BMT WBM

Port of Brisbane Sediment Sampling and Analysis Plan Implementation Report – 2016

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Synopsis: A report describing the physio-chemical characteristics of sediments to be dredging during the maintenance dredging program at the Port of Brisbane. The assessment was carried out in accordance with the project sampling and analysis plan (SAP) and the National Assessment Guidelines for Dredging (2009)

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Executive Summary

Port of Brisbane Pty Ltd (PBPL) proposes to undertake its annual maintenance dredging within the navigational areas of the Brisbane River and Moreton Bay, primarily using the Trailer Suction Hopper Dredge (TSHD) 'Brisbane'. Maintenance dredging works extend from the Hamilton Reach of the Brisbane River to the North West Channel located in northern Moreton Bay. The dredged material will either be placed at sea at the Mud Island Dredge Material Placement Area (MIDMPA) or in the Future Port Expansion (FPE) reclamation area.

The physical and chemical properties of proposed dredged sediment were characterised in accordance with the National Assessment Guidelines for Dredging (NAGD) to assess the suitability of dredged material for unconfined ocean disposal. The dredge area was divided into different dredging subareas based on existing contaminant data, comprising Zone 2 (Colmslie to Pinkenba), Zone 3 (within Port reaches) and Zone 4 (Entrance Channel). Zone 1 (upstream of the dredge area) is not part of the annual dredging and samples from this zone were collected as 'background' samples upstream of dredged areas. Sediment was also sampled at the MIDMPA and reference sites in Bramble Bay north of the Port of Brisbane.

Sediments within Zone 2 were characterised by a high proportion of fines (clays and silts), whereas Zones 3 and 4 generally were comprised of sands and fines. The Moreton Bay reference sites were comprised mostly of fines, whereas the MIDMPA were similar to Zone 4 being characterised by an equal proportion of sand and fines.

The sediments in the proposed dredging zones were found to be suitable for ocean disposal in accordance with the NAGD on the basis of the following results:

- The upper 95% confidence limits (95% UCL) of the mean concentrations of analysed metals and metalloids (except nickel) were less than respective NAGD screening levels, and therefore considered suitable for ocean disposal with NAGD with respect to these metals and metalloids.
- Nickel concentrations exceeded the NAGD screening level of 21 mg/kg at most sites within the dredging zone and sites within the Moreton Bay reference area. Similar nickel concentrations have been recorded previously, including reference areas unaffected by dredging and dredged material placement.
- Mercury concentrations exceeded the NAGD screening level of 0.15 mg/kg at four sites within zone 2 (sites 4-4, 5-1, 6-3 and 8-3), however the 95% UCL did not exceed the NAGD screening level. Similar mercury concentrations were observed at 5-1 in 2014 (0.17 mg/kg) and 2015 (0.18 to 0.21 mg/kg).
- Phase III elutriate and bioavailability testing was undertaken to investigate potential impacts of nickel and mercury on water quality and sediment biota. Samples containing the highest concentrations of nickel and mercury in bulk sediment were selected for analysis. Nickel and mercury concentrations were below relevant guideline levels for both elutriate (i.e. ANZECC/ARMCANZ 2000 water quality guideline levels) and dilute acid extraction (i.e. NAGD screening levels) for all samples. In accordance with NAGD, the sediments in the proposed dredge zones are characterised as suitable for ocean disposal with respect to nickel and mercury.
- Most organic contaminants including organotins, Total Petroleum Hydrocarbons (TPHs), Polyaromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs) had either concentrations below the LOR or the 95% UCLs were below the respective NAGD screening levels.

- *p,p'*-DDD was detected within ~25% of sites in the overall study area and *p,p'*-DDE was detected within ~68% of sites in the overall study area. Across all dredge areas the overall 95% UCL was below the screening level for *p,p'*-DDD but was above the screening level for *p,p'*-DDE. The concentrations and spatial distribution of *p,p'*-DDE and *p,p'*-DDD were consistent with that reported by BMT WBM (2013, 2015a, 2015b). . In addition, *trans*-Chlordane and Dieldrin were detected at one site (4-4), with *trans*-Chlordane concentrations above the screen level. No 95% UCL value was calculated for these parameters as they were only detected in one sample.
- *p,p'*-DDT was not detected in any samples. The laboratory limit of reporting (LOR) for *p,p'*-DDT was raised (to 3 – 6 µg/kg) due to high moisture content in samples. A value of half detection limit was therefore adopted for all samples (in accordance with NAGD), which exceeded the NAGD screening level of 1.6 µg/kg in all samples.
- Phase III elutriate and bioavailability (i.e. porewater) testing was undertaken to investigate the potential bioavailability of OCPs. Both elutriate and porewater testing resulted in concentrations below the laboratory LOR for all samples. It is noted that no marine trigger limits are given in ANZECC/ARMCANZ (2000) for DDD, DDT, DDE, Dieldrin or Chlordane. Based on the above results the bioavailability of OCPs is considered very low and no adverse impacts on water quality and sediment biota are expected with respect to OCPs during dredging and dredged material disposal. On the basis of the Phase II and Phase III testing for OCPs, the sediments in dredge Zones 2, 3 and 4 are considered suitable for ocean disposal as per the NAGD guidelines with respect to OCPs.
- Nutrient levels for Total Nitrogen and Total Kjeldahl Nitrogen were similar to previous surveys. NAGD does not provide screening levels for nutrients. However, given that nutrient concentrations were in the typical range of coastal sediments and harbour areas in Moreton Bay, the risk of adverse impacts caused by nutrients during loading and dredged material placement is considered to be low.
- Acid Sulfate Soil testing indicated that while sediments were characterised as potential acid sulfate soils (PASS), the acid neutralizing capacity at all sites was sufficient for neutralising acids upon oxidation.

The evaluation of laboratory and field QA/QC procedures and assessments indicated that all sampling, sample handling and storage and laboratory analysis was undertaken to a high standard providing scientific confidence that the presented results are valid to allow an assessment of sediment quality against the NAGD.

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1 Introduction

1.1 Background

Port of Brisbane Pty Ltd (PBPL) is required to maintain a minimum depth of clearance below the keel of vessels calling at the port to allow for effective shipping access to the port and ensure ship safety. PBPL undertakes an annual maintenance dredging program to ensure these minimum depths are maintained.

PBPL propose to undertake its annual maintenance dredging within the navigational areas of the Brisbane River and Moreton Bay, primarily using the Trailer Suction Hopper Dredge (TSHD) 'Brisbane'. Maintenance dredging works extend from the Hamilton Reach of the Brisbane River to the North West Channel located in northern Moreton Bay.

It is proposed that dredged material is placed at sea within the Mud Island Dredge Material Placement Area (MIDMPA) or in the Future Port Expansion (FPE) reclamation area. To assess suitability of dredged material for unconfined ocean placement, characterisation of the physical and chemical properties of proposed dredged sediment was required to be undertaken in accordance with the National Assessment Guidelines for Dredging (Commonwealth of Australia 2009; henceforth NAGD).

This report documents the findings of a sampling campaign conducted in August 2016. The overall aim of this study is to assess the physical and chemical properties of sediments to be dredged from the Port of Brisbane, and on the basis of the approach set out in NAGD, assess the suitability of dredged material for unconfined ocean disposal (if required). The specific objectives of the study were to:

- Describe and quantify the physical properties of sediments to be dredged;
- Quantify concentrations of potential contaminants in sediments to be dredged;
- Compare contaminant concentrations to screening levels set out in NAGD to determine whether there is a need for further assessment; and
- Assess the bioavailability of contaminants and potential toxicity effects based on comparisons of contaminant concentrations to guideline values.

1.2 Proposed Dredging

PBPL's area of responsibility in relation to maintenance and capital dredging within port limits can be broadly divided into two locations on the basis of the water body type, navigable depths and nature of dredged material:

- Moreton Bay dredge area (enclosed/open coastal waters); and
- Brisbane River dredge area, including the Port of Brisbane (middle/lower estuary).

This SAP specifically focusses on sediments in the Brisbane River dredge area, as well as the MIDMPA and 'reference' areas in western Moreton Bay. The Brisbane River dredge area extends from Hamilton Reach to the Outer Bar Cutting. Annual maintenance dredging is required to remove

sediments accumulated by natural siltation processes within the catchment and sediment loads from residential and commercial developments.

To ensure that declared depths of navigational channels are maintained at all times, PBPL undertakes 'insurance' dredging of up to -0.5 metres below the declared depth. On average, PBPL dredges about 400,000 m^3 to 450,000 m^3 of material each year. Additional dredging needs to be undertaken following major flood events, as occurred in 2011 and 2013.

The Brisbane River zone is divided into different dredging subareas based on existing contaminant data, comprising Zone 2, Zone 3 and Zone 4. It is noted that Zone 1 is not part of the annual dredging and samples from this zone have been used to collect reference samples upstream of the actual dredging areas.

The following average dredge volumes apply to the dredge subareas (Table 1-1).

Table 1-1 Approximate Maintenance Dredge Volumes

Dredging Subarea	Location	Average Dredge Volume (m^3)
Zone 2	Colmslie to Pinkenba	150,000
Zone 3	Within port reaches	250,000
Zone 4	Moreton Bay entrance channel	30,000

The maintenance dredging program is structured to maximise efficiencies and utilisation of PBPL's largest dredger, the *TSHD Brisbane*. The *TSHD Brisbane* typically carries out the majority of the port's maintenance dredging over a two month period between January and May (actual period varies depending on other commitments of the *TSHD Brisbane* and siltation patterns). The PBPL may also utilise smaller, more manoeuvrable dredging plant, such as grab dredgers and bed levellers, to maintain more confined areas within the Port Limits.

1.3 Offshore Disposal

The PBPL's policy with regard to dredged material is to maximise its beneficial reuse. In general, most of the material dredged by the PBPL from within Port Limits is used in reclamation works associated with development of the port. The reuse of this dredged material provides several benefits, including:

- Reduced pressure on sea disposal sites;
- The placement of any actual or potential acid sulphate material at depth beneath the water surface; and
- The containment of any contaminated material within a designated boundary, disconnected from the marine system and monitored to ensure the immobility of identified contaminants.

In 2009, the reclamation life of the FPE area was estimated to be approximately 30 years, based on the current level of port development at that time. Following extreme flood events in both 2011 and 2013 and the subsequent disposal of additional material in the FPE area, the estimated life of the FPE area was reduced by 20 years to 10 years. Given the importance of the FPE as an area to

dispose of material unsuitable for ocean disposal, there has been a shift in thinking around the management of the FPE area.

The current proposed management of dredged material is to, where practical, dispose at sea all dredged material deemed suitable for ocean disposal. This proposed management initiative will ensure the long term viability of the FPE area for the disposal of material deemed unsuitable for ocean disposal.

In the past, significant quantities of dredged material from the Brisbane River have been placed offshore at the MIDMPA. In recent years only smaller volumes of dredged material from boat harbours in southern Moreton Bay were placed at the MIDMPA. However, it is proposed that the MIDMPA will be utilised for material found suitable for ocean disposal in future PBPL maintenance dredging campaigns.

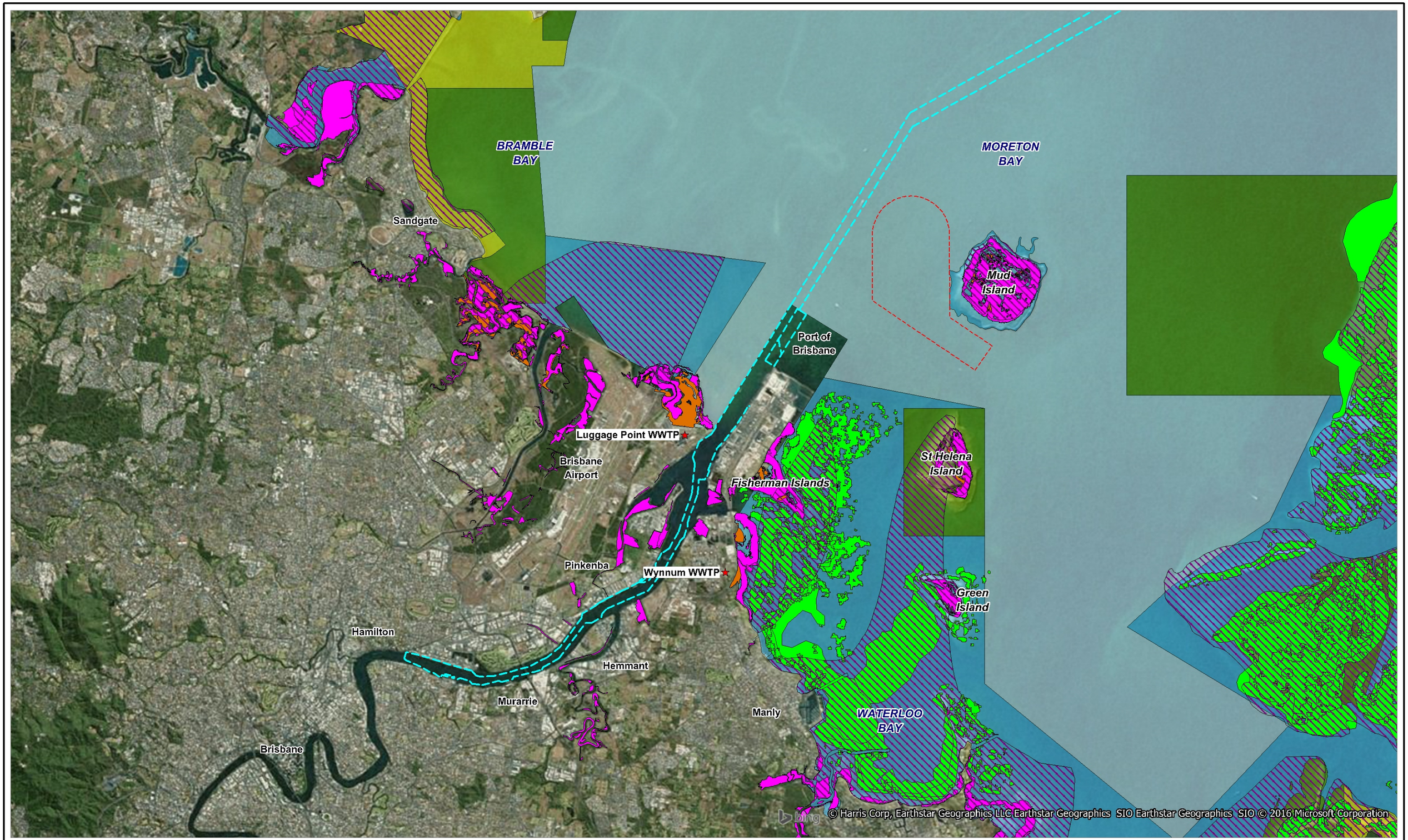
1.4 Marine Communities and Environmental Values

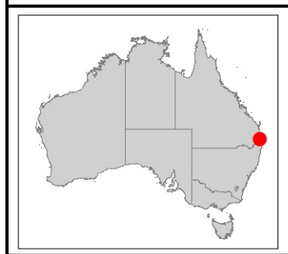
The loading (dredging) site is located within the lower Brisbane River. The foreshore of the lower Brisbane River is in a highly modified condition, but still retains isolated patches of mangrove forest and tidal flats. The river channel is comprised of muds and sands, and supports a locally important trawl fishery (BMT WBM 2008c).

The Port of Brisbane port facilities are located at the Brisbane River mouth on land reclaimed over a shallow sub-tidal river delta containing a series of low lying mangrove islands, collectively called the Fisherman Islands. Brisbane River and adjacent waters of Moreton Bay experiences freshwater flows and ongoing inputs of sediments and contaminants derived from human activities in its catchment. Two major sewage treatment plants also have their sewage discharges within kilometres of the Port facilities (Luggage Point and Wynnum North wastewater treatment plant).

Construction of the present day port facilities over intertidal and subtidal areas has resulted in extensive changes to the environmental character of the Fisherman Islands area. However, significant areas of mangrove, saltmarsh and seagrass have also been retained, and form part of the Fisherman Islands wetland complex on the south eastern side of the Port of Brisbane (BMT WBM 2014). Moreton Bay Marine Park is situated to the south and east of the FPE seawall. This area contains one of the largest semi-contiguous seagrass beds in western Moreton Bay. A Ramsar listed wetland (Moreton Bay Ramsar site) is situated south of the port facilities, comprising intertidal portions of the Fisherman Islands wetland complex. The seagrass and mudflats of the Ramsar site are recognised for their importance to dugong, marine turtles and migratory and resident shorebirds (BMT WBM 2008a).

MIDMPA is located between Mud Island and Fisherman Islands. Mud Island is an ancient coral reef that is no longer actively accreting coral skeletons, but still contains coral communities (Johnson and Neil 1998). MIDMPA is comprised of a mix of mud and sand substrate types, and provides habitat for a range of soft sediment benthic fauna (BMT WBM 2008b).





LEGEND

- Seagrass (2004)
- Mangroves (2014)
- Saltmarsh (2014)
- Navigation Channel
- Dredge material placement area
- Moreton Bay Ramsar wetlands

Moreton Bay Marine Park Zoning

- General use zone
- Habitat protection zone
- Conservation park zone
- Marine national park zone

Title:

Locality Plan and Environmental Features

Figure: 1-1

Rev: A

N

0 2.5 5km

Approx. Scale

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2 Methodology

2.1 Compliance with SAP and Guidelines

All sampling and analysis of sediments was undertaken in accordance with the NAGD (Commonwealth of Australia 2009). All sampling and analysis procedures followed the approach outlined in the sampling and analysis plan (SAP) prepared by BMT WBM on 17 October 2013. A copy of the SAP is provided in Appendix A.

2.2 Timing of Sampling

All sampling was undertaken in a single campaign during 24th to 28th August 2016, inclusive. Sampling was undertaken during daytime hours.

2.3 Sampling Locations and Sample Numbers

2.3.1 Sampling Locations

A map showing the sampling locations is provided in Figure 2-1. Thirty five locations were sampled with a Van Veen grab sampler in accordance with the SAP and NAGD requirements. This included 26 sample locations within the proposed dredging area (Zones 2, 3 and 4) and nine reference locations (Zone 1, MIDMPA and Moreton Bay reference sites).

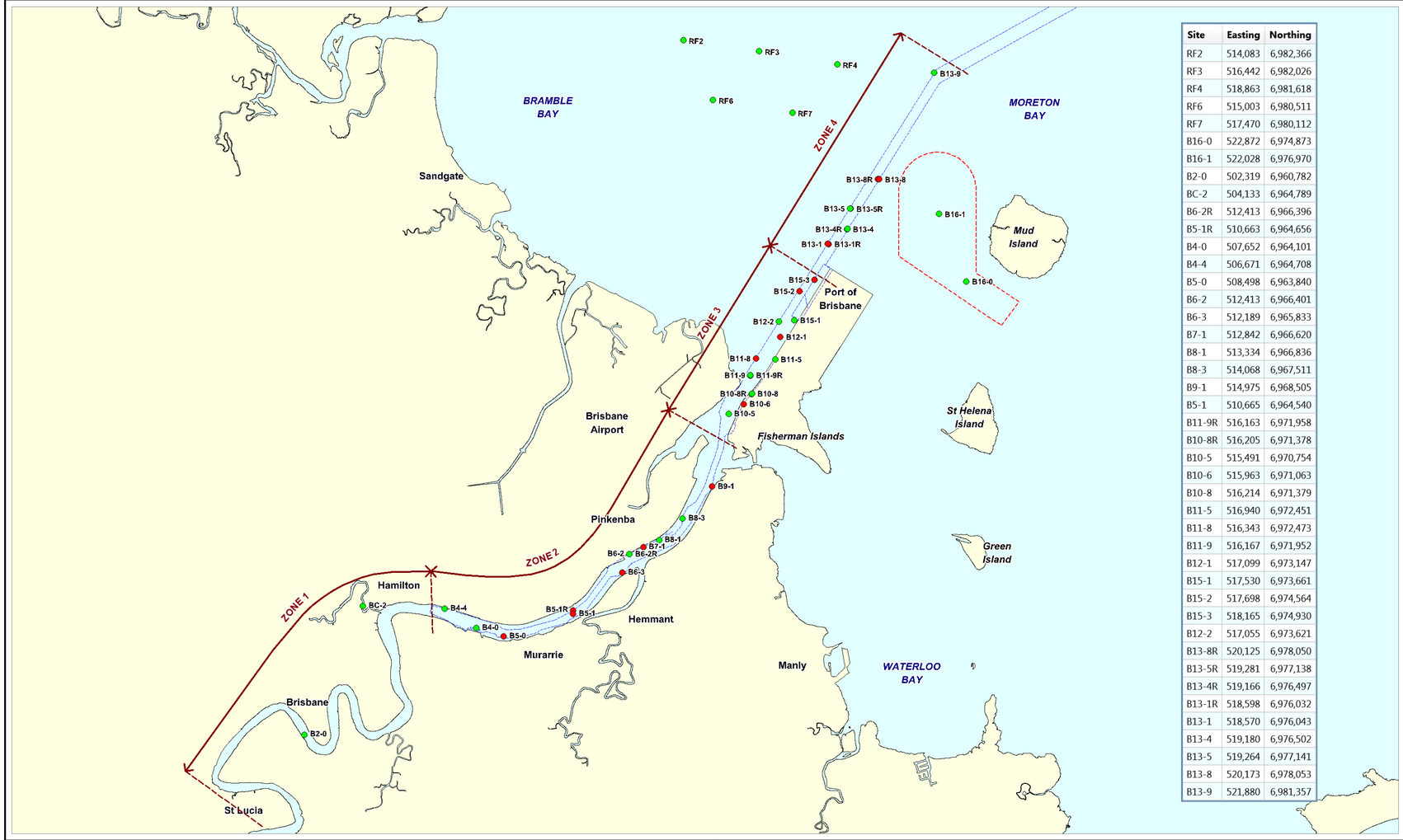
As per the SAP, all samples were analysed for a basic suite with a detailed suite analysed at selected study locations (refer to Figure 2-1 and Section 2.5).

2.3.2 Additional Field QA/QC Samples

In accordance with NAGD requirements and based on the number of sample locations, the following field and laboratory quality control samples were taken:

- Three field triplicate samples at 10% of locations to determine the small scale (measured in metres) spatial variability of the sediment physical and chemical characteristics, i.e. two additional grab samples at locations 5-1 (Zone 2), 11-9 (Zone 3) and 13-4 (Zone 4);
- Two triplicate split samples (primary sample from 5% of locations thoroughly mixed and split into three sample container sets) to assess laboratory variation, with one of the three samples sent to a second (reference) laboratory for analysis. Split samples were obtained at location 6-2 (Zone 2) and 10-6 (Zone 3); and
- Three trip blank containers (one per sampling day) filled with inert material (e.g. chromatographic sand) to be analysed concurrent with the analysis of volatile organic substances such as BTEX and TPH C6-C9.

All samples were submitted to the primary and secondary laboratories in one batch so no inter-batch samples were required.



Site	Easting	Northing
RF2	514,083	6,982,366
RF3	516,442	6,982,026
RF4	518,863	6,981,618
RF6	515,003	6,980,511
RF7	517,470	6,980,112
B16-0	522,872	6,974,873
B16-1	522,028	6,976,970
B2-0	502,319	6,960,782
BC-2	504,133	6,964,789
B6-2R	512,413	6,966,396
B5-1R	510,663	6,964,656
B4-0	507,652	6,964,101
B4-4	506,671	6,964,708
B5-0	508,498	6,963,840
B6-2	512,413	6,966,401
B6-3	512,189	6,965,833
B7-1	512,842	6,966,620
B8-1	513,334	6,966,836
B8-3	514,068	6,967,511
B9-1	514,975	6,968,505
B5-1	510,665	6,964,540
B11-9R	516,163	6,971,958
B10-8R	516,205	6,971,378
B10-5	515,491	6,970,754
B10-6	515,963	6,971,063
B10-8	516,214	6,971,379
B11-5	516,940	6,972,451
B11-8	516,343	6,972,473
B11-9	516,167	6,971,952
B12-1	517,099	6,973,147
B15-1	517,530	6,973,661
B15-2	517,698	6,974,564
B15-3	518,165	6,974,930
B12-2	517,055	6,973,621
B13-8R	520,125	6,978,050
B13-5R	519,281	6,977,138
B13-4R	519,166	6,976,497
B13-1R	518,598	6,976,032
B13-1	518,570	6,976,043
B13-4	519,180	6,976,502
B13-5	519,264	6,977,141
B13-8	520,173	6,978,053
B13-9	521,880	6,981,357

LEGEND

- Basic Suite
- Basic Suite and Detailed Suite
- Dredge Area
- Dredge Material Placement Area

Title:

Sampling Locations

Figure **2-1**

Rev: **A**

N

0 2.5 5km

Approx. Scale

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2.3.3 Elutriate and Bioavailability Analyses

Phase III testing was undertaken for parameters which have frequently exceeded the NAGD screening levels in the past. Based on the review of historical data in the SAP this included:

- Metals and metalloids;
- Organotins (TBT); and
- Organochlorine Pesticides (DDT, DDD, DDE, chlordane).

Phase III testing for metals/metalloids (and potential other metals/metalloids) was undertaken from the primary samples collected for the sediment quality assessment and based on the initial analysis results. Analysis was performed on the samples with the highest concentrations.

Bioavailability analysis for the organic contaminants (organotins and organochlorine pesticides) required porewater testing as per NAGD. Additional samples were collected for porewater testing at the locations which have historically shown the highest percentage of screening level exceedances. In order to meet required holding times, elutriate and bioavailability analysis for the organic contaminants was undertaken concurrent with the analysis of the primary samples.

As per the SAP, additional samples for porewater testing were obtained from five locations in Zone 2 and six locations in Zone 3.

2.4 Sample Collection and Handling

2.4.1 Survey Vessel, Sampling Equipment and Personnel

The BMT WBM vessel *Resolution II* was used for sampling the sediments. Both handheld GPS and differential GPS (dGPS) was used on the survey vessel for position fixing and navigation to each sampling location.

All sediment sampling was undertaken by a team of three qualified marine scientists and field technicians with experience in the implementation of sediment sampling and analysis programs.

2.4.2 Sampling Procedure

Sediment samples were collected using a stainless steel Van Veen grab sampler (0.14 m^2 gape). Only samples obtained with properly closed grab jaws were processed to ensure that the fine sediment fractions were retained.

In order to overcome issues with potential high variability at sampling locations, a minimum of two grabs were collected at each sampling location and pooled as one sample. An adequate number of grabs was obtained and pooled for each sample location ensuring that sufficient sediment was collected for all analyses.

2.4.3 Survey Vessel and Equipment House-Keeping

The vessel was thoroughly inspected and washed down prior to the beginning of sediment sampling each day. The workspace on the vessel was washed down regularly with ambient seawater to clean all surfaces and minimize the potential for dust contamination of samples. All

sample processing was undertaken away from any potential contamination sources such as engine exhausts, fuels, oils, greases, lead weights, zinc anodes, antifouling paint etc.

The grab sampler was thoroughly cleaned with De-con 90 solution prior to use and cleaned and rinsed with seawater between samples to prevent cross contamination between samples.

2.4.4 Sample Collection, Handling and Storage

Photographs of the grab samples were taken and grab samples were logged for its physical characteristics and variations in sediment type and texture (refer Appendix B). The grab samples from each location were carefully homogenized in a clean container prior to the filling of analytical laboratory-supplied clean sampling jars.

Nitrile gloves were worn by all field personnel handling the sediment, and gloves were disposed of after processing of each sample.

Sample bottles were labelled with a waterproof marker pen on the bottle label and lid. Sample bottles for organic analyses were filled with zero headspace to minimise volatilisation. A field trip blank sample container filled with clean chromatographic sand was placed with opened lid near the sample processing site while a sediment sample was completely processed.

All storage containers were chilled on ice immediately following sample collection. The samples were then transferred to BMT WBM office in sealed eskies at the end of each sampling day. Acid Sulfate Soil samples were frozen at the end of each sampling day to minimise potential oxidation of the sediment material.

At the end of the sampling campaign, all samples were submitted to the primary and secondary analytical laboratories. All samples were submitted to the laboratories with Chain of Custody documentation (Appendices C and D).

2.5 Laboratory Analysis

As per the SAP, all samples were analysed for a basic suite with a detailed suite analysed at selected study locations (refer to Figure 2-1 and Appendix A).

2.5.1 Analytical Tests

Primary analysis of sediment samples was conducted by Advanced Analytical Australia (AAA). Certain analyses were subcontracted by AAA to other NATA accredited laboratories such as Particle Size Distribution (Microanalysis Australia) and Total Organic Carbon (Sydney Analytical Laboratories). Australian Laboratory Services (ALS) was chosen as the secondary (reference) laboratory for inter-laboratory quality testing.

A total of 35 locations were analysed for a basic suite of parameters. Of these, 12 locations were also analysed for a detailed list of contaminants. Furthermore, elutriate and bioavailability (porewater and dilute acid extraction) testing was undertaken at selected locations as per the SAP.

Basic List of Parameters:

- Analysis included contaminants of (potential) concern and supplementary parameters:
  - Metals/Metalloids (As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, Zn, Al, Fe);

- Organotins (MBT, DBT, TBT);
- Organochlorine pesticides (including DDT, DDD, DDE, chlordane);
- Particle Size Distribution (PSD);
- Moisture content; and
- Total Organic Carbon (TOC).

Detailed List of Parameters:

- Analysis included 'low risk' parameters that have been detected in the past but generally in concentrations below Limit of Reporting (LOR) or NAGD screening levels:
  - Polycyclic Aromatic Hydrocarbons (PAHs);
  - Total Petroleum Hydrocarbons (TPHs);
  - Polychlorinated Biphenyls (PCBs);
  - Acid Sulfate Soils;
  - Nutrients (TP, TN, NO_x, TKN); and
  - Radionuclides.

Elutriate and Bioavailability Testing:

- Metals/Metalloids;
- Organotins (TBT); and
- Organochlorine pesticides (DDT, DDD, DDE, chlordane).

2.5.2 Laboratory Quality Control

Both laboratories followed laboratory Quality Control (QC) procedures in accordance with requirements outlined in Appendix F of NAGD. This included analysis of laboratory blanks, duplicates, certified surrogate materials and spiked samples.

Validation of all laboratory QC analyses was conducted in accordance with Appendix A of NAGD to confirm suitable data quality for undertaking a rigorous characterisation of the proposed dredge material.

2.5.2.1 Laboratory Blanks

The purpose of this assessment is to monitor potential laboratory contamination of samples due to potential cross-contamination of samples during laboratory preparation, extraction or analysis. Blank sample concentrations should be at or near the detection limit of the method used.

2.5.2.2 Laboratory Duplicates

This assessment refers to a randomly selected intra-laboratory split sample, which provides information regarding the method precision and sample heterogeneity. Results are presented as Relative Percent Difference (RPD) values of two sample concentrations for a specific contaminant.

NAGD recommends that duplicates should agree within a typical RPD of the method of ±35 %. This recommended RPD is typically not adopted by analytical laboratories as it does not account for the greater uncertainty for contaminant concentrations close to the method's detection limit. NAGD also notes that RPDs may not always agree within these limits where sediments are very inhomogeneous or vary greatly in grain size.

The primary laboratory AAA uses the following approach to assess duplicate RPD's:

- Result <10 times LOR – no limit to RPD; and
- Result >10 times LOR – RPD between 0% and 50%.

The secondary laboratory ALS follows this approach:

- Result <10 times LOR – no limit to RPD;
- Result between 10 and 20 times LOR – RPD between 0% and 50%; and
- Result >20 times LOR – RPD between 0% and 20%.

Refer to Appendices C and D for the acceptance criteria of subcontracted laboratories.

2.5.2.3 Surrogate and Matrix Spikes

Laboratory Control Samples are either certified reference materials or a blank sample spiked with known concentrations of the analytes of interest. The purpose of this measurement is to monitor method accuracy.

Matrix spikes refer to an intra-laboratory split sample spiked with a representative set of target analytes of known concentration. Matrix spikes are assessed to monitor potential sample matrix effects on analyte recoveries.

Surrogate spikes are used for organic analytes. Surrogates are known additions to samples which mimic the compounds of interested and are not normally expected to be present in the sample.

For both surrogate and matrix spikes, a calculation of the percent recovery of the spiked amount against the returned concentration is performed indicating analytical performance in terms of extraction efficiency.

NAGD states that recovery limits of 75% - 125% are generally acceptable. Analytical laboratories typically adopt specific surrogate and matrix spike recovery limits for the various contaminant compound groups. It is also noted that ideal recovery ranges may be waived in the event of sample matrix interference.

The primary laboratory AAA adopts the following acceptable surrogate and matrix spike recovery limits:

- Trace elements: 70-130%;
- Organic analyses: 50-150%;
- SVOC & speciated phenols: 10-140%; and
- Surrogates: 10-140%.

The secondary laboratory ALS adopts specific recovery limits for individual compounds.

2.6 Data Analysis

2.6.1 Sediment Contaminants

Concentrations of chemicals measured in sediment samples were compared to screening levels listed in Table 2 of NAGD to determine whether the material is suitable for unconfined placement at sea or if further analyses, such as elutriate, bioavailability or toxicity testing, are required.

Specifically, mean concentrations of chemical parameters at the upper 95% confidence level (95% UCL) were compared against NAGD guideline levels. This involved the following steps.

Data pre-treatment

Analytical values below detection limit were set to one-half of the laboratory Limit of Reporting (LOR) as per NAGD recommendation to facilitate 95% UCL calculation. Organic contaminant results were normalised to 1% TOC where the measured value is within the range of 0.2-10%. If TOC values were outside of this range, the highest (10%) or lowest (0.2%) value was adopted as appropriate. Organic parameters with concentrations below detection limits were not normalised to 1% TOC but were included at half their LOR.

One assumption in the calculation of the 95% UCL is that the samples are statistically independent. Therefore, field triplicate samples and laboratory split samples were not included in the 95% UCL calculation.

Selection of appropriate 95% UCL Calculation Method

The methodology for calculating the 95% UCL followed the approach recommended in Appendix A of NAGD. A Shapiro-Wilk test was used to determine whether data followed a normal distribution. The ProUCL (Version 4.1.00) software package was used for these calculations (Singh *et al.* 2010).

Calculation of 95% UCL and Comparison to Screening Levels

ProUCL Version 4.1.00 was used to calculate the 95% UCL. For normally distributed data, the arithmetic mean and standard deviation were calculated, and the 95% UCL was calculated using the one-tailed Student's *t* UCL test. For data that followed a log-normal (or other) distribution, the geomean was calculated, and the 95% UCL was analysed using non-parametric Jack-Knife analysis as per NAGD recommendation.

In some cases where only one value of a dataset was recorded above LOR, calculation of the Jack-Knife UCL was not possible. In these cases, the maximum recorded value of the dataset was conservatively used instead for comparison against NAGD trigger levels.

Should 95% UCL values for all analysed parameters fall below NAGD screening levels, the sediment would be considered clean and suitable for unconfined disposal at sea. Further testing was undertaken for samples where the NAGD screening level was exceeded, as described below.

2.6.2 Elutriate and Bioavailability Testing

Elutriate and bioavailability testing was undertaken as per NAGD for a range of contaminants which have regularly exceeded screening levels in the past.

Elutriate Testing:

The elutriate test is designed to simulate release of contaminants from sediment during dredged material disposal. Testing was carried out using the USEPA's standard seawater elutriate test which involves shaking the sediment samples with four times the volume of seawater at room temperature for 30 minutes. The sample was allowed to settle for one hour and the supernatant was centrifuged or filtered (0.45 µm) within 60 minutes, and analysed using analytical methods appropriate for determining ultra-trace levels in seawater.

Results were compared to the respective ANZECC/ARMCANZ (2000) marine water quality trigger value (for 95% protection of species).

Bioavailability Testing:

The Dilute Acid Extraction (DAE) method was used to provide an estimate of the bioavailable fraction of metals/metalloids. The sediment samples were extracted using a weak acid and result compared against the respective NAGD screening levels.

For organic contaminants, analysis of pore water is the recommended bioavailability test as per NAGD. Porewater is assumed to represent the major route of exposure to sediment contaminants by benthic organisms. Porewater results were compared to the respective ANZECC/ARMCANZ (2000) marine water quality trigger value (for 95% protection of species).

Should both elutriate and bioavailability tests result in values less than the respective guideline limits, the material would be considered clean and suitable for ocean disposal.

2.6.3 Acid Sulfate Soils

The results of the chromium-suite acid sulfate analysis were assessed against the Australian framework for Acid Sulfate Soil management in coastal systems (Ahern *et al.* 1998). The risk of acidification was determined by the acid-base accounting approach (Ahern *et al.* 2004). Net acidity was calculated from the results as a measure of the acid producing capacity of the sampled sediment upon complete oxidation.

The calculated net acidity was then compared to the QASSIT action criteria of 0.03% S or 18 mol H^+/tonne to assess the need for acid sulfate soil management if the dredged sediments were to be placed on land. The liming rate indicates the amount of lime that needs to be added to the soil to manage its acid generating capacity.

3 Results

Sediment logs of the sampled sediments are shown in Appendix B. Detailed laboratory results are provided in Appendices C and D for the primary and secondary laboratory, respectively.

3.1 Physical Sediment Characteristics

Figure 3-1 presents sediment grain particle size distribution (PSD) results for each location.

Zone 2 and 3

Similar to previous surveys, sand comprised 18% and 39% on average for Zones 2 and 3 in 2016. Sediments in these zones were generally characterised by a high proportion of fines (silt and clay), with most samples having greater than 80% of fine material. Exception to this were Zones 2 (including 9-1) and 3 (including 15-2 and 15-3) which had approximately 30% fine material, consistent with results from previous years.

The average proportion of silts was 38% and 29% for Zones 2 and 3, respectively. This was similar to the silt content recorded in previous surveys at Zone 2 (36.3% to 40%), but slightly less than recorded previously at Zone 3 (32% to 36%).

The proportion of clay material was lower than recorded in previous surveys, consisting on average 41% and 27% at Zones 2 and 3, respectively. In comparison, clay comprised (at Zones 2 and 3 respectively) an average of 48% and 32% in 2015, 45% and 36% in 2014 and 48% and 49% in 2013.

Zone 4

Zone 4 had coarser sediments than Zones 2 and 3, with an average sand content of 40.2% and 2.7% gravel, with 57% fines (combined silt and clay fractions). This was similar to results recorded in 2015 (47% sand, 1% gravel, and 52% fines).

MIDMPA

Sediments at MIDMPA locations were similar to Zone 4, with sand comprising 42%, gravel 3% and fines 55% on average. In 2015, sediments at MIDMPA were more comparable to Zones 2 and 3 having a greater proportion of fines (70%) compared to coarser fractions (29% sands and 0.7% gravel respectively). The proportion of fine sediment recorded was lower in 2014 (44%) and higher in 2013 (90%). This variation is most likely due to small scale sediment heterogeneity and low sampling effort (two sites only) at this location.

Reference/Background

In 2016 the Moreton Bay reference sites were characterised by a high proportion of fine sediment (89.6% on average). This was consistent with results from 2015 (85% fines), 2014 (86%) and 2013 (89%).

