BMT WBM

Port of Brisbane Sediment Sampling and Analysis Plan Implementation Report – 2017 Final Report

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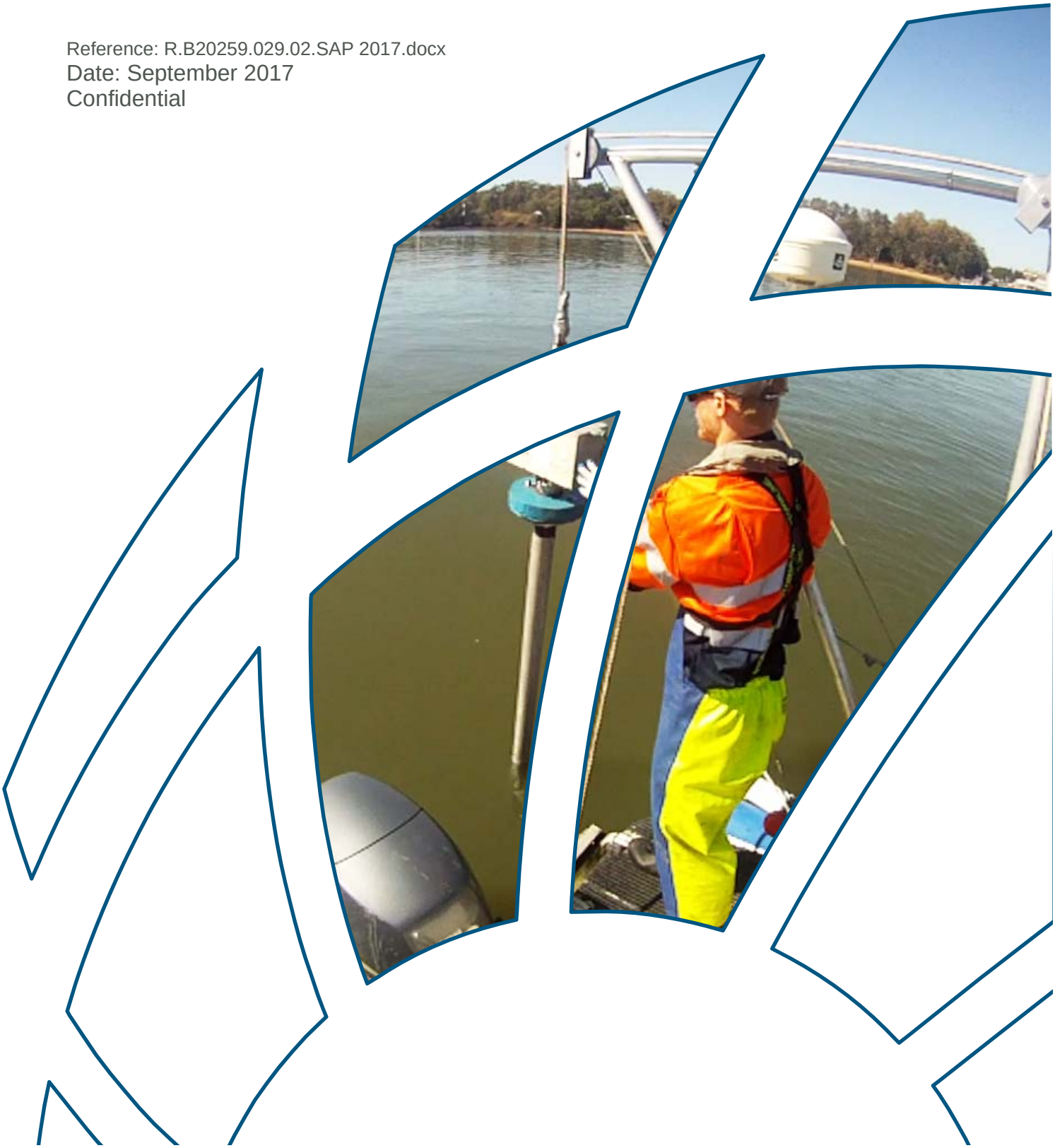

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BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane Qld 4000
Australia
PO Box 203, Spring Hill 4004

Tel: +61 7 3831 6744
Fax: + 61 7 3832 3627

ABN 54 010 830 421

www.bmtwbm.com.au

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Title:	Port of Brisbane Sediment Sampling and Analysis Plan Implementation Report – 2017 Final Report
Project Manager:	Dr Darren Richardson
Author:	Brad Hiles, Darren Richardson
Client:	Port of Brisbane Pty Ltd
Client Contact:	Jessica Rudd
Client Reference:	

Synopsis: **A report describing the physio-chemical characteristics of sediment to be dredging during the maintenance dredging program at the Port of Brisbane in 2017. 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 'Brisbane'.

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 Mud Island Dredge Material Placement Area (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. These results are consistent with sampling in 2016.

The sediments in the 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 and mercury) were less than respective NAGD screening levels, and therefore considered suitable for ocean disposal with NAGD with respect to these metals and metalloids.
- The 95% UCL nickel concentrations exceeded the NAGD screening level of 21 mg/kg within dredge Zones 2 and 3, but similar to Moreton Bay reference area. Similar nickel concentrations have been recorded previously, including reference areas unaffected by dredging and dredged material placement.
- The 95% UCL mercury concentrations exceeded the NAGD screening level of 0.15 mg/kg at zone 4 due to high concentration in a single sample (site 13-1 = 0.26 mg/kg). The 95% UCL for the overall dredge area did not exceed the NAGD screening level. The 95% UCL for all dredge sites pooled (0.11 mg/kg), Zone 2 (0.12 mg/kg) and Zone 4 (0.20 mg/kg) was greater than the reference site 80th percentile value of 0.10 mg/kg.
- The nickel and mercury concentrations recorded in 2017 were consistent with that recorded in previous surveys (2013-2016). Phase III dilute acid extraction testing was undertaken to investigate potential impacts of nickel and mercury on sediment biota. Samples containing the highest concentrations of nickel and mercury in bulk sediment were selected for analysis. Nickel concentrations were below NAGD screening levels for all samples, and mercury was below the limit of reporting. In accordance with NAGD, the sediments in the proposed dredge zones are characterised as suitable for ocean disposal with respect to nickel and mercury.
- All organic contaminants including organotins, Total Petroleum Hydrocarbons (TPHs), Polyaromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs) and organochlorine pesticides (OCPs) had concentrations below the LOR or the 95% UCLs were below the respective NAGD screening levels. In

contrast with previous survey results, no OCPs were detected, reflecting either laboratory errors or possibly dispersal/burial of OCPs resulting from flooding associated with ex Tropical Cyclone Debbie.

- 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 2017. 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 only kilometres to the 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).

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

Sampling was undertaken on the 11th July 2017 (Moreton Bay reference sites and DMPA) and 4th to 7th August 2017 (all other sites). All 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).

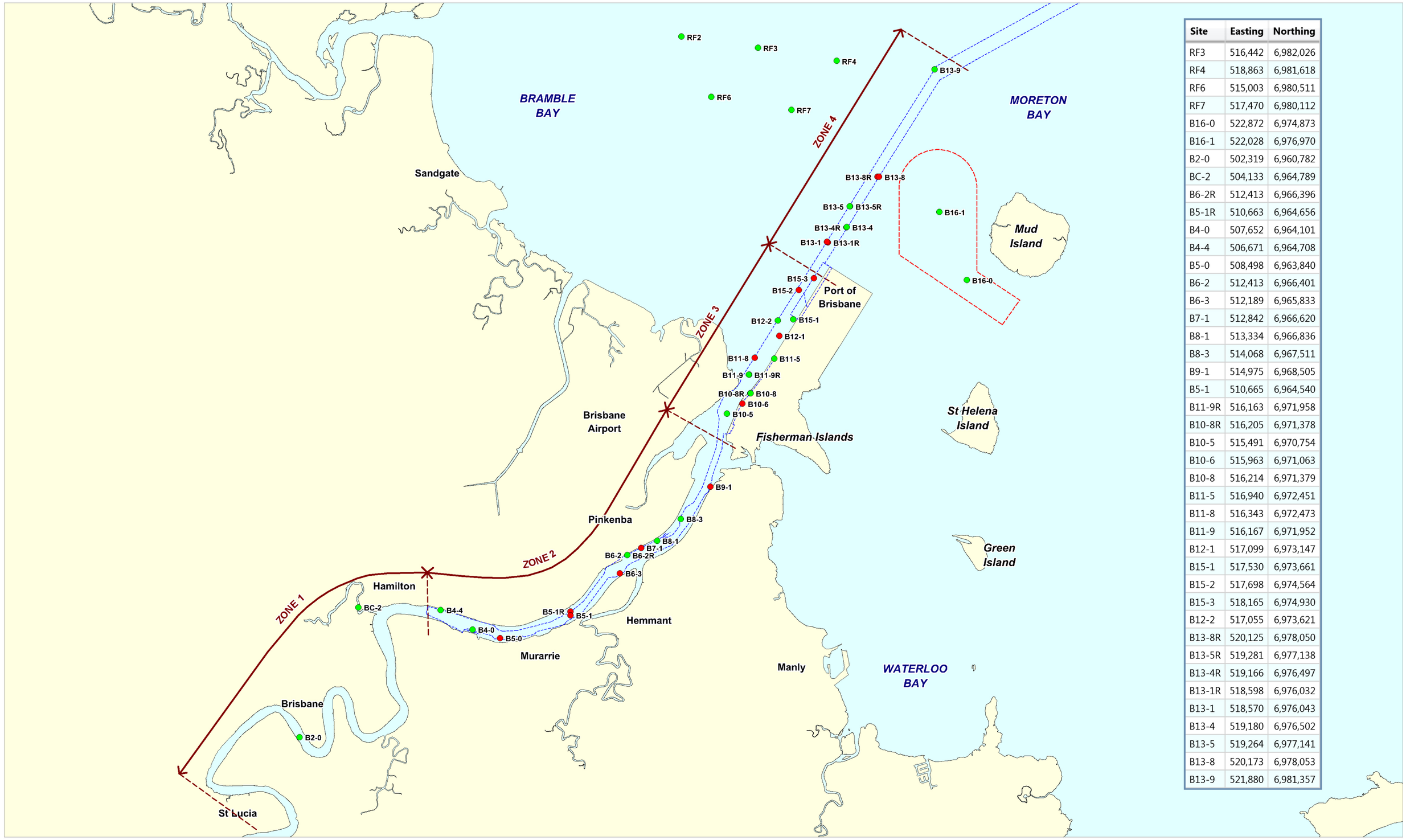
As per the SAP, all samples were analysed for a basic suite with a detailed suite analysed at selected study locations (refer to Figure 2-1 and Section 2.5).

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
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:

Actual Sediment Sampling Locations

Figure: **2-1**

Rev: **A**

N

0 2.5 5km

Approx. Scale

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Filepath : I:\B20259_I_BRH Port of Brisbane DLR\DRG\ECO_022_131212 Sediment Sampling Locations.wor

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 16% and 33% on average for Zones 2 and 3 in 2017. 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 (silts, clays and sub-clays). Exceptions to this were sites 5-1 (72%), 7-1 (66%), 9-1 (34%), 11-8 (58%), 11-5 (67%), 12-1 (43%), 12-2 (56%), 15-1 (51%), 15-2 (25%) and 15-3 (41%), consistent with results from previous years.

The average proportion of silts was 33% and 29% for Zones 2 and 3, respectively. This was similar to the silt content recorded in previous surveys. The proportion of clay material was 48% and 32% at Zones 2 and 3, respectively, which was higher than recorded in 2016 (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.

Overall, these results indicate that sediment grain size was largely consistent over time in zones 2 and 3.

Zone 4

Zone 4 had coarser sediments than Zones 2 and 3, with an average sand content of 41% and 1% gravel, with 57% fines (combined silt and clay fractions). This was similar to results recorded in 2016 (40% sand, 2.7% gravel, 57% fines) and 2015 (47% sand, 1% gravel, and 52% fines).

MIDMPA

Sediments at MIDMPA locations were similar to Zone 4, with sand comprising 34%, gravel 5% and fines 61% on average. The relative proportions were similar to 2016 results: sand = 42%, gravel = 3% and fines = 55%.

Reference/Background

In 2017 the Moreton Bay reference sites were characterised by a high proportion of fine sediment (84% on average). This was consistent with results from 2016 (89.6%), 2015 (85% fines), 2014 (86%) and 2013 (89%).

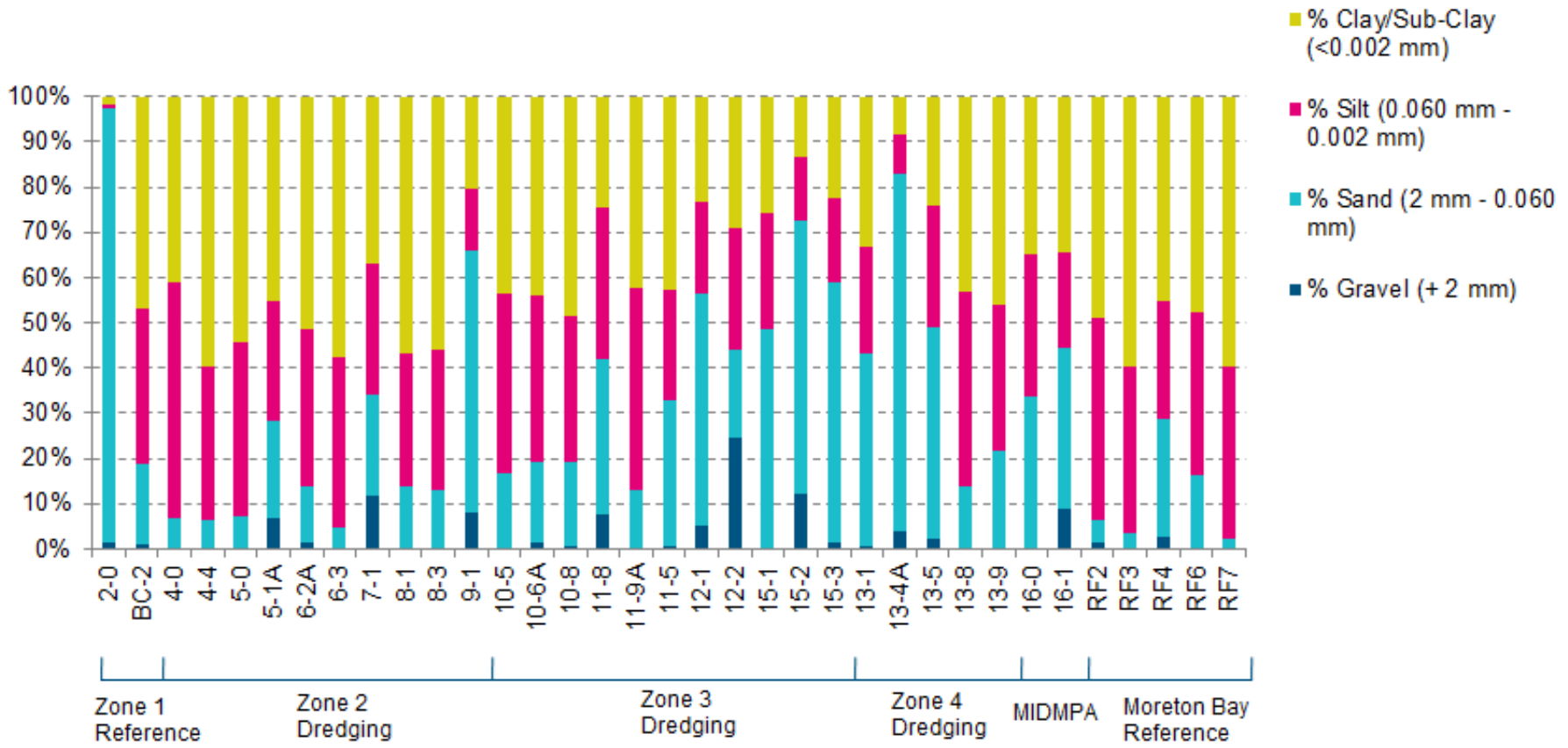

Figure 3-1 Sediment Particle Size Distribution Analysis – 2017

3.2 Analytical Results

3.2.1 Metals and Metalloids

3.2.1.1 Bulk Sediment

Summary data for metals and metalloids are presented in Table 3-1. Silver had concentrations less than the detection limit (0.1 mg/kg) in all samples at Zones 2, 3 and 4, unlike in 2016 when it was detected in 50% of samples at the same locations and at the same detection limit. Cadmium had concentrations less than the detection limit (0.1 mg/kg) in 92% of samples at Zones 2, 3 and 4, consistent with 2016 when it was detected in 89% of samples. All other metals and metalloids were detected in 100% of samples from Zones 2, 3 and 4.

Concentrations of most metals and metalloids within individual locations or dredged areas were generally below NAGD screening levels across the study area, except nickel and mercury. The trace metal and metalloid concentrations recorded at reference locations followed similar trends to those at the dredge sites, and were also consistent with trends observed in 2013, 2014, 2015 and 2016.

Nickel

The 95% UCL of the mean for nickel was 21.8 mg/kg within the dredged areas (Zones 2, 3 and 4), which was just over the NAGD screening level of 21 mg/kg. The 95% UCL in 2017 was similar to 2016 (22.1 mg/kg), which was less than 2015 (28.6 mg/kg) and 2014 (28.3 mg/kg) and much less than the 95% UCL recorded in 2013 (35.5 mg/kg).

At the dredge zone level:

- Zone 2 - the 95% UCL was 26.4 mg/kg (n = 10), exceeding the screening level. Nickel was slightly lower in 2017 than 2016 (28.3 mg/kg).
- Zone 3 - the 95% UCL was 21.1 mg/kg (n = 10), exceeding the screening level by 0.1 mg/kg. Nickel was slightly higher in 2017 than 2016 (20.2 mg/kg).
- Zone 4 - the 95% UCL was 19.9 mg/kg (n = 5), which was less than the screening level. Nickel was slightly higher in 2017 than 2016 (16.2 mg/kg).

In accordance with NAGD, nickel concentrations at the dredge site were compared to reference sites. The 80th percentile nickel concentration at the reference sites was 25 mg/kg, compared to the dredge site 95% UCL of 21.8 mg/kg and the 80th percentile of 23 mg/kg (Table 3-1). This indicates that the overall dredge site had nickel concentrations that were less than reference samples, but that Zone 2 had slightly greater nickel concentrations than reference (26 compared to 25 mg/kg).

Phase 3 testing was therefore undertaken to assess nickel bioavailability (Section 3.2.1.2).

Table 3-1 Summary statistics and 95% UCL's for combined locations in Zones 2, 3, and 4 – trace metals/metalloids and nutrients. Values highlighted in orange indicate exceedance of NAGD screen levels

Analytes	Units	PQL	Screening level (SL)	% samples detected	% > NADG	Mean	Geomean	Standard deviation	Distribution	95% UCL	80th %tile dredge	80th %tile reference
Trace Metals/Metalloids												
Aluminium	mg/kg	5	ND	100	0	17665.38	17008.78	4417.87	N	19145	NC4	NC4
Arsenic	mg/kg	0.4	ND	100	0	6.60	6.52	0.96	N	6.91	NC4	NC4
Cadmium	mg/kg	0.1	1.5	7.69	0	0.27	0.26	0.01	NC3	NC3	NC4	NC4
Chromium	mg/kg	0.1	80	100	0	33.65	32.82	7.00	N	36	NC4	NC4
Copper	mg/kg	0.1	65	100	3.84	26.35	22.00	19.47	N	33.03	NC4	NC4
Iron	mg/kg	5	ND	100	0	32846.15	32178.81	6278.17	N	34949	NC4	NC4
Lead	mg/kg	0.5	50	100	0	13.79	12.85	5.09	N	15.49	NC4	NC4
Mercury	mg/kg	0.01	0.15	100	7.69	0.09	0.08	0.05	N	0.11	0.06	0.10
Nickel	mg/kg	0.1	21	100	30.76	19.98	19.28	5.40	N	21.79	23	25
Silver	mg/kg	0.1	1	0	0	NC1	NC1	NC1	NC3	NC3	NC4	NC4
Zinc	mg/kg	0.5	200	100	0	78.75	67.08	36.20	N	90.88	NC4	NC4
Other Parameters												
Moisture Content	%	0.1	ND	100	0	52.81	51.32	11.62	X	56.7	NC4	NC4
Total Organic Carbon	%	0.01	ND	100	0	1.29	1.18	0.49	N	1.457	NC4	NC4
Phosphorus	mg/kg	1	ND	100	0	693.46	649.75	268.37	N	783.4	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	46.15	0	949.17	850.62	442.50	N	1179	NC4	NC4
Total Nitrogen	mg/kg	20	ND	46.15	0	949.17	850.62	442.50	N	1179	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

Mercury

Mercury concentrations exceeded the NAGD screening level of 0.15 mg/kg at one location in Zone 3 (B10-6 = 0.18 mg/kg) and one location within Zone 4 (13-1 = 0.26 mg/kg). No sites in Zone 2 exceeded NAGD screening level within Zone 2, unlike 2016 results were four sites exceeded the NAGD 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 0.12, 0.10 and 0.20 mg/kg, respectively.

The 95% UCL for all dredge sites pooled (0.11 mg/kg), Zone 2 (0.12 mg/kg) and Zone 4 (0.20 mg/kg) was greater than the reference site 80th percentile value of 0.10 mg/kg. Phase 3 testing was therefore undertaken to assess mercury bioavailability (Section 3.2.1.2).

3.2.1.2 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 levels 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, 2016).

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	Replicate	Mercury		Nickel	
			Bulk sediment	DAE	Bulk sediment	DAE
NAGD			0.15		21	
4	B13-1	0	0.26	<0.01	15	NM
4	B13-1	1		<0.01		NM
3	B12-2	0	0.07	NM	28	9.2
3	B11-9	0	0.1	NM	22	6.2
3	B10-6	0	0.18	<0.01	22	7.4
2	B9-1	0	0.06	NM	23	5.2
2	B5-1	0	0.15	<0.01	21	7.8
2	B5-0	0	0.11	NM	24	7.2
2	B4-0	0	0.08	NM	37	15
2	B4-4	0	0.14	NM	24	7

orange shading – sample exceeds screening level; NM = not measured (concentration in bulk sediment less than screening level)

3.2.2 Nutrients and Carbon Content

Total Nitrogen (TN) and Total Kjeldahl Nitrogen (TKN) concentrations across the dredge zones ranged between 360 and 1810 mg/kg. These values were slightly higher than recorded in 2016 (100 and 1650 mg/kg), 2015 (320 and 1530 mg/kg), and 2014 (220 to 1320 mg/kg). The 80th percentile TN at reference sites was 1330 mg/kg (850 to 1390 mg/kg), which was less than the 95% UCL (1179 mg/kg) concentration for the dredge zones. 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 310 to 1600 mg/kg (95% UCL = 783 mg/kg), which was slightly higher than recorded at reference (80th percentile = 686 mg/kg). TP concentrations across dredge zones in 2017 was lower than values reported in 2016 (270 to 1500 mg/kg) 2015 (390 to 1200 mg/kg) and 2014 (260 - 1300 mg/kg).

Total organic carbon content ranged between 0.36 to 2.4% across the dredge zones. The TOC 95% UCL for dredge zones and 80th percentile for reference sites were both 1.4%. TOC in 2014 -2016 were within the range recorded in 2017.

3.2.3 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 3.5 µgSn/kg, which was greater than in 2016 (1.0 µgSn/kg) and similar to 2015 (3.6 µgSn/kg). The 95% UCL for TBT was below the screening level at dredging Zones 3 (6.9 µgSn/kg) and 4 (5.7 µgSn/kg), and was not detected at Zone 2.

At the reference locations, organotin concentrations were mostly below the LOR with the exception of the monobutyl tin which was detected at all reference sites.

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.

3.2.4 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. A low-level detection of TPHs C29-C36 was recorded at location B6-3 (62 mg/kg, 1% TOC normalised = 29.5 mg/kg), consistent with 2016 results. This sample had TPH concentration 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 detected 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.

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

Analytes	Units	PQL	NAGD	% samples detected	% > NADG	Mean	Geomean	Standard deviation	Distribution	95% UCL
Organo-chlorine pesticides										
Aldrin	µg/kg	1	ND	0	ND	NC1	NC1	NC1	NC1	NC1
alpha-BHC	µg/kg	1	ND	0	ND	NC1	NC1	NC1	NC1	NC1
beta-BHC	µg/kg	1	ND	0	ND	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	ND	NC1	NC1	NC1	NC1	NC1
cis-Chlordane	µg/kg	1	0.5	0	ND	NC1	NC1	NC1	NC1	NC1
trans-Chlordane	µg/kg	1	0.5	0	ND	NC1	NC1	NC1	NC1	NC1
p,p'-DDD	µg/kg	1	2	0	0	NC1	NC1	NC1	NC1	NC1
p,p'-DDE	µg/kg	1	2.2	0	0	NC1	NC1	NC1	NC1	NC1
p,p'-DDT	µg/kg	1	1.6	0	0	NC1	NC1	NC1	NC1	NC1
Dieldrin	µg/kg	1	280	0	0	NC1	NC1	NC1	NC1	NC1
alpha-Endosulfan	µg/kg	1	ND	0	ND	NC1	NC1	NC1	NC1	NC1
beta-Endosulfan	µg/kg	1	ND	0	ND	NC1	NC1	NC1	NC1	NC1
Endosulfan Sulphate	µg/kg	1	ND	0	ND	NC1	NC1	NC1	NC1	NC1
Endrin	µg/kg	1	10	0	0	NC1	NC1	NC1	NC1	NC1
Endrin ketone	µg/kg	1	ND	0	ND	NC1	NC1	NC1	NC1	NC1
Endrin aldehyde	µg/kg	1	ND	0	ND	NC1	NC1	NC1	NC1	NC1
Heptachlor	µg/kg	1	ND	0	ND	NC1	NC1	NC1	NC1	NC1
Heptachlor epoxide	µg/kg	1	ND	0	ND	NC1	NC1	NC1	NC1	NC1
Hexachlorobenzene	µg/kg	1	ND	0	ND	NC1	NC1	NC1	NC1	NC1
Methoxychlor	µg/kg	1	ND	0	ND	NC1	NC1	NC1	NC1	NC1
Oxychlordane*	µg/kg	1	ND	0	ND	NC1	NC1	NC1	NC1	NC1
Organotins										
Monobutyltin	µgSn/kg	0.5	ND	15	ND	0.5	0.3	0.76	N	1.7

Results

Analytes	Units	PQL	NAGD	% samples detected	% > NADG	Mean	Geomean	Standard deviation	Distribution	95% UCL
Dibutyltin	µgSn/kg	0.5	ND	46	ND	1.6	0.8	0.76	N	4.0
Tributyltin	µgSn/kg	0.5	9.0	19	3.8	1.2	0.4	2.6	N	3.5
Total petroleum hydrocarbons										
TPH C6-C9	mg/kg	10	ND	0	ND	NC1	NC1	NC1	NC1	NC1
TPH C10-C14	mg/kg	10	ND	0	ND	NC1	NC1	NC1	NC1	NC1
TPH C15-C28	mg/kg	50	ND	0	ND	NC1	NC1	NC1	NC1	NC1
TPH C29-C36	mg/kg	50	ND	3.85	ND	NC2	NC2	NC2	NC2	NC2
Total TPH	mg/kg	50	550	3.85	0	NC2	NC2	NC2	NC2	NC2
PAHs										
Naphthalene	µg/kg	5	ND	7.7	0	6.5	4.4	5.3	X	13.2
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	30.8	0	9.8	8.5	5.9	N	14.2
Acenaphthene	µg/kg	5	ND	0	0	NC1	NC1	NC1	NC1	NC1
Fluorene	µg/kg	5	ND	15.4	0	6.9	5.2	5.0	X	13.2
Phenanthrene	µg/kg	5	ND	38.5	0	23.9	19.0	19.9	X	49.0
Anthracene	µg/kg	5	ND	30.8	0	9.4	8.0	6.0	N	13.7
Fluoranthene	µg/kg	5	ND	42.3	0	73.0	52.4	68.4	L	140.4
Pyrene	µg/kg	5	ND	42.3	0	86.2	62.6	78.6	L	168.4
Benz(a)anthracene	µg/kg	5	ND	42.3	0	43.4	33.6	36.7	X	89.6
Chrysene	µg/kg	5	ND	42.3	0	41.6	32.8	33.7	L	67.4
Benzo(b)&(k)fluoranthene	µg/kg	10	ND	46.1	0	121.9	92.7	98.3	N	200.7
Benzo(a)pyrene	µg/kg	5	ND	42.3	0	63.2	47.0	53.3	L	118.1
Indeno(1,2,3-cd)pyrene	µg/kg	5	ND	42.3	0	56.2	43.0	43.8	N	78.9
Dibenz(a,h)anthracene	µg/kg	5	ND	30.8	0	10.3	8.9	5.9	N	14.7
Benzo(g,h,i)perylene	µg/kg	5	ND	42.3	0	56.4	42.9	45.3	N	92.7
Coronene	µg/kg	10	ND	23.1	0	15.4	12.8	8.9	X	26.7

Results

Analytes	Units	PQL	NAGD	% samples detected	% > NADG	Mean	Geomean	Standard deviation	Distribution	95% UCL
Benzo(e)pyrene	µg/kg	5	ND	42.3	0	50.6	38.8	38.5	L	92.3
Perylene	µg/kg	5	ND	46.1	0	142.7	115.6	107.8	N	220.8
Total PAHs (as above)	µg/kg	100	10000	38.5	0	765.7	591.6	627.6	N	1242
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 Polyaromatic Hydrocarbons (PAHs)

Low level detections of various PAHs were recorded at all locations within all dredge zones. Total PAHs concentrations (corrected to 1% TOC) ranged from 250 (sites 15-2 and 15-3) to 2200 µg/kg (site 11-8), and therefore well below the NAGD screening level of 10,000 µg/kg in all samples. The 95% UCL for total PAHs across all dredge zones was 1242 µg/kg, which was greater than recorded in 2016 (537.1 µg/kg).

