

Human Health Risk Assessment – Sediments, Kendall Bay, New South Wales

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This report was prepared in July 2015, updated in June-September 2016 with additional data and finalised in November/December 2016/January 2017. An additional update was prepared in February/March 2018 to address NSW EPA comments including consideration of additional data. It is based on the information provided and reviewed at those times. Environmental Risk Sciences disclaims responsibility for any changes that may have occurred after this time.

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Glossary of Terms

ADI	Acceptable Daily Intake
ANZECC	Australia and New Zealand Environment and Conservation Council
AT	Averaging Time
BGL	Below Ground Level
BTEX	Benzene, toluene, ethylbenzene and total xylenes
BW	Body Weight
CF	Unit Conversion Factor
CoPC	Chemicals of Potential Concern
ED	Exposure Duration
EF	Exposure Frequency
ET	Exposure Time
HHRA	Human Health Risk Assessment
HI	Hazard Index
HIL	Health Investigation Level
HQ	Hazard Quotient
HSL	Health Screening Level
LOR	Limit of Reporting
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NSW EPA	Environment Protection Authority
PAH	Polycyclic aromatic hydrocarbon
RfC	Reference Concentration
RfD	Reference Dose
RME	Reasonable maximum exposure
SA	Surface area
TC	Tolerable Concentration
TDI	Tolerable Daily Intake
TDS	Total Dissolved Solids
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WHO	World Health Organisation

Executive Summary

Environmental Risk Sciences Pty Ltd (enRiskS) has been commissioned by Synnot & Wilkinson Pty Ltd (on behalf of Jemena Pty Ltd) to undertake a human health risk assessment to address the presence of PAH contamination in sediments at Kendall Bay, NSW (the "site").

Contamination is present in these sediments due to the presence of the former AGL Mortlake Gasworks. Activities at the site, loading and unloading at the wharf that was located nearby and discharges from the site through a large stormwater drain are likely to have resulted in the contamination found in the sediments. Contamination from the gasworks has included polycyclic aromatic hydrocarbons (PAHs) and other petroleum hydrocarbons. Metals have also been found to be present in the sediments which is likely to be due to historical activities along the Parramatta River and stormwater runoff from urban areas like roads.

Previous Investigations

Previous HHRAs have been undertaken for the site to determine if remediation was required and what areas needed to be remediated. These assessments identified that two areas required removal/remediation – Area A and Area B (**Figure 8**). Difficulties in implementation of the proposed remediation technologies have delayed works.

Additional Works – 2015-2017

Additional studies were undertaken between 2015 and 2017 to help to refine the remediation design including:

- Chemical analysis of sediments, surface waters, biota and odours
- Ecotoxicity testing of the sediments
- Bioaccessibility analysis
- Benthic ecology survey
- Black carbon (and other analyses) related to ecological assessment
- Review of a range of remedial methodologies to determine best practice options for the area
- Bulk sediment excavation trial.

Using these additional data, recent updates to national risk assessment guidance and consideration of the need (where possible) to retain mangroves, calculations have been undertaken to determine remediation criteria to be used in designing the remediation across Kendall Bay. The additional investigations have also resulted in changes to the areas to be remediated formerly known as Area A and B.

Proposed Remediation Criteria

Based on the exposure scenarios outlined in **Section 7** and the toxicity assessment in **Section 8**, remediation criteria have been determined that are protective of human health.

Table ES-1 Proposed Remediation Criteria

Location	Site-Specific Remediation Criteria
Beach Area	60 mg/kg
Central Mangrove Area	120 mg/kg
Western Corner of Kendall Bay	1 mg/kg

Application of Proposed Remediation Criteria

The basis of each of these proposed criteria has been assessed to determine the most appropriate criteria to apply in each of the newly identified remediation areas.

Table ES-2 Application of Proposed Remediation Criteria for Carcinogenic PAHs

Location	Site-Specific Remediation Criteria
Southern Remediation Area	
SA1	1 mg/kg
SA2	1 mg/kg
SA3 – western end adjacent to SA1	1 mg/kg
SA3 – rest of mangrove area	120 mg/kg
SA4	60 mg/kg
SA5	60 mg/kg
Northern Remediation Area	
NA1	1 mg/kg
NA2	Area submerged so ecological criteria more relevant
NA3	Area submerged so ecological criteria more relevant

Application of 1 mg/kg Criterion

It is proposed that the most stringent criterion is applied to areas with coal tars at or near the surface. This includes SA1, SA2, and NA1.

The RAP for the project outlines the intended remediation to be undertaken in SA1, SA2 and NA1. It includes in-situ stabilisation and capping.

Application of 60 and 120 mg/kg Criteria – Western edge of SA3

In the western end of the mangroves, there are several sites where the levels of PAHs exceed the adopted Human Health criteria of 1 mg/kg. Some of these are in Remediation area SA1 and will be remediated using in situ solidification. Several others are located in the western end of Remediation Area SA3 (such as sampling locations 16 and 23) but the highest levels in these areas are covered by the mangrove root mass which in this area can reach half a metre in depth.

The driver of risk in the calculation of the remediation criteria is dermal contact with the contaminated materials. It is assumed that a child may be come into direct contact with the sediments 20 days per year for 6 years in this part of the Bay and on each occasion lower arms, hands, lower legs and feet will be covered by the sediments. If such contact is prevented by the mangrove root mass or is, at least, greatly reduced due to the physical difficulty in reaching the contaminated materials, then the risk is much reduced and compliance with the remediation criteria is not strictly required.

Given the thickness of the overlaying dense root mat, the risk of human exposure in this western end of SA3 is deemed to be low and hence the adopted treatment in this area is to leave the mangrove root mass in place and ensure that any materials on the surface of the root mass are cleaned of any coke and coal washed onto the surface of the area as discussed below.

Application of 60 and 120 mg/kg Criteria – Rest of SA3, SA4 and SA5

The beach area and central mangrove area can be applied to the majority of SA3 as well as SA4 and SA5.

The RAP for the project outlines the intended remediation to be undertaken in SA3, SA4 and SA5. It is intended that all surface rubbish and weathered coal contamination will be removed to a nominal depth of 0.2 -0.3 m. The stormwater drain will be reengineered to better manage flow. Clean sand will be brought in to nourish all these areas and to provide a sufficient capping layer. As a result, little material currently at the surface will remain at the surface after the remediation is complete.

Remaining Areas

None of the health-based criteria need to be applied in areas NA2 and NA3 as these areas are submerged at all times and are not readily accessible to people. If people do access these areas, then any materials will be washed off immediately minimising any potential for dermal exposure. Remediation in these areas should be based on the ecological criteria developed by the CSIRO.

Other Exposure Pathways

Surface water sampling has demonstrated that concentrations for relevant chemicals are below relevant screening criteria.

Biota sampling has found that oysters and mussels collected in Kendall Bay did not contain any PAHs relevant to gasworks waste. The oyster samples did contain copper, cadmium and zinc. The concentrations were the same in the samples from all 3 Bays (Kendall, Majors and Exile Bays) indicating that the contamination was not related to the gasworks contamination. The levels of copper and zinc were above those that would be acceptable to consume on a regular long term basis. However, there is already an advisory in place for Sydney Harbour that recommends no seafood collected west of the Harbour Bridge should be consumed and a prohibition on the collection of oysters and mussels from the entire shoreline of Sydney Harbour. No further restrictions need to be implemented.

Potential Issues During Remediation

Odour modelling and modelling of evaporation of volatile chemicals has shown that none of the chemicals relevant to the gasworks waste are predicted to be present in shoreline locations even under worst case dispersion conditions at concentrations that are above conservative ambient air guidelines (protective of lifetime exposures). Odours have been predicted to be present, particularly under worst case dispersion conditions if no odour control measures are used, assuming that remediation occurs via bulk excavation. The bulk sediment excavation trial supported the findings of the modelling of odours and volatilisation of chemicals. If other remediation techniques are used that minimise how much of the surface of the sediments can be exposed to air the potential for odours will be reduced.

A range of odour control measures are proposed to be included in the project design. Additional odour control measures will be considered, if needed.

Section 1. Introduction

1.1 Background

Environmental Risk Sciences Pty Ltd (enRiskS) has been commissioned by Synnot & Wilkinson Pty Ltd (on behalf of Jemena Pty Ltd) to review existing data in regard to the potential human health risks posed by polycyclic aromatic hydrocarbons (PAHs) contamination in sediments at Kendall Bay, NSW ("the site") (refer to **Figure 1**) and to develop site-specific risk-based sediment criteria for PAHs for the site.

The land adjacent to Kendall Bay was occupied by the former AGL Mortlake gasworks from the late 1800s until the 1980s. Coal gasification occurred at the site. A wharf was located in Kendall Bay where spillages of materials occurred. A drain also existed in Kendall Bay where stormwater from the site was discharged. As a result, activities on the land have resulted in sediment contamination in the Bay.

The land was remediated for residential use between 2000 and 2002.

In 2004 the NSW EPA declared the sediments (within 200 m of the land boundary) as significantly contaminated land. In 2005 an agreement was made between AGL/Jemena and the NSW EPA in regard to further investigations, risk assessment and development of a remediation proposal. In 2007 this declaration was extended to a remediation order requiring the sediments not to be disturbed except by agreement with the NSW EPA.

Site-specific risk-based sediment criteria are required to allow further consideration of appropriate remediation approaches for the site given recent community concern about removal of mangroves during any remediation.

1.2 Objectives

The overall objectives of the assessment presented in this report are:

- Review of the existing monitoring data (including additional data collected in 2015/2016)
- Review of the existing human health risk assessments that were completed during the contaminated land site assessment process
- Development of a set of exposure scenarios and toxicity reference values relevant to the calculation of site-specific risk-based criteria
- Calculation of site-specific risk-based sediment criteria
- Consideration of the potential risks to human health from odours during the remediation

No assessment of environmental issues or off-site risks have been addressed in this report.

1.3 Methodology and Scope of Works

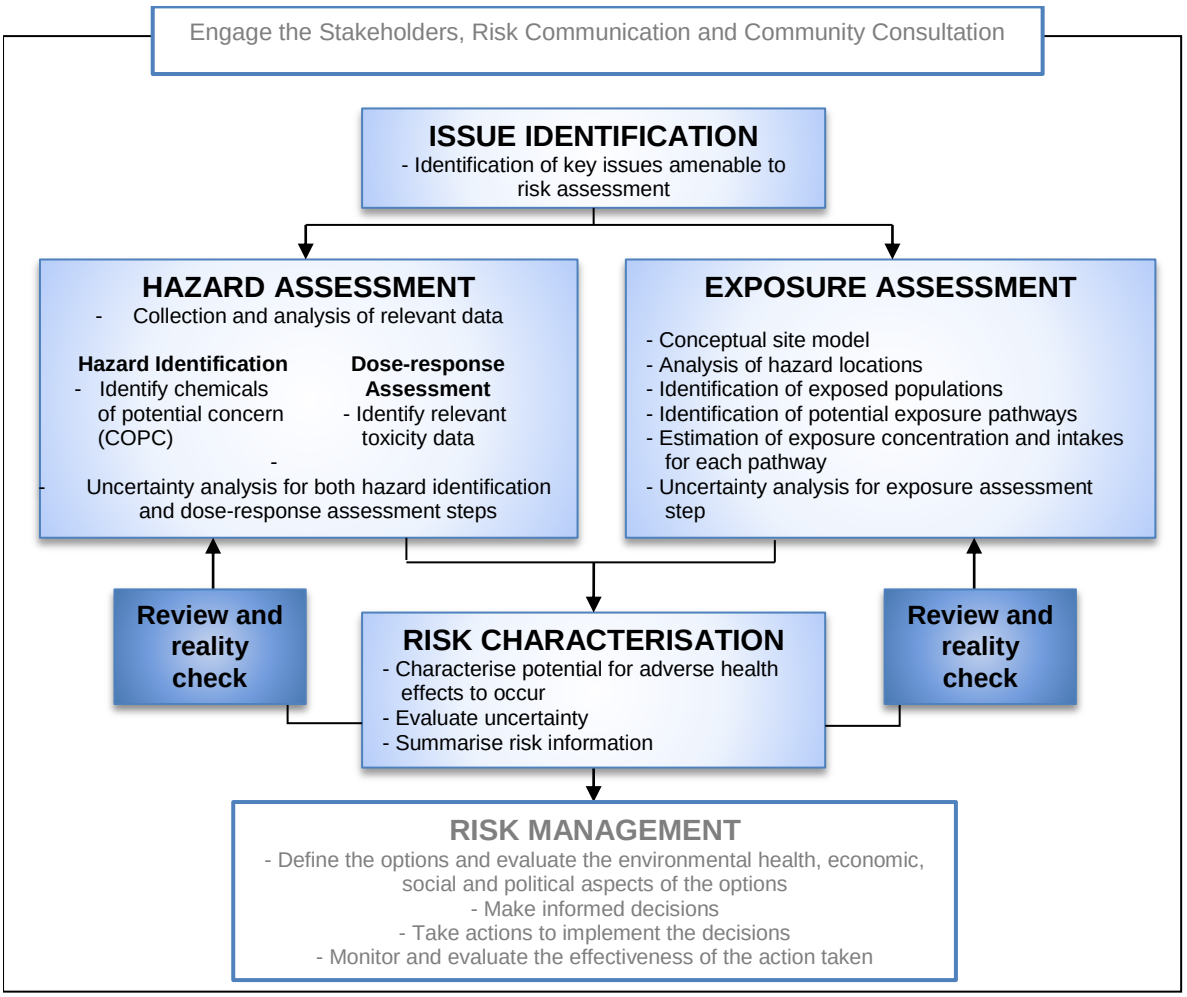
The approach taken for the quantitative assessment of human health risks is in accordance with guidelines/protocols endorsed by Australian regulators, including:

- Environmental Health Risk Assessment, Guidelines for Assessing Human Health Risks from Environmental Hazards (enHealth 2012b)
- Australian Exposure Factor Guide (enHealth 2012a)
- ASC NEPM (1999) National Environmental Protection Measure – Assessment of Site Contamination including:

- Schedule B1 Investigation Levels for Soil and Groundwater (NEPC 1999 amended 2013c)
- Schedule B4 Guideline on Health Risk Assessment Methodology (NEPC 1999 amended 2013a)
- Schedule B7 Guideline on Health-Based Investigation Levels (NEPC 1999 amended 2013b)
- Toolbox Note – Key principles for the remediation and management of contaminated sites (NEPC 2013)

The above documents are supplemented by protocols and guidelines developed by international agencies such as the USEPA (USEPA 1989, 1991, 2002, 2004, 2009).

The overall approach to health risk assessment recommended by the enHealth national risk assessment guidance document is outlined in the following **Figure** (enHealth 2012b).



Following this guidance, the assessment has been undertaken to include the following:

- Review of the background site information (**Section 2**);
- Review of the previous site investigations (**Section 3**);
- Review of the existing human health risk assessments (**Section 4**);
- Review of the new monitoring data for sediment, surface water and biota (**Section 5**);
- Establishment of exposure scenarios relevant to determining remediation criteria (**Section 6**);
- Identification of relevant toxicological information and data for the key chemicals (**Section 7**);
- Quantification and characterisation of the risks to human health and determination or remediation criteria and sensitivity analysis (**Section 8**);
- Consideration of odours during remediation (**Section 9**);
- Conclusions (**Section 10**).

1.4 Provided Information

This report has been based on a review of information relevant to the site presented in the following reports provided for this assessment:

- URS 2006, Environmental Risk Assessment for Sediments Adjacent to the Former AGL Mortlake Site
- URS 2007, Human Health Risk Assessment of Estuarine Sediments Adjacent to the Former AGL Mortlake Site
- NSW EPA 2007, Remediation Order No 23022.
- URS 2008, Preliminary Environmental Assessment, Remediation of Sediments in Kendall Bay, Mortlake
- URS 2009, Conceptual Remediation Action Plan for Kendall Bay Sediments
- Enviropacific Services 2010, Factual Investigation Report, Kendall Bay, Sydney, Kendall Bay
- CH2M Hill 2012, Jemena Kendall Bay Sediment Remediation Project – Final Remediation Method and Cost Peer Review
- Enviropacific Services 2013, Preliminary Assessment Report, EYR3016 – Remediation of Sediments, Kendall Bay
- SKM 2013, Contamination Factual Report, Additional Sediment Investigation, Kendall Bay Remediation Project
- SKM 2014, Updated Human Health and Ecological Risk Assessment, Kendall Bay Remediation Project, Sydney
- SKM 2014, Remediation Action Plan, Kendall Bay Sediment Remediation Project, Sydney
- NSW EPA 2007, Remediation Order No. 23022
- Jemena 2014, Memorandum, Kendall Bay – Background and Current Works

This report has been updated in 2016 using the following information:

- Synnot & Wilkinson 2016a, Kendall Bay Remediation Project, Sediment Contamination Studies, Data Report (Draft)
- Synnot & Wilkinson 2016b, Kendall Bay Remediation Project, Seawater Seasonal Monitoring, Data Report (Draft)
- Synnot & Wilkinson 2016c, Kendall Bay Remediation Project, Marine Tissue Investigation, Data Report (Draft)
- Todoroski Air Sciences 2018, Air Quality Assessment Kendall Bay Remediation Project

- SGS 2016, Air Sampling and Analysis During Kendall Bay Dredge Trial, September 2016
- Ektimo 2016, Emission Testing Report, SGS Australia P/L, Mortlake, Report No R003361a, September 2016

Section 2. Site Background

2.1 Site Description

2.1.1 General

In 2004 NSW EPA declared the sediments within 200 m of the shore of Kendall Bay and the southern shore of the Parramatta River where adjacent to the former AGL Mortlake Gasworks site as an investigation area due to potential contamination from the former Gasworks (URS 2007).

The area is approximately 9 km west of the Sydney CBD. The area includes Breakfast Point and is between Cabarita and Mortlake Points (see **Figure 1**). The Parramatta River flows from west to east past the site. Water depths in the main channel range from 10 to 20 m. The river bed slopes steeply from the shore to the main channel. In Kendall Bay water depths are generally less than 2 m except where dredging has occurred historically near the location of the former wharf where waters are approximately 5 m deep (URS 2007).

Recreational activities are expected to occur from the shore out to 1 m below Lowest Astronomical Tide (LAT).

The western shoreline of Kendall Bay is supported by a sea wall of various origins and designs. The sea wall bordering the west edge is vertical and was constructed concurrent with the recent development of the Breakfast Point precinct. The sea wall in the southern area is angled and appears to have been constructed prior to the development of Breakfast Point (E3 Consult 2011).

The south and southwest shorelines of the Bay consist mainly of mangroves and a small sandy beach is present along the southeast. North of the sandy beach, along Cabarita Park, sandstone bedrock outcroppings are visible along the shoreline (E3 Consult 2011).

The areas surrounding Kendall Bay comprise a mix of land uses. Cabarita Park is located along the east shore of Kendall Bay and Cabarita Marina is located to the east of Cabarita Park and Kendall Bay. A constructed walkway extends from Cabarita Park around to Breakfast Point. The Breakfast Point development located on the shoreline to the south and west of Kendall Bay comprises low to high density residential housing and open space areas. Along the eastern shoreline to the north of the beach, an outcrop of sandstone forms a platform from the constructed walkways of Cabarita Park and into the waters of Kendall Bay (E3 Consult 2011).

Directly adjacent to Kendall Bay above the sandstone sea wall a constructed walkway and open space areas are present. A stormwater outfall pipe protrudes from the sea wall in the southwest corner of Kendall Bay (E3 Consult 2011).

The uses of land adjoining Kendall Bay are as follows:

- To the west, low density residential properties of the Breakfast Point suburb;
- To the south-west, the Breakfast Point Country Club;
- To the south, low density residential properties;
- To the east, Cabarita Park; and
- To the north, the Parramatta River (E3 Consult 2011).

2.1.2 Site Geology

The Sydney 1:100 000 Geological Series Map (Herbert, 1983) indicates that Kendall Bay is underlain by the massive units of Triassic aged Hawkesbury Sandstones which in places may be overlain by remanent outcrops of the Ashfield Shale of the Winamatta Shale Group (DMR, 1991). The Hawkesbury Sandstone Group comprises a sequence of well-bedded, massive, medium-grained, quartz rich sandstones. It is common for the shallower sandstone units to be highly weathered, particularly along jointing features and then to grade with depth to medium to higher strength sandstone, with the frequency of jointing decreasing within the deeper massive sandstone units. The Ashfield Shale unit comprises black to dark grey shale and laminites, carbonaceous claystone and claystone. The shale and sandstone bedrock units are overlain by Quaternary to Tertiary aged fine grained alluvial silts and sediments that graded with depth to sandy clays and into weathered clays or sandstones. Regional groundwater is expected to be present at depth within the Hawkesbury Sandstone bedrock that underlies Kendall Bay. The capacity of the underlying massive units of the Hawkesbury Sandstone to contain and transmit groundwater is low, however, where jointing is well developed and bedding planes are present, the ability for groundwater to migrate through the bedrock is significantly higher. Groundwater present in the sandstone bedrock is expected to be confined to zones of relatively higher permeability within jointing, bedding planes, fractures and weathered features in the sandstone and it is likely that groundwater would flow along both vertical and horizontal migration pathways within the sandstone. A wide range of permeabilities of the Hawkesbury Sandstone have been reported and this is likely to be primarily due to the heterogeneity of the frequency and fracturing within the sandstone bedrock and the presence of numerous water bearing zones (E3 Consult 2011).

If groundwater is also present within the Ashfield Shale units, it is likely to have a low hydraulic conductivity and water would be transmitted primarily by flow through fractures such as joints and bedding plane partings. Thus, the transmissivity of the shale aquifer is dependent on the frequency, openness and orientation of the fracturing present. Groundwater within the Ashfield Shale is known to be saline and to be characterised by low concentrations of a number of heavy metals and is generally unsuitable for beneficial use (E3 Consult 2011).

Groundwater flow in both the shale and sandstone units is likely to be topographically controlled, with some structural influence and is expected to be in a generally easterly to north-easterly direction (E3 Consult 2011).

2.2 Site History

The gasworks site was purchased by AGL in 1883 for a coal gasification facility (“gasworks”), with the production of gas commencing in 1886. Over the next 80 years, operations expanded so that the site eventually became the largest gasworks in the southern hemisphere. Coal and labour shortages during WWII, coupled with increased availability of petroleum products in the 1950s and 1960s led to the use of petroleum feed stocks for the production of gas, replacing coal. In the 1960s, AGL began importing natural gas from South Australia and coal gasification was phased out in 1971. Between 1971 and the 1980s, gas supplies were provided by reforming naphtha (SKM 2014b).

During operation of the gasworks, coal was offloaded from wharves on the northern foreshore of the site (Parramatta River) and also in Kendall Bay. An oil/tar pipeline wharf was also located on the

northern foreshore. Significant land reclamation occurred along the northern and eastern shorelines up to 1944, with the 1944 shoreline corresponding to the current foreshore. The Kendall Bay wharf became the main coal loading facility for the gasworks with the wharves along the northern foreshore being removed. Ship access to the wharf was maintained by dredging the sediments to a depth of approximately 5 m below Lowest Astronomical Tide (LAT) (SKM 2014b).

The AGL Mortlake Gasworks site was remediated between 1999 and 2002, with the Kendall Bay wharf being removed a few years later. The land has since being redeveloped for residential and open space land use. The only infrastructure from the old gasworks that remains along the foreshore are portions of wharf timber piles that extend below the river bed (SKM 2014b).

In 2004 the NSW EPA a portion of the sediments were declared as an investigation area. The area declared was all sediments within 200 m of the land based boundary. The declaration was made due to the presence of PAHs and TPH due to the former gasworks. In 2007 further requirements were placed on the sediments. The additional actions require that no actions be allowed that could disturb the sediments without written permission from the NSW EPA (SKM 2014a; NSW EPA 2007).

Section 3. Review of Existing Monitoring Data

3.1 Review of Nature and Extent of Contamination in Sediments

3.1.1 2006/2007 – URS

URS collected sediment samples on 3 occasions in 2006 and 2007. In January 2006 18 locations were sampled at 0 to 0.1 m and 0.1 to 0.2 m depth. Four locations within the mangrove area were also sampled at a depth greater than 0.2 m. In June 2006 additional samples were collected at 10 locations in front of the mangrove area at the same depths. Deeper samples were also collected for 9 of these locations at 0.2 to 0.55 m depth depending on where refusal occurred for the push core. In June 2007 a further 5 locations were investigated by collecting samples at similar depths to the previous work (URS 2007).

The samples were analysed for TPH, BTEX and PAHs with free and total cyanide also measured for the samples taken in January 2006. Sampling locations are shown in **Figures 2** and **3.** The results for this investigation are provided in **Appendix A. Table 2** lists the maximum concentrations reported in the Mangrove Area and in the Beach Area for these sediments (URS 2007).

Table 1 Maximum Concentrations (URS 2007)

Key Chemical	Maximum Concentration (mg/kg)	Sample Location
Mangrove Area		
Benzene	1.6	QC03 (HH2-07 0.35-0.5 m)
Toluene	7.5	QC03 (HH2-07 0.35-0.5 m)
Ethylbenzene	14.6	QC03 (HH2-07 0.35-0.5 m)
Xylenes	81.7	QC03 (HH2-07 0.35-0.5 m)
TPH C6-C9	166	QC03 (HH2-07 0.35-0.5 m)
TPH C10-C14	9 390	QC03 (HH2-07 0.35-0.5 m)
TPH C15-C28	21 000	QC03 (HH2-07 0.35-0.5 m)
TPH C29-C36	6 450	QC03 (HH2-07 0.35-0.5 m)
Acenaphthene	193	QC03 (HH2-07 0.35-0.5 m)
Acenaphthylene	157	QC03 (HH2-07 0.35-0.5 m)
Anthracene	262	QC03 (HH2-07 0.35-0.5 m)
Benzo[a]anthracene	166	HH2-07 0.35-0.5 m
Benzo[a]pyrene	111	HH2-07 0.35-0.5 m
Benzo[b]fluoranthene	104	HH2-07 0.35-0.5 m
Benzo[ghi]perylene	35.4	HH2-07 0.35-0.5 m
Benzo[k]fluoranthene	82	QC03 (HH2-07 0.35-0.5 m)
Chrysene	154	QC03 (HH2-07 0.35-0.5 m)
Dibenzo[ah]anthracene	16.3	QC03 (HH2-07 0.35-0.5 m)
Fluoranthene	314	HH2-07 0.35-0.5 m
Fluorene	322	QC03 (HH2-07 0.35-0.5 m)
Indeno[123cd]pyrene	32.9	HH2-07 0.35-0.5 m
Naphthalene	1 310	HH2-07 0.35-0.5 m
Phenanthrene	819	QC03 (HH2-07 0.35-0.5 m)
Pyrene	409	HH2-05 0-0.1 m
Total PAHs	4 456	--
Benzo[a]pyrene TEQs	168	--

Key Chemical	Maximum Concentration (mg/kg)	Sample Location
Beach Area		
Benzene	<0.2	--
Toluene	<0.2	--
Ethylbenzene	<0.2	--
Xylenes	<0.2	--
TPH C6-C9	<10	--
TPH C10-C14	190	HH3-3 0.1-0.2 m
TPH C15-C28	6 090	HH3-3 0.1-0.2 m
TPH C29-C36	4 040	HH3-3 0.1-0.2 m
Acenaphthene	<0.5	--
Acenaphthylene	18.2	HH3-3 0.1-0.2 m
Anthracene	3.9	HH3-3 0.1-0.2 m
Benzo[a]anthracene	14.8	HH3-3 0.1-0.2 m
Benzo[a]pyrene	46.7	HH3-3 0.1-0.2 m
Benzo[b]fluoranthene	62.8	HH3-3 0.1-0.2 m
Benzo[ghi]perylene	26.6	HH3-3 0.1-0.2 m
Benzo[k]fluoranthene	27.5	HH3-3 0.1-0.2 m
Chrysene	19.1	HH3-3 0.1-0.2 m
Dibenzo[ah]anthracene	1.3	HSD03 0.1-0.2 m
Fluoranthene	22.9	HH3-3 0.1-0.2 m
Fluorene	<0.5	--
Indeno[123cd]pyrene	22.8	HH3-3 0.1-0.2 m
Naphthalene	1.2	HSD03 0.1-0.2 m
Phenanthrene	2.2	HH3-3 0.1-0.2 m
Pyrene	175	HH3-3 0.1-0.2 m
Total PAHs	446	
Benzo[a]pyrene TEQs	61	

3.1.2 2009 – AECOM

A short summary of this investigation was included in SKM (2014a). The report was unavailable for review for this exercise. The summary provided the following information:

The sediments on the western and central parts of Kendall Bay were investigated using push cores at 25 locations (PC1 to PC12, PC14 to PC17, PC19 to PC27); 16 surface grab samples located across the general area (SG1 – SG16), and 2 additional grab samples adjacent to stormwater discharge pipes (SW1 to SW2). Background sediment conditions were investigated by 3 push core located at Cabarita Point (PC28), the outer edge of Kendall Bay (PC29) and in Glades Bay (PC30). The push cores collected sediment samples from depths below the seabed of 0 – 0.02 m, 0.02 – 0.1 m, 0.2 – 0.4 m and 0.4 – 0.5 m. The surface grab samples were taken from a depth of 0 – 0.1 m. All primary sediment samples (103) were laboratory tested for PAHs, TPH, BTEX, cyanide (free and total) and pH. About half of these samples (52) were also tested for total organic carbon (TOC), while heavy metals were tested in 14 of the grab samples. (SKM 2014a).

This investigation was undertaken to assist in the development of an Environmental Impact Statement (EIS) for a marina in Kendall Bay. Permission was not granted to construct the marina. The study collected samples across Kendall Bay in all areas that might have been affected by the marina development. Samples were collected along each arm of the proposed marina wharf and in between each arm where boats would be moored. Samples from the sediments underneath the

proposed marina wharf were collected from the top 0.02 m, 0.02 to 0.1 m and >0.2 m in depth. Sediments in between the arms of the wharf were collected just from the surface (0-0.1 m).

Figures and data tables were included in the appendices of SKM (2014a). **Figure 4** shows the sampling locations. This information has been reviewed and the following has been found.

- PAHs were normalised to 1% organic carbon for all samples using the measured values for TOC. For samples with > 10% TOC the normalisation should have used a maximum value of 10%. These instructions are provided in the sediment quality guidelines and are to deal with the situation when most of the organic carbon arises from the PAH contamination itself. In such situations the theory behind normalisation falls apart as the expected reduced availability cannot occur.
- All the samples taken closest to the seawall report elevated levels of PAH contamination.

3.1.3 2011 – E3 Consult

E3 Consult undertook additional sediment investigations in Area A (mangrove and beach area) and Area B (wharf area) in late 2010. Cores were collected at 23 locations in Area A and 5 locations in Area B. The shallow sediments in some of the sample cores collapsed inside the core when extracted due to their very fine and unconsolidated nature. In these locations additional surface sediment samples were taken using a petite ponar grab sampler (E3 Consult 2011).

Samples were collected from cores at 0-0.3 m; 0.5 m; 1.0 m and at 0.5 or 1 m intervals for the full length of the core. Sediment samples (core and grab) were analysed for TPH, BTEX, PAHs, metals, total cyanide and TOC. Sampling locations are shown in **Figure 5**. Results are in **Appendix A**. Maximum concentrations at any depth and in the surface sediments are listed in **Table 2**. The beach area was represented by sampling locations SHA10, SHA17, SHA16, SHA19, SHA20. The mangrove area was represented by sampling locations SHA04-SHA09, SHA11-SHA15, SHA18. The wharf area was represented by sampling locations SHA21-SHA25 (E3 Consult 2011).