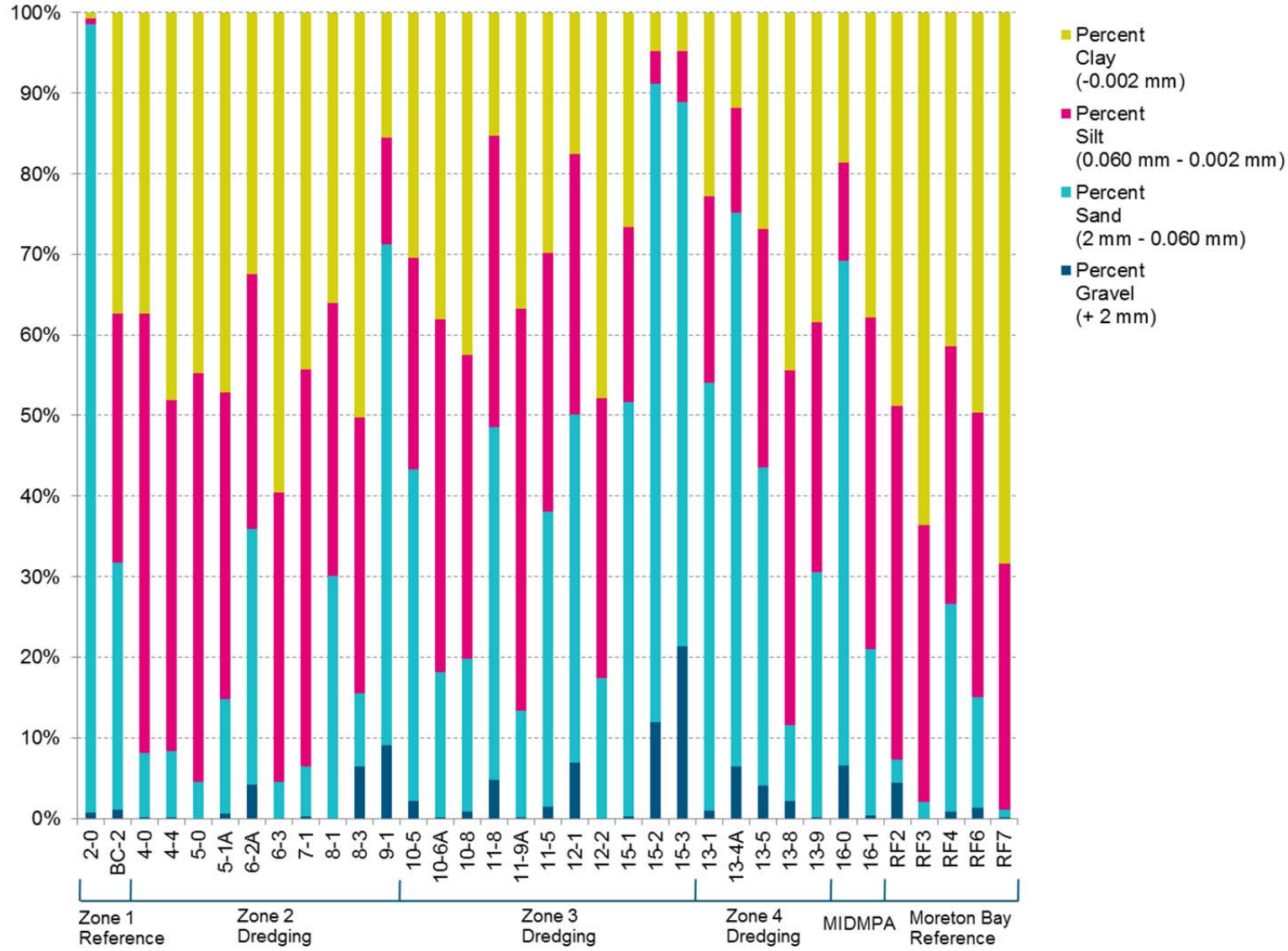

Figure 3-1 Particle Size Distribution Results

Sediments within Zone 1 were dominated by sands at site 2-0 in 2016 (97.8%), while site BC-2 had similar proportions of sand (31%), silt (31%) and clay (37%). In 2015 site 2-0 also had high proportions of sands (98%) however BC-2 contained 42% gravel as the dominant size fraction, 24% sand, 16% silt and 18% clay. Values recorded in 2014 indicated 98% sand at location 2-0 and 22% sand, 37.4% silt and 39.9% clay at BC-2 while 2013 results showed 99.1% sand at 2-1 and 61.8% sand, 16.3% silt and 21.5% clay at BC-2. These results suggest that sediment composition at site 2-0 was extremely stable while sediment composition at site BC-2 fluctuates, sometimes markedly, from year to year. These fluctuations are most likely reflecting small scale sediment heterogeneity at this location, and possibly temporal changes in sediment types.

3.2 Trace Elements

3.2.1 Bulk Sediment Analysis

All trace metals and metalloids tested for were detected in the present study. Cadmium (4 of 35 samples) and silver (16 of 35 primary samples) had the least number of detections, consistent with the results of the 2015 and 2014 sampling campaigns.

Concentrations of most metals and metalloids within individual locations or dredged areas were generally below NAGD screening levels across the study area), with the following exceptions:

- Nickel - concentrations exceeded the NAGD screening level of 21 mg/kg at twelve locations, in particular within the dredge Zone 2. The 95% UCL across all locations within the dredged areas (Zones 2, 3 and 4) was 22.1 mg/kg, which was less than 2015 (28.6 mg/kg) and 2014 (28.3 mg/kg) and much less than the concentration recorded in 2013 (35.5 mg/kg). The 95% UCL for nickel also exceeded the NAGD screening level for Zone 2 with concentrations of 28.3 mg/kg. 95% UCL for nickel at both Zones 3 and 4 were below the NAGD screening level with concentrations 20.2 and 16.2 mg/kg, respectively.
- Mercury – concentrations exceeded the NAGD screening level of 0.15 mg/kg at four locations within Zone 2 (4-4, 5-1, 6-3 and 8-3), while all other zones had concentration below the screening level. The 95% UCL across all locations within the dredge Zones 2, 3 and 4 (0.11 mg/kg) was less than the NAGD screening level (0.15 mg/kg). The 95% UCL value for Zones 2, 3 and 4 was 0.16, 0.10 and 0.06 mg/kg respectively. In comparison, sites 5-1 and 13-5 were above the screening level in 2015 and 2013, respectively, but no exceedance of the screening level was recorded in 2014 (BMT WBM 2013, 2015a).

The trace metal and metalloid concentrations recorded at reference locations followed similar trends to those at the dredge sites. In this regard, most metals and metalloids were below the NAGD screening level, except for nickel at one of the two locations in the MIDMPA, and two of the five Moreton Bay reference locations. Similar results were found in the 2013, 2014 and 2015.

In accordance with NAGD, 80th percentile nickel concentrations at reference (ambient) and dredged locations were compared to assess suitability for ocean disposal. Both the average (20.3 mg/kg) and 80th percentile values (23.8 mg/kg) for the dredge site were less than the ambient (reference site) 80th percentile value (24.4 mg/kg). On this basis, nickel was not considered a contaminant of potential concern, and dredged material would be considered suitable for ocean disposal. Phase III testing was however conservatively undertaken for both nickel and mercury.

Table 3-1 Summary Statistics and 95% UCLs for Combined Locations in Zones 2, 3 and 4. Values Highlighted in Orange Indicate Exceedance of NAGD Screening Levels – Trace Metals/Metalloids

Analytes	Units	PQL	Screening level (SL)	% samples detected	% samples >SL	Arithmetic mean	Geometric mean	Standard deviation	Distribution	95% UCL	80th %ile dredge	80th %tile reference
Trace Metals/Metalloids												
Aluminium	mg/kg	5	ND	100	0	17362	16258	5643	NC3	NC3	NC4	NC4
Arsenic	mg/kg	0.4	20	100	0	6.2	6.1	1.2	N	6.5	NC4	NC4
Cadmium	mg/kg	0.1	1.5	11	0	0.08	0.06	0.09	X	0.207	NC4	NC4
Chromium	mg/kg	0.1	50	100	0	34	32	9	N	36	NC4	NC4
Copper	mg/kg	0.1	65	100	0	23.3	20.2	11.5	N	26.4	NC4	NC4
Iron	mg/kg	5	ND	100	0	31423	30344	7905	NC3	NC3	NC4	NC4
Lead	mg/kg	0.5	50	100	0	12.6	11.3	6	L	17.5	NC4	NC4
Mercury	mg/kg	0.01	0.15	100	3.8	0.09	0.07	0.06	N	0.11	NC4	NC4
Nickel	mg/kg	0.1	21	100	38.5	20.3	19.1	7.3	G	22.1	23.8	24.4
Silver	mg/kg	0.1	1	50	0	0.14	0.10	0.14	X	0.26	NC4	NC4
Zinc	mg/kg	0.5	200	100	0	75	69	28	N	85	NC4	NC4
Other Parameters												
Moisture Content	%	0.1	ND	100	0	51.35	49.54	12.24	NC3	NC3	NC4	NC4
Total Organic Carbon	%	0.01	ND	100	0	4.91	1.42	18.18	NC3	NC3	NC4	NC4
Phosphorus	mg/kg	1	ND	100	0	649.23	597.39	278.93	NC3	NC3	NC4	NC4
Nitrate as N	mg/kg	0.1	ND	0	0	NC1	NC1	NC1	NC1	NC1	NC4	NC4
Nitrite as N	mg/kg	0.1	ND	0	0	NC1	NC1	NC1	NC1	NC1	NC4	NC4
Total Kjeldahl Nitrogen	mg/kg	20	ND	100	0	755.00	565.85	507.01	NC3	NC3	NC4	NC4
Total Nitrogen	mg/kg	20	ND	100	0	755.00	565.85	507.01	NC3	NC3	NC4	NC4

Blue shading = parameter not detected; Orange shading = UCL95% > screening level

ND = No Data, NC1 = not calculated due to no detections; NC2 = not calculated due to >30% of values being non-detects (applicable only to parameters with screening levels); NC3 = not calculated due to no NADG guideline; NC4 = not calculated as screening level not exceeded

Data distribution: N = Normal; L = log-normal; X = follows no statistical distribution

3.2.2 Bioavailability Testing

Phase III dilute acid extraction (bioavailability) tests were undertaken to further investigate the elevated sediment concentrations for nickel and mercury and their potential impact on sediment biota. Samples with the highest recorded nickel concentrations were selected for analysis from dredge Zones 2 and 3.

The dilute acid extraction (DAE) results (Table 3-2) were below the NAGD screening level for all samples. Mercury and nickel concentrations derived from DAE were consistent with levels recorded by BMT WBM from previous years (BMT WBM 2013, 2015a, 2015c).

These results indicate that the bioavailable fraction of these metals is unlikely to result in adverse impacts to sediment biota. On the basis of the Phase II and Phase III testing for metals and metalloids, the sediments in dredge Zones 2, 3 and 4 are considered suitable for ocean disposal as per the NAGD guidelines for all investigated metals and metalloids.

Table 3-2 Mercury and Nickel Bioavailability Results

Zone	Sample	Dilute Acid Extraction	
		Mercury (mg/kg)	Nickel (mg/kg)
PQL		0.01	0.1
NAGD		0.15	21
2	B4-4	0.1	6.6
2	B4-0	0.06	9.6
2	B5-1A	0.08	7.3
2	B5-1B	0.08	7
2	B5-1C	0.13	7
2	B6-3	0.05	5.9
2	B6-2A	0.05	7.9
2	B6-2B	0.06	6.8
2	B7-1	0.03	14
2	B8-3	0.02	6.7
2	B9-1	0.03	3.7
3	B12-2	0.05	6.9
3	B11-9A	0.08	5.9
3	B11-9B	0.04	5.3
3	B10-8	0.04	5.9
3	B10-6A	0.03	5.3

3.2.3 Total Petroleum Hydrocarbons (TPHs)

Concentrations of TPHs were at or below the LOR for the C6-C9, C10-C14 and C15-28 fractions at all locations. Low level detections of TPHs C29-C36 were recorded at locations B5-1A and B6-3. The maximum normalised concentration of 76.5 mg/kg is well below the NAGD screening level of 550 mg/kg. This is consistent with the results of BMT WBM from previous years (2013, 2015a, 2015c). TPHs were not assessed at the reference locations.

Therefore, the sediments in dredge Zones 2, 3 and 4 would be considered for ocean disposal as per the NAGD guidelines with respect to TPHs.

3.2.4 Polyaromatic Hydrocarbons (PAHs)

Relatively low level detections of various PAHs were noted at all investigated study locations within all dredge zones. Total PAHs concentrations were well below the NAGD screening level of 10,000 µg/kg in all samples with highest recorded concentrations recorded at 12-1 (1630 µg/kg), 5-1A (1420 µg/kg) and 13-1 (1230 µg/kg). The 95% UCL for total PAHs across all dredge zones was 537.1 µg/kg. These results are consistent with sampling results from previous years (BMT WBM 2013, 2015a, 2015c). PAHs were not assessed at the reference locations.

On the basis of these results, the sediments in dredge Zones 2, 3 and 4 would be considered suitable for ocean disposal as per the NAGD guidelines with respect to PAHs.

Table 3-3 Summary Statistics and 95% UCLs for Combined Locations in Zones 2, 3 and 4. Values Highlighted in Orange Indicate Exceedance of NAGD Screening Levels – Organic Compounds (Normalised to 1% TOC)

Analytes	Units	PQL	NAGD	% detections	% >NADG	Arithmetic mean	Geometric mean	Standard deviation	Distribution	95% UCL
Moisture Content	%	0.1	ND	100	0	50.3	47.9	13.50	NC	NC
Total Organic Carbon	%	0.01	ND	100	0	4.6	1.3	17.5	NC	NC
Organo-chlorine pesticides										
Aldrin	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
alpha-BHC	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
beta-BHC	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
gamma-BHC (Lindane)	µg/kg	1	0.32	0	0	NC1	NC1	NC1	NC1	NC1
delta-BHC	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
cis-Chlordane	µg/kg	1	0.5	0	0	NC1	NC1	NC1	NC1	NC1
trans-Chlordane	µg/kg	1	0.5	3.8	38.4	0.6	0.5	0.3	NC2	NC2
p,p'-DDD	µg/kg	1	2	34.6	3.84	1	0.8	0.6	G	1.3
p,p'-DDE	µg/kg	1	2.2	73	23	2.1	1.5	1.5	X	3.1
p,p'-DDT	µg/kg	1	1.6	0	0	NC1	NC1	NC1	NC1	NC1
Dieldrin	µg/kg	1	280	3.8	0	0.6	0.4	0.3	NC2	NC2
alpha-Endosulfan	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
beta-Endosulfan	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
Endosulfan Sulphate	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
Endrin	µg/kg	1	10	0	0	NC1	NC1	NC1	NC1	NC1
Endrin ketone	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
Endrin aldehyde	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
Heptachlor	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
Heptachlor epoxide	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
Hexachlorobenzene	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1

Results

Analytes	Units	PQL	NAGD	% detections	% >NADG	Arithmetic mean	Geometric mean	Standard deviation	Distribution	95% UCL
Methoxychlor	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
Oxychlordane*	µg/kg	1	ND	0	0	NC1	NC1	NC1	NC1	NC1
Organo-tins										
Monobutyl tin	µgSn/kg	0.5	ND	78.5	0	1.4	1.1	0.9	G	2
Dibutyl tin	µgSn/kg	0.5	ND	75	0	1.1	0.9	0.9	X	2
Tributyl tin	µgSn/kg	0.5	ND	57.1	0	0.7	0.5	0.6	G	1
Total Petroleum Hydrocarbons										
TPH C6-C9	mg/kg	10	550	0	0	NC1	NC1	NC1	NC1	NC1
TPH C10-14	mg/kg	10	550	0	0	NC1	NC1	NC1	NC1	NC1
TPH C15-28	mg/kg	50	550	0	0	NC1	NC1	NC1	NC1	NC1
TPH C29-36	mg/kg	50	550	16.7	-	38.2	23.3	26.2	NC2	NC2
PAHs										
Naphthalene	µg/kg	5	ND	16.7	0	3.5	2.4	2.4	NC2	NC2
1-Methylnaphthalene	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
2-Methylnaphthalene	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
Acenaphthylene	µg/kg	5	ND	8.3	0	3.8	2.4	2.6	NC2	NC2
Acenaphthene	µg/kg	5	ND	8.3	0	3.2	2.3	2.3	NC2	NC2
Fluorene	µg/kg	5	ND	16.7	0	3.5	2.4	2.4	NC2	NC2
Phenanthrene	µg/kg	5	ND	83.3	0	10.8	8.9	5.9	Normal	12.5
Anthracene	µg/kg	5	ND	25	0	3.8	2.9	2.4	NC2	NC2
Fluoranthene	µg/kg	5	ND	91.7	0	46.6	30.6	43.2	X	84.2
Pyrene	µg/kg	5	ND	91.7	0	47.4	31.4	44.5	X	87.4
Benz(a)anthracene	µg/kg	5	ND	83.3	0	23.7	14.9	25.7	X	46.3
Chrysene	µg/kg	5	ND	83.3	0	23.7	15.3	23.4	X	44.3
Benzo(b)&(k)fluoranthene	µg/kg	10	ND	83.3	0	56.8	34	62.4	X	112.2

Results

Analytes	Units	PQL	NAGD	% detections	% >NADG	Arithmetic mean	Geometric mean	Standard deviation	Distribution	95% UCL
Benzo(a)pyrene	µg/kg	5	ND	91.7	0	35.4	21.5	40.8	X	71.2
Indeno(1,2,3-cd)pyrene	µg/kg	5	ND	83.3	0	24.3	15	25.6	X	47
Dibenz(a,h)anthracene	µg/kg	5	ND	25	0	5	3.2	4.8	NC2	NC2
Benzo(g,h,i)perylene	µg/kg	5	ND	83.3	0	24.2	15.5	23.3	X	45.1
Coronene	µg/kg	10	ND	8.3	0	7.4	4.8	5.5	NC2	NC2
Benzo(e)pyrene	µg/kg	5	ND	83.3	0	20.6	13.1	20.5	X	38.8
Perylene	µg/kg	5	ND	91.7	0	80.4	32.1	146.8	X	264.8
Total PAHs (as above)	µg/kg	100	10000	83.3	0	407	265.2	367.6	Normal	537.1
Mono-PCB congeners	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
Di-PCB congeners	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
Tri-PCB congeners	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
Tetra-PCB congeners	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
Penta-PCB congeners	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
Hexa-PCB congeners	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
Hepta-PCB congeners	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
Octa-PCB congeners	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
Nona-PCB congeners	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
Deca-PCB congeners	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
Total PCB congeners	µg/kg	5	23	0	0	NC1	NC1	NC1	NC1	NC1

Blue shading = parameter not detected; Orange shading = UCL95% > screening level

ND = No Data, NC1 = not calculated due to no detections; NC2 = not calculated due to >30% of values being non-detects (applicable only to parameters with screening levels)

Data distribution: N = Normal; L = log-normal; X = follows no statistical distribution

3.2.5 Organochlorine Pesticides (OCPs)

3.2.5.1 Bulk Sediment

The concentrations for most OCPs were below the laboratory LOR at all study locations. The exceptions within the dredge zones were *p,p'*-DDD, *p,p'*-DDE, trans-Chlordane and Dieldrin. In summary:

- *p,p'*-DDD was detected within 9 of the 26 samples sites within the dredge areas (Zones 2, 3, and 40 of the study area (34.4%). Across all the dredged areas, the 95% UCL was 1.3 µg/kg which was less than the screening level of 2 µg/kg. Within individual zones the 95% UCL for DDD were 1.8 µg/kg (Zone 2), 0.9 µg/kg (Zone 3) and 1.3 µg/kg (Zone 4). A large number of non-detections were recorded at Zones 3 and 4 and the 95% UCL for these zones should only be considered indicative. DDD was not detected at any reference locations, any locations within the MIDMPA or at any locations upstream of the dredge area (zone 1).
- *p,p'*-DDE was detected within 24 of the 35 sample locations within the overall study area (~68%). Across all of the dredged areas (Zones 2, 3 and 4), the 95% UCL was 3.1 µg/kg which exceeded the screening level of 2 µg/kg. The 95% UCL value derived for Zone 2 was 3.8 µg/kg and 2.1 µg/kg for Zone 3. The 95% UCL for the Zone 4 was 1.7 µg/kg, but due to the large number of non-detections this number should be considered indicative. DDE was detected at Moreton Bay reference locations RF3 (2 µg/kg), RF6 (1 µg/kg) and RF7 (5 µg/kg), MIDMPA site 16-0 (3 µg/kg) and Zone 1 sites 2-0 and BC-2. The concentrations recorded in the dredged areas were within the range recorded at reference locations except for three sites (5-1A = 6 µg/kg; 8-3 = 10 µg/kg and 7-1 = 16 µg/kg).
- *trans-Chlordane* was general below the detection limits at most sites. The exception being, BC-2, 4-4 and 16-0 that had concentrations greater than the NAGD screening level for trans-Chlordane of 0.5 µg/kg.
- Dieldrin was detected at three sites (BC-2 = 1 µg/kg, 4-4 = 2 µg/kg and 7-1 = 1 µg/kg) in zone 2, however this is well below the NAGD screening level of 280 µg/kg.
- *p,p'*-DDT was not detected in any samples. Due to matrix interferences, the primary laboratory raised their detection limit to 3 µg/kg in many locations and 6 µg/kg for the remaining locations, which is well above the screening level of 1.6 µg/kg. DDT was not detected in secondary laboratory samples from 6-2 and 10-6, with values below the limit of detection (<0.5 µg/kg).

The concentrations and spatial distribution of *p,p'*-DDD and *p,p'*-DDE were consistent with that reported by BMT WBM (2013, 2015a, 2015b, 2015c). For most sites within the dredge areas, concentrations of *p,p'*-DDE residues were similar to that recorded at reference sites and the MIDMPA, suggesting broad-scale contamination for these parameters in western Moreton Bay.

3.2.5.2 Elutriate and Bioavailability Testing

Phase III elutriate and bioavailability (porewater) testing was undertaken to investigate the potential bioavailability of OCPs. As outlined in Section 2.6.2, five additional samples (plus one duplicate) were analysed from Zone 2 and six samples (plus two duplicates) were analysed from Zone 3.

Samples were analysed for locations where OCPs had been previously detected, targeting fine sediments.

OCP concentrations were below the laboratory LOR (detection limit = 0.03 µg/L) for all elutriate and pore water samples. It is noted that no marine trigger limits are given in ANZECC/ARMCANZ (2000) for DDD, DDT, DDE, Dieldrin or Chlordane.

On the basis of Phase II and Phase III testing for OCPs, the sediments in dredge Zones 2, 3 and 4 are considered suitable for ocean disposal as per the NAGD guidelines with respect to OCPs.

3.2.6 Organotins

Concentrations of organotins were either below the LOR or detected at low concentrations well below the NAGD screening level of 9 µgSn/kg across all dredge zones. The 95% UCL across all locations within the dredge Zones 2, 3 and 4 was 1.017 µgSn/kg which was less than 2015 (3.6 µgSn/kg) but higher than 2013 and 2014 (0.7 µgSn/kg and 0.9 µgSn/kg). The 95% UCL for TBT at dredging Zones 2, 3, and 4 was 1.693 µgSn/kg, 0.564 µgSn/kg and 0.683 µgSn/kg respectively.

At the reference locations, organotin concentrations were mostly below the LOR with the exception of the monobutyl tin compounds which were detected at all reference sites. Dibutyl tin and tributyl tin (TBT) were detected in low concentrations at BC-2 and 16-0.

TBT was not detected in both elutriate and bioavailability test samples (laboratory LOR for all samples. Based on these results the sediments in all dredge zones are considered suitable for ocean disposal as per the NAGD guidelines with respect to organotins.

3.2.7 Polychlorinated Biphenyls (PCBs)

Concentrations of PCBs were below the laboratory LOR at all investigated locations. Therefore, the sediments in the dredge zones are considered suitable for ocean disposal as per the NAGD guidelines with respect to PCBs. No assessment of PCBs was undertaken at the reference locations.

3.2.8 Radionuclides

Gross alpha and gross beta activity ranged between 0.072 to 0.31 Bg/g and 0.37 to 0.73 Bg/g respectively. Therefore, the NAGD screening level for the sum of gross alpha and beta was not exceeded in any samples, and on this basis sediments in the dredge zones are considered suitable for ocean disposal as per the NAGD guidelines with respect to radionuclides. No assessment of radionuclides was undertaken at the reference locations.

3.2.9 Nutrients and Carbon Content

In 2016, Total Nitrogen (TN) and Total Kjeldahl Nitrogen (TKN) concentrations across the dredge zones ranged between 100 and 1650 mg/kg compared to 320 and 1530 mg/kg in 2015, and 220 mg/kg and 1320 mg/kg in 2014. Consistent with previous surveys, nitrate and nitrite concentrations were below the LOR in all samples from dredge and reference zones.

Total Phosphorus (TP) concentrations across dredge zones ranged between 270 to 1500 mg/kg which was higher than across all reference which ranged between 180 to 660 mg/kg. TP

concentrations across dredge zones was similar to values report in 2015 (390 to 1200 mg/kg) and 2014 (260 - 1300 mg/kg).

Total organic carbon content ranged between 0.33 to 2.2% across the dredge zones and between 0.09 to 1.9% across reference zones. TOC in 2015 and 2014 were similar ranging between 0.3 to 2% and 0.15 to 2% respectively. No screening levels exist in NAGD for nutrients and carbon content in sediments. However, nutrient and carbon levels were considered to be consistent with other harbour areas in Moreton Bay (e.g. WBM 2005a, b).

3.2.10 Acid Sulfate Soils

Acid Sulfate Soil testing indicated that no management would be required for sediments at most locations (except site 5-1) within dredge Zones 2, 3 and 4 (Figure 2-1).

Actual acidity (TAA) was below the LOR at all locations indicating that the sediments are not actual acid sulfate soils. Chromium reducible sulfur was above the LOR at all locations indicating that the sediments are potential acid sulfate soils (PASS). Taking into account Acid Neutralising Capacity (ANC), the net acidity was less than the laboratory limit of reporting (10 moles H+/t) at all locations. This indicates that all sediments sampled have sufficient capacity for neutralising acids upon oxidation.

Table 3-4 Acid Sulfate Soil Results (Chromium Suite and SPOCAS)

Sample	pH $_{kcl}$	s-TAA pH 6.5	TAA pH 6.5	CRS	a-CRS	S_{KCl}	ANC_{BT}	s-ANC_{BT}	s-Net Acidity	a-Net Acidity	Liming rate	a-Net Acidity without ANCE	Liming rate without ANCE
Units	pH units	%w/w S	moles H+/t	%w/w	moles H+/t	%w/w S	% CaCO3	%w/w S	%w/w S	moles H+/t	kg CaCO3/t	moles H+/t	kg CaCO3/t
PQL		0.01	5	0.005	3	0.005	0.05	0.05	0.01	10	0.75	10	0.75
B5-0	8.6	<0.01	<5	0.23	140	0.084	1.9	0.62	<0.01	<10	<0.75	140	11
B5-1A	8.6	<0.01	<5	0.35	220	0.1	2.2	0.7	<0.01	<10	<0.75	220	16
B5-1B	8	<0.01	<5	0.31	190	0.13	1.6	0.5	<0.01	<10	<0.75	190	14
B5-1C	8.3	<0.01	<5	0.35	220	0.13	2	0.63	<0.01	<10	<0.75	220	16
B6-3	8.5	<0.01	<5	0.19	120	0.14	2.4	0.78	<0.01	<10	<0.75	120	8.9
B7-	8.2	<0.01	<5	0.16	98	0.095	2.5	0.82	<0.01	<10	<0.75	98	7.4
B15-3	9.4	<0.01	<5	0.08	51	0.039	2.2	0.7	<0.01	<10	<0.75	51	3.8
B15-2	9.5	<0.01	<5	0.04	28	0.03	3.1	0.98	<0.01	<10	<0.75	28	2.1
B12-1	8.9	<0.01	<5	0.24	150	0.085	3.1	1	<0.01	<10	<0.75	150	11
B11-8	9	<0.01	<5	0.19	120	0.079	3	0.95	<0.01	<10	<0.75	120	9
B10-6A	8.8	<0.01	<5	0.14	86	0.11	3.6	1.1	<0.01	<10	<0.75	86	6.4
B10-6B	8.9	<0.01	<5	0.18	110	0.11	3.7	1.2	<0.01	<10	<0.75	110	8.5
B13-8	9	<0.01	<5	0.17	110	0.14	7	2.2	<0.01	<10	<0.75	110	8.1
B13-1	9.2	<0.01	<5	0.17	110	0.071	3.1	1	<0.01	<10	<0.75	110	8.1
B9-1	9.1	<0.01	<5	0.08	51	0.057	2.4	0.77	<0.01	<10	<0.75	51	3.8

4 Data Validation

4.1 Laboratory QA/QC

Details of the laboratory QA/QC for the primary and secondary laboratories are provided in Appendix C and D. A summary of this assessment is provided in the following sections. Refer to Section 2.5.2 for a description of laboratory QA/QC procedures.

4.1.1 Limits of Reporting (LORs)

Due to matrix interference caused by high moisture content (>2.5%) the primary laboratory LORs for organochlorine pesticide (*trans*-Chlordane, *cis*-Chlordane, gamma-BHC (Lindane, DDT and Methoxyhlor) were raised well above the screening levels. The raised LORs resulted from inherent sediment properties in the study area.

The primary laboratory raised the LORs for DDT to 3.0 to 6.0 µg/kg, which was greater than the screening level of 1.6 µg/kg. In accordance with NAGD, a value of the half the detection limit was adopted (1.5 and 3 µg/kg), and therefore some samples exceeded the screening level. The derived 95% UCL for all dredging zones was 2.7 µg/kg and on this basis DDT exceeded the screening level. DDT was not detected in secondary laboratory samples from 6-2 and 10-6, with values below the limit of detection (<0.5 µg/kg).

All other LORs used by the primary laboratory were below relevant screening levels.

4.1.2 Sample Holding Times and Storage Conditions

All samples were received by the laboratories in appropriately pre-treated and preserved containers. Samples were chilled with ice whilst in the field and during delivery (ice packs). All analyses were undertaken by the laboratories within recommended holding times.

4.1.3 Laboratory Blanks

Results indicated that the laboratory blank assessment was within the acceptable criteria.

4.1.4 Laboratory Duplicates

Trace elements RDP duplicate were within the laboratories acceptable criteria.

4.1.5 Surrogate and Matrix Spikes

The assessment of surrogate and matrix spike recoveries was satisfactory for all samples.

4.2 Field QA/QC

4.2.1 Field Trip Blank

No BTEX compounds or volatile Total Petroleum Hydrocarbons (TPH C6-C9) were detected in any trip blank samples, indicating that samples were not contaminated with volatile organic carbons during field sampling and processing of samples.

4.2.2 Field Triplicates

The assessment of field triplicate samples collected at sites 5-1, 11-9 and 13-4 are presented in Table 4-1. With the exception of the OPC compound Perylene at site 5-1, RSDs for all other samples were below 50% NAGD criteria.

4.2.3 Field Triplicate Splits

Analyses of field triplicate splits were within the ±50 % NAGD criterion for RSDs or RPDs for most samples (Table 4-2). The exceptions were lead and TBT (Tributyl tin) at location 6-2. Sediment grain size showed a degree of heterogeneity in contrast to 2015, with the greatest variability occurring within (i.e. between the two primary laboratory samples) rather than between laboratories. The source of variation is not known, noting that most other metals at this location displayed a high degree of consistency between the primary intra-laboratory samples and secondary inter-laboratory sample.

The exceedance of the NAGD criterion for these parameters was not considered problematic given that it had low concentrations that were well below the screening levels.

4.3 Summary of Data Validation

Results from the present study indicated that the survey was undertaken to a high standard providing scientific confidence that the presented results are valid to allow an assessment of sediment quality against the NAGD guidelines.

The raised LOR for DDT required the adoption of half the detection limit (1.5 µg/kg and 3 µg/kg) for all non-detects, which is conservative in the context of detailed investigations undertaken in this region by BMT WBM (2015b).

Table 4-1 Summary of Triplicate Field Core Analysis for Sediment Contaminants. Orange Shading Indicates Exceedance of 50% Criterion for Relative Standard Deviation (RSD) or Relative Percent Difference (RPD)

Sample	Units	B13-4A	B13-4B	B13-4C	RSD	B5-1A	B5-1B	B5-1C	RSD	B11-9A	B11-9B	B11-9C	RSD
Moisture Content	%	31.3	29.2	21.1	19.8	62.4	62.6	58.3	3.9	57.5	52.2	57.7	5.5
Aluminium	mg/kg	8700	8400	5600	22.6	26000	26000	26000	0	19000	18000	16000	8.6
Arsenic	mg/kg	5.1	5	4	12.9	5.8	5.7	7.3	14.3	6.5	7	8.3	12.7
Cadmium	mg/kg	<0.1	<0.1	<0.1	NC	0.19	0.18	0.22	10.5	<0.1	<0.1	<0.1	NC
Chromium	mg/kg	19	18	14	15.5	40	39	42	3.7	36	37	35	2.7
Copper	mg/kg	12	8.6	16	30.3	33	32	32	1.7	22	22	22	0
Iron	mg/kg	19000	19000	15000	13.1	38000	37000	38000	1.5	33000	33000	32000	1.7
Lead	mg/kg	11	6.3	15	40.4	30	30	29	1.9	12	12	13	4.6
Mercury	mg/kg	0.02	0.02	0.02	0	0.14	0.13	0.2	24.1	0.11	0.11	0.16	22.7
Nickel	mg/kg	11	11	8.4	14.8	22	22	21	2.6	21	21	20	2.7
Silver	mg/kg	<0.1	<0.1	<0.1	NC	0.41	0.39	0.55	19.3	0.18	0.16	0.14	12.5
Zinc	mg/kg	56	76	79	17.7	110	110	110	0	73	74	74	0.7
Aldrin	µg/kg	<1	<1	<1	NC	<2	<2	<1		<1	<1	<1	NC
alpha-BHC	µg/kg	<1	<1	<1	NC	<2	<2	<1		<1	<1	<1	NC
beta-BHC	µg/kg	<1	<1	<1	NC	<2	<2	<1		<1	<1	<1	NC
gamma-BHC (Lindane)	µg/kg	<1	<1	<1	NC	<2	<2	<1		<1	<1	<1	NC
delta-BHC	µg/kg	<1	<1	<1	NC	<2	<2	<1		<1	<1	<1	NC
cis-Chlordane	µg/kg	<1	<1	<1	NC	<2	<2	<1		<1	<1	<1	NC
trans-Chlordane	µg/kg	<1	<1	<1	NC	<2	<2	<1		<1	<1	<1	NC
p,p'-DDD	µg/kg	<1	<1	<1	NC	3	4	3		2	1	1	43.3
p,p'-DDE	µg/kg	<1	<1	<1	NC	6	6	3		3	3	3	0
p,p'-DDT	µg/kg	<3	<3	<3	NC	<6	<6	<3		<3	<3	<3	NC
Dieldrin	µg/kg	<1	<1	<1	NC	<2	<2	<1		<1	<1	<1	NC
alpha-Endosulfan	µg/kg	<1	<1	<1	NC	<2	<2	<1		<1	<1	<1	NC

Data Validation

Sample	Units	B13-4A	B13-4B	B13-4C	RSD	B5-1A	B5-1B	B5-1C	RSD	B11-9A	B11-9B	B11-9C	RSD
beta-Endosulfan	µg/kg	<1	<1	<1	NC	<2	<2	<1	NC	<1	<1	<1	NC
Endosulfan Sulphate	µg/kg	<1	<1	<1	NC	<2	<2	<1	NC	<1	<1	<1	NC
Endrin	µg/kg	<1	<1	<1	NC	<2	<2	<1	NC	<1	<1	<1	NC
Endrin ketone	µg/kg	<1	<1	<1	NC	<2	<2	<1	NC	<1	<1	<1	NC
Endrin aldehyde	µg/kg	<1	<1	<1	NC	<2	<2	<1	NC	<1	<1	<1	NC
Heptachlor	µg/kg	<1	<1	<1	NC	<2	<2	<1	NC	<1	<1	<1	NC
Heptachlor epoxide	µg/kg	<1	<1	<1	NC	<2	<2	<1	NC	<1	<1	<1	NC
Hexachlorobenzene	µg/kg	<1	<1	<1	NC	<2	<2	<1	NC	<1	<1	<1	NC
Methoxychlor	µg/kg	<3	<3	<3	NC	<6	<6	<3	NC	<3	<3	<3	NC
Oxychlordane*	µg/kg	<1	<1	<1	NC	<2	<2	<1	NC	<1	<1	<1	NC
Monobutyl tin	µgSn/kg	<0.5	<0.5	<0.5	NC	8.2	6.6	7.8	11.0	1.7	3.6	2.3	38.3
Dibutyl tin	µgSn/kg	<0.5	<0.5	<0.5	NC	7.1	6.6	5.9	9.2	1.1	2.4	1.4	41.6
Tributyl tin	µgSn/kg	<0.5	<0.5	<0.5	NC	1.1	1.2	0.8	20.1	0.6	1.1	0.9	29.0
Total Organic Carbon	%	0.49	0.38	0.25	32.1	1.7	1.9	1.7	6.5	1.6	1.4	1.7	9.7
TPH C6-C9	mg/kg	-	-	-	-	<20	<20	<10	NC	-	-	-	-
TPH C10-14	mg/kg	-	-	-	-	<20	<20	<10	NC	-	-	-	-
TPH C15-28	mg/kg	-	-	-	-	<100	<100	63	NC	-	-	-	-
TPH C29-36	mg/kg	-	-	-	-	130	<100	88	27.2	-	-	-	-
Naphthalene	µg/kg	-	-	-	-	<10	<10	6	NC	-	-	-	-
1-Methylnaphthalene	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
2-Methylnaphthalene	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
Acenaphthylene	µg/kg	-	-	-	-	<10	<10	6	NC	-	-	-	-
Acenaphthene	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
Fluorene	µg/kg	-	-	-	-	11	<10	<5	NC	-	-	-	-
Phenanthrene	µg/kg	-	-	-	-	23	18	17	16.6	-	-	-	-

Data Validation

Sample	Units	B13-4A	B13-4B	B13-4C	RSD	B5-1A	B5-1B	B5-1C	RSD	B11-9A	B11-9B	B11-9C	RSD
Anthracene	µg/kg	-	-	-	-	<10	<10	7	NC	-	-	-	-
Fluoranthene	µg/kg	-	-	-	-	70	54	68	13.6	-	-	-	-
Pyrene	µg/kg	-	-	-	-	87	73	92	11.7	-	-	-	-
Benz(a)anthracene	µg/kg	-	-	-	-	36	30	40	14.2	-	-	-	-
Chrysene	µg/kg	-	-	-	-	39	32	38	10.4	-	-	-	-
Benzo(b)&(k)fluoranthene	µg/kg	-	-	-	-	85	68	110	24.1	-	-	-	-
Benzo(a)pyrene	µg/kg	-	-	-	-	46	35	62	28.4	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/kg	-	-	-	-	34	28	50	30.4	-	-	-	-
Dibenz(a,h)anthracene	µg/kg	-	-	-	-	<10	<10	10	NC	-	-	-	-
Benzo(g,h,i)perylene	µg/kg	-	-	-	-	37	30	50	26	-	-	-	-
Coronene	µg/kg	-	-	-	-	<20	<20	12	NC	-	-	-	-
Benzo(e)pyrene	µg/kg	-	-	-	-	34	27	40	19.3	-	-	-	-
Perylene	µg/kg	-	-	-	-	920	800	110	71.6	-	-	-	-
Total PAHs (as above)	µg/kg	-	-	-	-	1420	1190	720	32.1	-	-	-	-
Mono-PCB congeners	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
Di-PCB congeners	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
Tri-PCB congeners	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
Tetra-PCB congeners	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
Penta-PCB congeners	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
Hexa-PCB congeners	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
Hepta-PCB congeners	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
Octa-PCB congeners	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
Nona-PCB congeners	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
Deca-PCB congeners	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-
Total PCB congeners	µg/kg	-	-	-	-	<10	<10	<5	NC	-	-	-	-

Data Validation

Sample	Units	B13-4A	B13-4B	B13-4C	RSD	B5-1A	B5-1B	B5-1C	RSD	B11-9A	B11-9B	B11-9C	RSD
Nitrate as N	mg/kg	-	-	-	-	<0.1	<0.1	<0.1	NC	-	-	-	-
Nitrite as N	mg/kg	-	-	-	-	<0.1	<0.1	<0.1	NC	-	-	-	-
Total Kjeldahl Nitrogen	mg/kg	-	-	-	-	950	1020	950	4.2	-	-	-	-
Total Nitrogen	mg/kg	-	-	-	-	950	1020	950	4.2	-	-	-	-
Phosphorus	mg/kg	320	310	270	8.8	790	770	790	1.4	620	640	680	4.7

(-) = parameter not measured, NC = not calculated as values were below the detection limit.

