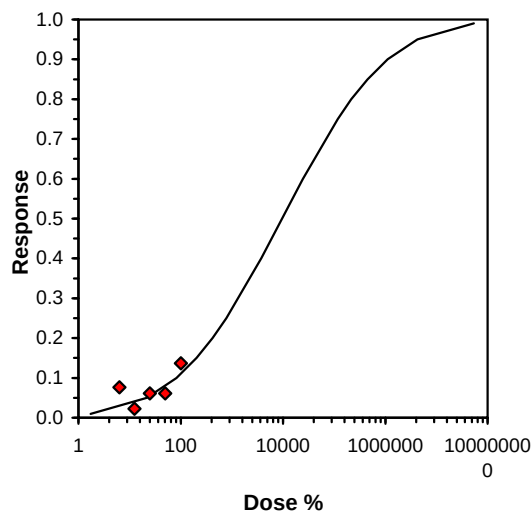
Start Date: 22/04/2010 20:00 Test ID: PR0588/03 Sample ID: VC4C (0.5-1M)
 End Date: 24/04/2010 20:00 Lab ID: 4130 Sample Type: SEL-Sediment elutriate
 Sample Date: Protocol: ESA 106 Test Species: SR-Saccostrea commercialis
 Comments:

Conc-%	1	2	3	4
FSW Control	0.7556	0.7333	0.7556	0.6667
6.3	0.6000	0.6667	0.7333	0.6889
12.5	0.7556	0.6000	0.7111	0.7778
25	0.6667	0.6444	0.7556	0.6667
50	0.6889	0.7111	0.6667	0.6667
100	0.6889	0.4889	0.6889	0.6444

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					t-Stat	1-Tailed Critical	MSD	Number Resp	Total Number
			Mean	Min	Max	CV%	N					
FSW Control	0.7278	1.0000	1.0227	0.9553	1.0536	4.546	4				49	180
6.3	0.6722	0.9237	0.9622	0.8861	1.0282	6.142	4	1.302	2.410	0.1120	59	180
12.5	0.7111	0.9771	1.0057	0.8861	1.0799	8.538	4	0.365	2.410	0.1120	52	180
25	0.6833	0.9389	0.9741	0.9319	1.0536	5.563	4	1.046	2.410	0.1120	57	180
50	0.6833	0.9389	0.9733	0.9553	1.0033	2.360	4	1.063	2.410	0.1120	57	180
100	0.6278	0.8626	0.9161	0.7743	0.9791	10.602	4	2.293	2.410	0.1120	67	180

Auxiliary Tests					Statistic	Critical	Skew	Kurt			
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)					0.933478	0.916	-0.84586	0.496483			
Bartlett's Test indicates equal variances (p = 0.36)					5.521427	15.08627					
Hypothesis Test (1-tail, 0.05)		NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test		100	>100		1	0.104516	0.143472	0.005483	0.004321	0.319742	5, 18
Treatments vs FSW Control											

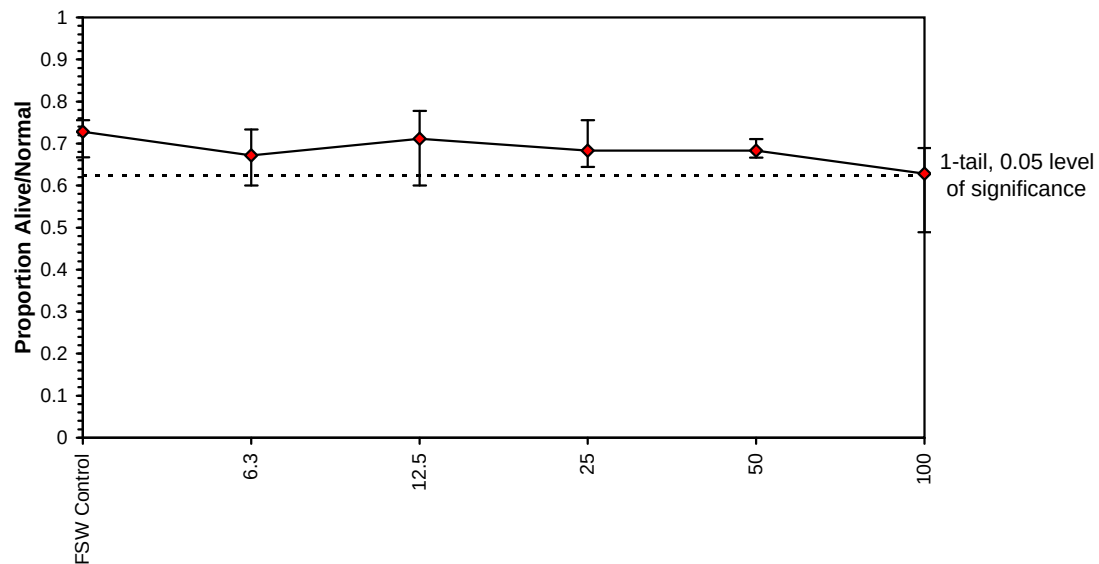
Maximum Likelihood-Probit											
Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	0.620886	0.635306	-0.62431	1.866086	0.272222	1.525613	7.814728	0.68	3.981286	1.610602	12
Intercept	2.528076	1.13293	0.307533	4.74862							
TSCR	0.279388	0.032749	0.2152	0.343577							
Point	Probits	%	95% Fiducial Limits								
EC01	2.674	1.715791									
EC05	3.355	21.4823									
EC10	3.718	82.64486									
EC15	3.964	205.118									
EC20	4.158	422.4435									
EC25	4.326	785.147									
EC40	4.747	3743.211									
EC50	5.000	9578.24									
EC60	5.253	24509.09									
EC75	5.674	116847.8									
EC80	5.842	217171.5									
EC85	6.036	447268									
EC90	6.282	1110083									
EC95	6.645	4270616									
EC99	7.326	53469670									



Bivalve Larval Development Test-Proportion Alive/Normal

Start Date:	22/04/2010 20:00	Test ID:	PR0588/03	Sample ID:	VC4C (0.5-1M)
End Date:	24/04/2010 20:00	Lab ID:	4130	Sample Type:	SEL-Sediment elutriate
Sample Date:		Protocol:	ESA 106	Test Species:	SR-Saccostrea commercialis
Comments:					

Dose-Response Plot



Bivalve Larval Development Test-Proportion Alive/Normal

Start Date:	22/04/2010 20:00	Test ID:	PR0588/03	Sample ID:	VC4C (0.5-1M)
End Date:	24/04/2010 20:00	Lab ID:	4130	Sample Type:	SEL-Sediment elutriate
Sample Date:		Protocol:	ESA 106	Test Species:	SR-Saccostrea commercialis
Comments:					

		Auxiliary Data Summary					
Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
FWS Control	% Alive / Normal	72.78	66.67	75.56	4.21	2.82	4
6.3		67.22	60.00	73.33	5.56	3.51	4
12.5		71.11	60.00	77.78	7.91	3.95	4
25		68.33	64.44	75.56	4.93	3.25	4
50		68.33	66.67	71.11	2.13	2.13	4
100		62.78	48.89	68.89	9.49	4.91	4
FWS Control	pH	8.20	8.20	8.20	0.00	0.00	1
6.3		8.20	8.20	8.20	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.10	8.10	8.10	0.00	0.00	1
100		7.90	7.90	7.90	0.00	0.00	1
FWS Control	Salinity ppt	35.10	35.10	35.10	0.00	0.00	1
6.3		35.20	35.20	35.20	0.00	0.00	1
12.5		35.30	35.30	35.30	0.00	0.00	1
25		35.40	35.40	35.40	0.00	0.00	1
50		35.50	35.50	35.50	0.00	0.00	1
100		35.50	35.50	35.50	0.00	0.00	1
FWS Control	DO %	100.00	100.00	100.00	0.00	0.00	1
6.3		96.90	96.90	96.90	0.00	0.00	1
12.5		96.40	96.40	96.40	0.00	0.00	1
25		96.50	96.50	96.50	0.00	0.00	1
50		95.70	95.70	95.70	0.00	0.00	1
100		92.20	92.20	92.20	0.00	0.00	1

Bivalve Larval Development Test-Proportion Alive/Normal

Start Date: 22/04/2010 20:00 Test ID: PR0588/04 Sample ID: SS4G
 End Date: 24/04/2010 20:00 Lab ID: 4131 Sample Type: SEL-Sediment elutriate
 Sample Date: Protocol: ESA 106 Test Species: SR-Saccostrea commercialis
 Comments:

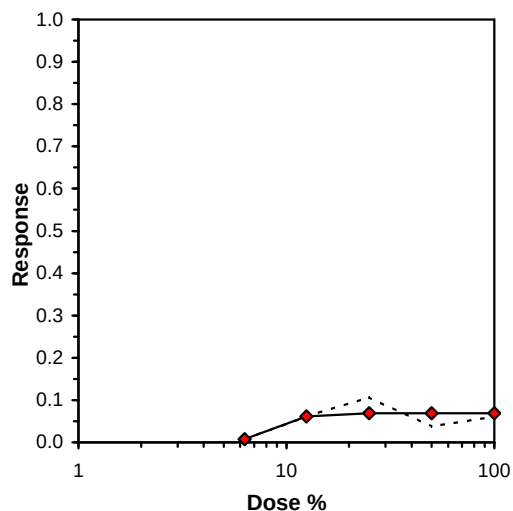
Conc-%	1	2	3	4
FSW Control	0.7556	0.7333	0.7556	0.6667
6.3	0.7556	0.7111	0.7778	0.6444
12.5	0.7111	0.6889	0.5556	0.7778
25	0.6667	0.6889	0.5778	0.6667
50	0.6889	0.7556	0.5778	0.7778
100	0.6889	0.6000	0.7111	0.7333

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%	N				Mean	N-Mean
FSW Control	0.7278	1.0000	1.0227	0.9553	1.0536	4.546	4				0.7278	1.0000
6.3	0.7222	0.9924	1.0172	0.9319	1.0799	6.402	4	0.106	2.410	0.1248	0.7222	0.9924
12.5	0.6833	0.9389	0.9759	0.8411	1.0799	10.207	4	0.904	2.410	0.1248	0.6833	0.9389
25	0.6500	0.8931	0.9383	0.8635	0.9791	5.448	4	1.629	2.410	0.1248	0.6778	0.9313
50	0.7000	0.9618	0.9940	0.8635	1.0799	9.752	4	0.553	2.410	0.1248	0.6778	0.9313
100	0.6833	0.9389	0.9742	0.8861	1.0282	6.369	4	0.937	2.410	0.1248	0.6778	0.9313

Auxiliary Tests					Statistic	Critical	Skew	Kurt			
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)					0.923296	0.916	-0.71508	-0.22567			
Bartlett's Test indicates equal variances (p = 0.75)					2.705912	15.08627					
Hypothesis Test (1-tail, 0.05)		NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test		100	>100		1	0.116948	0.160536	0.003916	0.005364	0.610062	5, 18
Treatments vs FSW Control											

Log-Logit Interpolation (200 Resamples)

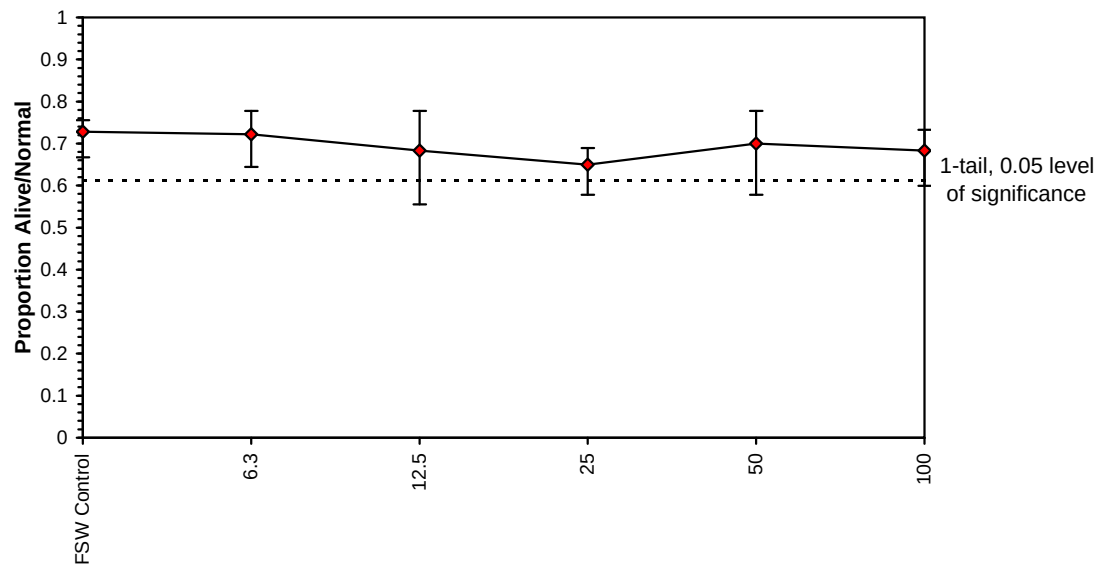
Point	%	SD	95% CL(Exp)	Skew
IC05	10.930			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Bivalve Larval Development Test-Proportion Alive/Normal