Based on 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.

3.2.6 Organochlorine Pesticides (OCPs)

3.2.6.1 Bulk Sediment

All organochlorine pesticides had concentrations less than the LOR of 1 µg/kg in all samples. This was inconsistent with results from previous years, in which *p,p'*-DDD and *p,p'*-DDE were consistently detected, often at concentrations exceeding NAGD screening levels. *p,p'*-DDT, trans-Chlordane and Dieldrin have also occasionally been detected previously but were not recorded in the present survey (BMT WBM 2016).

Factors that could lead to inconsistencies with results from previous surveys include:

- Changes to detection limits and laboratories. Not applicable - the same primary laboratory (Advanced Analytical Australia) has been used since 2013, and detection limits in 2017 were lower than or equal to previous years.
- Natural degradation. Unlikely - OCPs are persistent contaminants that degrade very slowly, at timescales measured in years to decades.
- Laboratory error. Possible – most OCPs occur at ultra-trace levels in the lower Brisbane River, usually at or only slightly above the LOR. Laboratory measurements are less accurate around the LOR. Notwithstanding this, the results were consistent between the primary and secondary laboratories. While the secondary laboratory detected DDE in four samples, three of the samples had concentrations less that the LOR adopted by the primary laboratory, and the fourth detection had very low levels (1.16 µg/kg). The secondary laboratory did not detect any other OCPs, consistent the with primary laboratory.
- Dispersal/burial of sediment between surveys. Possible – There was minor flooding in the Brisbane River in March 2017 associated with ex Tropical Cyclone Debbie. It is possible that flooding promoted burial and or flushing of sediment bound OCPs from the Brisbane River, as has been observed previously (e.g. 2011). The concentration of *p,p'*-DDE recorded at reference sites in 2016 (2.0 ± 1.7 µg/kg) and 2017 levels (2.5 ± 2.3 (S.E.) µg/kg) were not significantly different (Paired t-test, t = -0.39, p = 0.707). This does not suggest that flooding lead to major changes in DDE concentrations at western Moreton Bay reference sites.

Based on 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.

3.2.6.2 *Elutriate and Bioavailability Testing*

Phase III elutriate and bioavailability (porewater) testing was conservatively undertaken to investigate the potential bioavailability of OCPs. As outlined in Section 2.6.2, five additional samples were analysed from Zone 2 and six samples 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 = 0.1 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.

3.2.7 Polychlorinated Biphenyls (PCBs)

Concentrations of PCBs were below the laboratory LOR at all investigated locations. No assessment of PCBs was undertaken at the reference locations.

Therefore, the sediments in the dredge zones are considered suitable for ocean disposal as per the NAGD guidelines with respect to PCBs.

3.2.8 Radionuclides

Gross alpha and gross beta activity ranged between 0.06 to 0.24 Bg/g and 0.27 to 0.69 Bg/g respectively. These values were within the range recorded in 2016. No assessment of radionuclides was undertaken at the reference locations.

Therefore, the NAGD screening level for the sum of gross alpha and beta (35 Bg/g) 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.

3.2.9 Acid Sulfate Soils

Acid sulfate spil test results are presented in Table 3-4. The pH_{kcl} results ranged from 8.1-9.2 (alkaline) and TAA was below LOR, indicating that there was no existing acidity in sediments.

Potential acid sulfate soils were present, as indicated by CRS (S_{CR}) exceeding the threshold of 0.03% (0.09 to 0.35% w/w), and net acidity values were less than <0.005%.

Results from acid neutralising capacity (ANC) tests indicate that sediments have a high capacity to self-neutralise if exposed to oxygen, and that no liming would be required to treat soils if placed on land.

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

Sample	Units	PQL	Zone 2					Zone 3					Zone 4	
			B5-0	B5-1	B6-3	B7-1	B9-1	B10-6	B11-8	B12-1	B15-2	B15-3	B13-1	B13-8
Actual acidity														
pH $_{kcl}$	pH units		8.3	8.6	8.1	8.6	8.8	8.7	8.6	8.9	9.2	9.1	8.8	8.8
s-TAA pH 6.5	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TAA pH 6.5	moles H+/t	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Potential acidity														
CRS	%w/w	0.005	0.19	0.32	0.2	0.35	0.13	0.29	0.29	0.13	0.09	0.14	0.18	0.22
acidity-CRS	moles H+/t	3	120	200	130	220	80	180	180	82	55	88	110	130
S_{HCl}	%w/w S	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
S_{KCl}	%w/w S	0.005	0.13	0.15	0.17	0.18	0.09	0.18	0.17	0.092	0.078	0.091	0.093	0.13
S_{NAS}	%w/w S	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Acid neutralising capacity														
ANC_{BT}	% CaCO3	0.05	2.2	2.8	2.5	3.3	2.4	3.1	3.5	2.4	3.3	3.3	3.3	7.8
s-ANC_{BT}	%w/w S	0.05	0.7	0.9	0.8	1.1	0.77	1	1.1	0.76	1.1	1.1	1.1	2.5
Acid base accounting														
s-Net Acidity	%w/w S	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
a-Net Acidity	moles H+/t	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Liming rate	kg CaCO3/t	0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H+/t	5	120	200	130	220	80	180	180	82	55	88	110	130
Liming rate without ANCE	kg CaCO3/t	0.75	8.8	15	9.4	16	6	14	14	6.2	4.1	6.6	8.5	10
s-Net Acidity without ANCE	%w/w S	0.005	0.19	0.32	0.2	0.35	0.13	0.29	0.29	0.13	0.088	0.14	0.18	0.22

3.3 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.

3.3.1 Limits of Reporting (LORs)

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

3.3.2 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.

3.3.3 Laboratory Blanks

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

3.3.4 Laboratory Duplicates

Trace elements RDP duplicate were within the laboratories acceptable criteria.

3.3.5 Surrogate and Matrix Spikes

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

3.4 Field QA/QC

3.4.1 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.

3.4.2 Field Triplicates and Splits

Analyses of field triplicate samples were within the ±50 % NAGD criterion for RPDs for most samples (Table 3-6). The exceptions were:

- silver at site 13-4
- arsenic at site 11-9
- cadmium at site 10-6
- TBT at site 11-9.

The exceedance of the RPD criterion for metal and metalloid parameters is not problematic given that they had concentrations that were well below the screening levels. The exceedance of the RPD for TBT is a typical pattern in dredged sediments (NAGD 2009), and is indicative of high small-scale

heterogeneity, often due to the presence of small paint flakes in sediments, rather than laboratory error.

3.5 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.

Table 3-5 Summary of Relative Standard Deviation (RSD) Analysis for Detected Metals/metalloids and Nutrients (mg/kg). Orange Shading Indicates Exceedance of 50% Criterion

Site	Sample	Aluminium	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Mercury	Nickel	Phosphorus	Silver	Zinc	Nitrate as N^	Nitrite as N^	Total Kjeldahl Nitrogen^	Total Nitrogen^
13.4	B13-4	7200	4.8	<0.1	16	6.5	17000	7.4	0.02	9.6	310	0.25	43	----	----	----	----
	B13-4BT	10000	5.8	<0.1	21	7.4	22000	6.4	0.02	12	340	0.25	39	----	----	----	----
	B13-4CT	**13200**	**7.58**	<0.1	**25.5**	**7.5**	**28800**	**6.4**	**0.03**	**15.3**	----	0.05	**37.2**	----	----	----	----
	RSD	29.63	23.24	NC	22.81	7.72	26.21	8.57	24.74	23.27	6.53	62.98	7.47	NC	NC	NC	NC
11-9	B11-9	22000	7.7	<0.1	38	25	39000	15	0.1	22	730	<0.5	84	----	----	----	----
	B11-9BT	18000	8.1	<0.1	38	25	35000	15	0.09	21	730	<0.5	82	----	----	----	----
	B11-9CT	**21400**	**0.1**	<0.1	**45.3**	**24.2**	**43000**	**20**	**0.08**	**26.7**	----	**0.1**	**99.4**	----	----	----	----
	RSD	10.54	85.05	NC	10.42	1.87	10.26	17.32	11.11	13.10	0.00	NC	10.76	NC	NC	NC	NC
10-6	B10-6	21000	7.3	0.26	44	29	37000	16	0.18	22	650	<0.5	100	<0.1	<0.1	1370	1370
	B10-6BTS	21000	6.7	0.05	39	28	39000	14	0.12	23	690	<0.5	92	<0.1	<0.1	1330	1330
	B10-6CTS	**24900**	**8.83**	**0.1**	**51.2**	**31.7**	**45400**	**19.7**	**0.11**	**33.5**	**706**	**0.2**	**108**	----	<0.1	**1280**	**1280**
	RSD	10.10	14.43	80.27	13.71	6.47	10.84	17.46	27.70	24.35	4.23	NC	8.00	NC	NC	3.40	3.40
5-1	B5-1	19000	6	<0.1	37	29	35000	20	0.15	21	730	<0.5	93	<0.1	<0.1	1090	1090
	B5-1BT	17000	6.5	<0.1	37	29	34000	100	0.15	21	780	<0.5	92	<0.1	<0.1	1200	1200
	B5-1CT	**20400**	**8.06**	**0.2**	**51.2**	**32.6**	**40300**	**33.6**	**0.12**	**25.6**	**728**	**0.6**	**128**	----	**0.1**	**1100**	**1100**
	RSD	9.09	15.68	NC	19.64	6.88	9.29	83.60	12.37	11.79	3.95	NC	19.65	NC	NC	5.38	5.38
6-2	B6-2	21000	6.8	0.27	34	110	34000	17	0.09	20	1600	<0.5	180	----	----	----	----
	B6-2BTS	21000	6.6	0.34	36	50	36000	17	0.1	21	1700	<0.5	160	----	----	----	----
	B6-2CTS	**23200**	**7.9**	**0.3**	**44.2**	**36.6**	**39900**	**20.8**	**0.08**	**27.1**	----	**0.1**	**112**	----	----	----	----
	RSD	5.84	9.86	11.58	14.20	59.65	8.19	12.01	11.11	16.93	4.29	NC	23.20	NC	NC	NC	NC
LOR		5	0.4	0.1	0.1	0.1	5	0.5	0.01	0.1	1	0.1	0.5	0.1	0.1	20	20

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

Table 3-6 Summary of Relative Standard Deviation (RSD) Analysis for Detected Organics (µg/kg). Orange Shading Indicates Exceedance of 50% Criterion

Site	Sample	DDD	DDE	DDT	MBT	DBT	TBT	Acenaphthylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene	Coronene	Benzo(e)pyrene	Perylene	Total PAHs
13-4	B13-4	<1	<1	<1	<1	<1	<1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	B13-4BT	<1	<1	<1	<1	<1	<1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	B13-4CT	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	----	----	----	----	----		----	----	----	----	----	----	----	----	----	----
	RSD	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
11-9	B11-9	<1	<1	<1	<1	<1	**13**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	B11-9BT	<1	<1	<1	<1	<1	0.25	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	B11-9CT	<0.5	**0.8**	<0.5	<0.5	<0.5	**0.7**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	RSD	NC	NC	NC	NC	NC	155.6	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
10-6	B10-6	<1	<1	<1	**3.3**	<0.5	<0.5	**7**	<5	**19**	7	49	71	36	34	94	49	7	41	11	36	83	580
	B10-6BTS	<1	<1	<1	<0.5	<0.5	<0.5	**7**	<5	**21**	8	59	80	42	39	100	51	8	45	12	37	93	650
	B10-6CTS	<0.5	**1**	<0.5	<1	<1	<0.5	5	<10	**30**	<10	**60**		**30**	**20**	**20**	**50**	<10	**30**	<10	**30**	**70**	**470**
	RSD	NC	NC	NC	NC	NC	NC	18.23	NC	25.11	9.43	10.86	8.43	16.67	31.77	62.46	2.00	9.43	20.09	6.15	11.03	14.06	16.01
5-1	B5-1	<1	<1	<1	<0.5	**5.8**	<0.5	**9**	**5**	**20**	8	46	78	38	39	100	52	9	47	11	41	190	740
	B5-1BT	<1	<1	<1	<0.5	<0.5	<0.5	**10**	**9**	**60**	22	120	150	72	74	170	88	14	68	16	65	240	1250
	B5-1CT	<0.5	**1.16**	<0.5	<1	**4**	**1.6**	<10	<10	**20**	**10**	**70**		**40**	**40**	**30**	**70**	<10	**30**	<10	**50**	**60**	**580**

Results

Site	Sample	DDD	DDE	DDT	MBT	DBT	TBT	Acenaphthylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)&(k)fluoranthene	Benzo(a)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene	Coronene	Benzo(e)pyrene	Perylene	Total PAHs
	RSD	NC	NC	NC	NC	25.98	NC	7.44	40.41	69.28	56.79	47.99	44.66	38.16	39.07	70.00	25.71	30.74	39.38	26.19	23.32	56.89	40.84
6-2	B6-2	<1	<1	<1	2.2	<0.5	<0.5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	B6-2BTS	<1	<1	<1	<0.5	<0.5	<0.5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	B6-2CTS	<0.5	**0.84**	<0.5	<1	<1	**1.8**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	RSD	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	LOR	1	1	1	0.5	0.5	0.5	5	5	5	5	5	5	5	5	10	5	5	5	10	5	5	100

(-) = 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

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

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

Offices

Brisbane
Denver
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Mackay
Melbourne
Newcastle
Perth
Sydney
Vancouver

Document Control Sheet

BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane 4000
Queensland Australia
PO Box 203 Spring Hill 4004

Tel: +61 7 3831 6744
Fax: + 61 7 3832 3627

ABN 54 010 830 421

www.bmtwbm.com.au

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Project Manager:	Darren Richardson
Author:	Markus Billerbeck
Client:	Port of Brisbane Pty Ltd
Client Contact:	Craig Wilson/Rachael Attard
Client Reference:	

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

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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.

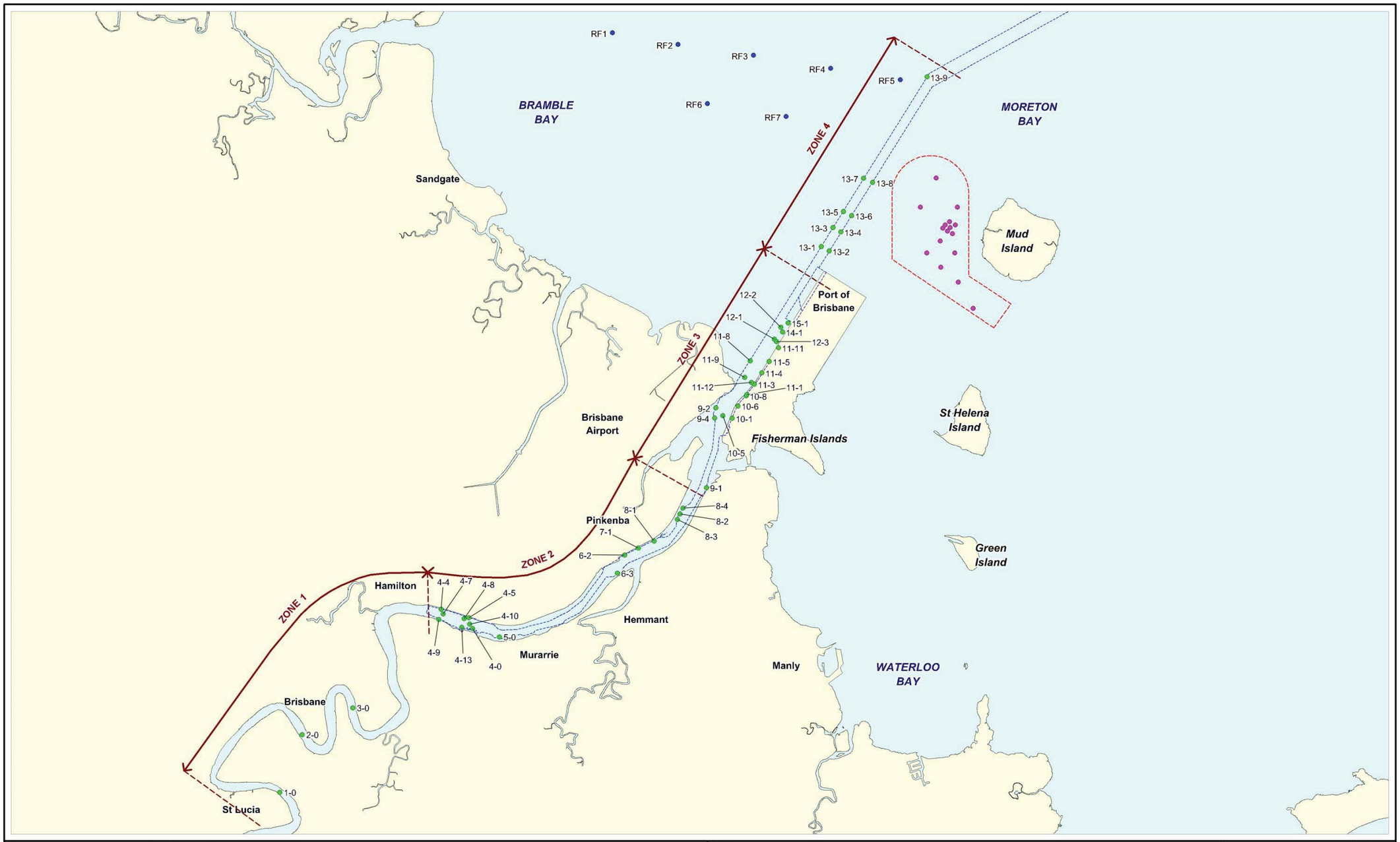
Table 2-1 Previous Routine Annual Sediment Quality Studies

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.

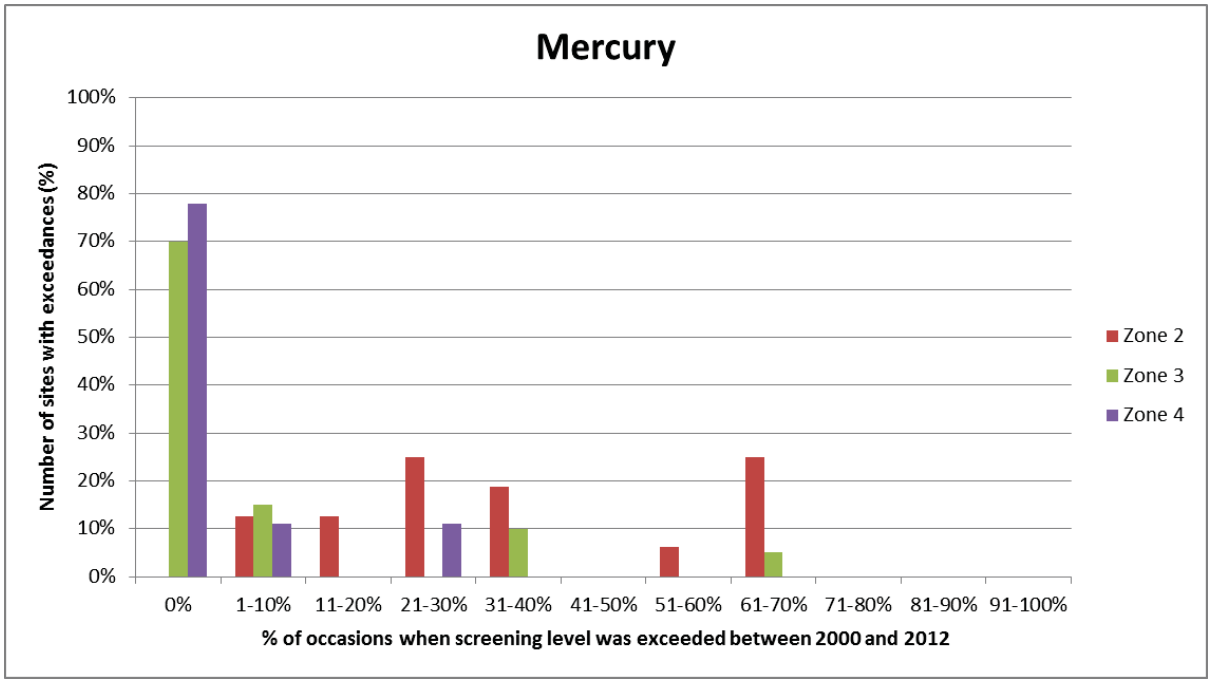


Figure 2-2 Exceedances of the NAGD Screening Level for Mercury between 2000 and 2012 in Dredge Zones 2, 3 and 4

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).

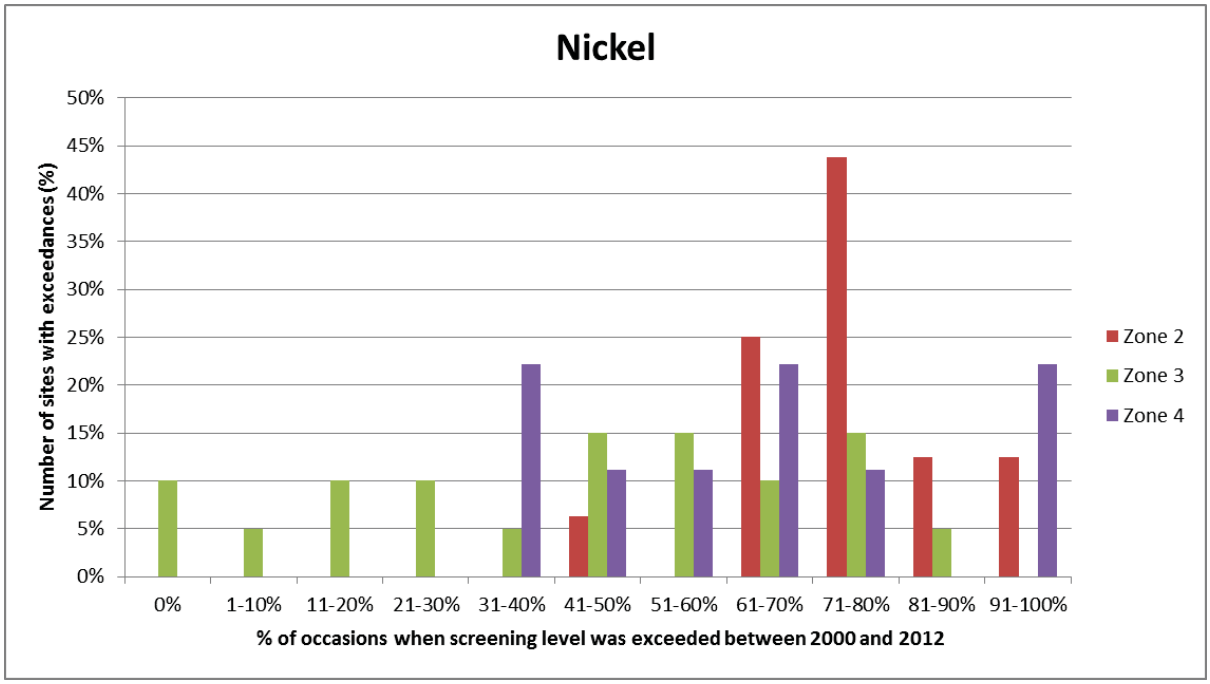


Figure 2-3 Exceedances of the NAGD Screening Level for Nickel between 2000 and 2012 in Dredge Zones 2, 3 and 4

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.