Table 4-2 Summary of Triplicate Laboratory Split Analysis. Orange Shading Indicates Exceedance of 50% Criterion for Relative Standard Deviation (RSD) or Relative Percent Difference (RPD)

Sample	Units	B10-6A	B10-6B	B10-6C	RSD	B6-2A	B6-2B	B6-2C	RSD
Moisture Content	%	62.1	61.4	62.0	0.8	51.7	55.6	54.7	5.1
Aluminium	mg/kg	19000	18000	21600	3.8	21000	20000	21900	3.4
Arsenic	mg/kg	6.9	5.6	9.15	14.7	6.7	6	7.49	7.8
Cadmium	mg/kg	<0.1	<0.1	<0.1	NC	0.38	0.75	0.6	46.3
Chromium	mg/kg	36	34	46.5	4.0	38	35	44.3	5.8
Copper	mg/kg	28	24	31.1	10.9	51	31	34.5	34.5
Iron	mg/kg	34000	31000	38000	6.5	35000	33000	35500	4.2
Lead	mg/kg	13	12	18.6	5.7	12	46	16.5	82.9
Mercury	mg/kg	0.11	0.09	0.07	14.1	0.09	0.1	0.07	7.4
Nickel	mg/kg	21	20	29.2	3.4	25	23	30.8	5.9
Silver	mg/kg	0.15	0.14	<0.1	4.9	0.15	0.13	<0.1	10.1
Zinc	mg/kg	82	77	118	4.4	110	94	119	11.1
Aldrin	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
alpha-BHC	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
beta-BHC	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
gamma-BHC (Lindane)	µg/kg	<2	<2	<0.25	NC	<1	<1	<0.25	NC
delta-BHC	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
cis-Chlordane	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
trans-Chlordane	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
p,p'-DDD	µg/kg	<2	<2	<0.50	NC	3	4	0.90	20.2
p,p'-DDE	µg/kg	3	3	0.69	0.0	5	5	2.31	0.0
p,p'-DDT	µg/kg	<6	<6	<0.50	NC	<3	<3	<0.50	NC
Dieldrin	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
alpha-Endosulfan	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC

Data Validation

Sample	Units	B10-6A	B10-6B	B10-6C	RSD	B6-2A	B6-2B	B6-2C	RSD
beta-Endosulfan	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
Endosulfan Sulphate	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
Endrin	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
Endrin ketone	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
Endrin aldehyde	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
Heptachlor	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
Heptachlor epoxide	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
Hexachlorobenzene	µg/kg	<2	<2	<0.50	NC	<1	<1	<0.50	NC
Methoxychlor	µg/kg	<6	<6	<0.50	NC	<3	<3	<0.50	NC
Oxychlordane	µg/kg	<2	<2	<0.5	NC	<1	<1	-	NC
Monobutyl tin	µgSn/kg	2.6	2.1	<1	15.0	1.8	2.2	<1	14.1
Dibutyl tin	µgSn/kg	1.4	1.1	<1	17.0	1.5	1.9	<1	16.6
Tributyl tin	µgSn/kg	<1.0	<1.0	0.6	NC	1.8	5.8	2.4	74.4
Total Organic Carbon	%	1.5	1.5	1.12	0.0	1.8	2	1.09	7.4
TPH C6-C9	mg/kg	<20	<20	<10	NC	-	-	-	-
TPH C10-14	mg/kg	<20	<20	<50	NC	-	-	-	-
TPH C15-28	mg/kg	<100	<100	<100	NC	-	-	-	-
TPH C29-36	mg/kg	<100	<100	<100	NC	-	-	-	-
Naphthalene	µg/kg	<10	<10	<5	NC	-	-	-	-
1-Methylnaphthalene	µg/kg	<10	<10	<5	NC	-	-	-	-
2-Methylnaphthalene	µg/kg	<10	<10	11	NC	-	-	-	-
Acenaphthylene	µg/kg	<10	<10	<5	NC	-	-	-	-
Acenaphthene	µg/kg	<10	<10	-	NC	-	-	-	-
Fluorene	µg/kg	<10	<10	6	NC	-	-	-	-
Phenanthrene	µg/kg	13	17	39	18.9	-	-	-	-

Data Validation

Sample	Units	B10-6A	B10-6B	B10-6C	RSD	B6-2A	B6-2B	B6-2C	RSD
Anthracene	µg/kg	<10	<10	13	NC	-	-	-	-
Fluoranthene	µg/kg	66	61	73	5.6	-	-	-	-
Pyrene	µg/kg	64	61	70	3.4	-	-	-	-
Benz(a)anthracene	µg/kg	33	28	38	11.6	-	-	-	-
Chrysene	µg/kg	33	30	28	6.7	-	-	-	-
Benzo(b)&(k)fluoranthene	µg/kg	83	66	-	16.1	-	-	-	-
Benzo(a)pyrene	µg/kg	50	39	25	17.5	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/kg	36	27	18	20.2	-	-	-	-
Dibenz(a,h)anthracene	µg/kg	<10	<10	6	NC	-	-	-	-
Benzo(g,h,i)perylene	µg/kg	37	29	18	17.1	-	-	-	-
Coronene	µg/kg	<20	<20	9	NC	-	-	-	-
Benzo(e)pyrene	µg/kg	31	25	16	15.2	-	-	-	-
Perylene	µg/kg	72	62	16	10.6	-	-	-	-
Total PAHs (as above)	µg/kg	520	440	424	11.8	-	-	-	-
Mono-PCB congeners	µg/kg	<10	<10	-	NC	-	-	-	-
Di-PCB congeners	µg/kg	<10	<10	-	NC	-	-	-	-
Tri-PCB congeners	µg/kg	<10	<10	-	NC	-	-	-	-
Tetra-PCB congeners	µg/kg	<10	<10	-	NC	-	-	-	-
Penta-PCB congeners	µg/kg	<10	<10	-	NC	-	-	-	-
Hexa-PCB congeners	µg/kg	<10	<10	-	NC	-	-	-	-
Hepta-PCB congeners	µg/kg	<10	<10	-	NC	-	-	-	-
Octa-PCB congeners	µg/kg	<10	<10	-	NC	-	-	-	-
Nona-PCB congeners	µg/kg	<10	<10	-	NC	-	-	-	-
Deca-PCB congeners	µg/kg	<10	<10	-	NC	-	-	-	-
Total PCB congeners	µg/kg	<10	<10	-	NC	-	-	-	-

Data Validation

Sample	Units	B10-6A	B10-6B	B10-6C	RSD	B6-2A	B6-2B	B6-2C	RSD
Nitrate as N	mg/kg	<0.1	<0.1	-	NC	-	-	-	-
Nitrite as N	mg/kg	<0.1	<0.1	-	NC	-	-	-	-
Total Kjeldahl Nitrogen	mg/kg	990	1130	1300	9.3	-	-	-	-
Total Nitrogen	mg/kg	990	1130	1300	9.3	-	-	-	-
Phosphorus	mg/kg	690	610	753	8.7	-	-	-	-

(-) = parameter not measured, NC = not calculated as values were below the detection limit.

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Appendix A Sampling and Analysis Plan

BMT WBM

Port of Brisbane Maintenance Dredging - Sediment Sampling and Analysis Plan 2013

Reference: R.B20259.001.02.SAP.docx
Date: October 2013
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Port of Brisbane Maintenance Dredging - Sediment Sampling and Analysis Plan 2013

Prepared for:	Port of Brisbane Pty Ltd
Prepared by:	BMT WBM Pty Ltd (Member of the BMT group of companies)

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Synopsis: **A sediment sampling and analysis plan for the assessment of physical and chemical sediment properties associated with Port of Brisbane maintenance dredging**

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
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1 Introduction

Port of Brisbane Pty Ltd (PBPL) is required to maintain a minimum depth of clearance below the keel of vessels calling at the port to allow for effective shipping access to the port and ensure ship safety. Channel depths are declared by the Harbour Master (Maritime Safety Queensland) and displayed on various shipping charts. PBPL undertakes an annual maintenance dredging program to ensure these minimum depths are maintained.

PBPL propose to undertake its annual maintenance dredging within the navigational areas of the Brisbane River and Moreton Bay, primarily using the Trailer Suction Hopper Dredge (TSHD) 'Brisbane'. Maintenance dredging works extend from the Hamilton Reach of the Brisbane River to the North West Channel located in northern Moreton Bay.

PBPL aims to ensure that all dredging activities, including extraction and placement of material, are undertaken in accordance with existing legislation and with minimal environmental harm. A key component of achieving this aim is to undertake a contaminant assessment of the material proposed for dredging prior to the commencement of the dredging program.

1.1 Sediment Sampling and Analysis Plan (SAP) Objectives

The aim of this SAP is to provide a set of procedures that will allow a statistically valid evaluation of the physical and chemical sediment properties of the sediments to be dredged. The results of this assessment will assist in determining the likely impacts of unconfined offshore disposal of the dredged sediment.

The assessment of physico-chemical sediment properties will be undertaken on the basis of the approach set out in the National Assessment Guidelines for Dredging (Commonwealth of Australia 2009; henceforth NAGD).

The specific SAP objectives are to:

- Provide a summary of proposed dredging and disposal operations for the project;
- Identify a list of contaminants based on a review of existing data and potential contaminant sources;
- Determine the number of samples required to provide an adequate characterisation of the physical and chemical sediment properties;
- Develop procedures for adequate field collection and handling of sediment samples;
- Outline adequate quality assurance and quality control (QA/QC) procedures for field sampling and laboratory analysis;
- Provide a description of statistical procedures used to determine the contaminant status of the dredged material;
- Describe procedures for validating the analytical data to assess whether the sample collection, handling and laboratory analysis was undertaken to a standard allowing assessment of sediment quality against the NAGD guidelines; and

- Outline the proposed reporting framework for the sediment quality results that will address the requirements of the Determining Authority.

1.2 Proposed Dredging

PBPL's area of responsibility in relation to maintenance and capital dredging within port limits can be broadly divided into two zones on the basis of the water body type, navigable depths and nature of dredged material:

- Moreton Bay zone (enclosed/open coastal waters); and
- Brisbane River zone including the Port of Brisbane (middle/lower estuary).

This SAP only considers assessment of sediments for the Brisbane River zone. The Brisbane River zone extends from Hamilton Reach to the Outer Bar Cutting. Annual maintenance dredging is required to remove sediments accumulated by natural siltation processes within the catchment and sediment loads from residential and commercial developments.

To ensure that declared depths of navigational channels are maintained at all times, PBPL undertakes 'insurance' dredging of up to -0.5 metres below the declared depth.

On average, PBPL dredges about 400,000 m^3 to 450,000 m^3 of material each year. Additional dredging needs to be undertaken following major flood events, i.e. in 2011 and 2013.

The Brisbane River zone is divided into different dredging subareas based on existing contaminant data (Figure 2-1), comprising Zone 2, Zone 3 and Zone 4. It is noted that Zone 1 is not part of the annual dredging and samples from this zone have been used to collect control samples upstream of the actual dredging areas.

The following average dredge volumes apply to the dredge subareas (Table 1-1):

Table 1-1 Approximate Maintenance Dredge Volumes

Dredging Subarea	Extents	Average Dredge Volume (m^3)
Zone 2	Colmslie to Pinkenba	150,000
Zone 3	Within port reaches	250,000
Zone 4	Moreton Bay entrance channel	30,000

The maintenance dredging program is structured to maximise efficiencies and utilisation of PBPL's largest dredger, the trailing suction hopper dredge *TSHD Brisbane*. The *TSHD Brisbane* typically carries out the majority of the ports maintenance dredging over a two month period between January and May (actual period varies depending on other commitments of the *TSHD Brisbane* and siltation patterns). The PBPL may also utilise smaller, more manoeuvrable dredging plant, such as grab dredgers and bed levellers, to maintain more confined areas within the Port Limits.

1.3 Offshore Disposal

The PBPL's policy with regard to dredged material is to maximise its beneficial reuse. In general, most of the material dredged by the PBPL from within Port Limits is used in reclamation works

associated with development of the port. The reuse of this dredged material provides several benefits, including:

- Reduced pressure on sea disposal sites;
- The placement of any actual or potential acid sulphate material at depth beneath the water surface; and
- The containment of any contaminated material within a designated boundary, disconnected from the marine system and monitored to ensure the immobility of identified contaminants.

In 2009, the reclamation life of the Future Port Expansion (FPE) area was estimated to be approximately 30 years, based on the current level of port development at that time. Following extreme flood events in both 2011 and 2013 and the subsequent disposal of additional material in the FPE area, the estimated life of the FPE area was reduced by 20 years to 10 years. Given the importance of the FPE as an area to dispose of material unsuitable for ocean disposal, there has been a shift in thinking around the management of the FPE area.

The current proposed management of dredged material is to, where practical, dispose at sea all dredged material deemed suitable for ocean disposal. This proposed management initiative will ensure the long term viability of the FPE area for the disposal of material deemed unsuitable for ocean disposal.

In the past, significant quantities of dredged material from the Brisbane River have been placed offshore at the Mud Island Dredge Material Placement Area (DMPA) (Figure 2-1). In recent years only smaller volumes of dredged material from boat harbours in southern Moreton Bay were placed at the Mud Island DMPA. However, it is proposed that the Mud Island DMPA will be utilised for material found suitable for ocean disposal in future PBPL maintenance dredging campaigns.

2 Review of Existing Information

Prior to each annual maintenance dredging campaign, PBPL undertook assessments of sediment quality at 45 sampling locations within the dredging zones 2 to 4 (Figure 2-1).

Additional samples were obtained from three locations in Zone 1 and Breakfast Creek upstream of the dredging area in order to assess potential sediment quality impacts from the upstream catchment. The sediment quality results for the annual sampling program between 2000 and 2013 are summarised in Section 2.1.

Due to major flooding in the Brisbane River catchment in early January 2011 and late January 2013, emergency dredging was required to maintain declared depths. Twelve to twenty locations were sampled within the port and three to four locations within the Mud Island DMPA for the 2011 and 2013 flood sampling campaigns, respectively. The sediment quality assessments included elutriate and bioavailability analyses for selected trace metals and organic contaminants.

Additionally, a comparison of sediment quality (organochlorine pesticides and dioxins) at 14 sampling locations at the Mud Island DMPA and seven reference sites in Moreton Bay (Sites RF1 to RF7 in Figure 2-1) was undertaken in 2013 to assess if the emergency dredging and disposal activities impacted on sediment and water quality in Moreton Bay. The sediment quality results for the 2011 and 2013 flood sampling are summarised in Section 2.2.

Conclusions based on the review of the annual and flood sampling data are provided in Section 2.3.

2.1 Annual Sediment Quality Data 2000 – 2013

Detailed sediment quality studies have been undertaken within the Port of Brisbane since 1998. This review considers sediment quality data collected between 2000 and 2012. This comprises the studies detailed in Table 2-1.

In addition to the routine monitoring documented in Table 2-1, further sampling was carried in 2011 and 2013 (Worley Parsons 2011b, 2013b, 2013c, 2013d) to assess the effects of floods on sediment quality. Refer to Section 2.2 for a description of these studies.

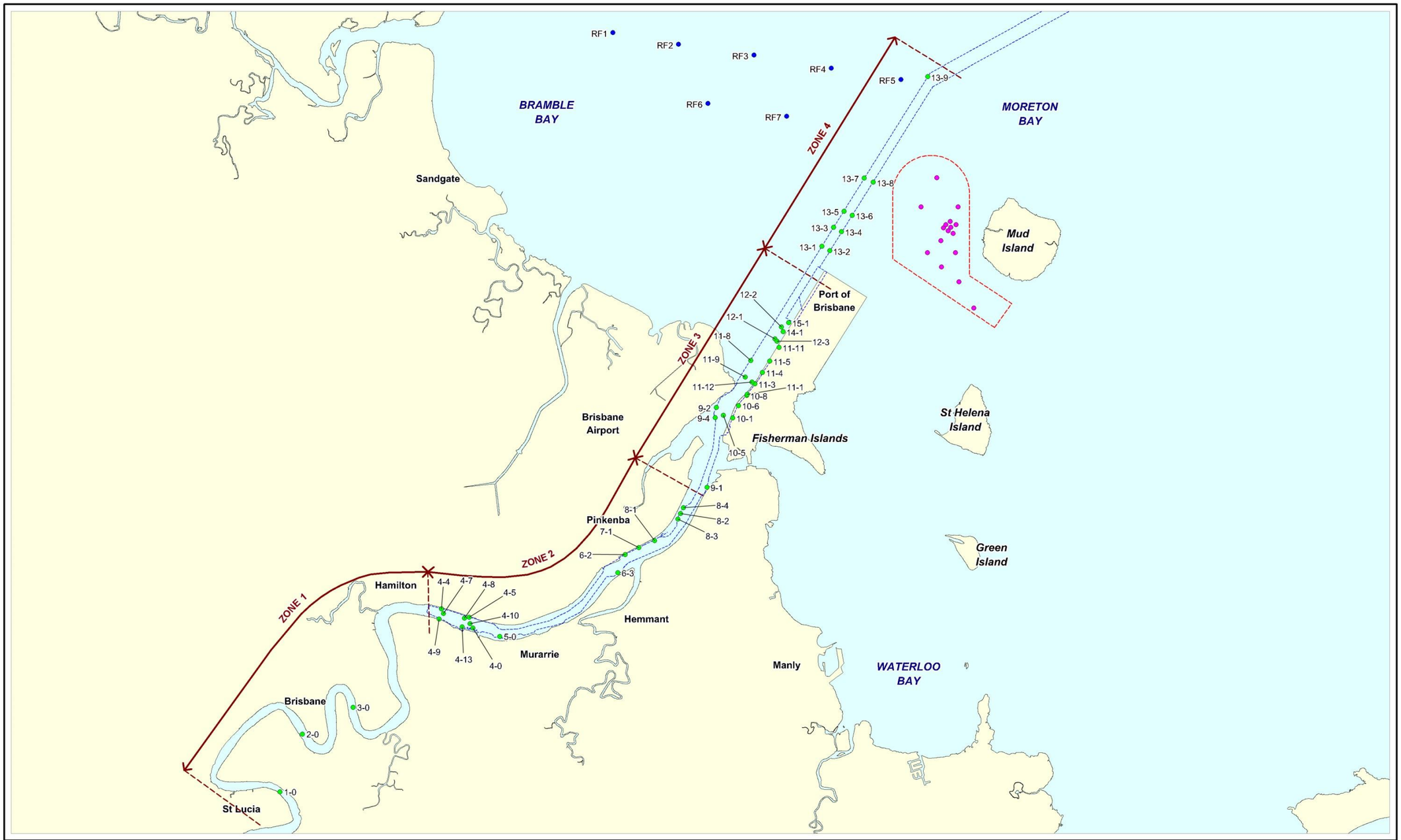
Table 2-1 Previous Routine Annual Sediment Quality Studies

Reference	Sampling Date
Maunsell McIntyre (2001)	November 2000
Butler Partners (2002)	November 2001
Hydrobiology (2003)	November 2002
Hydrobiology (2004)	November 2003
SKM (2005)	November 2004
SKM (2006)	January 2006
SKM (2007)	February 2007
Worley Parsons (2008)	January 2008
Worley Parsons (2009)	February 2009
GHD (2010)	January 2010
Worley Parsons (2011a)	December 2010
Worley Parsons (2012)	December 2011
Worley Parsons (2013a)	December 2012

A wide range of analytical parameters have been measured between 2000 and 2012 as summarised in Table 2-2. Analysis was undertaken at a total of 45 locations within the dredge areas. Additional samples were collected from three control locations upstream of the dredging areas as well as from Breakfast Creek (these locations are not within the dredge areas).

Table 2-2 Summary of Sediment Quality Data 2000 - 2012

Analytical Parameter	Measurement Events
Inorganics	
Metals & Metalloids	2000-2012
Organics	
Organotins	2000-2012
Total Petroleum Hydrocarbons (TPHs)	2000-2012
Benzene, Toluene, Ethylbenzene, Xylene (BTEX)	2000-2012
Polycyclic Aromatic Hydrocarbons (PAHs)	2000-2012 (30% of locations)
Organophosphate and Organochlorine Pesticides (OPPs and OCPs)	2000-2012 (40% of locations between 2000 and 2006)
Polychlorinated Biphenyls (PCBs)	2000-2012 (30% of locations)
Radionuclides	2010-2012
Acid Sulfate Soils	2000-2012



LEGEND

- Existing Sample Site
- Reference Sample Site
- DMPA Emergency Dredging Monitoring Sites
- Dredge Area
- Dredge Material Placement Area

Title:
Historic Sediment Sampling Locations

Figure: **2-1**

Rev: **A**

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

N

0 2.5 5km

Approx. Scale

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Filepath : I:\B20259_I_BRH Port of Brisbane DLR\DRG\ECO_019_130923 Sediment Sampling Plan.wor

2.1.1 Metals and Metalloids

Testing for metals and metalloids has included analysis of arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc between 2000 and 2012. Antimony and silver were also tested between 2001 and 2004.

The main contaminants of potential concern in terms of metals and metalloids were mercury and nickel. Mercury and nickel concentrations frequently exceeded the NAGD screening level at the 95% Upper Confidence Limit of the mean (95% UCL). Silver exceeded the NAGD screening level at the 95% UCL between 2002 and 2004. All other metals and metalloid 95% UCL concentrations were generally below the 95% UCL between 2000 and 2013.

The temporal and spatial trends observed for trace metals between 2000 and 2012 are detailed in the following sections.

2.1.1.1 Mercury

The NAGD screening level for mercury (0.15 mg/kg) was exceeded on numerous occasions in the Brisbane River dredge zones, particularly in Zone 2. Figure 2-2 shows the number of occasions when the screening level was exceeded between 2000 and 2012 and the number of sites for dredge zones 2 to 4 where exceedances were noted.

For Zone 2, mercury concentrations exceeded the screening level on 61 - 70% of occasions at 25% of locations. At a similar number of sites in Zone 2 exceedances were noted on 20 – 40% of occasions between 2000 and 2012.

Some exceedances of the mercury screening level were noted also for Zone 3 and Zone 4. However, those exceedances occurred only at a limited number of sites whilst no screening level exceedances were noted at 70 – 80% of locations in Zone 3 and Zone 4 between 2000 and 2012.

In Zone 3 most exceedances of the mercury screening level occurred at three sites (9-2, 10-6 and 11-8) occurring on 31 – 69% of occasions. In Zone 4, exceedances were only noted at two sites (13-5 and 13-6) on 8 – 23% of occasions.

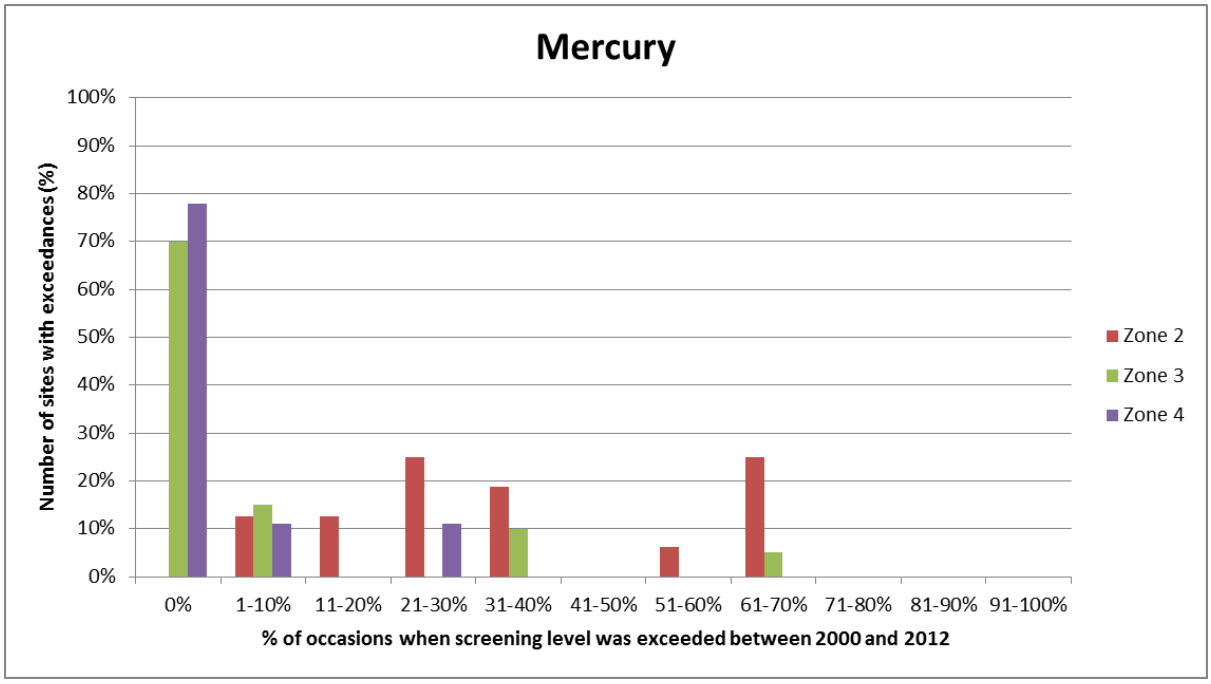


Figure 2-2 Exceedances of the NAGD Screening Level for Mercury between 2000 and 2012 in Dredge Zones 2, 3 and 4

2.1.1.2 Nickel

Exceedances of the nickel screening level (21 mg/kg) were noted for most locations across all dredge zones (Figure 2-3). Exceedances of the screening level on more than 80% of occasions were noted at a cumulative 56% of sites in Zone 2, 20% of sites in Zone 3 and 11% of sites in Zone 4. Average Nickel concentrations were 24.2 mg/kg for Zone 2, 20.1 mg/kg for Zone 3 and 21.4 mg/kg for Zone 4, i.e. close to the nickel screening level of 21 mg/kg.

Given the widespread exceedances of the nickel screening level across all dredge zones and that exceedances were also commonly noted for the upstream control sites, it appears likely that the elevated nickel concentrations are of natural origin. It is recognised that sediments in Australia including South-East Queensland commonly have high natural levels of nickel (NAGD 2009 and Preda & Cox 2002).

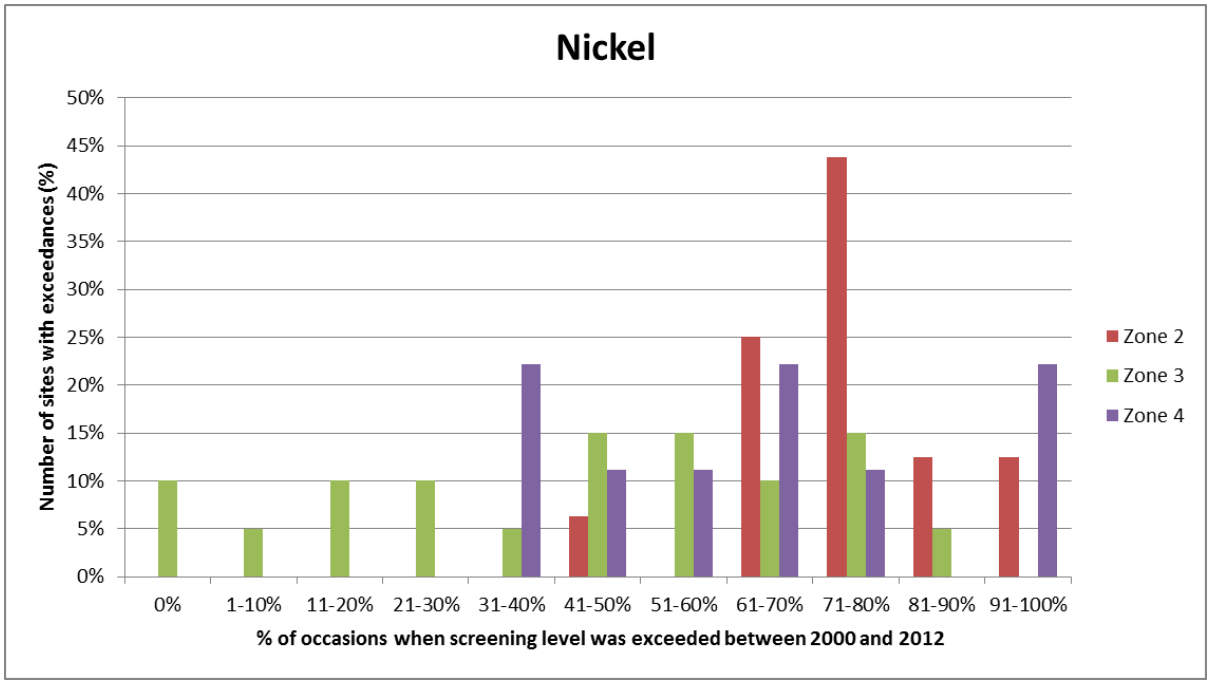


Figure 2-3 Exceedances of the NAGD Screening Level for Nickel between 2000 and 2012 in Dredge Zones 2, 3 and 4

2.1.1.3 Arsenic

Concentrations for arsenic were below the NAGD screening level of 20 mg/kg at all locations and dredge zones between 2000 and 2012.

2.1.1.4 Cadmium

Cadmium concentrations were below the NAGD screening level of 1.5 mg/kg with the exception of one site in Zone 2 (Site 6-2) where the screening level was met or exceeded between 2007 and 2009 with concentrations ranging between 1.5 – 6.3 mg/kg.

However, cadmium concentrations were below screening level at all locations between 2010 and 2012. The 95% UCL for cadmium was below the screening level between 2000 and 2013 for all dredge zones.

Average cadmium concentrations between 2000 and 2012 were 0.30 mg/kg for Zone 2, 0.20 mg/kg for Zone 3 and 0.17 mg/kg for Zone 4, i.e. well below the screening level across all dredge zones.

2.1.1.5 Chromium

Chromium concentrations were mostly below the screening level of 80 mg/kg. The only exceptions were noted at site 9-1 in Zone 3 where the screening level was exceeded in 2002 and 2012 with concentrations ranging between 94 – 100 mg/kg. However, the 95% UCL remained below the screening level. Furthermore, exceedances of the chromium screening level were noted at four sites in Zone 2 in 2000 with concentrations ranging between 88.6 – 101 mg/kg.

2.1.1.6 Copper

Copper concentrations exceeded the NAGD screening level of 65 mg/kg on a few occasions in Zone 2 and Zone 3. No exceedances of the copper screening level were noted for Zone 4 (Figure 2-4).

In Zone 2 exceedances were noted at five out of sixteen locations, with only one to two detections noted at four of these locations between 2000 and 2012. At site 6-2 in Zone 2 exceedances of the screening level occurred on 46% of occasions. However, in 2011 and 2012 copper concentrations were below the screening level at this site.

The only exceedances of the copper screening level in Zone 3 were noted for site 9-1 in 2000 and 2008.

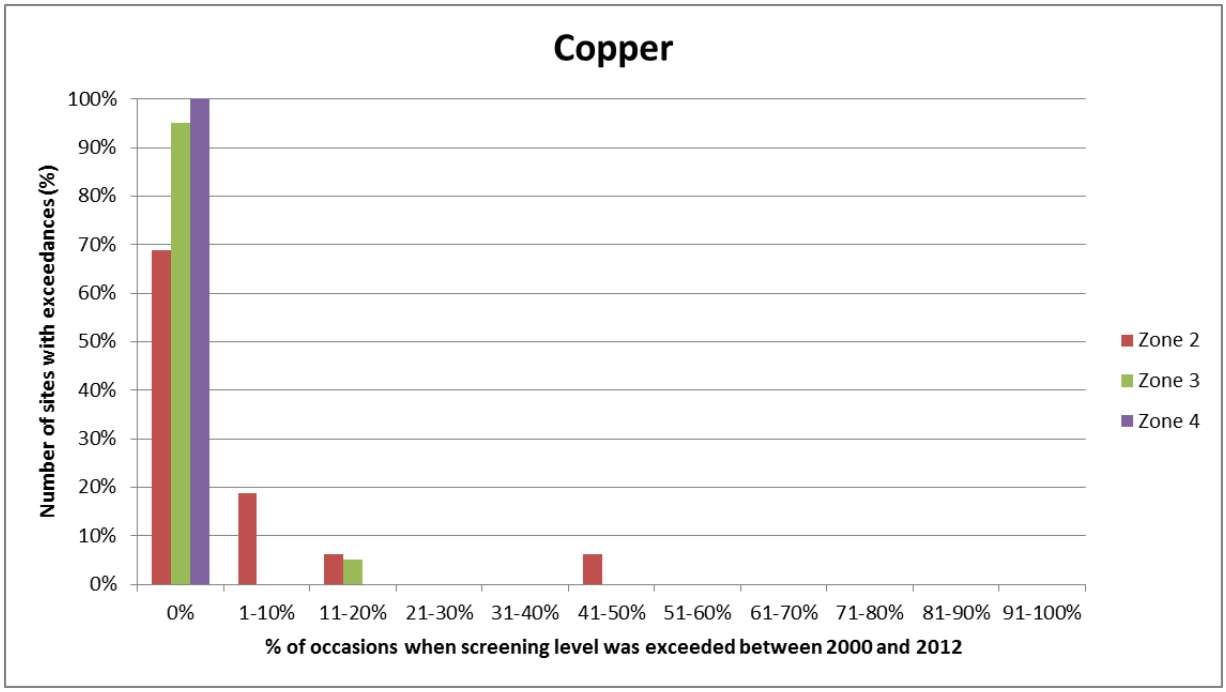


Figure 2-4 Exceedances of the NAGD Screening Level for Copper between 2000 and 2012 in Dredge Zones 2, 3 and 4

2.1.1.7 Lead

Some individual exceedances of the lead screening level (50 mg/kg) were noted, in particular in Zone 2 where exceedances were noted at seven locations (Figure 2-5). Since 2001 there were only single detections of lead above the screening level noted per annual sampling event. The 95% UCL for lead was below the NAGD screening level since 2001.

Exceedances on individual sites were noted on less than 20% of occasions, i.e. only once or twice between 2000 and 2012 in Zone 2. In Zone 3 and Zone 4, the only exceedances of the lead screening level were noted at single sites (9-1 in Zone 3 and 13-4 in Zone 4) and only on one or two occasions between 2000 and 2012.

The last screening level exceedance was noted in 2009 for Zone 2, in 2000 for Zone 3 and in 2010 for Zone 4. The average concentrations of lead between 2000 and 2012 were 26.9 mg/kg for Zone

2, 13.7 mg/kg for Zone 3 and 12.3 mg/kg for Zone 4, i.e. well below the screening level across all dredge zones.

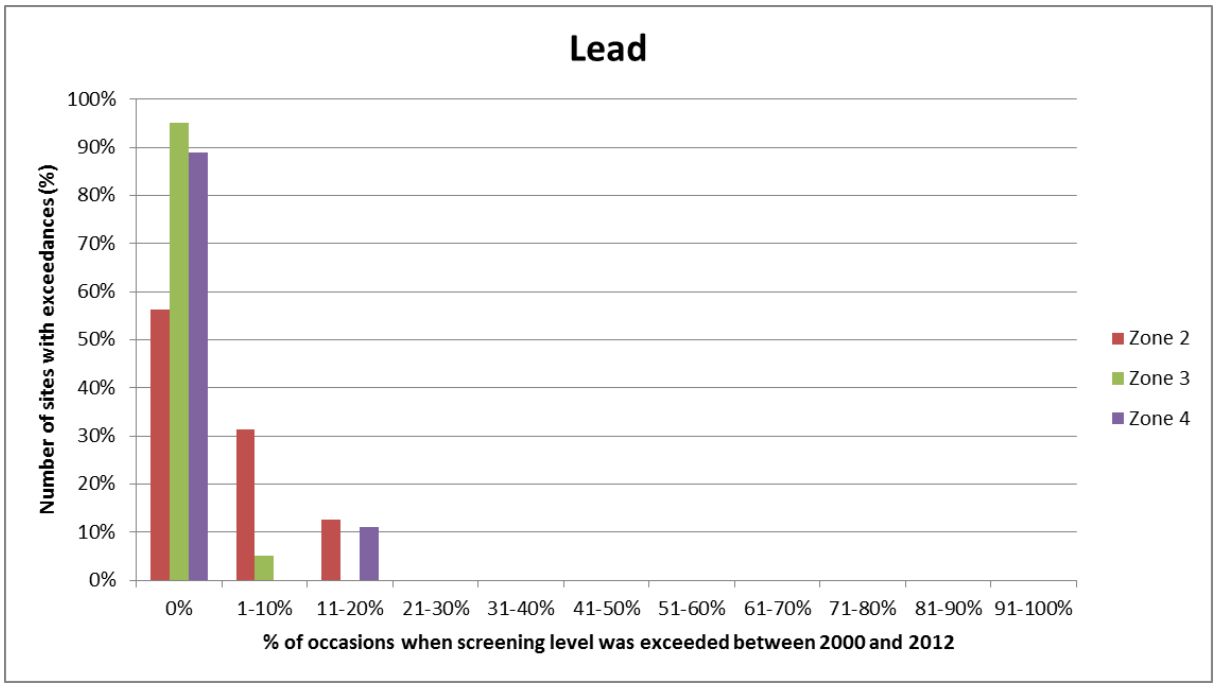


Figure 2-5 Exceedances of the NAGD Screening Level for Lead between 2000 and 2012 in Dredge Zones 2, 3 and 4

2.1.1.8 Zinc

Individual exceedances of the zinc screening level (200 mg/kg) were noted at eight locations in Zone 2. However, most of these exceedances occurred only once or twice (<15% occurrence) between 2000 and 2012 (Figure 2-6). Only at location 6-2 exceedances occurred on more than 30% of occasions (four times between 2000 and 2012). It is noted that the last exceedance of the zinc screening level in Zone 2 occurred in 2010.

In Zone 3 only a single exceedances was noted at location 9-1 in 2000. No exceedances of the zinc screening level were noted in Zone 4.

The average zinc concentration between 2000 and 2012 was 130.3 mg/kg for Zone 2, 74.0 mg/kg for Zone 3 and 57.1 mg/kg for Zone 4, i.e. well below the NAGD screening level across all dredge zones.

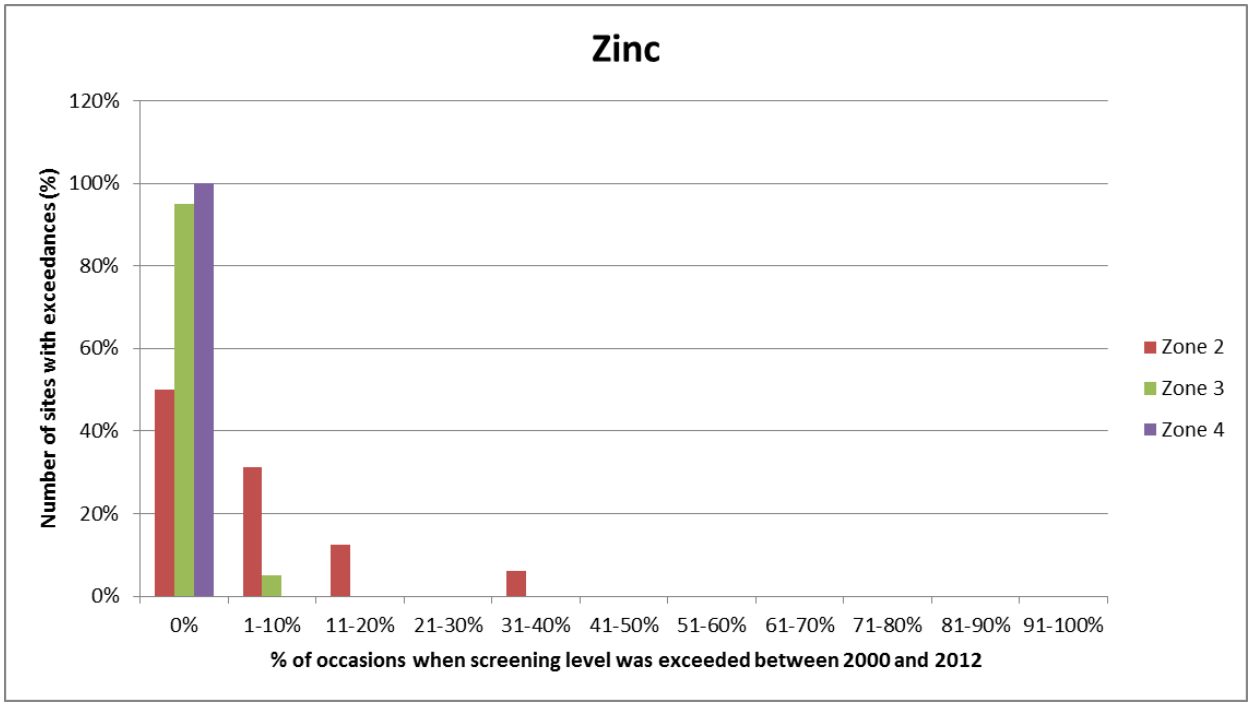


Figure 2-6 Exceedances of the NAGD Screening Level for Zinc between 2000 and 2012 in Dredge Zones 2, 3 and 4

2.1.1.9 Antimony and Silver

In addition to the metals and metalloids outlined above, antimony and silver were tested between 2001 and 2004. While antimony concentrations remained below the Limit of Reporting (LOR) for all sampling events, silver was detected at several locations and concentrations exceeded the screening level at one site in Zone 3 (11-8) between 2002 and 2004.