Start Date:	22/04/2010 20:00	Test ID:	PR0588/04	Sample ID:	SS4G
End Date:	24/04/2010 20:00	Lab ID:	4131	Sample Type:	SEL-Sediment elutriate
Sample Date:		Protocol:	ESA 106	Test Species:	SR-Saccostrea commercialis
Comments:					

Dose-Response Plot



Bivalve Larval Development Test-Proportion Alive/Normal

Start Date:	22/04/2010 20:00	Test ID:	PR0588/04	Sample ID:	SS4G
End Date:	24/04/2010 20:00	Lab ID:	4131	Sample Type:	SEL-Sediment elutriate
Sample Date:		Protocol:	ESA 106	Test Species:	SR-Saccostrea commercialis
Comments:					

		Auxiliary Data Summary					
Conc-%	Parameter	Mean	Min	Max	SD	CV%	N
FWS Control	% Alive / Normal	72.78	66.67	75.56	4.21	2.82	4
6.3		72.22	64.44	77.78	5.88	3.36	4
12.5		68.33	55.56	77.78	9.32	4.47	4
25		65.00	57.78	68.89	4.93	3.42	4
50		70.00	57.78	77.78	8.98	4.28	4
100		68.33	60.00	73.33	5.84	3.54	4
FWS Control	pH	8.20	8.20	8.20	0.00	0.00	1
6.3		8.20	8.20	8.20	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.10	8.10	8.10	0.00	0.00	1
100		8.00	8.00	8.00	0.00	0.00	1
FWS Control	Salinity ppt	35.10	35.10	35.10	0.00	0.00	1
6.3		35.10	35.10	35.10	0.00	0.00	1
12.5		35.30	35.30	35.30	0.00	0.00	1
25		35.30	35.30	35.30	0.00	0.00	1
50		35.40	35.40	35.40	0.00	0.00	1
100		35.50	35.50	35.50	0.00	0.00	1
FWS Control	DO %	100.00	100.00	100.00	0.00	0.00	1
6.3		97.00	97.00	97.00	0.00	0.00	1
12.5		96.10	96.10	96.10	0.00	0.00	1
25		96.60	96.60	96.60	0.00	0.00	1
50		96.40	96.40	96.40	0.00	0.00	1
100		95.00	95.00	95.00	0.00	0.00	1



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SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

Appendix 9 Geochemical Results Summary Table

APPROACHES and TURNING CIRCLE
(DREDGE AREA 1)

Analyte			TOC	Metals		Trace Metals														BTEX	TPHs						TRHs	Pesticides		PCBs
Sampling Month	Sample ID	Moisture Content (dried @ 103 °C)	Total Organic Carbon	Aluminium	Iron	Antimony	Arsenic	Cadmium	Chromium	Copper	Cobalt	Lead	Manganese	Nickel	Selenium	Silver	Vanadium	Zinc	Mercury	BTEX	C6 - C9 Fraction Normalised	C10 - C14 Fraction Normalised	C15 - C28 Fraction Normalised	C29 - C36 Fraction Normalised	Sum TPHs Normalised	C6-C10 Fraction	OC Pesticides	OP Pesticides	Total PCBs normalised	
		Units	%	%	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	µg/kg	µg/kg	µg/kg
		LOR	1	0.02	50	50	0.5	1	0.1	1	1	0.5	1	10	1	0.1	0.1	2	1	0.01	0.2	3	3	3	5	3-5	3	0.5-10	0.5	5
NAGD SL		-	-	-	-	2	20	1.5	80	65	-	50	-	21	-	1	-	200	0.15	-	-	-	-	-	550	-	0.32-280		23	
NAGD SQ High		-	-	-	-	25	70	10	370	270	-	220	-	52	-	3.7	-	410	1.0	-	-	-	-	-	-	-	-	-	-	
Nov-09	VC1A 0-0.5	18.3	0.07	---	---	<LOR	<LOR	<LOR	<LOR	4.1	<LOR	1.6	<LOR	<LOR	<LOR	<LOR	<LOR	6.1	0.71	---	---	---	---	---	---	-	---	--	---	
Nov-09	VC1A 0.5-1.2	19.9	0.08	---	---	<LOR	<LOR	<LOR	<LOR	3.3	<LOR	2.6	<LOR	<LOR	<LOR	<LOR	<LOR	16.5	<LOR	---	---	---	---	---	---	--	---	--	---	
Nov-09	VC1A 1.2-1.6	20.4	0.03	---	---	<LOR	<LOR	<LOR	1.7	2.8	<LOR	<LOR	34	<LOR	<LOR	<LOR	<LOR	2.2	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	-	<LOR	--	<LOR		
Nov-09	VC1B 0-0.6	23.5	0.1	---	---	<LOR	<LOR	0.4	<LOR	3.2	<LOR	1.2	<LOR	<LOR	<LOR	1.1	<LOR	4.7	<LOR	<LOR	<LOR	<LOR	60	60	120	--	<LOR	--	<LOR	
Nov-09	VC1B 0.6-1.2	18.9	0.06	---	---	<LOR	<LOR	<LOR	<LOR	2.4	<LOR	1	<LOR	<LOR	<LOR	<LOR	<LOR	2.5	<LOR	---	---	---	---	---	-	---	--	---		
Nov-09	VC1B 1.2-1.7	22.9	0.03	---	---	<LOR	1.7	<LOR	1.1	3.7	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	3	<LOR	---	---	---	---	---	---	--	---	--	---	
Nov-09	SS1A	20.2	0.08	---	---	<LOR	<LOR	<LOR	<LOR	1.6	<LOR	1.5	<LOR	<LOR	<LOR	<LOR	<LOR	2	<LOR	---	---	---	---	---	---	--	---	--	---	
Nov-09	SS1B	21.8	0.03	---	---	<LOR	<LOR	<LOR	<LOR	2	<LOR	2.2	<LOR	<LOR	<LOR	<LOR	<LOR	8	<LOR	---	---	---	---	---	---	--	---	--	---	
Nov-09	SS1C	20.9	<LOR	---	---	<LOR	<LOR	<LOR	1.2	3.9	<LOR	1.1	12	<LOR	<LOR	<LOR	<LOR	2.3	<LOR	---	---	---	---	---	---	--	---	--	---	
Nov-09	SS1D	19.8	<LOR	---	---	<LOR	<LOR	<LOR	1.2	3.4	<LOR	1	<LOR	<LOR	<LOR	<LOR	<LOR	2.1	<LOR	---	---	---	---	---	---	--	---	--	---	
Mar-10	SS4A	21.9	0.12	---	---	<LOR	<LOR	<LOR	1.2	<LOR	<LOR	1.8	<LOR	<LOR	<LOR	<LOR	88.8	2.8	<LOR	<LOR	---	<LOR	20	<LOR	20	--	<LOR	--	<LOR	
Mar-10	SS4E	17.8	0.02	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Mar-10	SS4F	21.3	0.4	---	---	<LOR	1.87	<LOR	3.5	3.9	<LOR	3.8	<LOR	<LOR	0.1	<LOR	32.9	8.6	0.02	---	---	---	---	---	---	---	---	---	---	
Mar-10	SS4G	16.3	0.13	---	---	<LOR	<LOR	<LOR	1.2	1	<LOR	1.6	<LOR	<LOR	<LOR	<LOR	56.3	2.5	<LOR	---	---	---	---	---	---	---	---	---	---	
Mar-10	SS4H	18.7	0.16	---	---	<LOR	1.19	<LOR	2.5	1.6	<LOR	3.2	<LOR	<LOR	<LOR	<LOR	2.4	8.6	0.02	---	---	---	---	---	---	---	---	---	---	
Mar-10	SS4I	21.1	0.05	---	---	<LOR	<LOR	<LOR	1	<LOR	<LOR	1.4	<LOR	<LOR	<LOR	<LOR	14.3	2.2	<LOR	<LOR	<LOR	25	180	135	340	--	<LOR	--	<LOR	
Mar-10	SS4J	20.5	0.07	---	---	<LOR	<LOR	<LOR	1.6	<LOR	<LOR	1.9	<LOR	<LOR	<LOR	<LOR	2.3	3.5	<LOR	---	---	---	---	---	---	--	---	--	---	
Mar-10	VC4B 0-0.5	10	0.04	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Mar-10	VC4B 0.5-1	17	0.12	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Mar-10	VC4B 1-1.5	22.8	0.04	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Mar-10	VC4B 1.5-2	22.3	0.07	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Mar-10	VC4C 0-0.5	21	0.46	---	---	<LOR	1.34	<LOR	3.2	2.6	<LOR	4.1	<LOR	<LOR	<LOR	<LOR	3.6	9.5	0.02	---	---	---	---	---	---	---	---	---	---	
Mar-10	VC4C 0.5-1	17.3	0.29	---	---	<LOR	<LOR	<LOR	2.9	2.8	<LOR	3.8	<LOR	<LOR	<LOR	<LOR	2.9	9.2	0.02	<LOR	<LOR	5	66	34	105	--	<LOR	--	<LOR	
Mar-10	VC4C 1-1.5	17.1	0.13	---	---	<LOR	1.2	<LOR	2.7	6.2	<LOR	2.7	<LOR	<LOR	<LOR	<LOR	2.8	6.1	0.04	---	---	---	---	---	---	---	---	---	---	
Mar-10	VC4C 1.5-2	22.7	0.25	---	---	<LOR	<LOR	<LOR	3.7	<LOR	<LOR	2.1	<LOR	<LOR	0.2	<LOR	4.8	2.8	0.02	---	---	---	---	---	---	---	---	---	---	
Mar-10	VC4D 0-0.5	14.4	0.11	---	---	<LOR	<LOR	<LOR	3.8	1.5	<LOR	3.2	<LOR	<LOR	<LOR	<LOR	2.3	7.2	0.09	---	---	---	---	---	---	---	---	---	---	
Mar-10	VC4D 0.5-1	15.2	0.06	---	---	<LOR	1.97	<LOR	2.2	<LOR	<LOR	1.6	<LOR	<LOR	<LOR	<LOR	<LOR	3	0.04	---	---	---	---	---	---	---	---	---	---	
Mar-10	VC4D 1-1.5	15.8	0.03	---	---	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	---	---	---	---	---	---	---	---	---	---	
Mar-10	VC4D 1.5-2	19.6	0.09	---	---	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.1	<LOR	<LOR	<LOR	<LOR	---	---	---	---	---	---	---	---	---	---	
Nov-11	SS5A	18.4	0.05	900	780	<LOR	<LOR	<LOR	1.2	<LOR	<LOR	1.7	<LOR	<LOR	0.1	<LOR	<LOR	3.1	<LOR	---	<LOR	---	---	---	---	<LOR	<LOR	<LOR	<LOR	
Nov-11	SS5B	23.3	0.07	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Nov-11	SS5C	22.4	0.05	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Nov-11	SS5D	28.1	0.96	3850	4400	<LOR	4.54	<LOR	7.5	6.6	0.6	9	18	2.4	0.3	<LOR	3.2	26.2	0.04	---	<LOR	<LOR	63	42	104	<LOR	<LOR	<LOR	<LOR	
Nov-11	VC5A (0-0.5)	21.1	0.24	1010	2020	<LOR	<LOR	<LOR	2.7	4.5	<LOR	11.1	<LOR	<LOR	0.2	<LOR	<LOR	46.4	0.02	<LOR	<LOR	<LOR	38	<LOR	38	<LOR	<LOR	<LOR	<LOR	
Nov-11	VC5A (0.5-1)	18.8	0.38	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Nov-11	VC5A (1.5-2)	31.2	4.76	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total No. of Samples		36	36	3	3	27	27	27	27	27	27	27	27	27	27	27	27	27	27	6	7	7	7	7	7	3	8	3	8	
No. of Samples below LOR		0	2	0	0	27	20	26	8	8	26	4	24	26	21	26	15	2	16	6	7	5	1	3	1	3	8	3	8	
% of Samples below LOR		0%	6%	0%	0%	100%	74%	96%	30%	30%	96%	15%	89%	96%	78%	96%	56%	7%	59%	100%	100%	71%	14%	43%	14%	100%	100%	100%	100%	
No																														

Notes:

All organics are normalised to 1% TOC (with 0.2 to 10% TOC)

Where results are below the analytical limit of Reporting (LOR), half the LOR has been used in the statistical analyses

* NAGD Sediment Quality High value = 70 µgSn/kg ; nc = not calculated; --- = not analysed

APPROACHES and TURNING CIRCLE
(DREDGE AREA 1)