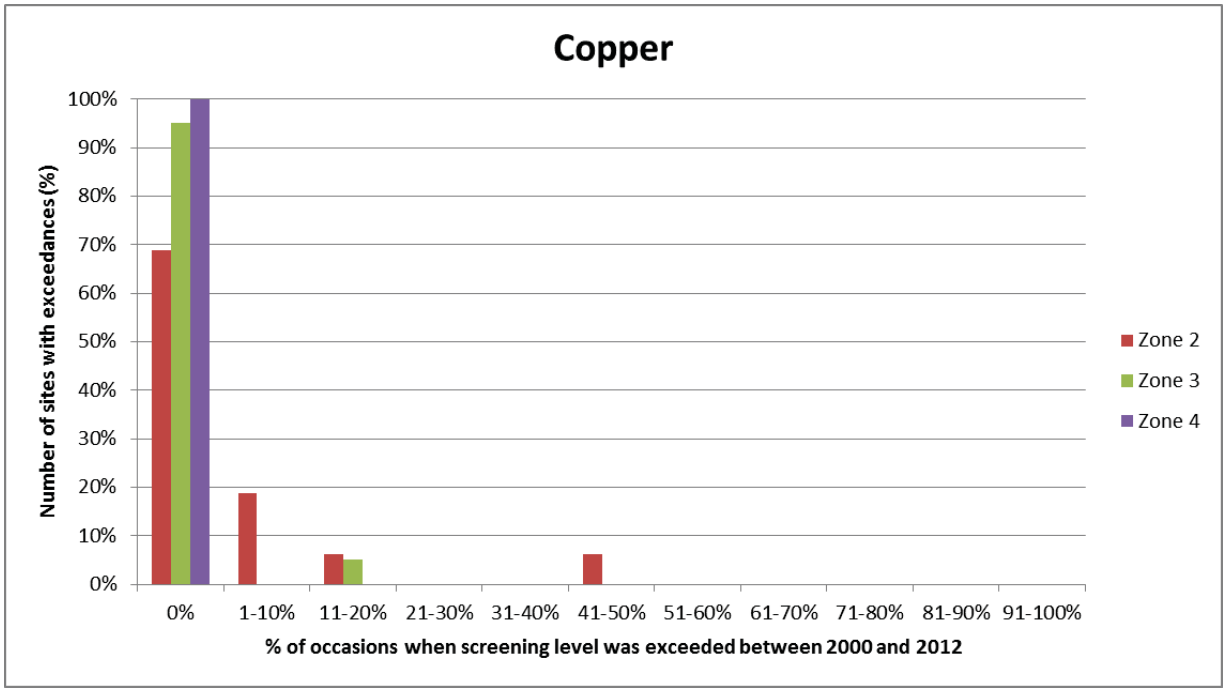


Figure 2-4 Exceedances of the NAGD Screening Level for Copper between 2000 and 2012 in Dredge Zones 2, 3 and 4

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.

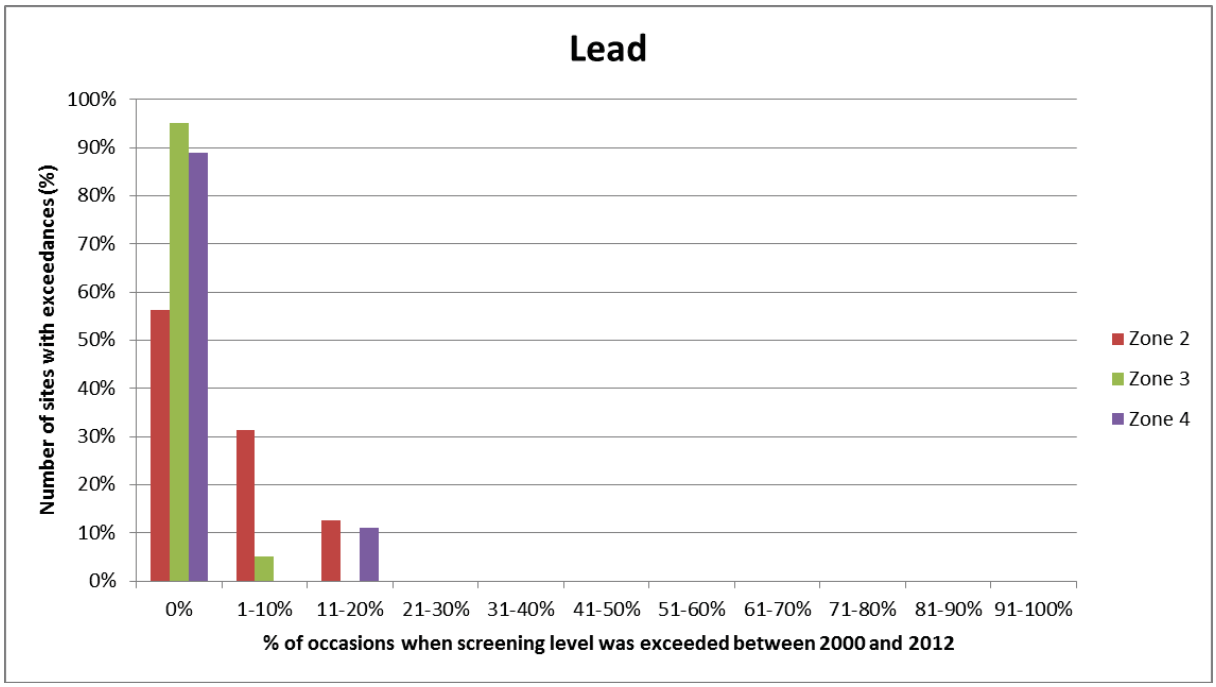


Figure 2-5 Exceedances of the NAGD Screening Level for Lead between 2000 and 2012 in Dredge Zones 2, 3 and 4

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.

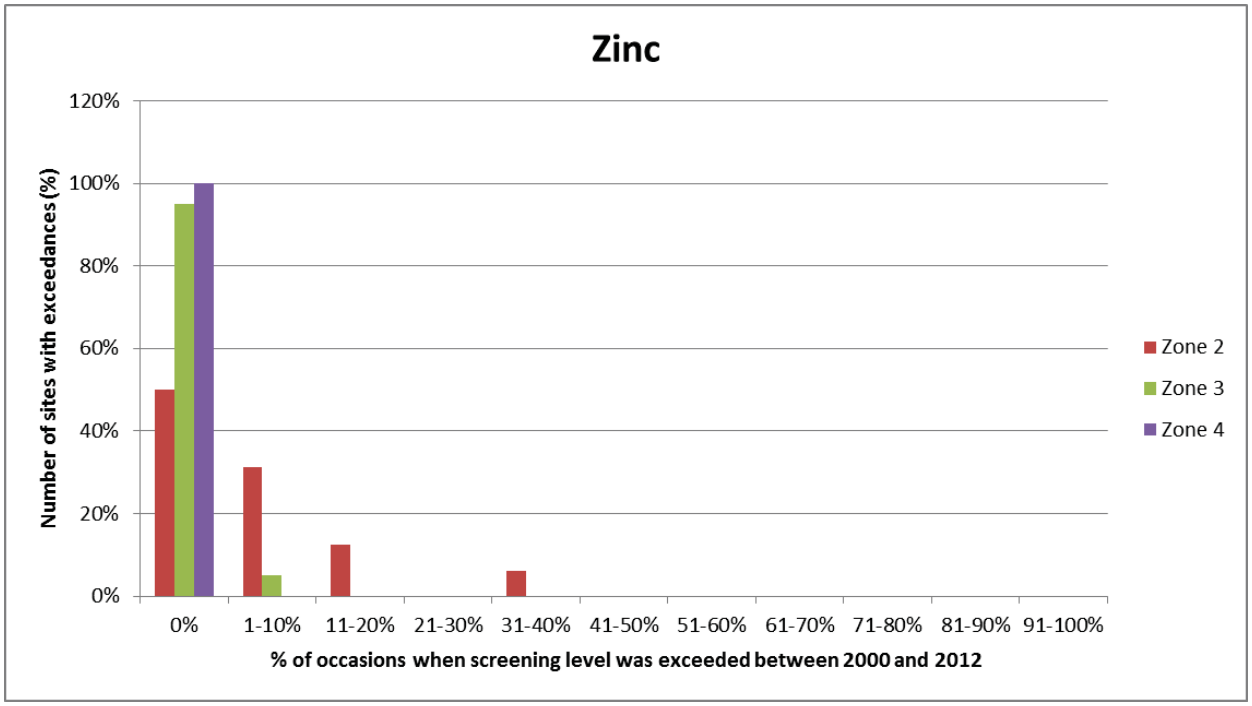


Figure 2-6 Exceedances of the NAGD Screening Level for Zinc between 2000 and 2012 in Dredge Zones 2, 3 and 4

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.

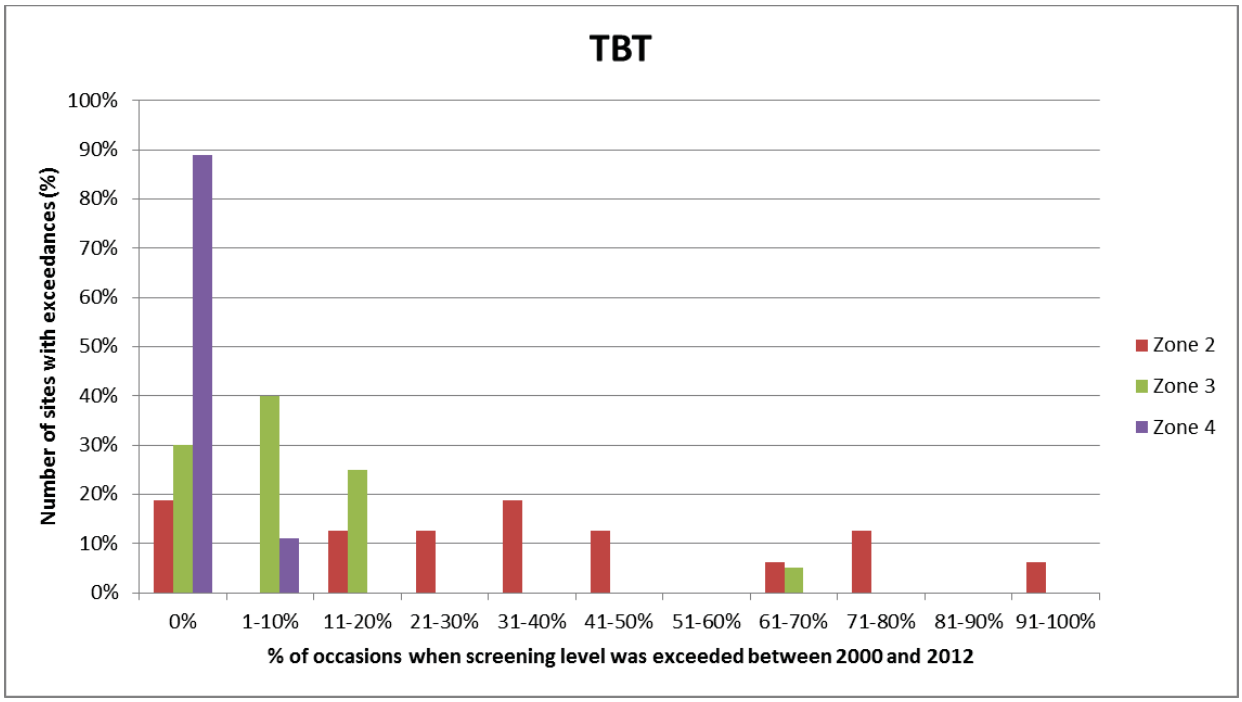


Figure 2-7 Exceedances of the NAGD Screening Level for TBT between 2000 and 2012 in Dredge Zones 2, 3 and 4

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.

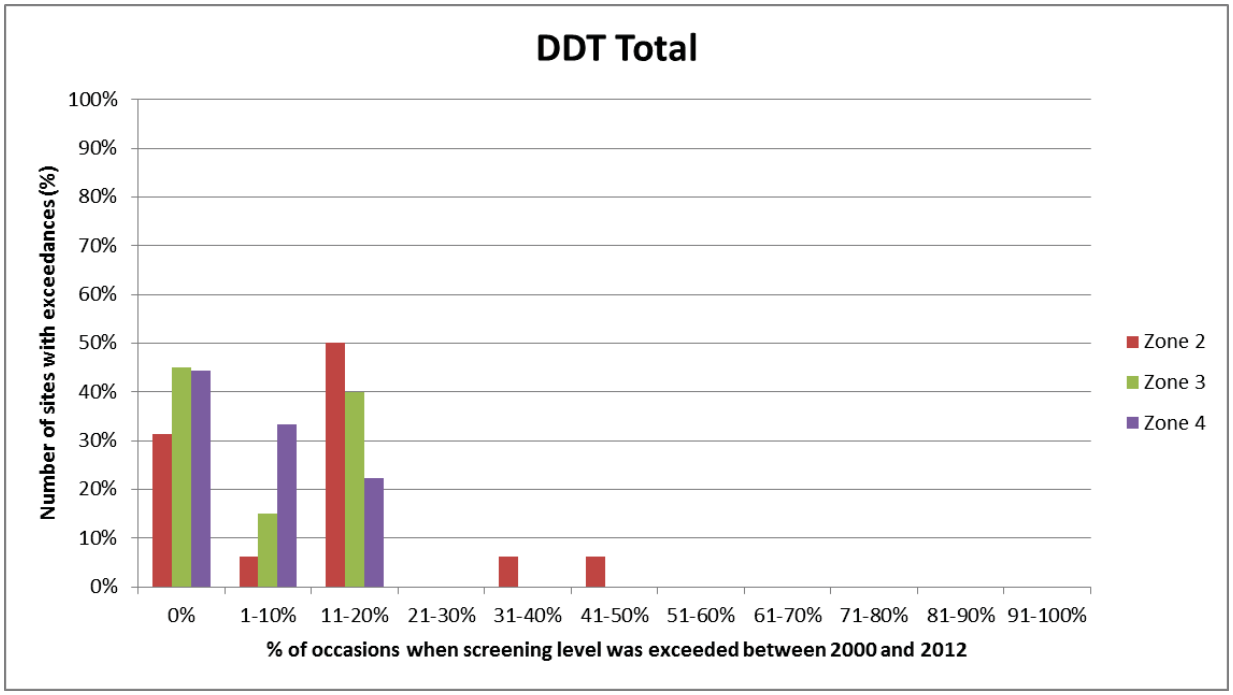
Total DDT concentrations and its metabolites DDD and DDE exceeded their respective screening levels (1.6, 2 and 2.2 µg/kg for DDT, DDD and DDE, respectively) on numerous occasions across all dredge zones (). This includes some exceedances of the NAGD high levels for DDT (46 µg/kg) and DDD (20 µg/kg), 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).



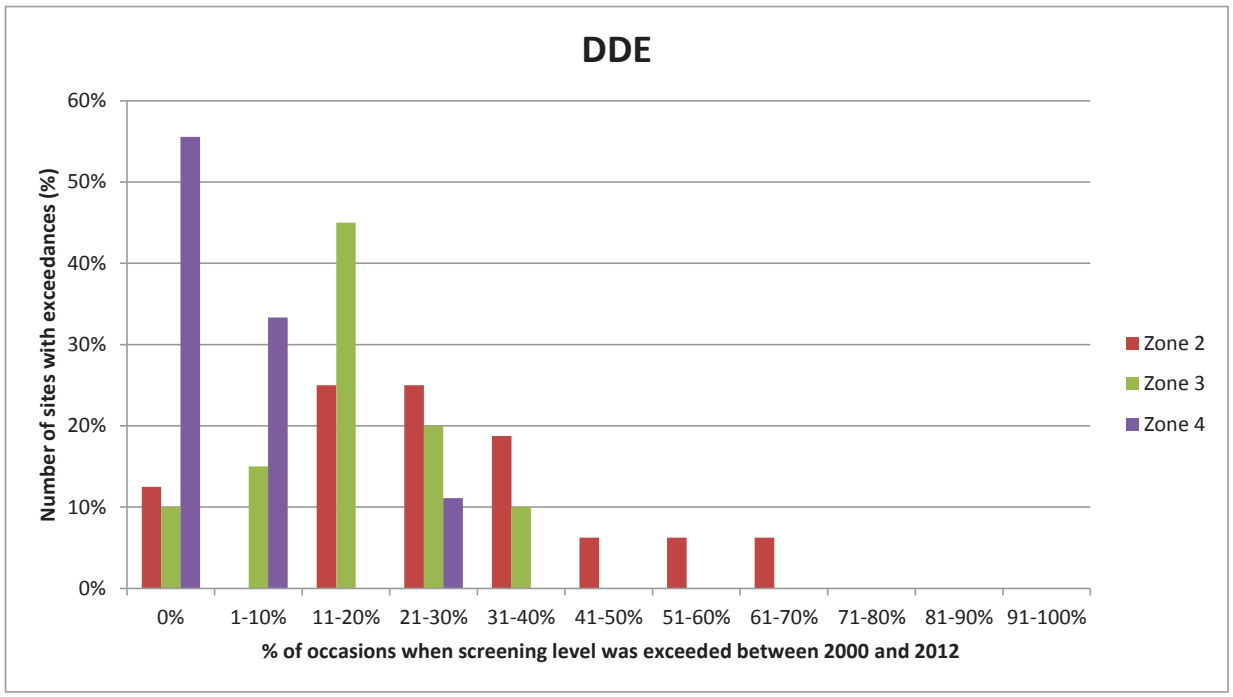


Figure 2-8 Exceedances of the NAGD Screening Level for total DDT (upper plot) and DDE (lower plot) between 2000 and 2012 in Dredge Zones 2, 3 and 4. Similar Trends for DDD.

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

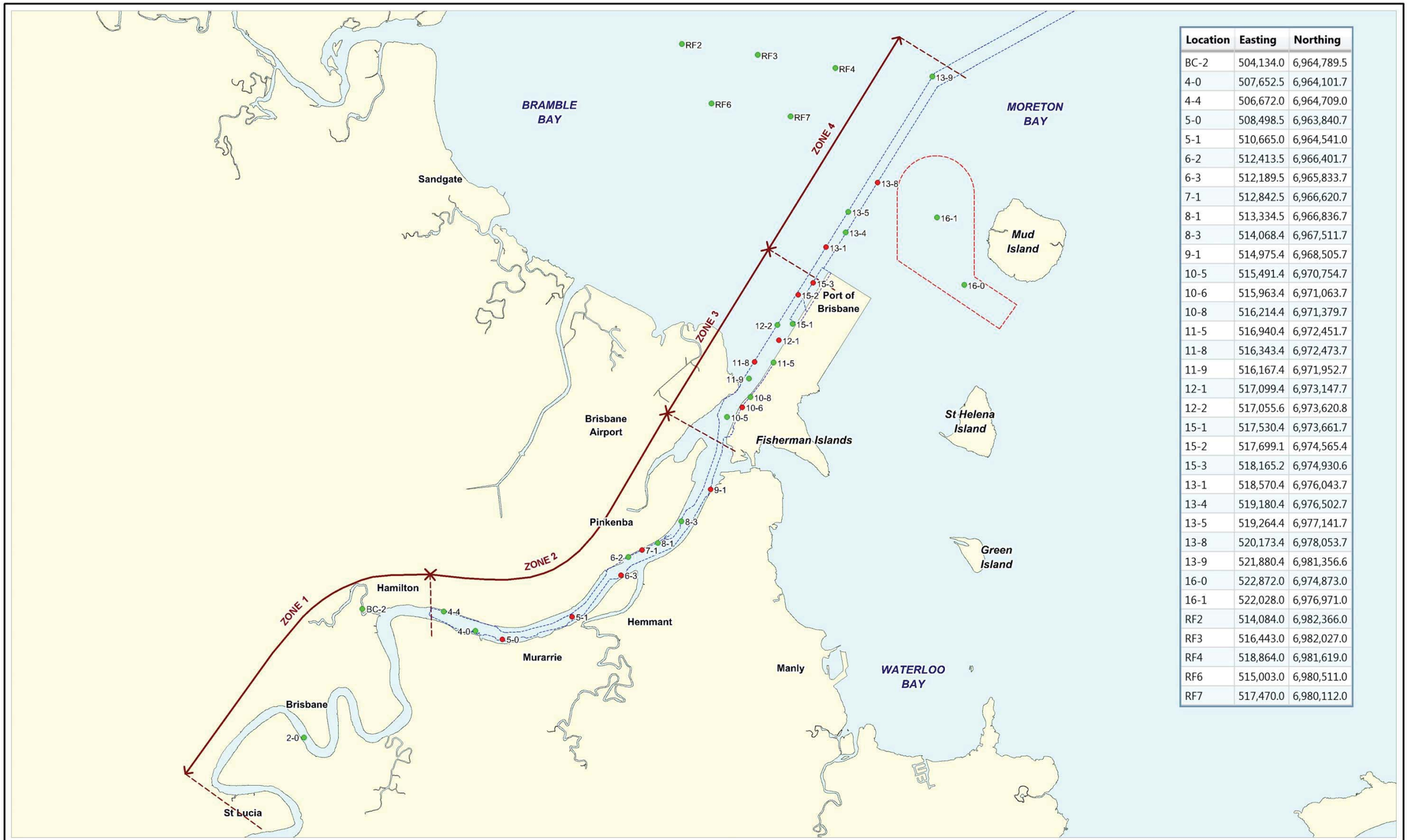
Additional sediment samples will be collected at selected locations for pore water testing of organic contaminants as part of the Phase III elutriate and bioavailability assessments (refer to Section 3.1.3).

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.

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BMT WBM Bangalow
6/20 Byron Street Bangalow 2479
Tel +61 2 6687 0466 Fax +61 2 66870422
Email bmtwbm@bmtwbm.com.au
Web www.bmtwml.com.au

BMT WBM Brisbane
Level 8, 200 Creek Street Brisbane 4000
PO Box 203 Spring Hill QLD 4004
Tel +61 7 3831 6744 Fax +61 7 3832 3627
Email bmtwbm@bmtwbm.com.au
Web www.bmtwml.com.au

BMT WBM Denver
8200 S. Akron Street, #B120
Centennial Denver Colorado 80112 USA
Tel +1 303 792 9814 Fax +1 303 792 9742
Email denver@bmtwbm.com
Web www.bmtwbm.com

BMT WBM London
1st Floor, International House
St Katherine's Way London E1W1TW
Email london@bmtwbm.co.uk
Web www.bmtwbm.com.au

BMT WBM Mackay
Suite 1, 138 Wood Street Mackay 4740
PO Box 4447 Mackay QLD 4740
Tel +61 7 4953 5144 Fax +61 7 4953 5132
Email mackay@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Melbourne
Level 5, 99 King Street Melbourne 3000
PO Box 604 Collins Street West VIC 8007
Tel +61 3 8620 6100 Fax +61 3 8620 6105
Email melbourne@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Newcastle
126 Belford Street Broadmeadow 2292
PO Box 266 Broadmeadow NSW 2292
Tel +61 2 4940 8882 Fax +61 2 4940 8887
Email newcastle@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Perth
Suite 6, 29 Hood Street Subiaco 6008
Tel +61 8 9328 2029 Fax +61 8 9486 7588
Email perth@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Sydney
Level 1, 256-258 Norton Street Leichhardt 2040
PO Box 194 Leichhardt NSW 2040
Tel +61 2 8987 2900 Fax +61 2 8987 2999
Email sydney@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Vancouver
Suite 401, 611 Alexander Street
Vancouver British Columbia V6E 3W1 Canada
Tel +1 604 683 5777 Fax +1 604 608 3232
Email vancouver@bmtwbm.com.au
Web www.bmtwbm.com

Appendix B Sediment Sampling Log

B.1 Sediment Grab Photographs

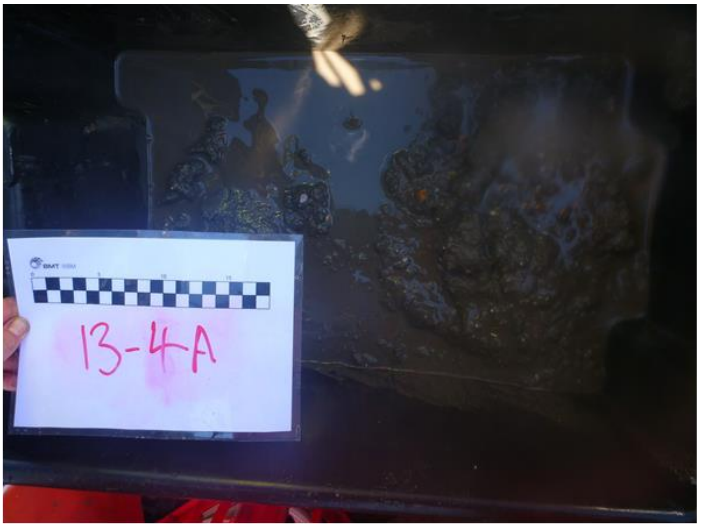
Sediment Sampling Log

Sediment Sampling Log

Sediment Sampling Log

Sediment Sampling Log


13-5


13-4A


13-4B


13-4C


13-1

B.2 2017 Sampling Log

Vessel: Resolution 2				Weather/Sea state: calm					
Type of sampler: Large grab				Sediment					Comment - Presence of organic matter or benthic flora/fauna, etc
Site	WPT	Time	Date	Depth	Colour	Odour	texture	Plasticity	
B11-5	GPS002	800	3/08/2017	15	brown/grey	slight	mud	mod	upper layer of brown mud overlaying grey lay, slight odour in lower horizon
B15-1	GPS001	820	3/08/2017	14.8	brown/grey	nil	mud/sand	mod	fine upper lay of sand overlaying mud layer, shell grit present in upper layer
B13-9	GPS003	850	3/08/2017	12.5	brown/grey	nil	soft mud	mod	light brown layer at surface
B13-8	GPS004	925	3/08/2017	11.8	grey	nil	sticky mud	soft-mod	shell grit present
B13-5		950	3/08/2017	9.3	grey	nil	fine mud	mod-high	soft upper brown at surface w/grit, firm clay/silt mixture below
B13-4	GPS009	1015	3/08/2017	7	grey	nil	lumpy clay/sand/shell	low	For all grabs, lumps of clay amongst sand and shell grit, some silt, grit mostly at surface
B13-4BT		120	3/08/2017	7	grey	nil	lumpy clay/sand/shell	low	
B13-4CT		125	3/08/2017	7	grey	nil	lumpy clay/sand/shell	low	
B13-1	GPS010	1100	3/08/2017	7.2	dark grey	nil	mud/sand	mod-high	sand in upper layer, overlaying mud/silt. Some lumps of clay throughout
B15-3	GPS011	1130	3/08/2017	11.2	grey	nil	mud/sand with shell grit	low-high (lumps of clay)	lumpy sample, lemon sized lumps of clay present, some shell grit at surface
B15-2	GPS013	1200	3/08/2017	12.9	grey	nil	mud/sand	high	thin layer of brown mud at surface, some clay giving high plasticity, clay throughput sample
B11-9	GPS014	1245	3/08/2017	14.4	brown/grey	nil	mud	mod	All grey mud with thin layer of brown mud at surface, no OM in B11-9 and B11-9CT, some OM in surface layer on B11-9BT
B11-9BT		1245	3/08/2017	14.4	brown/grey	nil	mud	mod	
B11-9CT		1245	3/08/2017	14.4	brown/grey	nil	mud	mod	
B11-8	GPS015	1315	3/08/2017	4	grey	nil	lumpy mud	high	brown layer at surface w/some shell grit throughout. Lumps of clay present amongst silts
B12-1	GPS 016	1330	3/08/2017	15.2	grey	nil	soft-firm mud	low-mod	Grabs slight different to each other, one with sand at surface and silt beneath, the other just mud
B10-6	GPS017	1410	3/08/2017	5.3	drak grey	nil	soft mud with shell grit	low	
B10-5	GPS018	1440	3/08/2017	14.8	grey	nil	soft mud	low	thin layer of brown mud at surface overlaying grey mud
B10-8	10-8R	830	7/08/2017	15	grey	nil	soft mud	low	brown upper layer over grey/black
B9-1	9-1R	840	7/08/2017	16	grey	nil	mud/sand	low	mud/sand miture with some shell grit
B8-3	8-3R	900	7/08/2017	15	grey	nil	mud	low	soft mud with upper layer of brown mud over grey
B6-2	6-2R	930	7/08/2017	11	grey	nil	mud	mod-high	brown upper layer over grey/black, some shell grit in upper layer
B6-3	6-3R	1000	7/08/2017	11	brown/grey	nil	mud	mod-high	
B5-1	5-1R	1015	7/08/2017	7	brown/grey	nil	mud/sand	mod-high	brown upper layer over grey, some shell grit in upper layer
B5-1BT		1015	7/08/2017	7	grey	nil	mud	mod-high	brown upper layer over grey, some shell grit in upper layer
B5-1CT		1015	7/08/2017	7	grey	nil	mud	mod-high	brown upper layer over grey, some shell grit in upper layer
B5-0	5-0R	1050	7/08/2017	9	grey	nil	mud	low	very soft mud, surface layer is brown
B4-0	4-0R	1100	7/08/2017	10	grey	nil	mud	low-high (	brown upper layer over grey/black, some shell grit in upper layer, one grab was relatively firm
B4-4	4-4R	1140	7/08/2017	10	grey	nil	mud	low	very soft mud, surface layer is brown
BC-2	BC2-R	1215	7/08/2017	3	brown/grey	nil	sand/mud	low	moderate-high amount of OM throughout sample, sample mainly sand with silt upper layer
B2-0	2-0R	1300	7/08/2017	13	brown/grey	nil	sand	low	some OM and mud clumps on surface
B7-1	7-1R	1350	7/08/2017	13	brown/grey	nil	mud	low-mod	brown overlaying grey mud

Sediment Sampling Log

Vessel: Resolution 2				Weather/Sea state: calm					
B8-1	8-1R	1500	7/08/2017	12	grey	nil	soft mud	low	brown overlaying grey mud, some shell grit at surface

Appendix C Sediment Quality Results – Primary Laboratory

SAMPLE RECEIPT NOTIFICATION

Attention : Brad Hiles

Client : BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane QLD 4000
Telephone : 07 3831 6744
Facsimile : 07 3832 3627

Project : Port of Brisbane - Sediment Analysis **Order Number :**

Laboratory Reference : A17/2852-A

Completed Chain of Custody accompanied samples.	**YES**
Samples were received in good condition and correctly preserved for all tests.	**YES**
Samples were received in sufficient time to allow laboratory to meet holding times.	**YES**
Samples were received chilled/chilling (if required).	**YES**

Date samples received : **08/08/2017**
Matrix : **Sediment**
No. of samples : **38**
Scheduled reporting date : **22/08/17**

Customer Services Officer : Trent Biggin

Telephone : 07 3268 1228
Email : brisbane@advancedanalytical.com.au

Contact your Customer Services Officer for all queries and issues regarding this sample batch.