Table 2 Maximum Concentrations (E3 Consult 2011)

Key Chemical	Maximum Concentration – all depths (mg/kg)	Sample Location	Maximum Concentration – near surface (mg/kg)	Sample Location
Mangrove Area				
Benzene	6.8	SHA05 4.3-4.4 m	<0.5	
Toluene	1.6	SHA04 1.5-1.6 m	<0.5	
Ethylbenzene	1.7	SHA07 3.8-3.9 m	<1	
Xylenes	37	SHA05 4.3-4.4 m	<3	
TPH C6-C9	22	SHA13 3.5-3.6 m	<25	
TPH C10-C14	880	SHA05 4.3-4.4 m	530	SHA11 PP-2 0-0.2 m
TPH C15-C28	13 000	SHA07 3.8-3.9 m	13 000	SHA11 PP-2 0-0.2 m
TPH C29-C36	5 800	SHA11 PP-2 0-0.2 m	5 800	SHA11 PP-2 0-0.2 m
Acenaphthene	81	SHA13 3.5-3.6 m	6.1	SHA11 PP-2 0-0.2 m
Acenaphthylene	83	SHA11 PP-2 0-0.2 m	83	SHA11 PP-2 0-0.2 m
Anthracene	51	SHA13 3.5-3.6 m	24	SHA11 PP-2 0-0.2 m
Benzo[a]anthracene	140	SHA07 3.5-3.6 m	78	SHA11 PP-2 0-0.2 m
Benzo[a]pyrene	190	SHA11 PP-2 0-0.2 m	190	SHA11 PP-2 0-0.2 m
Benzo[b]fluoranthene	190	SHA11 PP-2 0-0.2 m	190	SHA11 PP-2 0-0.2 m
Benzo[ghi]perylene	44	SHA07 3.5-3.6 m	44	SHA11 PP-2 0-0.2 m

Key Chemical	Maximum Concentration – all depths (mg/kg)	Sample Location	Maximum Concentration – near surface (mg/kg)	Sample Location
Chrysene	140	SHA07 3.5-3.6 m	63	SHA11 PP-2 0-0.2 m
Dibenzo[ah]anthracene	13	SHA07 3.5-3.6 m	7.3	SHA11 PP-2 0-0.2 m
Fluoranthene	330	SHA07 3.5-3.6 m	310	SHA11 PP-2 0-0.2 m
Fluorene	63	SHA13 3.5-3.6 m	6.2	SHA11 PP-2 0-0.2 m
Indeno[123cd]pyrene	56	SHA11 PP-2 0-0.2 m	56	SHA11 PP-2 0-0.2 m
Naphthalene	370	QC205 (SHA05 4.3-4.4 m)	55	SHA11 PP-2 0-0.2 m
Phenanthrene	190	SHA13 3.5-3.6 m	30	SHA11 PP-2 0-0.2 m
Pyrene	520	SHA11 PP-2 0-0.2 m	520	SHA11 PP-2 0-0.2 m
Total PAHs	1663	SHA11 PP-2 0-0.2 m	1663	SHA11 PP-2 0-0.2 m
Benzo[a]pyrene TEQs	230	SHA11 PP-2 0-0.2 m	230	SHA11 PP-2 0-0.2 m
Beach Area				
Benzene	<0.5	--	<0.5	--
Toluene	<0.5	--	<0.5	--
Ethylbenzene	<1	--	<1	--
Xylenes	<3	--	<3	--
TPH C6-C9	<25	--	<25	--
TPH C10-C14	170	SHA20 0.2-0.4 m	170	SHA20 0.2-0.4 m
TPH C15-C28	2 900	SHA20 0.2-0.4 m	2 900	SHA20 0.2-0.4 m
TPH C29-C36	170	SHA20 0.2-0.4 m	170	SHA20 0.2-0.4 m
Acenaphthene	18	SHA20 0.2-0.4 m	18	SHA20 0.2-0.4 m
Acenaphthylene	1.5	SHA20 0.2-0.4 m	1.5	SHA20 0.2-0.4 m
Anthracene	6.2	SHA20 0.2-0.4 m	6.2	SHA20 0.2-0.4 m
Benzo[a]anthracene	19	SHA20 0.2-0.4 m	19	SHA20 0.2-0.4 m
Benzo[a]pyrene	42	SHA20 0.2-0.4 m	42	SHA20 0.2-0.4 m
Benzo[b+k]fluoranthene	49	SHA20 0.2-0.4 m	49	SHA20 0.2-0.4 m
Benzo[ghi]perylene	13	SHA20 0.2-0.4 m	13	SHA20 0.2-0.4 m
Chrysene	20	SHA20 0.2-0.4 m	20	SHA20 0.2-0.4 m
Dibenzo[ah]anthracene	2.9	SHA20 0.2-0.4 m	2.9	SHA20 0.2-0.4 m
Fluoranthene	25	SHA20 0.2-0.4 m	25	SHA20 0.2-0.4 m
Fluorene	3.7	SHA20 0.2-0.4 m	3.7	SHA20 0.2-0.4 m
Indeno[123cd]pyrene	17	SHA20 0.2-0.4 m	17	SHA20 0.2-0.4 m
Naphthalene	11	SHA20 0.2-0.4 m	11	SHA20 0.2-0.4 m
Phenanthrene	8.7	SHA20 0.2-0.4 m	8.7	SHA20 0.2-0.4 m
Pyrene	45	SHA20 0.2-0.4 m	45	SHA20 0.2-0.4 m
Total PAHs	282	SHA20 0.2-0.4 m	282	SHA20 0.2-0.4 m
Benzo[a]pyrene TEQs	54	SHA20 0.2-0.4 m	54	SHA20 0.2-0.4 m
Wharf Area				
Benzene	5.1	SHA22 2.5-2.6 m	<0.5	
Toluene	10	SHA22 2.5-2.6 m	<0.5	
Ethylbenzene	22	SHA22 2.5-2.6 m	<1	
Xylenes	92	SHA22 2.5-2.6 m	<3	
TPH C6-C9	<250	--	<25	
TPH C10-C14	3 700	SHA22 3.0-3.1 m	170	SHB21 PP2 0-0.2 m
TPH C15-C28	33 000	SHA22 3.0-3.1 m	3 800	SHB24 PP2 0-0.2 m
TPH C29-C36	12 000	SHA22 3.0-3.1 m	2 200	SHB24 PP2 0-0.2 m
Acenaphthene	160	SHA22 2.5-2.6 m	4.4	SHB21 PP2 0-0.2 m
Acenaphthylene	80	SHA22 3.0-3.1 m	23	SHB24 PP2 0-0.2 m

Key Chemical	Maximum Concentration – all depths (mg/kg)	Sample Location	Maximum Concentration – near surface (mg/kg)	Sample Location
Anthracene	280	SHA22 3.0-3.1 m	17	SHB21 PP2 0-0.2 m
Benzo[a]anthracene	210	SHA22 3.0-3.1 m	31	SHB24 PP2 0-0.2 m
Benzo[a]pyrene	180	SHA22 3.0-3.1 m	56	SHB24 PP2 0-0.2 m
Benzo[b+k]fluoranthene	200	SHA22 3.0-3.1 m	64	SHB24 PP2 0-0.2 m
Benzo[ghi]perylene	49	SHA22 3.0-3.1 m	15	SHB24 PP2 0-0.2 m
Chrysene	190	SHA22 3.0-3.1 m	29	SHB24 PP2 0-0.2 m
Dibenzo[ah]anthracene	11	SHA22 3.0-3.1 m	3.8	SHB24 PP2 0-0.2 m
Fluoranthene	400	SHA22 3.0-3.1 m	60	SHB21 PP2 0-0.2 m
Fluorene	180	SHA22 3.0-3.1 m	9.4	SHB21 PP2 0-0.2 m
Indeno[123cd]pyrene	58	SHA22 3.0-3.1 m	25	SHB24 PP2 0-0.2 m
Naphthalene	600	SHA22 2.5-2.6 m	39	SHB21 PP2 0-0.2 m
Phenanthrene	490	SHA22 3.0-3.1 m	30	SHB21 PP2 0-0.2 m
Pyrene	440	SHA22 3.0-3.1 m	65	SHB21 PP2 0-0.2 m / SHB24 PP2 0-0.2 m
Total PAHs	1990	SHA22 2.5-2.6 m	421	SHB21 PP2 0-0.2 m
Benzo[a]pyrene TEQs	700	SHA22 2.5-2.6 m	72	SHB24 PP2 0-0.2 m

3.1.4 2013 – SKM

SKM undertook additional sediment sampling in July 2013 as part of preparatory works for remediation. They collected samples in a number of locations. Sampling locations are illustrated on **Figure 6**. The data from this investigation are provided in **Appendix A**. **Table 3** lists the maximum concentrations reported in the Mangrove Area (SS01-SS03, SS05, SS09-SS10, SS14-SS20) and in the Beach Area (SS21, SS22, SS23, SS24) for these sediments. Samples were also collected in the vicinity of the wharf (SS11, SS12, SS13, SS27, SS30) (SKM 2013).

These samples were analysed for TPH, BTEX, metals, TOC and PAHs (SKM 2013).

Table 3 Maximum Concentrations (SKM 2013)

Key Chemical	Maximum Concentration (mg/kg)	Sample Location
Mangrove Area		
TPH C10-C14	360	SS03C 1.0-1.1 m
TPH C15-C28	10 000	SS03C 1.0-1.1 m
TPH C29-C36	5 000	SS03C 1.0-1.1 m
Acenaphthene	5.6	SS03B 0.5-0.6 m
Acenaphthylene	26	SS03B 0.5-0.6 m
Anthracene	21	SS14C 1.0-1.1 m
Benzo[a]anthracene	65	SS03B 0.5-0.6 m
Benzo[a]pyrene	69	SS03B 0.5-0.6 m
Benzo[b]fluoranthene	77	SS03B 0.5-0.6 m
Benzo[ghi]perylene	28	SS03C 1.0-1.1 m
Chrysene	61	SS03B 0.5-0.6 m
Dibenzo[ah]anthracene	8.2	SS03C 1.0-1.1 m
Fluoranthene	150	SS03B 0.5-0.6 m
Fluorene	5.5	SS03B 0.5-0.6 m
Indeno[123cd]pyrene	31	SS03B 0.5-0.6 m
Naphthalene	7.7	SS14C 1.0-1.1 m
Phenanthrene	32	SS16B 0.5-0.6 m

Key Chemical	Maximum Concentration (mg/kg)	Sample Location
Pyrene	170	SS03B 0.5-0.6 m
Total PAHs	720	SS03C 1.0-1.1 m
Benzo[a]pyrene TEQs	95	SS03C 1.0-1.1 m
Beach Area		
TPH C15-C28	460	SS21C 1.0-1.1 m
TPH C29-C36	300	SS21C 1.0-1.1 m
Acenaphthene	0.1	SS21C 1.0-1.1 m
Acenaphthylene	3.2	SS21C 1.0-1.1 m
Anthracene	0.9	SS21C 1.0-1.1 m
Benzo[a]anthracene	4	SS21C 1.0-1.1 m
Benzo[a]pyrene	8.2	SS21C 1.0-1.1 m
Benzo[b+k]fluoranthene	11	SS21C 1.0-1.1 m
Benzo[ghi]perylene	4.3	SS21C 1.0-1.1 m
Chrysene	4.1	SS21C 1.0-1.1 m
Dibenzo[ah]anthracene	1	SS21C 1.0-1.1 m
Fluoranthene	5.8	SS22C 1.0-1.1 m
Fluorene	0.6	SS21C 1.0-1.1 m
Indeno[123cd]pyrene	5.3	SS21C 1.0-1.1 m
Naphthalene	0.8	SS21C 1.0-1.1 m
Phenanthrene	2.7	SS21C 1.0-1.1 m
Pyrene	9	SS22C 1.0-1.1 m
Total PAHs	60	SS21C 1.0-1.1 m
Benzo[a]pyrene TEQs	11	SS21C 1.0-1.1 m

3.1.5 2015 – Synnot & Wilkinson

Additional investigations have been undertaken in 2015 by Synnot & Wilkinson. Sampling locations were chosen based on gaining a better understanding of the contamination levels in the sediments, particularly those in and around the mangroves.

Samples were collected from the cores (or the grab samples) at 0-0.3 m; 0.3-0.7 m; and 0.9-1.0 m. Sediment samples were analysed for TPH, BTEX, PAHs, metals, total cyanide and TOC. Sampling locations are shown in **Figure 7**. Results are in **Appendix A**. Maximum concentrations at any depth are listed in **Table 4**. The beach area was represented by sampling locations 100-102, 1-6, 11-12, 19-20. The central mangrove area was represented by sampling locations 103-107, 8-9, 13-14, 17. The western mangrove area was represented by sampling locations 15-16, 23-26 (Synnot & Wilkinson 2015).

Table 4 Maximum Concentrations (Synnot & Wilkinson 2015)

Key Chemical	Maximum Concentration (mg/kg)	Sample Location
Mangrove Area (103-107, 8-9, 13-14, 17)		
TPH C10-C14	310	105B
TPH C15-C28	10 000	14B
TPH C29-C36	4 800	14B
Acenaphthene	8.1	105B
Acenaphthylene	34	109
Anthracene	25	105B
Benzo[a]anthracene	46	105B
Benzo[a]pyrene	95	109

Key Chemical	Maximum Concentration (mg/kg)	Sample Location
Benzo[b]fluoranthene	120	109
Benzo[ghi]perylene	23	109
Chrysene	38	105B
Dibenzo[ah]anthracene	11	14B
Fluoranthene	180	14B
Fluorene	14	105B
Indeno[123cd]pyrene	34	14B
Naphthalene	7.3	109
Phenanthrene	53	105A and 105B
Pyrene	250	14B
Total PAHs	770	14B
Benzo[a]pyrene TEQs	120	109
Beach Area (100-102, 1-6, 11-12, 19-20)		
TPH C15-C28	1300	11B
TPH C29-C36	770	11B
Acenaphthene	0.36	12B
Acenaphthylene	6.4	12B
Anthracene	1.6	12B
Benzo[a]anthracene	9.3	12B
Benzo[a]pyrene	19	12B
Benzo[b+k]fluoranthene	24	12B
Benzo[ghi]perylene	5.2	12B
Chrysene	9.2	12B
Dibenzo[ah]anthracene	1.3	12B
Fluoranthene	10	12B
Fluorene	0.99	11B
Indeno[123cd]pyrene	5.9	11B
Naphthalene	1.7	12B
Phenanthrene	2.5	12B
Pyrene	21	12B
Total PAHs	120	12B
Benzo[a]pyrene TEQs	24	12B
Western Mangrove Area (15, 16, 23-26)		
TPH C10-C14	2 300	25C
TPH C15-C28	16 000	15A
TPH C29-C36	6 400	15A
Acenaphthene	57	15B
Acenaphthylene	130	15B
Anthracene	130	15B
Benzo[a]anthracene	110	15B
Benzo[a]pyrene	110	25B
Benzo[b+k]fluoranthene	130	15B
Benzo[ghi]perylene	52	25B
Chrysene	90	15B
Dibenzo[ah]anthracene	12	25B
Fluoranthene	250	15B
Fluorene	89	15B
Indeno[123cd]pyrene	60	25B
Naphthalene	950	25C
Phenanthrene	290	15B

Key Chemical	Maximum Concentration (mg/kg)	Sample Location
Pyrene	250	15B
Total PAHs	2000	25C
Benzo[a]pyrene TEQs	150	25B

3.2 Uncertainties

A large amount of data has been collected in regard to these sediments over almost a decade.

Area A was originally estimated to be about 8 500 m^2 (0.85 ha). The NSW EPA guidance regarding the number of soil samples required to assess contamination indicates 19-20 sampling locations should be assessed for a site of this size (NSW EPA 1995). Through the various site investigations for the beach and mangrove areas a total of more than 100 locations have been sampled indicating that this site has been extensively investigated.

Comparing the maximum concentrations of benzo[a]pyrene TEQs found in the Beach area and the Mangrove area from each investigation as shown in **Table 5** shows that the results are fairly consistent. This is the case even though sediments are known to be extremely heterogeneous and the comparison is for maximum concentrations in each sampling round not averages or other statistical measures.

Table 5 Data Comparison

Investigation	Maximum Concentration BaP TEQs – Beach (mg/kg)	Maximum Concentration BaP TEQs – Mangroves (mg/kg)
URS 2007	61	168
E3 Consult 2011	54	230
SKM 2013	11	95
Synnot & Wilkinson 2015	24	120

These data are considered to be adequately representative of the contamination present in the sediments.

Section 4. Review of Existing Human Health Risk Assessments

4.1 URS 2007

4.1.1 Exposure Scenarios

URS considered the following activities as relevant for Kendall Bay:

- Picnics
- Walking (including dog walking)
- Fishing
- Kayaking
- Cycling
- Playing on the beach
- Swimming and wading from the beach
- Launching boats at the ramp adjacent to Cabarita Park

The exposure scenarios were developed for this risk assessment by looking at behaviours that could be undertaken in each of the three types of environment present. The area was broken into the following sections:

- Rocky area – one to the north of the mangroves and one where the beach interfaces with Cabarita Park
- Beach area - at the eastern end of Area A
- Mangrove area – significant stand of mangroves between the beach at the eastern end and the rocky area at the western end of Area A.

Consideration was given to the potential for exposure in each section. The exposure pathways considered are listed in **Table 6**.

Table 6 Receptors and Exposure Pathways (URS 2007)

Receptor	Exposure Pathway	Activity	Environment Type
Adults	Ingestion of fish and oysters	Fishing	Rocky, Beach, Mangrove
	Ingestion of Sediment	Wading (boating, fishing, walking) and swimming	Rocky, Beach, Mangrove
	Dermal Contact with Sediment	Wading (boating, fishing, walking) and swimming	Rocky, Beach, Mangrove
	Ingestion of Surface Water	Wading (boating, fishing, walking) and swimming	Rocky, Beach, Mangrove
	Dermal Contact with Surface Water	Wading (boating, fishing, walking) and swimming	Rocky, Beach, Mangrove
	Inhalation of Volatile Chemicals in Sediments	Wading (boating, fishing, walking), bird watching and swimming	Rocky, Beach, Mangrove
Older Children (5-15 years)	Ingestion of fish and oysters	Fishing	Rocky, Beach, Mangrove
	Ingestion of Sediment	Wading (boating, fishing, walking) and swimming	Rocky, Beach, Mangrove
	Dermal Contact with Sediment	Wading (boating, fishing, walking) and swimming	Rocky, Beach, Mangrove
	Ingestion of Surface Water	Wading (boating, fishing, walking) and swimming	Rocky, Beach, Mangrove

Receptor	Exposure Pathway	Activity	Environment Type
	Dermal Contact with Surface Water	Wading (boating, fishing, walking) and swimming	Rocky, Beach, Mangrove
	Inhalation of Volatile Chemicals in Sediments	Wading (boating, fishing, walking) and swimming	Rocky, Beach, Mangrove
Younger Children (0-5 years)	Ingestion of fish and oysters	Fishing	Rocky, Beach, Mangrove
	Ingestion of Sediment	Wading (boating, fishing, walking) and beach play	Rocky, Beach, Mangrove
	Dermal Contact with Sediment	Wading (boating, fishing, walking) and beach play	Rocky, Beach, Mangrove
	Ingestion of Surface Water	Wading (boating, fishing, walking) and beach play	Rocky, Beach, Mangrove
	Dermal Contact with Surface Water	Wading (boating, fishing, walking) and beach play	Rocky, Beach, Mangrove
	Inhalation of Volatile Chemicals in Sediments	Wading (boating, fishing, walking), beach play and visiting	Rocky, Beach, Mangrove

Even though swimming was listed here it was not assessed due to only infrequent detection of these chemicals at one location in surface waters. The detection occurred only when a sheen was present.

4.1.2 Exposure Assessment Parameters

The assumptions adopted for the quantification of potential intakes from exposure to PAHs in the sediments at Kendall Bay are presented in **Table 7**. All calculations are presented in **Appendix B**.

Table 7 Receptors and Exposure Pathways (URS 2007)

Parameter	Adult	Older Child	Younger Child
All Pathways			
Body Weight	70 kg	34.5 kg	13.2 kg
Exposure Duration	55 years	10 years (5 to 15 years)	4 years (1 to 5 years)
Averaging Time (Threshold)	20075 days	3650 days	1460 days
Averaging Time (Non-Threshold)	25550 days	25550 days	25550 days
Ingestion of Fish and Oysters			
Consumption of fish	Average - 0.15 kg 52 times per year RME – 0.15 kg 104 times per year	Average - 0.15 kg 52 times per year RME – 0.15 kg 104 times per year	Average - 0.75 kg 52 times per year RME – 0.75 kg 104 times per year
Consumption of oysters	Average – 3 oysters (24 g) 26 times per year RME – 3 oysters (24 g) 52 times per year	Average – 3 oysters (24 g) 26 times per year RME – 3 oysters (24 g) 52 times per year	Average – 1.5 oysters (12 g) 26 times per year RME – 1.5 oysters (12 g) 52 times per year
Incidental Ingestion of Sediments			
Beach Area	Average – 50 mg/kg 40 days per year RME – 50 mg/kg 112 days per year	Average – 100 mg/kg 73 days per year RME – 100 mg/kg 195 days per year	Average – 200 mg/kg 73 days per year RME – 200 mg/kg 195 days per year
Mangrove Area	Average – 50 mg/kg 40 days per year RME – 50 mg/kg 112 days per year	Average – 100 mg/kg 58 days per year RME – 100 mg/kg 140 days per year	Average – 200 mg/kg 40 days per year RME – 200 mg/kg 112 days per year
Rocky Area	Average – 50 mg/kg 24 days per year RME – 50 mg/kg 104 days per year	Average – 100 mg/kg 24 days per year RME – 100 mg/kg 104 days per year	Not Relevant
Dermal Contact with Sediments			
Beach Area	Average – 1415 cm^2 covered for 2 hrs per day 40 days per year RME – 3950 cm^2 covered for 2 hours per day 112 days per year	Average – 1838 cm^2 covered for 4 hrs per day 73 days per year RME – 3644 cm^2 covered for 8 hours per day 195 days per year	Average – 3330 cm^2 covered for 4 hrs per day 73 days per year RME – 8325 cm^2 covered for 8 hours per day 195 days per year

Parameter	Adult	Older Child	Younger Child
Mangrove Area	Average – 1415 cm^2 covered for 2 hrs per day 40 days per year RME – 3950 cm^2 covered for 2 hours per day 112 days per year	Average – 1838 cm^2 covered for 4 hrs per day 58 days per year RME – 3644 cm^2 covered for 8 hours per day 140 days per year	Average – 3330 cm^2 covered for 4 hrs per day 40 days per year RME – 8325 cm^2 covered for 8 hours per day 112 days per year
Rocky Area	Average – 1415 cm^2 covered for 2 hrs per day 24 days per year RME – 3950 cm^2 covered for 2 hours per day 104 days per year	Average – 1838 cm^2 covered for 4 hrs per day 24 days per year RME – 3644 cm^2 covered for 8 hours per day 104 days per year	Not Relevant
Dermal Absorption	0.005 per hour for PAHs	0.005 per hour for PAHs	0.005 per hour for PAHs
Adherence Rate	0.39 mg per cm^2 of skin	0.39 mg per cm^2 of skin	0.39 mg per cm^2 of skin
Inhalation of Volatile Chemicals			
Beach Area	Not Relevant	Not Relevant	Not Relevant
Mangrove Area	Average – 2.2 m^3 per hour for 2 hours per day for 40 days per year RME – 2.2 m^3 per hour for 2 hours per day for 112 days per year	Average – 1.6 m^3 per hour for 4 hours per day for 58 days per year RME – 1.6 m^3 per hour for 4 hours per day for 140 days per year	Average – 1.25 m^3 per hour for 4 hours per day for 40 days per year RME – 1.25 m^3 per hour for 8 hours per day for 112 days per year
Rocky Area	Not Relevant	Not Relevant	Not Relevant

4.1.3 Concentrations Used to Estimate Risks

The concentrations used by URS to estimate risk using the exposure scenarios listed above are provided in **Tables 8, 9** and **10**. The potential volatilisation of the volatile chemicals found in the sediments has been modelled and the estimated air concentrations are listed in **Table 11**.

Table 8 Concentrations used to estimate risk – beach area (URS 2007)

Chemical	Maximum Concentration – Ingestion (mg/kg)	Location	Maximum Concentration – Dermal (mg/kg)	Location
Benzo[a]anthracene	5.9	HSD03 (QC04)	4.55	HSD03 (QC04)
Benzo[a]pyrene	15.3	HSD03 (QC04)	14.2	HSD03 (QC04)
Benzo[b]fluoranthene	12.3	HH3 5	9.2	HSD03 (QC04)
Benzo[ghi]perylene	7.1	HSD03 (QC04)	6.5	HSD03 (QC04)
Benzo[k]fluoranthene	13.5	HSD03 (QC04)	12.5	HSD03 (QC04)
Chrysene	6.5	HSD03 (QC04)	5.9	HSD03 (QC04)
Dibenzo[ah]anthracene	2	HSD03 (QC04)	1.8	HSD03 (QC04)
Indeno[123cd]pyrene	6.5	HSD03 (QC04)	6.0	HSD03 (QC04)
Benzo[a]pyrene TEQs	21	--	19	--
TPH C15+	1990	HSD03 (QC04)	1782	HSD03 (QC04)

Table 9 Concentrations used to estimate risk – rocky area (URS 2007)

Chemical	Maximum Concentration - Ingestion (mg/kg)	Location	Maximum Concentration – Dermal (mg/kg)	Location
Benzo[a]anthracene	19.1	HSD12	15.8	HSD12/HSD13
Benzo[a]pyrene	16.9	HSD12	15.6	HSD12/HSD13
Benzo[b]fluoranthene	12	HSD12	11.1	HSD12/HSD13
Benzo[ghi]perylene	7.8	HSD12	7.4	HSD12/HSD13
Benzo[k]fluoranthene	15	HSD12	13.7	HSD12/HSD13
Chrysene	18.5	HSD12	16	HSD12/HSD13
Dibenzo[ah]anthracene	2.5	HSD12	2.3	HSD12/HSD13
Indeno[123cd]pyrene	7.4	HSD12	6.9	HSD12/HSD13

Chemical	Maximum Concentration - Ingestion (mg/kg)	Location	Maximum Concentration – Dermal (mg/kg)	Location
Benzo[a]pyrene TEQs	25	--	23	--
TPH C15+	3550	HSD12	3327	HSD12/HSD13

Table 10 Concentrations used to estimate risk – mangrove area (URS 2007)

Chemical	Maximum Concentration - Ingestion (mg/kg)		Maximum Concentration – Dermal (mg/kg)	
	Young Child	Older Child	Young Child	Older Child
Benzo[a]anthracene	145	105	52	57
Benzo[a]pyrene	62	62	45	45
Benzo[b]fluoranthene	51	51	36	35
Benzo[ghi]perylene	21	21	15	15
Benzo[k]fluoranthene	32	36	22	27
Chrysene	73	95	48	53
Dibenzo[ah]anthracene	7.2	7.8	5.1	5.7
Indeno[123cd]pyrene	19	20	14	15
Benzo[a]pyrene TEQs	95	92	63	65
Benzene	<LOR	1.6	<LOR	1.6
Xylenes	0.6	82	0.6	82
Naphthalene	31	1 310	30.6	1 310
TPH C6-C9	71	61	15	29
TPH C10-C14	660	9 390	214	1 485
TPH C15+	9 816	10 920	6 526	8 214

Table 11 Concentrations used to estimate risk – modelled air concentrations (URS 2007)

Chemical	Sediment Concentration (mg/kg)	Location	Air Concentration (mg/m^3)
TPH C6-C9 aliphatic	71	HH2_04	0.0003
TPH C10-C14 aromatic	660	HH2_05	0.001
TPH C10-C14 aliphatic	660	HH2_05	0.0023

4.1.4 Estimated Risks

The risk assessment then used the exposure assumptions and relevant concentrations to estimate the risks posed by the sediment contamination for people using Kendall Bay for recreation. **Tables 12, 13** and **14** provided the calculated risks.

Table 12 Calculated Risks – Adult (URS 2007)

Exposure Pathway	Non-threshold risk	Threshold risk
Adult – Average		
Ingestion of fish	$2x10^{-5}$	0.004
Ingestion of oysters	$1x10^{-5}$	0.002
Total - Fish	*$3x10^{-5}$*	*0.006*
Ingestion of sediments in beach areas	$9x10^{-7}$	0.005
Dermal contact with sediments in beach areas	$4x10^{-6}$	0.00008
Ingestion of sediments in mangrove area	$4x10^{-6}$	0.05
Dermal contact with sediments in mangrove area	$2x10^{-5}$	0.0005
Inhalation of volatile chemicals in mangrove area	NA	0.0001
Ingestion of sediments in rocky areas	$6x10^{-7}$	0.005
Dermal contact with sediments in rocky areas	$3x10^{-6}$	0.00009
Total – Direct Contact during Wading etc	*$3x10^{-5}$*	*0.06*

Exposure Pathway	Non-threshold risk	Threshold risk
Adult – Maximum		
Ingestion of fish	$4x10^{-5}$	0.008
Ingestion of oysters	$2x10^{-5}$	0.005
Total - Fish	*$6x10^{-5}$*	*0.01*
Ingestion of sediments in beach areas	$3x10^{-6}$	0.02
Dermal contact with sediments in beach areas	$2x10^{-5}$	0.0006
Total – Beach	*$2x10^{-5}$*	*0.02*
Ingestion of sediments in mangrove area	$1x10^{-5}$	0.2
Dermal contact with sediments in mangrove area	$1x10^{-4}$	0.004
Inhalation of volatile chemicals in mangrove area	NA	0.0003
Total – Mangrove	*$1x10^{-4}$*	*0.2*
Ingestion of sediments in rocky areas	$3x10^{-6}$	0.02
Dermal contact with sediments in rocky areas	$4x10^{-5}$	0.001
Total – Rocky	*$4x10^{-5}$*	*0.02*
Target Risk	$1x10^{-5}$	1

Threshold risks were estimated to be acceptable for all exposure scenarios and input concentrations. Non-threshold risks due to the carcinogenic PAHs are not acceptable for any of the combined exposure scenarios. For the average case, if exposure is confined to the beach and rocky areas, the estimated non-threshold risks are acceptable.

Table 13 Calculated Risks – Older Child (URS 2007)

Exposure Pathway	Non-threshold risk	Threshold risk
Older Child – Average		
Ingestion of fish	$3x10^{-6}$	0.003
Ingestion of oysters	$4x10^{-6}$	0.005
Total - Fish	*$7x10^{-6}$*	*0.008*
Ingestion of sediments in beach areas	$1x10^{-6}$	0.04
Dermal contact with sediments in beach areas	$8x10^{-6}$	0.0007
Ingestion of sediments in mangrove area	$4x10^{-6}$	0.3
Dermal contact with sediments in mangrove area	$2x10^{-5}$	0.004
Inhalation of volatile chemicals in mangrove area	NA	0.0005
Ingestion of sediments in rocky areas	$5x10^{-7}$	0.02
Dermal contact with sediments in rocky areas	$3x10^{-6}$	0.0005
Total – Direct Contact during Wading etc	*$4x10^{-5}$*	*0.4*
Older Child – Maximum		
Ingestion of fish	$2x10^{-5}$	0.02
Ingestion of oysters	$9x10^{-6}$	0.01
Total - Fish	*$2x10^{-5}$*	*0.03*
Ingestion of sediments in beach areas	$3x10^{-6}$	0.1
Dermal contact with sediments in beach areas	$8x10^{-5}$	0.008
Total – Beach	*$9x10^{-5}$*	*0.1*
Ingestion of sediments in mangrove area	$1x10^{-5}$	0.7
Dermal contact with sediments in mangrove area	$2x10^{-4}$	0.04
Inhalation of volatile chemicals in mangrove area	NA	0.001
Total – Mangrove	*$2x10^{-4}$*	*0.8*
Ingestion of sediments in rocky areas	$2x10^{-6}$	0.09
Dermal contact with sediments in rocky areas	$5x10^{-5}$	0.008
Total – Rocky	*$6x10^{-5}$*	*0.1*
Target Risk	$1x10^{-5}$	1

Threshold risks were estimated to be acceptable for all exposure scenarios and input concentrations. Non-threshold risks due to the carcinogenic PAHs are not acceptable for any of the combined exposure scenarios. For the average case, if exposure is confined to the beach or rocky areas, the estimated non-threshold risks are acceptable.

Table 14 Calculated Risks – Younger Child (URS 2007)

Exposure Pathway	Non-threshold risk	Threshold risk
Younger Child – Average		
Ingestion of fish	$4x10^{-5}$	0.1
Ingestion of oysters	$2x10^{-6}$	0.007
Total – Fish	*$4x10^{-5}$*	*0.1*
Ingestion of sediments in beach areas	$3x10^{-6}$	0.2
Dermal contact with sediments in beach areas	$1x10^{-5}$	0.003
Ingestion of sediments in mangrove area	$6x10^{-6}$	0.6
Dermal contact with sediments in mangrove area	$3x10^{-5}$	0.007
Inhalation of volatile chemicals in mangrove area	NA	0.0007
Total – Direct Contact during Wading etc	*$5x10^{-5}$*	*0.8*
Younger Child – Maximum		
Ingestion of fish	$8x10^{-5}$	0.2
Ingestion of oysters	$5x10^{-6}$	0.01
Total - Fish	*$9x10^{-5}$*	*0.2*
Ingestion of sediments in beach areas	$5x10^{-6}$	0.2
Dermal contact with sediments in beach areas	$2x10^{-4}$	0.05
Total – Beach	*$2x10^{-4}$*	*0.3*
Ingestion of sediments in mangrove area	$1x10^{-5}$	0.6
Dermal contact with sediments in mangrove area	$4x10^{-4}$	0.1
Inhalation of volatile chemicals in mangrove area	NA	0.0007
Total – Mangrove	*$4x10^{-4}$*	*0.7*
Target Risk	$1x10^{-5}$	1

Threshold risks were estimated to be acceptable for all exposure scenarios and input concentrations. Non-threshold risks due to the carcinogenic PAHs are not acceptable for any of the combined exposure scenarios.