Analyte		PAHs																				TBT			
Sampling Month	Sample ID	Naphthalene	2-Methylnaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(e)pyrene	Benzo(a)pyrene	Perylene	Benzo(g,h,i)perylene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	Coronene	Sum of PAHs	Sum of PAH normalised	TBT raw	TBT normalised
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µgSn/kg	µgSn/kg
LOR		5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4		0.5	0.5
NAGD SL		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10000	-	9
NAGD SQ High		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50000	-	70
Nov-09	VC1A 0-0.5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	---	---
Nov-09	VC1A 0.5-1.2	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	---	---
Nov-09	VC1A 1.2-1.6	<LOR	<LOR	<LOR	10	7	29	4	29	23	14	14	15	6	8	12	<LOR	10	<LOR	9	<LOR	190	950	26.8	134
Nov-09	VC1B 0-0.6	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	6	6	<LOR	<LOR	6	<LOR	<LOR	4	<LOR	<LOR	<LOR	<LOR	<LOR	22	110	22.9	115
Nov-09	VC1B 0.6-1.2	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	4	4	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	9	45	---	---
Nov-09	VC1B 1.2-1.7	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	---	---
Nov-09	SS1A	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	6	7	<LOR	<LOR	6	5	5	7	<LOR	5	<LOR	4	<LOR	45	225	6	30
Nov-09	SS1B	<LOR	<LOR	<LOR	22	12	32	8	63	49	25	24	30	16	16	24	8	17	8	15	7	374	1870	0.69	3.5
Nov-09	SS1C	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	6.4	32	
Nov-09	SS1D	<LOR	<LOR	<LOR	<LOR	<LOR	11	<LOR	15	12	9	6	9	<LOR	5	7	<LOR	5	<LOR	<LOR	<LOR	79	395	1.7	8.5
Mar-10	SS4A	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	0.8	4
Mar-10	SS4E	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	748	3740
Mar-10	SS4F	<LOR	<LOR	<LOR	<LOR	<LOR	14	5	27	29	18	15	20	10	13	19	6	19	<LOR	14	<LOR	209	523	51.6	129
Mar-10	SS4G	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	4	6	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	50	3.2	16
Mar-10	SS4H	6	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	5	5	<LOR	<LOR	<LOR	<LOR	<LOR	4	<LOR	<LOR	<LOR	<LOR	<LOR	25	125	3.2	16
Mar-10	SS4I	5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	5	25	0.9	4.5
Mar-10	SS4J	6	6	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	12	60	0.8	4
Mar-10	VC4B 0-0.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	27.1	136
Mar-10	VC4B 0.5-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	168	840
Mar-10	VC4B 1-1.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	138	690
Mar-10	VC4B 1.5-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	101	505
Mar-10	VC4C 0-0.5	14	6	<LOR	<LOR	<LOR	12	<LOR	21	19	11	10	16	7	9	13	14	10	<LOR	8	<LOR	170	370	22.5	49
Mar-10	VC4C 0.5-1	16	6	<LOR	<LOR	<LOR	31	<LOR	59	47	31	27	34	18	19	33	11	23	5	19	7	395	1362	66.9	231
Mar-10	VC4C 1-1.5	15	<LOR	<LOR	<LOR	<LOR	6	<LOR	6	6	<LOR	4	7	<LOR	<LOR	6	<LOR	4	<LOR	<LOR	<LOR	54	270	10.6	53
Mar-10	VC4C 1.5-2	8	6	<LOR	<LOR	<LOR	4	<LOR	4	4	<LOR	<LOR	4	<LOR	<LOR	<LOR	<LOR	5	<LOR	4	<LOR	39	156	1.6	6.4
Mar-10	VC4D 0-0.5	9	<LOR	<LOR	<LOR	<LOR	8	<LOR	12	12	7	6	11	<LOR	6	9	<LOR	7	<LOR	5	<LOR	92	460	<LOR	1.3
Mar-10	VC4D 0.5-1	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	<LOR	1.3
Mar-10	VC4D 1-1.5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	<LOR	1.3
Mar-10	VC4D 1.5-2	5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	5	25	<LOR	1.3
Nov-11	SS5A	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	1.3
Nov-11	SS5B	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	1.3
Nov-11	SS5C	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	1.3
Nov-11	SS5D	11	<LOR	12	8	6	34	11	50	47	36	33	50	21	28	45	15	33	6	28	8	482	502	16.7	17.4
Nov-11	VC5A (0-0.5)	5	<LOR	<LOR	<LOR	<LOR	4	<LOR	5	4	<LOR	<LOR	5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	23	96	1.4	5.8
Nov-11	VC5A (0.5-1)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.4	0.7
Nov-11	VC5A (1.5-2)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	0.1
Total No. of Samples		26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	32	32
No. of Samples below LOR		15	22	25	23	23	15	22	10	10	18	17	13	19	17	14	21	15	23	17	23	7	0	8	0
% of Samples below LOR		58%	85%	96%	88%	88%	58%	85%	38%	38%	69%	65%	50%	73%	65%	54%	81%	58%	88%	65%	88%	27%	0%	25%	0%
No. of Samples between LOR and NAGD SL		11	4	1	3	3	11	4	16	16	8	9	13	7	9	12	5	11	3	9	3	19	26	24	16
% of Samples between LOR and NAGD SL		42%	15%	4%	12%	12%	42%	15%	62%	62%	31%	35%	50%	27%	35%	46%	19%	42%	12%	35%	12%	73%	100%	75%	50%
No. of Samples above NAGD SL		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0	---	7
% of Samples above NAGD SL		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0%	---	22%
No. of Samples above NAGD SQ High		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0	---	9
% of Samples above NAGD SQ High		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0%	---	28%
Mean		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	296	nc	212
SD		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	456	nc	675
95% UCL of the mean		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	443	nc	408

Notes:
All organics are normalised to 1% TOC (with 0.2 to 10% TOC)
Where results are below the analytical limit of Reporting (LOR), half the LOR has been used in the statistical analyses
* NAGD Sediment Quality High value = 70 µgSn/kg nc = not calculated; --- = not analysed

SUB BERTH
(DREDGE AREA 2)

Analyte			TOC	Metals		Trace Metals															BTEX	TPHs						TRHs	Pesticides		PCBs
Sampling Month	Sample ID	Moisture Content (dried @ 103 °C)	Total Organic Carbon	Aluminium	Iron	Antimony	Arsenic	Cadmium	Chromium	Copper	Cobalt	Lead	Manganese	Nickel	Selenium	Silver	Vanadium	Zinc	Mercury	BTEX	C6 - C9 Fraction Normalised	C10 - C14 Fraction Normalised	C15 - C28 Fraction Normalised	C29 - C36 Fraction Normalised	Sum TPHs Normalised	C6-C10 Fraction	OC Pesticides	OP Pesticides	Total PCBs normalised		
Units		%	%	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	µg/kg	µg/kg	µg/kg	
LOR		1	0.02	50	50	0.5	1	0.1	1	1	0.5	1	10	1	0.1	0.1	2	1	0.01	0.2	3	3	3	5	3-5	3	0.5-10	0.5	5		
NAGD SL		-	-	-	-	2	20	1.5	80	65	-	50	-	21	-	1	-	200	0.15	-	-	-	-	-	550	-	0.32-280		23		
NAGD SQ High		-	-	-	-	25	70	10	370	270	-	220	-	52	-	3.7	-	410	1.0	-	-	-	-	-	-	-	-		-		
Nov-09	VC2A 0-0.1	17.1	0.02	---	---	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1.4	<LOR	---	---	---	---	---	---	--	---	--	---		
Nov-09	VC2A 1-1.4	15.4	1.13	---	---	<LOR	15	0.1	14.5	<LOR	3.1	1.4	<LOR	2.4	1.9	<LOR	22.8	3.3	<LOR	---	---	---	---	---	---	--	---	--	---		
Nov-09	VC2A 1.4-2	25.6	0.61	---	---	<LOR	3.21	0.1	24.4	4.6	0.7	10.7	12	2.3	0.3	<LOR	6.2	49.8	0.55	---	---	---	---	---	---	--	---	--	---		
Nov-09	VC2A 2-2.3	23.4	0.12	---	---	<LOR	<LOR	<LOR	3.1	2.3	<LOR	4.2	<LOR	<LOR	<LOR	<LOR	3	11	0.04	---	---	---	---	---	---	--	---	--	---		
Nov-09	VC2A 2.3-2.6	21.3	0.14	---	---	<LOR	1.18	<LOR	3.4	3.2	<LOR	3.1	<LOR	<LOR	<LOR	<LOR	2.6	6.9	0.03	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	--	<LOR	--	<LOR		
Nov-09	VC2B 0-0.5	15.8	0.14	---	---	<LOR	<LOR	<LOR	3.6	3.6	<LOR	3.9	<LOR	<LOR	<LOR	<LOR	3.3	20.7	0.03	<LOR	<LOR	<LOR	20	<LOR	20	--	<LOR	--	<LOR		
Nov-09	VC2B 0.5-0.9	19.4	0.58	---	---	<LOR	<LOR	<LOR	2.6	<LOR	<LOR	1.4	<LOR	<LOR	0.2	<LOR	2.2	3.5	0.02	---	---	---	---	---	---	--	---	--	---		
Nov-09	VC2B 0.9-1.5	19.3	0.19	---	---	<LOR	<LOR	<LOR	2.5	<LOR	<LOR	1.2	<LOR	<LOR	0.3	<LOR	2.9	2.6	0.02	---	---	---	---	---	---	--	---	--	---		
Nov-09	VC2B 1.5-2.2	21.4	<LOR	---	---	<LOR	<LOR	<LOR	1	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1.7	<LOR	---	---	---	---	---	---	--	---	--	---		
Nov-09	SS2A	21.8	0.03	---	---	<LOR	<LOR	<LOR	1.6	<LOR	<LOR	1.8	<LOR	<LOR	<LOR	<LOR	2.6	4.8	<LOR	---	---	---	---	---	---	--	---	--	---		
Nov-09	SS2B	38.1	0.42	---	---	<LOR	7.46	<LOR	10.8	5.7	0.9	9.5	18	3.2	0.6	<LOR	11.1	21.3	0.08	---	---	---	---	---	---	--	---	--	---		
Nov-09	SS2C	20.1	0.09	---	---	<LOR	<LOR	<LOR	1.6	1.2	<LOR	2.2	<LOR	<LOR	<LOR	<LOR	2.1	5	0.01	---	---	---	---	---	---	--	---	--	---		
Nov-09	SS2D	21.7	0.32	---	---	<LOR	<LOR	<LOR	1.8	1.9	<LOR	2	<LOR	<LOR	<LOR	<LOR	2.8	6.8	<LOR	---	---	---	---	---	---	--	---	--	---		
Mar-10	SS4B	17.4	0.05	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--	---	--	---		
Mar-10	SS4C	19	0.05	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--	---	--	---		
Mar-10	SS4D	25.5	0.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--	---	--	---		
Mar-10	VC4A 0-0.5	16.6	0.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--	---	--	---		
Mar-10	VC4A 0.5-1	14.1	0.08	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--	---	--	---		
Mar-10	VC4A 1-1.5	17.9	0.03	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--	---	--	---		
Mar-10	VC4A 1.5-2	21.4	0.05	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	--	---	--	---		
Total No. of Samples		20	20	0	0	13	13	13	13	13	13	13	13	13	13	13	13	13	13	2	2	2	2	2	2	---	2	---	2		
No. of Samples below LOR		0	1	---	---	13	9	11	1	6	10	2	11	10	8	13	2	0	5	2	2	2	1	2	1	---	2	---	2		
% of Samples below LOR		0%	5%	---	---	100%	69%	85%	8%	46%	77%	15%	85%	77%	62%	100%	15%	0%	38%	100%	100%	100%	50%	100%	50%	---	100%	---	100%		
No. of Samples between LOR and NAGD SL		20	19	---	---	0	4	2	12	7	3	11	2	3	5	0	11	13	7	0	0	0	1	0	1	---	0	---	0		
% of Samples between LOR and NAGD SL		100%	95%	---	---	0%	31%	15%	92%	54%	23%	85%	15%	23%	38%	0%	85%	100%	54%	0%	0%	0%	50%	0%	50%	---	0%	---	0%		
No. of Samples above NAGD SL		---	---	---	---	0	0	0	0	0	---	0	---	0	---	0	---	0	1	---	---	---	---	---	---	---	---	---	---		
% of Samples above NAGD SL		---	---	---	---	0%	0%	0%	0%	0%	---	0%	---	0%	---	0%	---	0%	8%	---	---	---	---	---	---	---	---	---	---		
No. of Samples above NAGD SQ High		---	---	---	---	0	0	0	0	0	---	0	---	0	---	0	---	0	0	---	---	---	---	---	---	---	---	---	---		
% of Samples above NAGD SQ High		---	---	---	---	0%	0%	0%	0%	0%	---	0%	---	0%	---	0%	---	0%	0%	---	---	---	---	---	---	---	---	---	---		
Mean		nc	0.21	nc	nc	<0.5	2.4	0.06	5.5	2.0	0.55	3.3	6.5	1.0	0.3	<0.1	4.9	10.7	0.06	nc	nc	nc	nc	nc	nc	nc	<0.5-10	nc	<5		
SD		nc	0.28	nc	nc	nc	4.3	0.02	7.0	1.8	0.79	3.3	4.0	1.0	0.5	nc	6.0	13.5	0.15	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc		
95% UCL of the mean		nc	0.31	nc	nc	<0.5	4.3	0.07	8.7	2.8	0.95	4.7	8.5	1.4	0.5	<0.1	7.5	16.7	0.13	nc	nc	nc	nc	nc	nc	nc	<0.5-10	nc	<5		

Notes:
All organics are normalised to 1% TOC (with 0.2 to 10% TOC)
Where results are below the analytical limit of Reporting (LOR), half the LOR has been used in the statistical analyses
* NAGD Sediment Quality High value = 70 µgSn/kg ; nc = not calculated; --- = not analysed