Note: Turnaround time begins at time of receipt at laboratory, surcharges may apply for fast turnaround.

Water samples will be appropriately stored for 1 month from date of receipt of samples.
Soil / Sediment samples will be appropriately stored for 2 months from date of receipt of samples.

COMMENTS:

REPORT OF ANALYSIS

Laboratory Reference: A17/2852-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: 38
Date Received: 08/08/2017
Date Completed: 30/08/2017

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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Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia

Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/1** **B11-5** **03/08/2017**	**/2** **B15-1** **03/08/2017**	**/3** **B13-9** **03/08/2017**	**/4** **B13-8** **03/08/2017**
Moisture Content						
Moisture Content	04-004	%	59.1	44.7	62.3	54.7
Trace Elements						
Aluminium	04-001	mg/kg	19,000	13,000	21,000	18,000
Arsenic	04-001	mg/kg	7.5	5.0	7.5	6.6
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	34	25	34	33
Copper	04-001	mg/kg	23	14	15	23
Iron	04-001	mg/kg	34,000	26,000	36,000	32,000
Lead	04-001	mg/kg	13	9.0	11	15
Mercury	04-002	mg/kg	0.08	0.05	0.05	0.08
Nickel	04-001	mg/kg	20	16	18	20
Phosphorus*	04-001	mg/kg	690	470	540	590
Silver	04-001	mg/kg	<0.5	<0.5	<0.5	<0.5
Zinc	04-001	mg/kg	87	51	54	71
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	[NA]	[NA]	[NA]	<10
TPH C10-C14	04-020	mg/kg	[NA]	[NA]	[NA]	<10
TPH C15-C28	04-020	mg/kg	[NA]	[NA]	[NA]	<50
TPH C29-C36	04-020	mg/kg	[NA]	[NA]	[NA]	<50
Surrogate Recovery	04-020	%	[NA]	[NA]	[NA]	88
Date Extracted	04-020	-	[NA]	[NA]	[NA]	14/08/2017
Date Analysed	04-020	-	[NA]	[NA]	[NA]	16/08/2017
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

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/1** **B11-5** **03/08/2017**	**/2** **B15-1** **03/08/2017**	**/3** **B13-9** **03/08/2017**	**/4** **B13-8** **03/08/2017**
p,p'-DDE	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
p,p'-DDT	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
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	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	102	101	100	96
Date Extracted	04-024	-	14/08/2017	14/08/2017	14/08/2017	14/08/2017
Date Analysed	04-024	-	16/08/2017	16/08/2017	16/08/2017	16/08/2017
Organotin Analysis						
Monobutyltin	04-026	µgSn/kg	<0.50	<0.50	<0.50	<0.50
Dibutyltin	04-026	µgSn/kg	<0.50	<0.50	3.0	2.2
Tributyltin	04-026	µgSn/kg	<0.50	<0.50	<0.50	<0.50
Surrogate Recovery	04-026	%	86	61	84	95
Date Extracted	04-026	-	28/08/2017	28/08/2017	28/08/2017	28/08/2017
Date Analysed	04-026	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
BTEX						
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]	16

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/1** **B11-5** **03/08/2017**	**/2** **B15-1** **03/08/2017**	**/3** **B13-9** **03/08/2017**	**/4** **B13-8** **03/08/2017**
Anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	5.0
Fluoranthene	04-022	µg/kg	[NA]	[NA]	[NA]	49
Pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	53
Benz(a)anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	28
Chrysene	04-022	µg/kg	[NA]	[NA]	[NA]	27
Benzo(b)&(k)fluoranthene	04-022	µg/kg	[NA]	[NA]	[NA]	72
Benzo(a)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	37
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	31
Dibenz(a,h)anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	6.0
Benzo(g,h,i)perylene	04-022	µg/kg	[NA]	[NA]	[NA]	33
Coronene	04-022	µg/kg	[NA]	[NA]	[NA]	<10
Benzo(e)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	28
Perylene	04-022	µg/kg	[NA]	[NA]	[NA]	48
Total PAHs (as above)	04-022	µg/kg	[NA]	[NA]	[NA]	440
Surrogate 1 Recovery	04-022	%	[NA]	[NA]	[NA]	104
Surrogate 2 Recovery	04-022	%	[NA]	[NA]	[NA]	109
Surrogate 3 Recovery	04-022	%	[NA]	[NA]	[NA]	98
Date Extracted	04-022	-	[NA]	[NA]	[NA]	14/08/2017
Date Analysed	04-022	-	[NA]	[NA]	[NA]	16/08/2017
Polychlorinated Biphenyls						
Mono:1	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Di:8,15	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Tri:18,22,28	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Tetra:44,52,66,77	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Penta:101,105,118,126	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Hexa:128,138,153,169	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Hepta:170,180,187	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Octa:195	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Nona: 206	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Deca: 209	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]	97
Surrogate 2 Recovery	04-029	%	[NA]	[NA]	[NA]	95

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
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Laboratory Reference:	-	-	/1	/2	/3	/4
Client Reference:	-	-	B11-5	B15-1	B13-9	B13-8
Date Sampled:	-	-	03/08/2017	03/08/2017	03/08/2017	03/08/2017
Analysis Description	**Method**	**Units**				
Date Extracted	04-029	-	[NA]	[NA]	[NA]	14/08/2017
Date Analysed	04-029	-	[NA]	[NA]	[NA]	16/08/2017
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.4	0.94	1.2	1.3
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]	1,080
Total Nitrogen^	SUB	mg/kg	[NA]	[NA]	[NA]	1,080
Gross Alpha^	SUB	mBq/g	[NA]	[NA]	[NA]	See Comments
Gross Beta^	SUB	mBq/g	[NA]	[NA]	[NA]	Comments
Particle Size Distribution^	SUB		[NA]	[NA]	[NA]	Comments
Chromium Reducible Suite^	SUB		[NA]	[NA]	[NA]	Comments

Laboratory Reference:	-	-	/5	/6	/7	/8
Client Reference:	-	-	B13-5	B13-4	B13-4BT	B13-1
Date Sampled:	-	-	03/08/2017	03/08/2017	03/08/2017	03/08/2017
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	46.7	23.3	33.8	40.5
Trace Elements						
Aluminium	04-001	mg/kg	17,000	7,200	10,000	14,000
Arsenic	04-001	mg/kg	6.7	4.8	5.8	7.6
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	33	16	21	29
Copper	04-001	mg/kg	19	6.5	7.4	14
Iron	04-001	mg/kg	32,000	17,000	22,000	28,000
Lead	04-001	mg/kg	14	7.4	6.4	11
Mercury	04-002	mg/kg	0.14	0.02	0.02	0.26
Nickel	04-001	mg/kg	18	9.6	12	15
Phosphorus*	04-001	mg/kg	530	310	340	480
Silver	04-001	mg/kg	<0.5	<0.5	<0.5	<0.5
Zinc	04-001	mg/kg	66	43	39	59

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
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Batch Number: A17/2852-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/5** **B13-5** **03/08/2017**	**/6** **B13-4** **03/08/2017**	**/7** **B13-4BT** **03/08/2017**	**/8** **B13-1** **03/08/2017**
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	[NA]	[NA]	[NA]	<10
TPH C10-C14	04-020	mg/kg	[NA]	[NA]	[NA]	<10
TPH C15-C28	04-020	mg/kg	[NA]	[NA]	[NA]	<50
TPH C29-C36	04-020	mg/kg	[NA]	[NA]	[NA]	<50
Surrogate Recovery	04-020	%	[NA]	[NA]	[NA]	92
Date Extracted	04-020	-	[NA]	[NA]	[NA]	14/08/2017
Date Analysed	04-020	-	[NA]	[NA]	[NA]	16/08/2017
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	<1.0	<1.0	<1.0
p,p'-DDT	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
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	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	96	97	92	96
Date Extracted	04-024	-	14/08/2017	14/08/2017	14/08/2017	14/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/5** **B13-5** **03/08/2017**	**/6** **B13-4** **03/08/2017**	**/7** **B13-4BT** **03/08/2017**	**/8** **B13-1** **03/08/2017**
Date Analysed	04-024	-	16/08/2017	16/08/2017	16/08/2017	16/08/2017
Organotin Analysis						
Monobutyltin	04-026	µgSn/kg	2.0	<0.50	<0.50	<0.50
Dibutyltin	04-026	µgSn/kg	1.7	<0.50	<0.50	<0.50
Tributyltin	04-026	µgSn/kg	<0.50	<0.50	<0.50	<0.50
Surrogate Recovery	04-026	%	80	64	78	84
Date Extracted	04-026	-	28/08/2017	28/08/2017	28/08/2017	28/08/2017
Date Analysed	04-026	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
BTEX						
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]	11
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]	12
Anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	6.0
Fluoranthene	04-022	µg/kg	[NA]	[NA]	[NA]	49
Pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	60
Benz(a)anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	32
Chrysene	04-022	µg/kg	[NA]	[NA]	[NA]	32
Benzo(b)&(k)fluoranthene	04-022	µg/kg	[NA]	[NA]	[NA]	130
Benzo(a)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	80
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	63
Dibenz(a,h)anthracene	04-022	µg/kg	[NA]	[NA]	[NA]	13
Benzo(g,h,i)perylene	04-022	µg/kg	[NA]	[NA]	[NA]	60
Coronene	04-022	µg/kg	[NA]	[NA]	[NA]	18
Benzo(e)pyrene	04-022	µg/kg	[NA]	[NA]	[NA]	52
Perylene	04-022	µg/kg	[NA]	[NA]	[NA]	80
Total PAHs (as above)	04-022	µg/kg	[NA]	[NA]	[NA]	700
Surrogate 1 Recovery	04-022	%	[NA]	[NA]	[NA]	102
Surrogate 2 Recovery	04-022	%	[NA]	[NA]	[NA]	104

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/5** **B13-5** **03/08/2017**	**/6** **B13-4** **03/08/2017**	**/7** **B13-4BT** **03/08/2017**	**/8** **B13-1** **03/08/2017**
Surrogate 3 Recovery	04-022	%	[NA]	[NA]	[NA]	99
Date Extracted	04-022	-	[NA]	[NA]	[NA]	14/08/2017
Date Analysed	04-022	-	[NA]	[NA]	[NA]	16/08/2017
Polychlorinated Biphenyls						
Mono:1	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Di:8,15	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Tri:18,22,28	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Tetra:44,52,66,77	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Penta:101,105,118,126	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Hexa:128,138,153,169	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Hepta:170,180,187	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Octa:195	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Nona: 206	04-029	µg/kg	[NA]	[NA]	[NA]	<5.0
Deca: 209	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]	97
Surrogate 2 Recovery	04-029	%	[NA]	[NA]	[NA]	97
Date Extracted	04-029	-	[NA]	[NA]	[NA]	14/08/2017
Date Analysed	04-029	-	[NA]	[NA]	[NA]	16/08/2017
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.1	0.36	0.61	1.1
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]	700
Total Nitrogen^	SUB	mg/kg	[NA]	[NA]	[NA]	700
Gross Alpha^	SUB	mBq/g	[NA]	[NA]	[NA]	See Comments
Gross Beta^	SUB	mBq/g	[NA]	[NA]	[NA]	Comments
Particle Size Distribution^	SUB		[NA]	[NA]	[NA]	Comments
Chromium Reducible Suite^	SUB		[NA]	[NA]	[NA]	Comments

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Laboratory Reference: Client Reference: Date Sampled: Analysis Description	- - - Method	- - - Units	/9 B15-3 03/08/2017	/10 B15-2 03/08/2017	/11 B12-2 03/08/2017	/12 B11-9 03/08/2017
Moisture Content						
Moisture Content	04-004	%	37.0	32.5	52.8	61.7
Trace Elements						
Aluminium	04-001	mg/kg	13,000	9,100	22,000	22,000
Arsenic	04-001	mg/kg	8.0	6.0	5.6	7.7
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	28	20	37	38
Copper	04-001	mg/kg	7.8	6.9	22	25
Iron	04-001	mg/kg	27,000	21,000	40,000	39,000
Lead	04-001	mg/kg	5.6	5.6	11	15
Mercury	04-002	mg/kg	0.02	0.02	0.07	0.1
Nickel	04-001	mg/kg	14	11	27	22
Phosphorus*	04-001	mg/kg	370	350	770	730
Silver	04-001	mg/kg	<0.5	<0.5	<0.5	<0.5
Zinc	04-001	mg/kg	35	34	3.6	84
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	<10	[NA]	[NA]
TPH C10-C14	04-020	mg/kg	<10	<10	[NA]	[NA]
TPH C15-C28	04-020	mg/kg	<50	<50	[NA]	[NA]
TPH C29-C36	04-020	mg/kg	<50	<50	[NA]	[NA]
Surrogate Recovery	04-020	%	96	93	[NA]	[NA]
Date Extracted	04-020	-	14/08/2017	14/08/2017	[NA]	[NA]
Date Analysed	04-020	-	16/08/2017	16/08/2017	[NA]	[NA]
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	<1.0	<1.0	<1.0

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/9** **B15-3** **03/08/2017**	**/10** **B15-2** **03/08/2017**	**/11** **B12-2** **03/08/2017**	**/12** **B11-9** **03/08/2017**
p,p'-DDT	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
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	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	95	91	96	97
Date Extracted	04-024	-	14/08/2017	14/08/2017	14/08/2017	14/08/2017
Date Analysed	04-024	-	16/08/2017	16/08/2017	16/08/2017	16/08/2017
Organotin Analysis						
Monobutyltin	04-026	µgSn/kg	<0.50	<0.50	<0.50	<0.50
Dibutyltin	04-026	µgSn/kg	<0.50	<0.50	<0.50	<0.50
Tributyltin	04-026	µgSn/kg	<0.50	<0.50	<0.50	13
Surrogate Recovery	04-026	%	86	84	58	108
Date Extracted	04-026	-	28/08/2017	28/08/2017	28/08/2017	28/08/2017
Date Analysed	04-026	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
BTEX						
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
1-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
2-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Acenaphthylene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Acenaphthene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Fluorene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Phenanthrene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Anthracene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/9** **B15-3** **03/08/2017**	**/10** **B15-2** **03/08/2017**	**/11** **B12-2** **03/08/2017**	**/12** **B11-9** **03/08/2017**
Fluoranthene	04-022	µg/kg	<5.0	8.0	[NA]	[NA]
Pyrene	04-022	µg/kg	<5.0	9.0	[NA]	[NA]
Benz(a)anthracene	04-022	µg/kg	<5.0	6.0	[NA]	[NA]
Chrysene	04-022	µg/kg	<5.0	5.0	[NA]	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	<10	14	[NA]	[NA]
Benzo(a)pyrene	04-022	µg/kg	<5.0	7.0	[NA]	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	<5.0	8.0	[NA]	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	<5.0	6.0	[NA]	[NA]
Coronene	04-022	µg/kg	<10	<10	[NA]	[NA]
Benzo(e)pyrene	04-022	µg/kg	<5.0	5.0	[NA]	[NA]
Perylene	04-022	µg/kg	23	21	[NA]	[NA]
Total PAHs (as above)	04-022	µg/kg	<100	<100	[NA]	[NA]
Surrogate 1 Recovery	04-022	%	102	97	[NA]	[NA]
Surrogate 2 Recovery	04-022	%	99	99	[NA]	[NA]
Surrogate 3 Recovery	04-022	%	99	96	[NA]	[NA]
Date Extracted	04-022	-	14/08/2017	14/08/2017	[NA]	[NA]
Date Analysed	04-022	-	16/08/2017	16/08/2017	[NA]	[NA]
Polychlorinated Biphenyls						
Mono:1	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Di:8,15	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Tri:18,22,28	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Tetra:44,52,66,77	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Penta:101,105,118,126	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Hexa:128,138,153,169	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Hepta:170,180,187	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Octa:195	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Nona:206	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Deca:209	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Total PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Surrogate 1 Recovery	04-029	%	98	94	[NA]	[NA]
Surrogate 2 Recovery	04-029	%	95	92	[NA]	[NA]
Date Extracted	04-029	-	14/08/2017	14/08/2017	[NA]	[NA]

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Laboratory Reference:	-	-	/9	/10	/11	/12
Client Reference:	-	-	B15-3	B15-2	B12-2	B11-9
Date Sampled:	-	-	03/08/2017	03/08/2017	03/08/2017	03/08/2017
Analysis Description	**Method**	**Units**				
Date Analysed	04-029	-	16/08/2017	16/08/2017	[NA]	[NA]
Subcontract Analysis						
Total Organic Carbon^	SUB	%	0.44	0.37	1.3	1.5
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	400	360	[NA]	[NA]
Total Nitrogen^	SUB	mg/kg	400	360	[NA]	[NA]
Gross Alpha^	SUB	mBq/g	See Comments	See Comments	[NA]	[NA]
Gross Beta^	SUB	mBq/g	Comments	Comments	[NA]	[NA]
Particle Size Distribution^	SUB		Comments	Comments	[NA]	[NA]
Chromium Reducible Suite^	SUB		Comments	Comments	[NA]	[NA]

Laboratory Reference:	-	-	/13	/14	/15	/16
Client Reference:	-	-	B11-9BT	B11-8	B11-8B	B12-1
Date Sampled:	-	-	03/08/2017	03/08/2017	03/08/2017	03/08/2017
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	57.7	45.7	[NA]	39.1
Trace Elements						
Aluminium	04-001	mg/kg	18,000	15,000	[NA]	12,000
Arsenic	04-001	mg/kg	8.1	6.9	[NA]	5.4
Cadmium	04-001	mg/kg	<0.1	<0.1	[NA]	<0.1
Chromium	04-001	mg/kg	38	29	[NA]	23
Copper	04-001	mg/kg	25	16	[NA]	12
Iron	04-001	mg/kg	35,000	30,000	[NA]	24,000
Lead	04-001	mg/kg	15	8.9	[NA]	8.7
Mercury	04-002	mg/kg	0.09	0.06	[NA]	0.05
Nickel	04-001	mg/kg	21	16	[NA]	14
Phosphorus*	04-001	mg/kg	730	490	[NA]	470
Silver	04-001	mg/kg	<0.5	<0.5	[NA]	<0.5
Zinc	04-001	mg/kg	82	51	[NA]	46
Total Petroleum Hydrocarbons						

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/13** **B11-9BT** **03/08/2017**	**/14** **B11-8** **03/08/2017**	**/15** **B11-8B** **03/08/2017**	**/16** **B12-1** **03/08/2017**
TPH C6-C9	04-021	mg/kg	[NA]	<10	[NA]	<10
TPH C10-C14	04-020	mg/kg	[NA]	<10	[NA]	<10
TPH C15-C28	04-020	mg/kg	[NA]	<50	[NA]	<50
TPH C29-C36	04-020	mg/kg	[NA]	<50	[NA]	<50
Surrogate Recovery	04-020	%	[NA]	88	[NA]	89
Date Extracted	04-020	-	[NA]	14/08/2017	[NA]	14/08/2017
Date Analysed	04-020	-	[NA]	16/08/2017	[NA]	16/08/2017
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
alpha-BHC	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
beta-BHC	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
delta-BHC	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
p,p'-DDD	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
p,p'-DDE	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
p,p'-DDT	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
Dieldrin	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
Endrin	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
Endrin ketone	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
Endrin aldehyde	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
Heptachlor	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
Methoxychlor	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	[NA]	<1.0
Surrogate Recovery	04-024	%	93	94	[NA]	90
Date Extracted	04-024	-	14/08/2017	14/08/2017	[NA]	14/08/2017
Date Analysed	04-024	-	16/08/2017	16/08/2017	[NA]	16/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/13** **B11-9BT** **03/08/2017**	**/14** **B11-8** **03/08/2017**	**/15** **B11-8B** **03/08/2017**	**/16** **B12-1** **03/08/2017**
Organotin Analysis						
Monobutyltin	04-026	µgSn/kg	<0.50	<0.50	[NA]	<0.50
Dibutyltin	04-026	µgSn/kg	<0.50	<0.50	[NA]	<0.50
Tributyltin	04-026	µgSn/kg	<0.50	<0.50	[NA]	<0.50
Surrogate Recovery	04-026	%	98	69	[NA]	79
Date Extracted	04-026	-	28/08/2017	28/08/2017	[NA]	28/08/2017
Date Analysed	04-026	-	29/08/2017	29/08/2017	[NA]	29/08/2017
BTEX						
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	[NA]	<5.0	[NA]	<5.0
1-Methylnaphthalene	04-022	µg/kg	[NA]	<5.0	[NA]	<5.0
2-Methylnaphthalene	04-022	µg/kg	[NA]	<5.0	[NA]	<5.0
Acenaphthylene	04-022	µg/kg	[NA]	<5.0	[NA]	5.0
Acenaphthene	04-022	µg/kg	[NA]	<5.0	[NA]	<5.0
Fluorene	04-022	µg/kg	[NA]	<5.0	[NA]	<5.0
Phenanthrene	04-022	µg/kg	[NA]	14	[NA]	11
Anthracene	04-022	µg/kg	[NA]	5.0	[NA]	<5.0
Fluoranthene	04-022	µg/kg	[NA]	46	[NA]	35
Pyrene	04-022	µg/kg	[NA]	54	[NA]	40
Benz(a)anthracene	04-022	µg/kg	[NA]	25	[NA]	20
Chrysene	04-022	µg/kg	[NA]	23	[NA]	19
Benzo(b)&(k)fluoranthene	04-022	µg/kg	[NA]	64	[NA]	55
Benzo(a)pyrene	04-022	µg/kg	[NA]	34	[NA]	30
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	[NA]	28	[NA]	26
Dibenz(a,h)anthracene	04-022	µg/kg	[NA]	5.0	[NA]	<5.0
Benzo(g,h,i)perylene	04-022	µg/kg	[NA]	30	[NA]	25
Coronene	04-022	µg/kg	[NA]	<10	[NA]	<10
Benzo(e)pyrene	04-022	µg/kg	[NA]	24	[NA]	21
Perylene	04-022	µg/kg	[NA]	87	[NA]	45
Total PAHs (as above)	04-022	µg/kg	[NA]	440	[NA]	330
Surrogate 1 Recovery	04-022	%	[NA]	96	[NA]	92
Surrogate 2 Recovery	04-022	%	[NA]	102	[NA]	99
Surrogate 3 Recovery	04-022	%	[NA]	95	[NA]	91

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/13** **B11-9BT** **03/08/2017**	**/14** **B11-8** **03/08/2017**	**/15** **B11-8B** **03/08/2017**	**/16** **B12-1** **03/08/2017**
Date Extracted	04-022	-	[NA]	14/08/2017	[NA]	14/08/2017
Date Analysed	04-022	-	[NA]	16/08/2017	[NA]	16/08/2017
Polychlorinated Biphenyls						
Mono:1	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Di:8,15	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Tri:18,22,28	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Tetra:44,52,66,77	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Penta:101,105,118,126	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Hexa:128,138,153,169	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Hepta:170,180,187	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Octa:195	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Nona: 206	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Deca: 209	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Total PCB congeners	04-029	µg/kg	[NA]	<5.0	[NA]	<5.0
Surrogate 1 Recovery	04-029	%	[NA]	92	[NA]	88
Surrogate 2 Recovery	04-029	%	[NA]	91	[NA]	88
Date Extracted	04-029	-	[NA]	14/08/2017	[NA]	14/08/2017
Date Analysed	04-029	-	[NA]	16/08/2017	[NA]	16/08/2017
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.4	0.88	[NA]	0.79
Nitrate as N^	SUB	mg/kg	[NA]	<0.1	[NA]	<0.1
Nitrite as N^	SUB	mg/kg	[NA]	<0.1	[NA]	<0.1
Total Kjeldahl Nitrogen^	SUB	mg/kg	[NA]	640	[NA]	640
Total Nitrogen^	SUB	mg/kg	[NA]	640	[NA]	640
Gross Alpha^	SUB	mBq/g	[NA]	See Comments	[NA]	See Comments
Gross Beta^	SUB	mBq/g	[NA]	Comments	[NA]	Comments
Particle Size Distribution^	SUB		[NA]	Comments	[NA]	Comments
Chromium Reducible Suite^	SUB		[NA]	Comments	[NA]	Comments

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/17	/18	/19	/21
Client Reference:	-	-	B10-6	B10-6BTS	B10-5	B10-8
Date Sampled:	-	-	03/08/2017	03/08/2017	03/08/2017	07/08/2017
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	59.6	60.3	58.1	58.6
Trace Elements						
Aluminium	04-001	mg/kg	21,000	21,000	17,000	19,000
Arsenic	04-001	mg/kg	7.3	6.7	7.1	7.3
Cadmium	04-001	mg/kg	0.26	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	44	39	37	37
Copper	04-001	mg/kg	29	28	27	26
Iron	04-001	mg/kg	37,000	39,000	32,000	34,000
Lead	04-001	mg/kg	16	14	16	14
Mercury	04-002	mg/kg	0.18	0.12	0.12	0.09
Nickel	04-001	mg/kg	22	23	21	21
Phosphorus*	04-001	mg/kg	650	690	700	720
Silver	04-001	mg/kg	<0.5	<0.5	<0.5	<0.5
Zinc	04-001	mg/kg	100	92	92	89
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	<10	[NA]	[NA]
TPH C10-C14	04-020	mg/kg	<10	<10	[NA]	[NA]
TPH C15-C28	04-020	mg/kg	<50	<50	[NA]	[NA]
TPH C29-C36	04-020	mg/kg	<50	<50	[NA]	[NA]
Surrogate Recovery	04-020	%	86	83	[NA]	[NA]
Date Extracted	04-020	-	14/08/2017	14/08/2017	[NA]	[NA]
Date Analysed	04-020	-	16/08/2017	17/08/2017	[NA]	[NA]
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	<1.0	<1.0	<1.0