4.1.5 Proposed Remediation

As a result of these risk estimates and the presence of aesthetic impacts in the sediment it was proposed to remediate two areas in the sediments within Kendall Bay. The locations of these areas is shown in **Figure 8**. Additional investigations (as described in **Section 3.0**) have proposed modifications to these agreed areas for remediation.

4.1.6 Review

The risk assessment undertaken by URS found that the risks due to the presence of the carcinogenic PAHs were not acceptable for any of the likely combination exposure scenarios, while the risks due to the chemicals that act via threshold mechanisms were acceptable.

There are a number of steps in the assessment where further consideration might change the assumptions or outcome including:

- The use of 0.75 kg as the assumed consumption rate of fish for small children – the value recommended by FSANZ was 0.075 kg.
- The use of the Knafla slope factor for dermal exposures to the carcinogenic PAHs – both USEPA and WHO have noted that the oral slope factor for these chemicals may not be sufficiently protective for dermal exposure but both of these organisation have failed to provide a relevant alternative. Health Canada staff proposed an approach (Knafla et al. 2006) to develop such a slope factor. This approach was adopted for this assessment and results in a 50 fold difference in toxicity compared to that estimated using the oral slope

factor from WHO. Since then the Health Canada team have updated their approach (Knafla et al. 2011) and the ASC NEPM revision has also further investigated the relevance of the original Knafla approach (see Appendix A2 of Schedule B7) (NEPC 1999 amended 2013b).

- The use of a dermal absorbance of 0.005 per hour – the USEPA recommend a dermal absorbance of 0.13 (13%) which was determined from studies over 24 hours. No information was collected during such studies about the shape of the uptake curve over those 24 hours or the uptake at shorter periods than 24 hours, consequently, it is difficult to adjust the absorbance percentage for exposures less than 24 hours. While it is possible (mathematically) to generate an hourly absorbance rate from this information, it is difficult to support such a calculation given the lack of data in regard to the shape of the uptake curve. When compared to soil, it is more likely that sediments will be washed off in between showers given that they can be immediately washed off while wading and swimming or they trigger a shower when a child returns home because the sediments are more obviously present. So they are unlikely to be present on the skin for a full 24 hours. So it is reasonable to suggest that assuming a 24 hour exposure is overly conservative. The absorbance percentage has been updated in the revision of the ASC NEPM (NEPC 1999 amended 2013b). Further consideration as to how to address this issue will be undertaken in this assessment (See **Sections 7.0** and **8.0**).
- There are a number of volatile chemicals that were reported to be present in the sediments in the mangrove area that were not assessed for volatilisation in this assessment including benzene, toluene, ethylbenzene and xylenes.
- Some of the concentrations used in this assessment were not the maximum concentration found at the site due to issues with tabulation of data. Also, additional data has been collected in regard to the chemical concentrations in the sediments since this assessment was completed. Further consideration will be given to the concentrations used to estimate the risks in **Sections 5.0** and **7.0**.
- The assessment assumed that the PAHs in the sediments were 100% bioavailable to people. This is normal practice and is an appropriately conservative assumption to make when specific information is not available to support any lower rate of availability. At the time of the URS assessment there was no methodology available to estimate whether PAHs were tightly bound into sediments or soil or whether they were readily available to those exposed. In 2015 a method became commercially available in Australia to determine bioaccessibility of PAHs so further consideration will be given to the assumption that the PAHs are 100% bioavailable in **Sections 7.0** and **8.0**.

4.2 SKM 2014a

4.2.1 Description of Assessment

SKM (2014a) undertook a review of all the sediment data that had been collected since 2007 to determine if the conceptual site model used by URS was still appropriate.

The human health risk assessment took the results from the URS (2007) risk assessment and just adjusted them based on changes in guidance that had taken place since the URS report was prepared. There was no detailed assessment of all the input parameters used by URS in the calculations or any change in the input concentrations used.

The adjustment made was based on the change in toxicity reference values recommended in the revision to the ASC NEPM in 2013. The revised ASC NEPM recommended a change in the toxicity equivalency factors for 3 of the carcinogenic PAHs as recommended by WHO and a change in the approach to assessing dermal exposure to these chemicals. The adjustment was made by taking the risk estimate for each exposure pathway and location from the URS assessment and converting it based on the change in toxicity reference values. For ingestion this resulted in a 1.3 fold reduction in estimated risk. For dermal exposure the reduction was 67 fold if the change in approach was included along with the change in toxic equivalency factors.

The ecological risk assessment reviewed all the sediment results collected from 2006 to 2013 and compared those values (individually, using averages and using a 49 cell grid) to the most recent sediment quality guidelines to determine which locations (and cells) were above the most recent high end sediment quality guideline (SQG-high).

4.2.2 Review

The limitations in the URS assessment discussed in **Section 4.1.6** in regard to human health are also relevant for this assessment given that the only update that was undertaken was to change the toxicity reference values.

Also in the update to the toxicity reference values, the use of the approach to estimating risk from dermal exposure to PAHs was discussed in detail. While the update recommended that in most cases it was not necessary to use the Knafla approach used in the URS assessment, it did flag that the approach should be considered when dealing with sites where coal tars were present. Many contaminated sites have elevated PAHs due to the use of fill containing ash and for such sites the Knafla approach is definitely less relevant. At this site, however, the sediments are contaminated with coal tars so the approach is relevant and should at least be considered in the uncertainty discussion of any assessment (Knafla et al. 2011; Knafla et al. 2006; NEPC 1999 amended 2013b).

Further consideration will be given in **Sections 6.0, 7.0** and **8.0** to estimating risks and calculating screening criteria for use in designing remediation at the site.

Section 5. Review of Sediment, Surface Water and Biota Data Collected in 2016

5.1 Additional Sediment Data

5.1.1 General

Synnot & Wilkinson (2016a) provides details of the additional sediment monitoring studies that have been undertaken across 2015 and 2016.

Additional sampling of sediments in Kendall Bay and surrounding areas was undertaken in 2015/16. The work was undertaken in 3 phases with a total of 10 sampling events between April 2015 and April 2016. All field work was supervised by Dr Russell Synnot and/or Dr Ian Irvine.

The area being investigated was broken up into various sections and these were progressively refined on the basis of data collected across the 10 sampling episodes. Five such areas were defined (three of them being background areas). The final areas are shown on **Figures 9** and **10**:

- Southern Investigation Area
- Northern Investigation Area
- Remainder of Kendall Bay – background area
- Exile Bay – background area
- Majors Bay – background area

5.1.2 Phase 1 Sampling – Mangrove Area

22 cores were collected during low (spring) tides from April 14-16 in 2015 (**Figure 11** shows the sampling locations). Where possible cores were pushed to a depth of 1.6 m or more. In the beach area and near the sea wall at the southern side of the mangroves, bedrock was shallower than this depth. Cores could not be collected between locations 17 – 13 – 19, surrounding the outlet of the stormwater drain, as the sloppy sediments in this area could not be retained by the corer.

Follow-up samples 105-107 (**Figure 11**) were collected in May 2015 from the same area, using a Dormer Undisturbed wet soil corer. Unfortunately, this method also resulted in poor recovery for the sloppy sediments in the vicinity of the stormwater outfall.

Cores were collected from the intertidal zone at low (spring) tide. Core sampling was hindered in many locations by the roots of the mangrove trees and layers of shell materials. Sampling was carried out by rotating 2 m lengths of 50 mm pre-washed UPVC tubing, with large teeth cut into the lower end, into the sediment. The teeth can cut through mangrove roots up to 20 mm diameter and allow coring of even firm clays. The tubes were rotated up to 1.8 m into the sediment, where conditions permit, although due to compaction and dewatering, and minor loss from the base in some cases, the cores obtained were rarely more than 1.4 m long. A new, pre-washed tube was used for each core location.

For volatile chemicals, samples were collected immediately after the collection of the core from the midpoint of the sampling interval (approx. 150 mm, 550 mm, 950 mm and 1350 mm depth) in accordance with Australian Standard AS 4482.2-1999 (AS 2005). For each sample, 3 mLs of sediment were collected from a freshly exposed surface using a syringe and inserted into a

laboratory prepared, pre-weighed, numbered vial containing 10 mLs of methanol. The vials were stored on ice until delivery to the laboratory.

An assessment of data quality assurance and quality control was undertaken and presented in the Sediment Data Report (Synnot & Wilkinson 2016). This evaluation identified that the data were of suitable quality for interpretation.

5.1.3 Phase 2 – Sampling for HHRA, ERA and Remediation Criteria

Further samples were collected between May 2015 and February 2016 for chemical and toxicity testing.

Five tube samples (300 mm X 100 mm tubes) were collected in the Kendall Bay mangroves at low tide, and a further two tube samples collected in mangroves in Exile Bay and Major's Bay, to determine background values. The remaining twenty-four samples were collected from Kendall Bay, Exile Bay and Major's Bay using multiple casts of a Petite Ponar grab sampler. Sampling locations are shown on **Figure 11**.

Tube samples for toxicity testing were collected by using a pre cleaned section of UPVC tubing (300 mm x 100 mm) into the sediment and excavating around it with capping top and bottom. Samples for chemical analysis were collected from the freshly exposed wall of the excavation after the removal of the tubes at the midpoint (150 mm).

An assessment of data quality assurance and quality control was undertaken and presented in the Sediment Data Report (Synnot & Wilkinson 2016). This evaluation identified that the data were of suitable quality for interpretation.

5.1.4 Phase 3 – Offshore Deep Sediment Sampling

Sampling was also undertaken in the waters of Kendall Bay to determine the extent of contamination across the sediments in the Bay. This work was undertaken in July, September and October 2015 and February, March and April 2016. Sampling locations are shown on **Figure 11**.

All sampling except the April 2016 sampling was carried out by Terratest Pty Ltd (Terratest) using a GeoProbe push tube rig mounted on a barge fixed in place with four spuds, except in a few deep locations in the northern part of the bay where the barge had to be anchored. In the majority of locations, cores were pushed to refusal, generally on firm-to-stiff clays. Cores were generally collected in 75 mm ID tubing except in September 2015, when 50 mm tubing was used in an attempt to obtain better recovery of the upper layer of sediment.

Stage 1 – 200-series cores

Cores were collected at 5 locations in a line across the southern part of Kendall Bay in July 2015. In all cases, sediment from the upper 2 m+ of the core was not retained due to the soft oily nature of the sediments.

Stage 2 – 500-series cores

Cores were collected at 19 locations, generally on a grid pattern in the south-western section of Kendall Bay. 50 mm tubing was used to obtain better recovery of the upper layer of sediment, and at locations where poor recovery was obtained, this was supplemented by pushing a 50 mm hand core from the barge.

Stage 3 – 600-series cores

Cores were collected at 22 locations, generally on a grid pattern in the south-western section of Kendall Bay, but with some cores also taken from the former SKM Area B remediation area, and surrounding it. At locations where poor recovery was obtained, the 75 mm push-cores were supplemented by pushing a 40 mm hand core from the barge.

Stage 4 – 700-series cores

Cores were collected at 19 locations, filling in and extending coverage in the south-western section of the Kendall Bay, and on transects covering the former SKM Area B remediation area, and surrounding it. At locations where poor recovery was obtained, the 75 mm push-cores were supplemented by pushing a 40 mm hand core from the barge.

Stage 5 – 800-series cores

Cores were collected at 12 locations, filling in and extending coverage in the south-western and northern sections of Kendall Bay. At locations where poor recovery was obtained, the 75 mm push-cores were supplemented by pushing a 40 mm hand core from the barge.

Stage 6 – 900-series cores

Cores were collected at 4 locations, filling in and extending coverage in the south-western and northern sections of Kendall Bay by pushing 40 mm hand cores from the boat.

A more detailed description of the sampling methodology is presented in the Sediment Data Report (Synnot & Wilkinson 2016).

An assessment of data quality assurance and quality control was undertaken and presented in the Sediment Data Report (Synnot & Wilkinson 2016). This evaluation identified that the data were of suitable quality for interpretation.

5.1.5 Phase 4 – Post RAP Additional Sampling

A range of additional sediment samples were collected in October 2017 to address some of the questions raised by the NSW EPA. Additional investigation of benthic ecology, ecotoxicity and bioaccessibility was required. When samples for these investigations were collected, samples were also collected to allow chemical analysis in line with the previous investigations. Samples were analysed for metals, PAHs, TRH and some other parameters including cyanide, particle size, organic carbon.

5.1.6 Results

Sediment samples were analysed using standard methods for marine samples, to the detection limits required, by Envirolab Services in Sydney (the primary lab), and the National Measurement Institute in Sydney (NMI, the reference lab). In 2016, Australian Laboratory Services (ALS) was used for some reference analyses. Samples were analysed for metals, PAHs, petroleum hydrocarbons and some other parameters including cyanide, particle size, organic carbon.

The results for sampling undertaken in 2015 and 2016 are reported in **Tables 15** to **20**. The results for sampling undertaken in October 2017 are reported in **Table 21**.

Table 15 Sediment Chemical Data Summary, Northern Investigation Area Kendall Bay (mg/kg) (2015-2016)

Analyte	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Sum C10 - C40	Naphthalene	Total +ve PAH's	TOC%	PAH Norm 1%	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	Total Cyanide
0 to 300 mm depth																	
No Samples	52	52	52	53	52	52	51	51	54	54	54	54	54	54	54	54	32
Mean	1457	7107	1093	9475	75	720	13	82	17	0.4	89	165	205	1.2	14	375	17
Min	<50	<100	<100	<250	0.07	2	1.5	0.3	5.6	<0.1	9	3	8.4	0.02	4	15	<0.5
Max	22000	71000	7500	100500	2800	13000	44	1300	32.5	1.2	210	2800	860	3.2	40	706	510
300 to 600 mm																	
No Samples	29	29	29	29	29	29	27	27	29	29	29	29	29	29	29	29	28
Mean	1637	4906	659	7201	209	909	9.0	153	21	0.5	71	82	309	0.9	13	314	2
Min	<50	<100	<100	<250	0.22	6.1	0.95	2.8	11	<0.1	11	8.5	24	0.14	4	39	<0.5
Max	14000	24000	2200	40200	3600	9900	34	1042	40.1	1.0	170	270	2300	1.8	38	670	10
600 + mm																	
No Samples	73	73	73	73	73	72	71	71	74	74	74	74	74	74	74	74	73
Mean	900	2632	357	3888	84	444	5.7	296	16	0.3	55	40	87	0.5	9.5	176	41
Min	<50	<100	<100	<250	<0.01	0.44	0.03	0.1	0.5	<0.1	4	1	4	<0.01	0.7	3	<0.5
Max	8300	26000	2500	36800	1100	4200	57	4500	36	1.4	320	220	300	2.0	64	1070	1269

Table 16. Sediment Chemical Data Summary, Southern Investigation Area Kendall Bay (mg/kg) (2015-2016)

Analyte	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Sum C10 - C40	Naphthalene	Total +ve PAH's	TOC %	PAH Norm 1%	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	Total Cyanide
0 to 300 mm depth																	
Samples	94	94	94	94	94	92	88	90	94	94	94	94	94	94	94	94	72
Mean	658	4949	795	6402	18	411	16	80	17	0.4	145	49	110	0.6	50	309	87
Min	<50	<100	<100	<250	<0.01	0.12	0.06	1.3	2	<0.1	3	2	6.1	0.01	1	10	<0.5
Max	8000	46000	6800	57900	860	3600	57	2650	54	1.2	530	143	660	8.5	230	820	780
300 to 600 mm																	
Samples	60	60	60	60	60	56	59	59	60	60	60	60	60	60	60	60	58
Mean	769	3752	548	5069	27	456	8.5	68	25	0.4	119	49	157	0.8	38	256	127
Min	<50	<100	<100	<250	<0.01	0.74	0.2	0.2	3	<0.1	3	3	6.7	0.01	2	11	<0.5
Max	5100	22000	3100	29300	500	3300	61	673	64	2.1	570	140	1590	6.5	320	710	1191

Analyte	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Sum C10 - C40	Naphthalene	Total +ve PAH's	TOC %	PAH Norm 1%	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	Total Cyanide
600 + mm																	
No Samples	235	235	235	235	235	229	232	213	235	235	235	235	235	235	235	235	212
Mean	406	1264	188	1857	68	260	2.8	192	18	0.3	38	20	52	0.3	12	101	13
Min	<50	<100	<100	<250	<0.01	<0.1	0.02	0.1	0.25	<0.1	3	0.7	2	<0.01	0.8	1	<0.5
Max	4800	15000	2500	19200	1100	3100	49	4407	62	1.4	450	130	290	1.9	200	1400	430

Table 17 Sediment Chemical Data Summary, Background Areas (mg/kg) (2015-2016)

Analyte	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Sum C10 - C40	Naphthalene	Total +ve PAH's	TOC %	PAH Norm 1%	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	Total Cyanide
Kendall Bay Background – 0 to 300 mm depth																	
No Samples	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	4
Mean	27	437	130	594	0.5	22	4.8	3.3	13	0.2	66	63	122	0.7	10	253	<0.5
Min	<50	<100	<100	<250	<0.01	0.2	0.08	0.64	4	<0.1	6.9	6.7	22	0.01	4	50	<0.5
Max	130	1800	390	2320	3.7	130	15	13	22	0.5	130	130	240	1.4	17	570	<0.5
Exile Bay Sites – 0 to 300																	
No Samples	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	2
Mean	25	127	67	219	0.1	7.3	1.5	4.2	14	0.4	53	82	115	0.4	6.5	250	<0.5
Min	<50	<100	<100	<250	0.01	1.2	0.6	1.9	4.0	<0.1	10	30	30	0.06	1.0	50	<0.5
Max	25	560	200	785	0.2	21	2.9	7.2	29	1.1	120	260	300	1.2	14	580	<0.5
Majors Bay Sites – 0 to 300																	
No Samples	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	1
Mean	25	355	145	526	0.1	10	2.9	7.4	17	1.1	124	91	182	0.6	13	426	
Min	<50	<100	<100	<250	0.01	1.3	0.44	1.02	6.9	<0.1	15	19	41	0.1	2	70	<0.5
Max	25	860	330	1215	0.17	22	6.3	49.5	23	2.0	230	140	250	0.84	24	760	<0.5

Table 18. Northern Investigation Area Volatiles Summary (2015-2016)

Analyte	TRH C_6 - C_9	TRH C_6 - C_{10}	vTPH C_6 - C_{10} less BTEX (F1)	Benzene	Toluene	Ethylbenzene	m+p-Xylene	o-Xylene	Naphthalene
0 to 300 mm depth									
No Samples	47	47	47	47	47	47	47	47	47
Mean	18	31	26	0.3	0.5	1.4	2.8	1.5	45
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Max	160	430	330	6	8	13	55	26	1,000
300 to 600 mm depth									
No Samples	12	12	12	12	12	12	12	12	12
Mean	43.5	102	77	0.5	0.9	11.1	5.9	8.0	165
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Max	260	670	480	4	5	96	31	59	1,100
>600 mm depth									
No Samples	82	82	82	82	82	82	82	82	82
Mean	33	61	47	1	1	3	7	4	125
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Max	400	790	500	40	19	62	130	76	1,600

Table 19. Southern Investigation Area Volatiles Summary (2015-2016)

Analyte	TRH C_6 - C_9	TRH C_6 - C_{10}	vTPH C_6 - C_{10} less BTEX (F1)	Benzene	Toluene	Ethylbenzene	m+p-Xylene	o-Xylene	Naphthalene
0 to 300 mm depth									
No Samples	85	85	85	85	85	85	85	85	85
Mean	11.9	13.2	13.1	0.1	0.3	0.6	1.0	0.5	5.4
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Max	12.5	49	45	0.5	1	3	1	2	220
300 to 600 mm depth									
No Samples	34	34	34	34	34	34	34	34	34
Mean	11.1	17.5	19.3	0.2	0.4	1.1	1.6	1.0	34
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Max	59	140	99	2	4	7	16	10	400
>600 mm depth									
No Samples	240	240	240	240	240	240	240	240	240

Analyte	TRH C_6 - C_9	TRH C_6 - C_{10}	vTPH C_6 - C_{10} less BTEX (F1)	Benzene	Toluene	Ethylbenzene	m+p-Xylene	o-Xylene	Naphthalene
Mean	9.4	21.3	25.1	0.8	0.7	1.2	2.5	1.7	72.7
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Max	140	460	1,100	87	25	54	96	110	5,900

Table 20 Background Areas Volatiles Summary (2015-2016)

Analyte	TRH C_6 - C_9	TRH C_6 - C_{10}	vTPH C_6 - C_{10} less BTEX (F1)	Benzene	Toluene	Ethylbenzene	m+p-Xylene	o-Xylene	Naphthalene
Kendall Bay Outside Investigation Area (0 to 300 mm depth)									
No Samples	14	14	14	14	14	14	14	14	14
Mean	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Max	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Exile Bay (0 to 300 mm depth)									
No Samples	4	4	4	4	4	4	4	4	4
Mean	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Max	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Majors Bay (0 to 300 mm depth)									
No Samples	10	10	10	10	10	10	10	10	10
Mean	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1
Max	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1

Table 21 Sediment Quality – October 2017 Sampling Only

Chemical	Max Concentration in Rest of Kendall Bay (mg/kg)	Maximum Concentration in Exile Bay (mg/kg)	Maximum Concentration in Majors Bay (mg/kg)	Maximum Concentration in Brays Bay (mg/kg)	Maximum Concentration in Canada Bay (mg/kg)	Maximum Concentration in Yaralla Bay (mg/kg)
Arsenic	24	26	17	17	23	18
Cadmium	<0.4	0.7	0.8	<0.4	0.4	1
Chromium	160	130	160	78	150	120
Copper	190	380	150	76	540	110
Lead	270	290	190	110	280	160
Mercury	1.5	1.3	0.8	0.5	0.9	0.7
Nickel	23	16	17	10	15	15
Zinc	740	570	480	270	580	570
Total PAHs	42	6.4	7.8	2.5	5.4	3.4
% Total Organic Carbon	7.6	2.3	3.2	1.2	2.3	2.8
Normalised PAHs (1%OC)	5.5	2.8	2.4	2.1	2.4	1.2
Benzene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	<1	<1	<1	<1	<1	<1
Xylenes	<1	<1	<1	<1	<1	<1
TRH F1	<25	<25	<25	<25	<25	<25
TRH F2	<50	<50	<50	<50	<50	<50
TRH F3	1200	110	<100	120	170	370
TRH F4	320	<100	<100	<100	<100	240
Acenaphthene	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	1.7	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	1	0.1	0.2	<0.1	0.1	<0.1
Benzo[a]anthracene	2.4	0.5	0.6	0.2	0.4	0.2
Benzo[a]pyrene	5.9	0.74	0.77	0.3	0.68	0.4
Benzo[b,j&k]fluoranthene	10	1	1	0.6	1	0.7
Benzo[ghi]perylene	2.8	0.4	0.4	0.2	0.4	0.2
Chrysene	2.7	0.5	0.6	0.2	0.4	0.3
Dibenzo[ah]anthracene	0.6	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	4.8	1	1.3	0.3	0.8	0.5
Fluorene	0.4	<0.1	<0.1	<0.1	0.3	<0.1
Indeno[123cd]pyrene	2.9	0.4	0.4	0.2	0.4	0.2
Naphthalene	0.7	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	2.4	0.4	0.8	0.1	0.3	0.2
Pyrene	6	1.1	1.3	0.4	0.9	0.6
Benzo[a]pyrene TEQs	7.9	1	1	<0.5	0.9	0.5

To allow a comparison between locations, the maximum concentrations found in the 0 to 300 mm layer of sediment in each location have been summarised in **Table 22** for all sampling events including October 2017.

Table 22 Sediment Quality Summary

Chemical	Maximum Concentration in Southern Remediation Area (mg/kg)	Maximum Concentration in Northern Remediation Area (mg/kg)	Max Concentration in Rest of Kendall Bay (mg/kg)	Maximum Concentration in Exile Bay (mg/kg)	Maximum Concentration in Majors Bay (mg/kg)	Maximum Concentration in Brays Bay (mg/kg)	Maximum Concentration in Canada Bay (mg/kg)	Maximum Concentration in Yaralla Bay (mg/kg)
Arsenic	54	33	24	29	23	17	23	18
Cadmium	1.2	1.2	0.5	1.1	2	<0.4	0.4	1
Chromium	530	210	160	130	230	78	150	120
Copper	143	2800	190	380	150	76	540	110
Lead	660	860	270	300	250	110	280	160
Mercury	8.5	3.2	1.5	1.3	0.8	0.5	0.9	0.7
Nickel	230	40	23	16	24	10	15	15
Zinc	820	706	740	580	760	270	580	570
Total PAHs	3600	13000	130	21	22	2.5	5.4	3.4
% Total Organic Carbon	0.06-57 (mean 16%)	1.5-44 (mean 13%)	0.08-15 (mean 4.8%)	0.6-2.9 (mean 1.5%)	0.4-6.3 (mean 2.9%)	1.2	2.3	2.8
Normalised PAHs (1%OC)	2650	1300	13	7.2	49.5	2.1	2.4	1.2
Benzene	0.5	6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	1	8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	3	13	<1	<1	<1	<1	<1	<1
Xylenes	3	81	<1	<2	<2	<1	<1	<1
TRH F1	45	330	<25	<25	<25	<25	<25	<25
TRH F2	8000	22000	130	25	25	<50	<50	<50
TRH F3	46000	71000	1800	560	860	120	170	370
TRH F4	6800	7500	390	200	330	<100	<100	240
Acenaphthene	230	210	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	96	720	1.7	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	240	800	1	0.1	0.2	<0.1	0.1	<0.1
Benzo[a]anthracene	140	550	2.4	0.5	0.6	0.2	0.4	0.2
Benzo[a]pyrene	110	550	5.9	0.74	0.77	0.3	0.68	0.4
Benzo[b,j&k]fluoranthene	110	640	10	1	1	0.6	1	0.7
Benzo[ghi]perylene	33	190	2.8	0.4	0.4	0.2	0.4	0.2
Chrysene	130	610	2.7	0.5	0.6	0.2	0.4	0.3
Dibenzo[ah]anthracene	13	48	0.6	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	290	1500	4.8	1	1.3	0.3	0.8	0.5
Fluorene	260	840	0.4	<0.1	<0.1	<0.1	0.3	<0.1
Indeno[123cd]pyrene	32	260	2.9	0.4	0.4	0.2	0.4	0.2

Chemical	Maximum Concentration in Southern Remediation Area (mg/kg)	Maximum Concentration in Northern Remediation Area (mg/kg)	Max Concentration in Rest of Kendall Bay (mg/kg)	Maximum Concentration in Exile Bay (mg/kg)	Maximum Concentration in Majors Bay (mg/kg)	Maximum Concentration in Brays Bay (mg/kg)	Maximum Concentration in Canada Bay (mg/kg)	Maximum Concentration in Yaralla Bay (mg/kg)
Naphthalene	860	2800	3.7	0.2	0.17	<0.1	<0.1	<0.1
Phenanthrene	720	2300	2.4	0.4	0.8	0.1	0.3	0.2
Pyrene	350	1400	6	1.1	1.3	0.4	0.9	0.6
Benzo[a]pyrene TEQs	150	750	7.9	1	1	<0.5	0.9	0.5

Comparison of these maximum sediment concentrations shows that all three Bays have similar levels of metals. The concentrations of PAHs and TRH are much higher in Kendall Bay (as would be expected) than in the other Bays. These results also show that the Northern Remediation Area has a higher level of contamination than that found in the Southern Remediation Area.

5.2 Surface Water Quality

5.2.1 General

Synnot & Wilkinson (2016b) provides details of the water quality monitoring studies that have been undertaken.

5.2.2 Selection of Sampling Sites

Sampling locations in Kendall Bay were generally selected to align with the locations of marine benthic biological sites. At each of these sites, benthic community analysis, sediment chemistry and and overlying water quality have been assessed.

Samples were also collected from Exile Bay and Majors Bay in the same locations, or near to the locations, where benthic grabs were taken for benthic community analysis and sediment chemistry.

Figure 11 shows the water sampling locations.

5.2.3 Sampling Frequency

As seawater quality may vary seasonally, the sampling program focussed on defining the variability of the levels of the Contaminants of Concern. It is proposed to undertake seasonal sampling throughout 2016 to provide an estimate of variability at each sampling location, as well as variability between the three bays.

The first sampling was done in January 2016 (9/01/2016) and the second in April 2016 (22/04/2016).

5.2.4 Seawater Sampling Sites

Table 22 Sampling Locations for Seawater

Location*	Samples – January 2016	Samples – April 2016	Samples – October 2017
Northern Remediation Area	KBWQ1	WQ1	KBWQ14
	KBWQ1	WQ1	KBWQ20 (dup 14)
	KBWQ2	WQ2	KBWQ13
	KBWQ3	WQ3	KBWQ19 (dup 13)
	KBWQ3	WQ4	
	KBWQ4a	WQ5	
	KBWQ4b	WQ6	
	KBWQ4c		
	KBWQ4c		
	KBWQ5		
	KBWQ6		
Southern Kendall Bay Offshore	KBWQ7	WQ7	KBWQ18
	KBWQ8	WQ8	KBWQ17
	KBWQ9	WQ9A	KBWQ16
	KBWQ9		
Boat Ramp	KBWQ10	WQ10	
Parramatta River Upstream of Kendall Bay			KBWQ8
Parramatta River Downstream of Kendall Bay			KBWQ9
Ferry Terminal	KBWQ11	WQ11	KBWQ15
	KBWQ11	WQ11	
Southern Remediation Area	KBWQ14	WQ14	KBWQ10
	KBWQ14	WQ15	KBWQ11
	KBWQ15	WQ16	KBWQ12

Location*	Samples – January 2016	Samples – April 2016	Samples – October 2017
	KBWQ16		
Exile Bay Inshore	KBWQ12	WQ12	KBW6
Exile Bay Offshore	KBWQ13	WQ13	KBW7
Majors Bay Inshore	KBWQ17	WQ17	KBW3
Majors Bay Offshore	KBWQ18	WQ18	KBW4
	KBWQ18		
River Quays	--	WQ19A	--
	--	WQ19A	--
Brays Bay	--	--	KBW1
	--	--	
Yaralla Bay	--	--	KBW2
Canada Bay	--	--	KBW5
QC Rinsate			KBW21
Trip Spike	TS		TS
Trip Blank	TB		TB

*Where no other bay is mentioned, sample locations were in Kendall Bay except for the Ferry Terminal samples which were in the Parramatta River north of the terminal.

5.2.5 Seawater Sampling

Seawater samples were collected using a decontaminated and de-ionised water-washed Niskin Bottle (Teflon) lowered into the water on a stainless steel cable. The retrieved sample was drained via an attached polyethylene tube to an open sample bottle directly or through a 0.45 micron single use filter for dissolved metal analyses. Multiple sample bottles, appropriate for the analytes to be tested, pre-cleaned by the analysing laboratory and, where required, containing sample preservative, were provided for each sample. Sample bottles were filled to the top so there was zero headspace.

5.2.6 Field Measurements

In-situ water quality monitoring was undertaken using a TPS model 90-FLT water quality meter which included a water quality logger in a single portable unit. The meter combines measurements of Dissolved Oxygen, Conductivity, TDS, pH, mV, Turbidity and Temperature. The meter was calibrated prior to each use using the proprietary methods provided in the TPS manual and using certified reagents.

5.2.7 Position Fixing

Offshore sampling sites were located using hand-held GPS to an accuracy of approximately 3 m. In addition, sample sites were referenced using cross bearings from landward marks.

5.2.8 Laboratory Analyses

The analyses were done by standard methods, which are set out in the laboratory reports included in the site investigation report. Envirolab was the main laboratory. The National Measurement Institute (NMI) was the reference laboratory. Samples were analysed for metals (total and dissolved), TPH, BTEX, PAHs, organochlorine pesticides, nutrients and water quality indicators in January 2016. Samples were analysed for metals (total and dissolved), TPH, BTEX, PAHs, organochlorine pesticides, nutrients, water quality and bacteriological indicators in April 2016.