SUB BERTH
(DREDGE AREA 2)

Analyte		PAHs																						TBT		
Sampling Month	Sample ID	Naphthalene	2-Methylnaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(e)pyrene	Benzo(a)pyrene	Perylene	Benzo(g,h,i)perylene	Dibenz(a,h)anthracene	Indeno(1,2,3.cd)pyrene	Coronene	Sum of PAHs	Sum of PAH normalised	TBT raw	TBT normalised	
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µgSn/kg	µgSn/kg	
LOR		5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4		0.5	0.5	
NAGD SL		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10000	-	9	
NAGD SQ High		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50000	-	70	
Nov-09	VC2A 0-0.1	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	---	---	
Nov-09	VC2A 1-1.4	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1.8	---	---	
Nov-09	VC2A 1.4-2	<LOR	<LOR	10	<LOR	4	42	9	65	61	39	31	44	19	17	40	8	29	12	23	7	460	754	---	---	
Nov-09	VC2A 2-2.3	5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	25	---	---	
Nov-09	VC2A 2.3-2.6	5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	25	5.4	27	
Nov-09	VC2B 0-0.5	9	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	9	45	3.4	17
Nov-09	VC2B 0.5-0.9	20	<LOR	7	<LOR	<LOR	17	5	23	23	17	14	20	8	11	20	5	14	<LOR	12	<LOR	216	372	---	---	
Nov-09	VC2B 0.9-1.5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	---	---	
Nov-09	VC2B 1.5-2.2	6	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	6	30	---	---	
Nov-09	SS2A	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	<LOR	1.25	
Nov-09	SS2B	6	5	10	17	30	169	62	237	179	97	94	95	50	43	89	21	47	14	45	20	1330	3167	4.2	10	
Nov-09	SS2C	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	6	6	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	16	80	46.7	234	
Nov-09	SS2D	5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	5	16	82.9	259	
Mar-10	SS4B	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	12.8	64	
Mar-10	SS4C	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	4	20		
Mar-10	SS4D	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	208	1040		
Mar-10	VC4A 0-0.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	113	565		
Mar-10	VC4A 0.5-1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	5.8	29		
Mar-10	VC4A 1-1.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	1.25		
Mar-10	VC4A 1.5-2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	1.25		
Total No. of Samples		13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	
No. of Samples below LOR		6	12	10	12	11	10	10	9	9	10	10	10	10	10	10	10	10	11	10	11	6	0	3	0	
% of Samples below LOR		46%	92%	77%	92%	85%	77%	77%	69%	69%	77%	77%	77%	77%	77%	77%	77%	77%	85%	77%	85%	46%	0%	23%	0%	
No. of Samples between LOR and NAGD SL		7	1	3	1	2	3	3	4	4	3	3	3	3	3	3	3	3	2	3	2	7	13	10	3	
% of Samples between LOR and NAGD SL		54%	8%	23%	8%	15%	23%	23%	31%	31%	23%	23%	23%	23%	23%	23%	23%	23%	15%	23%	15%	54%	100%	77%	23%	
No. of Samples above NAGD SL		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0	6	
% of Samples above NAGD SL		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0%	46%	
No. of Samples above NAGD SQ High		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	10	4	
% of Samples above NAGD SQ High		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	77%	31%	
Mean		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	350	nc	174	
SD		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	874	nc	307	
95% UCL of the mean		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	734	nc	314	

Notes:
All organics are normalised to 1% TOC (with 0.2 to 10% TOC)
Where results are below the analytical limit of Reporting (LOR), half the LOR has been used in the statistical analyses
* NAGD Sediment Quality High value = 70 µgSn/kg nc = not calculated; --- = not analysed

FIXED BERTHS #1 AND #2
(DREDGE AREA 3)

Analyte			TOC	Metals		Trace Metals														BTEX	TPHs					TRHs	Pesticides		PCBs	
Sampling Month	Sample ID	Moisture Content (dried @ 103 °C)	Total Organic Carbon	Aluminium	Iron	Antimony	Arsenic	Cadmium	Chromium	Copper	Cobalt	Lead	Manganese	Nickel	Selenium	Silver	Vanadium	Zinc	Mercury	BTEX	C6 - C9 Fraction Normalised	C10 - C14 Fraction Normalised	C15 - C28 Fraction Normalised	C29 - C36 Fraction Normalised	Sum TPHs Normalised	C6-C10 Fraction	OC Pesticides	OP Pesticides	Total PCBs normalised	
Units		%	%	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	µg/kg	µg/kg	µg/kg
LOR		1	0.02	50	50	0.5	1	0.1	1	1	0.5	1	10	1	0.1	0.1	2	1	0.01	0.2	3	3	3	5	3-5	3	0.5-10	0.5	5	
NAGD SL		-	-	-	-	2	20	1.5	80	65	-	50	-	21	-	1	-	200	0.15	-	-	-	-	-	550	-	0.32-280	-	23	
NAGD SQ High		-	-	-	-	25	70	10	370	270	-	220	-	52	-	3.7	-	410	1.0	-	-	-	-	-	-	-	-	-	-	
Nov-09	VC3A 0-0.6	24	0.69	---	---	<LOR	1.98	<LOR	5	3.1	<LOR	9	<LOR	1.3	0.2	<LOR	6.4	18.4	0.06	<LOR	<LOR	<LOR	19	22	41	--	<LOR	--	<LOR	
Nov-09	VC3A 0.6-1.3	22.6	0.19	---	---	<LOR	2.34	<LOR	2.8	1.9	<LOR	3.4	<LOR	<LOR	0.1	<LOR	2.5	5.8	0.03	---	---	---	---	---	---	--	---	--	---	
Nov-09	VC3A 1.3-1.9	21.6	0.25	---	---	<LOR	<LOR	<LOR	3.0	2.6	<LOR	9	<LOR	<LOR	<LOR	<LOR	2.1	30.1	0.04	---	---	---	---	---	---	--	---	--	---	
Nov-09	VC3A 1.9-2.4	22.2	0.14	---	---	<LOR	10.1	<LOR	2.3	<LOR	<LOR	1.4	<LOR	<LOR	0.2	<LOR	3.9	2.3	<LOR	---	---	---	---	---	---	--	---	--	---	
Nov-09	VC3B 0-0.5	19.1	0.41	---	---	<LOR	<LOR	<LOR	2.2	1.3	<LOR	2.4	<LOR	<LOR	<LOR	<LOR	2.5	6.3	0.02	<LOR	<LOR	<LOR	7	<LOR	7	--	<LOR	--	<LOR	
Nov-09	VC3B 0.5-0.9	23.9	0.22	---	---	<LOR	<LOR	<LOR	2.9	2	<LOR	3.4	<LOR	<LOR	0.1	<LOR	3.3	9	0.02	---	---	---	---	---	---	--	---	--	---	
Nov-09	SS3A	24.7	0.14	---	---	<LOR	1.7	0.2	7.1	33.2	1.5	60.2	14	2	0.2	<LOR	3.6	460	0.01	---	---	---	---	---	---	--	---	--	---	
Nov-09	SS3B	47.4	3.08	---	---	<LOR	8.85	0.2	22.8	21.7	1.8	25.5	40	5.7	1	0.2	19.3	95.9	0.20	---	---	---	---	---	---	--	---	--	---	
Nov-09	SS3C	40	1.3	---	---	<LOR	5.85	0.1	19.1	15.2	1.4	19.9	33	4.6	0.5	0.1	15.2	64.2	0.15	---	---	---	---	---	---	--	---	--	---	
Nov-09	SS3D	22	1.16	---	---	<LOR	1.5	<LOR	5.3	5.1	<LOR	4.5	12	1	0.2	<LOR	3.8	19.1	0.03	---	---	---	---	---	---	--	---	--	---	
Nov-11	SS5E	33.2	2.99	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	19	11	30	---	---	---	---	
Nov-11	VC5B (0-0.8)	27.5	0.69	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	48	35	83	---	---	---	---	
Nov-11	VC5B (0.8-1.3)	33.3	7.98	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Nov-11	VC5B (1.3-1.6)	16.6	1.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Nov-11	VC5C (0-0.5)	22.7	2.23	2790	3350	<LOR	1.4	<LOR	4.4	3.5	<LOR	5.8	---	1.3	0.2	<LOR	<LOR	17	0.09	---	<LOR	<LOR	22	21	43	<LOR	<LOR	<LOR	<LOR	
Nov-11	VC5C (0.5-1)	64.3	39.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Nov-11	VC5D (0-0.5)	61.3	34.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	---	---	---	---	---	---	<LOR	<LOR	---	
Nov-11	VC5D (1.8-2.1)	18	0.88	390	34500	<LOR	17	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.4	<LOR	<LOR	2.2	<LOR	<LOR	---	---	---	---	<LOR	<LOR	<LOR	<LOR		
Nov-11	VC5D (2.1-3.1)	30.3	4.61	7040	16400	<LOR	4.7	<LOR	7.3	3.4	1.5	2.2	57	4.2	1.5	<LOR	11.6	14.6	<LOR	<LOR	<LOR	1	10	26	37	<LOR	<LOR	<LOR	<LOR	
Nov-11	VC5E (0-0.6)	55.9	32.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	---	---	---	---	---	---	<LOR	<LOR	---	
Nov-11	VC5E (0.6-0.8)	27.8	1.14	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Nov-11	VC5E (1-1.6)	40.6	7.76	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	---	---	---	---	---	---	<LOR	<LOR	---	
Aug-12	C1_0-0.55	38.4	12.3	3130	5490	<LOR	13.9	0.1	12.8	13.5	1.0	22.7	15	3.6	0.7	0.1	13.9	112	0.12	---	---	---	---	---	---	---	---	---	---	
Aug-12	C2_0-0-0.5	27.4	1.27	4090	5870	<LOR	6.59	0.2	26.2	15	1.2	28.3	27	3.9	<LOR	0.3	12.3	102	0.44	---	---	---	3	57	46	105	---	---	---	
Aug-12	C3_0-0-0.1	63.6	31.8	9980	15700	<LOR	72.9	<LOR	22.7	12.8	4.1	5	11	8.7	1.3	<LOR	68.6	38.1	0.05	---	---	<LOR	63	65	128	---	---	---	---	
Aug-12	C4_0-0-0.1	57.7	29.4	8100	9710	<LOR	49.8	<LOR	19.9	4.6	1.7	2.2	<LOR	6.7	4.1	<LOR	50.6	6.2	0.05	---	---	<LOR	40	53	92	---	---	---	---	
Aug-12	C5_0-0-0.15	60.8	23.1	5360	13500	<LOR	49.5	<LOR	16.2	5.7	3.0	7.9	17	6.5	2.2	<LOR	46.2	33.8	0.04	---	---	<LOR	28	31	59	---	---	---	---	
Aug-12	C6_0-0-0.13	65.8	35.7	8620	5810	0.51	52.3	<LOR	20.1	5.6	3.3	3.2	12	8.7	3.7	<LOR	77.9	7.1	0.08	---	---	<LOR	59	78	138	---	---	---	---	
Aug-12	C7_0-0-0.10	67.2	38.7	3740	4150	<LOR	34.2	<LOR	8.2	3.7	2.2	3	<LOR	3.6	1.4	<LOR	17.4	16	0.04	---	---	<LOR	41	52	93	---	---	---	---	
Aug-12	C8_0-0-0.12	57.7	18.9	9300	15700	<LOR	50.6	<LOR	23.6	7.8	2.0	4	12	7.5	4.5	<LOR	38.7	8.2	0.08	---	---	<LOR	36	50	86	---	---	---	---	
Aug-12	C9_0-0-0.45	18.7	2.69	2350	1760	<LOR	3.74	<LOR	4.7	1.2	<LOR	1.8	<LOR	<LOR	0.6	<LOR	7.2	1.6	0.01	---	---	---	---	---	---	---	---	---	---	
Aug-12	C10_0-0.50	23.3	0.65	2060	2730	<LOR	3.36	<LOR	10.2	5.1	0.6	9.8	14	2.2	<LOR	0.1	6.9	25.5	0.14	---	---	<LOR	38	37	75	---	---	---	---	
Aug-12	C10_0.5-1.0	15.9	0.19	450	260	<LOR	<LOR	<LOR	2.0	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1.9	0.01	---	---	<LOR	<LOR	<LOR	<LOR	---	---	---	---	
Aug-12	C10_1.0-1.5	17.3	<LOR	500	60	<LOR	<LOR	<LOR	1.6	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	---	---	---	---	---	---	---	---	---	---	
Aug-12	C11_0-0-0.35	25.6	3.78	1510	2320	<LOR	3.51	<LOR	5.8	7.8	0.5	12	11	1.6	<LOR	<LOR	5.5	51.6	0.06	---	---	---	---	---	---	---	---	---	---	
Aug-12	C12_0-0-0.5	17.5	0.12	860	1800	<LOR	4.45	<LOR	4.1	1.6	<LOR	2.7	<LOR	1	<LOR	<LOR	3.1	6.1	0.07	---	---	---	---	---	---	---	---	---	---	
Aug-12	C12_0.5-1.0	17.3	0.																											