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/17** **B10-6** **03/08/2017**	**/18** **B10-6BTS** **03/08/2017**	**/19** **B10-5** **03/08/2017**	**/21** **B10-8** **07/08/2017**
p,p'-DDT	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
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	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	93	94	94	97
Date Extracted	04-024	-	14/08/2017	14/08/2017	14/08/2017	14/08/2017
Date Analysed	04-024	-	17/08/2017	17/08/2017	17/08/2017	17/08/2017
Organotin Analysis						
Monobutyltin	04-026	µgSn/kg	3.3	<0.50	<0.50	<0.50
Dibutyltin	04-026	µgSn/kg	<0.50	<0.50	6.0	<0.50
Tributyltin	04-026	µgSn/kg	<0.50	<0.50	<0.50	<0.50
Surrogate Recovery	04-026	%	126	66	84	62
Date Extracted	04-026	-	28/08/2017	28/08/2017	28/08/2017	28/08/2017
Date Analysed	04-026	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
BTEX						
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
1-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
2-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Acenaphthylene	04-022	µg/kg	7.0	7.0	[NA]	[NA]
Acenaphthene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Fluorene	04-022	µg/kg	<5.0	<5.0	[NA]	[NA]
Phenanthrene	04-022	µg/kg	19	21	[NA]	[NA]
Anthracene	04-022	µg/kg	7.0	8.0	[NA]	[NA]

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-A [R00]
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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/17** **B10-6** **03/08/2017**	**/18** **B10-6BTS** **03/08/2017**	**/19** **B10-5** **03/08/2017**	**/21** **B10-8** **07/08/2017**
Fluoranthene	04-022	µg/kg	49	59	[NA]	[NA]
Pyrene	04-022	µg/kg	71	80	[NA]	[NA]
Benz(a)anthracene	04-022	µg/kg	36	42	[NA]	[NA]
Chrysene	04-022	µg/kg	34	39	[NA]	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	94	100	[NA]	[NA]
Benzo(a)pyrene	04-022	µg/kg	49	51	[NA]	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	39	44	[NA]	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	7.0	8.0	[NA]	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	41	45	[NA]	[NA]
Coronene	04-022	µg/kg	11	12	[NA]	[NA]
Benzo(e)pyrene	04-022	µg/kg	36	37	[NA]	[NA]
Perylene	04-022	µg/kg	83	93	[NA]	[NA]
Total PAHs (as above)	04-022	µg/kg	580	650	[NA]	[NA]
Surrogate 1 Recovery	04-022	%	98	95	[NA]	[NA]
Surrogate 2 Recovery	04-022	%	103	102	[NA]	[NA]
Surrogate 3 Recovery	04-022	%	94	95	[NA]	[NA]
Date Extracted	04-022	-	14/08/2017	14/08/2017	[NA]	[NA]
Date Analysed	04-022	-	17/08/2017	17/08/2017	[NA]	[NA]
Polychlorinated Biphenyls						
Mono:1	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Di:8,15	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Tri:18,22,28	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Tetra:44,52,66,77	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Penta:101,105,118,126	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Hexa:128,138,153,169	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Hepta:170,180,187	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Octa:195	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Nona:206	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Deca:209	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Total PCB congeners	04-029	µg/kg	<5.0	<5.0	[NA]	[NA]
Surrogate 1 Recovery	04-029	%	93	92	[NA]	[NA]
Surrogate 2 Recovery	04-029	%	93	91	[NA]	[NA]
Date Extracted	04-029	-	14/08/2017	14/08/2017	[NA]	[NA]

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-A [R00]
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Laboratory Reference:	-	-	/17	/18	/19	/21
Client Reference:	-	-	B10-6	B10-6BTS	B10-5	B10-8
Date Sampled:	-	-	03/08/2017	03/08/2017	03/08/2017	07/08/2017
Analysis Description	**Method**	**Units**				
Date Analysed	04-029	-	17/08/2017	17/08/2017	[NA]	[NA]
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.6	1.6	1.5	1.5
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	1,370	1,330	[NA]	[NA]
Total Nitrogen^	SUB	mg/kg	1,370	1,330	[NA]	[NA]
Gross Alpha^	SUB	mBq/g	See Comments	See Comments	[NA]	[NA]
Gross Beta^	SUB	mBq/g	Comments	Comments	[NA]	[NA]
Particle Size Distribution^	SUB		Comments	Comments	[NA]	[NA]
Chromium Reducible Suite^	SUB		Comments	Comments	[NA]	[NA]

Laboratory Reference:	-	-	/22	/23	/24	/25
Client Reference:	-	-	B9-1	B8-3	B6-2	B6-2BTS
Date Sampled:	-	-	07/08/2017	07/08/2017	07/08/2017	07/08/2017
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	41.1	64.5	57.3	60.0
Trace Elements						
Aluminium	04-001	mg/kg	12,000	19,000	21,000	21,000
Arsenic	04-001	mg/kg	5.2	6.9	6.8	6.6
Cadmium	04-001	mg/kg	<0.1	<0.1	0.27	0.34
Chromium	04-001	mg/kg	31	37	34	36
Copper	04-001	mg/kg	24	27	110	50
Iron	04-001	mg/kg	28,000	35,000	34,000	36,000
Lead	04-001	mg/kg	9.3	16	17	17
Mercury	04-002	mg/kg	0.06	0.1	0.09	0.10
Nickel	04-001	mg/kg	23	21	20	21
Phosphorus*	04-001	mg/kg	630	760	1,600	1,700
Silver	04-001	mg/kg	<0.5	<0.5	<0.5	<0.5
Zinc	04-001	mg/kg	64	91	180	160
Total Petroleum Hydrocarbons						

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/22** **B9-1** **07/08/2017**	**/23** **B8-3** **07/08/2017**	**/24** **B6-2** **07/08/2017**	**/25** **B6-2BTS** **07/08/2017**
TPH C6-C9	04-021	mg/kg	<10	[NA]	[NA]	[NA]
TPH C10-C14	04-020	mg/kg	<10	[NA]	[NA]	[NA]
TPH C15-C28	04-020	mg/kg	<50	[NA]	[NA]	[NA]
TPH C29-C36	04-020	mg/kg	<50	[NA]	[NA]	[NA]
Surrogate Recovery	04-020	%	99	[NA]	[NA]	[NA]
Date Extracted	04-020	-	14/08/2017	[NA]	[NA]	[NA]
Date Analysed	04-020	-	17/08/2017	[NA]	[NA]	[NA]
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	<1.0	<1.0	<1.0
p,p'-DDT	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
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	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	100	97	95	94
Date Extracted	04-024	-	14/08/2017	14/08/2017	14/08/2017	14/08/2017
Date Analysed	04-024	-	17/08/2017	17/08/2017	17/08/2017	17/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/22	/23	/24	/25
Client Reference:	-	-	B9-1	B8-3	B6-2	B6-2BTS
Date Sampled:	-	-	07/08/2017	07/08/2017	07/08/2017	07/08/2017
Analysis Description	**Method**	**Units**				
Organotin Analysis						
Monobutyltin	04-026	µgSn/kg	1.0	<0.50	2.2	<0.50
Dibutyltin	04-026	µgSn/kg	2.7	<0.50	<0.50	<0.50
Tributyltin	04-026	µgSn/kg	2.0	<0.50	<0.50	<0.50
Surrogate Recovery	04-026	%	55	90	91	92
Date Extracted	04-026	-	28/08/2017	28/08/2017	28/08/2017	28/08/2017
Date Analysed	04-026	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
BTEX						
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
1-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
2-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Acenaphthylene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Acenaphthene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Fluorene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Phenanthrene	04-022	µg/kg	8.0	[NA]	[NA]	[NA]
Anthracene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Fluoranthene	04-022	µg/kg	27	[NA]	[NA]	[NA]
Pyrene	04-022	µg/kg	31	[NA]	[NA]	[NA]
Benz(a)anthracene	04-022	µg/kg	16	[NA]	[NA]	[NA]
Chrysene	04-022	µg/kg	15	[NA]	[NA]	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	47	[NA]	[NA]	[NA]
Benzo(a)pyrene	04-022	µg/kg	24	[NA]	[NA]	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	20	[NA]	[NA]	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	21	[NA]	[NA]	[NA]
Coronene	04-022	µg/kg	<10	[NA]	[NA]	[NA]
Benzo(e)pyrene	04-022	µg/kg	18	[NA]	[NA]	[NA]
Perylene	04-022	µg/kg	42	[NA]	[NA]	[NA]
Total PAHs (as above)	04-022	µg/kg	270	[NA]	[NA]	[NA]
Surrogate 1 Recovery	04-022	%	101	[NA]	[NA]	[NA]
Surrogate 2 Recovery	04-022	%	107	[NA]	[NA]	[NA]
Surrogate 3 Recovery	04-022	%	101	[NA]	[NA]	[NA]

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
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Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/22** **B9-1** **07/08/2017**	**/23** **B8-3** **07/08/2017**	**/24** **B6-2** **07/08/2017**	**/25** **B6-2BTS** **07/08/2017**
Date Extracted	04-022	-	14/08/2017	[NA]	[NA]	[NA]
Date Analysed	04-022	-	17/08/2017	[NA]	[NA]	[NA]
Polychlorinated Biphenyls						
Mono:1	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Di:8,15	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Tri:18,22,28	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Tetra:44,52,66,77	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Penta:101,105,118,126	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Hexa:128,138,153,169	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Hepta:170,180,187	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Octa:195	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Nona: 206	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Deca: 209	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Total PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Surrogate 1 Recovery	04-029	%	98	[NA]	[NA]	[NA]
Surrogate 2 Recovery	04-029	%	97	[NA]	[NA]	[NA]
Date Extracted	04-029	-	14/08/2017	[NA]	[NA]	[NA]
Date Analysed	04-029	-	17/08/2017	[NA]	[NA]	[NA]
Subcontract Analysis						
Total Organic Carbon^	SUB	%	0.82	1.6	1.4	1.5
Nitrate as N^	SUB	mg/kg	<0.1	[NA]	[NA]	[NA]
Nitrite as N^	SUB	mg/kg	<0.1	[NA]	[NA]	[NA]
Total Kjeldahl Nitrogen^	SUB	mg/kg	710	[NA]	[NA]	[NA]
Total Nitrogen^	SUB	mg/kg	710	[NA]	[NA]	[NA]
Gross Alpha^	SUB	mBq/g	See Comments	[NA]	[NA]	[NA]
Gross Beta^	SUB	mBq/g	Comments	[NA]	[NA]	[NA]
Particle Size Distribution^	SUB		Comments	[NA]	[NA]	[NA]
Chromium Reducible Suite^	SUB		Comments	[NA]	[NA]	[NA]

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference:	-	-	/26	/27	/28	/29
Client Reference:	-	-	B6-3	B5-1	B5-1BT	B5-0
Date Sampled:	-	-	07/08/2017	07/08/2017	07/08/2017	07/08/2017
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	66.4	54.2	56.9	61.1
Trace Elements						
Aluminium	04-001	mg/kg	23,000	19,000	17,000	21,000
Arsenic	04-001	mg/kg	7.8	6.0	6.5	6.5
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	40	37	37	40
Copper	04-001	mg/kg	37	29	29	34
Iron	04-001	mg/kg	39,000	35,000	34,000	38,000
Lead	04-001	mg/kg	19	20	100	17
Mercury	04-002	mg/kg	0.12	0.15	0.15	0.11
Nickel	04-001	mg/kg	23	21	21	24
Phosphorus*	04-001	mg/kg	890	730	780	860
Silver	04-001	mg/kg	<0.5	<0.5	<0.5	<0.5
Zinc	04-001	mg/kg	120	93	92	100
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	<10	<10	<10
TPH C10-C14	04-020	mg/kg	<10	<10	<10	<10
TPH C15-C28	04-020	mg/kg	<50	<50	<50	<50
TPH C29-C36	04-020	mg/kg	62	<50	<50	<50
Surrogate Recovery	04-020	%	88	83	92	98
Date Extracted	04-020	-	14/08/2017	14/08/2017	14/08/2017	14/08/2017
Date Analysed	04-020	-	17/08/2017	18/08/2017	18/08/2017	17/08/2017
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	<1.0	<1.0	<1.0

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/26** **B6-3** **07/08/2017**	**/27** **B5-1** **07/08/2017**	**/28** **B5-1BT** **07/08/2017**	**/29** **B5-0** **07/08/2017**
p,p'-DDT	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
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	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	94	100	99	100
Date Extracted	04-024	-	14/08/2017	14/08/2017	14/08/2017	14/08/2017
Date Analysed	04-024	-	17/08/2017	17/08/2017	17/08/2017	17/08/2017
Organotin Analysis						
Monobutyltin	04-026	µgSn/kg	<0.50	<0.50	<0.50	<0.50
Dibutyltin	04-026	µgSn/kg	2.8	5.8	<0.50	3.3
Tributyltin	04-026	µgSn/kg	3.6	<0.50	<0.50	3.4
Surrogate Recovery	04-026	%	97	81	82	82
Date Extracted	04-026	-	28/08/2017	28/08/2017	28/08/2017	28/08/2017
Date Analysed	04-026	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
BTEX						
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	<5.0	6.0	<5.0	<5.0
1-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0	<5.0	<5.0
2-Methylnaphthalene	04-022	µg/kg	<5.0	<5.0	<5.0	<5.0
Acenaphthylene	04-022	µg/kg	9.0	9.0	10	9.0
Acenaphthene	04-022	µg/kg	<5.0	<5.0	<5.0	<5.0
Fluorene	04-022	µg/kg	8.0	5.0	9.0	5.0
Phenanthrene	04-022	µg/kg	37	20	60	25
Anthracene	04-022	µg/kg	13	8.0	22	9.0

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/26** **B6-3** **07/08/2017**	**/27** **B5-1** **07/08/2017**	**/28** **B5-1BT** **07/08/2017**	**/29** **B5-0** **07/08/2017**
Fluoranthene	04-022	µg/kg	96	46	120	80
Pyrene	04-022	µg/kg	96	78	150	86
Benz(a)anthracene	04-022	µg/kg	42	38	72	41
Chrysene	04-022	µg/kg	44	39	74	41
Benzo(b)&(k)fluoranthene	04-022	µg/kg	110	100	170	110
Benzo(a)pyrene	04-022	µg/kg	54	52	88	55
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	50	42	71	47
Dibenz(a,h)anthracene	04-022	µg/kg	9.0	9.0	14	9.0
Benzo(g,h,i)perylene	04-022	µg/kg	51	47	68	49
Coronene	04-022	µg/kg	15	11	16	12
Benzo(e)pyrene	04-022	µg/kg	43	41	65	44
Perylene	04-022	µg/kg	170	190	240	180
Total PAHs (as above)	04-022	µg/kg	850	740	1,250	810
Surrogate 1 Recovery	04-022	%	98	97	102	103
Surrogate 2 Recovery	04-022	%	100	107	107	105
Surrogate 3 Recovery	04-022	%	95	99	99	99
Date Extracted	04-022	-	14/08/2017	14/08/2017	14/08/2017	14/08/2017
Date Analysed	04-022	-	17/08/2017	17/08/2017	17/08/2017	17/08/2017
Polychlorinated Biphenyls						
Mono:1	04-029	µg/kg	<5.0	<5.0	<5.0	<5.0
Di:8,15	04-029	µg/kg	<5.0	<5.0	<5.0	<5.0
Tri:18,22,28	04-029	µg/kg	<5.0	<5.0	<5.0	<5.0
Tetra:44,52,66,77	04-029	µg/kg	<5.0	<5.0	<5.0	<5.0
Penta:101,105,118,126	04-029	µg/kg	<5.0	<5.0	<5.0	<5.0
Hexa:128,138,153,169	04-029	µg/kg	<5.0	<5.0	<5.0	<5.0
Hepta:170,180,187	04-029	µg/kg	<5.0	<5.0	<5.0	<5.0
Octa:195	04-029	µg/kg	<5.0	<5.0	<5.0	<5.0
Nona:206	04-029	µg/kg	<5.0	<5.0	<5.0	<5.0
Deca:209	04-029	µg/kg	<5.0	<5.0	<5.0	<5.0
Total PCB congeners	04-029	µg/kg	<5.0	<5.0	<5.0	<5.0
Surrogate 1 Recovery	04-029	%	92	95	98	97
Surrogate 2 Recovery	04-029	%	91	99	96	95
Date Extracted	04-029	-	14/08/2017	14/08/2017	14/08/2017	14/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-A [R00]
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Laboratory Reference:	-	-	/26	/27	/28	/29
Client Reference:	-	-	B6-3	B5-1	B5-1BT	B5-0
Date Sampled:	-	-	07/08/2017	07/08/2017	07/08/2017	07/08/2017
Analysis Description	**Method**	**Units**				
Date Analysed	04-029	-	17/08/2017	17/08/2017	17/08/2017	17/08/2017
Subcontract Analysis						
Total Organic Carbon^	SUB	%	2.1	1.5	1.7	1.5
Nitrate as N^	SUB	mg/kg	<0.1	<0.1	<0.1	<0.1
Nitrite as N^	SUB	mg/kg	<0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen^	SUB	mg/kg	1,810	1,090	1,200	1,310
Total Nitrogen^	SUB	mg/kg	1,810	1,090	1,200	1,310
Gross Alpha^	SUB	mBq/g	See Comments	See Comments	See Comments	See Comments
Gross Beta^	SUB	mBq/g	Comments	Comments	Comments	Comments
Particle Size Distribution^	SUB		Comments	Comments	Comments	Comments
Chromium Reducible Suite^	SUB		Comments	Comments	Comments	Comments

Laboratory Reference:	-	-	/31	/32	/33	/34
Client Reference:	-	-	B4-0	B4-4	BC-2	B2-0
Date Sampled:	-	-	07/08/2017	07/08/2017	07/08/2017	07/08/2017
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	58.0	66.6	54.9	20.2
Trace Elements						
Aluminium	04-001	mg/kg	22,000	22,000	15,000	2,900
Arsenic	04-001	mg/kg	4.8	7.2	7.1	1.3
Cadmium	04-001	mg/kg	<0.1	<0.1	<0.1	<0.1
Chromium	04-001	mg/kg	45	40	29	9.0
Copper	04-001	mg/kg	34	41	34	2.8
Iron	04-001	mg/kg	43,000	39,000	28,000	10,000
Lead	04-001	mg/kg	13	22	37	2.9
Mercury	04-002	mg/kg	0.08	0.14	0.10	<0.01
Nickel	04-001	mg/kg	37	24	18	5.7
Phosphorus*	04-001	mg/kg	1,100	970	580	190
Silver	04-001	mg/kg	<0.5	<0.5	<0.5	<0.5
Zinc	04-001	mg/kg	95	130	130	17
Total Petroleum Hydrocarbons						

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Project Reference: Port of Brisbane - Sediment Analysis

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/31** **B4-0** **07/08/2017**	**/32** **B4-4** **07/08/2017**	**/33** **BC-2** **07/08/2017**	**/34** **B2-0** **07/08/2017**
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	<1.0	<1.0	<1.0
p,p'-DDT	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
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	<1.0	<1.0	<1.0	<1.0
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	<1.0	<1.0
Surrogate Recovery	04-024	%	97	99	99	96
Date Extracted	04-024	-	14/08/2017	14/08/2017	14/08/2017	14/08/2017
Date Analysed	04-024	-	17/08/2017	17/08/2017	17/08/2017	17/08/2017
Organotin Analysis						
Monobutyltin	04-026	µgSn/kg	<0.50	<0.50	9.7	<0.50
Dibutyltin	04-026	µgSn/kg	3.0	3.7	9.8	<0.50
Tributyltin	04-026	µgSn/kg	<0.50	4.5	4.7	<0.50
Surrogate Recovery	04-026	%	85	98	72	103
Date Extracted	04-026	-	28/08/2017	28/08/2017	28/08/2017	28/08/2017
Date Analysed	04-026	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Laboratory Reference:	-	-	/31	/32	/33	/34
Client Reference:	-	-	B4-0	B4-4	BC-2	B2-0
Date Sampled:	-	-	07/08/2017	07/08/2017	07/08/2017	07/08/2017
Analysis Description	**Method**	**Units**				
BTEX						
Poly Aromatic Hydrocarbons						
Polychlorinated Biphenyls						
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.8	2.4	2.3	0.20

Laboratory Reference:	-	-	/35	/36	/37	/38
Client Reference:	-	-	B7-1	B8-1	Trip Blank	Trip Blank
Date Sampled:	-	-	07/08/2017	07/08/2017	03/08/2017	07/08/2017
Analysis Description	**Method**	**Units**				
Moisture Content						
Moisture Content	04-004	%	59.8	67.6	<0.1	<0.1
Trace Elements						
Aluminium	04-001	mg/kg	19,000	22,000	[NA]	[NA]
Arsenic	04-001	mg/kg	6.8	6.5	[NA]	[NA]
Cadmium	04-001	mg/kg	<0.1	<0.1	[NA]	[NA]
Chromium	04-001	mg/kg	38	36	[NA]	[NA]
Copper	04-001	mg/kg	33	30	[NA]	[NA]
Iron	04-001	mg/kg	35,000	39,000	[NA]	[NA]
Lead	04-001	mg/kg	27	17	[NA]	[NA]
Mercury	04-002	mg/kg	0.11	0.10	[NA]	[NA]
Nickel	04-001	mg/kg	21	21	[NA]	[NA]
Phosphorus*	04-001	mg/kg	770	860	[NA]	[NA]
Silver	04-001	mg/kg	<0.5	<0.5	[NA]	[NA]
Zinc	04-001	mg/kg	110	99	[NA]	[NA]
Total Petroleum Hydrocarbons						
TPH C6-C9	04-021	mg/kg	<10	[NA]	<10	<10
TPH C10-C14	04-020	mg/kg	<10	[NA]	[NA]	[NA]
TPH C15-C28	04-020	mg/kg	<50	[NA]	[NA]	[NA]
TPH C29-C36	04-020	mg/kg	<50	[NA]	[NA]	[NA]
Surrogate Recovery	04-020	%	88	[NA]	[NA]	[NA]
Date Extracted	04-020	-	14/08/2017	[NA]	09/08/2017	09/08/2017

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North Ryde NSW 2113 Australia
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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/35** **B7-1** **07/08/2017**	**/36** **B8-1** **07/08/2017**	**/37** **Trip Blank** **03/08/2017**	**/38** **Trip Blank** **07/08/2017**
Date Analysed	04-020	-	17/08/2017	[NA]	10/08/2017	10/08/2017
Organochlorine Pesticides						
Aldrin	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
alpha-BHC	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
beta-BHC	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
gamma-BHC (Lindane)	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
delta-BHC	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
cis-Chlordane	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
trans-Chlordane	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
p,p'-DDD	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
p,p'-DDE	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
p,p'-DDT	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
Dieldrin	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
alpha-Endosulfan	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
beta-Endosulfan	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
Endosulfan Sulphate	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
Endrin	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
Endrin ketone	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
Endrin aldehyde	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
Heptachlor	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
Heptachlor epoxide	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
Hexachlorobenzene	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
Methoxychlor	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
Oxychlordane*	04-024	µg/kg	<1.0	<1.0	[NA]	[NA]
Surrogate Recovery	04-024	%	99	100	[NA]	[NA]
Date Extracted	04-024	-	14/08/2017	14/08/2017	[NA]	[NA]
Date Analysed	04-024	-	17/08/2017	17/08/2017	[NA]	[NA]
Organotin Analysis						
Monobutyltin	04-026	µgSn/kg	<0.50	<0.50	[NA]	[NA]
Dibutyltin	04-026	µgSn/kg	3.6	1.2	[NA]	[NA]
Tributyltin	04-026	µgSn/kg	<0.50	<0.50	[NA]	[NA]
Surrogate Recovery	04-026	%	90	92	[NA]	[NA]
Date Extracted	04-026	-	28/08/2017	28/08/2017	[NA]	[NA]

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North Ryde NSW 2113 Australia
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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/35** **B7-1** **07/08/2017**	**/36** **B8-1** **07/08/2017**	**/37** **Trip Blank** **03/08/2017**	**/38** **Trip Blank** **07/08/2017**
Date Analysed	04-026	-	29/08/2017	29/08/2017	[NA]	[NA]
BTEX						
Benzene	04-021	mg/kg	[NA]	[NA]	<0.20	<0.20
Toluene	04-021	mg/kg	[NA]	[NA]	<0.20	<0.20
Ethyl Benzene	04-021	mg/kg	[NA]	[NA]	<0.20	<0.20
m+p xylenes	04-021	mg/kg	[NA]	[NA]	<0.40	<0.40
o-xylene	04-021	mg/kg	[NA]	[NA]	<0.20	<0.20
Total BTEX	04-021	mg/kg	[NA]	[NA]	<1.2	<1.2
Surrogate 1 Recovery	04-021	%	[NA]	[NA]	89	97
Surrogate 2 Recovery	04-021	%	[NA]	[NA]	104	93
Surrogate 3 Recovery	04-021	%	[NA]	[NA]	90	97
Date Extracted	04-021	-	[NA]	[NA]	9/08/2017	9/08/2017
Date Analysed	04-021	-	[NA]	[NA]	11/08/2017	11/08/2017
Poly Aromatic Hydrocarbons						
Naphthalene	04-022	µg/kg	5.0	[NA]	[NA]	[NA]
1-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
2-Methylnaphthalene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Acenaphthylene	04-022	µg/kg	13	[NA]	[NA]	[NA]
Acenaphthene	04-022	µg/kg	<5.0	[NA]	[NA]	[NA]
Fluorene	04-022	µg/kg	6.0	[NA]	[NA]	[NA]
Phenanthrene	04-022	µg/kg	22	[NA]	[NA]	[NA]
Anthracene	04-022	µg/kg	10	[NA]	[NA]	[NA]
Fluoranthene	04-022	µg/kg	61	[NA]	[NA]	[NA]
Pyrene	04-022	µg/kg	86	[NA]	[NA]	[NA]
Benz(a)anthracene	04-022	µg/kg	42	[NA]	[NA]	[NA]
Chrysene	04-022	µg/kg	47	[NA]	[NA]	[NA]
Benzo(b)&(k)fluoranthene	04-022	µg/kg	170	[NA]	[NA]	[NA]
Benzo(a)pyrene	04-022	µg/kg	63	[NA]	[NA]	[NA]
Indeno(1,2,3-cd)pyrene	04-022	µg/kg	95	[NA]	[NA]	[NA]
Dibenz(a,h)anthracene	04-022	µg/kg	17	[NA]	[NA]	[NA]
Benzo(g,h,i)perylene	04-022	µg/kg	90	[NA]	[NA]	[NA]
Coronene	04-022	µg/kg	16	[NA]	[NA]	[NA]
Benzo(e)pyrene	04-022	µg/kg	130	[NA]	[NA]	[NA]

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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/35** **B7-1** **07/08/2017**	**/36** **B8-1** **07/08/2017**	**/37** **Trip Blank** **03/08/2017**	**/38** **Trip Blank** **07/08/2017**
Perylene	04-022	µg/kg	200	[NA]	[NA]	[NA]
Total PAHs (as above)	04-022	µg/kg	1,070	[NA]	[NA]	[NA]
Surrogate 1 Recovery	04-022	%	100	[NA]	[NA]	[NA]
Surrogate 2 Recovery	04-022	%	103	[NA]	[NA]	[NA]
Surrogate 3 Recovery	04-022	%	98	[NA]	[NA]	[NA]
Date Extracted	04-022	-	14/08/2017	[NA]	[NA]	[NA]
Date Analysed	04-022	-	17/08/2017	[NA]	[NA]	[NA]
Polychlorinated Biphenyls						
Mono:1	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Di:8,15	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Tri:18,22,28	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Tetra:44,52,66,77	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Penta:101,105,118,126	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Hexa:128,138,153,169	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Hepta:170,180,187	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Octa:195	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Nona: 206	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Deca: 209	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Total PCB congeners	04-029	µg/kg	<5.0	[NA]	[NA]	[NA]
Surrogate 1 Recovery	04-029	%	96	[NA]	[NA]	[NA]
Surrogate 2 Recovery	04-029	%	94	[NA]	[NA]	[NA]
Date Extracted	04-029	-	14/08/2017	[NA]	[NA]	[NA]
Date Analysed	04-029	-	17/08/2017	[NA]	[NA]	[NA]
Subcontract Analysis						
Total Organic Carbon^	SUB	%	1.5	1.7	[NA]	[NA]
Nitrate as N^	SUB	mg/kg	<0.1	[NA]	[NA]	[NA]
Nitrite as N^	SUB	mg/kg	<0.1	[NA]	[NA]	[NA]
Total Kjeldahl Nitrogen^	SUB	mg/kg	1,280	[NA]	[NA]	[NA]
Total Nitrogen^	SUB	mg/kg	1,280	[NA]	[NA]	[NA]
Gross Alpha^	SUB	mBq/g	See Comments	[NA]	[NA]	[NA]
Gross Beta^	SUB	mBq/g	Comments	[NA]	[NA]	[NA]
Particle Size Distribution^	SUB		Comments	[NA]	[NA]	[NA]
Chromium Reducible Suite^	SUB		Comments	[NA]	[NA]	[NA]

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Method	Method Description
04-004	Moisture by gravimetric, %
04-001	Metals by ICP-OES, mg/kg
04-002	Mercury by CVAAS, mg/kg
04-021	TRH (C6-C10) & BTEXN in Soil, Sediment & Water by P&T GCMS
04-020	TRH (C10-C40) in Soils & Sediments by GC-FID
04-024	OC & OP Pesticides by GCMS
04-026	Determination of Organotins in Sediment by GCMS
04-021	TRH C6-9 & BTEX by 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.
CRS suite was subcontracted to Envirolab Services (NATA Number 2901); reference Envirolab certificate number 173100.
Analysis was subcontracted to Sydney Analytical Laboratories (NATA Number 1884); reference SAL report number SAL26453.
Radionuclides were subcontracted to SGS Radiation Services reference ME303863 R0.
PSD was subcontracted to Microanalysis, see attached report.
PCB Analysis: For each degree of chlorination the BZ numbers of the indiviudal PCB congeners that were screened have been listed.
- Spike recovery for Al and Fe could not be accurately determined due to a significant background analyte concentration.