2.1.2 Organotins

Concentrations of TBT at the 95% UCL frequently exceeded the NAGD screening level (9 µg Sn/kg) between 2000 and 2012, particularly in dredge zones 2 and 3.

Exceedances of the TBT screening level were noted predominantly in Zone 2, including several exceedances of the NAGD high level of 70 µg Sn/kg (Figure 2-7). At sampling site 4-4 in Zone 2, the screening level was exceeded during all sampling events except in 2001, including six exceedances of the NAGD high level. At several other locations in Zone 2, screening level exceedances were noted between 20 to 70% of occasions.

In Zone 3, exceedances of the TBT screening level were typically only noted once or twice between 2000 and 2013, corresponding to 8% and 15% of occasions in Figure 2-7. The only exception was site 9-1, where exceedances of the screening level were noted on 69% of occasions. This included five sampling events where the NAGD high level was exceeded. This corresponds to a generally higher occurrence of metal/metalloid exceedances at this site as outlined in Section 1.1.1. It is noted that site 9-1 is the site located closest to Zone 2.

Only a single exceedance of the TBT screening level was noted at site 13-1 in Zone 4 in 2006.

The average normalised TBT concentration between 2000 and 2012 was 28.8 µg Sn/kg for Zone 2, 21.8 µg Sn/kg for Zone 3 and 0.7 µg Sn/kg for Zone 4. If site 9-1 is excluded from Zone 3, the average concentration is 4.4 µg Sn/kg, i.e. less than the NAGD screening level.

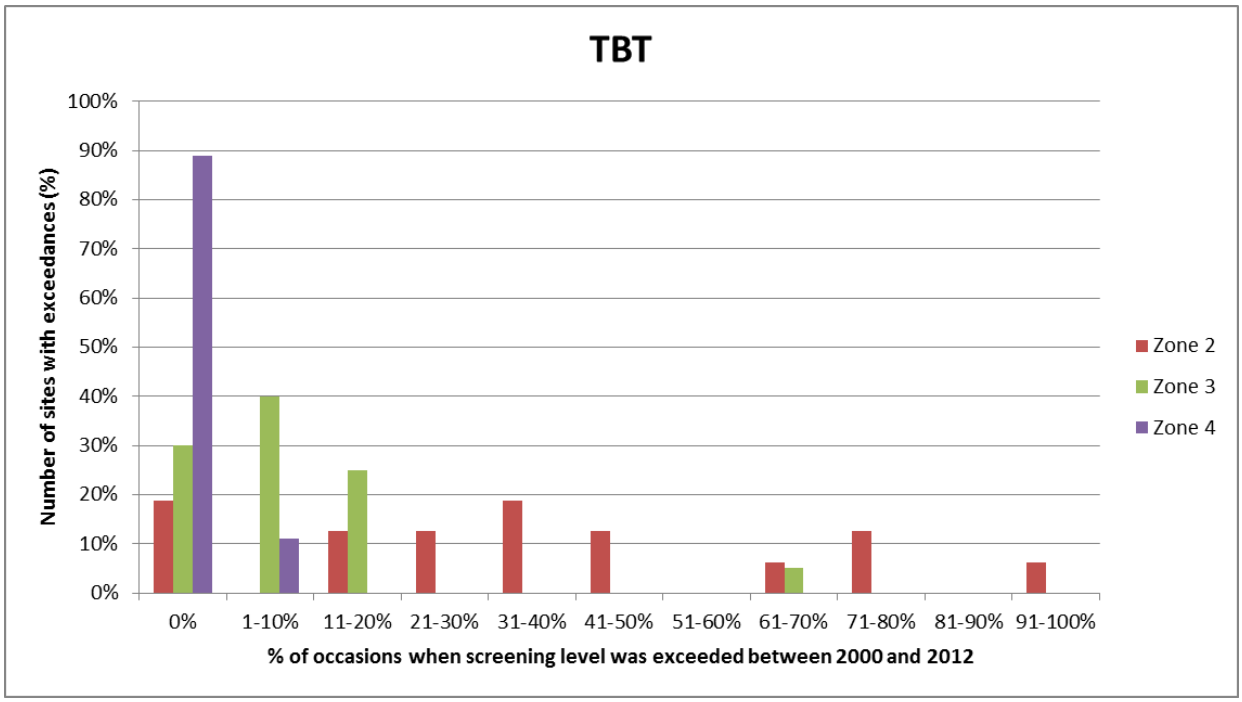


Figure 2-7 Exceedances of the NAGD Screening Level for TBT between 2000 and 2012 in Dredge Zones 2, 3 and 4

2.1.3 Benzene, Toluene, Ethylbenzene and Xylene (BTEX)

BTEX concentrations were below LOR in all samples and all zones between 2000 and 2012.

2.1.4 Total Petroleum Hydrocarbons (TPHs)

While TPHs were detected on several occasions across all dredge zones, the total TPH concentration was below the NAGD screening level of 550 mg/kg at all sampling locations between 2000 and 2012. Most detections of TPHs were noted in Zone 2, with less detections noted for Zone 3 and only some isolated detections recorded in Zone 4.

2.1.5 Polycyclic Aromatic Hydrocarbons (PAHs)

Total PAHs concentrations were mostly below the NAGD screening level of 10,000 µg/kg except for two individual detections above screening level in Zone 2 and Zone 3 in 2001. The 95% UCL for PAHs exceeded the screening level in 2011. However, since 2001, the total PAHs concentrations remained well below the screening level for all dredge zones.

2.1.6 Polychlorinated Biphenyls (PCBs)

Total PCBs concentrations were mostly well below the NAGD screening level of 23 µg/kg or below LOR. The only exceptions were site 10-6 in Zone 3 where detections above the screening level were noted in 2001 and 2012 and site 13-1 in Zone 4, where a detection above screening level was noted in 2011.

2.1.7 Organochlorine Pesticides (OCPs)

The 95% UCL concentrations of the OCPs dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethane (DDD) and Dichlordiphenyldichloroethylene (DDE) frequently exceeded the NAGD screening level between 2000 and 2013. In some cases the 95% UCL concentrations of chlordane also exceeded the NAGD screening level.

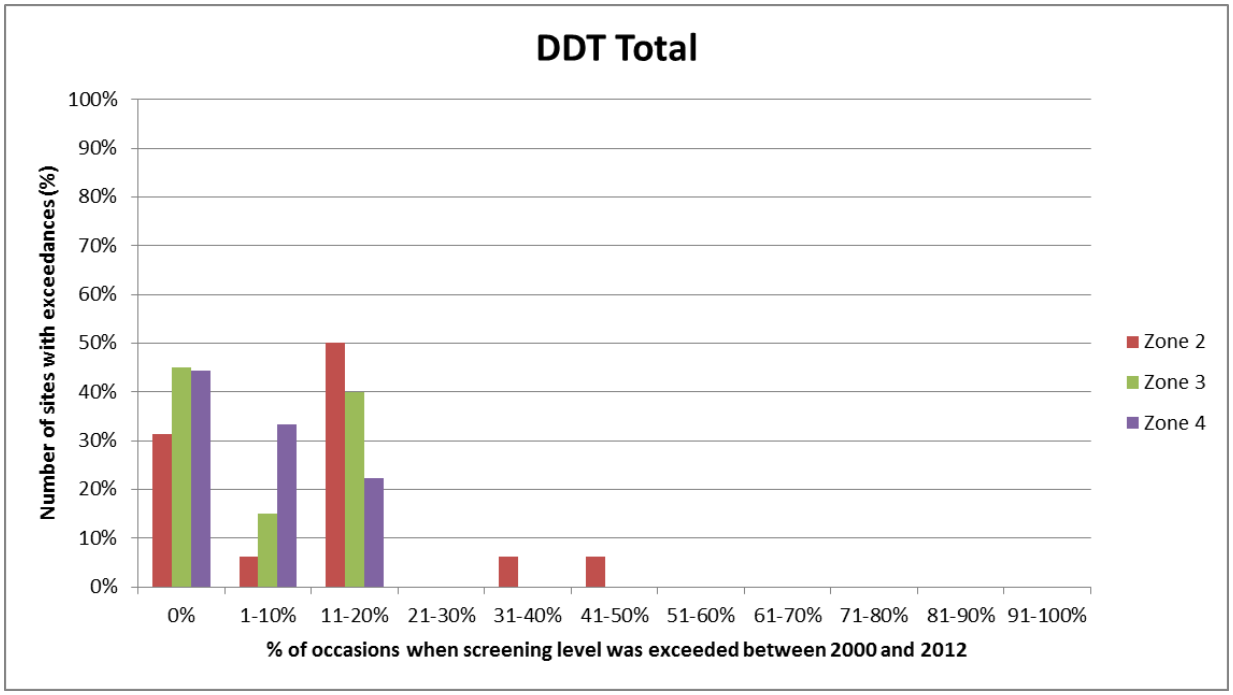
Total DDT concentrations and its metabolites DDD and DDE exceeded their respective screening levels (1.6, 2 and 2.2 µg/kg for DDT, DDD and DDE, respectively) on numerous occasions across all dredge zones (). This includes some exceedances of the NAGD high levels for DDT (46 µg/kg) and DDD (20 µg/kg), but DDE concentrations did not exceed the NADG high level of 27 µg/kg.

Most of these screening level exceedances for DDT, DDD and DDE were recorded at Zone 2, occasional exceedances of all three parameters were also recorded in Zone 3 and 4 between 2000 and 2012. The DDT breakdown product DDE was generally detected more frequently than DDT and DDD (Figure 2-8).

The presence of DDT and its metabolites across all dredge zones and consistent detections over the last decade demonstrates the long term environmental persistence of DDT and its metabolites.

Furthermore, several exceedances of the chlordane NAGD screening level of 0.5 µg/kg and the NAGD high level of 6 µg/kg were noted between 2000 and 2012.

In 2002, chlordane concentrations exceeded the screening level at all tested sampling locations in Zone 2, 3 and 4. Whilst no screening level exceedances were noted between 2003 and 2007, one to three locations in Zone 2 had concentrations higher than the screening level in 2008, 2009 and 2011 (sites 4-0, 4-4, 4-5, 4-7 and 4-8). One exceedance of the chlordane screening level was also noted in 2011 in Zone 3 (site 11-8).



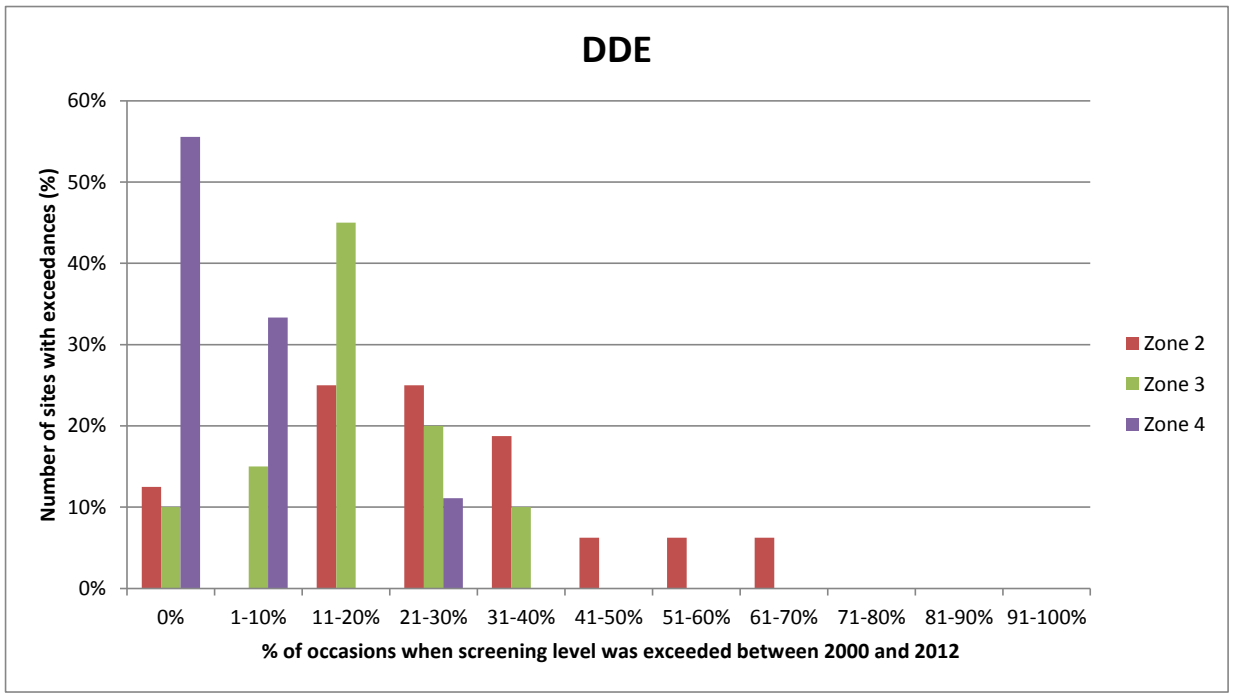


Figure 2-8 Exceedances of the NAGD Screening Level for total DDT (upper plot) and DDE (lower plot) between 2000 and 2012 in Dredge Zones 2, 3 and 4. Similar Trends for DDD.

2.1.9 Organophosphorus Pesticides (OPPs)

Concentrations of OPPs were below LOR for all sampled locations between 2000 and 2012.

2.1.10 Radionuclides

Radionuclides (gross alpha and beta) were analysed at eight sites across all dredge zones between 2010 and 2012.

Concentrations of radionuclides were detected in the January 2010 sampling but in concentrations well below the NAGD screening level of 35 Bq/g (maximum concentration 0.97 Bq/g). Radionuclide concentrations were below the LOR at all sites in all following sampling campaigns.

2.1.11 Acid Sulfate Potential

Acid sulfate soil testing indicates that the sediments in the dredge zone have no actual acidity but are generally considered to be Potential Acid Sulfate Soils (PASS). Assessments of the buffer capacity indicate that the sediments in all dredge zones have sufficient acid neutralizing capacity to buffer any acid potentially generated through onshore disposal.

Acid Sulfate Soil test results were generally consistent between 2000 and 2012.

2.2 Flood Sampling 2011 and 2013

The review of flood sampling sediment quality results included Worley Parsons (2011b, 2013b, 2013c, 2013d).

The 2011 and 2013 sampling campaigns (Worley Parsons 2011b and 2013b) included all parameters as per Table 1 of the NAGD. Additionally, porewater ammonium concentrations were measured and acid sulfate soils assessed in 2011. For both studies elutriate and bioavailability testing for nickel and mercury was undertaken.

Further testing for DDT, DDD, DDE and dioxins/furans was undertaken in 2013 including a comparison of 14 sampling locations at the Mud Island DMPA against seven Moreton Bay reference locations to assess whether the emergency dredging and disposal has affected sediment quality in Moreton Bay (Worley Parsons 2013c and 2013d).

2.2.1 Metals and Metalloids

In 2011, nickel (9 of 15 locations), mercury (3 of 15 locations) and lead (1 location) were the only metals to exceed their respective NAGD screening levels. In 2013, nickel was the only metal to exceed screening levels at 18 of the 24 locations sampled. All other metals/metalloids were below their respective screening levels.

Elutriate and bioavailability testing was undertaken for nickel and mercury in 2011 and 2013. For both sampling events, the elutriate concentrations for mercury were below LOR and nickel elutriate concentrations were well below the ANZECC/AMRCANZ (2000) 95% species protection level of 70 µg/L or below LOR. Furthermore, dilute acid extraction results for mercury and nickel indicated low bioavailability of these metals with concentrations below their respective NAGD screening level in all samples in 2011 and 2013.

These results indicated low likelihood for adverse water quality and sediment quality impacts during dredging and disposal for mercury and nickel.

2.2.1.1 Comparison to Annual Sampling

Consistent with the annual sampling undertaken between 2000 and 2012, nickel and mercury concentrations were the main contaminants of concern within the dredge areas with concentrations similar to the annual sampling events. Lead was detected above the screening level on some occasions during the annual sampling. Similar to the flood sampling, detections were noted only at single locations per annual event and 95% UCL concentrations were below the NAGD screening level.

2.2.2 Organochlorine Pesticides (OCPs)

DDT and its metabolites were detected in 2011 with DDE detected in nine of 15 locations. Whilst normalised DDD and DDE concentrations remained below their respective screening levels, normalised DDT concentrations exceeded the NAGD screening level at two locations. All other OCPs were below LOR at all locations in 2011.

In 2013, DDD was detected in one sample with a concentration exceeding the NAGD screening level. DDE exceeded the NAGD screening level of 2.2 µg/kg in all samples with a 95% UCL of 5.25 µg/kg.

2.2.2.1 Comparison to Annual Sampling

Similar to the annual sampling events, DDT and its metabolites were detected above the NAGD screening level in the flood sampling. Concentrations were similar to those detected in the annual sampling.

2.2.2.2 Comparison to Background Concentrations (2013)

Total DDT concentrations were below the LOR at all locations, including those at Mud Island DMPA and reference locations.

Sampling carried out prior to the 2013 emergency dredged material disposal event detected DDE at all 20 sampling locations within the dredged area, and one of the four locations within the DMPA. DDD was above the LOR in one sample within the dredged area (10µg/kg normalised to % TOC), and was also above the NAGD Screening level of 2 µg/kg.

Further more detailed sampling was carried out to compare contaminant concentrations at 14 locations in the DMPA and seven reference locations, following the 2013 emergency dredged material disposal event. The results of this sampling indicated that:

- DDT was again below the LOR at all locations, including those at Mud Island DMPA and reference locations.
- DDE was detected at all sampling locations with 95% UCL concentrations exceeding the NAGD screening level at both the DMPA and reference locations. This indicates that DDE was widespread throughout the study area.
- A comparison of the 80th percentile DDE of the reference locations was higher than historical levels of DDE in the Brisbane River. This indicates that the Brisbane River flood plume in

January 2013 impacted on the Brisbane River, Bramble Bay and the wider Moreton Bay region and the maintenance dredging operations undertaken by PBPL were not likely to have caused or spread this contamination.

- Additional elutriate and pore water analyses for OCPs indicated that DDD and DDE are likely adsorbed to the clay fraction of the sediment and thus not bioavailable.

2.2.3 Dioxins

Dioxins and furans were detected in the 2011 and 2013 flood sampling events. A toxic effect factor is allocated to each compounds which allows the total toxicity of combined dioxins and furans to be determined using the toxic equivalence (TEQ).

In 2011, the WHO-TEQ$_{(0.5\ LOR)}$ value (concentrations below LOR are assigned a concentration equal to half the LOR) was elevated at one location in Zone 3 with a concentration of 25.36 pg/g. All other sampling locations, including at the DMPA had concentrations between 6.02 and 10.89 pg/g WHO-TEQ.

In 2013, the WHO-TEQ concentrations were generally lower ranging between 0.5 pg/g to 5.3 pg/g.

There are no sediment quality guideline values for comparison that would apply to Australian sediments.

2.2.3.1 Comparison to Background Concentrations (2013)

The WHO-TEQ concentrations at the Mud Island DMPA sites ranged between 4.24 to 4.94 pg/g. The WHO-TEQ concentrations were higher at the reference site in comparison ranging between 7.87 to 7.97 pg/g. Approximately 99% of the sediment concentrations at all sampling locations comprised of 99% dioxins and 1% furans.

Pore water WHO-TEQs ranged between 0.5 and 7.3 pg/g at the DMPA and between 3.1 and 8.0 pg/g at the reference sites. Mean values and 95% UCL concentrations were lower than the 80th percentile of dioxins/furans at the reference area.

A comparison with historical data (Hermanussen et al. 2004; Mueller et al. 2004) shows that dioxins/furans have been historically present within Moreton Bay in elevated concentrations and that their concentrations are not directly related to dredging activities.

2.2.4 Organotins

Organotin concentrations were below the NAGD screening level or below LOR in 2011 and 2013.

2.2.4.1 Comparison to Annual Sampling

The relatively low concentrations of organotins in the flood sampling of 2011 and 2013 appear to be different to the pattern observed in the annual sampling campaigns. However, it should be noted that TBT was only detected at three locations above the NAGD screening for the annual 2010 and 2012 sampling events.

The overall low organotin concentrations across the dredge area after the 2011 and 2013 floods may be due to burial and mixing with sediments from the catchment.

2.2.5 Polychlorinated Biphenyls (PCBs)

PCB concentrations were below LOR at all sampling locations in 2011. In 2013, one location in Zone 3 had a normalised total PCB concentration (38.9 µg/kg) exceeding the NAGD screening level of 23 µg/kg. PCB concentrations were below LOR at all other locations in 2013.

2.2.5.1 Comparison to Annual Sampling

Similar to the annual sampling events, PCBs exceeded the NAGD screening level at only one location or were not detected.

2.2.6 Other Organic Contaminants

Concentrations of BTEX, TPHs, PAHs, OPPs, Phenols, Chlorobenzenes, halogenated compounds and non-organochlorine pesticides were either below LOR or below their respective screening levels in 2011 and 2013.

2.2.6.1 Comparison to Annual Sampling

The pattern observed for BTEX, TPHs, PAHs, OPPs were similar to the those observed in the annual sampling events, i.e. BTEX and OPPs were below their laboratory LORs whereas TPHs and PAHs were typically detected but at concentrations well below the respective NAGD screening levels.

2.2.7 Porewater Ammonia

Sediments at all locations had porewater concentrations below the literature derived guideline level of 11 mg/L (Batley and Simpson 2009). The only exception was one site in Zone 2 where the guideline level was marginally exceeded (16.6 mg/L).

2.2.8 Acid Sulfate Soil

Acid sulfate soils were tested in the 2011 flood sampling. Actual acidity was below the laboratory LOR for all samples, but potential acidity exceeded the QASSIT guideline limit identifying the samples as potential acid sulfate soils (PASS).

The acid neutralising capacity was sufficient in all samples resulting in a net acidity less than the LOR indicating that no liming would be required if the material would be placed on land.

2.2.8.1 Comparison to Annual Sampling

Results for the flood sampling were consistent with the annual maintenance dredge sampling.

2.3 Summary of Annual and Flood Sampling Data

Consistent across the annual and flood sampling events, the main contaminants of concern in the Brisbane River dredge area were the metals nickel and mercury, and DDT metabolites. TBT was also found above screening levels during routine annual monitoring, but was below screening levels in the 2011 and 2013 post-flood sampling episodes. This could suggest that the flood events had dispersed, diluted or buried TBT contaminated material.

Exceedances of the NAGD screening level for mercury, organochlorine pesticides and organotins were most frequently detected upstream of the Port area, i.e. in Zone 2 with a lower occurrence of screening level exceedances in the Port area (Zone 3) and the Entrance Channel area (Zone 4).

The similar spatial patterns of contaminant distribution observed between the regular annual sampling and the flood sampling indicates that catchment runoff from the urbanised and industrialised area upstream of the Port and not the Port of Brisbane is likely the main contributor of contaminants in the dredge area.

Organochlorine pesticides may be present due to broad non-point catchment sources or as legacy material. TBT is mainly originating from local marine industry sources and ships. Mercury may be introduced to the system via sewage treatment plant discharges (including trade waste) or other industrial point sources along the river.

The wide distribution of high nickel concentrations across the entire dredge area and upstream reference locations indicates that nickel is of natural origin (due to local mineralogy) across the broader catchment.

3 Sampling and Analysis

3.1 Sampling Rationale

3.1.1 Number of Sampling Locations

As per NAGD, the number of sample locations for medium sized projects (up to 500,000 m^3) should be divided into distinct sites based on their chemical characteristics. Based on the review of historical data (Section 2) and consistent with previous sampling campaigns, the dredge area was divided into three zones (Table 3-1).

Table 6 of NAGD was used to determine the number of sampling locations for each dredging subarea. Given that current, good quality data were available to support the classification, the number of sampling locations was halved and rounded up as per NAGD. Table 3-1 also shows the required number of sampling locations for Phase III testing (elutriate and bioavailability).

In addition to the required samples to be obtained from the dredge areas, samples will be collected also from upstream and downstream 'reference' areas. This includes two locations from Zone 1 which were sampled in previous sampling campaigns and five locations from Moreton Bay which were sampled as part of additional sediment sampling following the 2011 and 2013 flooding. Furthermore, two samples will be collected from the Mud Island DMPA.

Table 3-1 Number of Sampling Locations as per NAGD

Dredging Subarea	Classification	Dredge Volume (m^3)	# Locations – Phase II	# Locations – Phase III
Zone 2	Probably contaminated	150,000	10	5 + 1 replicate
Zone 3	Probably clean	250,000	11	6 + 2 replicates
Zone 4	Probably clean	30,000	5	3 + 1 replicate
Additional Samples				
Zone 1	Upstream Reference	N/A	2	N/A
Moreton Bay	Downstream Reference	N/A	5	N/A
Mud Island	DMPA	N/A	2	N/A

3.1.2 QA/QC Samples

In accordance with NAGD requirements, the following field and laboratory quality control samples will be obtained:

- Field triplicate samples (two additional grab samples at 10% of sample locations) to determine the small scale variability of the sediment physical and chemical characteristics. Based on a total of 26 primary locations in dredged areas (Zones 2, 3 and 4), field triplicate samples would be required at three locations. Two additional samples would therefore be collected at location 5-1 (Zone 2), 11-9 (Zone 3) and 13-4 (Zone 4).
- Triplicate split samples (primary sample from 5% of locations thoroughly mixed and split into three sample container sets) to assess laboratory variation, with one of the three samples sent to a second (reference) laboratory for analysis. Based on a total of 26 primary locations in dredged areas (Zones 2, 3 and 4), field split samples would be required at two locations. Split samples would be undertaken at location 6-2 (Zone 2) and 10-6 (Zone 3).

- One trip blank container per sampling day filled with inert material (e.g. chromatographic sand) to be analysed concurrent with the analysis of volatile organic substances such as; and
- One inter-batch sample from a previous batch of samples if more than one batch is submitted to the laboratory, to determine the analytical variation between batches. However, it is anticipated that all samples will be submitted in one batch.

Table 3-2 provides a summary of QA/QC samples to be obtained for the three dredging subareas.

Table 3-2 Number of Primary and QA/QC Samples

Dredging Subarea	Primary Samples	Field Triplicate Samples	Triplicate Split Samples	Trip blanks
Zone 2	10	2	2	1 per sampling day
Zone 3	11	2	2	
Zone 4	5	2		

3.1.3 Sampling for Elutriate and Bioavailability Testing

The sediment sampling will include additional sediment samples for Phase III testing (elutriate and bioavailability). Phase III testing will be undertaken for parameters which have frequently exceeded the NAGD screening levels in the past. Based on the review of historical data (Section 2) this will include:

- Metals and metalloids (nickel and mercury);
- Organotins (TBT); and
- Organochlorine Pesticides (DDT, DDD, DDE, chlordane).

Exceedances of NAGD screening levels were predominantly detected in Zone 2 and Zone 3. In accordance with Table 7 of NAGD, five locations would need to be sampled for Zone 2 and six locations for Zone 3 (Table 3-1).

In order to allow elutriate analysis, 20 L of seawater will be collected from the Mud Island DMPA.

Phase III testing for nickel and mercury (and potential other metals/metalloids) can be undertaken from the primary samples collected for the sediment quality assessment. The bioavailability analysis for nickel and mercury will involve dilute acid extraction as per NAGD. Analysis will be performed on the samples with the highest concentrations.

Bioavailability analysis for the organic contaminants (organotins and organochlorine pesticides) will require porewater testing as per NAGD. Additional samples will be collected for porewater testing at the locations which have historically shown the highest percentage of screening level exceedances. The proposed sampling locations for this testing are provided in Section 3.2.1. In order to meet required holding times, elutriate and bioavailability analysis for the organic contaminants will be undertaken concurrent with the analysis of the primary samples.

3.2 Sampling Locations

A map with the proposed sampling locations is provided in Figure 3-1. In order to provide consistency with previous sampling and to facilitate comparisons with historical data, most of the proposed sampling locations were selected from the set of historical sampling locations, and to

also focus on areas that are most frequently dredged. Additionally, sampling locations were added to close spatial gaps in sediment quality data. These include sampling locations 5-1 in Zone 2 as well as locations 9-5 and 9-6 in Zone 3 (Figure 3-1).

As outlined in more detail in Section 3.5, samples from all locations will be analysed for a basic suite of parameters. A selection of these sites will also be analysed for a detailed suite in addition to the basic suite including 'low risk' parameters that have been detected in the past but were typically below their respective NAGD screening levels.

3.2.1 Sampling Locations for Porewater Testing

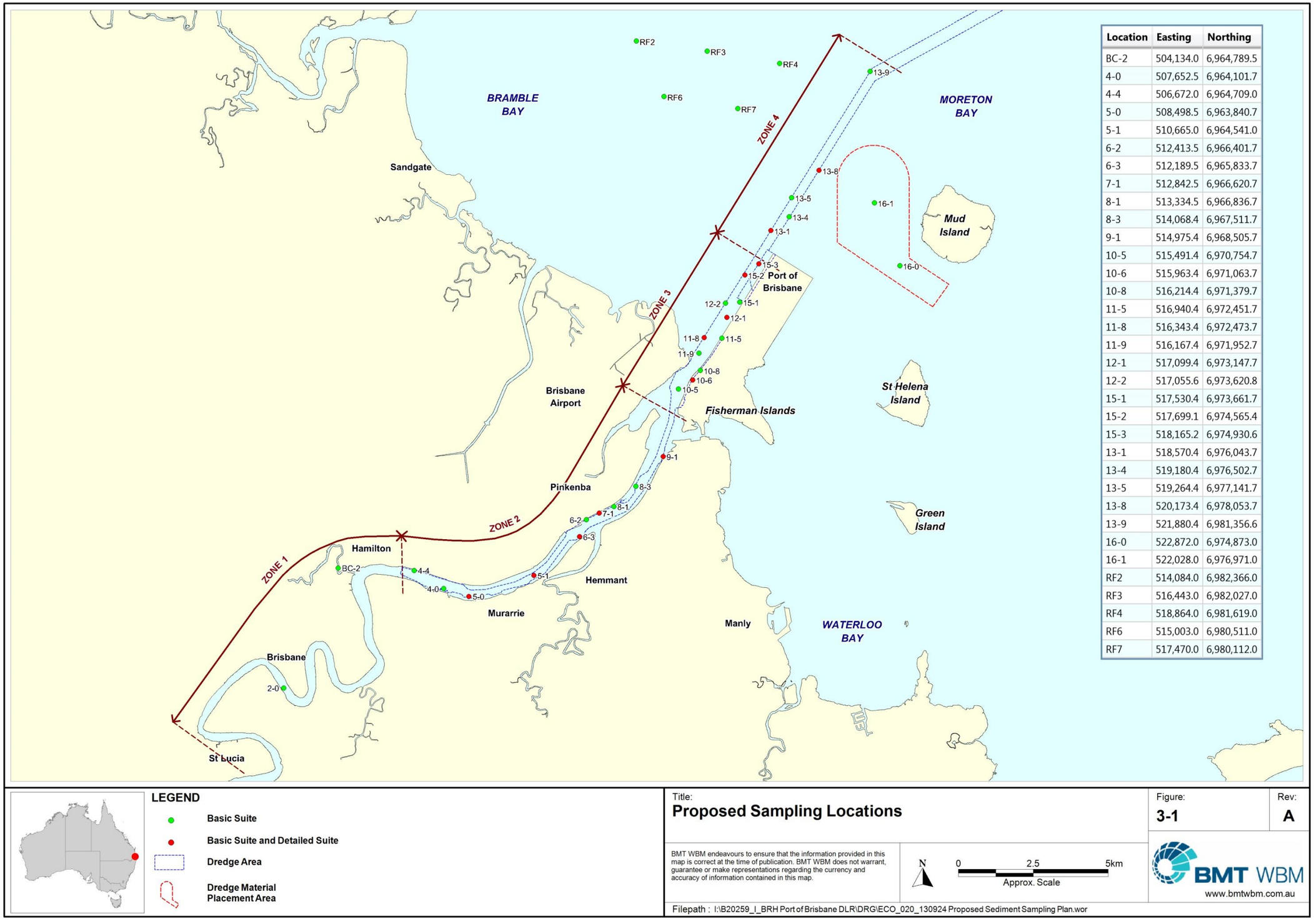
Additional sediment samples will be collected at selected locations for pore water testing of organic contaminants as part of the Phase III elutriate and bioavailability assessments (refer to Section 3.1.3).

Exceedances of NAGD screening levels were predominantly detected in Zone 2 and Zone 3. Five additional pore water samples (plus one replicate) and six samples (plus two replicates) will be collected from zones 2 and 3, respectively (see also Table 3-1). Four samples will be collected from Zone 4 however based on the historical data samples will only be analysed if contaminants exceed screening levels during Phase II sampling.

Based on the review of historical data, sample locations with the highest percentage of screening level exceedances between 2000 and 2012 were chosen for the additional pore water testing:

Zone 2: Locations 4-0, 5-0, 6-2, 7-1 and 8-3.

Zone 3: Locations 10-5, 10-6, 10-8, 11-8, 11-9 and 12-1.



Location	Easting	Northing
BC-2	504,134.0	6,964,789.5
4-0	507,652.5	6,964,101.7
4-4	506,672.0	6,964,709.0
5-0	508,498.5	6,963,840.7
5-1	510,665.0	6,964,541.0
6-2	512,413.5	6,966,401.7
6-3	512,189.5	6,965,833.7
7-1	512,842.5	6,966,620.7
8-1	513,334.5	6,966,836.7
8-3	514,068.4	6,967,511.7
9-1	514,975.4	6,968,505.7
10-5	515,491.4	6,970,754.7
10-6	515,963.4	6,971,063.7
10-8	516,214.4	6,971,379.7
11-5	516,940.4	6,972,451.7
11-8	516,343.4	6,972,473.7
11-9	516,167.4	6,971,952.7
12-1	517,099.4	6,973,147.7
12-2	517,055.6	6,973,620.8
15-1	517,530.4	6,973,661.7
15-2	517,699.1	6,974,565.4
15-3	518,165.2	6,974,930.6
13-1	518,570.4	6,976,043.7
13-4	519,180.4	6,976,502.7
13-5	519,264.4	6,977,141.7
13-8	520,173.4	6,978,053.7
13-9	521,880.4	6,981,356.6
16-0	522,872.0	6,974,873.0
16-1	522,028.0	6,976,971.0
RF2	514,084.0	6,982,366.0
RF3	516,443.0	6,982,027.0
RF4	518,864.0	6,981,619.0
RF6	515,003.0	6,980,511.0
RF7	517,470.0	6,980,112.0

LEGEND

- Basic Suite
- Basic Suite and Detailed Suite
- Dredge Area
- Dredge Material Placement Area

Title:
Proposed Sampling Locations

Figure: **3-1**
Rev: **A**

N
0 2.5 5km
Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : I:\B20259_I_BRH Port of Brisbane DLR\DRG\ECO_020_130924 Proposed Sediment Sampling Plan.wor

3.3 Sample Collection Methodology

3.3.1 Survey Vessel and Positioning

A suitable sampling vessel will be used to undertake sediment sampling. Navigation to the sampling locations will be undertaken using a differentially corrected global positioning system (GPS) with an accuracy of approximately ±1 m.

3.3.2 Sediment Grab Sampling

NAGD Appendix D states that:

'*grab samplers may be used, i.e., for maintenance dredging surveys in frequently dredged areas with substantial shipping traffic. Here, because the sediments are mixed continually, samples taken with a grab sampler can be representative as long as the grab is designed to retain the entire sample.*'

It is also noted that the one metre long sediment cores obtained in all previous sampling campaigns were always composited to single samples. Furthermore, highest contamination levels are typically expected in the top sediment layer, which would be sampled using a grab sampler. It is therefore proposed that a grab sampler will be used to obtain representative sediment samples.

All sediment sampling will be undertaken by experienced personnel. A Van Veen grab sampler (0.14 m^2 gape) will be used to collect surface sediments from all sample locations. Only samples obtained with properly closed grab jaws will be processed to ensure that the fine sediment fractions are retained.

The grab sampler will be thoroughly cleaned with De-con 90 solution prior to use and cleaned and rinsed with seawater to prevent cross contamination between samples.

In order to overcome issues with potential high variability at sampling locations, a minimum of two grabs will be collected at each sampling location and pooled as one sample. An adequate number of grabs will be obtained and pooled for each sample location to ensure that sufficient sediment is collected for all analyses.

3.3.3 Sample Handling

3.3.3.1 Sample Processing

Sample management procedures on the sampling vessel will include the careful processing of sediment samples following the recovery of the sediment grab sample from the seabed.

Photographs of the grab samples will be taken and field personnel will log each sample for its physical characteristics and variations in sediment type and texture. The grab samples from each location will be carefully homogenized in a clean container prior to the filling of analytical laboratory-supplied clean sampling jars.

Sample bottles will be labelled with a waterproof marker pen on the bottle label and lid. Sample bottles for organic analyses will be filled with zero headspace to prevent volatilisation. QA/QC samples will be blind-labelled to ensure that the laboratories cannot relate the QA sample back to the primary sample.

3.3.3.2 Sample Log

All sediment samples will be geotechnically logged upon collection on a standardised pro-forma. The following information will be recorded:

- Project name and number;
- The name of the sample collector;
- Date and Time of sampling;
- Type of grab sampler used;
- Field sample number;
- Northing and Easting of sample location (from onboard DGPS);
- Sediment colour;
- Sediment odour;
- Field texture (fine sand, silt, clay, sand, clayey sand);
- Tidal predictions and water depth at sample location (derived from onboard depth sounder);
- Weather and sea state conditions at the time of sampling; and
- General comments pertaining to the sample (e.g. presence of organic matter or benthic organisms, etc.

3.3.3.3 Sample Processing QA/QC

All sample handling and processing will be performed to minimise contamination and sample mix-ups. All sample equipment will be cleaned prior to sample collection using a scrub with decontamination solution followed by a rinse with seawater.

The workspace on the vessel will be washed down regularly with ambient seawater to clean all surfaces and minimize the potential for dust contamination of samples. All sample processing will be undertaken away from any potential contamination sources such as engine exhausts, fuels, oils, greases, lead weights, zinc anodes, antifouling paint etc.

Nitrile gloves will be worn by all field personnel handling the sediment, and gloves will be disposed of after processing of each sample.

Utmost care will be maintained in ensuring that cross-contamination between samples is not possible. Samples collected from each location will be placed into appropriately cleaned and preserved containers (labelled prior to filling) provided by the analytical laboratories.

Following sample processing and filling of sample containers, all samples will be immediately chilled on ice following sample collection. All acid sulfate soil samples will be transferred to a freezer at the end of each sampling day to minimise potential oxidation of the samples.

3.3.3.4 Sample Submission and Chain of Custody

All samples will be traced using Chain of Custody (COC) documentation submitted to the laboratory. This will ensure that sample possession and processing can be traced from sample collection to reporting of results.

The COC record may include, but is not limited to, the following information:

- Project name and number;
- Name(s) of sampler(s);
- Sample type, identification number and location;
- Date of collection;
- Number and types of containers;
- Required analyses;
- Preservatives (if any) and storage conditions; and
- Signatures documenting change of sample custody.

At the conclusion of the sampling program the sediment samples will be submitted to the analytical laboratories for processing and analysis in a single batch within prescribed holding times.

3.4 Health & Safety and Contingency Plan

3.4.1 Health and Safety

The vessel skipper will keep in close contact with Brisbane VTS/Harbour Control during sampling. Grab sampling can be completed at each location in around 20 minutes with logging and processing undertaken in locations out of the path of large vessels (as necessary and dependent upon shipping movements).

A single anchor may be used to anchor the vessel. The anchor would be placed upstream and upwind of the vessel. A marker buoy may be placed on the anchor if required.

The sampling vessel will display appropriate flags (R over Y) for the work being carried out at all times. Interactions with other vessel traffic will be minimised by being mindful of approaching vessels.

3.4.2 Adverse Weather

The planning of field sampling will involve regular checking of available weather forecast services for the study area. There are no unusual hazards in operating the grab sampler in wet weather.

In case of adverse weather conditions that would make sampling unacceptable due to strong winds and high waves, the sampling team and vessel operator would remain on stand-by until weather conditions improve to allow rigorous and safe collection of sediment samples.