FIXED BERTHS #1 AND #2
(DREDGE AREA 3)

Analyte		PAHs																				TBT			
Sampling Month	Sample ID	Naphthalene	2-Methylnaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(e)pyrene	Benzo(a)pyrene	Perylene	Benzo(g,h,i)perylene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	Coronene	Sum of PAHs	Sum of PAH normalised	TBT raw	TBT normalised
Units		µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µgSn/kg	µgSn/kg
LOR		5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4		0.5		
NAGD SL		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10000	-	9	
NAGD SQ High		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50000	-	70	
Nov-09	VC3A 0-0.6	16	<LOR	<LOR	4	<LOR	14	<LOR	21	22	14	12	16	7	9	15	7	13	<LOR	12	7	190	275	5	7.2
Nov-09	VC3A 0.6-1.3	9	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	9	45	---	---	
Nov-09	VC3A 1.3-1.9	5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	4	5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	15	60	---	---	
Nov-09	VC3A 1.9-2.4	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	---	---	
Nov-09	VC3B 0-0.5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	5	1.5	3.7	
Nov-09	VC3B 0.5-0.9	5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	5	23	---	---	
Nov-09	SS3A	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	0.5	2.5	
Nov-09	SS3B	39	7	12	<LOR	<LOR	33	9	54	50	28	25	42	13	21	34	16	31	6	27	13	462	150	141	46
Nov-09	SS3C	<LOR	13	15	<LOR	7	45	10	108	158	93	107	169	44	94	192	36	124	27	119	20	1380	1062	<LOR	0.2
Nov-09	SS3D	5	<LOR	<LOR	<LOR	<LOR	<LOR	4	4	<LOR	<LOR	4	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	18	16	1.2	1.0	
Nov-11	SS5E	18	6	<LOR	<LOR	<LOR	31	12	64	57	39	34	42	19	27	47	19	51	18	38	<LOR	522	175	1.8	0.6
Nov-11	VC5B (0-0.8)	31	8	10	24	19	177	41	178	154	89	73	96	52	51	91	34	64	21	54	14	1280	1855	215	312
Nov-11	VC5B (0.8-1.3)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.3	0.3
Nov-11	VC5B (1.3-1.6)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	0.2
Nov-11	VC5C (0-0.5)	16	<LOR	13	<LOR	<LOR	29	10	40	46	30	30	63	29	29	34	224	40	4	20	<LOR	657	295	10.6	4.8
Nov-11	VC5C (0.5-1)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	0.0
Nov-11	VC5D (0-0.5)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.4	0.2
Nov-11	VC5D (1.8-2.1)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	0.3
Nov-11	VC5D (2.1-3.1)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<LOR	0.1
Nov-11	VC5E (0-0.6)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	102	10
Nov-11	VC5E (0.6-0.8)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	47.6	42
Nov-11	VC5E (1-1.6)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	178	23
Aug-12	C1_0-0.55	<LOR	<LOR	14	23	20	160	22	156	134	100	90	120	40	63	100	84	39	17	38	7	1230	123	15.9	1.6
Aug-12	C2_0.0-0.5	<LOR	<LOR	28	7	10	82	24	102	94	74	59	90	35	52	82	48	44	<LOR	28	<LOR	859	676	2	1.6
Aug-12	C3_0.0-0.1	<LOR	<LOR	<LOR	<LOR	<LOR	7	<LOR	30	36	9	15	18	6	13	6	331	<LOR	<LOR	<LOR	<LOR	471	47	3.5	0.4
Aug-12	C4_0.0-0.1	<LOR	<LOR	<LOR	<LOR	<LOR	6	<LOR	15	30	<LOR	10	35	16	22	8	542	<LOR	<LOR	<LOR	<LOR	684	68	<LOR	0.0
Aug-12	C5_0.0-0.15	<LOR	<LOR	<LOR	<LOR	<LOR	9	<LOR	12	23	5	9	24	6	13	14	326	<LOR	<LOR	10	<LOR	451	45	2.2	0.2
Aug-12	C6_0.0-0.13	<LOR	<LOR	<LOR	<LOR	<LOR	7	<LOR	14	<LOR	6	16	34	13	24	19	369	<LOR	<LOR	<LOR	<LOR	502	50	<LOR	0.0
Aug-12	C7_0.0-0.10	<LOR	<LOR	<LOR	<LOR	<LOR	10	<LOR	63	69	9	14	11	<LOR	11	6	66	<LOR	<LOR	<LOR	<LOR	259	26	0.5	0.1
Aug-12	C8_0.0-0.12	<LOR	<LOR	<LOR	<LOR	<LOR	6	<LOR	18	<LOR	<LOR	8	57	21	19	15	250	42	<LOR	36	<LOR	472	47	<LOR	0.0
Aug-12	C9_0.0-0.45	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	19	8	5	5	34	<LOR	<LOR	6	<LOR	77	29	<LOR	0.1	
Aug-12	C10_0-0.50	<LOR	<LOR	34	<LOR	18	129	42	133	112	84	64	108	39	69	85	30	36	7	25	7	1020	1569	2.7	4.2
Aug-12	C10_0.5-1.0	<LOR	<LOR	<LOR	<LOR	<LOR	5	<LOR	6	5	<LOR	4	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	20	100	<LOR	1.3	
Aug-12	C10_1.0-1.5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	<LOR	1.3	
Aug-12	C11_0.0-0.35	10	<LOR	5	<LOR	<LOR	41	<LOR	56	52	38	21	49	11	21	35	27	26	<LOR	26	12	430	114	5.4	1.4
Aug-12	C12_0.0-0.5	<LOR	<LOR	4	<LOR	<LOR	8	<LOR	13	14	11	10	10	4	9	5	<LOR	6	<LOR	<LOR	<LOR	94	470	<LOR	1.3
Aug-12	C12_0.5-1.0	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	6	<LOR	0.7	
Aug-12	C12_1-1.5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	10	<LOR	1.3	
Aug-12	C13_0.0-0.5	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	6	6	4	<LOR	6	<LOR	4	5	36	<LOR	<LOR	<LOR	<LOR	67	76	0.7	0.8
Aug-12	C14_0.0-0.15	<LOR	12	<LOR	<LOR	<LOR	27	9	67	85	20	24	28	12	19	18	532	<LOR	<LOR	<LOR	<LOR	853	85	1.1	0.1
Aug-12	C15_0.0-0.5	83	24	25	4	11	60	26	97	97	63	52	68	24	44	65	44	46	8	33	10	884	475	2.3	1.2
Aug-12	C18_0.0-0.5	47	16	22	<LOR	12	85	18	118	100	59	51	79	19	42	65	23	53	12	41	15	877	1253	0.9	1.3
Aug-12	C18_0.5-0.9	<LOR	<LOR	<LOR	6	<LOR	<LOR	<LOR	8	8	<LOR	<LOR	40	11	10	15	74	<LOR	<LOR	<LOR	<LOR	172	31	<LOR	0.0
Total No. of Samples		34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	344				

Notes:
All organics are normalised to 1% TOC (with 0.2 to 10% TOC)
Where results are below the analytical limit of Reporting (LOR), half the LOR has been used in the statistical analyses
* NAGD Sediment Quality High value = 70 µgSn/kg nc = not calculated; --- = not analysed



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SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

Appendix 10 Dilution Modelling of Elutriate TBT at the Sydney Offshore Spoil Ground



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SEDIMENT SAMPLING AND ANALYSIS PLAN IMPLEMENTATION REPORT

Appendix 10A TBT Dilution Modelling for Sea Disposal at Sydney Offshore Spoil Ground – Approaches and Turning Circle (Dredge Area 1)



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CALTEX DREDGING – DREDGE AREA 1 (APPROACHES AND TURNING CIRCLE)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

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CALTEX DREDGING – DREDGE AREA 1 (APPROACHES AND TURNING CIRCLE)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

A1 INTRODUCTION

Either split hopper barges or trailer suction hopper dredgers are proposed to be used for dredge material disposal operations as part of the Caltex dredging project. In both of these vessels, doors in the bottom of the ship's hull (or the hull itself) would be opened, and the entire hopper contents (a mixture of water and solids) would be emptied within the Sydney Offshore Spoil Ground.

In the National Assessment Guidelines for Dredging (Commonwealth of Australia, 2009), hereafter denoted as NAGD, it is recommended that the applicable ANZECC/ARMCANZ (2000) marine water quality guidelines not be exceeded after allowing for initial mixing, defined as mixing which occurs within four hours of dumping.

Initial dilution of disposed dredged material in the ocean depends on a number of factors, such as water depth, stratification in the water column, and current velocities and directions. As described in Appendix A of the NAGD (refer page 59), initial dilution can be determined using either of two methods, namely:

- the liquid and suspended particulate phases of the waste may be assumed to be evenly distributed after four hours over a column of water bounded on the surface by the release zone and extending to the ocean floor, thermocline or halocline, if one exists, or to a depth of 20m, whichever is shallower (this methodology is denoted herein as the *analytical method*); or,
- it can be calculated using the US Army Engineers Waterways Research Station STFATE model (this methodology is denoted herein as the *numerical method*).

The most critical contaminant relative to screening levels for the subject dredging is tributyltin (TBT), and it is this contaminant that is considered herein. The more accurate numerical method (STFATE modelling) has been adopted herein to predict the initial dilution of TBT for disposal operations at the Sydney Offshore Spoil Ground. The analytical method is overly conservative for application in this case, given that the mixing zone is specified to only extend to a depth of 20 m in the methodology, when actual depths are approximately 100 m.

Background information is provided in Section A2, and the STFATE modelling is described in Section A3.



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CALTEX DREDGING – DREDGE AREA 1 (APPROACHES AND TURNING CIRCLE)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

A2 BACKGROUND INFORMATION

A2.1 TBT Concentrations

A summary of elutriate testing results for TBT is provided in **Table A1**, varying with location (Area 1, Area 2, Area 3, and combined over all areas).

Table A1: Elutriate testing results for TBT (95% upper confidence limit mean concentrations)

Area	TBT in Sediment (µg/kg) ¹	TBT in Elutriate (ng/L) ²	% of TBT released in elutriate test ³
1	430.7	3119	1.9
2	309.1	38.2	0.03
3	48.1	68.9	0.4
All	254.7	1133	1.2

It is evident that sediment and elutriate TBT concentrations were highest in Area 1. Given that these concentrations were significantly higher than for other areas (and all areas combined), simulating the disposal of Area 1 sediment is critical (would generate the highest concentrations of TBT in the water column). Therefore, disposal of only Area 1 sediments (i.e. the worst-case 95%UCL) has been simulated herein as per DSEWPaC's comments (refer Appendix 1 of the main report).

The ANZECC/ARMCANZ (2000) trigger values for TBT at the 95% and 99% levels of protection are 6 ng/L and 0.4 ng/L respectively.

A2.2 Dredged Sediment Properties

The sediment to be dredged varies in properties depending on location. The approximate proportions of various sediment types is provided in **Table A2**.

Table A2: Proportions (%) of various sediments to be dredged (by mass)

Area	Proportion (%)				
	Clay	Silt	Sand	Gravel	Total
1	5.3	2.1	89.1	3.5	100
2	6.0	2.0	92.0	0.0	100
3	13.4	3.7	68.9	14.0	100
All	8.3	2.7	82.3	6.7	100

¹ Normalised to 1% TOC within limits of 0.2% to 10% TOC.

² As remaining in the supernatant after the elutriate test and corrected for the seawater blank.

³ Assuming a sediment density of 2650kg/m³ and voids ratio of 0.37, and given that the elutriate test is undertaken with 4 times the volume of seawater. For example, for Area 1 it can be shown that with 431µg/kg of TBT in a sample (that is, per kg of solid particles), there would be 165,000ng/L of TBT initially (potentially available) in the elutriate testing container. The fact that only 3119ng/L remained in the supernatant after the elutriate test indicated that only 1.9% of the TBT was released.



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CALTEX DREDGING – DREDGE AREA 1 (APPROACHES AND TURNING CIRCLE)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

The proportions of sediments in the dredging vessel hopper prior to disposal would vary depending on the dredging methodology (backhoe loading a split hopper barge or trailer suction hopper dredging, with or without overflowing). Approximate proportions of insitu sediment (by volume)⁴ that would be located in the hopper for each dredging case are provided in **Table A3**. Note that it is proposed that a combination of trailer suction hopper dredging and backhoe dredging would be undertaken.

Table A3: Proportions of insitu sediment (by volume) for four dredging cases

Case	Dredging Operation	Proportion of insitu sediment (by volume) in hopper (%)
Case 1	backhoe loading a split hopper barge (with overflowing)	80
Case 2	backhoe loading a split hopper barge (no overflowing)	40
Case 3	trailer suction hopper dredging (with overflowing)	70
Case 4	trailer suction hopper dredging (no overflowing)	20

For the critical Area 1 location, approximate hopper volumetric fractions (proportion of each sediment type by volume, expressed as a decimal) for each of the sediment types were determined as listed in **Table A4**, based on an insitu solids proportion of 78% by mass (43% porosity)⁵ and bulking factors of 1.25, 2.5, 1.43, and 5.0 for each of the dredging cases respectively⁵.