5.2.9 Quality Control and Quality Assurance

The methodologies used for sampling, analysis and quality control and quality assurance (QC/QA) followed Standard Operating Procedures (SOPs). At least 10% of samples were split duplicates, and a further 5% of samples were split triplicates. The majority of the samples were sent to the main analysis laboratory (Envirolab). Some of the splits and the third samples of the triplicates were sent to the reference laboratory (NMI) for independent checking.

Field Quality Control Samples

Field quality control samples for sediments included field split duplicates and triplicates (replicate samples collected from the bowl after thorough mixing), field blanks and rinsate blanks (to test the decontamination of re-used equipment). Replicate samples were despatched to a second laboratory for inter-laboratory comparisons.

Preservation, Handling, Storage and Documentation

Sample handling techniques ensured that changes in the composition of the samples as a result of chemical, physical or biological action were minimised, that cross-contamination of samples did not occur during subsampling and subsequent handling, and that samples were not lost or mixed up between sampling and receipt by the analysing laboratories.

Appropriate containers and lids were used, i.e. Teflon-lined for organics; appropriate vials for volatiles and semi-volatiles. The container was completely filled with sample and for environmental samples the sample cooled to 4°C in an ice-filled Esky in the field and during shipment to the laboratory.

Waterproof labels and ink were used and labels fixed with clear waterproof tape as well. Each sample was marked with the sample date and time, the sample number, job name and analysis code.

Laboratory QC/QA

The laboratories followed standard procedures including an appropriate QC/QA program. This included analysis of laboratory control samples including blanks, laboratory replicates, spikes and/or standard materials in each batch of field samples.

5.2.10 Results (2016)

To date the waters in Kendall Bay, Exile Bay and Majors Bay have been sampled on two occasions:

- 19 January 2016
- 22 April 2016.

The analytical results are presented in **Tables 23-25**. The results provide a good basis to assess seasonal and annual variations in the water quality for:

- the waters of Kendall Bay
- comparative water quality of Majors and Exile Bays
- any impacts on water quality of the existing identified contamination of the sediments of Kendall Bay.

Results Summary

These results are summarised in the following tables.

Table 23 Surface Water Quality Monitoring Data (January 2016)

Chemical	Maximum Conc in Southern Remediation Area (µg/L)	Maximum Conc in Northern Remediation Area (µg/L)	Maximum Conc in Exile Bay (µg/L)	Maximum Conc in Majors Bay (µg/L)
Arsenic@	**2**	**2**	**2**	**3**
Cadmium@	<0.1	<0.1	<0.1	<0.1
Chromium@	<1	<1	<1	**5**
Copper@	**3**	**2**	**3**	**6**
Lead@	<1	<1	<1	**7**
Mercury@	<0.05	<0.05	<0.05	**0.08**
Nickel@	**1**	<1	<1	**2**
Zinc @	**1**	**3**	<1	**16**
Acenaphthene$	<0.01	<0.01	**0.02**	<0.01
Acenaphthylene$	**0.02**	**0.01**	**0.03**	<0.01
Anthracene$	**0.01**	<0.01	<0.01	<0.01
Benzo[a]anthracene$	**0.07**	<0.01	**0.02**	<0.01
Benzo[a]pyrene$	**0.12**	**0.01**	**0.04**	<0.01
Benzo[b,j&k]fluoranthene$	**0.2**	<0.02	**0.06**	<0.02
Benzo[ghi]perylene$	**0.09**	<0.01	**0.02**	<0.01
Chrysene$	**0.1**	<0.01	**0.02**	<0.01
Dibenzo[ah]anthracene$	**0.09**	<0.01	**0.02**	<0.01
Fluoranthene$	**0.14**	**0.03**	**0.09**	<0.01
Fluorene$	<0.01	<0.01	<0.01	**0.02**
Indeno[123cd]pyrene$	**0.02**	<0.01	<0.01	<0.01
Naphthalene$	**0.2**	**0.09**	<0.02	<0.02
Phenanthrene$	**0.06**	<0.02	<0.02	**0.04**
Pyrene$	**0.15**	**0.02**	**0.11**	<0.01
Benzo[a]pyrene TEQs$	**0.24**	<0.05	**0.07**	<0.05
Benzene	<1	<1	<1	<1
Toluene	**4**	**2**	**3**	**3**
Ethylbenzene	<1	<1	<1	<1
Xylenes	<2	<2	<2	<2
TRH F1	<10	<10	<10	<10
TRH F2	<50	<50	<50	<50
TRH F3	<100	<100	<100	**100**
TRH F4	<100	<100	<100	<100
Total Suspended Solids (mg/L)	**19**	**14**	**11**	**92**
Electrical Conductivity (µS/cm)	**44000**	**47000**	**45000**	**41000**
Total Phosphorus (mg/L)	**0.05**	<0.05	<0.05	**0.6**
Total Nitrogen (mg/L)	<0.1	<0.1	<0.1	<0.1
Ammonia (mg N/L)	<0.005	<0.005	<0.005	<0.005
NOx (mg N/L)	<0.005	**0.007**	<0.005	<0.005
Phosphate (mg P/L)	**0.01**	**0.009**	<0.005	**0.017**

Notes:

@ Data listed are for dissolved metals

These results from January 2016 show that:

- metal levels were higher in the samples from Majors Bay
- nutrient levels were higher in the samples from Majors Bay
- PAHs were higher in the Southern Remediation Area samples with the Exile Bay samples the next highest
- None of the samples had significant levels of petroleum hydrocarbons.

Table 24 Surface Water Quality Monitoring Data (April 2016)

Chemical	Maximum Conc in Southern Remediation Area (µg/L)	Maximum Conc in Northern Remediation Area (µg/L)	Maximum Conc in Exile Bay (µg/L)	Maximum Conc in Majors Bay (µg/L)
Arsenic@	**2**	**2**	**2**	**2**
Cadmium@	<0.1	<0.1	<0.1	<0.1
Chromium@	<1	<1	<1	<1
Copper@	**6**	**5**	**8**	**2**
Lead@	<1	**2**	<1	<1
Mercury@	<0.05	<0.05	<0.05	<0.05
Nickel@	**2**	**2**	**2**	<1
Zinc @	**11**	**17**	**8**	**6**
Acenaphthene$	**0.01**	**0.01**	<0.01	<0.01
Acenaphthylene$	**0.07**	**0.01**	<0.01	<0.01
Anthracene$	**0.02**	<0.01	<0.01	<0.01
Benzo[a]anthracene$	**0.07**	**0.01**	**0.01**	**0.02**
Benzo[a]pyrene$	**0.16**	**0.01**	**0.02**	**0.02**
Benzo[b,j&k]fluoranthene$	**0.22**	<0.02	**0.03**	**0.03**
Benzo[ghi]perylene$	**0.07**	<0.01	**0.02**	**0.02**
Chrysene$	**0.06**	<0.01	**0.01**	<0.01
Dibenzo[ah]anthracene$	**0.07**	<0.01	**0.01**	**0.01**
Fluoranthene$	**0.12**	**0.03**	**0.02**	**0.02**
Fluorene$	**0.02**	<0.01	<0.01	<0.01
Indeno[123cd]pyrene$	**0.02**	<0.01	<0.01	<0.01
Naphthalene$	<0.02	<0.02	<0.02	<0.02
Phenanthrene$	**0.05**	**0.05**	<0.03	<0.03
Pyrene$	**0.23**	**0.03**	**0.02**	**0.02**
Benzo[a]pyrene TEQs$	**0.26**	**0.02**	**0.04**	**0.04**
Benzene	<1	<1	<1	<1
Toluene	<1	<1	<1	<1
Ethylbenzene	<1	<1	<1	<1
Xylenes	<2	<2	<2	<2
TRH F1	<10	<10	<10	<10
TRH F2	<50	<50	<50	<50
TRH F3	<100	<100	<100	**110**
TRH F4	<100	<100	<100	<100
Total Suspended Solids (mg/L)	**22**	**14**	**21**	**63**
Electrical Conductivity (µS/cm)	**41000**	**42000**	**41000**	**40000**
Total Phosphorus (mg/L)	<0.25	<0.05	<0.25	<0.25
Total Nitrogen (mg/L)	<2	<2	<2	<2
Ammonia (mg N/L)	**0.09**	**0.074**	<0.005	**0.005**
NOx (mg N/L)	**0.05**	**0.04**	<0.005	<0.005
Phosphate (mg P/L)	**0.036**	**0.038**	**0.021**	**0.03**

Notes:

@ Data listed are for dissolved metals

These results from April 2016 show that:

- metal levels were higher in the samples from the Southern and Northern Remediation Area
- nutrient levels were higher in the samples from the Southern and Northern Remediation Area
- PAHs were higher in the samples from Exile and Majors Bay
- None of the samples had significant levels of petroleum hydrocarbons.

PAHs – Dissolved vs Total

For the April 2016 monitoring event, the laboratory was able to provide analysis of the water samples for both dissolved and total PAHs. The total PAHs analysis was the routine method used but the dissolved PAHs analysis included an additional filtration step.

Table 25 shows a comparison between the results for these two analyses for this round.

Table 25 Comparison of Results for Total and Dissolved PAHs Analysis (April 2016)

Chemical	Total PAHs - Southern Remediation Area (µg/L)	Dissolved PAHs - Southern Remediation Area (µg/L)	Total PAHs - Northern Remediation Area (µg/L)	Dissolved PAHs - Northern Remediation Area (µg/L)
Acenaphthene	**0.01**	<0.01	**0.01**	<0.01
Acenaphthylene	**0.07**	<0.01	**0.01**	<0.01
Anthracene	**0.02**	<0.01	<0.01	<0.01
Benzo[a]anthracene	**0.07**	<0.01	**0.01**	<0.01
Benzo[a]pyrene	**0.16**	<0.01	**0.01**	<0.01
Benzo[b,j&k]fluoranthene	**0.22**	<0.02	<0.02	<0.02
Benzo[ghi]perylene	**0.07**	<0.01	<0.01	<0.01
Chrysene	**0.06**	<0.01	<0.01	<0.01
Dibenzo[ah]anthracene	**0.07**	<0.01	<0.01	<0.01
Fluoranthene	**0.12**	**0.06**	**0.03**	**0.02**
Fluorene	**0.02**	<0.01	<0.01	<0.01
Indeno[123cd]pyrene	**0.02**	<0.01	<0.01	<0.01
Naphthalene	<0.02	<0.02	<0.02	<0.02
Phenanthrene	**0.05**	**0.05**	**0.05**	<0.03
Pyrene	**0.23**	**0.05**	**0.03**	<0.01
Benzo[a]pyrene TEQs	**0.26**	<0.05	**0.02**	<0.05

It is noted that while some of the lower molecular weight PAHs are still detectable in some of the samples, all of the carcinogenic PAHs are not detectable in the water samples that were filtered prior to analysis.

5.2.11 Results (2017)

Some additional water quality monitoring was undertaken in October 2017 in the waters of Kendall Bay, Exile Bay and Majors Bay.

The analytical results are presented in **Tables 26** and **27**. The results provide additional information to consider in evaluating:

- the waters of Kendall Bay
- comparative water quality of Majors, Brays, Canada, Yaralla and Exile Bays
- any impacts on water quality of the existing identified contamination of the sediments of Kendall Bay.

The results of the October 2017 monitoring are summarised in the following table.

Table 26 Surface Water Quality Monitoring Data (October 2017)

Chemical	Maximum Conc in Southern Remediation Area (µg/L)	Maximum Conc in Northern Remediation Area (µg/L)	Maximum Conc in Exile Bay (µg/L)	Maximum Conc in Majors Bay (µg/L)	Maximum Conc in Brays Bay (µg/L)	Maximum Conc in Yaralla/ Canada Bay (µg/L)
Arsenic@	**1**	**2**	**1**	**1**	**1**	**1**

Chemical	Maximum Conc in Southern Remediation Area (µg/L)	Maximum Conc in Northern Remediation Area (µg/L)	Maximum Conc in Exile Bay (µg/L)	Maximum Conc in Majors Bay (µg/L)	Maximum Conc in Brays Bay (µg/L)	Maximum Conc in Yaralla/ Canada Bay (µg/L)
Cadmium@	<0.1	<0.1	<0.1	**0.1**	<0.1	<0.1
Chromium@	<1	<1	<1	<1	<1	<1
Copper@	**5**	**5**	**5**	**4**	**4**	**4**
Lead@	<1	<1	<1	<1	<1	<1
Mercury@	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel@	**4**	**1**	**2**	**1**	<1	**1**
Zinc @	**13**	**12**	**9**	**11**	**10**	**11**
Acenaphthene$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene$	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01
Anthracene$	**0.02**	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]pyrene$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b,j&k]fluoranthene$	**0.06**	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo[ghi]perylene$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo[ah]anthracene$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene$	**0.08**	**0.02**	**0.02**	**0.04**	<0.01	<0.01
Fluorene$	**0.06**	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno[123cd]pyrene$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene$	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene$	**0.1**	<0.03	<0.01	<0.01	<0.01	<0.01
Pyrene$	**0.08**	**0.02**	<0.01	**0.04**	<0.01	<0.01
Benzo[a]pyrene TEQs$	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzene	<1	<1	<1	<1	<1	<1
Toluene	<1	<1	<1	<1	<1	<1
Ethylbenzene	<1	<1	<1	<1	<1	<1
Xylenes	<2	<2	<2	<2	<2	<2
TRH F1	<10	<10	<10	<10	<10	<10
TRH F2	<50	<50	<50	<50	<50	<50
TRH F3	<100	<100	<100	<100	<100	<100
TRH F4	<100	<100	<100	<100	<100	<100
Total Suspended Solids (mg/L)	**10**	**11**	**17**	**52**	**15**	**64**
Electrical Conductivity (µS/cm)	NA	NA	NA	NA	NA	NA
Total Dissolved Solids (mg/L)	**40000**	**40000**	**39000**	**40000**	**34000**	**36000**
Total Phosphorus (mg/L)	<0.05	**0.05**	<0.05	**0.09**	**0.06**	<0.05
Total Nitrogen (mg/L)	**0.3**	**0.3**	**0.2**	**0.4**	**0.3**	**0.3**
Ammonia (mg N/L)	**0.07**	**0.01**	**0.01**	**0.03**	**0.06**	**0.04**
NOx (mg N/L)	**0.03**	**0.005**	<0.005	**0.009**	**0.01**	**0.007**
Phosphate (mg P/L)	**0.02**	**0.02**	**0.02**	**0.02**	**0.03**	**0.02**
Total Coliforms (CFU/100 mLs)	**40**	**5**	**7**	**11**	**80**	**6**
Enterococci (CFU/100 mLs)	**1**	**4**	<10	**10**	<10	**10**

Notes:

@ Data listed are for dissolved metals

$ Data listed are for total PAH concentrations

These results from October 2017 show that:

- metal levels were similar in all these locations
- nutrient levels were similar in all these locations

- PAHs were around the limit of reporting in all locations with some slightly higher concentrations for the lower molecular weight non-carcinogenic PAHs (fluoranthene, pyrene etc) in the Southern Remediation Area samples
- Only one of the carcinogenic PAHs was detected in the samples from the Southern Remediation Area – it was benzo[b,j&k]fluoranthene which only contributes a small amount to the benzo[a]pyrene TEQs
- None of the samples had significant levels of petroleum hydrocarbons
- Microbiological water quality was similar in all these locations.

PAHs – Dissolved vs Total

For the October 2017 monitoring event, the laboratory also analysis of the water samples for both dissolved and total PAHs. The total PAHs analysis was the routine method used but the dissolved PAHs analysis included an additional filtration step.

Table 27 shows a comparison between the results for these two analyses for this round.

Table 27 Comparison of Results for Total and Dissolved PAHs Analysis (October 2017)

Chemical	Total PAHs - Southern Remediation Area (µg/L)	Dissolved PAHs - Southern Remediation Area (µg/L)	Total PAHs - Northern Remediation Area (µg/L)	Dissolved PAHs - Northern Remediation Area (µg/L)
Acenaphthene	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	<0.02	<0.01	<0.02	<0.01
Anthracene	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	<0.01	<0.01	<0.01	<0.01
Benzo[a]pyrene	<0.01	<0.01	<0.01	<0.01
Benzo[b,j&k]fluoranthene	<0.02	<0.02	<0.02	<0.02
Benzo[ghi]perylene	<0.01	<0.01	<0.01	<0.01
Chrysene	<0.01	<0.01	<0.01	<0.01
Dibenzo[ah]anthracene	<0.01	<0.01	<0.01	<0.01
Fluoranthene	**0.08**	**0.03**	**0.02**	**0.02**
Fluorene	**0.06**	<0.01	<0.01	<0.01
Indeno[123cd]pyrene	<0.01	<0.01	<0.01	<0.01
Naphthalene	<0.02	<0.02	<0.02	<0.02
Phenanthrene	**0.1**	<0.01	<0.03	<0.03
Pyrene	**0.08**	**0.03**	**0.02**	**0.02**
Benzo[a]pyrene TEQs	<0.05	<0.05	<0.05	<0.05

It is noted that while some of the lower molecular weight PAHs are still detectable although reduced in most cases, all of the carcinogenic PAHs were not detectable in the either the total or dissolved analyses.

5.3 Contamination in Biota

5.3.1 Previous Studies

Section 4.1 provides a discussion of the assessment undertaken by URS in regard to the potential for people to be exposed to PAHs in seafood caught in Kendall Bay. This assessment was based on monitoring results for oysters collected in 2006 and results for fish collected in 1999.

Table 28 Historical Data for PAHs in Seafood (URS 2007)

Chemical	2006 Oysters (mg/kg)	1999 Fish (mg/kg)
Acenaphthene	0.04	<0.1

Chemical	2006 Oysters (mg/kg)	1999 Fish (mg/kg)
Acenaphthylene	0.11	0.1
Anthracene	0.075	<0.1
Benzo[a]anthracene	0.59	0.1
Benzo[a]pyrene	0.44	0.1
Benzo[b,j&k]fluoranthene	1.7	0.1
Benzo[ghi]perylene	0.26	0.1
Chrysene	0.86	0.3
Dibenzo[ah]anthracene	0.12	<0.1
Fluoranthene	1.7	0.1
Fluorene	0.09	<0.1
Indeno[123cd]pyrene	0.24	0.1
Naphthalene	0.051	<0.1
Phenanthrene	0.57	0.1
Pyrene	1.3	0.2
Total PAHs	8.1	1.8
Benzo[a]pyrene TEQs	0.8	0.2

5.3.2 Existing Fishing Advisories

As was noted in the URS HHRA report, a fishing advisory was put in place across Sydney Harbour in 2006. These restrictions were due to contamination of sediments by dioxins. These contaminants are the result of contamination in Homebush Bay from a former chemical manufacturing site operated by Union Carbide. Homebush Bay is located approximately 4 km upstream of Kendall Bay. The fishing advisory recommends that no fish caught west of the Sydney Harbour Bridge should be consumed at all. For areas east of the Harbour Bridge the advisory recommends limiting consumption to one meal of fish caught in that part of the Harbour per month (see http://www.dpi.nsw.gov.au/fisheries/recreational/info/syd-harbour and http://www.foodauthority.nsw.gov.au/consumers/keeping-food-safe/special-care-foods/sydney-harbour-seafood/#.VaRVN_lvDwA).

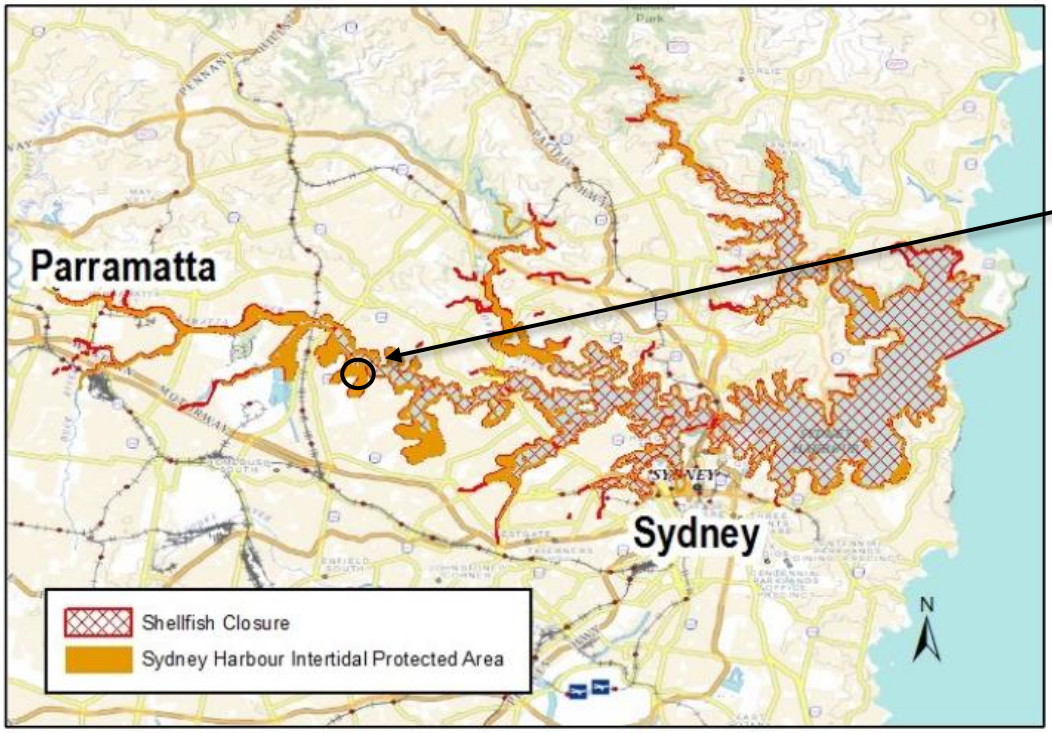
The fishing advisory means that fish and other seafood caught in and around Kendall Bay should not be consumed due to potential dioxin contamination. It is not due to the PAH contamination present in Kendall Bay.

In addition, the taking of any shellfish is prohibited throughout Sydney Harbour (NSW DPI 2012). DPI Fisheries have placed a closure on the taking of any shellfish (e.g. pipis, cockles, mussels, snails, whelks, oysters and abalone) in Sydney Harbour (and all its tributaries) as shown in the following diagram taken from NSW DPI 2012. This closure is in place for two reasons:

- These organisms can accumulate harmful substances as well as bacteria and viruses because they are filter feeders. The NSW Food Authority recommends that no recreationally caught shellfish should ever be consumed raw and notes that only shellfish harvested under a recognised program that ensures appropriate food safety controls are in place should be consumed. There are no recognised programs in Sydney Harbour for the collection of shellfish in accordance with NSW Food Authority requirements.
- DPI Fisheries has in place protections for intertidal zones around the entire shoreline of Sydney Harbour. The protected area extends from the mean high water mark to 10 m seaward from the mean low water mark. No oysters and mussels are permitted to be collected in this zone. The only shellfish that may be collected in this zone are abalone and lobster under certain conditions. These protected areas have been created to preserve and

protect invertebrates and their habitat and to act as a reservoir for repopulation for other areas where needed.

Figure 1. Sydney Harbour Shellfish & Intertidal Protected Area



Consequently, the consumption of seafood caught in Kendall Bay should not be occurring.

In response to a request from NSW EPA, samples of mussels and oysters were collected from Kendall Bay, Exile Bay and Majors Bay in 2016 to allow the assessment of risks via this exposure pathway for those situations where someone might not be aware of the restrictions that exist.

5.3.3 Biological tissue sampling

Synnot & Wilkinson (2016c) provides details of the work undertaken in 2016 to monitor contaminant levels in oysters and mussels relevant to this site.

Samples of oysters were collected at a designated area by working along the rocky shoreline and prising oysters from the rocks with steel chisels. The oysters were collected into iced Eskies and stored ready for dissection. The entire animal was first washed in de-ionised water to remove any sediment attached. The oysters and mussels were then opened and the entire animal was dissected from the shells, washed twice in de-ionised water and then placed in a laboratory-prepared clean jar. All dissections were undertaken in clean conditions using acid-washed stainless steel surgical instruments. All handling was undertaken with powder-free nitrile gloves. Mussels were sparse in distribution and those found were generally extremely small with little flesh inside; in some cases, it took many mussels to obtain a small part of a jar of tissue.

Mussels

One sample was collected in Kendall Bay from under the Buoy anchored at the end of the mound in the northern investigation area. Mussels were collected from under a jetty slightly north of the

sediment collection area in Exile Bay. In Majors Bay, the mussels were collected from inside an old tyre tied to a vessel at the mouth of the Bay. The sample locations are shown on **Figure 12**.

Oysters

Oysters were collected from the seawall in Kendall Bay slightly south of the base of the old wharf in the northern investigation area. In Exile Bay the oysters were collected from the sandstone seawall immediately south of the sediment collection sites. Oysters were collected from Majors Bay from a sandstone seawall on the north eastern side of the entrance to the Bay. The sample locations are shown on **Figure 12**.

Samples of dissected tissue in labelled jars were packed on frozen bricks and transported to the laboratory (Envirolabs) on the day of collection under a Chain of Custody for analysis using standard methods as set out in laboratory reports included at **Appendix B**.

5.3.4 Quality Control and Quality Assurance

A review of the data quality was undertaken Synnot & Wilkinson (2016c). The data was found to be suitable for interpretative use.

5.3.5 Results

The samples were analysed for PAHs, TRH and metals.

Table 29 2016 Data for Mussels Caught in Kendall Bay, Exile Bay and Majors Bay

Chemical	Kendall Bay (mg/kg)	Exile Bay (mg/kg)	Majors Bay (mg/kg)
Arsenic	<2	<2	<2
Cadmium	<0.2	<0.2	<0.2
Chromium	<1	<1	<1
Copper	<1	<1	<1
Lead	<1	<1	<1
Mercury	<0.1	<0.1	<0.1
Nickel	<1	<1	<1
Zinc	17	14	18
Acenaphthene	<0.1	<0.1	<0.1
Acenaphthylene	<0.1	<0.1	<0.1
Anthracene	<0.1	<0.1	<0.1
Benzo[a]anthracene	<0.1	<0.1	<0.1
Benzo[a]pyrene	<0.05	<0.05	<0.05
Benzo[b,j&k]fluoranthene	<0.2	<0.2	<0.2
Benzo[ghi]perylene	<0.1	<0.1	<0.1
Chrysene	<0.1	<0.1	<0.1
Dibenzo[ah]anthracene	<0.1	<0.1	<0.1
Fluoranthene	<0.1	<0.1	<0.1
Fluorene	<0.1	<0.1	<0.1
Indeno[123cd]pyrene	<0.1	<0.1	<0.1
Naphthalene	<0.1	<0.1	<0.1
Phenanthrene	<0.1	<0.1	<0.1
Pyrene	<0.1	<0.1	<0.1
Total PAHs	No detections	No detections	No detections
Benzo[a]pyrene TEQs	No detections	No detections	No detections
TRH >C10-C16	<50	<50	<50
TRH >C16-C34	460	450	430
TRH >C34-C40	140	200	170

No PAHs were detected in the samples of mussels. Also no metals were detected apart from low levels of zinc. The F3 and F4 fractions of TRH were detected but the levels were similar in all three Bays.

Table 30 2016 Data for Oysters Caught in Kendall Bay, Exile Bay and Majors Bay

Chemical	Kendall Bay (mg/kg)	Exile Bay (mg/kg)	Majors Bay (mg/kg)
Arsenic	<2	<2	<2
Cadmium	0.7	0.6	1
Chromium	<1	<1	<1
Copper	180	190	170
Lead	<1	<1	<1
Mercury	<0.1	<0.1	<0.1
Nickel	<1	<1	<1
Zinc	1100	1000	1900
Acenaphthene	<0.1	<0.1	<0.1
Acenaphthylene	<0.1	<0.1	<0.1
Anthracene	<0.1	<0.1	<0.1
Benzo[a]anthracene	<0.1	<0.1	<0.1
Benzo[a]pyrene	<0.05	<0.05	<0.05
Benzo[b,j&k]fluoranthene	<0.2	<0.2	<0.2
Benzo[ghi]perylene	<0.1	<0.1	<0.1
Chrysene	<0.1	<0.1	<0.1
Dibenzo[ah]anthracene	<0.1	<0.1	<0.1
Fluoranthene	<0.1	<0.1	<0.1
Fluorene	<0.1	<0.1	<0.1
Indeno[123cd]pyrene	<0.1	<0.1	<0.1
Naphthalene	<0.1	<0.1	<0.1
Phenanthrene	<0.1	<0.1	<0.1
Pyrene	<0.1	<0.1	<0.1
Total PAHs	No detections	No detections	No detections
Benzo[a]pyrene TEQs	No detections	No detections	No detections
TRH >C10-C16	<50	<50	<50
TRH >C16-C34	530	680	340
TRH >C34-C40	210	280	240

No PAHs were detected in the samples of oysters. The F3 and F4 fractions of TRH were detected but the levels were similar in all three Bays and were similar to the levels reported for mussels. Levels of copper, zinc and cadmium in these oysters were significantly elevated in the samples from all three Bays.

The maximum concentrations reported for oysters and mussels have been screened against relevant national and international guidelines to determine if any chemicals need more detailed assessment.

Guidance is available from Food Standards Australia and New Zealand about what levels of various contaminants can be present in foods in Australia. Additional guidance is available from the Joint Expert Committee on Food Additives (JECFA) at the World Health Organisation.

Metals

Food Standards Australia and New Zealand provide maximum levels for some contaminants and natural toxicants as well as generally expected levels for metals that are rarely present at concentrations in food that would be of concern.

Maximum levels (MLs) are the levels in food for contaminants and natural toxicants that must not be exceeded in food for sale in Australia.

Generally expected levels (GELs) are the levels of metals in various food types that would normally be expected in that food type – i.e. if metals are measured at such levels (or lower) in the relevant food type it does not indicate that any contamination of the food has occurred. If monitoring data in a relevant food type measures levels in excess of the 90th percentile value, it should trigger additional investigations to determine why such high levels are being reported and to track the source if possible (FSANZ 2001). GELs are provided by FSANZ for both Crustacea and fish.

Table 31 Screening Assessment of Oyster and Mussel Data

Chemical	Maximum Levels (mg/kg) #	Generally Expected Levels (mg/kg) #	
		Median	90th Percentile
Cadmium	2 (molluscs)		
Copper		10/0.5	20/2
Zinc		25/5	40/15

Notes:
GELs are listed for both Crustacea and fish in the following format – Crustacea/fish

Metal levels were not measured in the historical data.

In the 2016 data, elevated levels of cadmium, copper and zinc were detected in oysters from all three bays. Cadmium levels in all three samples were below the permitted maximum level so would not be expected to pose a risk. The levels of copper and zinc in these oysters were, however, significantly elevated above generally expected levels. For zinc, the measured levels are approximately 25 times the 90th percentile generally expected level. For copper, the measured levels are approximately 10 times the 90th percentile generally expected level. Consumption of oysters from Sydney Harbour is not permitted by DPI-Fisheries and NSW Food Authority. Given these results, it would also be recommended that oysters not be consumed based on these elevated metal levels. This recommendation would apply to all three Bays from which oysters were collected in 2016.

Metal levels in the samples of mussels were all in compliance with the maximum limits and generally expected levels recommended by FSANZ.

PAHs

The WHO Committee that looks at the presence of contaminants in food (JECFA) undertook a review of the potential for PAHs present in food (WHO 2006). JECFA determined that the daily intake of PAHs from all food sources was 4 ng/kg bw/d (mean) and 10 ng/kg bw/d (high end). Methods of cooking can add to the levels of PAHs in food (barbequing etc) so not all PAHs measured in ready to eat food comes from contamination of the original food source. This also means no specific guideline has been set for PAHs in food. JECFA compared the estimated intakes to a toxicity reference value of 100000 ng/kg bw/d (100 µg/kg bw/d) (the benchmark dose level for cancer) and found that the margin of exposure was in the order of 10000 to 25000 which was another reason no specific guideline was recommended.

Using the historical data where carcinogenic PAHs were detected in the oysters and fish caught around Kendall Bay, the contribution to daily intake can be calculated. The oysters were found to contain 0.8 mg BaP Equivalents/kg wet weight while the fish were found to contain 0.2 mg BaP Equivalents /kg wet weight. One meal of fish usually weighs approximately 0.11 to 0.15 g/meal. If one meal of fish is consumed per day, then the daily intake of carcinogenic PAHs from these fish or oysters would be 0.5 to 1 ng/kg bw/d, below the average and high end uptake from all food estimated by JECFA and well below the estimated benchmark dose level. None of the oysters or

mussels caught in 2016 reported detections for any of the PAHs so the additional intake from consumption is minimal using the more recent data.