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QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aluminium	mg/kg	<5	A17/2852-A-1	19000 || 19000 || RPD: 0	A17/2852-A-1	#
Arsenic	mg/kg	<0.4	A17/2852-A-1	7.5 || 7.6 || RPD: 1	A17/2852-A-1	103%
Cadmium	mg/kg	<0.1	A17/2852-A-1	<0.1 || <0.1	A17/2852-A-1	105%
Chromium	mg/kg	<0.1	A17/2852-A-1	34 || 34 || RPD: 0	A17/2852-A-1	98%
Copper	mg/kg	<0.1	A17/2852-A-1	23 || 23 || RPD: 0	A17/2852-A-1	101%
Iron	mg/kg	<5	A17/2852-A-1	34000 || 34000 || RPD: 0	A17/2852-A-1	#
Lead	mg/kg	<0.5	A17/2852-A-1	13 || 13 || RPD: 0	A17/2852-A-1	86%
Mercury	mg/kg	<0.01	A17/2852-A-1	0.08 || 0.08 || RPD: 0	A17/2852-A-1	105%
Nickel	mg/kg	<0.1	A17/2852-A-1	20 || 20 || RPD: 0	A17/2852-A-1	89%
Phosphorus*	mg/kg	<1	A17/2852-A-1	690 || 700 || RPD: 1	A17/2852-A-1	108%
Silver	mg/kg	<0.1	A17/2852-A-1	<0.5 || <0.5	A17/2852-A-1	111%
Zinc	mg/kg	<0.5	A17/2852-A-1	87 || 85 || RPD: 2	A17/2852-A-1	88%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
TPH C6-C9	mg/kg	<10	[NT]	[NT]	A17/2852-A-4	105%
TPH C10-C14	mg/kg	<10	[NT]	[NT]	A17/2852-A-4	94%
TPH C15-C28	mg/kg	<50	[NT]	[NT]	A17/2852-A-4	95%
TPH C29-C36	mg/kg	<50	[NT]	[NT]	A17/2852-A-4	99%
Surrogate Recovery	%	95	[NT]	[NT]	A17/2852-A-4	95%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	105%
alpha-BHC	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	102%
beta-BHC	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	111%
gamma-BHC (Lindane)	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	109%
delta-BHC	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	105%
cis-Chlordane	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	103%
trans-Chlordane	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	106%
p,p'-DDD	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	105%
p,p'-DDE	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	108%
p,p'-DDT	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	120%
Dieldrin	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	109%
alpha-Endosulfan	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	105%
beta-Endosulfan	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	106%
Endosulfan Sulphate	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	101%

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TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Endrin	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	127%
Endrin ketone	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	115%
Endrin aldehyde	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	88%
Heptachlor	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	126%
Heptachlor epoxide	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	103%
Hexachlorobenzene	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	105%
Methoxychlor	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	126%
Oxychlordane*	µg/kg	<1.0	[NT]	[NT]	A17/2852-A-4	106%
Surrogate Recovery	%	83	[NT]	[NT]	A17/2852-A-4	104%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyltin	µgSn/kg	<0.50		<0.50||<0.50	A17/2852-A-1	132%
Dibutyltin	µgSn/kg	<0.50		<0.50||<0.50	A17/2852-A-1	131%
Tributyltin	µgSn/kg	<0.50		<0.50||<0.50	A17/2852-A-1	128%
Surrogate Recovery	%	94		86||82||RPD: 5	A17/2852-A-1	116%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Benzene	mg/kg	<0.20	[NT]	[NT]	A17/2852-A-4	112%
Toluene	mg/kg	<0.20	[NT]	[NT]	A17/2852-A-4	123%
Ethyl Benzene	mg/kg	<0.20	[NT]	[NT]	A17/2852-A-4	115%
m+p xylenes	mg/kg	<0.40	[NT]	[NT]	A17/2852-A-4	128%
o-xylene	mg/kg	<0.20	[NT]	[NT]	A17/2852-A-4	112%
Total BTEX	mg/kg	<1.2	[NT]	[NT]	A17/2852-A-4	[NA]
Surrogate 1 Recovery	%	102	[NT]	[NT]	A17/2852-A-4	113%
Surrogate 2 Recovery	%	100	[NT]	[NT]	A17/2852-A-4	107%
Surrogate 3 Recovery	%	100	[NT]	[NT]	A17/2852-A-4	124%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Naphthalene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	108%
1-Methylnaphthalene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	102%
2-Methylnaphthalene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	107%
Acenaphthylene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	117%
Acenaphthene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	113%
Fluorene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	119%
Phenanthrene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	162%
Anthracene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	110%
Fluoranthene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	213%
Pyrene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	187%
Benz(a)anthracene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	127%
Chrysene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	146%

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TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Benzo(b)&(k)fluoranthene	µg/kg	<10	[NT]	[NT]	A17/2852-A-4	144%
Benzo(a)pyrene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	133%
Indeno(1,2,3-cd)pyrene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	140%
Dibenz(a,h)anthracene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	117%
Benzo(g,h,i)perylene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	131%
Coronene	µg/kg	<10	[NT]	[NT]	A17/2852-A-4	126%
Benzo(e)pyrene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	140%
Perylene	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	120%
Total PAHs (as above)	µg/kg	<100	[NT]	[NT]	A17/2852-A-4	[NA]
Surrogate 1 Recovery	%	101	[NT]	[NT]	A17/2852-A-4	104%
Surrogate 2 Recovery	%	106	[NT]	[NT]	A17/2852-A-4	109%
Surrogate 3 Recovery	%	90	[NT]	[NT]	A17/2852-A-4	106%

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Mono-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	103%
Di-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	101%
Tri-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	100%
Tetra-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	100%
Penta-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	98%
Hexa-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	98%
Hepta-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	97%
Octa-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	98%
Nona-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	97%
Deca-PCB congeners	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	94%
Total PCB congeners	µg/kg	<5.0	[NT]	[NT]	A17/2852-A-4	99%
Surrogate 1 Recovery	%	97	[NT]	[NT]	A17/2852-A-4	100%
Surrogate 2 Recovery	%	92	[NT]	[NT]	A17/2852-A-4	101%

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
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TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results
Total Organic Carbon^	%	<0.01	A17/2852-A-10	0.37||0.36||RPD: 3
Total Nitrogen^	mg/kg	<20	A17/2852-A-10	360||NA

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aluminium	mg/kg	<5	A17/2852-A-11	22000||20000||RPD: 10	A17/2852-A-21	#
Arsenic	mg/kg	<0.4	A17/2852-A-11	5.6||5.5||RPD: 2	A17/2852-A-21	101%
Cadmium	mg/kg	<0.1	A17/2852-A-11	<0.1||<0.1	A17/2852-A-21	105%
Chromium	mg/kg	<0.1	A17/2852-A-11	37||37||RPD: 0	A17/2852-A-21	97%
Copper	mg/kg	<0.1	A17/2852-A-11	22||25||RPD: 13	A17/2852-A-21	101%
Iron	mg/kg	<5	A17/2852-A-11	40000||37000||RPD: 8	A17/2852-A-21	#
Lead	mg/kg	<0.5	A17/2852-A-11	11||12||RPD: 9	A17/2852-A-21	85%
Mercury	mg/kg	<0.01	A17/2852-A-11	0.07||0.06||RPD: 15	A17/2852-A-21	95%
Nickel	mg/kg	<0.1	A17/2852-A-11	27||28||RPD: 4	A17/2852-A-21	87%
Phosphorus*	mg/kg	<1	A17/2852-A-11	770||770||RPD: 0	A17/2852-A-21	109%
Silver	mg/kg	<0.1	A17/2852-A-11	<0.5||<0.5	A17/2852-A-21	114%
Zinc	mg/kg	<0.5	A17/2852-A-11	3.6||3.2||RPD: 12	A17/2852-A-21	89%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
TPH C6-C9	mg/kg	<10	[NT]	[NT]
TPH C10-C14	mg/kg	<10	[NT]	[NT]
TPH C15-C28	mg/kg	<50	[NT]	[NT]
TPH C29-C36	mg/kg	<50	[NT]	[NT]
Surrogate Recovery	%	97	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Monobutyltin	µgSn/kg	<0.50	A17/2852-A-11	<0.50||<0.50	A17/2852-A-21	116%
Dibutyltin	µgSn/kg	<0.50	A17/2852-A-11	<0.50||<0.50	A17/2852-A-21	109%
Tributyltin	µgSn/kg	<0.50	A17/2852-A-11	<0.50||<0.50	A17/2852-A-21	78%
Surrogate Recovery	%	101	A17/2852-A-11	58||79||RPD: 31	A17/2852-A-21	75%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Total Organic Carbon^	%	<0.01	A17/2852-A-21	1.5||1.5||RPD: 0
Total Nitrogen^	mg/kg	<20	[NT]	[NT]

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
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North Ryde NSW 2113 Australia
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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aluminium	mg/kg	[NT]	A17/2852-A-21	19000 || 18000 || RPD: 5
Arsenic	mg/kg	[NT]	A17/2852-A-21	7.3 || 7.3 || RPD: 0
Cadmium	mg/kg	[NT]	A17/2852-A-21	<0.1 || <0.1
Chromium	mg/kg	[NT]	A17/2852-A-21	37 || 36 || RPD: 3
Copper	mg/kg	[NT]	A17/2852-A-21	26 || 26 || RPD: 0
Iron	mg/kg	[NT]	A17/2852-A-21	34000 || 34000 || RPD: 0
Lead	mg/kg	[NT]	A17/2852-A-21	14 || 14 || RPD: 0
Mercury	mg/kg	[NT]	A17/2852-A-21	0.09 || 0.09 || RPD: 0
Nickel	mg/kg	[NT]	A17/2852-A-21	21 || 21 || RPD: 0
Phosphorus*	mg/kg	[NT]	A17/2852-A-21	720 || 710 || RPD: 1
Silver	mg/kg	[NT]	A17/2852-A-21	<0.5 || <0.5
Zinc	mg/kg	[NT]	A17/2852-A-21	89 || 87 || RPD: 2

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
TPH C6-C9	mg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	[NA]
TPH C10-C14	mg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	92%
TPH C15-C28	mg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	97%
TPH C29-C36	mg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	98%
Surrogate Recovery	%	[NT]	[NT]	[NT]	A17/2852-A-35	91%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Aldrin	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	100%
alpha-BHC	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	101%
beta-BHC	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	116%
gamma-BHC (Lindane)	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	110%
delta-BHC	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	106%
cis-Chlordane	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	100%
trans-Chlordane	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	103%
p,p'-DDD	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	113%
p,p'-DDE	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	104%
p,p'-DDT	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	117%
Dieldrin	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	101%
alpha-Endosulfan	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	99%
beta-Endosulfan	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	108%
Endosulfan Sulphate	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	103%
Endrin	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	130%
Endrin ketone	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	115%
Endrin aldehyde	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	89%
Heptachlor	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	129%
Heptachlor epoxide	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	97%

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Hexachlorobenzene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	102%
Methoxychlor	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	124%
Oxychlordane*	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	98%
Surrogate Recovery	%	[NT]	[NT]	[NT]	A17/2852-A-35	100%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Monobutyltin	µgSn/kg	[NT]	A17/2852-A-21	<0.50 || <0.50
Dibutyltin	µgSn/kg	[NT]	A17/2852-A-21	<0.50 || <0.50
Tributyltin	µgSn/kg	[NT]	A17/2852-A-21	<0.50 || <0.50
Surrogate Recovery	%	[NT]	A17/2852-A-21	62 || 97 || RPD: 44

TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Naphthalene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	96%
1-Methylnaphthalene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	95%
2-Methylnaphthalene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	98%
Acenaphthylene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	113%
Acenaphthene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	107%
Fluorene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	110%
Phenanthrene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	110%
Anthracene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	109%
Fluoranthene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	82%
Pyrene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	94%
Benz(a)anthracene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	91%
Chrysene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	90%
Benzo(b)&(k)fluoranthene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	85%
Benzo(a)pyrene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	89%
Indeno(1,2,3-cd)pyrene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	90%
Dibenz(a,h)anthracene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	111%
Benzo(g,h,i)perylene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	79%
Coronene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	113%
Benzo(e)pyrene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	59%
Perylene	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	92%
Total PAHs (as above)	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	[NA]
Surrogate 1 Recovery	%	[NT]	[NT]	[NT]	A17/2852-A-35	104%
Surrogate 2 Recovery	%	[NT]	[NT]	[NT]	A17/2852-A-35	107%
Surrogate 3 Recovery	%	[NT]	[NT]	[NT]	A17/2852-A-35	101%

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
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TEST	Units	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Mono-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	101%
Di-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	98%
Tri-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	98%
Tetra-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	95%
Penta-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	96%
Hexa-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	96%
Hepta-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	96%
Octa-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	96%
Nona-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	95%
Deca-PCB congeners	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	90%
Total PCB congeners	µg/kg	[NT]	[NT]	[NT]	A17/2852-A-35	96%
Surrogate 1 Recovery	%	[NT]	[NT]	[NT]	A17/2852-A-35	95%
Surrogate 2 Recovery	%	[NT]	[NT]	[NT]	A17/2852-A-35	96%

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Total Organic Carbon^	%	[NT]	A17/2852-A-31	1.8||1.8||RPD:0
Total Nitrogen^	mg/kg	[NT]	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aluminium	mg/kg	[NT]	A17/2852-A-31	22000||23000||RPD:4
Arsenic	mg/kg	[NT]	A17/2852-A-31	4.8||4.8||RPD:0
Cadmium	mg/kg	[NT]	A17/2852-A-31	<0.1||<0.1
Chromium	mg/kg	[NT]	A17/2852-A-31	45||45||RPD:0
Copper	mg/kg	[NT]	A17/2852-A-31	34||34||RPD:0
Iron	mg/kg	[NT]	A17/2852-A-31	43000||43000||RPD:0
Lead	mg/kg	[NT]	A17/2852-A-31	13||13||RPD:0
Mercury	mg/kg	[NT]	A17/2852-A-31	0.08||0.09||RPD:12
Nickel	mg/kg	[NT]	A17/2852-A-31	37||37||RPD:0
Phosphorus*	mg/kg	[NT]	A17/2852-A-31	1100||1100||RPD:0
Silver	mg/kg	[NT]	A17/2852-A-31	<0.5||<0.5
Zinc	mg/kg	[NT]	A17/2852-A-31	95||94||RPD:1

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
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North Ryde NSW 2113 Australia
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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
TPH C6-C9	mg/kg	[NT]	[NT]	[NT]
TPH C10-C14	mg/kg	[NT]	[NT]	[NT]
TPH C15-C28	mg/kg	[NT]	[NT]	[NT]
TPH C29-C36	mg/kg	[NT]	[NT]	[NT]
Surrogate Recovery	%	[NT]	[NT]	[NT]

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Monobutyltin	µgSn/kg	[NT]	A17/2852-A-31	<0.50 || <0.50
Dibutyltin	µgSn/kg	[NT]	A17/2852-A-31	3.0 || 2.7 || RPD: 11
Tributyltin	µgSn/kg	[NT]	A17/2852-A-31	<0.50 || <0.50
Surrogate Recovery	%	[NT]	A17/2852-A-31	85 || 93 || RPD: 9

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
TPH C6-C9	mg/kg	[NT]	A17/2852-A-4	<10 || <10
TPH C10-C14	mg/kg	[NT]	A17/2852-A-4	<10 || <10
TPH C15-C28	mg/kg	[NT]	A17/2852-A-4	<50 || <50
TPH C29-C36	mg/kg	[NT]	A17/2852-A-4	<50 || <50
Surrogate Recovery	%	[NT]	A17/2852-A-4	88 || 90 || RPD: 2

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aldrin	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
alpha-BHC	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
beta-BHC	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
gamma-BHC (Lindane)	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
delta-BHC	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
cis-Chlordane	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
trans-Chlordane	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
p,p'-DDD	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
p,p'-DDE	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
p,p'-DDT	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
Dieldrin	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
alpha-Endosulfan	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
beta-Endosulfan	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
Endosulfan Sulphate	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
Endrin	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
Endrin ketone	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
Endrin aldehyde	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
Heptachlor	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
Heptachlor epoxide	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
Hexachlorobenzene	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
Methoxychlor	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
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North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Oxychlordane*	µg/kg	[NT]	A17/2852-A-4	<1.0 || <1.0
Surrogate Recovery	%	[NT]	A17/2852-A-4	96 || 101 || RPD: 5

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Naphthalene	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
1-Methylnaphthalene	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
2-Methylnaphthalene	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Acenaphthylene	µg/kg	[NT]	A17/2852-A-4	5.0 || <5.0
Acenaphthene	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Fluorene	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Phenanthrene	µg/kg	[NT]	A17/2852-A-4	16 || 15 || RPD: 6
Anthracene	µg/kg	[NT]	A17/2852-A-4	5.0 || <5.0
Fluoranthene	µg/kg	[NT]	A17/2852-A-4	49 || 48 || RPD: 2
Pyrene	µg/kg	[NT]	A17/2852-A-4	53 || 53 || RPD: 0
Benz(a)anthracene	µg/kg	[NT]	A17/2852-A-4	28 || 26 || RPD: 7
Chrysene	µg/kg	[NT]	A17/2852-A-4	27 || 25 || RPD: 8
Benzo(b)&(k)fluoranthene	µg/kg	[NT]	A17/2852-A-4	72 || 67 || RPD: 7
Benzo(a)pyrene	µg/kg	[NT]	A17/2852-A-4	37 || 34 || RPD: 8
Indeno(1,2,3-cd)pyrene	µg/kg	[NT]	A17/2852-A-4	31 || 30 || RPD: 3
Dibenz(a,h)anthracene	µg/kg	[NT]	A17/2852-A-4	6.0 || 6.0 || RPD: 0
Benzo(g,h,i)perylene	µg/kg	[NT]	A17/2852-A-4	33 || 30 || RPD: 10
Coronene	µg/kg	[NT]	A17/2852-A-4	<10 || <10
Benzo(e)pyrene	µg/kg	[NT]	A17/2852-A-4	28 || 26 || RPD: 7
Perylene	µg/kg	[NT]	A17/2852-A-4	48 || 50 || RPD: 4
Total PAHs (as above)	µg/kg	[NT]	A17/2852-A-4	440 || 410 || RPD: 7
Surrogate 1 Recovery	%	[NT]	A17/2852-A-4	104 || 103 || RPD: 1
Surrogate 2 Recovery	%	[NT]	A17/2852-A-4	109 || 109 || RPD: 0
Surrogate 3 Recovery	%	[NT]	A17/2852-A-4	98 || 104 || RPD: 6

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mono-PCB congeners	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Di-PCB congeners	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Tri-PCB congeners	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Tetra-PCB congeners	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Penta-PCB congeners	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Hexa-PCB congeners	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Hepta-PCB congeners	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Octa-PCB congeners	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Nona-PCB congeners	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Deca-PCB congeners	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Total PCB congeners	µg/kg	[NT]	A17/2852-A-4	<5.0 || <5.0
Surrogate 1 Recovery	%	[NT]	A17/2852-A-4	97 || 100 || RPD: 3
Surrogate 2 Recovery	%	[NT]	A17/2852-A-4	95 || 98 || RPD: 3

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
TPH C6-C9	mg/kg	[NT]	A17/2852-A-27	<10 || <10
TPH C10-C14	mg/kg	[NT]	A17/2852-A-27	<10 || <10
TPH C15-C28	mg/kg	[NT]	A17/2852-A-27	<50 || <50
TPH C29-C36	mg/kg	[NT]	A17/2852-A-27	<50 || <50
Surrogate Recovery	%	[NT]	A17/2852-A-27	83 || 90 || RPD: 8

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aldrin	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
alpha-BHC	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
beta-BHC	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
gamma-BHC (Lindane)	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
delta-BHC	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
cis-Chlordane	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
trans-Chlordane	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
p,p'-DDD	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
p,p'-DDE	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
p,p'-DDT	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
Dieldrin	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
alpha-Endosulfan	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
beta-Endosulfan	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
Endosulfan Sulphate	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
Endrin	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
Endrin ketone	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
Endrin aldehyde	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
Heptachlor	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
Heptachlor epoxide	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0
Hexachlorobenzene	µg/kg	[NT]	A17/2852-A-27	<1.0 || <1.0

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Methoxychlor	µg/kg	[NT]	A17/2852-A-27	<1.0||<1.0
Oxychlordane*	µg/kg	[NT]	A17/2852-A-27	<1.0||<1.0
Surrogate Recovery	%	[NT]	A17/2852-A-27	100||95||RPD: 5

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Naphthalene	µg/kg	[NT]	A17/2852-A-27	6.0||6.0||RPD: 0
1-Methylnaphthalene	µg/kg	[NT]	A17/2852-A-27	<5.0||<5.0
2-Methylnaphthalene	µg/kg	[NT]	A17/2852-A-27	<5.0||<5.0
Acenaphthylene	µg/kg	[NT]	A17/2852-A-27	9.0||10||RPD: 11
Acenaphthene	µg/kg	[NT]	A17/2852-A-27	<5.0||<5.0
Fluorene	µg/kg	[NT]	A17/2852-A-27	5.0||6.0||RPD: 18
Phenanthrene	µg/kg	[NT]	A17/2852-A-27	20||26||RPD: 26
Anthracene	µg/kg	[NT]	A17/2852-A-27	8.0||9.0||RPD: 12
Fluoranthene	µg/kg	[NT]	A17/2852-A-27	46||56||RPD: 20
Pyrene	µg/kg	[NT]	A17/2852-A-27	78||99||RPD: 24
Benz(a)anthracene	µg/kg	[NT]	A17/2852-A-27	38||46||RPD: 19
Chrysene	µg/kg	[NT]	A17/2852-A-27	39||46||RPD: 16
Benzo(b)&(k)fluoranthene	µg/kg	[NT]	A17/2852-A-27	100||130||RPD: 26
Benzo(a)pyrene	µg/kg	[NT]	A17/2852-A-27	52||68||RPD: 27
Indeno(1,2,3-cd)pyrene	µg/kg	[NT]	A17/2852-A-27	42||56||RPD: 29
Dibenz(a,h)anthracene	µg/kg	[NT]	A17/2852-A-27	9.0||10||RPD: 11
Benzo(g,h,i)perylene	µg/kg	[NT]	A17/2852-A-27	47||54||RPD: 14
Coronene	µg/kg	[NT]	A17/2852-A-27	11||14||RPD: 24
Benzo(e)pyrene	µg/kg	[NT]	A17/2852-A-27	41||50||RPD: 20
Perylene	µg/kg	[NT]	A17/2852-A-27	190||190||RPD: 0
Total PAHs (as above)	µg/kg	[NT]	A17/2852-A-27	740||880||RPD: 17
Surrogate 1 Recovery	%	[NT]	A17/2852-A-27	97||98||RPD: 1
Surrogate 2 Recovery	%	[NT]	A17/2852-A-27	107||102||RPD: 5
Surrogate 3 Recovery	%	[NT]	A17/2852-A-27	99||93||RPD: 6