Table A4: Volumetric fractions of each sediment type in hopper for four dredging cases, for Area 1

Sediment Type	Volumetric Fraction			
	Case 1	Case 2	Case 3	Case 4
Gravel	0.016	0.008	0.014	0.004
Medium Sand	0.408	0.204	0.357	0.102
Silt	0.010	0.005	0.008	0.002
Clay	0.024	0.012	0.021	0.006

Volumetric fractions for other areas have not been listed herein as simulations were only undertaken for the critical “worst case 95%UCL” Area 1 location.

⁴ With the remainder of material in the hopper generally being water, and noting that this insitu sediment also contains water filling the voids.

⁵ As recommended by Dr Paul Schroeder, Research Civil Engineer and dredging expert, Environmental Laboratory, US Army Corps of Engineers.



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CALTEX DREDGING – DREDGE AREA 1 (APPROACHES AND TURNING CIRCLE)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

A3 STFATE MODELLING

A3.1 Model Background

In STFATE, the behaviour of the material during disposal is assumed to be separated into three phases, namely:

- convective descent, during which the disposal cloud falls under the influence of gravity and its initial momentum is imparted by gravity;
- dynamic collapse, occurring when the descending cloud either impacts the bottom or arrives at a level of neutral buoyancy where descent is retarded and horizontal spreading dominates; and,
- passive transport-dispersion, commencing when the material transport and spreading are determined more by ambient currents and turbulence than by the dynamics of the disposal operation (USEPA, 1998).

Note that, given the size of the disposal area and time between disposal episodes, it can be assumed that subsequent disposal operations from the same dredging campaign would not interact in the water column. That is, only a single disposal operation has been simulated in each STFATE run.

A3.2 Cases Simulated

Four simulations were undertaken based on dredging of Area 1 sediments, that is for the four dredging cases as follows:

1. backhoe loading a split hopper barge (with overflowing);
2. backhoe loading a split hopper barge (no overflowing);
3. trailer suction hopper dredging (with overflowing); and,
4. trailer suction hopper dredging (no overflowing).

The inputs used in this modelling are described in Section A3.3, while the results are provided in Section A3.4.

A3.3 Modelling Inputs

The values selected as input variables into the STFATE model for Case 1 are summarised in **Table A5**. Note that in selecting default STFATE material properties (refer **Table A4**), sand was treated as “medium sand”. Also, it is recommended that the elutriate concentration be used as input for the type of modelling selected in STFATE, as adopted. This is reasonable since the ratio of solids (with voids) to water in the hopper is similar to the equivalent ratio in the elutriate.



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CALTEX DREDGING – DREDGE AREA 1 (APPROACHES AND TURNING CIRCLE)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

Table A5: Input variables used in STFATE modelling for Case 1

Variable		Units	Selection
Type of analysis			Section 404(b)(1) Regulatory Analysis for US Navigable Waters
Method of disposal			Split-hull barge
Program Options	Simulation type		Descent, collapse and diffusion (default coefficients)
	Evaluation type		Tier II, Compare Water Quality
	Initial TBT concentration in fluid fraction	mg/L	3.12×10^{-3}
	Background concentration at disposal site	mg/L	0
Output Options	Depths for which output desired	m	10, 25, 50, 75, 100
	Duration of the simulation	hours	4
	Long-term time step for diffusion	s	600
Site Description	Grid points		96 x 96
	Grid spacing	m	18 x 18
	Roughness height	m	1.5×10^{-3}
	Slope of bottom	degrees	0
	Constant water depth	m	100
	Water density	g/cm ³	1.025 constant
Material Description	Layers in vessel		1
	Volume of hopper	m ³	765
	Velocity of vessel	m/s	0.8
	Material type		Four types ⁶ , see Table A4
	Dredge material specific gravity		2.65
	Volumetric fraction (proportion of solids by volume)	m ³ /m ³	Four fractions, see Table A4
	Solid fraction fall velocity	mm/s	STFATE default for each material type
	Void ratio after deposition		STFATE default for each material type
	Critical shear stress	N/m ²	STFATE default for each material type
	Cohesive		STFATE default for each material type
	Stripped during descent		STFATE default for each material type
Velocity Data	Ambient velocity profile type		Single depth averaged velocity
	Depth averaged velocity	m/s	0.1
Disposal operation	Length of disposal vessel bin	m	31.2
	Width of disposal vessel bin	m	7.5
	Pre-disposal draft of vessel	m	3.5
	Post-disposal draft of vessel	m	1.3

⁶ Parameters for material types include the percent clay/ silt fraction as per DSEWPac's comments (refer Appendix 1 of the main report).



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CALTEX DREDGING – DREDGE AREA 1 (APPROACHES AND TURNING CIRCLE)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

Variable		Units	Selection
	Time needed to empty the disposal vessel	s	10
	Dumping over a depression		No

The only variable changed for Case 2 (compared to Case 1) was the volumetric fraction for each sediment type as per **Table A4**. For Case 3, the variables changed compared to Case 1 were as follows:

- volumetric fraction for each sediment type as per **Table A4**;
- volume of hopper of 965m³;
- length of disposal vessel bin of 35.5m;
- pre-disposal draft of vessel of 3.7m; and,
- post-disposal draft of vessel of 1.9m.

For Case 4, the only variable changed compared to Case 3 was the volumetric fraction for each sediment type as per **Table A4**.

A3.4 Modelling Results

The STFATE (numerical) modelling results for the four cases simulated are summarised in **Table A6**. The results were compared to the ANZECC/ARMCANZ (2000) marine water quality guidelines for TBT at the 95% protection level (i.e. 6 ng/L) and at the 99% level of protection (i.e. 0.4 ng/L). The multiplier required for each result to exceed the relevant guidelines is also provided.

Table A6: Summary of STFATE modelling results

Case	Maximum concentration of TBT in the water column after four hours (ng/L)	Multiplier that TBT concentration is less than	
		95% protection level	99% protection level
1 - backhoe loading a split hopper barge (with overflowing)	4.3×10 ⁻²	139	9.3
2 - backhoe loading a split hopper barge (no overflowing)	6.2×10 ⁻²	97	6.5
3 - trailer suction hopper dredging (with overflowing)	5.7×10 ⁻²	105	7.0
4 - trailer suction hopper dredging (no overflowing)	8.9×10 ⁻²	68	4.5

It is evident from the STFATE (numerical) method that after initial mixing (that is after four hours), TBT concentrations at the Sydney Offshore Spoil Ground would be less than the ANZECC/ARMCANZ (2000) trigger values at both the 95% and 99% protection levels for all four dredging scenarios for the “worst-case” Area 1 sediments.



CALTEX REFINERIES NSW

CALTEX DREDGING – DREDGE AREA 1 (APPROACHES AND TURNING CIRCLE)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

The results also indicate that of the four potential dredging methods, trailer suction hopper dredging without overflowing is likely to result in the highest concentration of TBT in the water column after initial mixing. However, the results for this method show that TBT in the water column is expected to be about 70 times *less than* the ANZECC/ ARMCANZ (2000) protection level for 95% of species.

Therefore, the concentrations of TBT in material from the proposed Caltex dredge areas are not of concern to water quality during disposal at the Sydney Offshore Spoil Ground.



CALTEX REFINERIES NSW

CALTEX DREDGING – DREDGE AREA 1 (APPROACHES AND TURNING CIRCLE)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

A4 REFERENCES

ANZECC/ARMCANZ (2000) *National Water Quality Management Strategy, Paper No. 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, October, Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), ISBN 09578245 0 5 (set), ISSN 1038 7072.

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Appendix 10B TBT Dilution Modelling for Sea Disposal at Sydney Offshore Spoil Ground – Fixed Berths #1 and #2 (Dredge Area 3)



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CALTEX DREDGING –DREDGE AREA 3 (FIXED BERTHS 1 AND 2)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

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CALTEX DREDGING –DREDGE AREA 3 (FIXED BERTHS 1 AND 2)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

A1 INTRODUCTION

A split hopper barge is proposed to be used for dredge material disposal operations as part of the Caltex maintenance dredging project. In this vessel, doors in the bottom of the ship's hull (or the hull itself) would be opened, and the entire hopper contents (a mixture of water and solids) would be emptied within the Sydney Offshore Spoil Ground.

In the National Assessment Guidelines for Dredging (Commonwealth of Australia, 2009), hereafter denoted as NAGD, it is recommended that the applicable ANZECC/ARMCANZ (2000) marine water quality guidelines not be exceeded after allowing for initial mixing, defined as mixing which occurs within four hours of dumping.

Initial dilution of disposed dredged material in the ocean depends on a number of factors, such as water depth, stratification in the water column, and current velocities and directions. As described in Appendix A of the NAGD (refer page 59), initial dilution can be determined using either of two methods, namely:

- the liquid and suspended particulate phases of the waste may be assumed to be evenly distributed after four hours over a column of water bounded on the surface by the release zone and extending to the ocean floor, thermocline or halocline, if one exists, or to a depth of 20 m, whichever is shallower (this methodology is denoted herein as the *analytical method*); or
- it can be calculated using the US Army Engineers Waterways Research Station STFATE model (this methodology is denoted herein as the *numerical method*).

The critical contaminant relative to screening levels for the subject dredging is tributyltin (TBT), and it is this contaminant that is considered herein. The more accurate numerical method (STFATE modelling) has been adopted herein to predict the initial dilution of TBT for disposal operations at the Sydney Offshore Spoil Ground. The analytical method is overly conservative for application in this case, given that the mixing zone is specified to only extend to a depth of 20 m in the methodology, when actual depths are about 100 m.

Background information is provided in Section A2, and the STFATE modelling is described in Section A3.



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CALTEX DREDGING –DREDGE AREA 3 (FIXED BERTHS 1 AND 2)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

A2 BACKGROUND INFORMATION

A2.1 TBT Concentrations

A summary of elutriate testing results for TBT in Dredge Area 3 (Berths 1 and 2) is provided in **Table A1**.

Table A1: Elutriate testing results for TBT (95% UCL mean concentrations)

Dredge Area	TBT in Sediment (µg/kg) ¹	TBT in Elutriate (ng/L) ²
3 (Berths 1 and 2)	25	16.2

Disposal of only Area 1 (Berths 1 and 2) sediments has been simulated herein. The ANZECC/ARMCANZ (2000) trigger values for TBT at the 95% and 99% levels of protection are 6ng/L and 0.4 ng/L respectively.

A2.2 Dredged Sediment Properties

The sediment to be dredged varies in properties depending on location. The approximate proportions of various sediment types are provided in **Table A2**.

Table A2: Proportions (%) of various sediments to be dredged (by mass)

Area	Proportion (%)				
	Clay	Silt	Sand	Gravel	Total
Dredge Area 3 (Berths 1 and 2)	7	4	80	10	101

The proportions of sediments in the dredging vessel hopper prior to disposal would vary depending on the dredging methodology, but in this case only a backhoe loading a split hopper barge without overflowing is assumed. Approximate proportions of *in situ* sediment (by volume)³ that would be located in the hopper are provided in

Table A3.

Table A3: Proportions of *in situ* sediment (by volume) for single dredging scenario

Case	Dredging Operation	Proportion of <i>in situ</i> sediment (by volume) in hopper (%)
Case 1	backhoe loading a split hopper barge (no overflowing)	30

¹ Normalised to 1% TOC.

² Remaining in the supernatant after the elutriate test.

³ With the remainder of material in the hopper generally being water, and noting that this *in situ* sediment also contains water filling the voids.



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CALTEX DREDGING –DREDGE AREA 3 (FIXED BERTHS 1 AND 2)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

For Dredge Area 3 (Berths 1 and 2) location, approximate hopper volumetric fractions (proportion of each sediment type by volume, expressed as a decimal) for each of the sediment types were determined as listed in **Table A4**, based on an *in situ* solids proportion of 78% by mass (43% porosity) and a bulking factor of 3.33 for the dredging scenario⁴.

Table A4: Volumetric fractions of each sediment type in hopper for four dredging cases, for Area 1

Sediment Type	Volumetric Fraction
	Case 1
Gravel	0.017
Medium Sand	0.137
Silt	0.007
Clay	0.012

Volumetric fractions for other areas have not been listed herein as simulations were only undertaken for the critical Dredge Area 3 (Berths 1 and 2) location.

⁴ As recommended by Dr Paul Schroeder, Research Civil Engineer and dredging expert, Environmental Laboratory, US Army Corps of Engineers.



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CALTEX DREDGING –DREDGE AREA 3 (FIXED BERTHS 1 AND 2)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

A3 STFATE MODELLING

A3.1 Model Background

In STFATE, the behaviour of the material during disposal is assumed to be separated into three phases, namely:

- convective descent, during which the disposal cloud falls under the influence of gravity and its initial momentum is imparted by gravity;
- dynamic collapse, occurring when the descending cloud either impacts the bottom or arrives at a level of neutral buoyancy where descent is retarded and horizontal spreading dominates; and,
- passive transport-dispersion, commencing when the material transport and spreading are determined more by ambient currents and turbulence than by the dynamics of the disposal operation (USEPA, 1998).

Note that, given the size of the disposal area and time between disposal episodes, it can be assumed that subsequent disposal operations from the same dredging campaign would not interact in the water column. That is, only a single disposal operation has been simulated in each STFATE run.

A3.2 Cases Simulated

One simulation was undertaken based on dredging of Area 3 (Berths 1 and 2) sediments, which is for the following dredging case:

1. backhoe loading a split hopper barge (no overflowing).