TRH

The TPHCWG recommended toxicity reference values for the various fractions of TRH in the 1990s (TPHCWG 1997). For aromatic petroleum hydrocarbons in the C16 to C35 range, the recommended oral reference dose was 0.03 mg/kg bw/day based on pyrene (C16). For the aliphatic hydrocarbons in the C16 to C35 range, the recommended oral reference dose was 2 mg/kg bw/d. If it is assumed people consume 0.11 to 0.15 g/day of oysters or mussels, then the daily intake of these higher fractions of TRH would be 0.5 to 1.5 µg/kg bw/d. If all of the higher end TRH present in the organisms were aromatic petroleum hydrocarbons, then the daily intake would be 20-60 fold lower than the tolerable intake. If they were a mix of aromatic and aliphatic petroleum hydrocarbons (which would be expected) then there would be an even bigger margin of safety.

Summary

DPI-Fisheries and NSW Food Authority have already placed limitations on the consumption of seafood caught in this part of Sydney Harbour for a range of reasons including contamination by dioxins. The contamination in sediments in Kendall Bay from the former gasworks (i.e. PAHs) does not appear to be affecting oysters or mussels in the most recent samples. However, the levels of copper and zinc in oysters collected from Kendall, Majors and Exile Bays were elevated above levels that would normally be considered safe to eat on a regular basis. The source of copper and zinc to these Bays is not the contamination in sediments in Kendall Bay from the former gasworks. It is more likely to be stormwater runoff from roads and other diffuse sources which are affecting most of Sydney Harbour. In line with the existing limits and advisories on the collection of seafood in Kendall Bay, it is recommended that seafood caught in Kendall Bay not be consumed due to the presence of metals like copper and zinc. The same recommendation applies to Majors Bay and Exile Bay.

Section 6. Screening Assessments

6.1 Sediment Screening Assessment

6.1.1 Chemical Concentrations

The southern end of Kendall Bay can be divided into 3 sub-areas based on the level of contamination and the type of environment. These sub-areas include:

- Beach
- Central area in mangroves
- Western end of mangroves and rocky area adjacent to sea wall.

Sampling locations from each of the major sediment investigations have been allocated into each of these areas for further consideration and screening as shown in **Table 32**.

Table 32 Sampling Location Breakdown

Investigation	Beach Area	Central Area	Western Area
URS 2007	HSD03, 04, HH3-1, HH3-2 HH3-3 HH3-4 HH3-5	HSD05, HSD06, HSD07, HSD08, HSD09, HH2-1, HH2-2, HH2-3, HH2-4, HH2-8, HH2-9, HH2-10	HSD10, HSD11, HSD12, HH2-5, HH2-6, HH2-7
E3 Consult 2011	SHA09, 10, 16, 17, 19, 20, 15	SHA06, 08, 14, 18	SHA01, 02, 03, 04, 05, 11, 13
SKM 2013	SS01, 04, 06, 20, 21, 22, 23	SS02, 16, 17, 18	SS03, 14, 15, 17
Synnot & Wilkinson 2015	1-3, 100, 101, 11, 12, 19, 20, 4, 102	8, 9, 13, 14, 17, 103, 104, 105, 106, 107	15, 16, 23, 24, 25, 26

Table 33 Maximum Concentrations in each Area (mg/kg)

Chemical	Beach Area		Central Mangrove Area		Western Mangrove Area	
	Max Conc (mg/kg)	Sampling Location	Max Conc (mg/kg)	Sampling Location	Max Conc (mg/kg)	Sampling Location
Benzene	ND		ND		1.6	HH2-07 0.35-0.5 m
Toluene	ND		ND		7.5	HH2-07 0.35-0.5 m
Ethylbenzene	ND		ND		14.6	HH2-07 0.35-0.5 m
Xylenes	ND		ND		81.7	HH2-07 0.35-0.5 m
TPH C6-C9	ND		ND		166	HH2-07 0.35-0.5 m
TPH C10-C14	190	HH3-3 0.1-0.2 m	310	105B	9 390	HH2-07 0.35-0.5 m
TPH C15-C28	6 090	HH3-3 0.1-0.2 m	10 000	14B	21 000	HH2-07 0.35-0.5 m
TPH C29-C36	4 040	HH3-3 0.1-0.2 m	4 800	14B	6 450	HH2-07 0.35-0.5 m
Acenaphthene	1.5	SHA20 0.2-0.4 m	8.1	105B	193	HH2-07 0.35-0.5 m
Acenaphthylene	18	SHA20 0.2-0.4 m	41	SHA14 PP 0-0.02 m	157	HH2-07 0.35-0.5 m
Anthracene	6.2	SHA20 0.2-0.4 m	25	105B	262	HH2-07 0.35-0.5 m
Benzo[a]anthracene	19	SHA20 0.2-0.4 m	46	105B	166	HH2-07 0.35-0.5 m
Benzo[a]pyrene	47	HH3-3 0.1-0.2 m	120	SHA14 PP 0-0.02 m	190	SHA11 PP-2 0-0.2 m
Benzo[b]fluoranthene	90	HH3-3 0.1-0.2 m	120	109	190	SHA11 PP-2 0-0.2 m
Benzo[ghi]perylene	27	HH3-3 0.1-0.2 m	25	SHA14 PP 0-0.02 m	52	25B

Chemical	Beach Area		Central Mangrove Area		Western Mangrove Area	
	Max Conc (mg/kg)	Sampling Location	Max Conc (mg/kg)	Sampling Location	Max Conc (mg/kg)	Sampling Location
Chrysene	20	HH3-3 0.1-0.2 m	38	105B	154	HH2-07 0.35-0.5 m
Dibenzo[ah]anthracene	2.9	SHA20 0.2-0.4 m	11	14B	16.3	HH2-07 0.35-0.5 m
Fluoranthene	25	SHA20 0.2-0.4 m	180	14B	314	HH2-07 0.35-0.5 m
Fluorene	3.7	SHA20 0.2-0.4 m	14	105B	322	HH2-07 0.35-0.5 m
Indeno[123cd]pyrene	23	HH3-3 0.1-0.2 m	34	14B	60	25B
Naphthalene	11	SHA20 0.2-0.4 m	24	SHA14 PP 0-0.02 m	1 310	HH2-07 0.35-0.5 m
Phenanthrene	9	SHA20 0.2-0.4 m	53	105A	819	HH2-07 0.35-0.5 m
Pyrene	175	HH3-3 0.1-0.2 m	320	SHA14 PP 0-0.02 m	520	SHA11 PP-2 0-0.2 m
Total PAHs	446	HH3-3 0.1-0.2 m	880	SHA14 PP 0-0.02 m	4 456	HH2-07 0.35-0.5 m
Benzo[a]pyrene TEQs	61	HH3-3 0.1-0.2 m	120	SHA14 PP 0-0.02 m	230	SHA11 PP-2 0-0.2 m

6.1.2 Screening Assessment – Historical Data

The maximum concentrations in each of the three areas have been screened against relevant national and international guidelines to determine which chemicals need remediation criteria.

The sediment results have been reviewed to identify whether the maximum concentration reported exceeds available human health risk based investigation levels, or screening guidelines. In relation to the review of sediment concentrations, the following guidelines have been adopted:

- **ASC NEPM Health Based Investigation Levels and Screening Levels.** The ASC NEPM provides risk-based Health Investigation Levels (HIL) for selected organic and inorganic chemicals in soils. Different levels are provided for a variety of exposure settings including residential, open-space / parks / recreational and commercial / industrial land uses. The NEPM HILs have been developed to be protective of human health and do not take into account environmental concerns. Sediment results have been compared to HIL-C values (recreation/open space) (NEPC 1999 amended 2013c).
- **ASC NEPM Management Levels.** In addition to these health based screening levels management limits have also been developed for the heavy end TRH fractions. These are based on aesthetic considerations, risks from direct contact, potential to form LNAPL, fire and explosive risks and effects on buried infrastructure. They are more stringent than guidelines that just consider workers coming into direct contact with the contaminated soil/sediment. The aesthetic considerations include things like discolouration and odour (NEPC 1999 amended 2013c).
- **USEPA Regional Screening Levels (RSLs).** The USEPA has derived screening levels for a range of media (including soil present on residential or industrial land) that are based on the protection of human health. In the absence of guidelines from the ASC NEPM, the USEPA RSLs for residential soil have been used for the purpose of identifying CoPCs in sediments (USEPA 2015).

Tables 34, 35 and **36** present comparisons of the maximum sediment concentrations in each area of the southern end of Kendall Bay with the relevant criteria from the listed sources. For all 3 parts the maximum total PAH concentration exceeds the ASC NEPM screening criteria. This indicates

that further screening of the PAHs that are not part of the carcinogenic PAHs is required. The guidelines provided by the USEPA RSLs allow such a screening to be undertaken and this is what has occurred in each of these **Tables**.

Table 34 Screening Assessment – Beach Area

Chemical	Beach Area		Screening Criteria	COPC (Y/N?)
	Max Conc (mg/kg)	Sampling Location		
TPH C10-C14	190	HH3-3 0.1-0.2 m	NL[N] *(Csat = 560 mg/kg)*	N
TPH C15-C28	6 090	HH3-3 0.1-0.2 m	2500[M]	**Y**
TPH C29-C36	4 040	HH3-3 0.1-0.2 m	10000[M]	N
Acenaphthene	1.5	SHA20 0.2-0.4 m	3600[R]	N
Acenaphthylene	18	SHA20 0.2-0.4 m	3600[RS]	N
Anthracene	6.2	SHA20 0.2-0.4 m	18000[R]	N
Benzo[a]anthracene	19	SHA20 0.2-0.4 m	See BaP TEQs	--
Benzo[a]pyrene	47	HH3-3 0.1-0.2 m	See BaP TEQs	--
Benzo[b+k]fluoranthene	90	HH3-3 0.1-0.2 m	See BaP TEQs	--
Benzo[ghi]perylene	27	HH3-3 0.1-0.2 m	See BaP TEQs	--
Chrysene	20	HH3-3 0.1-0.2 m	See BaP TEQs	--
Dibenzo[ah]anthracene	2.9	SHA20 0.2-0.4 m	See BaP TEQs	--
Fluoranthene	25	SHA20 0.2-0.4 m	2400[R]	N
Fluorene	3.7	SHA20 0.2-0.4 m	2400[R]	N
Indeno[123cd]pyrene	23	HH3-3 0.1-0.2 m	See BaP TEQs	--
Naphthalene	11	SHA20 0.2-0.4 m	NL[N] *(Csat = 9 mg/kg)*	N
Phenanthrene	9	SHA20 0.2-0.4 m	18000[RS]	N
Pyrene	175	HH3-3 0.1-0.2 m	1800[R]	N
Benzo[a]pyrene TEQs	61	HH3-3 0.1-0.2 m	3[N]	**Y**

Notes:

Refer to **Appendix A** for full analytical results

N = ASC NEPM HIL/HSL for open space/recreational soil (HSL-C sand 0-1m or HIL-C) (NEPC 1999 amended 2013c)

M = ASC NEPM (1999) Management Limits for non-volatile TPH fractions (NEPC 1999 amended 2013c)

R = USEPA Regional Screening Levels (residential soil) (USEPA 2015)

RS = USEPA Regional Screening Levels (residential soil) Surrogate used (acenaphthene value used for acenaphthylene; anthracene value used for phenanthrene) (USEPA 2015)

Based on this screening assessment for the beach area, site specific criteria need to be developed for the carcinogenic PAHs and TPH C15-C28. The heavy end TPH fraction can be addressed by setting remediation criteria for the carcinogenic PAHs (the major contributor to the TPH concentration) and requiring that all sediments at the surface not be discoloured or odorous.

Table 35 Screening Assessment – Central Mangrove Area

Chemical	Central Mangrove Area		Screening Criteria	COPC (Y/N?)
	Max Conc (mg/kg)	Sampling Location		
TPH C10-C14	310	105B	NL[N] *(Csat = 560 mg/kg)*	N
TPH C15-C28	10 000	14B	2500[M]	**Y**
TPH C29-C36	4 800	14B	10000[M]	N
Acenaphthene	8.1	105B	3600[R]	N
Acenaphthylene	41	SHA14 PP 0-0.02 m	3600[RS]	N
Anthracene	25	105B	18000[R]	N
Benzo[a]anthracene	46	105B	See BaP TEQs	--

Chemical	Central Mangrove Area		Screening Criteria	COPC (Y/N?)
	Max Conc (mg/kg)	Sampling Location		
Benzo[a]pyrene	120	SHA14 PP 0-0.02 m	See BaP TEQs	--
Benzo[b]fluoranthene	120	109	See BaP TEQs	--
Benzo[ghi]perylene	25	SHA14 PP 0-0.02 m	See BaP TEQs	--
Chrysene	38	105B	See BaP TEQs	--
Dibenzo[ah]anthracene	11	14B	See BaP TEQs	--
Fluoranthene	180	14B	2400[R]	N
Fluorene	14	105B	2400[R]	N
Indeno[123cd]pyrene	34	14B	See BaP TEQs	--
Naphthalene	24	SHA14 PP 0-0.02 m	NL[N] *(Csat = 9 mg/kg)*	N
Phenanthrene	53	105A	18000[RS]	N
Pyrene	320	SHA14 PP 0-0.02 m	1800[R]	N
Benzo[a]pyrene TEQs	120	SHA14 PP 0-0.02 m	3[N]	**Y**

Notes:

Refer to **Appendix A** for full analytical results

[N] = ASC NEPM HIL/HSL for open space/recreational soil (HSL-C sand 0-1m or HIL-C) (NEPC 1999 amended 2013c)

[M] = ASC NEPM (1999) Management Limits for non-volatile TPH fractions (NEPC 1999 amended 2013c)

[R] = USEPA Regional Screening Levels (residential soil) (USEPA 2015)

[RS] = USEPA Regional Screening Levels (residential soil) Surrogate used (acenaphthene value used for acenaphthylene anthracene value used for phenanthrene) (USEPA 2015)

Based on this screening assessment for the central mangrove area, site specific criteria need to be developed for the carcinogenic PAHs and TPH C15-C28. The heavy end TPH fraction can be addressed by setting remediation criteria for the carcinogenic PAHs (the major contributor to the TPH concentration) and requiring that all sediments at the surface not be discoloured or odorous.

Table 36 Screening Assessment – Western Mangrove Area

Chemical	Western Mangrove Area		Screening Criteria	COPC (Y/N?)
	Max Conc (mg/kg)	Sampling Location		
Benzene	1.6	HH2-07 0.35-0.5 m	NL[N] *(Csat = 360 mg/kg)*	N
Toluene	7.5	HH2-07 0.35-0.5 m	NL[N] *(Csat = 560 mg/kg)*	N
Ethylbenzene	14.6	HH2-07 0.35-0.5 m	NL[N] *(Csat = 64 mg/kg)*	N
Xylenes	81.7	HH2-07 0.35-0.5 m	NL[N] *(Csat = 300 mg/kg)*	N
TPH C6-C9	166	HH2-07 0.35-0.5 m	NL[N] *(Csat = 950 mg/kg)*	N
TPH C10-C14	9 390	HH2-07 0.35-0.5 m	NL[N] *(Csat = 560 mg/kg)*	N
TPH C15-C28	21 000	HH2-07 0.35-0.5 m	2500[M]	**Y**
TPH C29-C36	6 450	HH2-07 0.35-0.5 m	10000[M]	N
Acenaphthene	193	HH2-07 0.35-0.5 m	3600[R]	N
Acenaphthylene	157	HH2-07 0.35-0.5 m	3600[RS]	N
Anthracene	262	HH2-07 0.35-0.5 m	18000[R]	N
Benzo[a]anthracene	166	HH2-07 0.35-0.5 m	See BaP TEQs	--
Benzo[a]pyrene	190	SHA11 PP-2 0-0.2 m	See BaP TEQs	--
Benzo[b]fluoranthene	190	SHA11 PP-2 0-0.2 m	See BaP TEQs	--
Benzo[ghi]perylene	52	25B	See BaP TEQs	--
Chrysene	154	HH2-07 0.35-0.5 m	See BaP TEQs	--
Dibenzo[ah]anthracene	16.3	HH2-07 0.35-0.5 m	See BaP TEQs	--
Fluoranthene	314	HH2-07 0.35-0.5 m	2400[R]	N
Fluorene	322	HH2-07 0.35-0.5 m	2400[R]	N
Indeno[123cd]pyrene	60	25B	See BaP TEQs	--

Chemical	Western Mangrove Area		Screening Criteria	COPC (Y/N?)
	Max Conc (mg/kg)	Sampling Location		
Naphthalene	1 310	HH2-07 0.35-0.5 m	NL[N] *(Csat = 9 mg/kg)*	N
Phenanthrene	819	HH2-07 0.35-0.5 m	18000[RS]	N
Pyrene	520	SHA11 PP-2 0-0.2 m	1800[R]	N
Benzo[a]pyrene TEQs	230	SHA11 PP-2 0-0.2 m	3[N]	**Y**

Notes:

Refer to **Appendix A** for full analytical results

[N] = ASC NEPM HIL/HSL for open space/recreational soil (HSL-C sand 0-1m or HIL-C) (NEPC 1999 amended 2013c)

[M] = ASC NEPM (1999) Management Limits for non-volatile TPH fractions (NEPC 1999 amended 2013c)

[R] = USEPA Regional Screening Levels (residential soil) (USEPA 2017)

[RS] = USEPA Regional Screening Levels (residential soil) Surrogate used (acenaphthene value used for acenaphthylene; anthracene value used for phenanthrene) (USEPA 2017)

Based on this screening assessment for the western end of the mangroves, site specific criteria need to be developed for the carcinogenic PAHs and TPH C15-C28. The heavy end TPH fraction can be addressed by setting remediation criteria for the carcinogenic PAHs (the major contributor to the TPH concentration) and requiring that all sediments at the surface not be discoloured or odorous.

In summary, detailed consideration of the carcinogenic PAHs is required in all 3 parts of the southern end of Kendall Bay based on the historical data.

6.1.3 Screening Assessment – 2015-2017 Data

The maximum concentrations in the Southern and Northern Remediation Areas have been screened against relevant national and international guidelines to determine which chemicals need remediation criteria.

The sediment results have been reviewed to identify whether the maximum concentration reported exceeds available human health risk based investigation levels, or screening guidelines. In relation to the review of sediment concentrations, the following guidelines have been adopted:

- **ASC NEPM Health Based Investigation Levels and Screening Levels.** The ASC NEPM provides risk-based Health Investigation Levels (HIL) for selected organic and inorganic chemicals in soils. Different levels are provided for a variety of exposure settings including residential, open-space / parks / recreational and commercial / industrial land uses. The NEPM HILs have been developed to be protective of human health and do not take into account environmental concerns. Sediment results have been compared to HIL-C and HSL-C values (recreation/open space) (NEPC 1999 amended 2013c).
- **ASC NEPM Management Levels.** In addition to these health based screening levels, management limits have also been developed for the heavy end TRH fractions. These are based on aesthetic considerations, risks from direct contact, potential to form LNAPL, fire and explosive risks and effects on buried infrastructure. They are more stringent than guidelines that just consider workers coming into direct contact with the contaminated soil/sediment. The aesthetic considerations include things like discolouration and odour (NEPC 1999 amended 2013c).
- **USEPA Regional Screening Levels (RSLs).** The USEPA has derived screening levels for a range of media (including soil present on residential or industrial land) that are based on the protection of human health. In the absence of guidelines from the ASC NEPM, the

USEPA RSLs for residential soil have been used for the purpose of identifying CoPCs in sediments (USEPA 2017).

Table 37 presents comparisons of the maximum sediment concentrations in each of the remediation areas for the data collected between 2015 and 2017 with the relevant criteria from the listed sources. The screening guidelines include sediment or soil quality guidelines for the protection of human health. These sediment concentrations are the maximum values for all samples across each of the areas. Much of these data were collected at samples in deeper water away from the shore.

Table 37 Sediment Quality Screening Assessment (2015-2017)

Chemical	Maximum Concentration in Southern Remediation Area (mg/kg)	Maximum Concentration in Northern Remediation Area (mg/kg)	Human Health Guidelines – Soil (mg/kg)	COPC (Y/N?)
Arsenic	54	33	300[N]	N
Cadmium	1.2	1.2	90[N]	N
Chromium	530	210	300[N]	**Y**
Copper	143	2800	17000[N]	N
Lead	660	860	600[N]	**Y**
Mercury	8.5	3.2	80[N]	N
Nickel	230	40	1200[N]	N
Zinc	820	706	30000[N]	N
Total PAHs	3600	13000	300[N]	**Y**
Normalised PAHs (1%OC)	2650	1300	300[N]	**Y**
Benzene	0.5	6	NL[N] *(Csat = 360 mg/kg)*	N
Toluene	1	8	NL[N] *(Csat = 560 mg/kg)*	N
Ethylbenzene	3	13	NL[N] *(Csat = 64 mg/kg)*	N
Xylenes	3	81	NL[N] *(Csat = 300 mg/kg)*	N
Naphthalene	860	2800	NL[N] *(Csat = 9 mg/kg)*	N
TRH F1	45	330	NL[N] *(Csat = 950 mg/kg)*	N
TRH F2	8000	22000	NL[N] *(Csat = 560 mg/kg)*	N
TRH F3	46000	71000	2500[M]	**Y**
TRH F4	6800	7500	10000[M]	N
Acenaphthene	230	210	3600[R]	N
Acenaphthylene	96	720	3600[RS]	N
Anthracene	240	800	18000[R]	N
Benzo[a]anthracene	140	550	See BaP TEQs	--
Benzo[a]pyrene	110	550	See BaP TEQs	--
Benzo[b,j&k]fluoranthene	110	640	See BaP TEQs	--
Benzo[ghi]perylene	33	190	See BaP TEQs	--
Chrysene	130	610	See BaP TEQs	--
Dibenzo[ah]anthracene	13	48	See BaP TEQs	--
Fluoranthene	290	1500	2400[R]	N
Fluorene	260	840	2400[R]	N
Indeno[123cd]pyrene	32	260	See BaP TEQs	--
Naphthalene	860	2800	NL[N] *(Csat = 9 mg/kg)*	N
Phenanthrene	720	2300	18000[RS]	N
Pyrene	350	1400	1800[R]	N
Benzo[a]pyrene TEQs	150	750	3[N]	**Y**

Notes:

[N] = HIL-C and HSL-C values from ASC NEPM (i.e. recreational soil guidelines – surface soils where relevant) (NEPC 1999 amended 2013c)

[M] = Management Limits from ASC NEPM (NEPC 1999 amended 2013c)

[R] = USEPA Regional Screening Levels (residential soil) (USEPA 2017)

[RS] = USEPA Regional Screening Levels (residential soil) Surrogate used (acenaphthene value used for acenaphthylene; anthracene value used for phenanthrene) (USEPA 2017)

This screening assessment indicates that chromium, lead, PAHs (including the subset of carcinogenic PAHs specifically) and the F3 fraction of TRH are present in sediments at levels in some locations that are in exceedance of the soil health investigation levels.

TRH F3

The screening guideline used for the F3 fraction of TRH is a management limit. This guideline is based on screening soils to ensure that soils remaining at a site are not odorous or discoloured. The screening guidelines based on exposure via direct contact with soil in a recreational land use scenario for the F3 fraction is 5320 mg/kg (CRC CARE 2011). The highest values for the F3 fraction are above this value. This value is based on a child being exposed 365 days per year for 6 years consuming 50 mg/d of the sediments and exposing 2300 cm^2 of skin being in contact with the soil until the next shower.

For this site, direct contact does not occur in the same fashion.

- The samples with the highest F3 concentrations were located well within the part of the Bay that is always under water which means the contaminated sediments will not remain on the skin for any length of time minimising the potential for dermal exposure. \
- The highest concentration in the Northern Remediation area was at location 733 (71000 mg/kg). The highest concentration in the Southern Remediation area was at location MB14 (46000 mg/kg).
- The locations of these most contaminated areas also means that a young child is unlikely to be exposed in these areas as small children are unlikely to be able to reach them.
- In addition, multiple samples were taken in both these locations which give a better understanding of the concentrations to which people might be exposed:
    - Northern remediation area – location 733 is close to 734, 516 and 812 – averaging the results for all these locations gives a concentration of 21400 mg/kg.
    - Southern Remediation Area – location MB14 – this sample was split into 3 for analysis (MB14A, MB14B and MB14C) – averaging the results for these 3 samples gives a concentration of 23600 mg/kg.

The screening guideline for direct contact within a recreational landuse is made up of exposure via dermal contact (which contributes 80% of the exposure) and incidental ingestion (which contributes 20% of the exposure). If the relevant exposure at a site has a much lower level of exposure via dermal contact due to washoff then the following adjustments can be made to make this screening guideline more relevant for this site as shown in **Table 38**.

Table 38 Adjustments for Screening Guideline – F3 TRH

Adjustment	Revised Direct Contact Guideline (mg/kg)
Original Value based on Standard HIL-C/HSL-C scenario	5320
Dermal exposure reduced by half	9020
Dermal exposure 25% of original	13800
Dermal exposure 25% of original and exposure frequency reduced from 365 days per year to 182 days per year	27700

These adjustments are more realistic for direct contact with the sediments in the most affected locations. The average concentrations in both locations are below 27700 mg/kg.

In addition, it is appropriate to undertake further screening for this TRH fraction for the specific locations taken on the beach and immediately in front of it (sample locations 1, 2, 3, 4, 5, 6, 11, 100, 101 and 20) and within the mangrove area and immediately in front (12, 13, 14, 17, 18, 19, 8, 9, 102, 103, 104, 105, 106, 107 and 521). This assessment is provided in **Table 39**.

Table 39 F3 TRH within on shore areas of the beach and mangroves area (and in the area immediately in front)

Statistic	Concentration (mg/kg)
Beach Area – Surface	
Minimum	<100
Maximum	780
Beach Area – At depth (>300 mm)	
Minimum	<100
Maximum	1800
Mangrove Area – Surface	
Minimum	<100
Maximum	6600
Mangrove Area – At depth (>300 mm)	
Minimum	<100
Maximum	14000

This assessment shows that the samples taken around the beach are in compliance with the screening guideline used in **Table 37** (2500 mg/kg) especially at the surface.

This assessment shows that the samples taken around the mangrove area are above the guideline but are much lower than the values found in samples taken deeper in the Bay. Just reducing exposure from every day of the year to every third day brings the maximum concentration found at the surface in this area to an acceptable level (i.e. assuming 121 days per year exposure brings the guideline to 7500 mg/kg).

Lead and Chromium

The soil health investigation levels used as screening guidelines for lead and chromium were calculated assuming regular exposure to affected soil (daily for 35 years) without any wash off from the skin until the next time showering occurs. This is an overestimate of exposure when looking at sediments such as found at this site. Sediments are washed off the skin as a person exits the water where they may have been exposed reducing the length of time the chemicals stay on the skin. Also, it is not expected that people will be exposed to these sediments on a daily basis. If exposure is assumed to occur on 182 days per year instead of 365 days per year then the screening guideline would change from 300 mg/kg for chromium and 600 mg/kg for lead to 600 mg/kg for chromium and 1200 mg/kg. This change is more realistic for the way people might be exposed at this site and brings the maximum concentration reported in Kendall Bay to an acceptable level (i.e. maximum concentration is less than the adjusted guidelines). It is also noted that lead and chromium are most likely to be sourced from stormwater not the gasworks contamination in Kendall Bay.

PAHs/Carcinogenic PAHs

As for chromium and lead, the soil health investigation levels used as screening guidelines for the carcinogenic PAHs were calculated assuming regular exposure to affected soil (daily for 35 years) without any wash off from the skin until the next time showering occurs. This is an overestimate of exposure when looking at sediments such as found at this site. Sediments are washed off the skin

as a person exits the water where they may have been exposed reducing the length of time the chemicals stay on the skin. Also, it is not expected that people will be exposed to these sediments on a daily basis.

As PAHs are the most important part of the gasworks in regard to potential health risks, full calculations of site-specific remediation criteria have been undertaken in **Section 9**. These criteria will be relevant for both areas where sediments are always or sometimes inundated.

6.2 Seawater Screening Assessment

The data collected for seawater in Kendall Bay has been screened against relevant water quality guidelines for both human health and ecological protection. **Tables 40, 41** and **42** show this screening assessment for all monitoring events.

Table 40 Surface Water Quality Screening Assessment (January 2016)

Chemical	Maximum Conc in Southern Remediation Area (µg/L)	Maximum Conc in Northern Remediation Area (µg/L)	Recreational Water Quality Guidelines (µg/L) #	Ecological Water Quality Guidelines (µg/L)	COPC (y/n?)
Arsenic@	2	2	100[a]	2.3	N/N
Cadmium@	<0.1	<0.1	20[a]	0.7	N/N
Chromium@	<1	<1	500[a]	27.4	N/N
Copper@	3	2	2000[a]	1.3	N/**Y**
Lead@	<1	<1	100[a]	4.4	N/N
Mercury@	<0.05	<0.05	10[a]	0.1	N/N
Nickel@	1	<1	200[a]	7	N/N
Zinc @	1	3	3000[a]	15	N/N
Acenaphthene$	<0.01	<0.01	5300[U]	NA	N
Acenaphthylene$	0.02	0.01	5300[U]	NA	N
Anthracene$	0.01	<0.01	18000[U]	0.4	N/N
Benzo[a]anthracene$	0.07	<0.01	See BaP TEQs	See BaP TEQs	--
Benzo[a]pyrene$	0.12	0.01	See BaP TEQs	See BaP TEQs	--
Benzo[b,j&k]fluoranthene$	0.2	<0.02	See BaP TEQs	See BaP TEQs	--
Benzo[ghi]perylene$	0.09	<0.01	See BaP TEQs	See BaP TEQs	--
Chrysene$	0.1	<0.01	See BaP TEQs	See BaP TEQs	--
Dibenzo[ah]anthracene$	0.09	<0.01	See BaP TEQs	See BaP TEQs	--
Fluoranthene$	0.14	0.03	2900[U]	1.4	N/N
Fluorene$	<0.01	<0.01	8000[U]	NA	N/N
Indeno[123cd]pyrene$	0.02	<0.01	See BaP TEQs	See BaP TEQs	--
Naphthalene$	0.2	0.09	60[U]	70	N/N
Phenanthrene$	0.06	<0.02	1200[U]	2	N/N
Pyrene$	0.15	0.02	1200[U]	NA	N
Benzo[a]pyrene TEQs$	0.24	<0.05	0.1[a]	0.2	**Y/Y**
Benzene	<1	<1	10 [a]	500	N/N
Toluene	4	<1-2	8000[a]	180	N/N
Ethylbenzene	<1	<1	3000	5	N/N
Xylenes	<2	<2	6000[a]	75	N/N
TRH F1	<10	<10	15000[W]	NA	N
TRH F2	<50	<50	900-3000[W]	NA	N
TRH F3	<100	<100	900-3000[W]	NA	N
TRH F4	<100	<100	900-3000[W]	NA	N
Total Suspended Solids (mg/L)	19	14	NA	NA	
Electrical Conductivity (µS/cm)	44000	47000	NA	NA	
Total Phosphorus (mg/L)	0.05	<0.05	NA	0.03	N
Total Nitrogen (mg/L)	<0.1	<0.1	NA	0.3	N
Ammonia (mg N/L)	<0.005	<0.005	5[a]	0.015	N/N

Chemical	Maximum Conc in Southern Remediation Area (µg/L)	Maximum Conc in Northern Remediation Area (µg/L)	Recreational Water Quality Guidelines (µg/L) #	Ecological Water Quality Guidelines (µg/L)	COPC (y/n?)
NOx (mg N/L)	<0.005	0.007	NO_3 500[a] NO_2 30	0.015	N/N
Phosphate (mg P/L)	0.01	0.009	NA	0.03	N

Notes:

#	Recreational water quality guidelines calculated by multiplying drinking water guidelines by a factor of 10 to account for lower intake of water while swimming or boating compared to amount consumed when drinking as per NHMRC Guidelines for Managing Risks in Recreational Water (NHMRC 2008)
N	NHMRC Guidelines for Managing Risks in Recreational Water (NHMRC 2008)
a	NHMRC Australian Drinking Water Guidelines (multiplied by 10) (NHMRC 2011 updated 2017)
U	USEPA Regional Screening Guidelines for Tap Water (multiplied by 10) (USEPA 2017)
W	WHO Drinking Water Guidelines (WHO 2017)
A	ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000)
@	Data listed are for dissolved metals
$	Data listed are for total PAH concentrations
NA	Not available
NR	Not relevant
##	Not considered an appropriate indicator for recreational or drinking water quality guidelines (NHMRC 2008)

Based on this screening assessment of the January 2016 data:

- Carcinogenic PAHs were reported at concentrations slightly above both the human health and ecological screening guideline in the Southern Remediation Area. Both total and dissolved PAHs were analysed in the water samples from the April 2016 event as shown in **Table 25** (also **Table 27** for October 2017). These results indicate that the carcinogenic PAHs are attached to the particles suspended in the water. Given the results of the bioaccessibility testing on some of the sediments surrounding the bay, it is likely that the carcinogenic PAHs attached to the particles in the water samples are not particularly bioavailable. If it is assumed that 10% of the PAHs (as has been assumed for the sediments on the beach in Kendall Bay – also mid point for low bioaccessibility for the sand and higher bioaccessibility for mangrove area) attached to particles can be adsorbed into the body when ingested, then the concentrations found are similar or below both the human health and ecological screening guidelines. It is also noted that the screening guidelines are based on people swimming in these waters every day for a lifetime and consuming around 200 mLs of the water on every occasion which is likely to be conservative. As a result, no further assessment is required.
- Copper was also reported at a concentration slightly above the ecological screening value but well below the value protective of human health. The gasworks contamination in the sediments is not a source of copper to the environment. Copper is a common contaminant in urban areas as it washes off roads and other surfaces in stormwater. Similar or higher concentrations were reported in Majors and Exile Bays. No further detailed assessment is needed.