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ABN 20 105 644 979
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North Ryde NSW 2113 Australia
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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mono-PCB congeners	µg/kg	[NT]	A17/2852-A-27	<5.0 || <5.0
Di-PCB congeners	µg/kg	[NT]	A17/2852-A-27	<5.0 || <5.0
Tri-PCB congeners	µg/kg	[NT]	A17/2852-A-27	<5.0 || <5.0
Tetra-PCB congeners	µg/kg	[NT]	A17/2852-A-27	<5.0 || <5.0
Penta-PCB congeners	µg/kg	[NT]	A17/2852-A-27	<5.0 || <5.0
Hexa-PCB congeners	µg/kg	[NT]	A17/2852-A-27	<5.0 || <5.0
Hepta-PCB congeners	µg/kg	[NT]	A17/2852-A-27	<5.0 || <5.0
Octa-PCB congeners	µg/kg	[NT]	A17/2852-A-27	<5.0 || <5.0
Nona-PCB congeners	µg/kg	[NT]	A17/2852-A-27	<5.0 || <5.0
Deca-PCB congeners	µg/kg	[NT]	A17/2852-A-27	<5.0 || <5.0
Total PCB congeners	µg/kg	[NT]	A17/2852-A-27	<5.0 || <5.0
Surrogate 1 Recovery	%	[NT]	A17/2852-A-27	95 || 93 || RPD: 2
Surrogate 2 Recovery	%	[NT]	A17/2852-A-27	99 || 94 || RPD: 5

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
TPH C6-C9	mg/kg	[NT]	A17/2852-A-17	<10 || [NA]
TPH C10-C14	mg/kg	[NT]	A17/2852-A-17	<10 || <10
TPH C15-C28	mg/kg	[NT]	A17/2852-A-17	<50 || <50
TPH C29-C36	mg/kg	[NT]	A17/2852-A-17	<50 || <50
Surrogate Recovery	%	[NT]	A17/2852-A-17	86 || 90 || RPD: 5

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aldrin	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
alpha-BHC	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
beta-BHC	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
gamma-BHC (Lindane)	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
delta-BHC	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
cis-Chlordane	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
trans-Chlordane	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
p,p'-DDD	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
p,p'-DDE	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
p,p'-DDT	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
Dieldrin	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
alpha-Endosulfan	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
beta-Endosulfan	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
Endosulfan Sulphate	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
Endrin	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
Endrin ketone	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
Endrin aldehyde	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
Heptachlor	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
Heptachlor epoxide	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0
Hexachlorobenzene	µg/kg	[NT]	A17/2852-A-17	<1.0 || <1.0

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Methoxychlor	µg/kg	[NT]	A17/2852-A-17	<1.0||<1.0
Oxychlordane*	µg/kg	[NT]	A17/2852-A-17	<1.0||<1.0
Surrogate Recovery	%	[NT]	A17/2852-A-17	93||95||RPD: 2

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Naphthalene	µg/kg	[NT]	A17/2852-A-17	<5.0||<5.0
1-Methylnaphthalene	µg/kg	[NT]	A17/2852-A-17	<5.0||<5.0
2-Methylnaphthalene	µg/kg	[NT]	A17/2852-A-17	<5.0||<5.0
Acenaphthylene	µg/kg	[NT]	A17/2852-A-17	7.0||6.0||RPD: 15
Acenaphthene	µg/kg	[NT]	A17/2852-A-17	<5.0||<5.0
Fluorene	µg/kg	[NT]	A17/2852-A-17	<5.0||<5.0
Phenanthrene	µg/kg	[NT]	A17/2852-A-17	19||23||RPD: 19
Anthracene	µg/kg	[NT]	A17/2852-A-17	7.0||7.0||RPD: 0
Fluoranthene	µg/kg	[NT]	A17/2852-A-17	49||55||RPD: 12
Pyrene	µg/kg	[NT]	A17/2852-A-17	71||73||RPD: 3
Benz(a)anthracene	µg/kg	[NT]	A17/2852-A-17	36||38||RPD: 5
Chrysene	µg/kg	[NT]	A17/2852-A-17	34||36||RPD: 6
Benzo(b)&(k)fluoranthene	µg/kg	[NT]	A17/2852-A-17	94||90||RPD: 4
Benzo(a)pyrene	µg/kg	[NT]	A17/2852-A-17	49||45||RPD: 9
Indeno(1,2,3-cd)pyrene	µg/kg	[NT]	A17/2852-A-17	39||37||RPD: 5
Dibenz(a,h)anthracene	µg/kg	[NT]	A17/2852-A-17	7.0||7.0||RPD: 0
Benzo(g,h,i)perylene	µg/kg	[NT]	A17/2852-A-17	41||37||RPD: 10
Coronene	µg/kg	[NT]	A17/2852-A-17	11||11||RPD: 0
Benzo(e)pyrene	µg/kg	[NT]	A17/2852-A-17	36||34||RPD: 6
Perylene	µg/kg	[NT]	A17/2852-A-17	83||87||RPD: 5
Total PAHs (as above)	µg/kg	[NT]	A17/2852-A-17	580||590||RPD: 2
Surrogate 1 Recovery	%	[NT]	A17/2852-A-17	98||98||RPD: 0
Surrogate 2 Recovery	%	[NT]	A17/2852-A-17	103||104||RPD: 1
Surrogate 3 Recovery	%	[NT]	A17/2852-A-17	94||95||RPD: 1

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mono-PCB congeners	µg/kg	[NT]	A17/2852-A-17	<5.0 || <5.0
Di-PCB congeners	µg/kg	[NT]	A17/2852-A-17	<5.0 || <5.0
Tri-PCB congeners	µg/kg	[NT]	A17/2852-A-17	<5.0 || <5.0
Tetra-PCB congeners	µg/kg	[NT]	A17/2852-A-17	<5.0 || <5.0
Penta-PCB congeners	µg/kg	[NT]	A17/2852-A-17	<5.0 || <5.0
Hexa-PCB congeners	µg/kg	[NT]	A17/2852-A-17	<5.0 || <5.0
Hepta-PCB congeners	µg/kg	[NT]	A17/2852-A-17	<5.0 || <5.0
Octa-PCB congeners	µg/kg	[NT]	A17/2852-A-17	<5.0 || <5.0
Nona-PCB congeners	µg/kg	[NT]	A17/2852-A-17	<5.0 || <5.0
Deca-PCB congeners	µg/kg	[NT]	A17/2852-A-17	<5.0 || <5.0
Total PCB congeners	µg/kg	[NT]	A17/2852-A-17	<5.0 || <5.0
Surrogate 1 Recovery	%	[NT]	A17/2852-A-17	93 || 94 || RPD: 1
Surrogate 2 Recovery	%	[NT]	A17/2852-A-17	93 || 94 || RPD: 1

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
TPH C6-C9	mg/kg	[NT]	A17/2852-A-35	<10 || [NA]
TPH C10-C14	mg/kg	[NT]	A17/2852-A-35	<10 || <10
TPH C15-C28	mg/kg	[NT]	A17/2852-A-35	<50 || <50
TPH C29-C36	mg/kg	[NT]	A17/2852-A-35	<50 || 62
Surrogate Recovery	%	[NT]	A17/2852-A-35	88 || 99 || RPD: 12

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Aldrin	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
alpha-BHC	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
beta-BHC	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
gamma-BHC (Lindane)	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
delta-BHC	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
cis-Chlordane	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
trans-Chlordane	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
p,p'-DDD	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
p,p'-DDE	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
p,p'-DDT	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
Dieldrin	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
alpha-Endosulfan	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
beta-Endosulfan	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
Endosulfan Sulphate	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
Endrin	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
Endrin ketone	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
Endrin aldehyde	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
Heptachlor	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
Heptachlor epoxide	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
Hexachlorobenzene	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0

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ABN 20 105 644 979
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North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
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TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Methoxychlor	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
Oxychlordane*	µg/kg	[NT]	A17/2852-A-35	<1.0 || <1.0
Surrogate Recovery	%	[NT]	A17/2852-A-35	99 || 100 || RPD: 1

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Naphthalene	µg/kg	[NT]	A17/2852-A-35	5.0 || 5.0 || RPD: 0
1-Methylnaphthalene	µg/kg	[NT]	A17/2852-A-35	<5.0 || <5.0
2-Methylnaphthalene	µg/kg	[NT]	A17/2852-A-35	<5.0 || <5.0
Acenaphthylene	µg/kg	[NT]	A17/2852-A-35	13 || 13 || RPD: 0
Acenaphthene	µg/kg	[NT]	A17/2852-A-35	<5.0 || <5.0
Fluorene	µg/kg	[NT]	A17/2852-A-35	6.0 || 6.0 || RPD: 0
Phenanthrene	µg/kg	[NT]	A17/2852-A-35	22 || 26 || RPD: 17
Anthracene	µg/kg	[NT]	A17/2852-A-35	10 || 11 || RPD: 10
Fluoranthene	µg/kg	[NT]	A17/2852-A-35	61 || 90 || RPD: 38
Pyrene	µg/kg	[NT]	A17/2852-A-35	86 || 140 || RPD: 48
Benz(a)anthracene	µg/kg	[NT]	A17/2852-A-35	42 || 75 || RPD: 56
Chrysene	µg/kg	[NT]	A17/2852-A-35	47 || 68 || RPD: 37
Benzo(b)&(k)fluoranthene	µg/kg	[NT]	A17/2852-A-35	170 || 180 || RPD: 6
Benzo(a)pyrene	µg/kg	[NT]	A17/2852-A-35	63 || 85 || RPD: 30
Indeno(1,2,3-cd)pyrene	µg/kg	[NT]	A17/2852-A-35	95 || 75 || RPD: 24
Dibenz(a,h)anthracene	µg/kg	[NT]	A17/2852-A-35	17 || 13 || RPD: 27
Benzo(g,h,i)perylene	µg/kg	[NT]	A17/2852-A-35	90 || 73 || RPD: 21
Coronene	µg/kg	[NT]	A17/2852-A-35	16 || 16 || RPD: 0
Benzo(e)pyrene	µg/kg	[NT]	A17/2852-A-35	130 || 66 || RPD: 65
Perylene	µg/kg	[NT]	A17/2852-A-35	200 || 210 || RPD: 5
Total PAHs (as above)	µg/kg	[NT]	A17/2852-A-35	1070 || 1160 || RPD: 8
Surrogate 1 Recovery	%	[NT]	A17/2852-A-35	100 || 99 || RPD: 1
Surrogate 2 Recovery	%	[NT]	A17/2852-A-35	103 || 106 || RPD: 3
Surrogate 3 Recovery	%	[NT]	A17/2852-A-35	98 || 97 || RPD: 1

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Batch Number: A17/2852-A [R00]
Project Reference: Port of Brisbane - Sediment Analysis

TEST	Units	Blank	Duplicate Sm#	Duplicate Results
Mono-PCB congeners	µg/kg	[NT]	A17/2852-A-35	<5.0||<5.0
Di-PCB congeners	µg/kg	[NT]	A17/2852-A-35	<5.0||<5.0
Tri-PCB congeners	µg/kg	[NT]	A17/2852-A-35	<5.0||<5.0
Tetra-PCB congeners	µg/kg	[NT]	A17/2852-A-35	<5.0||<5.0
Penta-PCB congeners	µg/kg	[NT]	A17/2852-A-35	<5.0||<5.0
Hexa-PCB congeners	µg/kg	[NT]	A17/2852-A-35	<5.0||<5.0
Hepta-PCB congeners	µg/kg	[NT]	A17/2852-A-35	<5.0||<5.0
Octa-PCB congeners	µg/kg	[NT]	A17/2852-A-35	<5.0||<5.0
Nona-PCB congeners	µg/kg	[NT]	A17/2852-A-35	<5.0||<5.0
Deca-PCB congeners	µg/kg	[NT]	A17/2852-A-35	<5.0||<5.0
Total PCB congeners	µg/kg	[NT]	A17/2852-A-35	<5.0||<5.0
Surrogate 1 Recovery	%	[NT]	A17/2852-A-35	96||97||RPD: 1
Surrogate 2 Recovery	%	[NT]	A17/2852-A-35	94||96||RPD: 2

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.

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

REPORT OF ANALYSIS

Laboratory Reference: A17/2852-B [R00]

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

Contact: Brad Hiles

Order No:
Project: Port of Brisbane - Sediments - Elutriate
Sample Type: Sediment
No. of Samples: 39
Date Received: 08/08/2017
Date Completed: 30/08/2017

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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Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia

Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-B [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/4** **B13-8** **03/08/2017**	**/5** **B13-5** **03/08/2017**	**/6** **B13-4** **03/08/2017**	**/8** **B13-1** **03/08/2017**
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	72	72	106	55
Date Extracted	04-061	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
Date Analysed	04-061	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
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	<0.03	<0.03	<0.03	<0.03
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	<0.03	<0.03	<0.03	<0.03
Oxychlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	101	86	95	94
Date Extracted	04-072	-	21/08/2017	21/08/2017	21/08/2017	21/08/2017
Date Analysed	04-072	-	22/08/2017	22/08/2017	22/08/2017	22/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia

Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-B [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/12** **B11-9** **03/08/2017**	**/14** **B11-8** **03/08/2017**	**/16** **B12-1** **03/08/2017**	**/17** **B10-6** **03/08/2017**
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	72	89	64	75
Date Extracted	04-061	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
Date Analysed	04-061	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
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	<0.03	<0.03	<0.03	<0.03
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	<0.03	<0.03	<0.03	<0.03
Oxychlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	94	94	92	94
Date Extracted	04-072	-	21/08/2017	21/08/2017	21/08/2017	21/08/2017
Date Analysed	04-072	-	22/08/2017	22/08/2017	22/08/2017	22/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-B [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

Laboratory Reference:	-	-	**/19**	**/21**	**/23**	**/24**
Client Reference:	-	-	**B10-5**	**B10-8**	**B8-3**	**B6-2**
Date Sampled:	-	-	**03/08/2017**	**07/08/2017**	**07/08/2017**	**07/08/2017**
Analysis Description	**Method**	**Units**				
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	66	69	83	71
Date Extracted	04-061	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
Date Analysed	04-061	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
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	<0.03	<0.03	<0.03	<0.03
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	<0.03	<0.03	<0.03	<0.03
Oxychlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	102	100	84	98
Date Extracted	04-072	-	21/08/2017	21/08/2017	21/08/2017	21/08/2017
Date Analysed	04-072	-	22/08/2017	23/08/2017	23/08/2017	23/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-B [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/26** **B6-3** **07/08/2017**	**/29** **B5-0** **07/08/2017**	**/31** **B4-0** **07/08/2017**	**/35** **B7-1** **07/08/2017**
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	63	68	56	53
Date Extracted	04-061	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
Date Analysed	04-061	-	29/08/2017	30/08/2017	30/08/2017	30/08/2017
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	<0.03	<0.03	<0.03	<0.03
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	<0.03	<0.03	<0.03	<0.03
Oxychlordane	04-072	µg/L	<0.03	<0.03	<0.03	<0.03
Surrogate Recovery	04-072	%	94	86	97	101
Date Extracted	04-072	-	21/08/2017	21/08/2017	21/08/2017	21/08/2017
Date Analysed	04-072	-	23/08/2017	23/08/2017	23/08/2017	23/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia

Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
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Batch Number: A17/2852-B [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

Laboratory Reference:	-	-	**/39**
Client Reference:	-	-	**Elutriate Blank**
Date Sampled:	-	-	**N/A**
Analysis Description	**Method**	**Units**	
Tributyltin Analysis			
Tributyltin	04-061	µgSn/L	<0.0050
Surrogate Recovery	04-061	%	101
Date Extracted	04-061	-	29/08/2017
Date Analysed	04-061	-	30/08/2017
Elutriate - OCP			
Aldrin	04-072	µg/L	<0.03
alpha-BHC	04-072	µg/L	<0.03
beta-BHC	04-072	µg/L	<0.03
gamma-BHC (Lindane)	04-072	µg/L	<0.03
delta-BHC	04-072	µg/L	<0.03
cis-Chlordane	04-072	µg/L	<0.03
trans-Chlordane	04-072	µg/L	<0.03
p,p'-DDD	04-072	µg/L	<0.03
p,p'-DDE	04-072	µg/L	<0.03
p,p'-DDT	04-072	µg/L	<0.03
Dieldrin	04-072	µg/L	<0.03
alpha-Endosulfan	04-072	µg/L	<0.03
beta-Endosulfan	04-072	µg/L	<0.03
Endosulfan Sulphate	04-072	µg/L	<0.03
Endrin	04-072	µg/L	<0.03
Endrin ketone	04-072	µg/L	<0.03
Endrin aldehyde	04-072	µg/L	<0.03
Heptachlor	04-072	µg/L	<0.03
Heptachlor epoxide	04-072	µg/L	<0.03
Hexachlorobenzene	04-072	µg/L	<0.03
Methoxychlor	04-072	µg/L	<0.03
Oxychlordane	04-072	µg/L	<0.03
Surrogate Recovery	04-072	%	100
Date Extracted	04-072	-	21/08/2017
Date Analysed	04-072	-	23/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
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Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
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Batch Number: A17/2852-B [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

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.
No duplicate and spike QC due to insufficient samples.

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
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North Ryde NSW 2113 Australia
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Fax: +61 2 9888 9577
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Batch Number: A17/2852-B [R00]
Project Reference: Port of Brisbane - Sediments - Elutriate

QUALITY ASSURANCE REPORT

TEST	UNITS	Blank	Duplicate Sm#	Duplicate Results	Spike Sm#	Spike Results
Tributyltin	µgSn/L	<0.0050	[NT]	[NT]	External	92%
Surrogate Recovery	%	100	[NT]	[NT]	External	109%
Date Extracted	-	29/08/2017	[NT]	[NT]	External	29/08/2017
Date Analysed	-	29/08/2017	[NT]	[NT]	External	29/08/2017

TEST	UNITS	Blank
Aldrin	µg/L	<0.03
alpha-BHC	µg/L	<0.03
beta-BHC	µg/L	<0.03
gamma-BHC (Lindane)	µg/L	<0.03
delta-BHC	µg/L	<0.03
cis-Chlordane	µg/L	<0.03
trans-Chlordane	µg/L	<0.03
p,p'-DDD	µg/L	<0.03
p,p'-DDE	µg/L	<0.03
p,p'-DDT	µg/L	<0.03
Dieldrin	µg/L	<0.03
alpha-Endosulfan	µg/L	<0.03
beta-Endosulfan	µg/L	<0.03
Endosulfan Sulphate	µg/L	<0.03
Endrin	µg/L	<0.03
Endrin ketone	µg/L	<0.03
Endrin aldehyde	µg/L	<0.03
Heptachlor	µg/L	<0.03
Heptachlor epoxide	µg/L	<0.03
Hexachlorobenzene	µg/L	<0.03
Methoxychlor	µg/L	<0.03
Oxychlordane	µg/L	<0.03
Surrogate Recovery	%	109

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.

Advanced Analytical Australia Pty Ltd Ph: +61 2 9888 9077

REPORT OF ANALYSIS

Laboratory Reference: A17/2852-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: 38
Date Received: 08/08/2017
Date Completed: 30/08/2017

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.

ilac-MRA NATA Accreditation No.15109

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia

Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Batch Number: A17/2852-C [R00]
Project Reference: Port of Brisbane - Porewater

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/12** **B11-9** **03/08/2017**	**/14** **B11-8** **03/08/2017**	**/15** **B11-8B** **03/08/2017**	**/16** **B12-1** **03/08/2017**
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	60	81	109	75
Date Extracted	04-061	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
Date Analysed	04-061	-	30/08/2017	30/08/2017	30/08/2017	30/08/2017
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	%	94	95	86	93
Date Extracted	04-072	-	22/08/2017	22/08/2017	22/08/2017	22/08/2017
Date Analysed	04-072	-	23/08/2017	23/08/2017	23/08/2017	23/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Project Reference: Port of Brisbane - Porewater

Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/17** **B10-6** **03/08/2017**	**/19** **B10-5** **03/08/2017**	**/20** **B10-5B** **03/08/2017**	**/23** **B8-3** **07/08/2017**
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	97	80	84	51
Date Extracted	04-061	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
Date Analysed	04-061	-	30/08/2017	30/08/2017	30/08/2017	30/08/2017
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	%	92	82	93	92
Date Extracted	04-072	-	22/08/2017	22/08/2017	22/08/2017	22/08/2017
Date Analysed	04-072	-	23/08/2017	23/08/2017	23/08/2017	23/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia

Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
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Laboratory Reference: **Client Reference:** **Date Sampled:** **Analysis Description**	- - - **Method**	- - - **Units**	**/24** **B6-2** **07/08/2017**	**/29** **B5-0** **07/08/2017**	**/30** **B5-0B** **07/08/2017**	**/31** **B4-0** **07/08/2017**
Tributyltin Analysis						
Tributyltin	04-061	µgSn/L	<0.0050	<0.0050	<0.0050	<0.0050
Surrogate Recovery	04-061	%	60	68	63	68
Date Extracted	04-061	-	29/08/2017	29/08/2017	29/08/2017	29/08/2017
Date Analysed	04-061	-	30/08/2017	30/08/2017	30/08/2017	30/08/2017
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	86	88	98
Date Extracted	04-072	-	22/08/2017	22/08/2017	22/08/2017	22/08/2017
Date Analysed	04-072	-	23/08/2017	23/08/2017	23/08/2017	23/08/2017

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia

Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

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Laboratory Reference:	-	-	**/35**
Client Reference:	-	-	**B7-1**
Date Sampled:	-	-	**07/08/2017**
Analysis Description	**Method**	**Units**	
Tributyltin Analysis			
Tributyltin	04-061	µgSn/L	<0.0050
Surrogate Recovery	04-061	%	63
Date Extracted	04-061	-	29/08/2017
Date Analysed	04-061	-	30/08/2017
Organochlorine Pesticides			
Aldrin	04-072	µg/L	<0.1
alpha-BHC	04-072	µg/L	<0.1
beta-BHC	04-072	µg/L	<0.1
gamma-BHC (Lindane)	04-072	µg/L	<0.1
delta-BHC	04-072	µg/L	<0.1
cis-Chlordane	04-072	µg/L	<0.1
trans-Chlordane	04-072	µg/L	<0.1
p,p'-DDD	04-072	µg/L	<0.1
p,p'-DDE	04-072	µg/L	<0.1
p,p'-DDT	04-072	µg/L	<0.1
Dieldrin	04-072	µg/L	<0.1
alpha-Endosulfan	04-072	µg/L	<0.1
beta-Endosulfan	04-072	µg/L	<0.1
Endosulfan Sulphate	04-072	µg/L	<0.1
Endrin	04-072	µg/L	<0.1
Endrin ketone	04-072	µg/L	<0.1
Endrin aldehyde	04-072	µg/L	<0.1
Heptachlor	04-072	µg/L	<0.1
Heptachlor epoxide	04-072	µg/L	<0.1
Hexachlorobenzene	04-072	µg/L	<0.1
Methoxychlor	04-072	µg/L	<0.1
Mirex	04-072	µg/L	<0.1
Surrogate Recovery	04-072	%	61
Date Extracted	04-072	-	22/08/2017
Date Analysed	04-072	-	23/08/2017

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11 Julius Avenue
North Ryde NSW 2113 Australia
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Fax: +61 2 9888 9577
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Batch Number: A17/2852-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.
No duplicate and spike QC due to insufficient samples.

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North Ryde NSW 2113 Australia
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Batch Number: A17/2852-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	76%
Surrogate Recovery	%	74	[NT]	[NT]	External	76%
Date Extracted	-	29/08/2017	[NT]	[NT]	External	29/08/2017
Date Analysed	-	30/08/2017	[NT]	[NT]	External	30/08/2017

TEST	UNITS	Blank
Aldrin	µg/L	<0.1
alpha-BHC	µg/L	<0.1
beta-BHC	µg/L	<0.1
gamma-BHC (Lindane)	µg/L	<0.1
delta-BHC	µg/L	<0.1
cis-Chlordane	µg/L	<0.1
trans-Chlordane	µg/L	<0.1
p,p'-DDD	µg/L	<0.1
p,p'-DDE	µg/L	<0.1
p,p'-DDT	µg/L	<0.1
Dieldrin	µg/L	<0.1
alpha-Endosulfan	µg/L	<0.1
beta-Endosulfan	µg/L	<0.1
Endosulfan Sulphate	µg/L	<0.1
Endrin	µg/L	<0.1
Endrin ketone	µg/L	<0.1
Endrin aldehyde	µg/L	<0.1
Heptachlor	µg/L	<0.1
Heptachlor epoxide	µg/L	<0.1
Hexachlorobenzene	µg/L	<0.1
Methoxychlor	µg/L	<0.1
Mirex	µg/L	<0.1
Surrogate Recovery	%	72

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
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Batch Number: A17/2852-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.

Advanced Analytical Australia Pty Ltd
ABN 20 105 644 979
11 Julius Avenue
North Ryde NSW 2113 Australia
Ph: +61 2 9888 9077
Fax: +61 2 9888 9577
contact@advancedanalytical.com.au
www.advancedanalytical.com.au

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 173100

Client Details

Client	Advanced Analytical Aust. Pty Ltd
Attention	Trent Biggin
Address	11 Julius Ave, North Ryde, NSW, 2113

Sample Details

Your Reference	**A17/2852A**
Number of Samples	14 soils
Date samples received	10/08/2017
Date completed instructions received	10/08/2017

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.