The inputs used in this modelling are described in Section A3.3, while the results are provided in Section A3.4.

A3.3 Modelling Inputs

The values selected as input variables into the STFATE model for Case 1 are summarised in **Table A5**. Note that in selecting default STFATE material properties, sand was treated as “medium sand”. Also, it is recommended that the elutriate concentration be used as input for the type of modelling selected in STFATE, as adopted. This is reasonable since the ratio of solids (with voids) to water in the hopper is similar to the equivalent ratio in the elutriate.



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CALTEX DREDGING –DREDGE AREA 3 (FIXED BERTHS 1 AND 2)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

Table A5: Input variables used in STFATE modelling for Case 1

Variable		Units	Selection
Type of analysis			Section 404(b)(1) Regulatory Analysis for US Navigable Waters
Method of disposal			Split-hull barge
Program Options	Simulation type		Descent, collapse and diffusion (default coefficients)
	Evaluation type		Tier II, Compare Water Quality
	Initial TBT concentration in fluid fraction	mg/L	1.62×10^{-5} (TBT)
	Background concentration at disposal site	mg/L	0 (TBT)
Output Options	Depths for which output desired	m	10, 20, 25, 50, 75, 100
	Duration of the simulation	hours	4
	Long-term time step for diffusion	s	600
Site Description	Grid points		96 x 96
	Grid spacing	m	18 x 18
	Roughness height	m	1.5×10^{-3}
	Slope of bottom	degrees	0
	Constant water depth	m	100
	Water density	g/cm ³	1.025 constant
Material Description	Layers in vessel		1
	Volume of hopper	m ³	500
	Velocity of vessel	m/s	1.03
	Material type		Four types, see Table A4
	Dredge material specific gravity		2.65
	Volumetric fraction (proportion of solids by volume)	m ³ /m ³	Four fractions, see Table A4
	Solid fraction fall velocity	mm/s	STFATE default for each material type
	Void ratio after deposition		STFATE default for each material type
	Critical shear stress	N/m ²	STFATE default for each material type
	Cohesive		STFATE default for each material type
	Stripped during descent		STFATE default for each material type
Velocity Data	Ambient velocity profile type		Single depth averaged velocity
	Depth averaged velocity	m/s	0.1
Disposal operation	Length of disposal vessel bin	m	31.2
	Width of disposal vessel bin	m	7.5
	Pre-disposal draft of vessel	m	3.5
	Post-disposal draft of vessel	m	1.3
	Time needed to empty the disposal vessel	s	10
	Dumping over a depression		No



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CALTEX DREDGING –DREDGE AREA 3 (FIXED BERTHS 1 AND 2)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

A3.4 Modelling Results

The STFATE (numerical) modelling results for the four cases simulated are summarised in **Table A6**. The results were compared to the ANZECC/ARMCANZ (2000) marine water quality guidelines for TBT at the 95% protection level (i.e. 6 ng/L) and at the 99% level of protection (i.e. 0.4 ng/L). The multiplier required for each result to exceed the relevant guidelines is also provided.

Table A6: Summary of STFATE modelling results

Case	Maximum concentration of TBT in the water column after four hours (ng/L)	Multiplier that TBT concentration is less than	
		95% protection level	99% protection level
1 - backhoe loading a split hopper barge (no overflowing)	2.86×10^{-7}	20979	1399

It is evident from the STFATE (numerical) method that after initial mixing (that is after four hours), TBT concentrations at the Sydney Offshore Spoil Ground would be less than the ANZECC/ARMCANZ (2000) trigger values at both the 95% and 99% protection levels for TBT.

Therefore, the concentrations of TBT in material from Dredge Area 3 (Berths 1 and 2) are not of concern to water quality during disposal at the Sydney Offshore Spoil Ground.



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CALTEX DREDGING –DREDGE AREA 3 (FIXED BERTHS 1 AND 2)

TBT DILUTION MODELLING FOR SEA DISPOSAL AT SYDNEY OFFSHORE SPOIL GROUND

A4 REFERENCES

ANZECC/ARMCANZ (2000) *National Water Quality Management Strategy, Paper No. 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, October, Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), ISBN 09578245 0 5 (set), ISSN 1038 7072

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

United States Environmental Protection Agency [USEPA] (1998) *Evaluation of Dredged Material Proposed for Discharge in Waters of the US, Testing Manual, Inland Testing Manual*, EPA 823-B-98-004, USEPA and US Army Corps of Engineers, February



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Appendix 11 Planning Focus Meeting Minutes

Caltex Maintenance Dredging Project

NOTES FROM PLANNING FOCUS MEETING (PFM)

Meeting Date: 16th September 2011

Meeting location – 2 Market St, Sydney

Meeting opened 11.00.

Attendees

Attendees:	Company
Christina Halim (CH)	Caltex
Kylie Gordon (KG)	Caltex
Orla Murray (OM)	WorleyParsons
Matt Potter (MP)	WorleyParsons
Marcel Green (MG)	I&I (Fisheries)
Ryan Bennett (RB)	SPC
Craig Patterson (CP)	OEH
Apologies:	Company
Barry McDonnell	Caltex
Stuart Carr	Maritime
Rory Gray	Maritime
Gary Batman	SPC

Item #	Item Description	WP Response
1	Primary Approval	
	RB RB, as a planner for SPC, indicated that the project would likely fall under Part 4 of the <i>Environmental Planning and Assessment Act, 1979</i> (EP&A Act) under Clause 69 of State Environmental Planning Policy (Infrastructure) 2007 (I-SEPP). RB also indicated that Schedule 3 of the EP&A Regulations should be checked to ensure that the project is not Designated Development (i.e. an “extractive industry” with an area greater than 2ha, within 40m of a waterway, within 200m of a coastline or in areas of acid sulfate soil material or contamination).	There are two options: a) Approach Maritime formally with reason to consider that the dredging is in Maritime's interest and could be carried out under Part 5 of the EP&A Act. b) Undertake the dredging under Part 4 of the EP&A Act as consent is required in accordance with Clause 69 of the I-SEPP. Please refer to additional advice to be provided by WorleyParsons on the approval process.
	RB If consent is required, each authority would get 28 days for responding to the	Noted.

		application.	
	RB	Maritime, as owner of the sand, may have a preferred option for the disposal of the sand (i.e. Maritime may wish to sell the sand).	Noted. As discussed, the sand is unlikely to be acceptable to Councils or government authorities due to the elevated concentrations of TBT. As such, it is unlikely that the sand would be reused without some sort of treatment (such as cement stabilisation) which would reduce the value of the sand as a product.
	RB	A new SEPP is soon to be gazetted. The SEPP should be checked to ensure that there are no other provisions for State Significant Development (SSD) and Designated Development should be checked.	The only relevant Class of State Significant Development proposed in the new SEPP is Class 18 "Port Facilities and Wharf or Boating Facilities". This only applies where there is a capital investment value (CIV) >\$30M. The CIV for this project is ≤ \$15M and therefore, does not trigger SSD.
	CP	The decision of Part 4 versus Part 5 is critical and affects whether the project would be integrated development under Part 4.	Noted.
2	Secondary Approvals		
	RB	SPC's role in approvals would be provision of Harbour Master Approval. SPC would not be involved as a consent or determining authority. The application form for Harbour Master approval can be found on the SPC website. Approval would not take a substantial amount of time. It is also possible to pre-consult SPC. Applications for HM Approval require the completion of the Environmental Assessment.	Noted.
	MG	If Maritime authorises the works, it takes away the Fisheries authority role (for dredging, not for harm to marine vegetation).	Noted.
	RB	There is currently a long turn-around time for review of sea dumping applications by the Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC). SPC have been looking into the feasibility of capital and maintenance dredging. It may be that the future workload of SEWPaC is reduced, hence reducing the review timeframe.	WP liaison with SEWPaC indicated SEWPaC has a high workload but the Department tries to adhere to the 90 day statutory period. Note that should any clarifications be required within the first 60days, the 90 day period starts again following submission of additional material. SEWPaC have advised that a separate sea dumping permit

			application would be required for the capital dredge material. SEWPaC have been informed that we wish to undertake sampling and analysis as soon as possible.
	?	Consultation with the Office of Water in Primary Industries is required. A Controlled Activity Approval (CAA) under the <i>Water Management Act, 2000</i> (WM Act) may be required if the project falls under Part 4 of the EP&A Act, otherwise, the Office of Water may be required in a consultative role.	A CAA or concurrence from the Office of Water is likely to be required as the project would involve the “removal of material” (i.e. the removal of material, whether or not extractive material...) on “water front land” (i.e. the bed of an estuary or within coastal waters of the state). This is likely to be a simple matter and the Office of Water would be consulted during the Environmental Assessment process once the approvals pathway (i.e. Part 4 vs Part 5) has been determined.
	CP	OEH would primarily be concerned about the impact to the aquatic reserve and bird habitat past Bonna Point from noise and sedimentation (potentially contaminated).	Noted.
	CP	The EPL application process time is 60 days. As this is longer than the proposed dredging timeframe (i.e. 6 or 11 weeks depending on methodology), CP will look to see if there is a way around issuing a licence for such a short period.	Noted.
	CP	OEH would base any EPL conditions on previous licences issued for dredging Botany bay. WP should look at the EPL(s) for Port Botany works and make sure the environmental assessments covers similar issues.	Noted.
3	Marine Ecology Assessment		
	MG	The assessment should focus on the distribution and extent of seagrass. The footprint is most likely too far out, too deep and too well shipped.	Noted.
	MG	As such, a desktop study would likely suffice. A biota survey of the dredge and disposal areas is probably not required.	Noted.
	MG	Sydney Water could be contacted for access to the survey data used for the	Noted.

		desalination pipeline project.	
	RB	A Marine Mammal Management Plan for cetaceans may be required as a condition of approval such as recently required for dredging in Botany Bay. The recent plan provided a map of zones. The plan involved volunteers who observe whale migrations and communicate the migrations with the dredging operator. The migration seasons should be considered in relation to the project timeframe.	Noted. Management of cetaceans is also required for transport to and disposal at the offshore spoil ground in accordance with conditions of any sea dumping permit that would be issued.
	CB	A seagrass reference panel was set up for the Energy Australia cable project.	Noted.
	MG/KG	The nearest commercial fishing occurs in Georges River (oyster farming). The fish farm which was located adjacent to the Caltex wharf is no longer there (believed moved to Georges River).	Noted.
4	Noise Assessment		
	CP	Kurnell residents are very sensitive to noise. Caltex have received complaints from residents on current waterfront works.	Noted. Caltex response by email (CH)- Caltex is unsure what this relates to. Caltex received one community complaint about a month or so ago in relation to dust from maintenance work being carried out on the wharf, however CH is not aware if this was raised/discussed with the OEH. CP maybe referring to concerns raised about the proposed work to upgrade the Jet Pipeline capacity. However this work has not commenced and is yet to be approved by the NSW Department of Planning & Infrastructure.
	CP	The noise assessment should consider the cumulative impact from the jet pipeline works, a 12 month project.	Caltex response by email (CH) - while the Jet Pipeline Upgrade project is expected to take 12 months to complete, the work in the refinery's right of way, that might generate noise impacts for the nearby residents is anticipated to take 3-4 months to complete. Caltex anticipates approval by the NSW Department of Planning & Infrastructure in the near future and anticipate work starting in Q4 2011.

	MP	A 1km limit for dredging was employed for the WDA desalination pipeline dredging and was limited to daylight hours.	
5	Proposed Dredging and Disposal Methodology		
	CP	OEH agrees that due to the elevated TBT concentrations in the proposed dredge material, and the lack of TBT guidelines for reuse, the public and Council are unlikely to agree with the reuse of the sand.	Noted.
	CP	OEH agree that land disposal would require full dewatering, access for transferring spoil from barges to trucks, and trucking/ transport issues.	Noted.
	CP	OEH doesn't see a problem with the proposed dredging method, i.e. using a trailer suction hopper dredge (TSHD) based on its efficiency and the type of material to be dredged (i.e. limited fines).	Noted.
6	Other Comments		
	RB	A search should be conducted to see if there are any submarine cables (e.g. Optus and Telstra) within the dredge footprint.	An assessment of existing services would be undertaken during the environmental assessment. It would also be expected that the dredging Contractor would carry out a services search prior to dredging.
	KG	Botany Bay Protection Council (Burnie Clarke) recently raised concerns over dredging in Botany Bay.	Noted.
	CP	An oil slick was reported in the media in April 2011. As such, the community are very aware of downstream impacts from such disturbances.	Community concerns noted. This is likely to be an issue for consideration by SEWPaC regarding sea disposal. SEWPaC would consider that there is potential for additional contamination since the previous investigations as a result of any reported slick. WP requested additional information from Caltex. Caltex responded with information on the management of the oily water discharge including information that no contamination was evident on

			the shoreline during inspections by OEH. WP added testing of PAHs and TPHs in surface samples to the Supplementary SAP and submitted to SEWPaC. Whilst no additional contamination is expected, this testing would likely flag if there has been an impact to the proposed dredge area as a result of the discharge.
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Appendix 12 Data Validation Summary

Field Triplicates - Sediment

Notes:
The relative standard deviation (RSD) for field triplicates or relative percent difference (RPD) for field replicates should be within $\pm 50\%$, although they may not always do so where the sediments
Sample S55Y was assumed to be a "split triplicate" sample which was analysed by the secondary laboratory. The sample label and results indicate the sample may have been one of the missing field triplicates.