3.4.3 Equipment Failure

The grab sampler and lifting arrangement is sufficiently robust and no failure of the equipment is expected to occur during the sampling. Prior to sampling, all equipment will be thoroughly checked and repaired if necessary.

In the unlikely event of equipment failure during sampling, repairs to any equipment would be undertaken as soon as possible to minimise delays as far as practical.

3.5 Contaminants List

3.5.1 Rationale for Selection of Sampling Parameters

In accordance with NAGD, the contaminants to be investigated should include:

- Toxic substances known, from previous investigations, to occur in dredge area sediments at levels greater than one-tenth of the screening levels; or
- Based on the historical review, substances potentially present at such levels in the sediments to be dredged.

Based on the review of existing sediment quality data (Section 2), samples will be analysed as follows:

Basic List of Parameters:

- Analysis undertaken at all sampling locations;
- Analysis includes contaminants of (potential) concern and supplementary parameters:
  - Metals/Metalloids (As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, Zn, Al, Fe);
  - Organotins (MBT, DBT, TBT);
  - Organochlorine Pesticides (including DDT, DDD, DDE, chlordane);
  - Particle size distribution;
  - Moisture content; and
  - Total Organic Carbon.

Detailed List of Parameters:

- Analysis undertaken at 30% of sampling locations and new sampling locations (i.e. 5-1, 9-5 and 9-6).
- Analysis includes ‘low risk’ parameters that have been detected in the past but generally in concentrations below LOR or NAGD screening levels:
  - Polycyclic Aromatic Hydrocarbons (PAHs);
  - Total Petroleum Hydrocarbons (TPHs);
  - Polychlorinated Biphenyls (PCBs);
  - Acid Sulfate Soils;
  - Nutrients (TP, TN, NOx, TKN); and

- Radionuclides.

Elutriate and Bioavailability Testing:

- Metals/Metalloids (Hg and Ni);
- Organotins (TBT); and
- Organochlorine Pesticides (DDT, DDD, DDE, chlordane).

3.6 Laboratory Analysis

3.6.1 Analytical Laboratories

Primary analysis of the sediment samples will be conducted by Advanced Analytical Australia Pty Ltd (AAA). Australian Laboratory Services (ALS) will be used as the secondary (reference) laboratory for inter-laboratory quality testing.

Both analytical laboratories are fully accredited by the National Association of Testing Authorities (NATA). AAA will subcontract some of the analyses to specialised NATA accredited laboratories, i.e. Sydney Analytical Laboratories (ammonia, Total Organic Carbon) and Microanalysis (Particle Size Distribution).

3.6.2 Analytical Tests

The primary laboratory Advanced Analytical Australia will perform all analyses in accordance with NAGD and will meet or provide better practical quantitation limits (PQL) than the target PQL's (Table 3-3).

Table 3-3 Analytical Parameters and Practical Quantitation Limits

Parameter	Target Practical Quantitation Limit (required)	Practical Quantitation Limit (Advanced Analytical Australia)
Moisture Content	0.1%	0.1%
Particle Size (sieve and sedigraph)	Size distribution (sieve + hydrometer or equivalent) and rates of settlement after 50% and 90% of settlement in seawater if possible.	10 to 0.001mm Settling velocities in m/s for all particle size fractions
Total Organic Carbon	0.1%	0.01%
Total Petroleum Hydrocarbons	100 mg/kg	10-50 mg/kg
Polychlorinated Biphenyls	5 µg/kg	5 µg/kg
PAHs (naphthalene, acenaphthalene, acenapthene, fluorene, phenanthene, anthracene, total fluoranthene, benzo [a]anthracene, benzo [a] pyrene, chrysene, dibenz[a,h] anthracene, pyrene, 2-methylnapthalene)	Individual - 5 µg/kg; Sum of PAHs - 100 µg/kg	Individual - 5 µg/kg; Sum of PAHs - 100 µg/kg

Parameter	Target Practical Quantitation Limit (required)	Practical Quantitation Limit (Advanced Analytical Australia)
Trace Metals and Metalloids (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc)	0.1 – 100 mg/kg, Hg- 0.01 mg/kg	0.1 – 5 mg/kg, Hg – 0.01 mg/kg
Organotins (MBT, DBT, TBT)	1 µg Sn/kg	0.5 µg Sn/kg
OCP Pesticides	1 µg/kg	OCP-1 µg/kg
Total Nitrogen Total Kjeldahl Nitrogen Nitrate & Nitrite as N Total Phosphorus	N/A N/A 0.1 mg/kg N/A	20 mg/kg 20 mg/kg 0.1 mg/kg 1 mg/kg
Acid Sulfate Soils	N/A	2 mole H^+/tonne
Radionuclides	N/A	35 Bq/g

3.6.3 Sample Containers

Based on the proposed analyses, the following sample containers would be required per sample:

- 2 x 250 mL glass jar – organic/inorganic chemical analysis;
- 1 x 125 mL glass jar – nutrient analyses;
- 1 x medium plastic clipseal bag (50-100 g) – particle size distribution; and
- 1 x small clipseal bag (200 g) – acid sulfate soil.

3.6.4 Quality Control – Laboratory Analysis

Both laboratories will follow laboratory QC procedures in accordance with requirements outlined in Appendix F of NAGD. This includes analysis of laboratory blanks, duplicates, certified reference materials and spiked samples.

3.6.4.1 Laboratory Blanks

The purpose of this assessment is to monitor a potential laboratory contamination of samples due to potential cross-contamination of samples during laboratory preparation, extraction or analysis. Blank sample concentrations should be at or near the detection limit of the method used.

3.6.4.2 Laboratory Duplicates

This assessment refers to a randomly selected intra-laboratory split sample, which provides information regarding the method precision and sample heterogeneity. Results are presented as Relative Percent Difference (RPD) values of two sample concentrations for a specific contaminant.

NAGD recommends that duplicates should agree within a typical RPD of the method of ±35 %. This recommended RPD is typically not adopted by analytical laboratories as it does not account for the greater uncertainty for contaminant concentrations close to the method's detection limit.

The primary laboratory AAA uses the following approach to assess duplicate RPD's:

- Result <10 times LOR – no limit to RPD; and
- Result >10 times LOR – RPD between 0% and 50%.

The secondary laboratory ALS adopts specific RPDs for individual compounds.

3.6.4.3 Surrogate and Matrix Spikes

Laboratory Control Samples are either certified reference materials or a blank sample spiked with known concentrations of the analytes of interest. The purpose of this measurement is to monitor method accuracy.

Matrix spikes refer to an intra-laboratory split sample spiked with a representative set of target analytes of known concentration. Matrix spikes are assessed to monitor potential sample matrix effects on analyte recoveries.

Surrogate spikes are used for organic analytes. Surrogates are known additions to samples which mimic the compounds of interest and are not normally expected to be present in the sample.

For both surrogate and matrix spikes, a calculation of the percent recovery of the spiked amount against the returned concentration is performed indicating analytical performance in terms of extraction efficiency.

NAGD states that recovery limits of 75% - 125% are generally acceptable. Analytical laboratories typically adopt specific surrogate and matrix spike recovery limits for the various contaminant compound groups. It is also noted that ideal recovery ranges may be waived in the event of sample matrix interference.

The primary laboratory AAA adopts the following acceptable surrogate and matrix spike recovery limits:

- Trace elements: 70-130%;
- Organic analyses: 50-150%;
- SVOC & speciated phenols: 10-140%; and
- Surrogates: 10-140%.

The secondary laboratory ALS adopts specific recovery limits for individual compounds.

3.7 Data Analysis

3.7.1 Sediment Contaminants

Concentrations of chemicals measured in sediment samples at each dredging sub-area (or reference area) will be compared to screening levels listed in Table 2 of NAGD. This will provide a basis for determining whether dredged material is suitable for unconfined placement at sea or if further analyses, such as elutriate, bioavailability or toxicity testing, are required.

For each dredging sub-area, the mean concentrations of chemical parameters at the upper 95% confidence level (95% UCL) will be calculated and compared against NAGD guideline levels. This involves the following steps.

Data pre-treatment

Analytical values below detection limit will be set to one-half of the laboratory Limit of Reporting (LOR) as per NAGD recommendation to facilitate 95% UCL calculation. Organic contaminant results will be normalised to 1% Total Organic Carbon (TOC) where the measured value is within the range of 0.2-10%. If TOC values are outside of this range, the highest (10%) or lowest (0.2%) value will be adopted as appropriate. Organic parameters with concentrations below detection limits will not be normalised to 1% TOC but included at half their LOR.

One assumption in the calculation of the 95% UCL is that the samples are statistically independent. Therefore, field triplicate samples and laboratory split samples will not be included in the 95% UCL calculation.

Outliers

Outliers will be treated in accordance with the procedure in NAGD. In summary this will involve:

(a) Outliers (for all parameters) will be identified as any data points greater than two standard deviations.

(b) For TBT, where outliers are detected, the stored portion of the sample will be analysed in triplicate.

(c) If the original result is not confirmed through the re-analysis, it will be discarded in favour of the mean of the three triplicate samples.

NAGD does not provided guidance on treatment of outliers for other parameters. Outliers for other parameters will be noted in the report but included in calculation of the 95% UCL.

Selection of appropriate 95% UCL Calculation Method

The methodology for calculating the 95% UCL follows the approach recommended in Appendix A of NAGD. A Shapiro-Wilk test will be used to determine whether data followed a normal distribution. The ProUCL (Version 4.1.00) software package will be used for these calculations (Singh et al. 2010).

Calculation of 95% UCL and Comparison to Screening Levels

ProUCL Version 4.1.00 will be used to calculate the 95% UCL. For normally distributed data, the arithmetic mean and standard deviation will be calculated, and the 95% UCL calculated using the one-tailed Student's *t* UCL test. For data that follows a log-normal (or other) distribution, the geomean will be calculated, and the 95% UCL analysed using non-parametric Jack-Knife analysis as per NAGD recommendation.

In cases where an insufficient number of discrete values in the dataset would not allow calculation of the 95% UCL (e.g. most values below LOR), the maximum recorded value of the dataset will be conservatively used instead for comparison against NAGD trigger levels.

Should 95% UCL values for all analysed parameters fall below NAGD screening levels, the sediment would be considered clean and suitable for unconfined disposal at sea.

3.7.2 Baseline Concentrations

NAGD states that ambient baseline concentrations can be determined by sampling of sediment at reference areas in the vicinity of an existing disposal site. Similar to the approach followed in Worley Parsons (2013c, d), the data collected from the five reference locations in Moreton Bay would be used to derive ambient baseline concentrations if required (RF2, 3, 4, 6 and 7 in Figure 3-1).

3.8 Elutriate and Bioavailability Testing

As outlined on Section 3.1.3, elutriate and bioavailability testing will be undertaken as per NAGD for a range of contaminants which have regularly exceeded screening levels in the past.

Elutriate Testing:

The elutriate test is designed to simulate release of contaminants from sediment during dredged material disposal. Testing will be carried out using the USEPA's standard seawater elutriate test which involves shaking the sediment samples with four times the volume of seawater at room temperature for 30 minutes. The sample will be allowed to settle for one hour and the supernatant centrifuged or filtered (0.45 µm) within sixty minutes, and analysed using analytical methods appropriate for determining ultra-trace levels in seawater.

Results will be compared to the respective ANZECC/ARMCANZ (2000) marine water quality trigger value (for 95% or 99% protection of species, as appropriate).

Bioavailability Testing:

The Dilute Acid Extraction (DAE) method will be used to provide an estimate of the bioavailable fraction of the contaminant of concern in case of metal/metalloid analysis. The sediment samples will be extracted using a weak acid and the results compared against the respective NAGD screening levels.

Porewater analysis would be undertaken for organic contaminants such as TBT. Porewater is assumed to represent the major route of exposure to sediment contaminants by benthic organisms and is the recommended bioavailability test for organic contaminants as per NAGD. Porewater results would be compared to the respective ANZECC/ARMCANZ (2000) marine water quality trigger value (for 95% protection of species).

Should both elutriate and bioavailability tests result in values less than the respective guideline limits, the material would be considered clean and suitable for ocean disposal.

3.8.1 Acid Sulfate Soils

The results of the chromium-suite acid sulfate analysis will be assessed against the Australian framework for Acid Sulfate Soil management in coastal systems (Ahern et al. 1998). The risk of acidification will be determined by the acid-base accounting approach (Ahern et al. 2004). Net acidity will be calculated from the results as a measure of the acid producing capacity of the sampled sediment upon complete oxidation.

The calculated net acidity will then be compared to the QASSIT action criteria of 0.03% S or 18 mol H+/tonne to assess the need for acid sulfate soil management if the dredged sediments were to be placed on land.

The liming rate will indicate the amount of lime that needs to be added to the soil to manage its acid generating capacity.

3.9 Data Validation

All laboratory analyses will be validated in accordance with Appendix A of NAGD to confirm suitable data quality for undertaking a rigorous characterisation of the proposed dredge material.

Data Validation will involve assessment of the following:

- Sample holding times and storage conditions;
- Laboratory blanks, duplicates and surrogate/matrix spikes; and
- Field triplicates samples, triplicate sample splits and trip blank.

The proposed data quality objectives for data validation are outlined in Table 3-4.

Table 3-4 Data Quality Objectives for Data Validation

Parameter	Data Quality Objective
Holding Time	Samples received within specified holding time (NAGD Appendix H)
Field Triplicate Samples	Relative Standard Deviation <50%
Triplicate Split Samples, including inter-laboratory samples	Relative Standard Deviation <50%
Laboratory Blanks	At or near the Limit of Reporting (LOR)
Laboratory Duplicate Samples	Relative Percent Difference (RPD) <35% or as per laboratory requirements
Laboratory Matrix Spikes	Recovery as per laboratory requirements
Surrogate Spikes	Recovery as per laboratory requirements

3.10 Reporting

The reporting of sediment quality results will be undertaken in a SAP Implementation Report in accordance with NAGD including the following components:

- Summary of the SAP, or SAP appended to the report;
- Outline of potential problems encountered and deviations from the SAP, including justification;
- Description of the sampling carried out, along with the actual sampling locations, sample numbers (including replicates and QA samples), completed COC forms, field logs and description of sediments;
- Comparison of the 95% UCL of mean chemical concentrations of sediments in the dredge subareas;
- Assessment of QA/QC procedures for both field and laboratory data;

- Data validation including comparison to data quality objectives;
- Appendices including all laboratory and field data; and
- Conclusions as to the acceptability or otherwise of the dredge material for unconfined ocean disposal and recommendations as to further work required.

4 References

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Worley Parsons (2013c) Emergency Dredging Sediment Sampling – Round 2 Organochlorine Pesticides Results. Report prepared for Port of Brisbane Pty Ltd.

Worley Parsons (2013d) Emergency Dredging Sediment Sampling – Round 2 Dioxin Results. Report prepared for Port of Brisbane Pty Ltd.

Appendix B Sediment Sample Logs

Sediment Sample Logs

Table B-1 Sediment Log

Site No.	Date	Time	Depth (m)	Weather conditions	Colour	Field texture	Plasticity	Odour	Shell grit (%)	Biota (%)
2-0	24/8/16	8:04	10	Overcast, light WN breeze (5nt)	Grey-brown	Course sand, <10% pebbles with slight proportion of fines	None	None	0	7
BC-2	24/8/16	8:51	2	Overcast, light WN breeze (5nt)	Brown-grey	Mud with surface lay of sands	Moderate	None	2	0
4-4	24/8/16	9:23	10	Overcast, light WN breeze (5nt)	Brown-grey	Mud with surface layer of brown fines over grey mud	Low	None	0	1
4-0	24/8/16	9:44	9.2	Overcast, light WN breeze (5nt)	Brown-grey	Mud with <10% sandy and surface layer of brown fines over grey mud	Moderate	None	0	1
5-0	24/8/16	10:00	8.3	Overcast, light WN breeze (5nt)	Grey-brown	Mud with blotches of black mud throughout	Low	None	0	3
5-1A	24/8/16	11:00	8.4	Overcast, light WN breeze (5nt)	Grey	Mud	moderate	None	2	1
5-1B	24/8/16	11:00	8.4	Overcast, light WN breeze (5nt)	Grey-brown	Mud with surface layer of brown fines/grits over grey mud	High	Slight	7	0
5-1C	24/8/16	11:00	8.4	Raining, ,moderate (10nt) WN breeze and ebbing tide	Grey	Mud	High	None	2	0
6-3	24/8/16	11:51	14	Raining, ,moderate (10nt) WN breeze and ebbing tide	Grey	Mud with <5% sand.	None	None	0	0
6-2	24/8/16	12:13	14	Raining, ,moderate (10nt) WN breeze and ebbing tide	Grey-brown	Mud	Low	None	2	1
7-1	24/8/16	12:37	13.2	Raining, ,moderate (10nt) WN breeze and ebbing tide	Grey-brown	Mud with surface layer of brown fines over grey mud	Mod-high	None	1	6
8-1	24/8/16	13:00	15	Raining, ,moderate (10nt) WN breeze and ebbing tide	Grey	Mud with surface layer of brown fines over grey mud	Low	None	1	0
8-3	24/8/16	13:19	10.8	Raining, ,moderate (10nt) WN breeze and ebbing tide	Grey	Mud	Mod-high	None	7	0
9-1	24/8/16	13:30	12	Raining, ,moderate (10nt) WN breeze and ebbing tide	Grey	Mud with ~30% sand	Low	None	0	3
15-3	25/8/16	7:00	9	Sunny, 10-15nt NW	Brown/grey	Mud with <10% sand	None	None	10	5
15-2	25/8/16	7:41	10.4	Sunny, 10-15nt NW	Grey/brown	Mud with <20% sand	None	None	40	0
12-2	25/8/16	8:40	7	Sunny, 10-15nt NW	Grey	Mud with surface layer of brown fines	Low	None	1	0
12-1	25/8/16	9:08	14.5	Sunny, 10-15nt NW	Grey	Mud with surface layer of brown fines	Low	None	5	3
11-8	25/8/16	9:38	5.5	Sunny, 10-15nt NW	Grey	Mud with surface layer of brown fines	Low	None	2	0
11-9A	25/8/16	10:00	14	Sunny, 10-15nt NW	Grey	Mud with <5% sand and surface layer of brown fines	Low	None	0	0
11-9B	25/8/16	10:00	14	Sunny, 10-15nt NW	Grey	Mud with <5% sand and surface layer of brown fines	Low	None	0	0
11-9C	25/8/16	10:00	14	Sunny, 10-15nt NW	Grey	Mud with <5% sand and surface layer of brown fines	Low	None	0	5
10-8	25/8/16	11:09	14.5	Sunny, 10-15nt NW	Grey	Mud with surface layer of brown fines	Low	None	2	0
10-6	25/8/16	11:24	5.5	Sunny, 10-15nt NW	Grey	Mud	Low	None	0	0
10-5	25/8/16	12:00	14	Sunny, 10-15nt NW	Grey	Mud with surface layer of sand	Low-moderate	None	0	0
11-5	26/8/16	7:00	14.5	Sunny and calm (~5nt NW breeze)	Grey	Mud, with <5% sand and blotches of black mud throughout	Low	None	2	0
15-1		7:15	14.5	Sunny and calm (~5nt NW breeze)	Grey	Mud	Low	None	2	0
RF3		7:46	8.4	Sunny and calm (~5nt NW breeze)	Grey/brown	Mud	Low-moderate	None	0	0
RF2		8:06	7.6	Sunny and calm (~5nt NW breeze)	grey	Mud with <5% sand and surface layer of brown fines	Low-moderate	None	0	0
RF6		8:30	6.6	Sunny and calm (~5nt NW breeze)	Grey	Mud with surface layer of brown fines	Low-moderate	None	3	0
RF7		8:44	7.8	Sunny and calm (~5nt NW breeze)	Grey	Mud with surface layer of brown fines	Low	None	2	0
RF4		9:00	9	Sunny and calm (~5nt NW breeze)	Grey	Mud with surface layer of brown fines	Low-moderate	None	0	0
13-9			15	Sunny and calm (~5nt NW breeze)	Grey	Mud with <5% sand and surface layer of brown fines	Low	None	0	3
16-0			8.1	Sunny and calm (~5nt NW breeze)	Grey	Mud with <5% sand and surface layer of brown fines	Low	None	0	0
16-1			8.2	Sunny and calm (~5nt NW breeze)	Grey	Mud with ~30% sand and particles of light brown clay throughout (<5%)	Low	None	15	0
13-8			7.3	Sunny and calm (~5nt NW breeze)	Grey	Mud with surface layer of brown fines	Low	None	2	0
13-5			6.2	Sunny and calm (~5nt NW breeze)	Grey	Mud with surface layer of brown fines	Low	None	10	0
13-4A			6.6	Sunny and calm (~5nt NW breeze)	Grey/brown	~60% mud and 40%sand			25	0
13-4B			6.6	Sunny and calm (~5nt NW breeze)	Grey/brown	~60% mud and 40%sand			20	0
13-4C			6.6	Sunny and calm (~5nt NW breeze)	Grey	~50% mud and 50%sand			5	0

Sediment Grab Photographs

Sediment Sample Logs


B8-3


B9-1


15-3


15-2


12-2


12-1

Sediment Sample Logs

Sediment Sample Logs


13-5


13-4A


13-4B


13-4C


13-1

Appendix C Laboratory Results – Primary Laboratory

REPORT OF ANALYSIS

Laboratory Reference: A16/3433-A [R00]

Client: BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane QLD 4000

Contact: Brad Hiles

Order No:
Project: Port of Brisbane - Sediment Analysis
Sample Type: Sediment
No. of Samples: 49
Date Received: 29/08/2016
Date Completed: 2/11/2016

Laboratory Contact Details:

Client Services Manager: Trent Biggin
Technical Enquiries: Andrew Bradbury
Telephone: +61 7 3268 1228
Fax: +61 7 3268 1238
Email: brisbane@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:

Rama Nimmagadda
Technical Manager

Comments:
All samples tested as submitted by client. All attached results have been checked and approved for release.
This is the Final Report and supersedes any reports previously issued with this reference number.
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Accreditation No.15109

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/1	/2	/3	/4
Client Reference:	-	-	B2-0	BC-2	B4-4	B4-0
Date Sampled:	-	-	8:04 24/08/2016	8:51 24/08/2016	9:23 24/08/2016	9:44 24/08/2016
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	16.8	55.7	63.3	61.3
Trace Elements						
Aluminium	04-001	mg/kg	2,500	18,000	21,000	23,000
Arsenic	04-001	mg/kg	1.3	7.9	8.4	6.0
Cadmium	04-001	mg/kg	<0.1	0.13	<0.1	<0.1
Chromium	04-001	mg/kg	13	34	41	45
Copper	04-001	mg/kg	2.7	39	40	35
Iron	04-001	mg/kg	11,000	31,000	38,000	41,000
Lead	04-001	mg/kg	10	38	24	17
Mercury	04-002	mg/kg	<0.01	0.14	0.15	0.11
Nickel	04-001	mg/kg	5.7	21	24	32
Phosphorus*	04-001	mg/kg	180	620	880	880
Silver	04-001	mg/kg	<0.1	0.42	0.23	0.15
Zinc	04-001	mg/kg	16	160	130	110
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<2	<2
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<2	<2
beta-BHC	04-024	µg/kg	<1.0	<1.0	<2	<2
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<2	<2
delta-BHC	04-024	µg/kg	<1.0	<1.0	<2	<2
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<2	<2
trans-Chlordane	04-024	µg/kg	<1.0	1.0	2.0	<2
p,p'-DDD	04-024	µg/kg	<1.0	1.0	2.0	<2
p,p'-DDE	04-024	µg/kg	1.0	4.0	4.0	4.0
p,p'-DDT	04-024	µg/kg	<3	<3	<6	<6
Dieldrin	04-024	µg/kg	<1.0	1.0	2.0	<2
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<2	<2
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<2	<2
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<2	<2
Endrin	04-024	µg/kg	<1.0	<1.0	<2	<2

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/1** **B2-0** **8:04** **24/08/2016**	**/2** **BC-2** **8:51** **24/08/2016**	**/3** **B4-4** **9:23** **24/08/2016**	**/4** **B4-0** **9:44** **24/08/2016**
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<2	<2
Endrin aldehyde	04-024	µg/kg	<1.0	<1.0	<2	<2
Heptachlor	04-024	µg/kg	<1.0	<1.0	<2	<2
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<2	<2
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<2	<2
Methoxychlor	04-024	µg/kg	<3	<3	<6	<6
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<2	<2
Surrogate Recovery	04-024	%	109	109	93	93
Date Extracted	04-024	-	30/08/2016	30/08/2016	30/08/2016	30/08/2016
Date Analysed	04-024	-	31/08/2016	31/08/2016	31/08/2016	31/08/2016
Organotins						
Monobutyl tin	04-026	µgSn/kg	<0.50	12	5.8	2.9
Dibutyl tin	04-026	µgSn/kg	<0.50	8.9	7.8	2.0
Tributyl tin	04-026	µgSn/kg	<0.50	3.0	6.0	1.7
Surrogate 1 Recovery	04-026	%	85	77	79	78
Date Extracted	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Date Analysed	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Total Petroleum Hydrocarbons						
BTEX						
Poly Aromatic Hydrocarbons						
Polychlorinated Biphenyls						
Subcontract Analysis						
Total Organic Carbon^	SUB	%	0.09	1.9	2.2	2.0
Particle Size Distribution^	SUB		See comments	See comments	See comments	See comments

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/5	/7	/8	/9
Client Reference:	-	-	B5-0	B1	B5-1A	B5-1B
Date Sampled:	-	-	10:13 24/08/2016	10:00 24/08/2016	11:00 24/08/2016	11:00 24/08/2016
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	61.9	0.1	62.4	62.6
Trace Elements						
Aluminium	04-001	mg/kg	22,000	[NA]	26,000	26,000
Arsenic	04-001	mg/kg	6.4	[NA]	5.8	5.7
Cadmium	04-001	mg/kg	<0.1	[NA]	0.19	0.18
Chromium	04-001	mg/kg	41	[NA]	40	39
Copper	04-001	mg/kg	35	[NA]	33	32
Iron	04-001	mg/kg	37,000	[NA]	38,000	37,000
Lead	04-001	mg/kg	19	[NA]	30	30
Mercury	04-002	mg/kg	0.13	[NA]	0.14	0.13
Nickel	04-001	mg/kg	24	[NA]	22	22
Phosphorus*	04-001	mg/kg	790	[NA]	790	770
Silver	04-001	mg/kg	0.20	[NA]	0.41	0.39
Zinc	04-001	mg/kg	110	[NA]	110	110
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	[NA]	<2	<2
alpha-BHC	04-024	µg/kg	<2	[NA]	<2	<2
beta-BHC	04-024	µg/kg	<2	[NA]	<2	<2
gamma-BHC (Lindane)	04-024	µg/kg	<2	[NA]	<2	<2
delta-BHC	04-024	µg/kg	<2	[NA]	<2	<2
cis-Chlordane	04-024	µg/kg	<2	[NA]	<2	<2
trans-Chlordane	04-024	µg/kg	<2	[NA]	<2	<2
p,p'-DDD	04-024	µg/kg	2.0	[NA]	3.0	4.0
p,p'-DDE	04-024	µg/kg	3.0	[NA]	6.0	6.0
p,p'-DDT	04-024	µg/kg	<6	[NA]	<6	<6
Dieldrin	04-024	µg/kg	<2	[NA]	<2	<2
alpha-Endosulfan	04-024	µg/kg	<2	[NA]	<2	<2
beta-Endosulfan	04-024	µg/kg	<2	[NA]	<2	<2
Endosulfan Sulphate	04-024	µg/kg	<2	[NA]	<2	<2
Endrin	04-024	µg/kg	<2	[NA]	<2	<2
Endrin ketone	04-024	µg/kg	<2	[NA]	<2	<2

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/5	/7	/8	/9
Client Reference:	-	-	B5-0	B1	B5-1A	B5-1B
Date Sampled:	-	-	10:13 24/08/2016	10:00 24/08/2016	11:00 24/08/2016	11:00 24/08/2016
Analysis Description	**Method**	**Units**				
Endrin aldehyde	04-024	µg/kg	<2	[NA]	<2	<2
Heptachlor	04-024	µg/kg	<2	[NA]	<2	<2
Heptachlor epoxide	04-024	µg/kg	<2	[NA]	<2	<2
Hexachlorobenzene	04-024	µg/kg	<2	[NA]	<2	<2
Methoxychlor	04-024	µg/kg	<6	[NA]	<6	<6
Oxychlordane*	04-024	µg/kg	<2	[NA]	<2	<2
Surrogate Recovery	04-024	%	95	[NA]	99	103
Date Extracted	04-024	-	30/08/2016	[NA]	30/08/2016	30/08/2016
Date Analysed	04-024	-	31/08/2016	[NA]	31/08/2016	31/08/2016
Organotins						
Monobutyl tin	04-026	µgSn/kg	3.8	[NA]	8.2	6.6
Dibutyl tin	04-026	µgSn/kg	2.8	[NA]	7.1	6.6
Tributyl tin	04-026	µgSn/kg	3.6	[NA]	1.1	1.2
Surrogate 1 Recovery	04-026	%	81	[NA]	82	87
Date Extracted	04-026	-	2/09/2016	[NA]	2/09/2016	2/09/2016
Date Analysed	04-026	-	2/09/2016	[NA]	2/09/2016	2/09/2016
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<20.0	<10	<20	<20
TPH C10-14	04-020	mg/kg	<20	[NA]	<20	<20
TPH C15-28	04-020	mg/kg	<100	[NA]	<100	<100
TPH C29-36	04-020	mg/kg	<100	[NA]	130	<100
Surrogate Recovery	04-020	%	110	99	113	108
Date Extracted	04-020	-	30/08/2016	5/09/2016	30/08/2016	30/08/2016
Date Analysed	04-020	-	1/09/2016	5/09/2016	1/09/2016	1/09/2016
BTEX						
Benzene	04-021	mg/kg	[NA]	<0.20	[NA]	[NA]
Toluene	04-021	mg/kg	[NA]	<0.20	[NA]	[NA]
Ethyl Benzene	04-021	mg/kg	[NA]	<0.20	[NA]	[NA]
m+p xylenes	04-021	mg/kg	[NA]	<0.40	[NA]	[NA]
o-xylene	04-021	mg/kg	[NA]	<0.20	[NA]	[NA]
Total BTEX	04-021	mg/kg	[NA]	<1.2	[NA]	[NA]
Surrogate 1 Recovery	04-021	%	[NA]	99	[NA]	[NA]

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/5	/7	/8	/9
Client Reference:	-	-	B5-0	B1	B5-1A	B5-1B
Date Sampled:	-	-	10:13 24/08/2016	10:00 24/08/2016	11:00 24/08/2016	11:00 24/08/2016
Analysis Description	**Method**	**Units**				
Surrogate 2 Recovery	04-021	%	[NA]	83	[NA]	[NA]
Surrogate 3 Recovery	04-021	%	[NA]	100	[NA]	[NA]
Date Extracted	04-021	-	[NA]	5/09/2016	[NA]	[NA]
Date Analysed	04-021	-	[NA]	5/09/2016	[NA]	[NA]
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<10	[NA]	<10	<10
1-Methylnaphthalene	04-022	µg/kg	<10	[NA]	<10	<10
2-Methylnaphthalene	04-022	µg/kg	<10	[NA]	<10	<10
Acenaphthylene	04-022	µg/kg	<10	[NA]	<10	<10
Acenaphthene	04-022	µg/kg	<10	[NA]	<10	<10
Fluorene	04-022	µg/kg	<10	[NA]	11	<10
Phenanthrene	04-022	µg/kg	20	[NA]	23	18
Anthracene	04-022	µg/kg	<10	[NA]	<10	<10
Fluoranthene	04-022	µg/kg	84	[NA]	70	54
Pyrene	04-022	µg/kg	84	[NA]	87	73
Benz(a)anthracene	04-022	µg/kg	36	[NA]	36	30
Chrysene	04-022	µg/kg	42	[NA]	39	32
Benzo(b)&(k)fluoranthene	04-022	µg/kg	96	[NA]	85	68
Benzo(a)pyrene	04-022	µg/kg	55	[NA]	46	35
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	43	[NA]	34	28
Dibenz(a,h)anthracene	04-022	µg/kg	<10	[NA]	<10	<10
Benzo(g,h,i)perylene	04-022	µg/kg	45	[NA]	37	30
Coronene	04-022	µg/kg	<20	[NA]	<20	<20
Benzo(e)pyrene	04-022	µg/kg	36	[NA]	34	27
Perylene	04-022	µg/kg	120	[NA]	920	800
Total PAHs (as above)	04-022	µg/kg	660	[NA]	1,420	1,190
Surrogate 1 Recovery	04-022	%	98	[NA]	100	95
Surrogate 2 Recovery	04-022	%	89	[NA]	93	92
Surrogate 3 Recovery	04-022	%	95	[NA]	99	98
Date Extracted	04-022	-	30/08/2016	[NA]	30/08/2016	30/08/2016
Date Analysed	04-022	-	31/08/2016	[NA]	31/08/2016	31/08/2016
Polychlorinated Biphenyls						

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/5	/7	/8	/9
Client Reference:	-	-	B5-0	B1	B5-1A	B5-1B
Date Sampled:	-	-	10:13 24/08/2016	10:00 24/08/2016	11:00 24/08/2016	11:00 24/08/2016
Analysis Description	**Method**	**Units**				
Mono-PCB congeners	04-029	µg/kg	<10	[NA]	<10	<10
Di-PCB congeners	04-029	µg/kg	<10	[NA]	<10	<10
Tri-PCB congeners	04-029	µg/kg	<10	[NA]	<10	<10
Tetra-PCB congeners	04-029	µg/kg	<10	[NA]	<10	<10
Penta-PCB congeners	04-029	µg/kg	<10	[NA]	<10	<10
Hexa-PCB congeners	04-029	µg/kg	<10	[NA]	<10	<10
Hepta-PCB congeners	04-029	µg/kg	<10	[NA]	<10	<10
Octa-PCB congeners	04-029	µg/kg	<10	[NA]	<10	<10
Nona-PCB congeners	04-029	µg/kg	<10	[NA]	<10	<10
Deca-PCB congeners	04-029	µg/kg	<10	[NA]	<10	<10
Total PCB congeners	04-029	µg/kg	<10	[NA]	<10	<10
Surrogate 1 Recovery	04-029	%	96	[NA]	101	98
Surrogate 2 Recovery	04-029	%	103	[NA]	108	104
Date Extracted	04-029	-	30/08/2016	[NA]	30/08/2016	30/08/2016
Date Analysed	04-029	-	31/08/2016	[NA]	31/08/2016	31/08/2016
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.8	[NA]	1.7	1.9
Nitrate as N^	SUB	mg/kg	<0.1	[NA]	<0.1	<0.1
Nitrite as N^	SUB	mg/kg	<0.1	[NA]	<0.1	<0.1
Total Kjeldahl Nitrogen^	SUB	mg/kg	1,220	[NA]	950	1,020
Total Nitrogen^	SUB	mg/kg	1,220	[NA]	950	1,020
Gross Alpha^	SUB	mBq/g	See comments	[NA]	See comments	See comments
Gross Beta^	SUB	mBq/g	See comments	[NA]	See comments	See comments
Particle Size Distribution^	SUB		See comments	[NA]	See comments	[NA]
Chromium Reducible Suite^	SUB		See Comments	[NA]	See Comments	See Comments

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/10	/11	/12	/13
Client Reference:	-	-	B5-1C	B6-3	B6-2A	B6-2B
Date Sampled:	-	-	11:00 24/08/2016	11:51 24/08/2016	12:00 24/08/2016	12:00 24/08/2016
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	58.3	66.5	51.7	55.6
Trace Elements						
Aluminium	04-001	mg/kg	26,000	23,000	21,000	20,000
Arsenic	04-001	mg/kg	7.3	9.1	6.7	6.0
Cadmium	04-001	mg/kg	0.22	<0.1	0.38	0.75
Chromium	04-001	mg/kg	42	42	38	35
Copper	04-001	mg/kg	32	40	51	31
Iron	04-001	mg/kg	38,000	40,000	35,000	33,000
Lead	04-001	mg/kg	29	22	12	46
Mercury	04-002	mg/kg	0.20	0.13	0.09	0.1
Nickel	04-001	mg/kg	21	24	25	23
Phosphorus*	04-001	mg/kg	790	890	1,500	1,900
Silver	04-001	mg/kg	0.55	0.22	0.15	0.13
Zinc	04-001	mg/kg	110	120	110	94
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<2	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<2	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<2	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<2	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<2	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<2	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<2	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	3.0	3.0	3.0	4.0
p,p'-DDE	04-024	µg/kg	3.0	3.0	5.0	5.0
p,p'-DDT	04-024	µg/kg	<3	<6	<3	<3
Dieldrin	04-024	µg/kg	<1.0	<2	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<2	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<2	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<2	<1.0	<1.0
Endrin	04-024	µg/kg	<1.0	<2	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<2	<1.0	<1.0

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: Client Reference: Date Sampled: Analysis Description	- - - Method	- - - Units	/10 B5-1C 11:00 24/08/2016	/11 B6-3 11:51 24/08/2016	/12 B6-2A 12:00 24/08/2016	/13 B6-2B 12:00 24/08/2016
Endrin aldehyde	04-024	µg/kg	<1.0	<2	<1.0	<1.0
Heptachlor	04-024	µg/kg	<1.0	<2	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<2	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<2	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<3	<6	<3	<3
Oxychlordane*	04-024	µg/kg	<1.0	<2	<1.0	<1.0
Surrogate Recovery	04-024	%	94	102	99	98
Date Extracted	04-024	-	30/08/2016	30/08/2016	30/08/2016	30/08/2016
Date Analysed	04-024	-	31/08/2016	31/08/2016	31/08/2016	31/08/2016
Organotins						
Monobutyl tin	04-026	µgSn/kg	7.8	4.8	1.8	2.2
Dibutyl tin	04-026	µgSn/kg	5.9	3.0	1.5	1.9
Tributyl tin	04-026	µgSn/kg	0.80	3.0	1.8	5.8
Surrogate 1 Recovery	04-026	%	77	82	72	74
Date Extracted	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Date Analysed	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	<20.0	[NA]	[NA]
TPH C10-14	04-020	mg/kg	<10	<20	[NA]	[NA]
TPH C15-28	04-020	mg/kg	63	<100	[NA]	[NA]
TPH C29-36	04-020	mg/kg	88	120	[NA]	[NA]
Surrogate Recovery	04-020	%	109	109	[NA]	[NA]
Date Extracted	04-020	-	30/08/2016	30/08/2016	[NA]	[NA]
Date Analysed	04-020	-	1/09/2016	1/09/2016	[NA]	[NA]
BTEX						
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	6.0	<10	[NA]	[NA]
1-Methylnaphthalene	04-022	µg/kg	<5.0	<10	[NA]	[NA]
2-Methylnaphthalene	04-022	µg/kg	<5.0	<10	[NA]	[NA]
Acenaphthylene	04-022	µg/kg	6.0	<10	[NA]	[NA]
Acenaphthene	04-022	µg/kg	<5.0	<10	[NA]	[NA]
Fluorene	04-022	µg/kg	<5.0	<10	[NA]	[NA]

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/10	/11	/12	/13
Client Reference:	-	-	B5-1C	B6-3	B6-2A	B6-2B
Date Sampled:	-	-	11:00 24/08/2016	11:51 24/08/2016	12:00 24/08/2016	12:00 24/08/2016
Analysis Description	**Method**	**Units**				
Phenanthrene	04-022	µg/kg	17	16	[NA]	[NA]
Anthracene	04-022	µg/kg	7.0	<10	[NA]	[NA]
Fluoranthene	04-022	µg/kg	68	66	[NA]	[NA]
Pyrene	04-022	µg/kg	92	75	[NA]	[NA]
Benz(a)anthracene	04-022	µg/kg	40	32	[NA]	[NA]
Chrysene	04-022	µg/kg	38	41	[NA]	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	110	97	[NA]	[NA]
Benzo(a)pyrene	04-022	µg/kg	62	54	[NA]	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	50	44	[NA]	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	10	<10	[NA]	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	50	49	[NA]	[NA]
Coronene	04-022	µg/kg	12	<20	[NA]	[NA]
Benzo(e)pyrene	04-022	µg/kg	40	36	[NA]	[NA]
Perylene	04-022	µg/kg	110	130	[NA]	[NA]
Total PAHs (as above)	04-022	µg/kg	720	640	[NA]	[NA]
Surrogate 1 Recovery	04-022	%	91	102	[NA]	[NA]
Surrogate 2 Recovery	04-022	%	89	94	[NA]	[NA]
Surrogate 3 Recovery	04-022	%	96	102	[NA]	[NA]
Date Extracted	04-022	-	30/08/2016	30/08/2016	[NA]	[NA]
Date Analysed	04-022	-	31/08/2016	31/08/2016	[NA]	[NA]
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	[NA]
Di-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	[NA]
Tri-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	[NA]
Tetra-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	[NA]
Penta-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	[NA]
Hexa-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	[NA]
Hepta-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	[NA]
Octa-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	[NA]
Nona-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	[NA]
Deca-PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	[NA]
Total PCB congeners	04-029	µg/kg	<5.0	<10	[NA]	[NA]