Table 41 Surface Water Quality Screening Assessment (April 2016)

Chemical	Maximum Conc in Southern Remediation Area (µg/L)	Maximum Conc in Northern Remediation Area (µg/L)	Recreational Water Quality Guidelines (µg/L) #	Ecological Water Quality Guidelines (µg/L)	COPC (y/n? for HH and for Eco)
Arsenic@	2	2	100[a]	2.3	N/N
Cadmium@	<0.1	<0.1	20[a]	0.7	N/N
Chromium@	<1	<1	500[a]	27.4	N/N
Copper@	6	5	2000[a]	1.3	N/**Y**
Lead@	<1	2	100[a]	4.4	N/N
Mercury@	<0.05	<0.05	10[a]	0.1	N/N
Nickel@	2	2	200[a]	7	N/N
Zinc @	11	17	3000[a]	15	N/**Y**
Acenaphthene$	0.01	0.01	5300[U]	NA	N
Acenaphthylene$	0.07	0.01	5300[U]	NA	N
Anthracene$	0.02	<0.01	18000[U]	0.4	N/N
Benzo[a]anthracene$	0.07	0.01	See BaP TEQs	See BaP TEQs	--
Benzo[a]pyrene$	0.16	0.01	See BaP TEQs	See BaP TEQs	--
Benzo[b,j&k]fluoranthene$	0.22	<0.02	See BaP TEQs	See BaP TEQs	--
Benzo[ghi]perylene$	0.07	<0.01	See BaP TEQs	See BaP TEQs	--
Chrysene$	0.06	<0.01	See BaP TEQs	See BaP TEQs	--
Dibenzo[ah]anthracene$	0.07	<0.01	See BaP TEQs	See BaP TEQs	--
Fluoranthene$	0.12	0.03	2900[U]	1.4	N/N
Fluorene$	0.02	<0.01	8000[U]	NA	N/N
Indeno[123cd]pyrene$	0.02	<0.01	See BaP TEQs	See BaP TEQs	--
Naphthalene$	<0.02	<0.02	60[U]	70	N/N
Phenanthrene$	0.05	0.05	1200[U]	2	N/N
Pyrene$	0.23	0.03	1200[U]	NA	N
Benzo[a]pyrene TEQs$	0.26	0.02	0.1[a]	0.2	**Y/Y**
Benzene	<1	<1	10 [a]	500	N/N
Toluene	<1	<1	8000[a]	180	N/N
Ethylbenzene	<1	<1	3000	5	N/N
Xylenes	<2	<2	6000[a]	75	N/N
TRH F1	<10	<10	15000[W]	NA	N
TRH F2	<50	<50	900-3000[W]	NA	N
TRH F3	<100	<100	900-3000[W]	NA	N
TRH F4	<100	<100	900-3000[W]	NA	N
Total Suspended Solids (mg/L)	22	14	NR	0.5-10 (estuarine) 6-50 (lowland rivers)	N
Electrical Conductivity (µS/cm)	41000	42000	NR	NR	NR
Total Phosphorus (mg/L)	<0.25	<0.05	NR	0.03	N
Total Nitrogen (mg/L)	<2	<2	NR	0.3	N
Ammonia (mg N/L)	0.09	0.074	5[a]	0.015	N/**Y**
NOx (mg N/L)	0.05	0.04	NO_3 500[a] NO_2 30	0.015	N/**Y**
Phosphate (mg P/L)	0.036	0.038	NR	0.005	N
Total Coliforms (CFU/100 mLs)	30	20	##	NR	NR
Enterococci (CFU/100 mLs)	1	32	Class A $\leq$ 40[N]	NR	N

Notes:

#	Recreational water quality guidelines calculated by multiplying drinking water guidelines by a factor of 10 to account for lower intake of water while swimming or boating compared to amount consumed when drinking as per NHMRC Guidelines for Managing Risks in Recreational Water (NHMRC 2008)
N	NHMRC Guidelines for Managing Risks in Recreational Water (NHMRC 2008)
a	NHMRC Australian Drinking Water Guidelines (multiplied by 10) (NHMRC 2011 updated 2017)
U	USEPA Regional Screening Guidelines for Tap Water (multiplied by 10) (USEPA 2017)
W	WHO Drinking Water Guidelines (WHO 2017)
A	ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000)

@ Data listed are for dissolved metals
$ Data listed are for total PAH concentrations
NA Not available
NR Not relevant
Not considered an appropriate indicator for recreational or drinking water quality guidelines (NHMRC 2008)

Based on this screening assessment of the April 2016 data:

- Carcinogenic PAHs were reported at concentrations slightly above both the human health and ecological screening guideline in the Southern Remediation Area. Both total and dissolved PAHs were analysed in the water samples from the April 2016 event as shown in **Table 25** (also **Table 27** for October 2017). These results indicated that the carcinogenic PAHs are attached to the particles suspended in the water. Given the results of the bioaccessibility testing on some of the sediments surrounding the bay, it is likely that the carcinogenic PAHs attached to the particles in the water samples are not particularly bioavailable. If it is assumed that 10% of the PAHs (as has been assumed for the sediments on the beach in Kendall Bay) attached to particles can be adsorbed into the body when ingested, then the concentrations found are below both the human health and ecological screening guidelines. It is also noted that the screening guidelines are based on people swimming in these waters every day for a lifetime and consuming around 200 mLs of the water on every occasion which is likely to be conservative. As a result, no further assessment is required.
- Zinc and copper were reported at concentrations slightly above the ecological screening value but well below the values protective of human health. The gasworks contamination in the sediments is not a source of copper or zinc to the environment. Both of these metals are common contaminants in stormwater in urban areas. Similar or higher concentrations were reported in Majors and Exile Bays. No further detailed assessment is needed.

Table 42 Surface Water Quality Screening Assessment (October 2017)

Chemical	Maximum Conc in Southern Remediation Area (µg/L)	Maximum Conc in Northern Remediation Area (µg/L)	Recreational Water Quality Guidelines (µg/L) #	Ecological Water Quality Guidelines (µg/L)	COPC (y/n? for HH and for Eco)
Arsenic@	1	2	100[a]	2.3	N/N
Cadmium@	<0.1	<0.1	20[a]	0.7	N/N
Chromium@	<1	<1	500[a]	27.4	N/N
Copper@	5	5	2000[a]	1.3	N/**Y**
Lead@	<1	<1	100[a]	4.4	N/N
Mercury@	<0.05	<0.05	10[a]	0.1	N/N
Nickel@	4	1	200[a]	7	N/N
Zinc @	13	12	3000[a]	15	N/N
Acenaphthene$	<0.01	<0.01	5300[U]	NA	N
Acenaphthylene$	<0.02	<0.02	5300[U]	NA	N
Anthracene$	0.02	<0.01	18000[U]	0.4	N/N
Benzo[a]anthracene$	<0.01	<0.01	See BaP TEQs	See BaP TEQs	--
Benzo[a]pyrene$	<0.01	<0.01	See BaP TEQs	See BaP TEQs	--
Benzo[b,j&k]fluoranthene$	0.06	<0.02	See BaP TEQs	See BaP TEQs	--
Benzo[ghi]perylene$	<0.01	<0.01	See BaP TEQs	See BaP TEQs	--
Chrysene$	<0.01	<0.01	See BaP TEQs	See BaP TEQs	--
Dibenzo[ah]anthracene$	<0.01	<0.01	See BaP TEQs	See BaP TEQs	--
Fluoranthene$	0.08	0.02	2900[U]	1.4	N/N
Fluorene$	0.06	<0.01	8000[U]	NA	N/N
Indeno[123cd]pyrene$	<0.01	<0.01	See BaP TEQs	See BaP TEQs	--
Naphthalene$	<0.02	<0.02	60[U]	70	N/N

Chemical	Maximum Conc in Southern Remediation Area (µg/L)	Maximum Conc in Northern Remediation Area (µg/L)	Recreational Water Quality Guidelines (µg/L) #	Ecological Water Quality Guidelines (µg/L)	COPC (y/n? for HH and for Eco)
Phenanthrene$	0.1	<0.03	1200[U]	2	N/N
Pyrene$	0.08	0.02	1200[U]	NA	N
Benzo[a]pyrene TEQs$	<0.05	<0.05	0.1[a]	0.2	N/N
Benzene	<1	<1	10 [a]	500	N/N
Toluene	<1	<1	8000[a]	180	N/N
Ethylbenzene	<1	<1	3000	5	N/N
Xylenes	<2	<2	6000[a]	75	N/N
TRH F1	<10	<10	15000[W]	NA	N
TRH F2	<50	<50	900-3000[W]	NA	N
TRH F3	<100	<100	900-3000[W]	NA	N
TRH F4	<100	<100	900-3000[W]	NA	N
Total Suspended Solids (mg/L)	10	11	NR	0.5-10 (estuarine) 6-50 (lowland rivers)	N
Electrical Conductivity (µS/cm)	NA	NA	NR	NR	NR
Total Dissolved Solids (mg/L)	40000	40000	NR	NR	NR
Total Phosphorus (mg/L)	<0.05	0.05	NR	0.03	**Y**
Phosphate (mg P/L)	0.02	0.02	NR	0.005	**Y**
Total Nitrogen (mg/L)	0.3	0.3	NR	0.3	N
Ammonia (mg N/L)	0.07	0.01	5[a]	0.015	N/**Y**
NOx (mg N/L)	0.03	0.005	NO_3 500[a] NO_2 30	0.015	N/**Y**
Total Coliforms (CFU/100 mLs)	40	5	##	NR	NR
Enterococci (CFU/100 mLs)	1	4	Class A ≤ 40[N]	NR	N

Notes:

#	Recreational water quality guidelines calculated by multiplying drinking water guidelines by a factor of 10 to account for lower intake of water while swimming or boating compared to amount consumed when drinking as per NHMRC Guidelines for Managing Risks in Recreational Water (NHMRC 2008)
N	NHMRC Guidelines for Managing Risks in Recreational Water (NHMRC 2008)
a	NHMRC Australian Drinking Water Guidelines (multiplied by 10) (NHMRC 2011 updated 2017)
U	USEPA Regional Screening Guidelines for Tap Water (multiplied by 10) (USEPA 2017)
W	WHO Drinking Water Guidelines (WHO 2017)
A	ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000)
@	Data listed are for dissolved metals
$	Data listed are for total PAH concentrations
NA	Not available
NR	Not relevant
##	Not considered an appropriate indicator for recreational or drinking water quality guidelines (NHMRC 2008)

Based on this screening assessment of the October 2017 data:

- Carcinogenic PAHs were reported at concentrations below the relevant screening guidelines so were at acceptable concentrations in this round of monitoring (using the total values as well as the dissolved values)
- Copper was reported at concentrations slightly above the ecological screening value. The gasworks contamination in the sediments in Kendall Bay is not a source of copper to the environment. Copper is known to be a common contaminant of stormwater in urban areas. Similar concentrations were reported in the surrounding Bays. No further detailed assessment is needed.

The surface water sampling has demonstrated that concentrations for relevant chemicals are all well below relevant screening criteria except for copper. Copper is not present in these waters due to the

gasworks contamination. The sediment concentrations of copper are similar across the whole area and copper is known to be present in stormwater runoff from urban areas.

In summary, exposure to the surface waters in Kendall Bay does not pose unacceptable risk to human health. Concentrations of common urban pollutants (like metals) are similar in samples from all the Bays in the area including Kendall Bay. The presence of gasworks contamination in Kendall Bay does result in some PAHs being present in the surface waters at time but the levels are not above guidelines.

Section 7. Exposure Scenarios for Calculation of Remediation Criteria

7.1 General

This section provides a short discussion on the potential receptors (human groups) and exposure pathways that are considered to be of significance in this assessment. In addition, where identified as of potential significance and warranting quantification in this assessment, the potential for exposure has been quantified using industry best practice and guidance available from enHealth, ASC NEPM and USEPA (enHealth 2012b; NEPC 1999 amended 2013a; USEPA 1989, 1991, 2002, 2004, 2009).

The assessment presented has addressed potential worst-case exposure to the key chemicals in soil and exposure has been calculated for a ***Reasonable Maximum Exposure (RME)*** scenario estimated by using intake variables and chemical concentrations that define the highest exposure that is reasonably likely to occur in the area assessed. The RME is likely to provide a conservative or overestimate of total exposure and, therefore, health risk.

The quantification of exposure has involved consideration of the following:

- Identification of relevant ***exposure parameters*** for each of the identified exposure pathways and receptors. The magnitude of the exposure is a function of a number of variables (termed exposure parameters), which describe the physical, and behavioural parameters relevant to the potentially exposed population. Exposure parameters which are considered representative have been selected. Where available, additional exposure data has been obtained from Australian sources (enHealth 2012b; NEPC 1999 amended 2013a); and
- Estimation of the ***chemical concentration*** in each medium relevant to the receptor groups and exposure pathways (enHealth 2012b; NEPC 1999 amended 2013a; USEPA 1991, 2002).

7.2 Quantification of Exposure

7.2.1 Identified Receptors and Exposure Pathways

Table 43 presents the receptors and exposure pathways considered to be relevant for these sediments.

Table 43 Summary of Key Exposure Groups and Pathways

Receptor	Exposure Pathway/Mechanism	Activity
Adults	Incidental ingestion and dermal contact with sediments • Beach area • Mangrove area • Rocky area	Exposure may occur while undertaking a variety of recreational activities • Walking • Wading • Swimming • Bird watching • Supervising children
Children	Incidental ingestion and dermal contact with sediments • Beach area • Mangrove area • Rocky area	Exposure may occur while undertaking a variety of recreational activities • Beach play • Wading • Swimming

Currently, there is a fishing advisory in place for all of Sydney Harbour (see http://www.dpi.nsw.gov.au/fisheries/recreational/info/syd-harbour and http://www.foodauthority.nsw.gov.au/consumers/keeping-food-safe/special-care-foods/sydney-harbour-seafood/#.VaRVN_lvDwA). For areas west of the Sydney Harbour Bridge the advice is to not consume any fish at all. For areas east of the Bridge the advice is to limit intake to one meal per month. These restrictions are in place due to contamination of sediments by dioxins. These contaminants are sourced from a former chemical manufacturing site in Homebush Bay located approximately 4 km upstream of Kendall Bay. However, these restrictions also mean that fish caught in and around Kendall Bay should not be consumed regardless of any additional contamination due to the sediments at Kendall Bay.

In addition, the taking of any shellfish is prohibited throughout Sydney Harbour (NSW DPI 2012). Oysters are included in this prohibition.

Consequently, consumption of seafood has not been included in the exposure scenarios to be assessed in this risk assessment to determine screening criteria for the site.

7.2.2 Nature of Materials Across Kendall Bay

The various site investigations of the sediments at Kendall Bay have shown that there is variety in the types of contamination reported in different areas of the Southern end of the Bay.

Beach

The easterly end of the Bay is where the beach is located. There is little obvious contamination in this area. The area is well covered by sand to which chemicals like PAHs (from gasworks waste) do not adhere well. The results for sediments in this area and in front of this area show low levels of contamination. Samples collected in the initial monitoring events on the beach and in front of the beach including sampling locations 1,2,3,4,5,6,11 and 20. Total PAH levels in these samples ranged from <0.1 to 120 (mean 16) mg/kg. Concentrations of benzo[a]pyrene TEQs for these samples range from 0.01 to 20 (mean 4) mg/kg.

The following photos show the sands in the beach area and the encroachment of the mangroves into the beach area.





Mangrove Area

The central part of the Bay shoreline has a healthy stand of mangroves which is valued by the local community. This area is made up of sandy material with mangroves and mangrove roots. It is also a

place where weathered coal materials wash up onto the sand. It is these materials that contribute to the PAH concentrations in the surface samples from this area.

The following photos include close up photos of the coal pieces as well as photos of the area under the mangroves showing sand and these coal pieces. On some occasions there is a large quantity of these coal pieces under the mangroves, at other times most has been washed away leaving small amounts. Some of the samples at depth in this area show higher levels of contamination but these are not accessible to people recreating along the shoreline as it is not easy to dig through the roots of the mangrove trees.













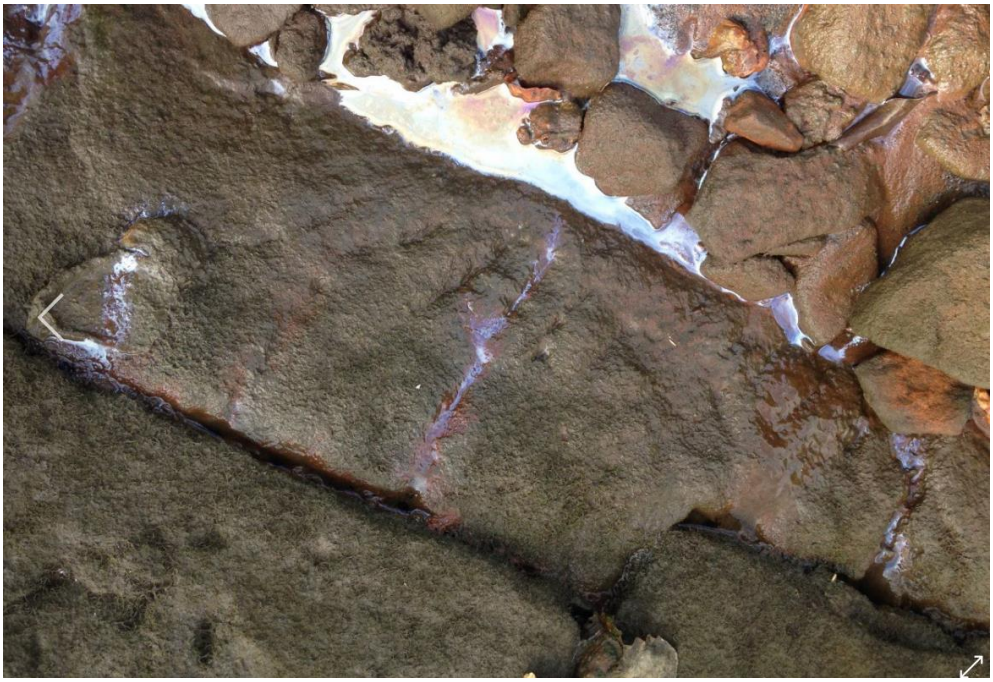


Western End of Bay

At the western end of the Bay, material containing coal tars is present at or near the surface. The following photos show this corner of the Bay and the characteristics of some of this material – the black tars in the sediments and the potential for sufficient contamination near the surface to produce sheens on the waters at times.







7.2.3 Bioavailability/Bioaccessibility (Ingestion)

Background

Bioavailability is an important factor for determining the amount of a chemical that may be absorbed into the body when in contact with contaminated soil or sediment.

When a chemical is ingested, bioavailability is a reflection of the amount of a chemical that can be dissolved (from the sediments in this case) into the gastrointestinal fluids and then absorbed across the membranes of the gastrointestinal tract into the bloodstream (i.e. what is biologically available). The entire amount of a chemical present in soil or sediment does not necessarily dissolve into the gastrointestinal fluids as some of it is well bound up within the soil or sediment particles. Also, not all of what does dissolve into the gastrointestinal fluids may cross into the bloodstream.

Another aspect to consider is the relative bioavailability of the chemical. This involves consideration of the exposure conditions (and media) in the situation of interest with those under which the critical dose-response (toxicity) study was undertaken (typically dissolved in water or food) to check that the two are comparable. If the critical study is based on contamination in soil, then it may be assumed that it would have a similar relative bioavailability to the situation where contaminated soil is ingested. However, if the critical study introduces the chemical into the organism being studied in water or food, it may have a different relative bioavailability that is relevant at a contaminated site.

Organisms, including humans, only respond to the fraction that is biologically available. For some chemicals, all of the concentration measured in the soil or sediment sample will be biologically available as the chemical is readily soluble or the contamination is fresh and has not had time to become bound up within the soil or sediments. For other chemicals, only a small portion will be biologically available because they are highly insoluble in water or they bind tightly to organic carbon in soil or sediments.

Bioavailability varies depending on the source of the contamination, the age of the contamination, the conditions under which aging of the contamination has occurred, how exposure is occurring and differences between individual people.

It is normal practice to assume 100% bioavailability unless additional site-specific and chemical-specific information is available to allow a change. It is acknowledged that an assumption of 100% bioavailability of PAHs will tend to overestimate risk in many situations as it is recognised that the bioavailability of PAHs in ash used in fill (where the PAHs are well bound to the particulates as a result of the combustion process) is low. However, the bioavailability of PAHs in gasworks sites where coal tars may be present is likely to be higher and so, without additional information, the conservative assumption of 100% bioavailability is required.

A study by Hansen et al (2007) demonstrated bioavailability of PAHs in three different soil samples ranging from 14% to 40% using an *in vitro* bioavailability model that simulates gastric digestion (Hansen et al. 2007). In addition, the Massachusetts DEP uses a relative absorption fraction of 28% for PAHs in its risk assessment program for contaminated land (MADEP 2008).

Recently a method for assessing the bioaccessibility of PAHs has become available in Australia. Bioaccessibility testing looks at how much of a chemical will dissolve into the gastrointestinal fluids from soil or sediment. It does not consider the second step in the process – the chemical in the gastrointestinal fluids crossing over the membranes into the blood stream so it is a conservative estimate of the bioavailable fraction.

Bioaccessibility is used because it is more readily measured than the uptake of the chemical into the circulatory system so methodologies to better estimate bioavailability have focussed on this part of the process. The methodology used for this investigation was developed by researchers at the University of South Australia based on the Physiologically Based Extraction Test (PBET) with

variations recommended by a number of researchers (Cave et al. 2010; Collins et al. 2013; Gouliarmou et al. 2013; Tilston et al. 2011).

Results for Kendall Bay

A number of samples were taken for bioaccessibility testing at Kendall Bay on 28 May 2015. Samples were taken at the sampling locations 100, 101, 102 and 103. Samples 100 and 101 were taken within the beach area. Samples 102 and 103 were taken in the mangrove area.

Additional samples were collected in October 2017 – EN1, 2, 3 and 4. EN1 was taken in the south west corner of the Bay within the mangrove area. This sample was divided into two sections (top and bottom). EN2 was taken close to the stormwater drain. EN3 was taken at the edge of the mangrove area and EN4 was taken within the delta from the stormwater drain in front of the mangrove area. EN1 was sampled on two occasions as there was some confusion in the labelling of the samples. The second occasion was in January 2018.

The bioaccessibility testing only evaluated the bioaccessible fraction via ingestion of the sediments.

All of the analyses were undertaken in duplicate on each occasion. In the reports the duplicates were referred to as sample number – a and – b. Full reports detailing the testing undertaken by University of South Australia is provided at **Appendix C**. **Figure 13** shows the sampling locations.

The results are provided in **Table 44**.

Table 44 Bioaccessibility Results

Chemical	100	101	102	103	EN1A	EN1B	EN2	EN3	EN4
Total PAHs (mg/kg)	13	3.1	54	83	31	502	71	6.6	17
Benzo[a]pyrene TEQs (mg/kg)	2.4	0.8	9.4	13	5.3	64	12	1.2	2.9
Bioaccessible Fraction (mg/kg (%))									
Acenaphthene	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Acenaphthylene	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	1.51 (6%)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Anthracene	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Benzo[a]anthracene	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	2.86 (18%)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Benzo[a]pyrene	<0.3 (--)	<0.3 (--)	0.63 (9.4%)	0.88 (9%)	0.52 (13%)	13.8 (29%)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Benzo[b,j&k]fluoranthene	<0.3 (--)	<0.3 (--)	1.04 (18%)	1.5 (18%)	0.9 (18%)	19.2 (31%)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Benzo[ghi]perylene	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	2.25 (13%)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Chrysene	<0.3 (--)	<0.3 (--)	0.46 (11%)	0.52 (9%)	<0.3 (--)	2.19 (10%)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Dibenzo[ah]anthracene	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	0.9 (16%)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Fluoranthene	<0.3 (--)	<0.3 (--)	<0.3 (--)	0.34 (4%)	<0.3 (--)	30.1 (33%)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Fluorene	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Indeno[123cd]pyrene	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	2.1 (14%)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Naphthalene	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	0.4 (--)	0.45 (10%)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Phenanthrene	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	0.48 (6%)	<1.3 (--)	<1.3 (--)	<1.2 (--)
Pyrene	<0.3 (--)	<0.3 (--)	<0.3 (--)	<0.3 (--)	1.3 (19%)	50.8 (31%)	2.4 (20%)	<1.3 (--)	<1.2 (--)
Total PAHs	<0.7 (--)	<0.6 (--)	2.3 (4%)	3.4 (4%)	5 (15%)	127 (25%)	2.4 (4%)	<1.3 (--)	<1.2 (--)

Beach

Samples from locations 100 and 101 were found to have no bioaccessible PAHs present. These samples contained low levels of the carcinogenic PAHs in the range of 1-3 mg/kg which is similar to most of the surface samples in the beach area.

Mangroves/ Stormwater Drain/ Delta in Front of Mangroves

Samples from location 102 and 103 were found to have bioaccessible PAHs ranging from 4 to 18 % depending on the individual PAHs. These samples contained higher levels of the carcinogenic PAHs in the range of 10-15 mg/kg (benzo[a]pyrene TEQs) which is similar to most of the surface samples in the central mangrove area.

Sample EN2 was collected close to the stormwater drain. Most of the PAHs in this sample were not in a bioaccessible form. Only pyrene was able to move into the simulated gastrointestinal fluids. The bioaccessible fraction was 20% for pyrene and 4% overall. This sample contained higher levels of the carcinogenic PAHs in the range of 10-15 mg/kg (benzo[a]pyrene TEQs) which is similar to most of the surface samples in the central mangrove area.

Sample EN3 was collected at the edge of the mangroves around the water's edge. None of the PAHs in this sample were in a bioaccessible form. This sample contained only a low level of the carcinogenic PAHs – 1 mg/kg (benzo[a]pyrene TEQs) – which is closer to the situation in the beach area.

Sample EN4 was collected within the sand delta in front of the mangroves and stormwater drain. None of the PAHs in this sample were in a bioaccessible form. This sample contained only a low level of the carcinogenic PAHs – 3 mg/kg (benzo[a]pyrene TEQs) – which is closer to the situation in the beach area.

As a result, it has been assumed that the bioavailable fraction across the beach area is 20% in the calculations related to incidental ingestion of the sediments.

South West Corner/ Mangroves/ Materials at Depth

Sample EN1 was collected in the south western corner of the mangroves. This sample included both surface materials (EN1A) and deeper materials that were present amongst and below the mangrove root mass (EN1B).

Sample EN1A provided a similar picture as samples 102, 103 and EN2. This sample was found to have bioaccessible PAHs ranging from 13 to 19 % depending on the individual PAHs. This sample contained higher levels of the carcinogenic PAHs – 5 mg/kg (benzo[a]pyrene TEQs) – which is similar to most of the surface samples in the central mangrove area.

Sample EN1B was found to have bioaccessible PAHs ranging from 6 to 31 % depending on the individual PAHs. This sample contained significantly higher levels of the carcinogenic PAHs as would be expected in this part of the Bay – 64 mg/kg (benzo[a]pyrene TEQs).

Sample EN1B indicates there is a difference between the material at the surface which people are able to access if they recreate within the mangroves and the material at depth below the mangrove root mass. The material at depth is more contaminated and more of it is bioaccessible as would be expected because it contains more coal tar.

In regard to the most westerly end of the mangrove area, no samples were collected in this area for bioaccessibility testing. This area has the highest concentrations of PAH contamination. Much of this area contains sediments that are odorous and releases black ooze when walked across or disturbed in some other way. As a result, it has been assumed that the bioavailable fraction across the western end of the mangrove area is 100% in the calculations related to incidental ingestion of the sediments.

Summary

Given these results, the following assumptions about bioaccessibility related to incidental ingestion of the sediments have been made to allow the calculation of remediation criteria:

- the bioavailable fraction across the beach area and in the sand delta in front of the mangrove area is 10%
- the bioavailable fraction for the surface materials across the mangrove area is 20%
- the bioavailable fraction for the coal tar affected materials (at depth and in the most western corner of the Bay) is 100%

7.2.4 Bioavailability/Bioaccessibility (Dermal)

Section 6.2.1, Appendix A2 of Schedule B7 of the ASC NEPM discusses how the HIL values for PAHs were determined (NEPC 1999 amended 2013b).

The discussion notes that there were a number of variations considered in regards to these calculations for this group of chemicals, in particular. The calculations considered the use of a range of different values for some of the assumptions. The different values were presented to the Australian regulators overseeing the ASC NEPM process for their consideration.

The variations included:

- using the standard USEPA approach to assess exposure via dermal contact
- using the Knafla et al. approach as was undertaken in the URS 2007 HHRA
- using the slope factor derived from the WHO drinking water guidelines
- using the slope factor from the NZ Ministry for the Environment guidance
- using an age dependent adjustment factor for cancer or not (NEPC 1999 amended 2013b).

A choice was made by Australian regulators as to which set of these variables were to be included in the calculations for the HILs. HILs for low density residential land uses were calculated using 5 different sets of values for the relevant assumptions:

- use of oral TRV from NZ MfE (for both ingestion and dermal contact) and no age dependent adjustment factor
- use of oral TRV from WHO (for both ingestion and dermal contact) and no age dependent adjustment factor
- use of oral TRV from NZ MfE (for both ingestion and dermal contact) with age dependent adjustment factors
- use of oral TRV from WHO (for both ingestion and dermal contact) with age dependent adjustment factors
- use of oral TRV from NZ MfE for ingestion and Knalfa approach for dermal contact) and no age dependent adjustment factor

The chosen value was the one based on the WHO TRV and age dependent adjustment factors. However, the following discussion of the relevance of the Knalfa approach was included in the discussion:

It is noted that while the approach adopted for the derivation of the HILs has not directly incorporated the dermal approach outlined by Knafla et al. (2011), individual jurisdictions may require consideration of these issues in a site-specific assessment, particularly where people may come into direct contact with coal tar.

While this choice was appropriate to conservatively screen sites to decide which need site specific risk assessment, the combination used was not necessarily the correct choice for every site where PAHs are present at elevated levels as implied by the note about sites with coal tar.

The review in the ASC NEPM noted that consideration should be given as to which combination of these variables should be included whenever site-specific risk calculations are needed. Such consideration includes the source of the PAH contamination, the level of contamination and the age of the contamination or, in other words, the bioavailability of the PAHs.

The results for sample locations 100 and 101 provide evidence that the normal USEPA approach to assessing exposure via dermal contact is appropriate for the beach area. The results for sample locations 102 and 103 provide evidence that the normal USEPA approach to assessing exposure via dermal contact is appropriate for the central mangrove area.

The observations discussed above in regard to the western end of the mangrove area indicate that the Knafla approach needs to be considered to appropriately assess dermal exposure given the nature of the contamination in this area as it may be possible for people to come into direct contact with coal tars in this area.

Both the standard USEPA approach and the Knafla approach will be used to assess dermal contact in this part of the site.

7.2.5 Incidental Ingestion of Sediments

Ingestion of sediments is a key pathway of exposure relevant for this site, particularly for young children. In childhood development the sucking and mouthing of hands or objects is a natural behaviour, being more prevalent during teething. As children grow older they are less likely to place objects in their mouth.