[illegible][illegible]

Split Duplicates - Elutriate

Analyte			TBT
Units			µgSn/kg
LOR			2
Elutriate Duplicate of	Mar-10	SS4G*	26
		FT1*	35
		Mean	30.5
		% RPD	<29.5

Notes:
The relative percent difference (RPD) for split duplicates and the RSD for split triplicates should be within ±35%.
*Pre-TBT blank correction value (Final value is corrected for blank TBT concentration)

Field Blanks

Analyte	Moisture Content	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Total Xylenes	Sum of BTEX	Naphthalene	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	C6 - C10 Fraction
Units	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR	1	0.2	0.2	0.2	0.2	0.2	0.5	0.2	0.2	3	3	3	5	3	3
Mar-10	TRIP BLANK	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	-	<3	-	-	-	-	-
Nov-11	TRIP BLANK	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2	<3	<3	<3	<5	<3	<3

	Moisture Content (dried @ 103 °C)	TOC	Metals																PAHs																				Sum of PAHs	TBT raw
			Al	Fe	Sb	As	Cd	Cr	Cu	Co	Pb	Mn	Ni	Se	Ag	V	Zn	Hg	Naphthalene	2-Methylnaphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(e)pyrene	Benzo(a)pyrene	Perylene	Benzo(g,h,i)perylene	Dibenz(a,h)anthracene	Indeno(1,2,3.cd)pyrene	Coronene		
Field Triplicate 1 (Data Quality Objective: <50% RSD)																																								
C2_0.0-0.5	27.4	1.27	4090	5870	<0.50	6.59	0.2	26.2	15	1.2	28.3	27	3.9	<0.1	0.3	12.3	102	0.44	<5	<5	28	7	10	82	24	102	94	74	59	90	35	52	82	48	44	<4	28	2.5	859	2.0
T01A	29.5	1.74	4650	7040	<0.50	8.12	0.2	30.3	18.1	1.4	34.6	30	4.3	<0.1	0.3	13.9	128	0.5	<5	<5	33	14	17	146	26	153	144	129	113	149	39	108	102	38	90	<4	53	28	1380	2.7
T01B	29.1	1.81	5100	7740	<0.50	9.64	0.3	37.9	18.1	1.5	35.2	31	4.8	<0.1	0.4	15.9	130	0.69	<5	<5	36	15	17	176	33	208	196	148	126	155	38	103	111	38	88	<4	57	27	1570	3.0
Average	28.7	1.61	4613	6883	<LOR	8.12	0.23	31.5	17.1	1.4	32.7	29	4.3	<LOR	0.3	14.0	120	0.54	<LOR	<LOR	32	12	15	135	28	154	145	117	99	131	37	88	98	41	74	<LOR	46	19	1270	2.6
SD	1.1	0.29	506	945	NA	1.53	0.06	5.9	1.8	0.2	3.8	2	0.5	NA	0.1	1.8	16	0.13	NA	NA	4	4	4	48	5	53	51	38	36	36	2	31	15	6	26	NA	16	14	368	0.5
RSD (%)	3.9	18.3	11.0	13.7	NA	18.8	24.7	18.9	10.5	11.2	11.7	7.1	10.4	NA	17.3	12.9	13.0	24.0	NA	NA	12.5	36.3	27.6	35.7	17.1	34.3	35.3	32.8	35.8	27.4	5.6	35.3	15.1	14.0	35.1	NA	34.2	75.4	29.0	20.0
Field Triplicate 2 (Data Quality Objective: <50% RSD)																																								
C11_0.0-0.35	25.6	3.78	1510	2320	<0.50	3.51	<0.1	5.8	7.8	0.5	12	11	1.6	<0.1	<0.1	5.5	51.6	0.06	10	<5	5	<4	<4	41	<4	56	52	38	21	49	11	21	35	27	26	<4	26	12	430	5.4
T02A	25.5	1.33	1590	2110	<0.50	2.65	<0.1	6.1	4.6	<0.5	8.5	12	1.9	<0.1	<0.1	5.7	31	0.05	<5	<5	5	<4	<4	24	4	28	27	19	17	20	6	13	16	14	11	<4	8	<5	212	3.6
T02B	22.9	2.12	1410	1860	<0.50	3.39	<0.1	5.3	3.9	<0.5	7.2	5	1.5	<0.1	<0.1	5.3	26.2	0.05	<5	6	<4	<4	21	4	31	31	23	20	29	12	18	25	25	21	<4	14	<5	280	5.1	
Average	24.7	2.41	1503	2097	<LOR	3.18	<LOR	5.7	5.4	<LOR	9.2	9	1.7	<LOR	<LOR	5.5	36	0.05	<LOR	<LOR	<LOR	<LOR	<LOR	29	<LOR	38	37	27	19	33	10	17	25	22	19	<LOR	16	<LOR	307	4.7
SD	1.5	1.25	90	230	NA	0.47	NA	0.4	2.1	NA	2.5	4	0.2	NA	NA	0.2	13	0.01	NA	NA	NA	NA	NA	11	NA	15	13	10	2	15	3	4	10	7	8	NA	9	NA	112	1.0
RSD (%)	6.2	51.9	6.0	11.0	NA	14.6	NA	7.0	38.3	NA	26.9	40.6	12.5	NA	NA	3.6	37.2	10.8	NA	NA	NA	NA	NA	37.6	NA	40.1	36.6	37.6	10.8	45.4	33.3	23.3	37.5	31.8	39.5	NA	57.3	NA	36.3	20.5
Split Duplicate (Data Quality Objective: <35% RPD)																																								
C6_0.0-0.13	65.8	35.7	8620	5810	0.51	52.3	<0.1	20.1	5.6	3.3	3.2	12	8.7	3.7	<0.1	77.9	7.1	0.08	<5	<5	<5	<5	<5	7	<5	14	<5	6	16	34	13	24	19	369	<5	<5	<5	<5	502	<0.5
QC1	63.4	37.4	9050	7480	<0.50	42.9	<0.1	15.6	4.6	2.4	2.8	13	7.4	2.3	<0.1	51.6	7.8	0.05	<5	<5	<5	<5	<5	6	<5	13	<5	7	15	32	13	22	16	381	11	<5	10	<5	526	<0.5
Mean	64.6	36.6	8835	6645	<LOR	47.6	<LOR	17.9	5.1	2.9	3.0	13	8.1	3.0	<LOR	64.8	7.5	0.07	<LOR	<LOR	<LOR	<LOR	<LOR	6.5	<LOR	13.5	<LOR	6.5	15.5	33	13	23	17.5	375	<LOR	<LOR	<LOR	<LOR	514	<LOR
% RPD	4	-5	-5	-25	NA	20	NA	25	20	32	13	-8	16	47	NA	41	-9	46	NA	NA	NA	NA	NA	15	NA	7	NA	-15	6	6	0	9	17	-3	NA	NA	NA	NA	-5	NA
Split Duplicate (Data Quality Objective: <35% RPD)																																								
C10_0-0.50	23.3	0.65	2060	2730	<0.50	3.36	<0.1	10.2	5.1	0.6	9.8	14	2.2	<0.1	0.1	6.9	25.5	0.14	<5	<5	34	<4	18	129	42	133	112	84	64	108	39	69	85	30	36	7	25	7	1020	2.7
QC6	22.2	0.58	2210	3120	<0.50	3.75	<0.1	14.1	27.6	0.6	11	15	2.5	<0.1	0.1	6.6	79.6	0.14	<5	<5	17	<4	5	42	13	80	72	76	39	66	19	57	42	17	45	<4	19	13	622	2.0
Mean	22.8	0.62	2135	2925	<LOR	3.56	<LOR	12.2	16.4	0.6	10.4	15	2.4	<LOR	0.1	6.8	52.6	0.14	<LOR	<LOR	26	<LOR	12	86	28	107	92	80	52	87	29	63	64	24	41	<LOR	22	10	821	2.4
% RPD	5	11	-7	-13	NA	-11	NA	-32	-138	0	-12	-7	-13	NA	0	4	-103	0	NA	NA	67	NA	113	102	105	50	43	10	49	48	69	19	68	55	-22	NA	27	-60	48	30
Field Blanks (DQO: close to LOR)																																								
QC3	5.4	NA	480	1350	<0.50	3.62	<0.1	1.6	<1.0	<0.5	<1.0	12	<1.0	<0.1	<0.1	2.8	1.6	<0.01																						
QC4	5.1	NA	470	1390	<0.50	3.82	<0.1	1.6	<1.0	<0.5	<1.0	14	<1.0	<0.1	<0.1	3	1.6	<0.01																						
QC10	<1.0	NA	530	1580	<0.50	4.3	<0.1	1.9	<1.0	<0.5	<1.0	14	<1.0	<0.1	<0.1	3.4	2.1	<0.01																						
Average	ND	ND	493	1440	<LOR	3.9	<LOR	1.7	<LOR	<LOR	<LOR	13.3	<LOR	<LOR	<LOR	3.1	1.8	<LOR																						
SD	ND	ND	32	123	NA	0.3	NA	0.2	NA	NA	NA	1.2	NA	NA	NA	0.3	0.3	NA																						
RSD (%)	ND	ND	6.5	9	NA	8.9	NA	10.2	NA	NA	NA	8.7	NA	NA	NA	10.0	16.3	NA																						
Mean of Split Duplicate/Interlaboratory sample (Data Quality Objective: <35% RPD)																																								
Mean C6_0.0-0.13 and QC1	64.6	36.6	8835	6645	<LOR	48	<LOR	18	5.1	2.9	3	13	8.1	3.0	<LOR	65	7.5	0.07	<LOR	<LOR	<LOR	<LOR	<LOR	6.5	<LOR	13.5	<LOR	6.5	16	33	13	23	18	375	<LOR	<LOR	<LOR	<LOR	514	<LOR
QC2	64.7	42.8	NA	NA	<0.50	35	<0.1	13	4.0	2.5	2	11	6.2	2.3	<0.1	47	6.3	0.06	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	23	55	22	14	690	14	<10	21	<20	840	1.4	
Average	64.7	39.7	ND	ND	<LOR	41.3	<LOR	15.4	4.6	2.7	2.5	11.8	7.1	2.7	<LOR	55.9	6.9	0.1	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	19	NA	NA	23	16	533	<LOR	<LOR	<LOR	<LOR	677	<LOR
% RPD	0	-16	ND	ND	NA	31	NA	31	24	13	40	13	26	26	NA	32	17	8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-39	NA	NA	4	22	-59	NA	NA	NA	NA	-48	NA
Mean of Split Duplicate/Interlaboratory sample (Data Quality Objective: <35% RPD)																																								
Mean of C10_0-0.50 and QC6	22.8	0.62	2135	2925	<LOR	3.6	<LOR	12.2	16.4	0.60	10.4	15	2.4	<LOR	0.1	6.8	53	0.14	<LOR	<LOR	26	<LOR	11.5	86	28	107	92	80	52	87	29	63	63.5	23.5	40.5	<LOR	22	10	821	2.4
QC7	22.1	0.60	na	na	<0.50	3.8	<0.1	11	5.6	0.59	10.0	16	2.5	0.55	<0.1	7.1	26	0.17	7	<5.0	7	<5.0	<5.0	16	<5.0	38	39	25	23	58	24	33	20	25	<5.0	20	<10	330	2.4	
Average	22.4	0.61	ND	ND	<LOR	3.7	<LOR	11.6	11.0	0.60	10.2	15	2.4	<LOR	<LOR	6.9	39	0.16	<LOR	<LOR	16	<LOR	<LOR	51	<LOR	72	66	53	37	NA	NA	44	48	22	33	<LOR	21	<LOR	575.5	2.4
% RPD	3	2	ND	ND	NA	-7	NA	10	98	2	4	-10	-6	NA	NA	-5	68	-19	NA	NA	114	NA	NA	137	NA	95	81	105	77	NA	NA	90	63	16	47	NA	10	NA	85	-2

Elutriate QA/QC (DQO: <35% RSD)		
Sample ID	TBT	As
C2_0.0-0.5	<2	13.2
QC5	<2	13.1
Mean	<2	13.2
RPD (%)	nc	0.8

Elutriate Seawater Blank (DQO: close to LOR)

Sample ID	As	TBT
Elutriate Blank	2	<2

1M HCl Extractions (DQO: <35% RSD)	
Sample ID	As
C2_0.0-0.5	1.4
QC5	1.4
Mean	1.4
RSD (%)	0.0

TPH					
	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	Sum TPHs
Field Tripl (DQO:<50% RSD)					
C2_0.0-0.5	na	4	72	58	134
T01A	na	6	116	119	241
T01B	na	7	116	99	222
Average	na	6	101	92	199
SD	na	2	25	31	57
RSD (%)	na	27	25	34	29

TPH					
	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	Sum TPHs
Split Dupl (DQO:<35% RPD)					
C6_0.0-0.13	na	1.5	593	782	1380
QC1	na	1.5	321	439	760
Mean	na	1.5	457.0	610.5	1070
% RPD	na	0	60	56	58