Report Details

Date results requested by	18/08/2017
Date of Issue	18/08/2017

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Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

David Springer, General Manager

Chromium Suite						
Our Reference		173100-1	173100-2	173100-3	173100-4	173100-5
Your Reference	UNITS	A17/2852A/4	A17/2852A/8	A17/2852A/9	A17/2852A/10	A17/2852A/14
Sample ID		B13-8	B13-1	B15-3	B15-2	B11-8
Date Sampled		03/08/2017	03/08/2017	03/08/2017	03/08/2017	03/08/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	18/08/2017	18/08/2017	18/08/2017	18/08/2017	18/08/2017
Date analysed	-	18/08/2017	18/08/2017	18/08/2017	18/08/2017	18/08/2017
pH $_{kcl}$	pH units	8.8	8.8	9.1	9.2	8.6
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	0.22	0.18	0.14	0.09	0.29
a-Chromium Reducible Sulfur	moles H^+ /t	130	110	88	55	180
S_{HCl}	%w/w S	<0.005	<0.005	<0.005	<0.005	<0.005
S_{KCl}	%w/w S	0.13	0.093	0.091	0.078	0.17
S_{NAS}	%w/w S	<0.005	<0.005	<0.005	<0.005	<0.005
ANC_{BT}	% $CaCO_3$	7.8	3.3	3.3	3.3	3.5
s-ANC_{BT}	%w/w S	2.5	1.1	1.1	1.1	1.1
s-Net Acidity	%w/w S	<0.005	<0.005	<0.005	<0.005	<0.005
a-Net Acidity	moles H^+ /t	<5	<5	<5	<5	<5
Liming rate	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+ /t	130	110	88	55	180
Liming rate without ANCE	kg $CaCO_3$ /t	10	8.5	6.6	4.1	14
s-Net Acidity without ANCE	%w/w S	0.22	0.18	0.14	0.088	0.29

Chromium Suite						
Our Reference		173100-6	173100-7	173100-8	173100-9	173100-10
Your Reference	UNITS	A17/2852A/16	A17/2852A/17	A17/2852A/18	A17/2852A/22	A17/2852A/26
Sample ID		B12-1	B10-6	B10-6BTS	B9-1	B6-3
Date Sampled		03/08/2017	03/08/2017	03/08/2017	07/08/2017	07/08/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	18/08/2017	18/08/2017	18/08/2017	18/08/2017	18/08/2017
Date analysed	-	18/08/2017	18/08/2017	18/08/2017	18/08/2017	18/08/2017
pH $_{kcl}$	pH units	8.9	8.7	8.7	8.8	8.1
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	0.13	0.29	0.29	0.13	0.20
a-Chromium Reducible Sulfur	moles H^+ /t	82	180	180	80	130
S_{HCl}	%w/w S	<0.005	<0.005	<0.005	<0.005	<0.005
S_{KCl}	%w/w S	0.092	0.18	0.15	0.090	0.17
S_{NAS}	%w/w S	<0.005	<0.005	<0.005	<0.005	<0.005
ANC_{BT}	% $CaCO_3$	2.4	3.1	3.2	2.4	2.5
s-ANC_{BT}	%w/w S	0.76	1.0	1.0	0.77	0.80
s-Net Acidity	%w/w S	<0.005	<0.005	<0.005	<0.005	<0.005
a-Net Acidity	moles H^+ /t	<5	<5	<5	<5	<5
Liming rate	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+ /t	82	180	180	80	130
Liming rate without ANCE	kg $CaCO_3$ /t	6.2	14	13	6.0	9.4
s-Net Acidity without ANCE	%w/w S	0.13	0.29	0.29	0.13	0.20

Chromium Suite					
Our Reference		173100-11	173100-12	173100-13	173100-14
Your Reference	UNITS	A17/2852A/27	A17/2852A/28	A17/2852A/29	A17/2852A/35
Sample ID		B5-1	B5-1BT	B5-0	B7-1
Date Sampled		07/08/2017	07/08/2017	07/08/2017	07/08/2017
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	18/08/2017	18/08/2017	18/08/2017	18/08/2017
Date analysed	-	18/08/2017	18/08/2017	18/08/2017	18/08/2017
pH $_{kcl}$	pH units	8.6	8.6	8.3	8.6
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01
TAA pH 6.5	moles H^+ /t	<5	<5	<5	<5
Chromium Reducible Sulfur	%w/w	0.32	0.25	0.19	0.35
a-Chromium Reducible Sulfur	moles H^+ /t	200	160	120	220
S_{HCl}	%w/w S	<0.005	<0.005	<0.005	<0.005
S_{KCl}	%w/w S	0.15	0.11	0.13	0.18
S_{NAS}	%w/w S	<0.005	<0.005	<0.005	<0.005
ANC_{BT}	% $CaCO_3$	2.8	2.7	2.2	3.3
s-ANC_{BT}	%w/w S	0.90	0.85	0.70	1.1
s-Net Acidity	%w/w S	<0.005	<0.005	<0.005	<0.005
a-Net Acidity	moles H^+ /t	<5	<5	<5	<5
Liming rate	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+ /t	200	160	120	220
Liming rate without ANCE	kg $CaCO_3$ /t	15	12	8.8	16
s-Net Acidity without ANCE	%w/w S	0.32	0.25	0.19	0.35

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						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			18/08/2017	1	18/08/2017	18/08/2017		18/08/2017	[NT]
Date analysed	-			18/08/2017	1	18/08/2017	18/08/2017		18/08/2017	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	1	8.8	8.8	0	96	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	1	<0.01	<0.01	0	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	<5	1	<5	<5	0	105	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	1	0.22	0.20	10	100	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	<3	1	130	130	0	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	1	0.13	0.13	0	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	1	7.8	7.5	4	[NT]	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	1	2.5	2.4	4	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	<5	1	<5	<5	0	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	<0.75	<0.75	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	<5	1	130	130	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	10	9.6	4	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	1	0.22	0.20	10	[NT]	[NT]

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			[NT]	11	18/08/2017	18/08/2017		18/08/2017	[NT]
Date analysed	-			[NT]	11	18/08/2017	18/08/2017		18/08/2017	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	11	8.6	8.6	0	96	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	[NT]	11	<0.01	<0.01	0	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	[NT]	11	<5	<5	0	120	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	[NT]	11	0.32	0.30	6	101	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	[NT]	11	200	190	5	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	[NT]	11	<0.005	<0.005	0	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	[NT]	11	0.15	0.15	0	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	[NT]	11	<0.005	<0.005	0	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	[NT]	11	2.8	2.6	7	[NT]	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	[NT]	11	0.90	0.84	7	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	[NT]	11	<0.005	<0.005	0	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	[NT]	11	<5	<5	0	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	11	<0.75	<0.75	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	[NT]	11	200	190	5	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	[NT]	11	15	14	7	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	[NT]	11	0.32	0.30	6	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

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.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

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.

ANALYTICAL REPORT

CLIENT DETAILS

Contact	Joanne Oliveri
Client	AU INTERLABS
Address	5266 683 ENVI WRS PERTH 28 Millrose Drive Malaga WA 6090
Telephone	(08) 9475 0099
Facsimile	(Not specified)
Email	Joanne.Oliveri@sgs.com
Project	**10081**
Order Number	**10081**
Samples	14

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	**ME303863 R0**
Date Received	29/8/2017
Date Reported	6/9/2017

COMMENTS

Whilst SGS laboratories conform to ISO:17025 standards, results of analysis in this report fall outside of the current scope of NATA accreditation .

SIGNATORIES

S. Rutkowski

Stephen Rutkowski
Senior Health Physicist

Gross alpha and beta in solids [ARS-SOP-AS315/AS504] Tested: 4/9/2017

PARAMETER	UOM	LOR	10081-1 A17/2852A/4 SOIL - ME303863.001	10081-2 A17/2852A/8 SOIL - ME303863.002	10081-3 A17/2852A/9 SOIL - ME303863.003	10081-4 A17/2852A/10 SOIL - ME303863.004	10081-5 A17/2852A/14 SOIL - ME303863.005
Gross alpha	Bq/g	0.06	0.08 ±0.07	0.08 ±0.07	0.09 ±0.07	0.07 ±0.07	0.14 ±0.09
Gross beta	Bq/g	0.15	0.27 ±0.16	0.56 ±0.18	0.52 ±0.18	0.41 ±0.18	0.52 ±0.19

PARAMETER	UOM	LOR	10081-6 A17/2852A/16 SOIL - ME303863.006	10081-7 A17/2852A/17 SOIL - ME303863.007	10081-8 A17/2852A/18 SOIL - ME303863.008	10081-9 A17/2852A/22 SOIL - ME303863.009	10081-10 A17/2852A/26 SOIL - ME303863.010
Gross alpha	Bq/g	0.06	0.10 ±0.08	0.06 ±0.07	0.11 ±0.08	0.14 ±0.09	0.13 ±0.08
Gross beta	Bq/g	0.15	0.50 ±0.16	0.50 ±0.19	0.47 ±0.18	0.50 ±0.17	0.61 ±0.19

PARAMETER	UOM	LOR	10081-11 A17/2852A/27 SOIL - ME303863.011	10081-12 A17/2852A/28 SOIL - ME303863.012	10081-13 A17/2852A/29 SOIL - ME303863.013	10081-14 A17/2852A/35 SOIL - ME303863.014
Gross alpha	Bq/g	0.06	0.12 ±0.08	0.20 ±0.10	0.14 ±0.08	0.24 ±0.10
Gross beta	Bq/g	0.15	0.46 ±0.18	0.69 ±0.17	0.64 ±0.18	0.59 ±0.18

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

Appendix D Sediment Quality Results – Secondary Laboratory

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB1716215**

Client	: **BMT WBM GROUP LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR BRAD GRANT	Contact	: Customer Services EB
Address	: PO BOX 203 SPRING HILL BRISBANE QLD 4004	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: brad.grant@bmtwbm.com.au	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3831 6744	Telephone	: +61-7-3243 7222
Facsimile	: +61 07 3832 3627	Facsimile	: +61-7-3243 7218
Project	: 20259 Port of Brisbane - Sediment Quality	Page	: 1 of 3
Order number	: ----	Quote number	: EB2016BMTWBM0005 (BNBQ/032/16)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: BRAD HILES		

Dates

Date Samples Received	: 08-Aug-2017 11:05	Issue Date	: 08-Aug-2017
Client Requested Due Date	: 17-Aug-2017	Scheduled Reporting Date	: **17-Aug-2017**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 10.2°C - Ice present
Receipt Detail	: MEDIUM ESKY	No. of samples received / analysed	: 5 / 5

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Radiological analysis will be undertaken by ALS Laboratory Group (Ceska Lipa). The estimated date for this data is 26/9/17.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- **Particle Size Distribution analysis will be conducted by ALS Environmental, Newcastle, NATA accreditation no. 825, Site No. 1656.**
- **Ultra trace OC Pesticides, Ultra trace PCB's and Ultra trace PAH's analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of work order.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EA150H Particle Size Analysis by Hydrometer: AS1289	SOIL - EG005-SD Total Iron and Aluminium in Sediments by	SOIL - EG020-SD Total Metals in Sediments by ICPMS (NODG)	SOIL - EG035T-LL Total Mercury by FIMS - Low Level (SOLID)	SOIL - EP090 (solids) Organotins	SOIL - EP131A OC Pesticides (Ultratrace)
EB1716215-001	03-Aug-2017 10:15	B13-4CT	✓	✓	✓	✓	✓	✓	✓
EB1716215-002	03-Aug-2017 12:45	B11-9CT	✓	✓	✓	✓	✓	✓	✓
EB1716215-003	03-Aug-2017 14:10	B10-6CTS	✓		✓	✓	✓	✓	✓
EB1716215-004	07-Aug-2017 09:30	B6-2CTS	✓		✓	✓	✓	✓	✓
EB1716215-005	07-Aug-2017 10:15	B5-1CT	✓	✓	✓	✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA033 Chromium Suite for Acid Sulphate Soils	SOIL - EA250 (Subcontracted) Gross beta/alpha activity in Soils	SOIL - EK059G (solids) Nitrite plus Nitrate as N (NOx) - soluble by	SOIL - EK062G (Solids) Total Nitrogen as N (TKN + NOx) By Discrete	SOIL - EP003 Total Organic Carbon (TOC) in Soil	SOIL - EP131B PCB's (Ultratrace)	SOIL - TPH only TRH (C6 - C40)
EB1716215-001	03-Aug-2017 10:15	B13-4CT					✓		
EB1716215-002	03-Aug-2017 12:45	B11-9CT					✓		
EB1716215-003	03-Aug-2017 14:10	B10-6CTS	✓	✓	✓	✓	✓	✓	✓
EB1716215-004	07-Aug-2017 09:30	B6-2CTS					✓		
EB1716215-005	07-Aug-2017 10:15	B5-1CT	✓	✓	✓	✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EK061G (Solids) Total Kjeldahl Nitrogen as N (TKN) By Discrete	SOIL - EK067G (Solids) Total Phosphorus as P by Discrete Analyser	SOIL - EP132B Ultratrace PAH's
EB1716215-003	03-Aug-2017 14:10	B10-6CTS	✓	✓	✓
EB1716215-005	07-Aug-2017 10:15	B5-1CT	✓	✓	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **SOIL** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received Date	Samples Received Evaluation	Instructions Received Date	Instructions Received Evaluation
EA033: Chromium Suite for Acid Sulphate Soils							
B10-6CTS	Snap Lock Bag	04-Aug-2017	02-Nov-2017	08-Aug-2017	×	----	----

Requested Deliverables

BRAD GRANT

- A4 - AU Tax Invoice (INV)	Email	brad.grant@bmtwbm.com.au

BRAD HILES

- *AU Certificate of Analysis - NATA (COA)	Email	brad.hiles@bmtwbm.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	brad.hiles@bmtwbm.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	brad.hiles@bmtwbm.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	brad.hiles@bmtwbm.com.au
- Attachment - Report (SUBCO)	Email	brad.hiles@bmtwbm.com.au
- Chain of Custody (CoC) (COC)	Email	brad.hiles@bmtwbm.com.au
- EDI Format - XTab (XTAB)	Email	brad.hiles@bmtwbm.com.au

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1716215**	Page	: 1 of 9
Amendment	: **(Preliminary Report)**		
Client	: **BMT WBM GROUP LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR BRAD GRANT	Contact	: Customer Services EB
Address	: PO BOX 203 SPRING HILL BRISBANE QLD 4004	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3831 6744	Telephone	: +61-7-3243 7222
Project	: 20259 Port of Brisbane - Sediment Quality	Date Samples Received	: 08-Aug-2017 11:05
Order number	: ----	Date Analysis Commenced	: 09-Aug-2017
C-O-C number	: ----	Issue Date	: 17-Aug-2017 17:13
Sampler	: BRAD HILES		
Site	: ----		
Quote number	: BNBQ/032/16		
No. of samples received	: 5		
No. of samples analysed	: 5		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

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

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

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

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

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

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 : Positive PCB result is confirmed by re-extraction and re-analysis.LOR is raised due to high amount of moistures is present.
- EP090: Sample B11-9CT shows poor matrix spike recovery due to matrix interference. Confirmed by re-extraction and re-analysis.
- **Ultra trace OC Pesticides, Ultra trace PCB's and Ultra trace PAH's analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- 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.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	B13-4CT	B11-9CT	B10-6CTS	B6-2CTS	B5-1CT
			Client sampling date / time	03-Aug-2017 10:15	03-Aug-2017 12:45	03-Aug-2017 14:10	07-Aug-2017 09:30	07-Aug-2017 10:15
Compound	CAS Number	LOR	Unit	EB1716215-001	EB1716215-002	EB1716215-003	EB1716215-004	EB1716215-005
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	----	8.3	----	8.3
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	----	<2	----	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	----	<0.02	----	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	----	0.338	----	0.666
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	----	211	----	415
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	----	----	4.39	----	2.75
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	----	----	876	----	549
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	----	----	1.40	----	0.88
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	----	1.5	----	1.5
Net Acidity (sulfur units)	----	0.02	% S	----	----	<0.02	----	0.08
Net Acidity (acidity units)	----	10	mole H+ / t	----	----	<10	----	49
Liming Rate	----	1	kg CaCO3/t	----	----	<1	----	4
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	----	0.34	----	0.66
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	----	211	----	415
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	----	16	----	31
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	41.6	62.2	59.9	57.2	54.9
EA150: Particle Sizing								
+75µm	----	1	%	59	11	----	----	13
+150µm	----	1	%	54	2	----	----	7
+300µm	----	1	%	43	<1	----	----	3
+425µm	----	1	%	31	<1	----	----	2
+600µm	----	1	%	16	<1	----	----	1
+1180µm	----	1	%	3	<1	----	----	<1
+2.36mm	----	1	%	2	<1	----	----	<1
+4.75mm	----	1	%	<1	<1	----	----	<1
+9.5mm	----	1	%	<1	<1	----	----	<1
+19.0mm	----	1	%	<1	<1	----	----	<1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	B13-4CT	B11-9CT	B10-6CTS	B6-2CTS	B5-1CT
				Client sampling date / time	03-Aug-2017 10:15	03-Aug-2017 12:45	03-Aug-2017 14:10	07-Aug-2017 09:30	07-Aug-2017 10:15
Compound	CAS Number	LOR	Unit		EB1716215-001	EB1716215-002	EB1716215-003	EB1716215-004	EB1716215-005
					Result	Result	Result	Result	Result
EA150: Particle Sizing - Continued									
+37.5mm	----	1	%		<1	<1	----	----	<1
+75.0mm	----	1	%		<1	<1	----	----	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		21	39	----	----	44
Silt (2-60 µm)	----	1	%		17	37	----	----	35
Sand (0.06-2.00 mm)	----	1	%		60	24	----	----	21
Gravel (>2mm)	----	1	%		2	<1	----	----	<1
Cobbles (>6cm)	----	1	%		<1	<1	----	----	<1
EG005-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		13200	21400	24900	23200	20400
Iron	7439-89-6	50	mg/kg		28800	43000	45400	39900	40300
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg		7.58	10.1	8.83	7.90	8.06
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	0.1	0.3	0.2
Chromium	7440-47-3	1.0	mg/kg		25.5	45.3	51.2	44.2	51.2
Copper	7440-50-8	1.0	mg/kg		7.5	24.2	31.7	36.6	32.6
Lead	7439-92-1	1.0	mg/kg		6.4	20.0	19.7	20.8	33.6
Nickel	7440-02-0	1.0	mg/kg		15.3	26.7	33.5	27.1	25.6
Silver	7440-22-4	0.1	mg/kg		<0.1	0.1	0.2	0.1	0.6
Zinc	7440-66-6	1.0	mg/kg		37.2	99.4	108	112	128
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		0.03	0.08	0.11	0.08	0.12
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		----	----	<0.1	----	0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		----	----	1280	----	1100
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		----	----	1280	----	1100
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		----	----	706	----	728
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.72	3.60	1.21	1.24	1.17
EP080/071: Total Petroleum Hydrocarbons									

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	B13-4CT	B11-9CT	B10-6CTS	B6-2CTS	B5-1CT
				Client sampling date / time	03-Aug-2017 10:15	03-Aug-2017 12:45	03-Aug-2017 14:10	07-Aug-2017 09:30	07-Aug-2017 10:15
Compound	CAS Number	LOR	Unit		EB1716215-001	EB1716215-002	EB1716215-003	EB1716215-004	EB1716215-005
					Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued									
C6 - C9 Fraction	----	10	mg/kg		----	----	<10	----	<10
C10 - C14 Fraction	----	50	mg/kg		----	----	<50	----	<50
C15 - C28 Fraction	----	100	mg/kg		----	----	<100	----	<100
C29 - C36 Fraction	----	100	mg/kg		----	----	<100	----	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		----	----	<50	----	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		----	----	<10	----	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		----	----	<10	----	<10
>C10 - C16 Fraction	----	50	mg/kg		----	----	<50	----	<50
>C16 - C34 Fraction	----	100	mg/kg		----	----	<100	----	<100
>C34 - C40 Fraction	----	100	mg/kg		----	----	<100	----	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		----	----	<50	----	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		----	----	<50	----	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		----	----	<0.2	----	<0.2
Toluene	108-88-3	0.5	mg/kg		----	----	<0.5	----	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		----	----	<0.5	----	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		----	----	<0.5	----	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		----	----	<0.5	----	<0.5
^ Sum of BTEX	----	0.2	mg/kg		----	----	<0.2	----	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg		----	----	<0.5	----	<0.5
Naphthalene	91-20-3	1	mg/kg		----	----	<1	----	<1
EP090: Organotin Compounds									
Monobutyltin	78763-54-9	1	µgSn/kg		<1	<1	<1	<1	<1
Dibutyltin	1002-53-5	1	µgSn/kg		<1	<1	<1	<1	**4**
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	**0.7**	<0.5	**1.8**	**1.6**
EP131A: Organochlorine Pesticides									
Aldrin	309-00-2	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
alpha-BHC	319-84-6	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
beta-BHC	319-85-7	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
delta-BHC	319-86-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
4.4`-DDD	72-54-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Client sample ID	B13-4CT	B11-9CT	B10-6CTS	B6-2CTS	B5-1CT
				Client sampling date / time	03-Aug-2017 10:15	03-Aug-2017 12:45	03-Aug-2017 14:10	07-Aug-2017 09:30	07-Aug-2017 10:15
					EB1716215-001	EB1716215-002	EB1716215-003	EB1716215-004	EB1716215-005
					Result	Result	Result	Result	Result
EP131A: Organochlorine Pesticides - Continued									
4.4`-DDE	72-55-9	0.50	µg/kg		<0.50	**0.80**	**1.00**	**0.84**	**1.16**
4.4`-DDT	50-29-3	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.50	µg/kg		<0.50	**0.80**	**1.00**	**0.84**	**1.16**
Dieldrin	60-57-1	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
alpha-Endosulfan	959-98-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
beta-Endosulfan	33213-65-9	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Endosulfan sulfate	1031-07-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
^ Endosulfan (sum)	115-29-7	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Endrin	72-20-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Endrin aldehyde	7421-93-4	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Endrin ketone	53494-70-5	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Heptachlor	76-44-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Heptachlor epoxide	1024-57-3	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Hexachlorobenzene (HCB)	118-74-1	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
gamma-BHC	58-89-9	0.25	µg/kg		<0.25	<0.25	<0.25	<0.25	<0.25
Methoxychlor	72-43-5	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
cis-Chlordane	5103-71-9	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
trans-Chlordane	5103-74-2	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
^ Total Chlordane (sum)	----	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Oxychlordane	27304-13-8	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.50	µg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
EP131B: Polychlorinated Biphenyls (as Aroclors)									
^ Total Polychlorinated biphenyls	----	5.0	µg/kg		----	----	<6.2	----	**9.7**
Aroclor 1016	12674-11-2	5.0	µg/kg		----	----	<6.2	----	<6.2
Aroclor 1221	11104-28-2	5.0	µg/kg		----	----	<6.2	----	<6.2
Aroclor 1232	11141-16-5	5.0	µg/kg		----	----	<6.2	----	<6.2
Aroclor 1242	53469-21-9	5.0	µg/kg		----	----	<6.2	----	<6.2
Aroclor 1248	12672-29-6	5.0	µg/kg		----	----	<6.2	----	<6.2
Aroclor 1254	11097-69-1	5.0	µg/kg		----	----	<6.2	----	**9.7**
Aroclor 1260	11096-82-5	5.0	µg/kg		----	----	<6.2	----	<6.2
EP132B: Polynuclear Aromatic Hydrocarbons									
3-Methylcholanthrene	56-49-5	10	µg/kg		----	----	<10	----	<10
2-Methylnaphthalene	91-57-6	10	µg/kg		----	----	<10	----	<10
7.12-Dimethylbenz(a)anthracene	57-97-6	10	µg/kg		----	----	<10	----	<10

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	B13-4CT	B11-9CT	B10-6CTS	B6-2CTS	B5-1CT
				Client sampling date / time	03-Aug-2017 10:15	03-Aug-2017 12:45	03-Aug-2017 14:10	07-Aug-2017 09:30	07-Aug-2017 10:15
Compound	CAS Number	LOR	Unit		EB1716215-001	EB1716215-002	EB1716215-003	EB1716215-004	EB1716215-005
					Result	Result	Result	Result	Result
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Acenaphthene	83-32-9	10	µg/kg		----	----	<10	----	<10
Acenaphthylene	208-96-8	10	µg/kg		----	----	<10	----	<10
Anthracene	120-12-7	10	µg/kg		----	----	<10	----	**10**
Benz(a)anthracene	56-55-3	10	µg/kg		----	----	**30**	----	**40**
Benzo(a)pyrene	50-32-8	10	µg/kg		----	----	**40**	----	**50**
Benzo(b+j)fluoranthene	205-99-2 205-82-3	10	µg/kg		----	----	**50**	----	**80**
Benzo(e)pyrene	192-97-2	10	µg/kg		----	----	**30**	----	**50**
Benzo(g.h.i)perylene	191-24-2	10	µg/kg		----	----	**30**	----	**30**
Benzo(k)fluoranthene	207-08-9	10	µg/kg		----	----	**20**	----	**30**
Chrysene	218-01-9	10	µg/kg		----	----	**20**	----	**40**
Coronene	191-07-1	10	µg/kg		----	----	<10	----	<10
Dibenz(a.h)anthracene	53-70-3	10	µg/kg		----	----	<10	----	<10
Fluoranthene	206-44-0	10	µg/kg		----	----	**60**	----	**70**
Fluorene	86-73-7	10	µg/kg		----	----	<10	----	<10
Indeno(1.2.3.cd)pyrene	193-39-5	10	µg/kg		----	----	**20**	----	**20**
N-2-Fluorenyl Acetamide	53-96-3	100	µg/kg		----	----	<100	----	<100
Naphthalene	91-20-3	10	µg/kg		----	----	<10	----	<10
Perylene	198-55-0	10	µg/kg		----	----	**70**	----	**60**
Phenanthrene	85-01-8	10	µg/kg		----	----	**30**	----	**20**
Pyrene	129-00-0	10	µg/kg		----	----	**70**	----	**80**
^ Sum of PAHs	----	10	µg/kg		----	----	**470**	----	**580**
^ Benzo(a)pyrene TEQ (zero)	----	10	µg/kg		----	----	**50**	----	**70**
^ Benzo(a)pyrene TEQ (half LOR)	----	10	µg/kg		----	----	**60**	----	**70**
^ Benzo(a)pyrene TEQ (LOR)	----	10	µg/kg		----	----	**60**	----	**80**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		----	----	**68.1**	----	**77.3**
Toluene-D8	2037-26-5	0.2	%		----	----	**65.8**	----	**79.1**
4-Bromofluorobenzene	460-00-4	0.2	%		----	----	**71.0**	----	**86.7**
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		**115**	**77.0**	**95.5**	**105**	**101**
EP131S: OC Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.50	%		**64.2**	**67.7**	**72.8**	**60.7**	**59.0**
EP131T: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.5	%		----	----	**104**	----	**88.8**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	B13-4CT	B11-9CT	B10-6CTS	B6-2CTS	B5-1CT
				Client sampling date / time	03-Aug-2017 10:15	03-Aug-2017 12:45	03-Aug-2017 14:10	07-Aug-2017 09:30	07-Aug-2017 10:15
Compound	CAS Number	LOR	Unit		EB1716215-001	EB1716215-002	EB1716215-003	EB1716215-004	EB1716215-005
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		----	----	**87.0**	----	**69.0**
Anthracene-d10	1719-06-8	10	%		----	----	**101**	----	**92.0**
4-Terphenyl-d14	1718-51-0	10	%		----	----	**106**	----	**96.1**

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	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	27	131
Anthracene-d10	1719-06-8	35	139
4-Terphenyl-d14	1718-51-0	30	164

BMT WBM Bangalow
6/20 Byron Street, Bangalow 2479
Tel +61 2 6687 0466 Fax +61 2 66870422
Email bmtwbm@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Brisbane
Level 8, 200 Creek Street, Brisbane 4000
PO Box 203, Spring Hill QLD 4004
Tel +61 7 3831 6744 Fax +61 7 3832 3627
Email bmtwbm@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Denver
8200 S. Akron Street, #B120
Centennial, Denver Colorado 80112 USA
Tel +1 303 792 9814 Fax +1 303 792 9742
Email denver@bmtwbm.com
Web www.bmtwbm.com

BMT WBM London
International House, 1st Floor
St Katharine's Way, London E1W 1AY
Email london@bmtwbm.co.uk
Web www.bmtwbm.com

BMT WBM Mackay
PO Box 4447, Mackay QLD 4740
Tel +61 7 4953 5144 Fax +61 7 4953 5132
Email mackay@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Melbourne
Level 5, 99 King Street, Melbourne 3000
PO Box 604, Collins Street West VIC 8007
Tel +61 3 8620 6100 Fax +61 3 8620 6105
Email melbourne@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Newcastle
126 Belford Street, Broadmeadow 2292
PO Box 266, Broadmeadow NSW 2292
Tel +61 2 4940 8882 Fax +61 2 4940 8887
Email newcastle@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Perth
Level 4, 20 Parkland Road, Osborne, WA 6017
PO Box 1027, Innaloo WA 6918
Tel +61 8 9328 2029 Fax +61 8 9486 7588
Email perth@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Sydney
Suite G2, 13-15 Smail Street, Ultimo, Sydney 2007
Tel +61 2 8960 7755 Fax +61 2 8960 7745
Email sydney@bmtwbm.com.au
Web www.bmtwbm.com.au

BMT WBM Vancouver
Suite 401, 611 Alexander Street
Vancouver British Columbia V6A 1E1 Canada
Tel +1 604 683 5777 Fax +1 604 608 3232
Email vancouver@bmtwbm.com
Web www.bmtwbm.com