The potential intake of PAHs identified in surface sediments via incidental ingestion has been undertaken using the following equation:

$$Daily\ Chemical\ \ Intake_{Is} = C_s \bullet \frac{IRs \bullet FI \bullet B \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \qquad \text{(mg/kg/day)}$$

where:

Cs	= Concentration of impacted sediments (mg/kg)
IRs	= Ingestion rate of sediments (mg/day)
FI	= Fraction of daily ingestion that is derived from contamination source (unitless), taken as 1
B	= Bioavailability or absorption of chemical via ingestion (unitless) (see **Section 7.2.3**)
CF	= Conversion factor of $1x10^{-6}$ to convert mg to kg
EF	= Exposure frequency (days/year)
ED	= Exposure duration (years)
BW	= Body weight (kg)
AT	= Averaging time for threshold exposures, (=ED x 365 days)

AT(NT) = Averaging time for non-threshold exposures (=70 years x 365 days)

The assumptions adopted for the quantification of potential intakes via incidental ingestion of sediments for a young child are presented in **Table 21**. All calculations are presented in **Appendix B**. Young children are the focus of the calculations as the risks posed are higher for this lifestage – using relevant exposure assumptions to backcalculate a relevant screening criteria gives the most conservative result and, therefore, the most relevant for determining criteria for remediation.

7.2.6 Dermal Contact with Sediments

Dermal absorption of chemicals from sediments depends on the area of skin in contact with the sediment, concentration of the chemical in the sediment, duration of contact with the sediment, how tightly the chemical is bound into the sediment and the ability of the chemical to penetrate the skin.

The assessment has been generally undertaken using the approach presented by the USEPA. The USEPA define a simple approach to the evaluation of dermal absorption associated with soil contact (USEPA 1989, 1991, 2004). This is presented in the following equation:

$$Daily\ Chemical\ Intake = C_s \bullet \frac{SAs \bullet AF \bullet ABSd \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \qquad \text{(mg/kg/day)}$$

where:

Cs = Concentration in sediment (mg/kg)
SAs = Surface area of body exposed to sediment per day (cm^2/day)
AF = Adherence factor, amount of soil that adheres to the skin per unit area which depends on sediment properties and area of body (mg/cm^2 per event)
ABSd = Dermal absorption fraction (unitless) – 6% used as discussed in **Section 8.2.1**
FE = Fraction of day exposed before washing sediments off skin
CF = Conversion factor of $1x10^{-6}$ to convert mg to kg
EF = Exposure frequency (days/year)
ED = Exposure duration, taken to be 6 years for children and 29 years for adults
BW = Body weight (kg), taken to be 15 kg for children and 70 kg for adults as per ASC NEPM 1999
AT = Averaging time for threshold exposures, (=ED x 365 days)
AT(NT) = Averaging time for non-threshold exposures (=70 years x 365 days)

The assumptions adopted for the quantification of potential intakes via dermal absorption from soil for a young child are presented in **Table 21**. All calculations are presented in **Appendix B**. Young children are the focus of the calculations as the risks posed are higher for this lifestage – using relevant exposure assumptions to backcalculate a relevant screening criteria gives the most conservative result and, therefore, the most relevant for determining criteria for remediation.

7.2.7 Age Dependent Adjustment Factor

The USEPA guidance document – *Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens (2005)* – provides a methodology to assess the potential for additional susceptibility to a carcinogen if a person is exposed as a child compared to when they are exposed only as an adult (USEPA 2005). The USEPA determined that there is a need to consider this potential for chemicals found to act via a mutagenic mode of action. Benzo[a]pyrene has been found to act via this mode of action by the USEPA. However, none of the toxicity reference values currently available from WHO, USEPA or other relevant sources have included this consideration into their calculation. The ASC NEPM recommends that this issue be addressed on a site specific

basis and included the methodology into the calculation of the HIL-A and HIL-C values for the carcinogenic PAHs (NEPC 1999 amended 2013a, 1999 amended 2013b).

The USEPA guidance document recommends the following approach:

- additional 10 fold factor included in the risk calculations for first 2 years of life;
- additional 3 fold factor included in the risk calculations for next 14 years of life;
- no additional factor included in the risk calculations for adults (USEPA 2005).

It is normal practice (as outlined in the ASC NEPM (NEPC 1999 amended 2013a, 1999 amended 2013b) to calculate risks for young children (0-6 years) and for adults (7-35 years). Consequently, relevant weighting factors based on the USEPA approach have been included in the calculations. These weighting factors are based on the following calculations:

$$Weighting\ Factor = \frac{(2\ years\ x\ 10\ fold\ factor)+(4\ years\ x\ 3\ fold\ factor)}{6} = 5.3 \text{ (young child)}$$

$$Weighting\ Factor = \frac{(10\ years\ x\ 3\ fold\ factor)+(19\ years\ x\ 1\ fold\ factor)}{29} = 1.7 \text{ (older child and adult)}$$

These weighting factors have been applied to the non-threshold calculations for all exposure pathways included in **Appendix B**.

7.2.8 Exposure Scenario Assumptions

Exposure assumptions relevant to receptors are presented in **Table 45**. A summary of the exposure parameters, equations and calculated risks are presented in **Appendix B**.

Table 45 Summary of Exposure Parameters Adopted –Ingestion and Dermal Contact with Sediment – Young Children

Exposure Parameter	Value adopted for this assessment	Value adopted in URS 2007
Child – 0-5 years		
Ingestion rate (soil)	50 mg/day of sediment (NEPC 1999 amended 2013b)	200 mg/day
Skin surface area	0.035 + 0.03 + 0.07 + 0.04 m^2 (total 1.75 m^2 or 1750 cm^2) based on the mean values for skin surface area for lower arms (half of arm value), hands, lower legs (half of leg value) and feet for 2-3 year old (enHealth 2012a)	Average case – 3 330 cm^2 Maximum case – 8 325 cm^2
Soil to skin adherence factor	0.17 lower arms 0.49 hands 0.7 lower legs 21 feet mg sediment/cm^2 (USEPA 2008)	0.39 mg sediment/cm^2
Fraction of day exposed	0.33 – assumes that sediment remains on child's skin for 8 hours before being washed off	0.17 – assumes that sediment remains on child's skin for 4 hours (achieved in URS assessment by adjusting the USEPA absorption rate of the chemicals from /day to /hour)
Exposure frequency	Beach Area – 40 days per year 2 days per week for 5 warmer months 1 day per fortnight for 7 cooler months 70% of visits occur when tide is low enough to play in affected sediments without sediments being immediately washed off Central Mangrove Area – 20 days per year	Beach area Average case – 73 days per year Maximum case – 195 days per year Mangrove area Average case – 40 days per year Maximum case – 112 days per year Rocky area (older children) Average case – 24 days per year

Exposure Parameter	Value adopted for this assessment	Value adopted in URS 2007
	50% of visits to beach area include time spent in central area of mangroves Western Mangrove Area – 20 days per year 50% of visits to beach area include time spent in central area of mangroves (Professional judgement)	Maximum case – 104 days per year
Bioavailability	Beach Area – 10% Central Mangrove Area – 20% Western Mangrove Area – 100%	100%
Exposure duration	6 years (NEPC 1999 amended 2013b)	4 years
Body weight	15 kg (NEPC 1999 amended 2013b)	13.2 kg

7.3 Sensitivity Analysis

The exposure scenarios outlined in above are viewed to be the most appropriate values to use in establishing screening criteria for each area of the Bay.

To provide further information to support this assessment, a sensitivity analysis has also been undertaken. The main exposure assumptions that could be varied are the number of days children may be present at the site, the area of skin exposed during recreation (without washoff) and the bioavailability of the PAHs. The rest of the assumptions are fairly standard values from the ASC NEPM or already specifically adjusted for sediments.

Increasing the number of days of exposure is not necessarily very relevant for young children, however, it is likely to be more relevant for older children so the same calculations will also be undertaken for older children aged between 5 and 15 years.

The sensitivity analysis will involve the same calculations as outlined in **Section 7.2.5** and **7.2.6** with variations in the assumptions about exposure frequency and bioavailability as outlined in **Table 46**.

Table 46 Exposure Parameters Adopted for Sensitivity Analysis – Ingestion and Dermal Contact with Sediment

Exposure Parameter	Value adopted for sensitivity assessment
Child – 0-5 years	
Exposure Frequency	Beach Area – 40-100 days per year Central Mangrove Area – 20-50 days per year (Professional judgement)
Bioavailability	Beach Area – 10-50% Central Mangrove Area – 20-50%
Skin Surface Area	0.04 + 0.04 + 0.08 + 0.05 m^2 (total 2.1 m^2 or 2100 cm^2) based on the 95th percentile values for skin surface area for lower arms (half of arm value), hands, lower legs (half of leg value) and feet for 2-3 year old (enHealth 2012a)
Child – 5-15 years	
Exposure Frequency	Beach Area – 40-100 days per year Central Mangrove Area – 20-50 days per year (Professional judgement)
Bioavailability	Beach Area – 10-50% Central Mangrove Area – 20-50%
Body Weight	35 kg based on female 8-11 year old (enHealth 2012a)
Exposure Duration	10 years
Skin surface area	540 + 585 cm^2 (total 1125 cm^2) based on the surface area for hands and 75% of feet of 6-11 year old (enHealth 2012a)

7.4 Uncertainties

The quantification of exposure has adopted a number of conservative assumptions as recommended by the ASC NEPM (NEPC 1999 amended 2013a, 1999 amended 2013b). Many of the parameters adopted for RME are considered to be an overestimate of actual exposures of young children.

The values adopted for the purpose of quantifying exposure are point values that are derived from a wide range of physiological or behavioural values that are better defined using a distribution. It is overly complex to present the assessment based on distributions hence the point values identified provide a reasonable approximation of the RME. The overall approach, however, is expected to result in an overestimate of actual exposure.

While not quantified in this assessment, potential exposure and chemical intake by older children and adults will be lower than considered for young children.

Section 8. Toxicity Assessment for Calculating Screening Criteria

8.1 General

The quantitative assessment of potential risks to human health for any chemical requires the consideration of the health end-points and where carcinogenicity is identified; the mechanism of action needs to be understood.

For chemicals that are not carcinogenic, a threshold exists below which there are no adverse effects (for all relevant end-points). The threshold typically adopted in risk calculations (a tolerable daily intake [TDI] or tolerable concentration [TC]) is based on the lowest no observed adverse effect level (NOAEL), typically from animal or human (e.g. occupational) studies, and the application of a number of safety or uncertainty factors. Intakes/exposures lower than the TDI/TC are considered safe, or not associated with an adverse health risk (enHealth 2012b).

Where the chemical has the potential for carcinogenic effects the mechanism of action needs to be understood as this defines the way that the dose-response is assessed. Carcinogenic effects are associated with multi-step and multi-mechanism processes that may include genetic damage, altering gene expression and stimulating proliferation of transformed cells. Some carcinogens have the potential to result in genetic (DNA) damage (gene mutation, gene amplification, chromosomal rearrangement) and are termed genotoxic carcinogens. For these carcinogens it is assumed that any exposure may result in one mutation or one DNA damage event that is considered sufficient to initiate the process for the development of cancer sometime during a lifetime (enHealth 2012b). Hence no safe-dose or threshold is assumed and assessment of exposure is based on a linear non-threshold approach using slope factors or unit risk values.

For other (non-genotoxic) carcinogens, while some form of genetic damage (or altered cell growth) is still necessary for cancer to develop, it is not the primary mode of action for these chemicals. For these chemicals carcinogenic effects are associated with indirect mechanisms (that do not directly interact with genetic material) where a threshold is believed to exist (enHealth 2012b).

Dose-response values (threshold or non-threshold) that are considered relevant to the characterisation of potential health effects associated with exposure to the key chemicals identified have been selected from credible peer-reviewed sources as outlined in (enHealth 2012b) and (NEPC 1999 amended 2013a).

8.2 Identification of Dose-Response Values for CoPCs

8.2.1 Benzo(a)pyrene and PAHs

General

Several comprehensive reviews of polycyclic aromatic hydrocarbons (PAHs) and benzo(a)pyrene (BaP) in the environment and toxicity to humans are available (ATSDR 1995; CCME 2008; WHO 1998).

PAHs are a large group of organic compounds with two or more fused aromatic rings made up of carbon and hydrogen atoms. PAHs are formed from incomplete combustion of organic materials such as processing of coal, crude oil, combustion of natural gas, refuse, vehicle emissions, heating,

cooking and tobacco smoking as well as natural processes including carbonisation. The natural background level is due to PAH production in plant species. Because of such widespread sources, PAHs are present almost everywhere. Food is considered to be the major source of human exposure to PAH due to the formation of PAH during cooking or from atmospheric deposition of PAHs on grains, fruits and vegetables (WHO 1998).

There are several hundred PAHs, including derivatives of PAHs. The best known (and studied) is benzo[a]pyrene (BaP). While there are hundreds of PAHs, typically only 16 individual PAHs are analysed in site contamination investigations. These individual PAHs address a broad range of the equivalent carbon spectrum and are therefore more commonly reported and assessed (WHO 1998).

The major sources of PAHs in soil at any given location invariably contribute a mixture of PAHs, not just single compounds. Various PAH source types can be distinguished based on the characteristic compositions of PAH mixtures and information on the site history, but the contaminated soil matrix is nonetheless challenging from an environmental risk assessment perspective, since in a PAH contaminated soil there is likely to be a diverse compositional range of non-carcinogenic, and carcinogenic PAHs of varying potency (WHO 1998).

The major approach advocated by regulatory agencies such as the NEPC (Fitzgerald, D.J. 1991, 1998; Fitzgerald, D. James et al. 2004; NEPC 1999 amended 2013b), California EPA (CEPA 1999), Netherlands (Baars et al. 2001), the UK Environment Agency (UK DEFRA and EA 2002), Canada (CCME 2008, 2010) and USEPA (USEPA 2014) for assessing the human health risks of PAH-containing mixtures involves the use of “toxicity equivalence factors” (TEFs). This approach relates the toxicity of other (potentially carcinogenic) individual PAHs to that of BaP, the most widely studied carcinogenic PAH.

There are more than a dozen sets of equivalency numbers that have been proposed over the last two decades. The most recent (published final) review of TEFs and their basis, presented by CCME suggests the use of TEFs recommended by the World Health Organization, with minor modifications (CCME 2008, 2010; WHO 1998). This is a scheme based on order of magnitude cancer potency.

Any finer-scale assertions about relative potency for more generic application are hard to justify given the current state of knowledge and confounding influences such as the route of exposure, or non-additive effects in complex PAH mixtures. It is not currently possible to develop different relative potency schemes across different exposure routes (oral, dermal, inhalation), owing to a lack of data. Hence, the TEFs adopted have been applied for all routes of exposure for the carcinogenic PAHs assessed. Application of the TEFs are relevant to the assessment of PAHs that are considered to be carcinogenic. Other PAHs that are not carcinogenic should be assessed separately on an individual basis using a threshold approach.

The following table presents a summary of the TEFs adopted for the assessment of carcinogenic PAHs:

Table 47 TEFs for PAHs (CCME 2010)

PAH	IARC Classification	US EPA Classification	TEF
Benzo(a)anthracene	2B	B2	0.1
Benzo(a)pyrene	1	B2	1
Benzo(b+j)fluoranthene	2B	B2	0.1
Benzo(k)fluoranthene	2B	B2	0.1

PAH	IARC Classification	US EPA Classification	TEF
Benzo(g,h,i)perylene*	3	D	0.01
Chrysene	2B	B2	0.01
Dibenz(a,h)anthracene	2A	B2	1
Indeno(1,2,3-cd)pyrene	2B	B2	0.1

Notes: 1/A= Human Carcinogen, 2A/B2= Probable Human Carcinogen, 2B/C=Possible Human Carcinogen, 3/D= Not classifiable.

* Benzo(g,h,i)perylene included due to positive findings in genotoxicity studies (WHO 1998). Note there are insufficient data available to determine carcinogenicity.

The toxic effects of different PAH compounds in a mixture are additive. Experimental evidence suggests that this is a fair assumption (CCME 2008, 2010; Fitzgerald, D.J. 1991, 1998).

The following relates to the approach used to assess BaP (which can be used for the assessment of BaP alone or for carcinogenic PAHs using the above TEFs).

Dermal Exposures

BaP is suggested to act largely as a point-of-contact carcinogen (Knafla et al. 2006) when dermal exposure occurs rather than via systemic mechanisms. It is, therefore, more appropriate to derive soil guideline values for the dermal route of exposure using a route-specific slope factor, as opposed to considering it on the basis of systemic absorption and use of the oral slope factor.

For most compounds such data are not available, however, for BaP Knafla and coauthors from Health Canada derived a dermal slope factor, normalised to a per unit skin surface area basis, that is relevant to the assessment of BaP in soil in skin (Knafla et al. 2011). The dermal slope factor derived by Knafla et al. was 3.5 $(\mu g/cm^2/day)^{-1}$ and appropriate methods and parameters have been suggested by Knafla et al. (2011) for the use of this factor in the assessment of soil exposures. The dermal slope factor is an extension of previous work published previously by these researchers where a dermal slope factor was derived on the basis of skin carcinogenicity from skin painting studies with mice (Knafla et al. 2006). The revised dermal slope factor (Knafla et al. 2011) considered various factors for interspecies extrapolation, particularly in relation to sensitivity (to tumour development) and differences in epidermal (target tissue) thickness. This dermal slope factor has not yet been adopted for use by other international agencies, however, CCME (CCME 2010) indicate that Health Canada may consider the revised dermal slope factor once published (as occurred in 2011).

Background

Intakes of BaP from sources other than soil have been considered to range from 0.166-1.6 µg/day with intakes derived from food identified as the most significant (Fitzgerald, D.J. 1991). In 2006 the WHO Joint Expert Committee on Food Additives (JECFA) reviewed potential intakes and health effects of PAHs in food. They found that intake of benzo[a]pyrene was on average 0.28 µg/day with a high level intake of 0.7 µg/day (WHO 2006).

Classification

The International Agency for Research on Cancer has classified BaP as 1: human carcinogen (IARC 2010). The US EPA has classified BaP as B2: probable human carcinogen (USEPA 2014).

Toxicity Reference Values

BaP has been shown to be carcinogenic via all routes of exposure. BaP is an indirect carcinogen, that is, its carcinogenicity results from its metabolites, primarily various epoxides, as opposed to BaP itself. Several different types of tumours have been observed as a result of exposure to BaP, although tumour development is closely related to route of administration, i.e., dermal application induces skin tumours and oral administration induces gastric tumours. Exposure to BaP causes disruption to cellular genetic material, in particular, DNA adducts are formed as a result of exposure and BaP is considered to be a genotoxic carcinogen (WHO 1998).

In addition, BaP has been demonstrated to be a skin irritant and dermal sensitiser (WHO 1998).

The USEPA has concluded that BaP (and carcinogenic PAHs assessed on the basis of TEFs) acts via a mutagenic mode of action and recommends that susceptibility associated with early lifetime exposures be addressed. No non-threshold values available for BaP have been derived to specifically address early lifetime susceptibility and hence this issue needs to be addressed when characterising exposure to BaP at a particular site depending on the age of people who may be users of the site (USEPA 2005).

On this basis a peer-reviewed non-threshold reference value is recommended for BaP. The following non-threshold values are available from Level 1 Australian and International sources:

Table 48 Adopted Toxicity Reference Values for PAHs/Benzo[a]pyrene

Source	Value	Basis/Comments
Australian		
ADWG (NHMRC 2011 Updated 2016)	Not available	Current guideline of 0.00001 mg/L is based on the consideration of health effects in relation to the limit of determination for analysis. The assessment provided by the WHO is noted.
OCS	No evaluation available	
International		
WHO (WHO 2011) (WHO 2000) (WHO 2010)	SF = 0.5 $(mg/kg/day)^{-1}$ **UR =8.7x10^{-5} $(ng/m^3)^{-1}$**	A drinking water guideline of 0.0007 mg/L was derived on the basis of an excess lifetime cancer risk of10^{-5} from an oral carcinogenicity study and a two-stage birth-death mutation model. Slope factor has been calculated on the basis of a 70kg adult and consumption of 2 L water per day. Inhalation unit risk derived based on observations in coke oven workers to mixtures of PAHs. It is noted that the composition of PAHs to which coke oven workers are exposed may differ from that present in ambient air, or derived from soil contamination. It is noted that an inhalation UR is in the same order of magnitude as that derived using a linear multistage model associated with lung tumours in a rat inhalation study of coal tar/pitch condensation aerosols.
MfE (MfE 2011)	**SF = 0.233 $(mg/kg/day)^{-1}$**	Review of the carcinogenic reference values available for oral intakes by MfE considered the range of values available and differences in approaches adopted for low dose extrapolation. The application of cross-species scaling appeared to be the most significant factor affecting the cancer potency estimates. While not applying cross-species scaling is consistent with the approach outlined in NHMRC, the MfE review recommended that is is appropriate for BaP (NHMRC 1999). Review of available studies (14 risk estimates using 4 databases) resulted in the calculation of a slope factor based on the geometric mean and scaled allometrically.
UK (UK DEFRA and EA 2002)	Derived index doses from WHO evaluations	Oral index dose derived on the basis of WHO approach and a lifetime cancer risk of 10^{-5}. Inhalation index dose based on WHO approach and adopting an air guideline of 0.25 ng/m^3. The air guideline is equivalent to a lifetime cancer risk of $4x10^{-5}$.
RIVM (Baars et al. 2001)	SF = 0.2 $(mg/kg/day)^{-1}$	Oral SF derived by RIVM based on a chronic oral carcinogenic rat study and linear multistage model. The study considered was more recent than that considered by the WHO. No inhalation assessment is provided by RIVM.
CCME (CCME 2010)	SF = 2.3 $(mg/kg/day)^{-1}$	Oral SF derived from a less than lifetime diet study on inbred CFW-Swiss mice associated with incidence of papillomas and squamous cell carcinomas and linear extrapolation. This is the same study as used by the US EPA in the derivation of

Source	Value	Basis/Comments
		their oral slope factor. The CCME review also noted that dermal exposures and primary oral exposures result in different kinds of cancers. Health Canada is currently reviewing data with respect to the derivation of a dermal cancer slope factor, which may require consideration when peer-reviewed and published. The oral slope factor has been used to derive a soil guideline associated with exposures via oral, dermal and inhalation exposures.
OEHHA (CEPA 1999)	SF = 11.5 $(mg/kg/day)^{-1}$ UR =0.0011 to0.0033 $(ug/m^3)^{-1}$	Oral SF derived using the same model and study as reported by the US EPA (IRIS 2010) and CCME (2008), with the upper end of the range of values adopted by OEHHA. Inhalation UR derived on the basis of respiratory tract tumours in an inhalation study in hamsters and a linearised multistage model.
USEPA (USEPA 2014)	SF = 7.3 $(mg/kg/day)^{-1}$	Oral SF (last reviewed in 1994) derived on the basis of the same study considered by CCME (above) where a range of slope factors were derived (4.5 to 11.7 $(mg/kg/day)^{-1}$). The geometric mean was adopted as the recommended slope factor for derivation of a drinking water guideline. No assessment of inhalation toxicity is available.

The most recent review was conducted by MfE and the methodology used for low dose extrapolation was reviewed (MfE 2011).

There is a wide range of non-threshold reference values available for oral intakes of BaP (and the other carcinogenic PAHs. As noted in Appendix A2 of Schedule B7, a number of variations were considered in the HIL calculations.

The calculations considered the use of a range of different values for some of the assumptions. The different values were presented to the Australian regulators overseeing the ASC NEPM process for their consideration.

The variations included:

- using the standard USEPA approach to assess exposure via dermal contact
- using the Knafla et al. approach as was undertaken in the URS 2007 HHRA
- using the slope factor derived from the WHO drinking water guidelines (0.5 per mg/kg bw/d)
- using the slope factor from the NZ Ministry for the Environment guidance (0.233 per mg/kg bw/d)
- using an age dependent adjustment factor for cancer or not (NEPC 1999 amended 2013b).

A choice was made by Australian regulators as to which set of these variables were to be included in the calculations for the HILs. HILs for low density residential land uses were calculated using 5 different sets of values for the relevant assumptions:

- use of oral TRV from NZ MfE (for both ingestion and dermal contact) and no age dependent adjustment factor
- use of oral TRV from WHO (for both ingestion and dermal contact) and no age dependent adjustment factor
- use of oral TRV from NZ MfE (for both ingestion and dermal contact) with age dependent adjustment factors
- use of oral TRV from WHO (for both ingestion and dermal contact) with age dependent adjustment factors
- use of oral TRV from NZ MfE for ingestion and Knalfa approach for dermal contact) and no age dependent adjustment factor

The resultant guidance values (HIL-A) ranged from 0.3 to 20 mg/kg. The Australian regulators chose 3 mg/kg for use as the conservative, widely applicable guideline. This was on the basis that

while some sites requiring evaluation are former gasworks or other sites with highly bioavailable PAHs, many sites have PAHs present from less bioavailable sources including asphalt and ash.

The ASC NEPM review recommends the use of the MfE slope factor for site-specific risk assessments especially where the source of PAHs is one of these less bioavailable forms (MfE 2011; NEPC 1999 amended 2013b). It also recommends that consideration of whether to adjust for early life stage exposure and dermal exposure be undertaken on a site-specific basis depending on the source of PAHs at the site and the proposed use of the site.

In some parts of Kendall Bay where people have access, the main source of contamination in the surface sediments is weathered coal as discussed in **Section 7.2.2**. The potential risks posed by this type of contamination are similar to that at the majority of sites across Australia for which the HILs for PAHs were developed. Consequently, for this assessment the NZ MfE slope factor has been adopted in line with the ASC NEPM recommendations. The use of an age dependent adjustment factor has been included for all risk calculations across these areas.

There are also some parts of the Bay somewhat accessible to people that have coal tars present at the surface or near surface. In line with the ASC NEPM recommendations, the risks from dermal exposure in this part of the Bay have been assessed using the approach recommended in Knafla et al. (Knafla et al. 2011; Knafla et al. 2006). The age dependent adjustment factors have also been included for the risk calculations in this part of the Bay.

The data available on inhalation exposures are dominated by occupational studies associated with exposure to coke oven emissions or coal tar pitch aerosols. BaP is not volatile and hence the relevance of these studies to the assessment of dust issues derived from contaminated sites is not clear. It is, therefore, recommended that the geometric mean of the oral slope factor (discussed above) be considered for the assessment of all pathways of exposure including inhalation.

Bioaccessibility testing (as discussed in **Section 7.2.3**) was undertaken for the sediments at this site. In the beach area and the central mangrove area, the availability of the PAHs in the sediments is quite low and so the standard USEPA approach to assessing risks from dermal contact via systemic mechanisms is appropriate for use. For the western end of the mangrove area where the highest levels of contamination (and coal tars) are present the Knafla approach is more appropriate.

Summary

On the basis of the discussion above, the following toxicity reference values (TRVs) have been adopted for BaP for this site:

Beach Area and Central Mangrove Area

- Oral TRV (TRV_O) = 0.233 $(mg/kg/day)^{-1}$ (MfE 2011) (dermal and ingestion)
- Dermal absorption factor (DAF) = 0.06 (or 6%) (MfE 2011)
- BaP equivalents to be determined for carcinogenic PAHs using TEFs presented by CCME (CCME 2010)
- Adjustment for early life exposure included
- Bioavailability assumed to be 10% for beach area and 20% for central mangrove area

Western Mangrove Area

- Oral TRV (TRV_O) = 0.233 $(mg/kg/day)^{-1}$ (MfE 2011) (ingestion only)

- Dermal absorption factor (DAF) = 0.06 (or 6%) (MfE 2011)
- BaP equivalents to be determined for carcinogenic PAHs using TEFs presented by CCME (CCME 2010)
- Adjustment for early life exposure included
- Use of Knafla dermal slope factor – 25 $(mg/kg/d)^{-1}$ (Knafla et al. 2006)
- Bioavailability assumed to be 100%

Threshold PAHs

Not all the PAHs are considered to be, or potentially be carcinogenic (and genotoxic) and hence the use of the BaP TRV noted above only relates to the assessment of BaP and the other carcinogenic PAHs. Few toxicological evaluations are available for these PAHs and hence the evaluations and quantitative TRVs provided by the USEPA (IRIS) have been adopted in this assessment, as summarised in **Table 49**.

Table 49 Adopted TRVs for Threshold PAHs (USEPA IRIS)

Threshold PAH	Adopted TRV	Reference
Acenaphthene	Oral TRV = 0.06 mg/kg/day Adopted for all exposure pathways* Background intake = 0% Conversion to inhalation reference concentration using 70 kg body weight and 20 m^3 per day air inhalation – 0.21 mg/m^3	USEPA
Acenaphthylene	No TRV available hence the oral TRV derived for acenaphthene has been adopted as this has been determined to be an appropriate surrogate compound	USEPA
Anthracene	Oral TRV = 0.3 mg/kg/day Adopted for all exposure pathways* Background intake = 0% Conversion to inhalation reference concentration using 70 kg body weight and 20 m^3 per day air inhalation – 1.05 mg/m^3	USEPA
Fluoranthene	Oral TRV = 0.04 mg/kg/day Adopted for all exposure pathways* Background intake = 0% Conversion to inhalation reference concentration using 70 kg body weight and 20 m^3 per day air inhalation – 0.14 mg/m^3	USEPA
Fluorene	Oral TRV = 0.04 mg/kg/day Adopted for all exposure pathways* Background intake = 0% Conversion to inhalation reference concentration using 70 kg body weight and 20 m^3 per day air inhalation – 0.14 mg/m^3	USEPA
Naphthalene	Oral TRV = 0.02 mg/kg/day Inhalation TRV = 0.003 mg/m^3 Background intake = 5%	USEPA
Phenanthrene	No TRV available hence the oral TRV derived for anthracene has been adopted as this has been determined to be an appropriate surrogate compound	USEPA
Pyrene	Oral TRV = 0.03 mg/kg/day Adopted for all exposure pathways* Background intake = 0% Conversion to inhalation reference concentration using 70 kg body weight and 20 m^3 per day air inhalation – 0.105 mg/m^3	USEPA

* Where the oral TRV is adopted for inhalation exposures an inhalation TRV has been calculated on the basis of 20 m^3 air inhaled per day and a body weight of 70 kg (USEPA 2009).

8.3 Uncertainties

In general, the available scientific information is insufficient to provide a thorough understanding of all of the potential toxic properties of chemicals to which humans may be exposed. It is necessary,

therefore, to extrapolate these properties from data obtained under other conditions of exposure and involving experimental laboratory animals. The majority of the toxicological knowledge of chemicals comes from experiments with laboratory animals, although there may be interspecies differences in chemical absorption, metabolism, excretion and toxic response. There may also be uncertainties concerning the relevance of animal studies using exposure routes that differ from human exposure routes. In addition, the necessity to extrapolate results of short-term or sub-chronic animal studies to humans exposed over a lifetime has inherent uncertainty.

With respect to the assessment of key chemicals identified in this assessment, the approach for evaluating risks to mixtures of chemicals assumes dose additivity and does not account for potential synergism, antagonism or differences in target organ specificity and mechanism of action. In general, the additive approach has the effect of overestimating the risks. However, it is noted that the assessment of a range of petroleum related compounds presented in this report have similar toxicological endpoints (rather than the parent compound itself). For these compounds the consideration of cumulative exposure on the basis of additivity is considered appropriate.

Overall the toxicological data presented are considered to be current and adequate for the assessment of risks to human health associated with the potential exposure to the key chemicals identified in groundwater that may move off the site.