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/10** **B5-1C** **11:00** **24/08/2016**	**/11** **B6-3** **11:51** **24/08/2016**	**/12** **B6-2A** **12:00** **24/08/2016**	**/13** **B6-2B** **12:00** **24/08/2016**
Surrogate 1 Recovery	04-029	%	95	101	[NA]	[NA]
Surrogate 2 Recovery	04-029	%	105	108	[NA]	[NA]
Date Extracted	04-029	-	30/08/2016	30/08/2016	[NA]	[NA]
Date Analysed	04-029	-	31/08/2016	31/08/2016	[NA]	[NA]
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.7	2.2	1.8	2.0
Nitrate as N^	SUB	mg/kg	<0.1	<0.1	[NA]	[NA]
Nitrite as N^	SUB	mg/kg	<0.1	<0.1	[NA]	[NA]
Total Kjeldahl Nitrogen^	SUB	mg/kg	950	1,650	[NA]	[NA]
Total Nitrogen^	SUB	mg/kg	950	1,650	[NA]	[NA]
Gross Alpha^	SUB	mBq/g	See comments	See comments	[NA]	[NA]
Gross Beta^	SUB	mBq/g	See comments	See comments	[NA]	[NA]
Particle Size Distribution^	SUB		See comments	See comments	See comments	[NA]
Chromium Reducible Suite^	SUB		See Comments	See Comments	[NA]	[NA]

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Laboratory Reference:	-	-	/14	/15	/16	/17
Client Reference:	-	-	B7-1	B8-1	B8-3	B15-3
Date Sampled:	-	-	12:30 24/08/2016	13:00 24/08/2016	13:20 24/08/2016	7:00 25/08/2016
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	59.7	56.9	55.2	22.5
Trace Elements						
Aluminium	04-001	mg/kg	28,000	18,000	23,000	5,800
Arsenic	04-001	mg/kg	4.4	6.2	8.9	5.1
Cadmium	04-001	mg/kg	<0.1	<0.1	0.33	<0.1
Chromium	04-001	mg/kg	48	36	46	18
Copper	04-001	mg/kg	32	27	31	4.2
Iron	04-001	mg/kg	49,000	33,000	40,000	16,000
Lead	04-001	mg/kg	9.6	14	18	3.5
Mercury	04-002	mg/kg	0.07	0.12	0.29	0.02
Nickel	04-001	mg/kg	45	20	22	9.1
Phosphorus*	04-001	mg/kg	1,200	700	790	270
Silver	04-001	mg/kg	0.11	0.17	0.66	<0.1
Zinc	04-001	mg/kg	86	88	95	27
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	3.0	3.0	5.0	<1.0
p,p'-DDE	04-024	µg/kg	16	3.0	10	<1.0
p,p'-DDT	04-024	µg/kg	<3	<3	<3	<3
Dieldrin	04-024	µg/kg	1.0	<1.0	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0

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Laboratory Reference:	-	-	/14	/15	/16	/17
Client Reference:	-	-	B7-1	B8-1	B8-3	B15-3
Date Sampled:	-	-	12:30 24/08/2016	13:00 24/08/2016	13:20 24/08/2016	7:00 25/08/2016
Analysis Description	**Method**	**Units**				
Endrin aldehyde	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<3	<3	<3	<3
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	98	93	99	94
Date Extracted	04-024	-	30/08/2016	30/08/2016	30/08/2016	30/08/2016
Date Analysed	04-024	-	31/08/2016	31/08/2016	31/08/2016	31/08/2016
Organotins						
Monobutyl tin	04-026	µgSn/kg	0.90	2.8	2.7	<0.50
Dibutyl tin	04-026	µgSn/kg	0.70	1.6	2.5	<0.50
Tributyl tin	04-026	µgSn/kg	1.3	1.5	<0.50	<0.50
Surrogate 1 Recovery	04-026	%	79	76	74	69
Date Extracted	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Date Analysed	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	[NA]	[NA]	<10
TPH C10-14	04-020	mg/kg	<10	[NA]	[NA]	<10
TPH C15-28	04-020	mg/kg	<50	[NA]	[NA]	<50
TPH C29-36	04-020	mg/kg	<50	[NA]	[NA]	<50
Surrogate Recovery	04-020	%	116	[NA]	[NA]	115
Date Extracted	04-020	-	30/08/2016	[NA]	[NA]	30/08/2016
Date Analysed	04-020	-	1/09/2016	[NA]	[NA]	1/09/2016
BTEX						
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
1-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
2-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
Acenaphthylene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
Acenaphthene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
Fluorene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0

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Laboratory Reference:	-	-	/14	/15	/16	/17
Client Reference:	-	-	B7-1	B8-1	B8-3	B15-3
Date Sampled:	-	-	12:30 24/08/2016	13:00 24/08/2016	13:20 24/08/2016	7:00 25/08/2016
Analysis Description	**Method**	**Units**				
Phenanthrene	04-022	µg/kg	10	[NA]	[NA]	<5.0
Anthracene	04-022	µg/kg	<5.0	[NA]	[NA]	<5.0
Fluoranthene	04-022	µg/kg	52	[NA]	[NA]	<5.0
Pyrene	04-022	µg/kg	49	[NA]	[NA]	<5.0
Benz(a)anthracene	04-022	µg/kg	25	[NA]	[NA]	<5.0
Chrysene	04-022	µg/kg	23	[NA]	[NA]	<5.0
Benzo(b)&(k)fluoranthene	04-022	µg/kg	54	[NA]	[NA]	<10
Benzo(a)pyrene	04-022	µg/kg	33	[NA]	[NA]	<5.0
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	26	[NA]	[NA]	<5.0
Dibenz(a,h)anthracene	04-022	µg/kg	5.0	[NA]	[NA]	<5.0
Benzo(g,h,i)perylene	04-022	µg/kg	27	[NA]	[NA]	<5.0
Coronene	04-022	µg/kg	<10	[NA]	[NA]	<10
Benzo(e)pyrene	04-022	µg/kg	20	[NA]	[NA]	<5.0
Perylene	04-022	µg/kg	48	[NA]	[NA]	5.0
Total PAHs (as above)	04-022	µg/kg	370	[NA]	[NA]	<100
Surrogate 1 Recovery	04-022	%	96	[NA]	[NA]	94
Surrogate 2 Recovery	04-022	%	91	[NA]	[NA]	85
Surrogate 3 Recovery	04-022	%	101	[NA]	[NA]	103
Date Extracted	04-022	-	30/08/2016	[NA]	[NA]	30/08/2016
Date Analysed	04-022	-	31/08/2016	[NA]	[NA]	31/08/2016
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Di-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Tri-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Tetra-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Penta-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Hexa-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Hepta-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Octa-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Nona-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Deca-PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0
Total PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	<5.0

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Laboratory Reference:	-	-	/14	/15	/16	/17
Client Reference:	-	-	B7-1	B8-1	B8-3	B15-3
Date Sampled:	-	-	12:30 24/08/2016	13:00 24/08/2016	13:20 24/08/2016	7:00 25/08/2016
Analysis Description	**Method**	**Units**				
Surrogate 1 Recovery	04-029	%	98	[NA]	[NA]	96
Surrogate 2 Recovery	04-029	%	105	[NA]	[NA]	100
Date Extracted	04-029	-	30/08/2016	[NA]	[NA]	30/08/2016
Date Analysed	04-029	-	31/08/2016	[NA]	[NA]	31/08/2016
Subcontract Analysis						
Total Organic Carbon^	SUB	%	2.1	1.6	1.8	0.34
Nitrate as N^	SUB	mg/kg	<0.1	[NA]	[NA]	<0.1
Nitrite as N^	SUB	mg/kg	<0.1	[NA]	[NA]	<0.1
Total Kjeldahl Nitrogen^	SUB	mg/kg	1,460	[NA]	[NA]	100
Total Nitrogen^	SUB	mg/kg	1,460	[NA]	[NA]	100
Gross Alpha^	SUB	mBq/g	See comments	[NA]	[NA]	See comments
Gross Beta^	SUB	mBq/g	See comments	[NA]	[NA]	See comments
Particle Size Distribution^	SUB		See comments	See comments	See comments	See comments

Laboratory Reference:	-	-	/18	/19	/20	/21
Client Reference:	-	-	B15-2	B12-2	B12-1	B11-8
Date Sampled:	-	-	7:40 25/08/2016	8:40 25/08/2016	9:08 25/08/2016	9:30 25/08/2016
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	22.8	57.2	49.1	41.1
Trace Elements						
Aluminium	04-001	mg/kg	5,900	19,000	16,000	14,000
Arsenic	04-001	mg/kg	4.9	5.6	6.7	5.6
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	14	35	31	29
Copper	04-001	mg/kg	4.5	21	20	17
Iron	04-001	mg/kg	15,000	35,000	31,000	27,000
Lead	04-001	mg/kg	3.7	10	12	9.6
Mercury	04-002	mg/kg	0.02	0.08	0.09	0.09
Nickel	04-001	mg/kg	8.7	25	19	17

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/18** **B15-2** **7:40** **25/08/2016**	**/19** **B12-2** **8:40** **25/08/2016**	**/20** **B12-1** **9:08** **25/08/2016**	**/21** **B11-8** **9:30** **25/08/2016**
Phosphorus*	04-001	mg/kg	270	690	650	550
Silver	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Zinc	04-001	mg/kg	27	70	63	62
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDE	04-024	µg/kg	<1.0	4.0	2.0	2.0
p,p'-DDT	04-024	µg/kg	<3	<3	<3	<3
Dieldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin aldehyde	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<3	<3	<3	<3
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	94	96	95	94
Date Extracted	04-024	-	30/08/2016	30/08/2016	30/08/2016	30/08/2016
Date Analysed	04-024	-	31/08/2016	31/08/2016	31/08/2016	1/09/2016
Organotins						
Monobutyl tin	04-026	µgSn/kg	<0.50	1.1	2.1	1.5
Dibutyl tin	04-026	µgSn/kg	<0.50	0.80	1.9	1.3

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/18** **B15-2** **7:40** **25/08/2016**	**/19** **B12-2** **8:40** **25/08/2016**	**/20** **B12-1** **9:08** **25/08/2016**	**/21** **B11-8** **9:30** **25/08/2016**
Tributyl tin	04-026	µgSn/kg	<0.50	<0.50	0.60	0.60
Surrogate 1 Recovery	04-026	%	61	75	68	67
Date Extracted	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Date Analysed	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	[NA]	<10	<10
TPH C10-14	04-020	mg/kg	<10	[NA]	<10	<10
TPH C15-28	04-020	mg/kg	<50	[NA]	<50	<50
TPH C29-36	04-020	mg/kg	<50	[NA]	<50	<50
Surrogate Recovery	04-020	%	113	[NA]	116	107
Date Extracted	04-020	-	30/08/2016	[NA]	30/08/2016	30/08/2016
Date Analysed	04-020	-	1/09/2016	[NA]	1/09/2016	1/09/2016
BTEX						
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<5.0	[NA]	<5.0	8.0
1-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	<5.0	<5.0
2-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	<5.0	<5.0
Acenaphthylene	04-022	µg/kg	<5.0	[NA]	10	5.0
Acenaphthene	04-022	µg/kg	<5.0	[NA]	<5.0	<5.0
Fluorene	04-022	µg/kg	<5.0	[NA]	<5.0	<5.0
Phenanthrene	04-022	µg/kg	<5.0	[NA]	20	21
Anthracene	04-022	µg/kg	<5.0	[NA]	7.0	7.0
Fluoranthene	04-022	µg/kg	8.0	[NA]	200	94
Pyrene	04-022	µg/kg	8.0	[NA]	210	80
Benz(a)anthracene	04-022	µg/kg	<5.0	[NA]	120	41
Chrysene	04-022	µg/kg	<5.0	[NA]	110	41
Benzo(b)&(k)fluoranthene	04-022	µg/kg	<10	[NA]	290	98
Benzo(a)pyrene	04-022	µg/kg	6.0	[NA]	190	61
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	<5.0	[NA]	120	42
Dibenz(a,h)anthracene	04-022	µg/kg	<5.0	[NA]	22	8.0
Benzo(g,h,i)perylene	04-022	µg/kg	<5.0	[NA]	110	42
Coronene	04-022	µg/kg	<10	[NA]	21	<10

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Laboratory Reference:	-	-	/18	/19	/20	/21
Client Reference:	-	-	B15-2	B12-2	B12-1	B11-8
Date Sampled:	-	-	7:40 25/08/2016	8:40 25/08/2016	9:08 25/08/2016	9:30 25/08/2016
Analysis Description	**Method**	**Units**				
Benzo(e)pyrene	04-022	µg/kg	<5.0	[NA]	97	35
Perylene	04-022	µg/kg	7.0	[NA]	87	54
Total PAHs (as above)	04-022	µg/kg	<100	[NA]	1,630	640
Surrogate 1 Recovery	04-022	%	96	[NA]	99	87
Surrogate 2 Recovery	04-022	%	89	[NA]	93	86
Surrogate 3 Recovery	04-022	%	103	[NA]	102	97
Date Extracted	04-022	-	30/08/2016	[NA]	30/08/2016	30/08/2016
Date Analysed	04-022	-	31/08/2016	[NA]	31/08/2016	31/08/2016
Polychlorinated Biphenyls						
Mono-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	<5.0
Di-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	<5.0
Tri-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	<5.0
Tetra-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	<5.0
Penta-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	<5.0
Hexa-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	<5.0
Hepta-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	<5.0
Octa-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	<5.0
Nona-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	<5.0
Deca-PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	<5.0
Total PCB congeners	04-029	µg/kg	<5.0	[NA]	<5.0	<5.0
Surrogate 1 Recovery	04-029	%	97	[NA]	101	91
Surrogate 2 Recovery	04-029	%	101	[NA]	108	99
Date Extracted	04-029	-	30/08/2016	[NA]	30/08/2016	30/08/2016
Date Analysed	04-029	-	31/08/2016	[NA]	31/08/2016	31/08/2016
Subcontract Analysis						
Total Organic Carbon^	SUB	%	0.33	1.4	1.2	1.2
Nitrate as N^	SUB	mg/kg	<0.1	[NA]	<0.1	<0.1
Nitrite as N^	SUB	mg/kg	<0.1	[NA]	<0.1	<0.1
Total Kjeldahl Nitrogen^	SUB	mg/kg	170	[NA]	580	720
Total Nitrogen^	SUB	mg/kg	170	[NA]	580	720
Gross Alpha^	SUB	mBq/g	See comments	[NA]	See comments	See comments
Gross Beta^	SUB	mBq/g	See comments	[NA]	See comments	See comments

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Laboratory Reference:	-	-	/18	/19	/20	/21
Client Reference:	-	-	B15-2	B12-2	B12-1	B11-8
Date Sampled:	-	-	7:40 25/08/2016	8:40 25/08/2016	9:08 25/08/2016	9:30 25/08/2016
Analysis Description	**Method**	**Units**				
Particle Size Distribution^	SUB		See comments	See comments	See comments	See comments

Laboratory Reference:	-	-	/23	/24	/25	/26
Client Reference:	-	-	B11-9A	B11-9B	B11-9C	B10-8
Date Sampled:	-	-	10:00 25/08/2016	10:00 25/08/2016	10:51 25/08/2016	11:00 25/08/2016
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	57.5	52.2	57.7	59.5
Trace Elements						
Aluminium	04-001	mg/kg	19,000	18,000	16,000	20,000
Arsenic	04-001	mg/kg	6.5	7.0	8.3	6.9
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	36	37	35	38
Copper	04-001	mg/kg	22	22	22	27
Iron	04-001	mg/kg	33,000	33,000	32,000	35,000
Lead	04-001	mg/kg	12	12	13	12
Mercury	04-002	mg/kg	0.11	0.11	0.16	0.09
Nickel	04-001	mg/kg	21	21	20	22
Phosphorus*	04-001	mg/kg	620	640	680	650
Silver	04-001	mg/kg	0.18	0.16	0.14	0.13
Zinc	04-001	mg/kg	73	74	74	84
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	2.0	1.0	1.0	<1.0

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Laboratory Reference: Client Reference: Date Sampled: Analysis Description	- - - Method	- - - Units	/23 B11-9A 10:00 25/08/2016	/24 B11-9B 10:00 25/08/2016	/25 B11-9C 10:51 25/08/2016	/26 B10-8 11:00 25/08/2016
p,p'-DDE	04-024	µg/kg	3.0	3.0	3.0	3.0
p,p'-DDT	04-024	µg/kg	<3	<3	<3	<3
Dieldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin aldehyde	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<3	<3	<3	<3
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	96	92	93	97
Date Extracted	04-024	-	30/08/2016	30/08/2016	30/08/2016	30/08/2016
Date Analysed	04-024	-	1/09/2016	1/09/2016	1/09/2016	1/09/2016
Organotins						
Monobutyl tin	04-026	µgSn/kg	1.7	3.6	2.3	1.7
Dibutyl tin	04-026	µgSn/kg	1.1	2.4	1.4	1.3
Tributyl tin	04-026	µgSn/kg	0.60	1.1	0.90	0.70
Surrogate 1 Recovery	04-026	%	71	77	80	91
Date Extracted	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Date Analysed	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Total Petroleum Hydrocarbons						
BTEX						
Poly Aromatic Hydrocarbons						
Polychlorinated Biphenyls						
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.6	1.4	1.7	1.3
Particle Size Distribution^	SUB		See comments	[NA]	[NA]	See comments

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/27	/28	/29	/30
Client Reference:	-	-	B10-6A	B10-6B	B2	B10-5
Date Sampled:	-	-	11:30 25/08/2016	11:30 25/08/2016	11:30 25/08/2016	12:00 25/08/2016
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	62.1	61.4	0.1	48.2
Trace Elements						
Aluminium	04-001	mg/kg	19,000	18,000	[NA]	14,000
Arsenic	04-001	mg/kg	6.9	5.6	[NA]	5.8
Cadmium	04-001	mg/kg	<0.1	<0.1	[NA]	<0.1
Chromium	04-001	mg/kg	36	34	[NA]	29
Copper	04-001	mg/kg	28	24	[NA]	18
Iron	04-001	mg/kg	34,000	31,000	[NA]	27,000
Lead	04-001	mg/kg	13	12	[NA]	9.6
Mercury	04-002	mg/kg	0.11	0.09	[NA]	0.07
Nickel	04-001	mg/kg	21	20	[NA]	17
Phosphorus*	04-001	mg/kg	690	610	[NA]	550
Silver	04-001	mg/kg	0.15	0.14	[NA]	<0.1
Zinc	04-001	mg/kg	82	77	[NA]	59
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<2	<2	[NA]	<1.0
alpha-BHC	04-024	µg/kg	<2	<2	[NA]	<1.0
beta-BHC	04-024	µg/kg	<2	<2	[NA]	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<2	<2	[NA]	<1.0
delta-BHC	04-024	µg/kg	<2	<2	[NA]	<1.0
cis-Chlordane	04-024	µg/kg	<2	<2	[NA]	<1.0
trans-Chlordane	04-024	µg/kg	<2	<2	[NA]	<1.0
p,p'-DDD	04-024	µg/kg	<2	<2	[NA]	<1.0
p,p'-DDE	04-024	µg/kg	3.0	3.0	[NA]	2.0
p,p'-DDT	04-024	µg/kg	<6	<6	[NA]	<3
Dieldrin	04-024	µg/kg	<2	<2	[NA]	<1.0
alpha-Endosulfan	04-024	µg/kg	<2	<2	[NA]	<1.0
beta-Endosulfan	04-024	µg/kg	<2	<2	[NA]	<1.0
Endosulfan Sulphate	04-024	µg/kg	<2	<2	[NA]	<1.0
Endrin	04-024	µg/kg	<2	<2	[NA]	<1.0
Endrin ketone	04-024	µg/kg	<2	<2	[NA]	<1.0

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/27	/28	/29	/30
Client Reference:	-	-	B10-6A	B10-6B	B2	B10-5
Date Sampled:	-	-	11:30 25/08/2016	11:30 25/08/2016	11:30 25/08/2016	12:00 25/08/2016
Analysis Description	**Method**	**Units**				
Endrin aldehyde	04-024	µg/kg	<2	<2	[NA]	<1.0
Heptachlor	04-024	µg/kg	<2	<2	[NA]	<1.0
Heptachlor epoxide	04-024	µg/kg	<2	<2	[NA]	<1.0
Hexachlorobenzene	04-024	µg/kg	<2	<2	[NA]	<1.0
Methoxychlor	04-024	µg/kg	<6	<6	[NA]	<3
Oxychlordane*	04-024	µg/kg	<2	<2	[NA]	<1.0
Surrogate Recovery	04-024	%	99	103	[NA]	97
Date Extracted	04-024	-	30/08/2016	30/08/2016	[NA]	30/08/2016
Date Analysed	04-024	-	1/09/2016	1/09/2016	[NA]	1/09/2016
Organotins						
Monobutyl tin	04-026	µgSn/kg	2.6	2.1	[NA]	1.3
Dibutyl tin	04-026	µgSn/kg	1.4	1.1	[NA]	0.80
Tributyl tin	04-026	µgSn/kg	<1.0	<1.0	[NA]	0.60
Surrogate 1 Recovery	04-026	%	81	80	[NA]	76
Date Extracted	04-026	-	2/09/2016	2/09/2016	[NA]	2/09/2016
Date Analysed	04-026	-	2/09/2016	2/09/2016	[NA]	2/09/2016
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<20	<20	<10	[NA]
TPH C10-14	04-020	mg/kg	<20	<20	[NA]	[NA]
TPH C15-28	04-020	mg/kg	<100	<100	[NA]	[NA]
TPH C29-36	04-020	mg/kg	<100	<100	[NA]	[NA]
Surrogate Recovery	04-020	%	116	114	100	[NA]
Date Extracted	04-020	-	30/08/2016	30/08/2016	5/09/2016	[NA]
Date Analysed	04-020	-	1/09/2016	1/09/2016	5/09/2016	[NA]
BTEX						
Benzene	04-021	mg/kg	[NA]	[NA]	<0.20	[NA]
Toluene	04-021	mg/kg	[NA]	[NA]	<0.20	[NA]
Ethyl Benzene	04-021	mg/kg	[NA]	[NA]	<0.20	[NA]
m+p xylenes	04-021	mg/kg	[NA]	[NA]	<0.40	[NA]
o-xylene	04-021	mg/kg	[NA]	[NA]	<0.20	[NA]
Total BTEX	04-021	mg/kg	[NA]	[NA]	<1.2	[NA]
Surrogate 1 Recovery	04-021	%	[NA]	[NA]	100	[NA]

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/27	/28	/29	/30
Client Reference:	-	-	B10-6A	B10-6B	B2	B10-5
Date Sampled:	-	-	11:30 25/08/2016	11:30 25/08/2016	11:30 25/08/2016	12:00 25/08/2016
Analysis Description	**Method**	**Units**				
Surrogate 2 Recovery	04-021	%	[NA]	[NA]	80	[NA]
Surrogate 3 Recovery	04-021	%	[NA]	[NA]	96	[NA]
Date Extracted	04-021	-	[NA]	[NA]	5/09/2016	[NA]
Date Analysed	04-021	-	[NA]	[NA]	6/09/2016	[NA]
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<10	<10	[NA]	[NA]
1-Methylnaphthalene	04-022	µg/kg	<10	<10	[NA]	[NA]
2-Methylnaphthalene	04-022	µg/kg	<10	<10	[NA]	[NA]
Acenaphthylene	04-022	µg/kg	<10	<10	[NA]	[NA]
Acenaphthene	04-022	µg/kg	<10	<10	[NA]	[NA]
Fluorene	04-022	µg/kg	<10	<10	[NA]	[NA]
Phenanthrene	04-022	µg/kg	13	17	[NA]	[NA]
Anthracene	04-022	µg/kg	<10	<10	[NA]	[NA]
Fluoranthene	04-022	µg/kg	66	61	[NA]	[NA]
Pyrene	04-022	µg/kg	64	61	[NA]	[NA]
Benz(a)anthracene	04-022	µg/kg	33	28	[NA]	[NA]
Chrysene	04-022	µg/kg	33	30	[NA]	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	83	66	[NA]	[NA]
Benzo(a)pyrene	04-022	µg/kg	50	39	[NA]	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	36	27	[NA]	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	<10	<10	[NA]	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	37	29	[NA]	[NA]
Coronene	04-022	µg/kg	<20	<20	[NA]	[NA]
Benzo(e)pyrene	04-022	µg/kg	31	25	[NA]	[NA]
Perylene	04-022	µg/kg	72	62	[NA]	[NA]
Total PAHs (as above)	04-022	µg/kg	520	440	[NA]	[NA]
Surrogate 1 Recovery	04-022	%	99	93	[NA]	[NA]
Surrogate 2 Recovery	04-022	%	92	87	[NA]	[NA]
Surrogate 3 Recovery	04-022	%	102	95	[NA]	[NA]
Date Extracted	04-022	-	30/08/2016	30/08/2016	[NA]	[NA]
Date Analysed	04-022	-	1/09/2016	1/09/2016	[NA]	[NA]
Polychlorinated Biphenyls						

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/27** **B10-6A** **11:30** **25/08/2016**	**/28** **B10-6B** **11:30** **25/08/2016**	**/29** **B2** **11:30** **25/08/2016**	**/30** **B10-5** **12:00** **25/08/2016**
Mono-PCB congeners	04-029	µg/kg	<10	<10	[NA]	[NA]
Di-PCB congeners	04-029	µg/kg	<10	<10	[NA]	[NA]
Tri-PCB congeners	04-029	µg/kg	<10	<10	[NA]	[NA]
Tetra-PCB congeners	04-029	µg/kg	<10	<10	[NA]	[NA]
Penta-PCB congeners	04-029	µg/kg	<10	<10	[NA]	[NA]
Hexa-PCB congeners	04-029	µg/kg	<10	<10	[NA]	[NA]
Hepta-PCB congeners	04-029	µg/kg	<10	<10	[NA]	[NA]
Octa-PCB congeners	04-029	µg/kg	<10	<10	[NA]	[NA]
Nona-PCB congeners	04-029	µg/kg	<10	<10	[NA]	[NA]
Deca-PCB congeners	04-029	µg/kg	<10	<10	[NA]	[NA]
Total PCB congeners	04-029	µg/kg	<10	<10	[NA]	[NA]
Surrogate 1 Recovery	04-029	%	96	92	[NA]	[NA]
Surrogate 2 Recovery	04-029	%	104	98	[NA]	[NA]
Date Extracted	04-029	-	30/08/2016	30/08/2016	[NA]	[NA]
Date Analysed	04-029	-	1/09/2016	1/09/2016	[NA]	[NA]
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.5	1.5	[NA]	1.1
Nitrate as N^	SUB	mg/kg	<0.1	<0.1	[NA]	[NA]
Nitrite as N^	SUB	mg/kg	<0.1	<0.1	[NA]	[NA]
Total Kjeldahl Nitrogen^	SUB	mg/kg	990	1,130	[NA]	[NA]
Total Nitrogen^	SUB	mg/kg	990	1,130	[NA]	[NA]
Gross Alpha^	SUB	mBq/g	See comments	See comments	[NA]	[NA]
Gross Beta^	SUB	mBq/g	See comments	See comments	[NA]	[NA]
Particle Size Distribution^	SUB		See comments	[NA]	[NA]	See comments

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/32	/33	/34	/35
Client Reference:	-	-	B11-5	B15-1	RF3	RF2
Date Sampled:	-	-	7:00 26/08/2016	7:15 26/08/2016	7:40 26/08/2016	8:00 26/08/2016
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	53.6	46.2	63.8	64.0
Trace Elements						
Aluminium	04-001	mg/kg	15,000	13,000	25,000	24,000
Arsenic	04-001	mg/kg	5.4	4.3	6.7	5.7
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	30	25	43	43
Copper	04-001	mg/kg	19	13	22	19
Iron	04-001	mg/kg	28,000	24,000	39,000	38,000
Lead	04-001	mg/kg	9.8	7.6	15	14
Mercury	04-002	mg/kg	0.07	0.05	0.1	0.10
Nickel	04-001	mg/kg	17	15	24	21
Phosphorus*	04-001	mg/kg	520	410	610	560
Silver	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Zinc	04-001	mg/kg	66	47	76	73
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<2	<2
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<2	<2
beta-BHC	04-024	µg/kg	<1.0	<1.0	<2	<2
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<2	<2
delta-BHC	04-024	µg/kg	<1.0	<1.0	<2	<2
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<2	<2
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<2	<2
p,p'-DDD	04-024	µg/kg	<1.0	<1.0	<2	<2
p,p'-DDE	04-024	µg/kg	2.0	2.0	2.0	<2
p,p'-DDT	04-024	µg/kg	<3	<3	<6	<6
Dieldrin	04-024	µg/kg	<1.0	<1.0	<2	<2
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<2	<2
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<2	<2
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<2	<2
Endrin	04-024	µg/kg	<1.0	<1.0	<2	<2
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<2	<2

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/32** **B11-5** **7:00** **26/08/2016**	**/33** **B15-1** **7:15** **26/08/2016**	**/34** **RF3** **7:40** **26/08/2016**	**/35** **RF2** **8:00** **26/08/2016**
Endrin aldehyde	04-024	µg/kg	<1.0	<1.0	<2	<2
Heptachlor	04-024	µg/kg	<1.0	<1.0	<2	<2
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<2	<2
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<2	<2
Methoxychlor	04-024	µg/kg	<3	<3	<6	<6
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<2	<2
Surrogate Recovery	04-024	%	94	96	96	98
Date Extracted	04-024	-	30/08/2016	30/08/2016	30/08/2016	30/08/2016
Date Analysed	04-024	-	1/09/2016	1/09/2016	1/09/2016	1/09/2016
Organotins						
Monobutyl tin	04-026	µgSn/kg	1.3	0.90	1.1	1.1
Dibutyl tin	04-026	µgSn/kg	0.90	<0.50	<1.0	<1.0
Tributyl tin	04-026	µgSn/kg	<0.50	<0.50	<1.0	<1.0
Surrogate 1 Recovery	04-026	%	78	78	77	77
Date Extracted	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Date Analysed	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Total Petroleum Hydrocarbons						
BTEX						
Poly Aromatic Hydrocarbons						
Polychlorinated Biphenyls						
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.1	0.98	1.4	1.2
Particle Size Distribution^	SUB		See comments	See comments	See comments	See comments

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/36	/37	/38	/39
Client Reference:	-	-	RF6	RF7	RF4	B13-9
Date Sampled:	-	-	8:30 26/08/2016	8:45 26/08/2016	9:00 26/08/2016	9:20 26/08/2016
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	59.7	63.5	55.1	61.7
Trace Elements						
Aluminium	04-001	mg/kg	19,000	25,000	17,000	20,000
Arsenic	04-001	mg/kg	6.2	6.3	5.0	7.3
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	37	43	32	34
Copper	04-001	mg/kg	17	25	12	14
Iron	04-001	mg/kg	33,000	39,000	29,000	33,000
Lead	04-001	mg/kg	13	15	10	11
Mercury	04-002	mg/kg	0.09	0.11	0.08	0.05
Nickel	04-001	mg/kg	19	26	16	17
Phosphorus*	04-001	mg/kg	510	660	420	500
Silver	04-001	mg/kg	<0.1	0.14	<0.1	<0.1
Zinc	04-001	mg/kg	62	79	50	50
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<2	<2	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<2	<2	<1.0
beta-BHC	04-024	µg/kg	<1.0	<2	<2	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<2	<2	<1.0
delta-BHC	04-024	µg/kg	<1.0	<2	<2	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<2	<2	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<2	<2	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	<2	<2	<1.0
p,p'-DDE	04-024	µg/kg	1.0	5.0	<2	<1.0
p,p'-DDT	04-024	µg/kg	<3	<6	<6	<3
Dieldrin	04-024	µg/kg	<1.0	<2	<2	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<2	<2	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<2	<2	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<2	<2	<1.0
Endrin	04-024	µg/kg	<1.0	<2	<2	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<2	<2	<1.0

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/36** **RF6** **8:30** **26/08/2016**	**/37** **RF7** **8:45** **26/08/2016**	**/38** **RF4** **9:00** **26/08/2016**	**/39** **B13-9** **9:20** **26/08/2016**
Endrin aldehyde	04-024	µg/kg	<1.0	<2	<2	<1.0
Heptachlor	04-024	µg/kg	<1.0	<2	<2	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<2	<2	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<2	<2	<1.0
Methoxychlor	04-024	µg/kg	<3	<6	<6	<3
Oxychlordane*	04-024	µg/kg	<1.0	<2	<2	<1.0
Surrogate Recovery	04-024	%	97	96	92	102
Date Extracted	04-024	-	30/08/2016	30/08/2016	30/08/2016	30/08/2016
Date Analysed	04-024	-	1/09/2016	1/09/2016	1/09/2016	1/09/2016
Organotins						
Monobutyl tin	04-026	µgSn/kg	1.2	2.2	0.80	<1.0
Dibutyl tin	04-026	µgSn/kg	<0.50	1.6	<0.50	<1.0
Tributyl tin	04-026	µgSn/kg	<0.50	<1.0	<0.50	<1.0
Surrogate 1 Recovery	04-026	%	71	78	76	74
Date Extracted	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Date Analysed	04-026	-	3/09/2016	3/09/2016	3/09/2016	3/09/2016
Total Petroleum Hydrocarbons						
BTEX						
Poly Aromatic Hydrocarbons						
Polychlorinated Biphenyls						
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.1	1.5	1.0	1.1
Particle Size Distribution^	SUB		See comments	See comments	See comments	See comments

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/40	/41	/42	/43
Client Reference:	-	-	B16-1	B3	B16-1	B13-8
Date Sampled:	-	-	10:00 26/08/2016	10:00 26/08/2016	10:10 26/08/2016	10:30 26/08/2016
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	57.9	<0.1	38.2	57.7
Trace Elements						
Aluminium	04-001	mg/kg	20,000	[NA]	11,000	17,000
Arsenic	04-001	mg/kg	6.7	[NA]	4.1	6.4
Cadmium	04-001	mg/kg	<0.1	[NA]	<0.1	<0.1
Chromium	04-001	mg/kg	36	[NA]	22	34
Copper	04-001	mg/kg	24	[NA]	9.8	16
Iron	04-001	mg/kg	35,000	[NA]	20,000	29,000
Lead	04-001	mg/kg	12	[NA]	6.1	11
Mercury	04-002	mg/kg	0.10	[NA]	0.03	0.05
Nickel	04-001	mg/kg	23	[NA]	13	18
Phosphorus*	04-001	mg/kg	660	[NA]	350	480
Silver	04-001	mg/kg	0.14	[NA]	<0.1	<0.1
Zinc	04-001	mg/kg	74	[NA]	37	55
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	15	[NA]	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	30	[NA]	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
p,p'-DDE	04-024	µg/kg	3.0	[NA]	<1.0	1.0
p,p'-DDT	04-024	µg/kg	<3	[NA]	<3	<3
Dieldrin	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
Endrin	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/40	/41	/42	/43
Client Reference:	-	-	B16-1	B3	B16-1	B13-8
Date Sampled:	-	-	10:00 26/08/2016	10:00 26/08/2016	10:10 26/08/2016	10:30 26/08/2016
Analysis Description	**Method**	**Units**				
Endrin aldehyde	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
Heptachlor	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<3	[NA]	<3	<3
Oxychlordane*	04-024	µg/kg	<1.0	[NA]	<1.0	<1.0
Surrogate Recovery	04-024	%	95	[NA]	96	95
Date Extracted	04-024	-	30/08/2016	[NA]	30/08/2016	30/08/2016
Date Analysed	04-024	-	1/09/2016	[NA]	2/09/2016	2/09/2016
Organotins						
Monobutyl tin	04-026	µgSn/kg	2.1	[NA]	0.60	1.2
Dibutyl tin	04-026	µgSn/kg	1.6	[NA]	<0.50	0.70
Tributyl tin	04-026	µgSn/kg	0.80	[NA]	<0.50	<0.50
Surrogate 1 Recovery	04-026	%	76	[NA]	68	73
Date Extracted	04-026	-	2/09/2016	[NA]	2/09/2016	2/09/2016
Date Analysed	04-026	-	3/09/2016	[NA]	3/09/2016	3/09/2016
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	[NA]	<10	[NA]	<10
TPH C10-14	04-020	mg/kg	[NA]	[NA]	[NA]	<10
TPH C15-28	04-020	mg/kg	[NA]	[NA]	[NA]	<50
TPH C29-36	04-020	mg/kg	[NA]	[NA]	[NA]	<50
Surrogate Recovery	04-020	%	[NA]	103	[NA]	115
Date Extracted	04-020	-	[NA]	5/09/2016	[NA]	30/08/2016
Date Analysed	04-020	-	[NA]	5/09/2016	[NA]	1/09/2016
BTEX						
Benzene	04-021	mg/kg	[NA]	<0.20	[NA]	[NA]
Toluene	04-021	mg/kg	[NA]	<0.20	[NA]	[NA]
Ethyl Benzene	04-021	mg/kg	[NA]	<0.20	[NA]	[NA]
m+p xylenes	04-021	mg/kg	[NA]	<0.40	[NA]	[NA]
o-xylene	04-021	mg/kg	[NA]	<0.20	[NA]	[NA]
Total BTEX	04-021	mg/kg	[NA]	<1.2	[NA]	[NA]
Surrogate 1 Recovery	04-021	%	[NA]	103	[NA]	[NA]

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Laboratory Reference:	-	-	/40	/41	/42	/43
Client Reference:	-	-	B16-1	B3	B16-1	B13-8
Date Sampled:	-	-	10:00 26/08/2016	10:00 26/08/2016	10:10 26/08/2016	10:30 26/08/2016
Analysis Description	**Method**	**Units**				
Surrogate 2 Recovery	04-021	%	[NA]	81	[NA]	[NA]
Surrogate 3 Recovery	04-021	%	[NA]	96	[NA]	[NA]
Date Extracted	04-021	-	[NA]	5/09/2016	[NA]	[NA]
Date Analysed	04-021	-	[NA]	6/09/2016	[NA]	[NA]
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
1-Methylnaphthalene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
2-Methylnaphthalene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
Acenaphthylene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
Acenaphthene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
Fluorene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
Phenanthrene	04-022	µg/kg	[NA]	[NA]	[NA]	14
Anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
Fluoranthene	04-022	µg/kg	[NA]	[NA]	[NA]	42
Pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	47
Benz(a)anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	21
Chrysene	04-022	µg/kg	[NA]	[NA]	[NA]	22
Benzo(b)&(k)fluoranthene	04-022	µg/kg	[NA]	[NA]	[NA]	49
Benzo(a)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	29
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	20
Dibenz(a,h)anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	<5.0
Benzo(g,h,i)perylene	04-022	µg/kg	[NA]	[NA]	[NA]	20
Coronene	04-022	µg/kg	[NA]	[NA]	[NA]	<10
Benzo(e)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	18
Perylene	04-022	µg/kg	[NA]	[NA]	[NA]	27
Total PAHs (as above)	04-022	µg/kg	[NA]	[NA]	[NA]	310
Surrogate 1 Recovery	04-022	%	[NA]	[NA]	[NA]	90
Surrogate 2 Recovery	04-022	%	[NA]	[NA]	[NA]	84
Surrogate 3 Recovery	04-022	%	[NA]	[NA]	[NA]	96
Date Extracted	04-022	-	[NA]	[NA]	[NA]	30/08/2016
Date Analysed	04-022	-	[NA]	[NA]	[NA]	1/09/2016
Polychlorinated Biphenyls						

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Laboratory Reference:	-	-	/40	/41	/42	/43
Client Reference:	-	-	B16-1	B3	B16-1	B13-8
Date Sampled:	-	-	10:00 26/08/2016	10:00 26/08/2016	10:10 26/08/2016	10:30 26/08/2016
Analysis Description	**Method**	**Units**				
Mono-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Di-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Tri-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Tetra-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Penta-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Hexa-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Hepta-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Octa-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Nona-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Deca-PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Total PCB congeners	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Surrogate 1 Recovery	04-029	%	[NA]	[NA]	[NA]	91
Surrogate 2 Recovery	04-029	%	[NA]	[NA]	[NA]	98
Date Extracted	04-029	-	[NA]	[NA]	[NA]	30/08/2016
Date Analysed	04-029	-	[NA]	[NA]	[NA]	1/09/2016
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.5	[NA]	0.50	1.2
Nitrate as N^	SUB	mg/kg	[NA]	[NA]	[NA]	<0.1
Nitrite as N^	SUB	mg/kg	[NA]	[NA]	[NA]	<0.1
Total Kjeldahl Nitrogen^	SUB	mg/kg	[NA]	[NA]	[NA]	220
Total Nitrogen^	SUB	mg/kg	[NA]	[NA]	[NA]	220
Gross Alpha^	SUB	mBq/g	[NA]	[NA]	[NA]	See comments
Gross Beta^	SUB	mBq/g	[NA]	[NA]	[NA]	See comments
Particle Size Distribution^	SUB		See comments	[NA]	See comments	See comments
Chromium Reducible Suite^	SUB		[NA]	[NA]	[NA]	See Comments

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: Client Reference: Date Sampled: Analysis Description	- - - Method	- - - Units	/44 B13-5 10:50 26/08/2016	/45 B13-4A 11:15 26/08/2016	/46 B13-4B 11:15 26/08/2016	/47 B13-4C 11:15 26/08/2016
Moisture Content						
Moisture Content	04-004	%	47.2	31.3	29.2	21.1
Trace Elements						
Aluminium	04-001	mg/kg	15,000	8,700	8,400	5,600
Arsenic	04-001	mg/kg	6.3	5.1	5.0	4.0
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	31	19	18	14
Copper	04-001	mg/kg	16	12	8.6	16
Iron	04-001	mg/kg	28,000	19,000	19,000	15,000
Lead	04-001	mg/kg	12	11	6.3	15
Mercury	04-002	mg/kg	0.09	0.02	0.02	0.02
Nickel	04-001	mg/kg	15	11	11	8.4
Phosphorus*	04-001	mg/kg	450	320	310	270
Silver	04-001	mg/kg	0.22	<0.1	<0.1	<0.1
Zinc	04-001	mg/kg	57	56	76	79
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDE	04-024	µg/kg	2.0	<1.0	<1.0	<1.0
p,p'-DDT	04-024	µg/kg	<3	<3	<3	<3
Dieldrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/44	/45	/46	/47
Client Reference:	-	-	B13-5	B13-4A	B13-4B	B13-4C
Date Sampled:	-	-	10:50 26/08/2016	11:15 26/08/2016	11:15 26/08/2016	11:15 26/08/2016
Analysis Description	**Method**	**Units**				
Endrin aldehyde	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<3	<3	<3	<3
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	97	98	116	102
Date Extracted	04-024	-	30/08/2016	30/08/2016	30/08/2016	30/08/2016
Date Analysed	04-024	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Organotins						
Monobutyl tin	04-026	µgSn/kg	1.0	<0.50	<0.50	<0.50
Dibutyl tin	04-026	µgSn/kg	0.60	<0.50	<0.50	<0.50
Tributyl tin	04-026	µgSn/kg	<0.50	<0.50	<0.50	<0.50
Surrogate 1 Recovery	04-026	%	73	70	74	71
Date Extracted	04-026	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Date Analysed	04-026	-	3/09/2016	3/09/2016	3/09/2016	3/09/2016
Total Petroleum Hydrocarbons						
BTEX						
Poly Aromatic Hydrocarbons						
Polychlorinated Biphenyls						
Subcontract Analysis						
Total Organic Carbon^	SUB	%	0.95	0.49	0.38	0.25
Particle Size Distribution^	SUB		See comments	See comments	[NA]	[NA]

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/48	/49
Client Reference:	-	-	B13-1	B9-1
Date Sampled:	-	-	12:00 26/08/2016	24/08/2016
Analysis Description	**Method**	**Units**		
Moisture Content				
Moisture Content	04-004	%	41.3	37.1
Trace Elements				
Aluminium	04-001	mg/kg	13,000	12,000
Arsenic	04-001	mg/kg	6.1	4.9
Cadmium	04-001	mg/kg	<0.1	<0.1
Chromium	04-001	mg/kg	27	30
Copper	04-001	mg/kg	12	18
Iron	04-001	mg/kg	26,000	26,000
Lead	04-001	mg/kg	7.2	7.6
Mercury	04-002	mg/kg	0.04	0.04
Nickel	04-001	mg/kg	15	21
Phosphorus*	04-001	mg/kg	390	450
Silver	04-001	mg/kg	<0.1	<0.1
Zinc	04-001	mg/kg	42	60
Organochlorine Pesticides				
Aldrin	04-024	µg/kg	<1.0	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	<1.0
p,p'-DDE	04-024	µg/kg	<1.0	1.0
p,p'-DDT	04-024	µg/kg	<3	<3
Dieldrin	04-024	µg/kg	<1.0	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0
Endrin	04-024	µg/kg	<1.0	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/48** **B13-1** **12:00** **26/08/2016**	**/49** **B9-1** **24/08/2016**
Endrin aldehyde	04-024	µg/kg	<1.0	<1.0
Heptachlor	04-024	µg/kg	<1.0	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0
Methoxychlor	04-024	µg/kg	<3	<3
Oxychlordane*	04-024	µg/kg	<1.0	<1.0
Surrogate Recovery	04-024	%	123	97
Date Extracted	04-024	-	30/08/2016	30/08/2016
Date Analysed	04-024	-	2/09/2016	2/09/2016
Organotins				
Monobutyl tin	04-026	µgSn/kg	<0.50	1.0
Dibutyl tin	04-026	µgSn/kg	<0.50	0.70
Tributyl tin	04-026	µgSn/kg	<0.50	1.2
Surrogate 1 Recovery	04-026	%	69	66
Date Extracted	04-026	-	2/09/2016	2/09/2016
Date Analysed	04-026	-	3/09/2016	3/09/2016
Total Petroleum Hydrocarbons				
TPH C6-C9	04-021	mg/kg	<10	<10
TPH C10-14	04-020	mg/kg	<10	<10
TPH C15-28	04-020	mg/kg	<50	<50
TPH C29-36	04-020	mg/kg	<50	<50
Surrogate Recovery	04-020	%	134	115
Date Extracted	04-020	-	30/08/2016	30/08/2016
Date Analysed	04-020	-	1/09/2016	1/09/2016
BTEX				
Poly Aromatic Hydrocarbons				
Naphthalene	04-022	µg/kg	7.0	<5.0
1-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0
2-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0
Acenaphthylene	04-022	µg/kg	<5.0	<5.0
Acenaphthene	04-022	µg/kg	12	<5.0
Fluorene	04-022	µg/kg	11	<5.0

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	**/48**	**/49**
Client Reference:	-	-	**B13-1**	**B9-1**
Date Sampled:	-	-	**12:00 26/08/2016**	**24/08/2016**
Analysis Description	**Method**	**Units**		
Phenanthrene	04-022	µg/kg	130	13
Anthracene	04-022	µg/kg	29	<5.0
Fluoranthene	04-022	µg/kg	210	35
Pyrene	04-022	µg/kg	230	33
Benz(a)anthracene	04-022	µg/kg	80	16
Chrysene	04-022	µg/kg	75	16
Benzo(b)&(k)fluoranthene	04-022	µg/kg	130	34
Benzo(a)pyrene	04-022	µg/kg	95	20
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	58	14
Dibenz(a,h)anthracene	04-022	µg/kg	10	<5.0
Benzo(g,h,i)perylene	04-022	µg/kg	60	15
Coronene	04-022	µg/kg	10	<10
Benzo(e)pyrene	04-022	µg/kg	47	12
Perylene	04-022	µg/kg	42	30
Total PAHs (as above)	04-022	µg/kg	1,230	240
Surrogate 1 Recovery	04-022	%	101	92
Surrogate 2 Recovery	04-022	%	98	88
Surrogate 3 Recovery	04-022	%	111	94
Date Extracted	04-022	-	30/08/2016	30/08/2016
Date Analysed	04-022	-	1/09/2016	1/09/2016
Polychlorinated Biphenyls				
Mono-PCB congeners	04-029	µg/kg	<5.0	<5.0
Di-PCB congeners	04-029	µg/kg	<5.0	<5.0
Tri-PCB congeners	04-029	µg/kg	<5.0	<5.0
Tetra-PCB congeners	04-029	µg/kg	<5.0	<5.0
Penta-PCB congeners	04-029	µg/kg	<5.0	<5.0
Hexa-PCB congeners	04-029	µg/kg	<5.0	<5.0
Hepta-PCB congeners	04-029	µg/kg	<5.0	<5.0
Octa-PCB congeners	04-029	µg/kg	<5.0	<5.0
Nona-PCB congeners	04-029	µg/kg	<5.0	<5.0
Deca-PCB congeners	04-029	µg/kg	<5.0	<5.0
Total PCB congeners	04-029	µg/kg	<5.0	<5.0

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Batch Number: A16/3433-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	**/48**	**/49**
Client Reference:	-	-	**B13-1**	**B9-1**
Date Sampled:	-	-	**12:00 26/08/2016**	**24/08/2016**
Analysis Description	**Method**	**Units**		
Surrogate 1 Recovery	04-029	%	105	94
Surrogate 2 Recovery	04-029	%	111	101
Date Extracted	04-029	-	30/08/2016	30/08/2016
Date Analysed	04-029	-	1/09/2016	1/09/2016
Subcontract Analysis				
Total Organic Carbon^	SUB	%	94.0	0.59
Nitrate as N^	SUB	mg/kg	<0.1	<0.1
Nitrite as N^	SUB	mg/kg	<0.1	<0.1
Total Kjeldahl Nitrogen^	SUB	mg/kg	480	520
Total Nitrogen^	SUB	mg/kg	480	520
Gross Alpha^	SUB	mBq/g	See comments	See comments
Gross Beta^	SUB	mBq/g	See comments	See comments
Particle Size Distribution^	SUB		See comments	See comments
Chromium Reducible Suite^	SUB		See Comments	See Comments

Method	Method Description
04-004	Moisture by gravimetric, %
04-001	Metals by ICP-OES, mg/kg
04-002	Mercury by CVAAS, mg/kg
04-024	OC & OP Pesticides by GCMS
04-026	Organotins by GCMS, µgSn/kg
04-021	TRH C6-9 & BTEX by P&T GCMS, mg/kg
04-020	TRH by GC-FID & P&T GCMS, mg/kg
04-022	PAHs & Phenols by GCMS
04-029	PCBS (as congeners) by GCMS, µg/kg
SUB	Subcontracted Analysis

Result Comments
[<] Less than
[INS] Insufficient sample for this test
[NA] Test not required
*Analyte is not covered by NATA scope of accreditation.
For organic analyses, LORs have been raised for samples with a high moisture content.
Some sample heterogeneity suspected for sample 21. For organotin analyses, some suspected sample heterogeneity and LORs have been raised x2 for samples with a high moisture content.
CRS suite was subcontracted to Envirolab Services (NATA Number 2901); reference Envirolab certificate number 152616.
Analysis was subcontracted to Sydney Analytical Laboratories (NATA Number 1884); reference SAL report number SAL25978B.
- Spike recovery for Al and Fe could not be accurately determined due to a significant background analyte concentration.
Radionuclides were subcontracted to SGS Radiation Services ref report: ME300752

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QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aluminium	mg/kg	<5	A16/3433-A-1	2500 || 2500 || RPD: 0	A16/3433-A-1	#
Arsenic	mg/kg	<0.4	A16/3433-A-1	1.3 || 1.4 || RPD: 7	A16/3433-A-1	96%
Cadmium	mg/kg	<0.1	A16/3433-A-1	<0.1 || <0.1	A16/3433-A-1	97%
Chromium	mg/kg	<0.1	A16/3433-A-1	13 || 11 || RPD: 17	A16/3433-A-1	91%
Copper	mg/kg	<0.1	A16/3433-A-1	2.7 || 3.1 || RPD: 14	A16/3433-A-1	94%
Iron	mg/kg	<5	A16/3433-A-1	11000 || 12000 || RPD: 9	A16/3433-A-1	#
Lead	mg/kg	<0.5	A16/3433-A-1	10 || 12 || RPD: 18	A16/3433-A-1	82%
Mercury	mg/kg	<0.01	A16/3433-A-1	<0.01 || <0.01	A16/3433-A-1	108%
Nickel	mg/kg	<0.1	A16/3433-A-1	5.7 || 5.9 || RPD: 3	A16/3433-A-1	89%
Phosphorus*	mg/kg	<1	A16/3433-A-1	180 || 190 || RPD: 5	A16/3433-A-1	96%
Silver	mg/kg	<0.1	A16/3433-A-1	<0.1 || <0.1	A16/3433-A-1	101%
Zinc	mg/kg	<0.5	A16/3433-A-1	16 || 16 || RPD: 0	A16/3433-A-1	92%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	91%
alpha-BHC	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	90%
beta-BHC	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	90%
gamma-BHC (Lindane)	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	93%
delta-BHC	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	101%
cis-Chlordane	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	89%
trans-Chlordane	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	97%
p,p'-DDD	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	88%
p,p'-DDE	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	81%
p,p'-DDT	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	88%
Dieldrin	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	90%
alpha-Endosulfan	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	91%
beta-Endosulfan	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	95%
Endosulfan Sulphate	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	80%
Endrin	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	94%
Endrin ketone	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	91%
Endrin aldehyde	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	83%
Heptachlor	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	98%
Heptachlor epoxide	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	49%
Hexachlorobenzene	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	96%
Methoxychlor	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	98%
Oxychlordane*	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-21	94%
Surrogate Recovery	%	120	[NT]	[NT]	A16/3433-A-21	49%

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TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	<0.50	[NT]	[NT]	A16/3433-A-21	94%
Dibutyl tin	µgSn/kg	<0.50	[NT]	[NT]	A16/3433-A-21	88%
Tributyl tin	µgSn/kg	<0.50	[NT]	[NT]	A16/3433-A-21	75%
Surrogate 1 Recovery	%	89	[NT]	[NT]	A16/3433-A-21	75%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
TPH C6-C9	mg/kg	<10	[NT]	[NT]	A16/3433-A-21	[NA]
TPH C10-14	mg/kg	<10	[NT]	[NT]	A16/3433-A-21	104%
TPH C15-28	mg/kg	<50	[NT]	[NT]	A16/3433-A-21	103%
TPH C29-36	mg/kg	<50	[NT]	[NT]	A16/3433-A-21	98%
Surrogate Recovery	%	123	[NT]	[NT]	A16/3433-A-21	108%

TEST	UNITS	Blank
Benzene	mg/kg	<0.20
Toluene	mg/kg	<0.20
Ethyl Benzene	mg/kg	<0.20
m+p xylenes	mg/kg	<0.40
o-xylene	mg/kg	<0.20
Total BTEX	mg/kg	<1.2
Surrogate 1 Recovery	%	84
Surrogate 2 Recovery	%	88
Surrogate 3 Recovery	%	92

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Naphthalene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	92%
1-Methylnaphthalene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	100%
2-Methylnaphthalene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	100%
Acenaphthylene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	99%
Acenaphthene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	100%
Fluorene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	95%
Phenanthrene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	88%
Anthracene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	93%
Fluoranthene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	127%
Pyrene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	115%
Benz(a)anthracene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	119%
Chrysene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	105%
Benzo(b)&(k)fluoranthene	µg/kg	<10	[NT]	[NT]	A16/3433-A-21	104%
Benzo(a)pyrene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	104%
Indeno(1,2,3-cd)pyrene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	105%
Dibenz(a,h)anthracene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	95%
Benzo(g,h,i)perylene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	108%

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TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Coronene	µg/kg	<10	[NT]	[NT]	A16/3433-A-21	90%
Benzo(e)pyrene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	100%
Perylene	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	96%
Total PAHs (as above)	µg/kg	<100	[NT]	[NT]	A16/3433-A-21	[NA]
Surrogate 1 Recovery	%	107	[NT]	[NT]	A16/3433-A-21	89%
Surrogate 2 Recovery	%	90	[NT]	[NT]	A16/3433-A-21	93%
Surrogate 3 Recovery	%	113	[NT]	[NT]	A16/3433-A-21	95%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Mono-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	98%
Di-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	95%
Tri-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	98%
Tetra-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	98%
Penta-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	95%
Hexa-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	92%
Hepta-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	93%
Octa-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	95%
Nona-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	92%
Deca-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	86%
Total PCB congeners	µg/kg	<5.0	[NT]	[NT]	A16/3433-A-21	94%
Surrogate 1 Recovery	%	107	[NT]	[NT]	A16/3433-A-21	96%
Surrogate 2 Recovery	%	109	[NT]	[NT]	A16/3433-A-21	101%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results
Total Organic Carbon^	%	<0.01	A16/3433-A-12	1.8||1.6||RPD: 12
Total Nitrogen^	mg/kg	<20	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aluminium	mg/kg	<5	A16/3433-A-11	23000||23000||RPD: 0	A16/3433-A-21	#
Arsenic	mg/kg	<0.4	A16/3433-A-11	9.1||9.2||RPD: 1	A16/3433-A-21	94%
Cadmium	mg/kg	<0.1	A16/3433-A-11	<0.1||<0.1	A16/3433-A-21	100%
Chromium	mg/kg	<0.1	A16/3433-A-11	42||43||RPD: 2	A16/3433-A-21	92%
Copper	mg/kg	<0.1	A16/3433-A-11	40||40||RPD: 0	A16/3433-A-21	97%
Iron	mg/kg	<5	A16/3433-A-11	40000||39000||RPD: 3	A16/3433-A-21	#
Lead	mg/kg	<0.5	A16/3433-A-11	22||22||RPD: 0	A16/3433-A-21	80%
Mercury	mg/kg	<0.01	A16/3433-A-11	0.13||0.15||RPD: 14	A16/3433-A-21	103%
Nickel	mg/kg	<0.1	A16/3433-A-11	24||24||RPD: 0	A16/3433-A-21	83%
Phosphorus*	mg/kg	<1	A16/3433-A-11	890||890||RPD: 0	A16/3433-A-21	95%
Silver	mg/kg	<0.1	A16/3433-A-11	0.22||0.22||RPD: 0	A16/3433-A-21	102%
Zinc	mg/kg	<0.5	A16/3433-A-11	120||130||RPD: 8	A16/3433-A-21	82%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	<1.0	[NT]	[NT]	External	79%
alpha-BHC	µg/kg	<1.0	[NT]	[NT]	External	85%
beta-BHC	µg/kg	<1.0	[NT]	[NT]	External	84%
gamma-BHC (Lindane)	µg/kg	<1.0	[NT]	[NT]	External	89%
delta-BHC	µg/kg	<1.0	[NT]	[NT]	External	87%
cis-Chlordane	µg/kg	<1.0	[NT]	[NT]	External	98%
trans-Chlordane	µg/kg	<1.0	[NT]	[NT]	External	102%
p,p'-DDD	µg/kg	<1.0	[NT]	[NT]	External	97%
p,p'-DDE	µg/kg	<1.0	[NT]	[NT]	External	93%
p,p'-DDT	µg/kg	<1.0	[NT]	[NT]	External	111%
Dieldrin	µg/kg	<1.0	[NT]	[NT]	External	101%
alpha-Endosulfan	µg/kg	<1.0	[NT]	[NT]	External	102%
beta-Endosulfan	µg/kg	<1.0	[NT]	[NT]	External	105%
Endosulfan Sulphate	µg/kg	<1.0	[NT]	[NT]	External	94%
Endrin	µg/kg	<1.0	[NT]	[NT]	External	108%
Endrin ketone	µg/kg	<1.0	[NT]	[NT]	External	95%
Endrin aldehyde	µg/kg	<1.0	[NT]	[NT]	External	90%
Heptachlor	µg/kg	<1.0	[NT]	[NT]	External	92%
Heptachlor epoxide	µg/kg	<1.0	[NT]	[NT]	External	109%
Hexachlorobenzene	µg/kg	<1.0	[NT]	[NT]	External	95%
Methoxychlor	µg/kg	<1.0	[NT]	[NT]	External	112%
Oxychlordane*	µg/kg	<1.0	[NT]	[NT]	External	112%
Surrogate Recovery	%	96	[NT]	[NT]	External	95%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	<0.50	[NT]	[NT]	External	82%
Dibutyl tin	µgSn/kg	<0.50	[NT]	[NT]	External	82%
Tributyl tin	µgSn/kg	<0.50	[NT]	[NT]	External	82%
Surrogate 1 Recovery	%	87	[NT]	[NT]	External	87%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
TPH C6-C9	mg/kg	[NA]	[NT]	[NT]	External	101%
TPH C10-14	mg/kg	[NA]	[NT]	[NT]	External	101%
TPH C15-28	mg/kg	[NA]	[NT]	[NT]	External	101%
TPH C29-36	mg/kg	[NA]	[NT]	[NT]	External	96%
Surrogate Recovery	%	[NA]	[NT]	[NT]	External	107%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Naphthalene	µg/kg	[NA]	[NT]	[NT]	External	94%
1-Methylnaphthalene	µg/kg	[NA]	[NT]	[NT]	External	98%
2-Methylnaphthalene	µg/kg	[NA]	[NT]	[NT]	External	98%
Acenaphthylene	µg/kg	[NA]	[NT]	[NT]	External	91%
Acenaphthene	µg/kg	[NA]	[NT]	[NT]	External	96%
Fluorene	µg/kg	[NA]	[NT]	[NT]	External	95%
Phenanthrene	µg/kg	[NA]	[NT]	[NT]	External	94%
Anthracene	µg/kg	[NA]	[NT]	[NT]	External	87%
Fluoranthene	µg/kg	[NA]	[NT]	[NT]	External	96%
Pyrene	µg/kg	[NA]	[NT]	[NT]	External	96%
Benz(a)anthracene	µg/kg	[NA]	[NT]	[NT]	External	96%
Chrysene	µg/kg	[NA]	[NT]	[NT]	External	99%
Benzo(b)&(k)fluoranthene	µg/kg	[NA]	[NT]	[NT]	External	100%
Benzo(a)pyrene	µg/kg	[NA]	[NT]	[NT]	External	99%
Indeno(1,2,3-cd)pyrene	µg/kg	[NA]	[NT]	[NT]	External	93%
Dibenz(a,h)anthracene	µg/kg	[NA]	[NT]	[NT]	External	94%
Benzo(g,h,i)perylene	µg/kg	[NA]	[NT]	[NT]	External	98%
Coronene	µg/kg	[NA]	[NT]	[NT]	External	96%
Benzo(e)pyrene	µg/kg	[NA]	[NT]	[NT]	External	106%
Perylene	µg/kg	[NA]	[NT]	[NT]	External	93%
Total PAHs (as above)	µg/kg	[NA]	[NT]	[NT]	External	[NA]
Surrogate 1 Recovery	%	[NA]	[NT]	[NT]	External	96%
Surrogate 2 Recovery	%	[NA]	[NT]	[NT]	External	87%
Surrogate 3 Recovery	%	[NA]	[NT]	[NT]	External	99%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Mono-PCB congeners	µg/kg	[NA]	[NT]	[NT]	External	102%
Di-PCB congeners	µg/kg	[NA]	[NT]	[NT]	External	97%
Tri-PCB congeners	µg/kg	[NA]	[NT]	[NT]	External	100%
Tetra-PCB congeners	µg/kg	[NA]	[NT]	[NT]	External	97%
Penta-PCB congeners	µg/kg	[NA]	[NT]	[NT]	External	96%
Hexa-PCB congeners	µg/kg	[NA]	[NT]	[NT]	External	96%
Hepta-PCB congeners	µg/kg	[NA]	[NT]	[NT]	External	97%
Octa-PCB congeners	µg/kg	[NA]	[NT]	[NT]	External	96%
Nona-PCB congeners	µg/kg	[NA]	[NT]	[NT]	External	95%
Deca-PCB congeners	µg/kg	[NA]	[NT]	[NT]	External	93%
Total PCB congeners	µg/kg	[NA]	[NT]	[NT]	External	97%
Surrogate 1 Recovery	%	[NA]	[NT]	[NT]	External	98%
Surrogate 2 Recovery	%	[NA]	[NT]	[NT]	External	100%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Total Organic Carbon^	%	<0.01	A16/3433-A-23	1.6||1.5||RPD:6
Total Nitrogen^	mg/kg	<20	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aluminium	mg/kg	<5	A16/3433-A-21	14000||14000||RPD:0	A16/3433-A-42	#
Arsenic	mg/kg	<0.4	A16/3433-A-21	5.6||5.4||RPD:4	A16/3433-A-42	94%
Cadmium	mg/kg	<0.1	A16/3433-A-21	<0.1||<0.1	A16/3433-A-42	99%
Chromium	mg/kg	<0.1	A16/3433-A-21	29||29||RPD:0	A16/3433-A-42	92%
Copper	mg/kg	<0.1	A16/3433-A-21	17||24||RPD:34	A16/3433-A-42	96%
Iron	mg/kg	<5	A16/3433-A-21	27000||28000||RPD:4	A16/3433-A-42	#
Lead	mg/kg	<0.5	A16/3433-A-21	9.6||10||RPD:4	A16/3433-A-42	81%
Mercury	mg/kg	<0.01	A16/3433-A-21	0.09||0.09||RPD:0	A16/3433-A-42	108%
Nickel	mg/kg	<0.1	A16/3433-A-21	17||17||RPD:0	A16/3433-A-42	85%
Phosphorus*	mg/kg	<1	A16/3433-A-21	550||540||RPD:2	A16/3433-A-42	93%
Silver	mg/kg	<0.1	A16/3433-A-21	<0.1||<0.1	A16/3433-A-42	106%
Zinc	mg/kg	<0.5	A16/3433-A-21	62||64||RPD:3	A16/3433-A-42	83%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	85%
alpha-BHC	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	88%
beta-BHC	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	85%
gamma-BHC (Lindane)	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	89%
delta-BHC	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	88%
cis-Chlordane	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	104%
trans-Chlordane	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	111%
p,p'-DDD	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	102%
p,p'-DDE	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	98%
p,p'-DDT	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	105%
Dieldrin	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	105%
alpha-Endosulfan	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	105%
beta-Endosulfan	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	109%
Endosulfan Sulphate	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	94%
Endrin	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	113%
Endrin ketone	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	107%
Endrin aldehyde	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	100%
Heptachlor	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	94%
Heptachlor epoxide	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	129%
Hexachlorobenzene	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	97%
Methoxychlor	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	95%
Oxychlordane*	µg/kg	<1.0	[NT]	[NT]	A16/3433-A-42	127%
Surrogate Recovery	%	109	[NT]	[NT]	A16/3433-A-42	111%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	<0.50	[NT]	[NT]	A16/3433-A-42	96%
Dibutyl tin	µgSn/kg	<0.50	[NT]	[NT]	A16/3433-A-42	90%
Tributyl tin	µgSn/kg	<0.50	[NT]	[NT]	A16/3433-A-42	74%
Surrogate 1 Recovery	%	86	[NT]	[NT]	A16/3433-A-42	77%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Total Organic Carbon^	%	<0.01	A16/3433-A-35	1.2||1.2||RPD: 0
Total Nitrogen^	mg/kg	<20	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aluminium	mg/kg	[NT]	A16/3433-A-32	15000||15000||RPD: 0
Arsenic	mg/kg	[NT]	A16/3433-A-32	5.4||6.0||RPD: 11
Cadmium	mg/kg	[NT]	A16/3433-A-32	<0.1||<0.1
Chromium	mg/kg	[NT]	A16/3433-A-32	30||29||RPD: 3
Copper	mg/kg	[NT]	A16/3433-A-32	19||19||RPD: 0
Iron	mg/kg	[NT]	A16/3433-A-32	28000||27000||RPD: 4
Lead	mg/kg	[NT]	A16/3433-A-32	9.8||9.7||RPD: 1
Mercury	mg/kg	[NT]	A16/3433-A-32	0.07||0.07||RPD: 0
Nickel	mg/kg	[NT]	A16/3433-A-32	17||17||RPD: 0
Phosphorus*	mg/kg	[NT]	A16/3433-A-32	520||540||RPD: 4
Silver	mg/kg	[NT]	A16/3433-A-32	<0.1||<0.1
Zinc	mg/kg	[NT]	A16/3433-A-32	66||65||RPD: 2

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	80%
alpha-BHC	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	86%
beta-BHC	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	86%
gamma-BHC (Lindane)	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	89%
delta-BHC	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	87%
cis-Chlordane	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	99%
trans-Chlordane	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	103%
p,p'-DDD	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	96%
p,p'-DDE	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	91%
p,p'-DDT	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	113%
Dieldrin	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	111%
alpha-Endosulfan	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	103%
beta-Endosulfan	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	106%
Endosulfan Sulphate	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	94%
Endrin	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	107%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Endrin ketone	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	98%
Endrin aldehyde	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	93%
Heptachlor	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	92%
Heptachlor epoxide	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	124%
Hexachlorobenzene	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	97%
Methoxychlor	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	117%
Oxychlordane*	µg/kg	[NT]	[NT]	[NT]	A16/3433-A-1	127%
Surrogate Recovery	%	[NT]	[NT]	[NT]	A16/3433-A-1	99%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	[NT]	[NT]	[NT]	A16/3433-A-1	92%
Dibutyl tin	µgSn/kg	[NT]	[NT]	[NT]	A16/3433-A-1	86%
Tributyl tin	µgSn/kg	[NT]	[NT]	[NT]	A16/3433-A-1	88%
Surrogate 1 Recovery	%	[NT]	[NT]	[NT]	A16/3433-A-1	87%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
TPH C6-C9	mg/kg	[NT]	[NT]	[NT]	A16/3433-A-5	95%
TPH C10-14	mg/kg	[NT]	[NT]	[NT]	A16/3433-A-5	[NT]
TPH C15-28	mg/kg	[NT]	[NT]	[NT]	A16/3433-A-5	[NT]
TPH C29-36	mg/kg	[NT]	[NT]	[NT]	A16/3433-A-5	[NT]
Surrogate Recovery	%	[NT]	[NT]	[NT]	A16/3433-A-5	75%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aluminium	mg/kg	[NT]	A16/3433-A-42	11000 || 10000 || RPD: 10
Arsenic	mg/kg	[NT]	A16/3433-A-42	4.1 || 4.1 || RPD: 0
Cadmium	mg/kg	[NT]	A16/3433-A-42	<0.1 || <0.1
Chromium	mg/kg	[NT]	A16/3433-A-42	22 || 21 || RPD: 5
Copper	mg/kg	[NT]	A16/3433-A-42	9.8 || 9.5 || RPD: 3
Iron	mg/kg	[NT]	A16/3433-A-42	20000 || 20000 || RPD: 0
Lead	mg/kg	[NT]	A16/3433-A-42	6.1 || 5.6 || RPD: 9
Mercury	mg/kg	[NT]	A16/3433-A-42	0.03 || 0.03 || RPD: 0
Nickel	mg/kg	[NT]	A16/3433-A-42	13 || 12 || RPD: 8
Phosphorus*	mg/kg	[NT]	A16/3433-A-42	350 || 340 || RPD: 3
Silver	mg/kg	[NT]	A16/3433-A-42	<0.1 || <0.1
Zinc	mg/kg	[NT]	A16/3433-A-42	37 || 36 || RPD: 3

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	[NT]	[NT]	[NT]	External	83%
alpha-BHC	µg/kg	[NT]	[NT]	[NT]	External	89%
beta-BHC	µg/kg	[NT]	[NT]	[NT]	External	87%
gamma-BHC (Lindane)	µg/kg	[NT]	[NT]	[NT]	External	91%
delta-BHC	µg/kg	[NT]	[NT]	[NT]	External	88%
cis-Chlordane	µg/kg	[NT]	[NT]	[NT]	External	102%
trans-Chlordane	µg/kg	[NT]	[NT]	[NT]	External	107%
p,p'-DDD	µg/kg	[NT]	[NT]	[NT]	External	97%
p,p'-DDE	µg/kg	[NT]	[NT]	[NT]	External	94%
p,p'-DDT	µg/kg	[NT]	[NT]	[NT]	External	104%
Dieldrin	µg/kg	[NT]	[NT]	[NT]	External	105%
alpha-Endosulfan	µg/kg	[NT]	[NT]	[NT]	External	107%
beta-Endosulfan	µg/kg	[NT]	[NT]	[NT]	External	108%
Endosulfan Sulphate	µg/kg	[NT]	[NT]	[NT]	External	92%
Endrin	µg/kg	[NT]	[NT]	[NT]	External	108%
Endrin ketone	µg/kg	[NT]	[NT]	[NT]	External	100%
Endrin aldehyde	µg/kg	[NT]	[NT]	[NT]	External	92%
Heptachlor	µg/kg	[NT]	[NT]	[NT]	External	92%
Heptachlor epoxide	µg/kg	[NT]	[NT]	[NT]	External	114%
Hexachlorobenzene	µg/kg	[NT]	[NT]	[NT]	External	100%
Methoxychlor	µg/kg	[NT]	[NT]	[NT]	External	101%
Oxychlordane*	µg/kg	[NT]	[NT]	[NT]	External	117%
Surrogate Recovery	%	[NT]	[NT]	[NT]	External	98%

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	[NT]	[NT]	[NT]	External	90%
Dibutyl tin	µgSn/kg	[NT]	[NT]	[NT]	External	88%
Tributyl tin	µgSn/kg	[NT]	[NT]	[NT]	External	91%
Surrogate 1 Recovery	%	[NT]	[NT]	[NT]	External	93%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Total Organic Carbon^	%	[NT]	A16/3433-A-46	0.38 || 0.35 || RPD: 8
Total Nitrogen^	mg/kg	[NT]	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	[NT]	[NT]	[NT]	External	79%
alpha-BHC	µg/kg	[NT]	[NT]	[NT]	External	87%
beta-BHC	µg/kg	[NT]	[NT]	[NT]	External	83%
gamma-BHC (Lindane)	µg/kg	[NT]	[NT]	[NT]	External	87%
delta-BHC	µg/kg	[NT]	[NT]	[NT]	External	86%
cis-Chlordane	µg/kg	[NT]	[NT]	[NT]	External	97%
trans-Chlordane	µg/kg	[NT]	[NT]	[NT]	External	102%
p,p'-DDD	µg/kg	[NT]	[NT]	[NT]	External	98%
p,p'-DDE	µg/kg	[NT]	[NT]	[NT]	External	93%
p,p'-DDT	µg/kg	[NT]	[NT]	[NT]	External	99%
Dieldrin	µg/kg	[NT]	[NT]	[NT]	External	101%
alpha-Endosulfan	µg/kg	[NT]	[NT]	[NT]	External	100%
beta-Endosulfan	µg/kg	[NT]	[NT]	[NT]	External	105%
Endosulfan Sulphate	µg/kg	[NT]	[NT]	[NT]	External	94%
Endrin	µg/kg	[NT]	[NT]	[NT]	External	110%
Endrin ketone	µg/kg	[NT]	[NT]	[NT]	External	96%
Endrin aldehyde	µg/kg	[NT]	[NT]	[NT]	External	96%
Heptachlor	µg/kg	[NT]	[NT]	[NT]	External	88%
Heptachlor epoxide	µg/kg	[NT]	[NT]	[NT]	External	107%
Hexachlorobenzene	µg/kg	[NT]	[NT]	[NT]	External	90%
Methoxychlor	µg/kg	[NT]	[NT]	[NT]	External	88%
Oxychlordane*	µg/kg	[NT]	[NT]	[NT]	External	106%
Surrogate Recovery	%	[NT]	[NT]	[NT]	External	99%

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Batch Number: A16/3433-A [R00]

Project Reference: Port of Brisbane - Sediment Analysis

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyl tin	µgSn/kg	[NT]	[NT]	[NT]	External	90%
Dibutyl tin	µgSn/kg	[NT]	[NT]	[NT]	External	87%
Tributyl tin	µgSn/kg	[NT]	[NT]	[NT]	External	83%
Surrogate 1 Recovery	%	[NT]	[NT]	[NT]	External	91%

Comments:

RPD = Relative Percent Deviation

[NT] = Not Tested

[N/A] = Not Applicable

'#' = Spike recovery data could not be calculated due to high levels of contaminants

Acceptable replicate reproducibility limit or RPD: 30%

Acceptable matrix spike & LCS recovery limits: Trace elements 70-130%
Organic analyses 50-150%
SVOC & speciated phenols 10-140%
Surrogates 10-140%

When levels outside these limits are obtained, an investigation into the cause of the deviation is performed before the batch is accepted or rejected, and results are released.

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ANALYTICAL REPORT

WORLD RECOGNISED ACCREDITATION

CLIENT DETAILS

Contact	Jacob Borger
Client	AU INTERLABS
Address	5266 683 ENVI WRS PERTH 28 Reid Road Perth Airport WA 6105
Telephone	(08) 9373 3697
Facsimile	(Not specified)
Email	jacob.borger@sgs.com
Project	**9811**
Order Number	**9811**
Samples	16

LABORATORY DETAILS

Manager	Adam Atkinson
Laboratory	SGS Melbourne EH&S
Address	10/585 Blackburn Road Notting Hill Victoria 3168
Telephone	+61395743200
Facsimile	+61395743399
Email	Au.SampleReceipt.Melbourne@sgs.com
SGS Reference	**ME300752 R0**
Date Received	21/9/2016
Date Reported	4/10/2016

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 16987.

SIGNATORIES

S. Rutkowski

Stephen Rutkowski
Senior Health Physicist

Gross alpha and beta in solids [ARS-SOP-AS315/AS504] Tested: 26/9/2016

PARAMETER	UOM	LOR	A16/3433/5 B5-0 9811-1 SOIL - ME300752.001	A16/3433/8 B5-1A 9811-2 SOIL - ME300752.002	A16/3433/9 B5-1B 9811-3 SOIL - ME300752.003	A16/3433/10 B5-1C 9811-4 SOIL - ME300752.004	A16/3433/11 B6-3 9811-5 SOIL - ME300752.005
Gross alpha	Bq/g	0.07	0.31 ±0.11	0.31 ±0.11	0.23 ±0.12	0.10 ±0.08	0.19 ±0.09
Gross beta	Bq/g	0.25	0.56 ±0.19	0.54 ±0.19	0.51 ±0.16	0.37 ±0.17	0.42 ±0.18

PARAMETER	UOM	LOR	A16/3433/14 B7-1 9811-6 SOIL - ME300752.006	A16/3433/17 B15-3 9811-7 SOIL - ME300752.007	A16/3433/18 B15-2 9811-8 SOIL - ME300752.008	A16/3433/20 B12-1 9811-9 SOIL - ME300752.009	A16/3433/21 B11-8 9811-10 SOIL - ME300752.010
Gross alpha	Bq/g	0.07	0.18 ±0.09	0.22 ±0.12	0.13 ±0.08	0.17 ±0.09	0.21 ±0.10
Gross beta	Bq/g	0.25	0.57 ±0.20	0.64 ±0.17	0.73 ±0.18	0.44 ±0.18	0.63 ±0.19

PARAMETER	UOM	LOR	A16/3433/27 B10-6A 9811-11 SOIL - ME300752.011	A16/3433/28 B10-6B 9811-12 SOIL - ME300752.012	A16/3433/43 B13-8 9811-13 SOIL - ME300752.013	A16/3433/48 B13-1 9811-14 SOIL - ME300752.014	A16/3433/49 B9-1 9811-15 SOIL - ME300752.015
Gross alpha	Bq/g	0.07	0.13 ±0.10	0.072 ±0.072	0.10 ±0.08	0.18 ±0.09	0.13 ±0.10
Gross beta	Bq/g	0.25	0.53 ±0.16	0.53 ±0.18	0.50 ±0.18	0.59 ±0.19	0.45 ±0.17

PARAMETER	UOM	LOR	A16/3433/21 B11-8 9811-10D SOIL - ME300752.016
Gross alpha	Bq/g	0.07	0.14 ±0.10
Gross beta	Bq/g	0.25	0.57 ±0.16

METHOD	METHODOLOGY SUMMARY
ARS-SOP-AS315/AS504	Gross alpha and gross beta in solids after preparation to meet standard calibrated geometries. Preparation involves drying, crushing and sieving where necessary.

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
		NVL	Not validated.	LOR	Limit of Reporting.
**	Indicative data, theoretical holding time exceeded.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

REPORT OF ANALYSIS

Laboratory Reference: A16/3433-B [R00]

Client: BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane QLD 4000

Contact: Brad Hiles

Order No:
Project: Port of Brisbane - Elutriate
Sample Type: Sediment
No. of Samples: 50
Date Received: 29/08/2016
Date Completed: 7/09/2016

Laboratory Contact Details:

Client Services Manager: Trent Biggin
Technical Enquiries: Andrew Bradbury
Telephone: +61 7 3268 1228
Fax: +61 7 3268 1238
Email: brisbane@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:

Rama Nimmagadda
Technical Manager

Comments:
All samples tested as submitted by client. All attached results have been checked and approved for release.
This is the Final Report and supersedes any reports previously issued with this reference number.
Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

Accreditation No.15109

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Batch Number: A16/3433-B [R00]
Project Reference: Port of Brisbane - Elutriate

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/4** **B4-0** **9:44** **24/08/2016**	**/5** **B5-0** **10:13** **24/08/2016**	**/12** **B6-2A** **12:00** **24/08/2016**	**/14** **B7-1** **12:30** **24/08/2016**
Elutriate - OCP						
Aldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
gamma-BHC (Lindane)	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
delta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
cis-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
trans-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDD	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDE	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDT	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Dieldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endosulfan Sulphate	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin ketone	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin aldehyde	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Heptachlor epoxide	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Hexachlorobenzene	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Methoxychlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Mirex	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	88	82	86	87
Date Extracted	04-072	-	1/09/2016	1/09/2016	1/09/2016	1/09/2016
Date Analysed	04-072	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	78	87	83	78
Date Extracted	04-061	-	06/09/2016	06/09/2016	06/09/2016	06/09/2016
Date Analysed	04-061	-	06/09/2016	06/09/2016	06/09/2016	06/09/2016

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Batch Number: A16/3433-B [R00]
Project Reference: Port of Brisbane - Elutriate

Laboratory Reference:	-	-	/16	/20	/21	/23
Client Reference:	-	-	B8-3	B12-1	B11-8	B11-9A
Date Sampled:	-	-	13:20 24/08/2016	9:08 25/08/2016	9:30 25/08/2016	10:00 25/08/2016
Analysis Description	**Method**	**Units**				
Elutriate - OCP						
Aldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
gamma-BHC (Lindane)	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
delta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
cis-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
trans-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDD	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDE	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDT	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Dieldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endosulfan Sulphate	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin ketone	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin aldehyde	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Heptachlor epoxide	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Hexachlorobenzene	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Methoxychlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Mirex	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	75	85	92	85
Date Extracted	04-072	-	1/09/2016	1/09/2016	1/09/2016	1/09/2016
Date Analysed	04-072	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	81	80	76	75
Date Extracted	04-061	-	06/09/2016	06/09/2016	06/09/2016	06/09/2016
Date Analysed	04-061	-	06/09/2016	06/09/2016	06/09/2016	06/09/2016

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Batch Number: A16/3433-B [R00]
Project Reference: Port of Brisbane - Elutriate

Laboratory Reference:	-	-	/26	/27	/30	/50
Client Reference:	-	-	B10-8	B10-6A	B10-5	Elutriate Blank
Date Sampled:	-	-	11:00 25/08/2016	11:30 25/08/2016	12:00 25/08/2016	26/08/2016
Analysis Description	**Method**	**Units**				
Elutriate - OCP						
Aldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
gamma-BHC (Lindane)	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
delta-BHC	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
cis-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
trans-Chlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDD	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDE	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
p,p'-DDT	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Dieldrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
alpha-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
beta-Endosulfan	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endosulfan Sulphate	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin ketone	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Endrin aldehyde	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Heptachlor epoxide	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Hexachlorobenzene	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Methoxychlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Mirex	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	93	90	95	98
Date Extracted	04-072	-	1/09/2016	1/09/2016	1/09/2016	1/09/2016
Date Analysed	04-072	-	2/09/2016	2/09/2016	2/09/2016	2/09/2016
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	80	81	80	107
Date Extracted	04-061	-	06/09/2016	06/09/2016	06/09/2016	06/09/2016
Date Analysed	04-061	-	06/09/2016	06/09/2016	06/09/2016	06/09/2016

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Batch Number: A16/3433-B [R00]
Project Reference: Port of Brisbane - Elutriate

Method	Method Description
04-072	Pesticides in waters by GCMS, µg/L
04-061	Determination of Tributyltin in saline waters by GCMS

Result Comments
[<] Less than
[INS] Insufficient sample for this test
[NA] Test not required
*Analyte is not covered by NATA scope of accreditation.

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Batch Number: A16/3433-B [R00]
Project Reference: Port of Brisbane - Elutriate

QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/L	<0.03	[NT]	[NT]	External	87%
alpha-BHC	µg/L	<0.03	[NT]	[NT]	External	92%
beta-BHC	µg/L	<0.03	[NT]	[NT]	External	91%
gamma-BHC (Lindane)	µg/L	<0.03	[NT]	[NT]	External	93%
delta-BHC	µg/L	<0.03	[NT]	[NT]	External	93%
cis-Chlordane	µg/L	<0.03	[NT]	[NT]	External	90%
trans-Chlordane	µg/L	<0.03	[NT]	[NT]	External	90%
p,p'-DDD	µg/L	<0.03	[NT]	[NT]	External	89%
p,p'-DDE	µg/L	<0.03	[NT]	[NT]	External	93%
p,p'-DDT	µg/L	<0.03	[NT]	[NT]	External	78%
Dieldrin	µg/L	<0.03	[NT]	[NT]	External	96%
alpha-Endosulfan	µg/L	<0.03	[NT]	[NT]	External	90%
beta-Endosulfan	µg/L	<0.03	[NT]	[NT]	External	93%
Endosulfan Sulphate	µg/L	<0.03	[NT]	[NT]	External	89%
Endrin	µg/L	<0.03	[NT]	[NT]	External	93%
Endrin ketone	µg/L	<0.03	[NT]	[NT]	External	90%
Endrin aldehyde	µg/L	<0.1	[NT]	[NT]	External	79%
Heptachlor	µg/L	<0.03	[NT]	[NT]	External	78%
Heptachlor epoxide	µg/L	<0.03	[NT]	[NT]	External	95%
Hexachlorobenzene	µg/L	<0.03	[NT]	[NT]	External	81%
Methoxychlor	µg/L	<0.1	[NT]	[NT]	External	79%
Mirex	µg/L	<0.03	[NT]	[NT]	External	94%
Surrogate Recovery	%	98	[NT]	[NT]	External	88%

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Batch Number: A16/3433-B [R00]
Project Reference: Port of Brisbane - Elutriate

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Tributyltin	µgSn/L	<0.0050	[NT]	[NT]	External	77%
Surrogate Recovery	%	92	[NT]	[NT]	External	80%
Date Extracted	-	06/09/2016	[NT]	[NT]	External	06/09/2016
Date Analysed	-	06/09/2016	[NT]	[NT]	External	06/09/2016

Comments:
RPD = Relative Percent Deviation
[NT] = Not Tested
[N/A] = Not Applicable
'#' = Spike recovery data could not be calculated due to high levels of contaminants
Acceptable replicate reproducibility limit or RPD: 30%
Acceptable matrix spike & LCS recovery limits: Trace elements 70-130%
Organic analyses 50-150%
SVOC & speciated phenols 10-140%
Surrogates 10-140%
When levels outside these limits are obtained, an investigation into the cause of the deviation is performed before the batch is accepted or rejected, and results are released.

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REPORT OF ANALYSIS

Laboratory Reference: A16/3433-C [R00]

Client: BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane QLD 4000

Contact: Brad Hiles

Order No:
Project: Port of Brisbane - Porewater
Sample Type: Sediment
No. of Samples: 49
Date Received: 29/08/2016
Date Completed: 13/09/2016

Laboratory Contact Details:

Client Services Manager: Trent Biggin
Technical Enquiries: Andrew Bradbury
Telephone: +61 7 3268 1228
Fax: +61 7 3268 1238
Email: brisbane@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:

Rama Nimmagadda
Technical Manager

Comments:
All samples tested as submitted by client. All attached results have been checked and approved for release.
This is the Final Report and supersedes any reports previously issued with this reference number.
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ilac-MRA NATA Accreditation No.15109

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Batch Number: A16/3433-C [R00]
Project Reference: Port of Brisbane - Porewater

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/4** **B4-0** **9:44** **24/08/2016**	**/5** **B5-0** **10:13** **24/08/2016**	**/6** **B5-0B** **10:13** **24/08/2016**	**/12** **B6-2A** **12:00** **24/08/2016**
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	78	72	95	87
Date Extracted	04-061	-	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Date Analysed	04-061	-	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Organochlorine Pesticides						
Aldrin	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
alpha-BHC	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
beta-BHC	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
gamma-BHC (Lindane)	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
delta-BHC	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
cis-Chlordane	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
trans-Chlordane	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
p,p'-DDD	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Dieldrin	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
alpha-Endosulfan	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
beta-Endosulfan	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endrin	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endrin ketone	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endrin aldehyde	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Hexachlorobenzene	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Methoxychlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Mirex	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Surrogate Recovery	04-072	%	91	89	84	89
Date Extracted	04-072	-	8/09/2016	8/09/2016	8/09/2016	8/09/2016
Date Analysed	04-072	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016

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Batch Number: A16/3433-C [R00]
Project Reference: Port of Brisbane - Porewater

Laboratory Reference:	-	-	/14	/16	/20	/21
Client Reference:	-	-	B7-1	B8-3	B12-1	B11-8
Date Sampled:	-	-	12:30 24/08/2016	13:20 24/08/2016	9:08 25/08/2016	9:30 25/08/2016
Analysis Description	**Method**	**Units**				
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	83	88	94	92
Date Extracted	04-061	-	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Date Analysed	04-061	-	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Organochlorine Pesticides						
Aldrin	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
alpha-BHC	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
beta-BHC	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
gamma-BHC (Lindane)	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
delta-BHC	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
cis-Chlordane	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
trans-Chlordane	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
p,p'-DDD	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Dieldrin	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
alpha-Endosulfan	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
beta-Endosulfan	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endrin	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endrin ketone	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endrin aldehyde	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Hexachlorobenzene	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Methoxychlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Mirex	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Surrogate Recovery	04-072	%	87	91	83	68
Date Extracted	04-072	-	8/09/2016	8/09/2016	8/09/2016	8/09/2016
Date Analysed	04-072	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016

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Batch Number: A16/3433-C [R00]
Project Reference: Port of Brisbane - Porewater

Laboratory Reference:	-	-	/22	/23	/26	/27
Client Reference:	-	-	11-8B	B11-9A	B10-8	B10-6A
Date Sampled:	-	-	9:30 25/08/2016	10:00 25/08/2016	11:00 25/08/2016	11:30 25/08/2016
Analysis Description	**Method**	**Units**				
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	76	76	88	87
Date Extracted	04-061	-	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Date Analysed	04-061	-	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Organochlorine Pesticides						
Aldrin	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
alpha-BHC	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
beta-BHC	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
gamma-BHC (Lindane)	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
delta-BHC	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
cis-Chlordane	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
trans-Chlordane	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
p,p'-DDD	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Dieldrin	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
alpha-Endosulfan	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
beta-Endosulfan	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endrin	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endrin ketone	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endrin aldehyde	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Hexachlorobenzene	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Methoxychlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Mirex	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Surrogate Recovery	04-072	%	91	84	87	87
Date Extracted	04-072	-	8/09/2016	8/09/2016	8/09/2016	8/09/2016
Date Analysed	04-072	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016

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Batch Number: A16/3433-C [R00]
Project Reference: Port of Brisbane - Porewater

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/30** **B10-5** **12:00** **25/08/2016**	**/31** **B10-5B** **12:00** **25/08/2016**	**/39** **B13-9** **9:20** **26/08/2016**	**/43** **B13-8** **10:30** **26/08/2016**
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	90	88	96	97
Date Extracted	04-061	-	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Date Analysed	04-061	-	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Organochlorine Pesticides						
Aldrin	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
alpha-BHC	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
beta-BHC	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
gamma-BHC (Lindane)	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
delta-BHC	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
cis-Chlordane	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
trans-Chlordane	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
p,p'-DDD	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Dieldrin	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
alpha-Endosulfan	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
beta-Endosulfan	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endrin	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endrin ketone	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Endrin aldehyde	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Hexachlorobenzene	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Methoxychlor	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Mirex	04-072	µg/L	<0.1	<0.1	<0.1	<0.1
Surrogate Recovery	04-072	%	88	86	82	79
Date Extracted	04-072	-	8/09/2016	8/09/2016	8/09/2016	8/09/2016
Date Analysed	04-072	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016

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Batch Number: A16/3433-C [R00]
Project Reference: Port of Brisbane - Porewater

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	**-** **-** **-** **Method**	**-** **-** **-** **Units**	**/44** **B13-5** **10:50** **26/08/2016**	**/48** **B13-1** **12:00** **26/08/2016**
Tributyltin Analysis				
Tributyltin	04-061	µgSn/L	[NA]	<0.0050
Surrogate Recovery	04-061	%	[NA]	94
Date Extracted	04-061	-	[NA]	9/09/2016
Date Analysed	04-061	-	[NA]	9/09/2016
Organochlorine Pesticides				
Aldrin	04-072	µg/L	NA	<0.1
alpha-BHC	04-072	µg/L	NA	<0.1
beta-BHC	04-072	µg/L	NA	<0.1
gamma-BHC (Lindane)	04-072	µg/L	NA	<0.1
delta-BHC	04-072	µg/L	NA	<0.1
cis-Chlordane	04-072	µg/L	NA	<0.1
trans-Chlordane	04-072	µg/L	NA	<0.1
p,p'-DDD	04-072	µg/L	NA	<0.1
p,p'-DDE	04-072	µg/L	NA	<0.1
p,p'-DDT	04-072	µg/L	NA	<0.1
Dieldrin	04-072	µg/L	NA	<0.1
alpha-Endosulfan	04-072	µg/L	NA	<0.1
beta-Endosulfan	04-072	µg/L	NA	<0.1
Endosulfan Sulphate	04-072	µg/L	NA	<0.1
Endrin	04-072	µg/L	NA	<0.1
Endrin ketone	04-072	µg/L	NA	<0.1
Endrin aldehyde	04-072	µg/L	NA	<0.1
Heptachlor	04-072	µg/L	NA	<0.1
Heptachlor epoxide	04-072	µg/L	NA	<0.1
Hexachlorobenzene	04-072	µg/L	NA	<0.1
Methoxychlor	04-072	µg/L	NA	<0.1
Mirex	04-072	µg/L	NA	<0.1
Surrogate Recovery	04-072	%	NA	86
Date Extracted	04-072	-	NA	8/09/2016
Date Analysed	04-072	-	NA	12/09/2016

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Batch Number: A16/3433-C [R00]
Project Reference: Port of Brisbane - Porewater

Method	Method Description
04-061	Determination of Tributyltin in saline waters by GCMS
04-072	Pesticides in waters by GCMS, µg/L

Result Comments
[<] Less than
[INS] Insufficient sample for this test
[NA] Test not required
*Analyte is not covered by NATA scope of accreditation.

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Batch Number: A16/3433-C [R00]
Project Reference: Port of Brisbane - Porewater

QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Tributyltin	µgSn/L	<0.0050	[NT]	[NT]	External	87%
Surrogate Recovery	%	97	[NT]	[NT]	External	91%
Date Extracted	-	9/09/2016	[NT]	[NT]	External	9/09/2016
Date Analysed	-	9/09/2016	[NT]	[NT]	External	9/09/2016

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/L	<0.1	[NT]	[NT]	External	94%
alpha-BHC	µg/L	<0.1	[NT]	[NT]	External	100%
beta-BHC	µg/L	<0.1	[NT]	[NT]	External	97%
gamma-BHC (Lindane)	µg/L	<0.1	[NT]	[NT]	External	97%
delta-BHC	µg/L	<0.1	[NT]	[NT]	External	101%
cis-Chlordane	µg/L	<0.1	[NT]	[NT]	External	91%
trans-Chlordane	µg/L	<0.1	[NT]	[NT]	External	90%
p,p'-DDD	µg/L	<0.1	[NT]	[NT]	External	95%
p,p'-DDE	µg/L	<0.1	[NT]	[NT]	External	95%
p,p'-DDT	µg/L	<0.1	[NT]	[NT]	External	91%
Dieldrin	µg/L	<0.1	[NT]	[NT]	External	97%
alpha-Endosulfan	µg/L	<0.1	[NT]	[NT]	External	90%
beta-Endosulfan	µg/L	<0.1	[NT]	[NT]	External	96%
Endosulfan Sulphate	µg/L	<0.1	[NT]	[NT]	External	93%
Endrin	µg/L	<0.1	[NT]	[NT]	External	96%
Endrin ketone	µg/L	<0.1	[NT]	[NT]	External	93%
Endrin aldehyde	µg/L	<0.1	[NT]	[NT]	External	83%
Heptachlor	µg/L	<0.1	[NT]	[NT]	External	91%
Heptachlor epoxide	µg/L	<0.1	[NT]	[NT]	External	102%
Hexachlorobenzene	µg/L	<0.1	[NT]	[NT]	External	88%
Methoxychlor	µg/L	<0.1	[NT]	[NT]	External	89%
Mirex	µg/L	<0.1	[NT]	[NT]	External	95%
Surrogate Recovery	%	99	[NT]	[NT]	External	94%

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Batch Number: A16/3433-C [R00]
Project Reference: Port of Brisbane - Porewater

Comments:
RPD = Relative Percent Deviation
[NT] = Not Tested
[N/A] = Not Applicable
'#' = Spike recovery data could not be calculated due to high levels of contaminants

Acceptable replicate reproducibility limit or RPD:	30%
Acceptable matrix spike & LCS recovery limits:	Trace elements 70-130%
	Organic analyses 50-150%
	SVOC & speciated phenols 10-140%
	Surrogates 10-140%

When levels outside these limits are obtained, an investigation into the cause of the deviation is performed before the batch is accepted or rejected, and results are released.

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REPORT OF ANALYSIS

Laboratory Reference: A16/3433-D [R00]

Client: BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane QLD 4000

Contact: Brad Hiles

Order No:
Project: Port of Brisbane -DAE
Sample Type: Sediment
No. of Samples: 49
Date Received: 29/08/2016
Date Completed: 29/09/2016

Laboratory Contact Details:

Client Services Manager: Trent Biggin
Technical Enquiries: Andrew Bradbury
Telephone: +61 7 3268 1228
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Email: brisbane@advancedanalytical.com.au
andrew.bradbury@advancedanalytical.com.au

Attached Results Approved By:

Rama Nimmagadda
Technical Manager

Comments:
All samples tested as submitted by client. All attached results have been checked and approved for release.
This is the Final Report and supersedes any reports previously issued with this reference number.
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Batch Number: A16/3433-D [R00]
Project Reference: Port of Brisbane -DAE

Laboratory Reference:	-	-	/3	/4	/8	/9
Client Reference:	-	-	B4-4	B4-0	B5-1A	B5-1B
Date Sampled:	-	-	9:23 24/08/2016	9:44 24/08/2016	11:00 24/08/2016	11:00 24/08/2016
Analysis Description	**Method**	**Units**				
Dilute Acid Extraction - Metal						
Mercury	04-002	mg/kg	0.1	0.06	0.08	0.08
Nickel	04-001	mg/kg	6.6	9.6	7.3	7.0

Laboratory Reference:	-	-	/10	/11	/12	/13
Client Reference:	-	-	B5-1C	B6-3	B6-2A	B6-2B
Date Sampled:	-	-	11:00 24/08/2016	11:51 24/08/2016	12:00 24/08/2016	12:00 24/08/2016
Analysis Description	**Method**	**Units**				
Dilute Acid Extraction - Metal						
Mercury	04-002	mg/kg	0.13	0.05	0.05	0.06
Nickel	04-001	mg/kg	7.0	5.9	7.9	6.8

Laboratory Reference:	-	-	/14	/16	/19	/23
Client Reference:	-	-	B7-1	B8-3	B12-2	B11-9A
Date Sampled:	-	-	12:30 24/08/2016	13:20 24/08/2016	8:40 25/08/2016	10:00 25/08/2016
Analysis Description	**Method**	**Units**				
Dilute Acid Extraction - Metal						
Mercury	04-002	mg/kg	0.03	0.02	0.05	0.08
Nickel	04-001	mg/kg	14	6.7	6.9	5.9

Laboratory Reference:	-	-	/24	/26	/27	/49
Client Reference:	-	-	B11-9B	B10-8	B10-6A	B9-1
Date Sampled:	-	-	10:00 25/08/2016	11:00 25/08/2016	11:30 25/08/2016	24/08/2016
Analysis Description	**Method**	**Units**				
Dilute Acid Extraction - Metal						
Mercury	04-002	mg/kg	0.04	0.04	0.03	0.03
Nickel	04-001	mg/kg	5.3	5.9	5.3	3.7

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
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contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A16/3433-D [R00]
Project Reference: Port of Brisbane -DAE

Method	Method Description
04-002	Mercury by CVAAS, mg/kg
04-001	Metals by ICP-OES, mg/kg

Result Comments
[<] Less than
[INS] Insufficient sample for this test
[NA] Test not required
*Analyte is not covered by NATA scope of accreditation.

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Batch Number: A16/3433-D [R00]
Project Reference: Port of Brisbane -DAE

QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Mercury	mg/kg	<0.01	A16/3433-D-3	0.1 || 0.1 || RPD: 0	A16/3433-D-3	100%
Nickel	mg/kg	<0.1	A16/3433-D-3	6.6 || 7.2 || RPD: 9	A16/3433-D-3	87%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mercury	mg/kg	[NT]	A16/3433-D-16	0.02 || 0.02 || RPD: 0
Nickel	mg/kg	[NT]	A16/3433-D-16	6.7 || 6.7 || RPD: 0

Comments:
RPD = Relative Percent Deviation
[NT] = Not Tested
[N/A] = Not Applicable
'#' = Spike recovery data could not be calculated due to high levels of contaminants
Acceptable replicate reproducibility limit or RPD: 30%
Acceptable matrix spike & LCS recovery limits: Trace elements 70-130%
Organic analyses 50-150%
SVOC & speciated phenols 10-140%
Surrogates 10-140%
When levels outside these limits are obtained, an investigation into the cause of the deviation is performed before the batch is accepted or rejected, and results are released.

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Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS 152616

Client:

Advanced Analytical Aust. Pty Ltd
11 Julius Ave
North Ryde
NSW 2113

Attention: Trent Biggin

Sample log in details:

Your Reference:	**A16/3433**		
No. of samples:	15 Soils		
Date samples received / completed instructions received	30/08/16	/	30/08/16

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	6/09/16	/	6/09/16
Date of Preliminary Report:	Not Issued		

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Accredited for compliance with ISO/IEC 17025 - Testing **Tests not covered by NATA are denoted with *.**

Results Approved By:

David Springer
General Manager

Chromium Suite Our Reference: Your Reference Sample ID Date Sampled Type of sample	UNITS ---------- - ---------- 	152616-1 A16/3433/5 B5-0 24/08/2016 Sediment	152616-2 A16/3433/8 B5-1A 24/08/2016 Sediment	152616-3 A16/3433/9 B5-1B 24/08/2016 Sediment	152616-4 A16/3433/10 B5-1C 24/08/2016 Sediment	152616-5 A16/3433/11 B6-3 24/08/2016 Sediment
pH kcl	pH units	8.6	8.6	8.0	8.3	8.5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
Chromium Reducible Sulfur	%w/w	0.23	0.35	0.31	0.35	0.19
a-Chromium Reducible Sulfur	moles H^+/t	140	220	190	220	120
S_{KCl}	%w/w S	0.084	0.10	0.13	0.13	0.14
ANC_{BT}	% $CaCO_3$	1.9	2.2	1.6	2.0	2.4
s-ANC_{BT}	%w/w S	0.62	0.70	0.50	0.63	0.78
s-Net Acidity	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
a-Net Acidity	moles H^+/t	<10	<10	<10	<10	<10
Liming rate	kg $CaCO_3$/t	<0.75	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+/t	140	220	190	220	120
Liming rate without ANCE	kg $CaCO_3$/t	11	16	14	16	8.9

Chromium Suite Our Reference: Your Reference	UNITS ----------	152616-6 A16/3433/14	152616-7 A16/3433/17	152616-8 A16/3433/18	152616-9 A16/3433/20	152616-10 A16/3433/21
Sample ID	----------	B7-	B15-3	B15-2	B12-1	B11-8
Date Sampled		24/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
pH $_{kcl}$	pH units	8.2	9.4	9.5	8.9	9.0
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
Chromium Reducible Sulfur	%w/w	0.16	0.08	0.04	0.24	0.19
a-Chromium Reducible Sulfur	moles H^+/t	98	51	28	150	120
S_{KCl}	%w/w S	0.095	0.039	0.030	0.085	0.079
ANC_{BT}	% $CaCO_3$	2.5	2.2	3.1	3.1	3.0
s-ANC_{BT}	%w/w S	0.82	0.70	0.98	1.0	0.95
s-Net Acidity	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
a-Net Acidity	moles H^+/t	<10	<10	<10	<10	<10
Liming rate	kg $CaCO_3$/t	<0.75	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+/t	98	51	28	150	120
Liming rate without ANCE	kg $CaCO_3$/t	7.4	3.8	2.1	11	9.0

Chromium Suite Our Reference: Your Reference	UNITS ----------	152616-11 A16/3433/27	152616-12 A16/3433/28	152616-13 A16/3433/43	152616-14 A16/3433/48	152616-15 A16/3433/49
Sample ID	----------	B10-6A	B10-6B	B13-8	B13-1	B9-1
Date Sampled		25/08/2016	25/08/2016	26/08/2016	26/08/2016	24/08/2016
Type of sample		Sediment	Sediment	Sediment	Sediment	Sediment
pH $_{kcl}$	pH units	8.8	8.9	9.0	9.2	9.1
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
Chromium Reducible Sulfur	%w/w	0.14	0.18	0.17	0.17	0.08
a-Chromium Reducible Sulfur	moles H^+/t	86	110	110	110	51
S_{KCl}	%w/w S	0.11	0.11	0.14	0.071	0.057
ANC_{BT}	% $CaCO_3$	3.6	3.7	7.0	3.1	2.4
s-ANC_{BT}	%w/w S	1.1	1.2	2.2	1.0	0.77
s-Net Acidity	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
a-Net Acidity	moles H^+/t	<10	<10	<10	<10	<10
Liming rate	kg $CaCO_3$/t	<0.75	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+/t	86	110	110	110	51
Liming rate without ANCE	kg $CaCO_3$/t	6.4	8.5	8.1	8.1	3.8

Method ID	Methodology Summary
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

QUALITY CONTROL Chromium Suite	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
pH kcl	pH units		Inorg-068	[NT]	152616-1	8.6 || 8.6 || RPD: 0	LCS-1	100%
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	152616-1	<0.01 || <0.01	[NR]	[NR]
TAA pH 6.5	moles H^+/t	5	Inorg-068	<5	152616-1	<5 || <5	LCS-1	110%
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	152616-1	0.23 || 0.24 || RPD: 4	LCS-1	97%
a-Chromium Reducible Sulfur	moles H^+/t	3	Inorg-068	<3	152616-1	140 || 150 || RPD: 7	[NR]	[NR]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NR]	[NR]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	152616-1	0.084 || 0.085 || RPD: 1	[NR]	[NR]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NR]	[NR]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	152616-1	1.9 || 1.8 || RPD: 5	[NR]	[NR]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	152616-1	0.62 || 0.57 || RPD: 8	[NR]	[NR]
s-Net Acidity	%w/w S	0.01	Inorg-068	<0.01	152616-1	<0.01 || <0.01	[NR]	[NR]
a-Net Acidity	moles H^+/t	10	Inorg-068	<10	152616-1	<10 || <10	[NR]	[NR]
Liming rate	kg $CaCO_3$/t	0.75	Inorg-068	<0.75	152616-1	<0.75 || <0.75	[NR]	[NR]
a-Net Acidity without ANCE	moles H^+/t	10	Inorg-068	<10	152616-1	140 || 150 || RPD: 7	[NR]	[NR]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	Inorg-068	<0.75	152616-1	11 || 11 || RPD: 0	[NR]	[NR]

QUALITY CONTROL Chromium Suite	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
pH kcl	pH units	152616-11	8.8 || 8.8 || RPD: 0
s-TAA pH 6.5	%w/w S	152616-11	<0.01 || <0.01
TAA pH 6.5	moles H^+/t	152616-11	<5 || <5
Chromium Reducible Sulfur	%w/w	152616-11	0.14 || 0.19 || RPD: 30
a-Chromium Reducible Sulfur	moles H^+/t	152616-11	86 || 120 || RPD: 33
S_{HCl}	%w/w S	[NT]	[NT]
S_{KCl}	%w/w S	152616-11	0.11 || 0.11 || RPD: 0
S_{NAS}	%w/w S	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	152616-11	3.6 || 4.0 || RPD: 11
s-ANC_{BT}	%w/w S	152616-11	1.1 || 1.3 || RPD: 17
s-Net Acidity	%w/w S	152616-11	<0.01 || <0.01

Client Reference: A16/3433

QUALITY CONTROL Chromium Suite	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
a-Net Acidity	moles H^+/t	152616-11	<10 || <10
Liming rate	kg $CaCO_3$/t	152616-11	<0.75 || <0.75
a-Net Acidity without ANCE	moles H^+/t	152616-11	86 || 120 || RPD: 33
Liming rate without ANCE	kg $CaCO_3$/t	152616-11	6.4 || 9.0 || RPD: 34

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NR: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Appendix D Laboratory Results – Secondary Laboratory

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1621205**	Page	: 1 of 8
Amendment	: **(Preliminary Report)**		
Client	: **BMT WBM GROUP LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR BRAD GRANT	Contact	: John Pickering
Address	: PO BOX 203 SPRING HILL BRISBANE QLD 4004	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3831 6744	Telephone	: +61 7 3552 8634
Project	: Port of Brisbane - Sediment Quality 20259	Date Samples Received	: 26-Aug-2016 14:10
Order number	: ----	Date Analysis Commenced	: 29-Aug-2016
C-O-C number	: ----	Issue Date	: 09-Sep-2016 13:15
Sampler	: BRAD HILES		
Site	: ----		
Quote number	: ----		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Greg Vogel	Laboratory Manager	Brisbane Acid Sulphate Soils, Stafford, QLD
Greg Vogel	Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Matt Frost	Senior Organic Chemist	Brisbane Inorganics, Stafford, QLD
Matt Frost	Senior Organic Chemist	Brisbane Organics, Stafford, QLD

General Comments

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

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

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

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

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

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

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

- EP131B : Particular sample #EB1621205_02 LOR is raised due to high amount of moistures is present.
- EP090 Organotin: Sample 'B10-6C' shows poor matrix spike recovery for MBT due to matrix interference.
- EP090 Organotin: High LCS recovery for MBT deemed acceptable as all associated analyte results are less than LOR.
- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.
- Radiological work undertaken by ALS Laboratory Group (Ceska Lipa) under CAI accreditation No. L1163. Report No. NATA and CAI accreditations' are both recognised under ILAC.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	B6-2C	B10-6C	----	----	----
			Client sampling date / time	24-Aug-2016 12:00	25-Aug-2016 11:30	----	----	----
Compound	CAS Number	LOR	Unit	EB1621205-001	EB1621205-002	--------	--------	--------
				Result	Result	----	----	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	8.6	----	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	<2	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	<0.02	----	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	0.262	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	163	----	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	----	2.88	----	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	----	574	----	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	----	0.92	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	1.5	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	----	<0.02	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	----	<10	----	----	----
Liming Rate	----	1	kg CaCO3/t	----	<1	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	0.26	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	163	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	12	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	54.7	62.0	----	----	----
EG005-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	21900	21600	----	----	----
Iron	7439-89-6	50	mg/kg	35500	38000	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1	mg/kg	7.49	9.15	----	----	----
Cadmium	7440-43-9	0.1	mg/kg	0.6	<0.1	----	----	----
Chromium	7440-47-3	1	mg/kg	44.3	46.5	----	----	----
Copper	7440-50-8	1	mg/kg	34.5	31.1	----	----	----
Lead	7439-92-1	1	mg/kg	16.5	18.6	----	----	----
Nickel	7440-02-0	1	mg/kg	30.8	29.2	----	----	----
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	B6-2C	B10-6C	----	----	----
			Client sampling date / time	24-Aug-2016 12:00	25-Aug-2016 11:30	----	----	----
Compound	CAS Number	LOR	Unit	EB1621205-001	EB1621205-002	--------	--------	--------
				Result	Result	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS - Continued								
Zinc	7440-66-6	1	mg/kg	**119**	**118**	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	**0.07**	**0.07**	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	**0.3**	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	**1300**	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	**1300**	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	**753**	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**1.09**	**1.12**	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	----	<10	----	----	----
C10 - C14 Fraction	----	50	mg/kg	----	<50	----	----	----
C15 - C28 Fraction	----	100	mg/kg	----	<100	----	----	----
C29 - C36 Fraction	----	100	mg/kg	----	<100	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	----	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	----	<10	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	----	<10	----	----	----
>C10 - C16 Fraction	----	50	mg/kg	----	<50	----	----	----
>C16 - C34 Fraction	----	100	mg/kg	----	<100	----	----	----
>C34 - C40 Fraction	----	100	mg/kg	----	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	----	<50	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	----	<50	----	----	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	----	<0.2	----	----	----
Toluene	108-88-3	0.5	mg/kg	----	<0.5	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg	----	<0.5	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	<0.5	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	B6-2C	B10-6C	----	----	----
			Client sampling date / time	24-Aug-2016 12:00	25-Aug-2016 11:30	----	----	----
Compound	CAS Number	LOR	Unit	EB1621205-001	EB1621205-002	--------	--------	--------
				Result	Result	----	----	----
EP080: BTEXN - Continued								
ortho-Xylene	95-47-6	0.5	mg/kg	----	<0.5	----	----	----
^ Sum of BTEX	----	0.2	mg/kg	----	<0.2	----	----	----
^ Total Xylenes	1330-20-7	0.5	mg/kg	----	<0.5	----	----	----
Naphthalene	91-20-3	1	mg/kg	----	<1	----	----	----
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	<1	----	----	----
Dibutyltin	1002-53-5	1	µgSn/kg	<1	<1	----	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg	**2.4**	**0.6**	----	----	----
EP131A: Organochlorine Pesticides								
Aldrin	309-00-2	0.5	µg/kg	<0.50	<0.50	----	----	----
alpha-BHC	319-84-6	0.5	µg/kg	<0.50	<0.50	----	----	----
beta-BHC	319-85-7	0.5	µg/kg	<0.50	<0.50	----	----	----
delta-BHC	319-86-8	0.5	µg/kg	<0.50	<0.50	----	----	----
4.4`-DDD	72-54-8	0.5	µg/kg	**0.90**	<0.50	----	----	----
4.4`-DDE	72-55-9	0.5	µg/kg	**2.31**	**0.69**	----	----	----
4.4`-DDT	50-29-3	0.5	µg/kg	<0.50	<0.50	----	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.5	µg/kg	**3.21**	**0.69**	----	----	----
Dieldrin	60-57-1	0.5	µg/kg	<0.50	<0.50	----	----	----
alpha-Endosulfan	959-98-8	0.5	µg/kg	<0.50	<0.50	----	----	----
beta-Endosulfan	33213-65-9	0.5	µg/kg	<0.50	<0.50	----	----	----
Endosulfan sulfate	1031-07-8	0.5	µg/kg	<0.50	<0.50	----	----	----
^ Endosulfan (sum)	115-29-7	0.5	µg/kg	<0.50	<0.50	----	----	----
Endrin	72-20-8	0.5	µg/kg	<0.50	<0.50	----	----	----
Endrin aldehyde	7421-93-4	0.5	µg/kg	<0.50	<0.50	----	----	----
Endrin ketone	53494-70-5	0.5	µg/kg	<0.50	<0.50	----	----	----
Heptachlor	76-44-8	0.5	µg/kg	<0.50	<0.50	----	----	----
Heptachlor epoxide	1024-57-3	0.5	µg/kg	<0.50	<0.50	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/kg	<0.50	<0.50	----	----	----
gamma-BHC	58-89-9	0.25	µg/kg	<0.25	<0.25	----	----	----
Methoxychlor	72-43-5	0.5	µg/kg	<0.50	<0.50	----	----	----
cis-Chlordane	5103-71-9	0.5	µg/kg	<0.50	<0.50	----	----	----
trans-Chlordane	5103-74-2	0.5	µg/kg	<0.50	<0.50	----	----	----
^ Total Chlordane (sum)	----	0.5	µg/kg	<0.50	<0.50	----	----	----
Oxychlordane	27304-13-8	0.5	µg/kg	<0.50	<0.50	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	B6-2C	B10-6C	----	----	----
			Client sampling date / time	24-Aug-2016 12:00	25-Aug-2016 11:30	----	----	----
Compound	CAS Number	LOR	Unit	EB1621205-001	EB1621205-002	--------	--------	--------
				Result	Result	----	----	----
EP131A: Organochlorine Pesticides - Continued								
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.5	µg/kg	<0.50	<0.50	----	----	----
EP131B: Polychlorinated Biphenyls (as Aroclors)								
^ Total Polychlorinated biphenyls	----	5	µg/kg	----	<6.2	----	----	----
Aroclor 1016	12674-11-2	5	µg/kg	----	<6.2	----	----	----
Aroclor 1221	11104-28-2	5	µg/kg	----	<6.2	----	----	----
Aroclor 1232	11141-16-5	5	µg/kg	----	<6.2	----	----	----
Aroclor 1242	53469-21-9	5	µg/kg	----	<6.2	----	----	----
Aroclor 1248	12672-29-6	5	µg/kg	----	<6.2	----	----	----
Aroclor 1254	11097-69-1	5	µg/kg	----	<6.2	----	----	----
Aroclor 1260	11096-82-5	5	µg/kg	----	<6.2	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	----	<5	----	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg	----	<5	----	----	----
Acenaphthylene	208-96-8	4	µg/kg	----	11	----	----	----
Acenaphthene	83-32-9	4	µg/kg	----	<5	----	----	----
Fluorene	86-73-7	4	µg/kg	----	6	----	----	----
Phenanthrene	85-01-8	4	µg/kg	----	39	----	----	----
Anthracene	120-12-7	4	µg/kg	----	13	----	----	----
Fluoranthene	206-44-0	4	µg/kg	----	73	----	----	----
Pyrene	129-00-0	4	µg/kg	----	70	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg	----	38	----	----	----
Chrysene	218-01-9	4	µg/kg	----	28	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	----	23	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg	----	15	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg	----	16	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg	----	25	----	----	----
Perylene	198-55-0	4	µg/kg	----	16	----	----	----
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	----	18	----	----	----
Dibenz(a.h)anthracene	53-70-3	4	µg/kg	----	6	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	----	18	----	----	----
Coronene	191-07-1	5	µg/kg	----	9	----	----	----
^ Sum of PAHs	----	4	µg/kg	----	424	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	----	77.8	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	B6-2C	B10-6C	----	----	----
				Client sampling date / time	24-Aug-2016 12:00	25-Aug-2016 11:30	----	----	----
Compound	CAS Number	LOR	Unit		EB1621205-001	EB1621205-002	--------	--------	--------
					Result	Result	----	----	----
EP080S: TPH(V)/BTEX Surrogates - Continued									
Toluene-D8	2037-26-5	0.2	%		----	**71.4**	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		----	**87.3**	----	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		**121**	**109**	----	----	----
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.5	%		**80.6**	**51.8**	----	----	----
EP131T: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.5	%		----	**48.1**	----	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		----	**120**	----	----	----
Anthracene-d10	1719-06-8	10	%		----	**117**	----	----	----
4-Terphenyl-d14	1718-51-0	10	%		----	**110**	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	53	134
Toluene-D8	2037-26-5	60	131
4-Bromofluorobenzene	460-00-4	59	127
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP131S: OC Pesticide Surrogate			
Dibromo-DDE	21655-73-2	10	119
EP131T: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	10	106
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	55	135
Anthracene-d10	1719-06-8	70	136
4-Terphenyl-d14	1718-51-0	57	127

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