Section 9. Calculation of Remediation Criteria

9.1 Quantitative Assessment of Risk

9.1.1 Approach

Risk characterisation is the final step in a quantitative risk assessment. It involves the incorporation of the exposure and toxicity assessment to provide a quantitative evaluation of risk. Risk is characterised separately for threshold and non-threshold carcinogenic effects as outlined in the following:

Threshold Risk

The quantification of potential exposure and risks to human health associated with the presence of key chemicals in surface soil at the site has been undertaken by comparing the estimated intake (or exposure concentration) with the threshold values adopted that represent a tolerable intake (or concentration), with consideration for background intakes. The calculated ratio is termed a Hazard Index (HI), which is the sum of all ratios (termed hazard Quotients [HQ]) over all relevant pathways of exposure. These are calculated using the following equations:

$$Hazard\ \ Quotient\,[HQ]\,(oral\ or\ dermal) = \frac{Daily\ \ Chemical\ \ Intake}{(ADI, TDI, RfD - Background)}$$

$$Hazard\ \ Quotient\,[HQ]\,(inhalation) = \frac{Exposure\ Concentration\ in\ Air}{(TC, RfC - Background)\ or\ \ TWA}$$

$$Hazard\ \ Index\,(HI) = \sum_{All\ pathways} HQ$$

The interpretation of an acceptable HI needs to recognise an inherent degree of conservatism that is built in to the establishment of appropriate guideline (threshold) values (using many uncertainty factors) and the exposure assessment. Hence, in reviewing and interpreting the calculated HI the following is noted:

- A HI less than or equal to a value of 1 (where intake or exposure is less than or equal to the threshold) represents no cause for concern (as per risk assessment industry practice, supported by protocols outlined in ASC NEPM and US EPA guidance (NEPC 1999 amended 2013a; USEPA 1989, 1991)); and
- A HI greater than 1 requires further consideration within the context of the assessment undertaken, particularly with respect to the level of conservatism in the assumptions adopted for the quantification of exposure and the level of uncertainty within the toxicity (threshold) values adopted (NEPC 1999 amended 2013a; USEPA 1989, 1991).

Non-Threshold Risk

Non-threshold carcinogenic risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential non-threshold carcinogen. The numerical estimate of excess lifetime cancer risk is calculated as follows for oral/dermal and inhalation exposures:

Carcinogenic Risk (oral or dermal) = Daily Chemical Intake • Cancer Slope Factor

Carcinogenic Risk (inhalation) = Exposure Concentration in Air • Inhalation Unit Risk

The total non-threshold carcinogenic risk is the sum of the risk for each chemical for each pathway.

For the assessment of contaminated land the ASC NEPM has defined that an acceptable non-threshold carcinogenic risk (as a sum over all non-threshold chemicals and exposure pathways) is $1x10^{-5}$. On this basis a total Target Risk value of $>1 \times 10^{-5}$ has been adopted as indicating conditions that would warrant further assessment. Risks values $\leq 1 \times 10^{-5}$ are considered to be representative of acceptable risks (NEPC 1999 amended 2013a).

9.2 Calculation of Remediation Criteria

Remediation criteria have been determined using the exposure scenarios and assumptions for each of the 3 sections of the southern end of Kendall Bay. The calculations are included in **Appendix B**. The proposed remediation criteria have then been considered for application in the other areas flagged for remediation in the rest of the Bay.

9.2.1 Beach Area

Risks have been backcalculated using the same exposure scenario and assumptions used for young children accessing the beach area.

These criteria are based on children being exposed via incidental ingestion and dermal contact with the sediments on 40 days per year. For incidental ingestion it is assumed that the PAHs are only 10% bioavailable and that dermal uptake is more in line with the standard USEPA approach given the nature of the PAHs in the Beach Area. Using these assumptions, a remediation criteria of 60 mg/kg of benzo[a]pyrene TEQs will result in a risk below $1x10^{-5}$.

Table 50 Proposed Remediation Criteria

Receptor/Exposure Pathway	Proposed Remediation Criteria (mg/kg)	Calculated Non-Threshold Risk at Criteria
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	60	$1x10^{-7}$ $8x10^{-6}$

9.2.2 Central Mangrove Area

Risks have been backcalculated using the exposure scenarios and assumptions for young children visiting the mangroves in the central part of the southern end of Kendall Bay. These criteria are based on such children being exposed via incidental ingestion and dermal contact with the sediments on 20 days per year and assume PAHs are only 20% bioavailable and that dermal uptake is more in line with the standard USEPA approach given the nature of the PAHs in the Central Mangrove Area. Using these assumptions, a remediation criteria of 120 mg/kg of benzo[a]pyrene TEQs will result in a risk below $1x10^{-5}$.

Table 51 Proposed Remediation Criteria

Receptor/Exposure Pathway	Proposed Remediation Criteria (mg/kg)	Calculated Non-Threshold Risk at Criteria
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	120	$5x10^{-7}$ $8x10^{-6}$

9.2.3 Western Mangrove Area

Risks have been backcalculated using the exposure scenarios and assumptions for young children visiting the mangroves in the western end of the mangrove area. These criteria are based on such children being exposed via incidental ingestion and dermal contact with the sediments on 20 days per year and assume PAHs are 100% bioavailable and that dermal uptake is higher due to the nature of the tars and other materials in this part of the Bay so the Knafla approach for assessing potential risks from dermal exposure is more appropriate. Using these assumptions, a remediation criteria of 1 mg/kg of benzo[a]pyrene TEQs will result in a risk below $1x10^{-5}$.

Table 52 Proposed Remediation Criteria

Receptor/Exposure Pathway	Proposed Remediation Criteria (mg/kg)	Calculated Non-Threshold Risk at Criteria
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	1	$2x10^{-8}$ $8x10^{-6}$

9.2.4 Other Parts of Kendall Bay

The additional investigations that have occurred across 2015 and 2016 have been used to clarify the areas to be remediated in the Bay outside of the Southern part of the Bay. The remediation criteria developed to protect human health in the Southern part of the Bay were designed to cover similar types of exposure as would be expected to occur in the other areas of the Bay so the relevant criteria to apply in each of the identified areas to be remediated have been identified. Table 46 shows the relevant criteria for each area.

Table 53 Proposed Remediation Criteria

Location	Site-Specific Remediation Criteria
Southern Remediation Area	
SA1	1 mg/kg
SA2	1 mg/kg
SA3 – western end adjacent to SA1	1 mg/kg
SA3 – rest of mangrove area	120 mg/kg
SA4	60 mg/kg
SA5	60 mg/kg
Northern Remediation Area	
NA1	1 mg/kg
NA2	Area submerged so ecological criteria more relevant
NA3	Area submerged so ecological criteria more relevant

9.3 Sensitivity Analysis

Additional variations on the scenarios described in **Section 7.0** have been undertaken to further inform the development of screening criteria for the design of remediation at the site. The calculations are included in **Appendix B**.

Varying Bioavailability

Varying the assumed bioavailability values does not significantly change the proposed screening criteria as this value is only used in the ingestion calculations. **Tables 54** and **55** illustrate this matter. The ingestion pathway only contributes approximately 10% to the estimated risks.

Table 54 Sensitivity Analysis (Bioavailability) – Beach Area

Receptor/Exposure Pathway	Proposed Remediation Criteria (mg/kg)	Calculated Non-Threshold Risk at Criteria
10% Bioavailability		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	60	$2x10^{-7}$ $9x10^{-6}$
20% Bioavailability		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	60	$5x10^{-7}$ $9x10^{-6}$
30% Bioavailability		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	60	$7x10^{-7}$ $9x10^{-6}$
40% Bioavailability		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	60	$9x10^{-7}$ $9x10^{-6}$
50% Bioavailability		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	60	$1x10^{-6}$ $9x10^{-6}$

Table 55 Sensitivity Analysis (Bioavailability) – Central Mangrove Area

Receptor/Exposure Pathway	Proposed Remediation Criteria (mg/kg)	Calculated Non-Threshold Risk at Criteria
20% Bioavailability		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	120	$5x10^{-7}$ $9x10^{-6}$
30% Bioavailability		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	120	$7x10^{-7}$ $9x10^{-6}$
40% Bioavailability		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	120	$9x10^{-7}$ $9x10^{-6}$
50% Bioavailability		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	120	$1x10^{-6}$ $9x10^{-6}$

Varying Exposure Frequency

Varying the number of days a small child is present at the site does change the proposed screening values as this change affects both the dermal and ingestion pathways. **Tables 56** and **57** illustrate this matter. The value for this parameter used in the primary calculations is 40 days per year for the beach area and 20 days per year for each of the central mangrove and western mangrove areas. For the beach area, this corresponds to 1 visit per week during the warmer months and 1 visit per fortnight for the rest of the year with 70% of those visits happening during low tide which is a relatively high frequency given the nature of the site and the availability of a range of outdoor play locations nearby.

Table 56 Sensitivity Analysis (Exposure Frequency) – Beach Area

Receptor/Exposure Pathway	Proposed Remediation Criteria (mg/kg)	Calculated Non-Threshold Risk at Criteria
Exposure Frequency = 40 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	60	$2x10^{-7}$ $8x10^{-6}$
Exposure Frequency = 60 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	40	$2x10^{-7}$ $8x10^{-6}$
Exposure Frequency = 80 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	30	$2x10^{-7}$ $8x10^{-6}$
Exposure Frequency = 100 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	25	$2x10^{-7}$ $9x10^{-6}$

Table 57 Sensitivity Analysis (Exposure Frequency) – Central Mangrove Area

Receptor/Exposure Pathway	Proposed Remediation Criteria (mg/kg)	Calculated Non-Threshold Risk at Criteria
Exposure Frequency = 20 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	120	$5x10^{-7}$ $8x10^{-6}$
Exposure Frequency = 30 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	85	$5x10^{-7}$ $9x10^{-6}$
Exposure Frequency = 40 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	65	$5x10^{-7}$ $9x10^{-6}$
Exposure Frequency = 50 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	50	$5x10^{-7}$ $9x10^{-6}$

Varying Skin Surface Area

The estimates of skin surface area used in the calculations were based on the mean values listed for hands, feet, legs and arms for a 2-3 year old. **Tables 58** and **59** show the difference in proposed remediation criteria if the 95th percentile values for the skin surface area for these body parts listed in the enHealth Exposure Factors Guide are used instead of the mean values (enHealth 2012a). The change in total skin surface area is not large (1750 to 2100 cm^2 – approx. 15% change).

Table 58 Sensitivity Analysis (Skin Surface Area) – Beach Area

Receptor/Exposure Pathway	Proposed Remediation Criteria (mg/kg)	Calculated Non-Threshold Risk at Criteria
Mean skin surface area		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	60	$2x10^{-7}$ $8x10^{-6}$
95th percentile skin surface area		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	60	$2x10^{-7}$ $1x10^{-5}$

Table 59 Sensitivity Analysis (Skin Surface Area) – Central Mangrove Area

Receptor/Exposure Pathway	Proposed Remediation Criteria (mg/kg)	Calculated Non-Threshold Risk at Criteria
Mean skin surface area		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	60	$2x10^{-7}$ $8x10^{-6}$
95th percentile skin surface area		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	60	$2x10^{-7}$ $1x10^{-5}$

Assuming an older child rather than a young child visits the site

It is more likely that a higher level of visitation would be relevant for an older child rather than one under the age of 5. **Tables 60** and **61** illustrate the results if the calculations are undertaken varying the exposure frequency for an older child.

Table 60 Sensitivity Analysis (Exposure Frequency – Older Child) – Beach Area

Receptor/Exposure Pathway	Proposed Remediation Criteria (mg/kg)	Calculated Non-Threshold Risk at Criteria
Exposure Frequency = 40 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	65	$2x10^{-7}$ $9x10^{-6}$
Exposure Frequency = 60 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	45	$2x10^{-7}$ $9x10^{-6}$
Exposure Frequency = 80 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	33	$2x10^{-7}$ $9x10^{-6}$
Exposure Frequency = 100 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	27	$2x10^{-7}$ $9x10^{-6}$

Table 61 Sensitivity Analysis (Exposure Frequency – Older Child) – Central Mangrove Area

Receptor/Exposure Pathway	Proposed Remediation Criteria (mg/kg)	Calculated Non-Threshold Risk at Criteria
Exposure Frequency = 20 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	130	$4x10^{-7}$ $9x10^{-6}$
Exposure Frequency = 30 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	90	$4x10^{-7}$ $9x10^{-6}$
Exposure Frequency = 40 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	68	$4x10^{-7}$ $9x10^{-6}$
Exposure Frequency = 50 days		
Ingestion of PAHs in sediments Dermal contact with PAHs in sediments	55	$4x10^{-7}$ $9x10^{-6}$

Summary

Changing the assumed values for bioavailability or skin surface area makes little difference to the proposed remediation criteria but changing the exposure frequencies does change these values. While the sensitivity analysis has considered more days of exposure than the primary case, it is also likely that there could be less days of exposure than the primary case which would result in proposed remediation criteria that are higher than the primary case.

It is considered that the most appropriate exposure frequencies are the values used in the primary case calculations.

9.4 Proposed Remediation Criteria

Based on the exposure scenarios outlined in **Section 7** and the toxicity assessment in **Section 8**, remediation criteria have been determined that are protective of human health.

Table 62 Proposed Remediation Criteria

Location	Site-Specific Remediation Criteria
Beach Area	60 mg/kg
Central Mangrove Area	120 mg/kg
Western Corner of Kendall Bay	1 mg/kg

9.5 Application of Proposed Remediation Criteria

The basis of each of these proposed criteria has been assessed to determine the most appropriate criteria to apply in each of the newly identified remediation areas. **Figure 9** shows the locations of each of these areas.

Table 63 Application of Proposed Remediation Criteria for Carcinogenic PAHs

Location	Site-Specific Remediation Criteria
Southern Remediation Area	
SA1	1 mg/kg
SA2	1 mg/kg
SA3 – western end adjacent to SA1	1 mg/kg
SA3 – rest of mangrove area	120 mg/kg
SA4	60 mg/kg
SA5	60 mg/kg
Northern Remediation Area	
NA1	1 mg/kg
NA2	Area submerged so ecological criteria more relevant
NA3	Area submerged so ecological criteria more relevant

9.5.1 Application of 1 mg/kg Criterion

It is proposed that the most stringent criterion is applied to areas with coal tars at or near the surface. This includes SA1, SA2, and NA1.

The RAP for the project outlines the intended remediation to be undertaken in SA1, SA2 and NA1. It includes in-situ stabilisation and capping.

9.5.2 Application of 60 and 120 mg/kg Criteria

Western edge of SA3

In the western end of the mangroves, there are several sites where the levels of PAHs exceed the adopted Human Health criteria of 1 mg/kg. Some of these are in Remediation area SA1 and will be remediated using in situ solidification. Several others are located in the western end of Remediation Area SA3 (such as sampling locations 16 and 23) but the highest levels in these areas are covered by the mangrove root mass which in this area can reach half a metre in depth.

The driver of risk in the calculation of the remediation criteria is dermal contact with the contaminated materials. It is assumed that a child may be come into direct contact with the sediments 20 days per year for 6 years in this part of the Bay and on each occasion lower arms,

hands, lower legs and feet will be covered by the sediments. If such contact is prevented by the mangrove root mass or is, at least, greatly reduced due to the physical difficulty in reaching the contaminated materials, then the risk is much reduced and compliance with the remediation criteria is not strictly required.

Given the thickness of the overlaying dense root mat, the risk of human exposure in this western end of SA3 is deemed to be low and hence the adopted treatment in this area is to leave the mangrove root mass in place and ensure that any materials on the surface of the root mass are cleaned of any coke and coal washed onto the surface of the area as discussed below.

Rest of SA3, SA4 and SA5

The beach area and central mangrove area can be applied to the majority of SA3 as well as SA4 and SA5.

The RAP for the project outlines the intended remediation to be undertaken in SA3, SA4 and SA5. It is intended that all surface rubbish and weathered coal contamination will be removed to a nominal depth of 0.2 -0.3 m. The stormwater drain will be reengineered to better manage flow. Clean sand will be brought in to nourish all these areas and to provide a sufficient capping layer. As a result, little material currently at the surface will remain at the surface after the remediation is complete.

9.5.3 Remaining Areas

None of the health-based criteria need to be applied in areas NA2 and NA3 as these areas are submerged at all times and are not readily accessible to people. If people do access these areas, then any materials will be washed off immediately minimising any potential for dermal exposure. Remediation in these areas should be based on the ecological criteria developed by the CSIRO.

9.6 Uncertainties

Uncertainty in any assessment refers to a lack of knowledge (that could be better refined through the collection of additional data or conduct of additional studies) and is an important aspect of the risk assessment process. An assessment of uncertainty is a qualitative process relating to the selection and rejection of specific data, estimates or scenarios within the risk assessment. In general, to compensate for uncertainty, conservative assumptions are often made that result in an overestimate rather than an underestimate of risk.

In general, the uncertainties and limitations of the risk assessment can be classified into the following categories, where uncertainties relevant to each have been addressed within the report (as noted):

- Toxicological assessment (addressed in **Section 8.3**)
- Exposure assessment (addressed in **Section 7.4**).

A detailed sensitivity analysis has been undertaken as outlined in **Section 7.3** with results reported in **Section 9.3**.

Section 10. Consideration of Emissions During Remediation

10.1 General

Todoroski Air Sciences was commissioned to undertake air dispersion modelling to estimate odours and ambient air concentrations of PAHs and other chemicals that may be emitted from an excavation surface during remediation works on the sediments in Kendall Bay (Todoroski Air Sciences 2018). The full report is included in **Appendix D**.

The work involved odour measurements using flux hoods, modelling odour dispersion and release of individual chemicals (using the maximum concentrations reported in sediments across Kendall Bay) using appropriate air dispersion models and relevant meteorological information.

10.2 Odour Modelling

A full description of the odour monitoring and modelling is provided in Todoroski Air Sciences (2018) (See **Appendix D**).

The measurement of odour flux and air dispersion modelling has allowed the prediction of odour concentrations in each remediation area.

Odour monitoring was undertaken using flux hoods on the surface of the sediments. These measurements were taken on 15-16 February and 9-10 March 2016. The locations of each sample are shown in **Diagram 1**. The results for the odour measurements are provided in **Table 64**.



Diagram 1 Odour Sampling Locations

Table 64 Results for Odour Monitoring

Sample ID	Sample Location	Sample Type	Specific odour emission rate (SOER) (OU.m^3/m^2/s)
15201A	Southern	Water surface	0.099
16206A	Southern	Shoreline – undisturbed	0.1
16207A	Southern	Shoreline – disturbed	0.46
09303A	Southern	Sediment	1.3
09304A	Southern	Sediment	0.59
09305A	Southern	Sediment	0.3
09306A	Southern	Sediment	3.4
09307A	Southern	Sediment	0.25
15203B	Northern	Sediment	3.1
15202Bw	Northern	Water surface	0.17
15204Bw	Northern	Water surface	0.26
15205B	Northern	Sediment	0.43
9301B	Northern	Sediment	0.93
9302B	Northern	Sediment	2.0
09308B	Northern	Sediment	0.16
10309B	Northern	Sediment	8.9
10310B	Northern	Sediment	8.1

These emission rates (maximum and average) were then used in the air dispersion modelling to estimate odours likely at sensitive receptors.

The odour modelling has been undertaken on the basis that contaminated sediments will be brought to the surface and moved into skip bins which, when full, will be moved to the treatment area. It has been assumed while the materials are stored in the skip bins on a barge in the remediation areas the sediments will be exposed to the air and odours may be emitted. The modelling assumes that a surface area of 400 m^2 of sediments may be exposed and available for odours to be emitted – i.e. an area of 20 m x 20 m.

The preferred remediation approach now includes less bulk sediment excavation and an increase in the use of in-situ stabilisation. This will significantly reduce the potential for odours to be released from the sediments as much smaller amounts of the sediments will be exposed at the surface at any time. In fact, it is now proposed that, while a number of skip bins (2 m^3) will be present on a barge close to the excavator, only one bin will be uncovered at any particular time. Lids will be placed on each bin. They will only be removed while that particular bin is being filled with material and then the lid will be replaced. It is expected that a bin could take an hour to fill.

Using the worst-case assumptions about exposed material and assuming worst-case meteorological conditions, the estimated odour units at each receptor are listed in **Table 66**. **Diagram 2** shows the receptor locations used in the modelling.

The NSW EPA provide assessment criteria for odour to use in evaluation the potential for odours from an activity. **Table 65** lists these criteria.

Table 65 Odour Assessment Criteria (NSW DEC 2006)

Population of Affected Community	Odour Assessment Criteria (OU odour units)
Rural 1 residence (i.e. approx. 2 people)	7
Rural ~10 people	6
Rural ~30 people	5
Rural ~125 people	4
Rural ~500 people	3
Urban >2000 people and/or schools/hospitals	2

The odour assessment criteria relevant for use at Kendall Bay is the urban criteria. This means odours from the remediation works need to be managed to keep them below 2 odour units at any residences.

Diagrams 3 to **6** provide predicted ground level odour concentrations in relation to the worst case and average case meteorological conditions/measured odours from the modelling.



Diagram 2 Sensitive receptor locations assessed in this study

Table 66 99th percentile nose-response average ground level odour concentrations (OU)

Receptor ID	Excavations in Southern Remediation Area		Excavations in Northern Remediation Area		Criteria
	Maximum	Average	Maximum	Average	
Staging Area					
R1	0.0	0.0	0.0	0.0	2
R2	0.0	0.0	0.0	0.0	2
R3	0.0	0.0	0.1	0.0	2
R4	0.0	0.0	0.0	0.0	2
R5	0.0	0.0	0.0	0.0	2
Northern Remediation Area					
R6	0.1	0.0	0.3	0.2	2
R7	0.1	0.0	0.4	0.2	2
R8	0.1	0.0	0.7	0.3	2
R9	0.1	0.0	0.9	0.3	2
R10	0.1	0.0	1.0	0.3	2
R11	0.1	0.0	1.2	0.4	2
R12	0.1	0.0	0.4	0.1	2
R13	0.1	0.0	0.3	0.1	2
R14	0.1	0.0	0.2	0.1	2
R15	0.1	0.0	0.1	0.1	2
R16	0.1	0.0	0.1	0.0	2
R17	0.1	0.0	0.1	0.0	2
R18	0.1	0.0	0.1	0.0	2
Southern Remediation Area					
R19	0.4	0.1	0.1	0.0	2
R20	0.7	0.2	0.1	0.0	2
R21	0.4	0.1	0.1	0.0	2
R22	0.5	0.2	0.1	0.0	2
R23	0.7	0.2	0.1	0.0	2
R24	1.5	0.4	0.1	0.0	2
R25	2.0	0.6	0.2	0.1	2
R26	0.0	0.0	0.0	0.0	2
R27	0.0	0.0	0.1	0.0	2
R28	0.0	0.0	0.0	0.0	2



Diagram 3 **Predicted 99th percentile nose response average ground level odour concentrations (Southern Remediation Area) (Maximum)**



Diagram 4 **Predicted 99th percentile nose response average ground level odour concentrations (Southern Remediation Area) (Average)**



Diagram 5 **Predicted 99th percentile nose response average ground level odour concentrations (Northern Remediation Area) (Maximum)**



Diagram 6 **Predicted 99th percentile nose response average ground level odour concentrations (Northern Remediation Area) (Average)**

These odour unit estimations are based on emissions from 400 m^2 of exposed sediments. Even in the worst-case situation where the maximum measured odour is emitted from all of the exposed surface (400m^2), the modelling shows that the odour assessment criteria of 2 odour units will be complied with at all sensitive receptors when excavations are occurring in either remediation area.

Using these assumptions about exposed material, it is predicted that the works will also be in compliance with the odour assessment criteria at all sensitive receptors for works in either remediation area under average conditions.

The odour modelling is likely to have overestimated potential odours for the following reasons:

- Contaminated materials will not be exposed to the air while stored in skip bins on the barge while remediation continues through a day as each skip bin will be fitted with a close fitting lid immediately after filling is complete.
- This means that the surface area where contaminated material could be exposed to air will be much smaller than 400 m^2 as it will be limited to the material in the back hoe bucket during the small amount of time between the bucket leaving the water in the Bay and the material in the bucket being deposited in the skip bins (under the water in bin where possible) and any spills of material onto the barge. Using a smaller surface area will lead to a smaller odour footprint.
- The worst case meteorological conditions (i.e. most still) occur at night and no excavation or other works will be occurring during the night for the life of the project.
- Housekeeping will occur at the end of each day to ensure all equipment that is not returned to the treatment building will be wiped clean of any spills of contaminated sediments before work is completed each day.
- The modelling assumed the worst case measured odour emission rates from the various locations occurred across the whole 400 m^2 modelled as an emitting surface. Much of the area to be remediated is likely to have lower rates of odour emission as the concentrations of gasworks chemicals in the sediments vary across the areas to be remediated and are lower in many areas.

As a result, it is expected that, while odours are likely to be detected while works are occurring, they should be at low levels under most meteorological conditions. Further measures for odour control will be considered as final plans for the methods to be used for remediation are finalised.

The length of time works will be occurring in the most affected areas will be an important parameter to understand to assist in determining what control measures will be required and for how long they will be needed. Advice on the length of time odours may be elevated (i.e. few days versus few weeks) will be an important matter to communicate to the residents.

10.3 Speciated Chemical Modelling

Todoroski Air Sciences also predicted the potential concentrations of individual chemicals at relevant locations. The modelling was based on emission rates for each chemical based on the worst concentrations of each chemical reported in the sediments This approach is based on evaporation of chemicals from soil and so is likely to overestimate the potential evaporation of such chemicals from wet sediments as the water covering the sediments will limit evaporation (Todoroski Air Sciences 2018).

The key volatile pollutants reported to be present in the sediments across this investigation are benzene, toluene, ethylbenzene and xylenes. These chemicals are common urban air pollutants as they are present in vehicle fuels and are emitted during combustion (vehicles, fires, gas cooking etc). They have a sufficiently high vapour pressure that they may be emitted/released from the wet sediments as they are moved around during the excavations. Other pollutants reported to be present in the sediments, like PAHs or metals, do not have the characteristics that would result in them being released from the sediments during movement/remediation.

The emission rate for each of these chemicals was based on the average concentration of the chemical in the sediments across the remediation areas. It was assumed that the amount of the chemical in the sediment could be released over the 1 hour handling period where a bin may have exposed sediments. **Table 67** lists the sediment concentrations and the estimated emission rates.

Table 67 Estimated emission rates for key chemicals

Chemical	Sediment Concentration (mg/kg)	Emission Rate (g/s)
Benzene	0.8	0.00061
Toluene	1.5	0.0011
Ethylbenzene	1.4	0.0011
m,p-Xylene	2.7	0.0021
o-Xylene	1.6	0.0013

Using these estimated emission rates and the air dispersion modelling, concentrations for each of these chemicals have been estimated for each remediation area (see **Table 68**).

Table 68 Maximum Air Concentrations Estimated at the Footpath

Chemical	Emission Rate (g/s)	Southern Remediation Area (µg/m^3)	Northern Remediation Area (µg/m^3)	Averaging Period	Criteria
Benzene	0.00061	0.9	0.7	1 hour	29
Toluene	0.0011	1.7	1.4		360
Ethylbenzene	0.0011	1.6	1.3		800
m+p-Xylene	0.0021	3.2	2.5		190
o-Xylene	0.0013	1.9	1.5		190

These worst case predicted concentrations (based on a 1 hour averaging period) can then be compared to conservative long term air quality criteria to determine if any are likely to be present at concentrations that might be of concern. With respect to the assessment of these predicted ambient air concentrations, the following guidelines have been adopted for the purpose of screening:

- **ASC NEPM Toxicity Profiles (Schedule B7).** The ASC NEPM (1999) provides a summary of toxicity information used to create the risk-based Health Investigation and Screening Levels (HSLs). These summaries include inhalation reference concentrations or oral toxicity values which can be converted into inhalation reference concentrations assuming these conservative default parameter values – body weight 70 kg and inhalation rate of 20 m^3 per day (NEPC 1999 amended 2013b).
- **CRC CARE (2013).** Appendix C of the Petroleum Hydrocarbon Vapour Intrusion Guidance provides details of ambient air guidelines and odour thresholds for petroleum hydrocarbons (CRC CARE 2013).

There is limited availability of odour thresholds for many of these chemicals. Odour thresholds are also based on the odours when just the chemical being tested is evaluated. In the case of these

sediments, there is a complex mixture of chemicals present that will change the concentrations at which odours will be detected.

Comparison of the modelled concentrations that could occur during the remediation with guidelines for life time exposure or odours is provided in **Table 69**.

Table 69 Screening Assessment – Ambient Air Concentrations (Modelled)

Chemical	Maximum Estimated Concentration (µg/m^3) (1 hour averaging period)	Screening Guideline – Health (µg/m^3) (averaged over a lifetime)	Screening Guideline – Odour (µg/m^3)	In Compliance with Guidelines (Y/N?)
Benzene	0.9	1.7[C]	8700[C]	✓
Toluene	1.7	5000[C]	640[C]	✓
Ethylbenzene	1.6	260[C]	740[C]	✓
m+p-Xylene	3.2	870[C]	180[C]	✓
o-Xylene	1.9			

Notes:

[N] = ASC NEPM inhalation toxicity reference values listed in Schedule B7 Appendix A1 or converted to inhalation value from oral toxicity reference value assuming standard defaults of 70 kg person and 20 m^3 air inhaled per day (NEPC 1999 amended 2013b)

[C] = CRC CARE Petroleum Vapour Intrusion Guidance (CRC CARE 2013)

The conservative modelling that has been undertaken has estimated that the concentrations for each of the chemicals will be very low even with 400 m^2 of exposed contaminated sediments during remediation and the worst case meteorological conditions for dispersion. These worst-case estimated concentrations are all well below the health based ambient air guidelines which are based on breathing air containing that concentration all day long for a lifetime. This remediation project will only occur for a limited time, so these guidelines are conservative.

In regard to odour, it is difficult to demonstrate that these chemicals will be below concentrations where odours can be detected due to the limited availability of odour thresholds and the fact that a mixture of chemicals is present in the sediments and will be present in the air. Estimating odours for a mixture from odour thresholds for individual chemicals does not work effectively. The odour measurement and modelling described in **Section 10.2** was undertaken because of this difficulty. As noted above, odours from these works are likely under worst case meteorological conditions and so a number of odour controls are already proposed and more will be added if needed. A trial bulk sediment excavation project has been proposed which will assist in assessing the need for additional odour control measures.

10.4 Air Monitoring During Bulk Sediment Trial (September 2016)

The bulk sediment excavation trial proposed in **Section 10.3** was undertaken in September 2016. The results of odour and air emissions monitoring undertaken during the trial excavation are reported in SGS (2016) and Ektimo (2016). The trial was undertaken in the Northern Remediation Area in the vicinity of sediments that were known to be highly odorous. These reports are provided in **Appendix E**.

10.4.1 Odour Monitoring

Ektimo were engaged to undertake odour sampling downwind of the barge where excavation was occurring on 22 September 2016. Odour monitoring was undertaken in accordance with the relevant methods in the NSW EPA/OEH *Approved Methods for the Sampling and Analysis of Air Pollutants*

in New South Wales, January 2007 (i.e. OM-7). The monitoring was undertaken in duplicate (Ektimo 2016).

Table 70 Odour Monitoring – Bulk Sediment Excavation Trial

Parameter	Test 1	Test 2
Hedonic Tone	Neutral	Neutral
Odour Character	Salty	Salty

The sampling was undertaken in a location approximately 20 m down wind of the excavation barge. On the day of the trial the wind was west to west northwest which meant the downwind location was on the water. A boat was used to undertake the sampling and it was moved to maintain the downwind location during the sampling period. The boat used did not have an outboard motor to minimise any potential interference (SGS 2016, Ektimo 2016).

An odour was detected in the sample from one of the tests but not from the other. The character of the odour was that of salty water with a neutral hedonic tone so is likely to have been due to the location where the sample was collected (on the river) rather than the excavation trial.

10.4.2 Air Quality Monitoring

SGS was engaged to undertake more chemical-specific air quality monitoring during the trial. On the day the wind direction was determined to allow choice of up and down wind sampling locations. The upwind site was the shoreline in front of the Breakfast Point residences adjacent to the Northern Remediation Area. The downwind site was on the water and sampling was conducted from a boat (SGS 2016).

Samples were collected upwind and downwind to measure VOCs, TPH fractions and PAHs. Field measurements for total VOCs, lower explosive limit (LEL), H_2S, and windspeed/direction were also collected. Samples for TPH fractions and VOCs were sampled in accordance with USEPA TO15 with one set of samples collected over 8 hours (using regulator) at each location. A duplicate sample was collected at the shoreline over 8 hours. A grab sample was also collected in the downwind location using a TO15 canister. For PAHs, samples were collected onto an XAD resin tube using NIOSH method 5506. Air was drawn through the tubes using SKC PCXR sampling pumps and relevant low flow adaptors (SGS 2016).

Passive sampling devices for VOCs were also deployed in the upwind location as close as possible to the adjacent residences (SGS 2016).

For the field measurements, the following equipment was used:

- PID – MiniRAE 3000 PID (total VOCs)
- Gas detector – Impact Pro Multi-Gas Detector (LEL, H_2S)
- Anemometer - Kestrel 1000
- Weather station – IC0346 Wireless Weather Station

Field Results

The field measurements reported no detections for total VOCs, explosive gases or hydrogen sulfide at any location during the trial.

Table 71 Downwind Field Measurements – Bulk Sediment Excavation Trial

Parameter	First Down Wind Location		Second Down Wind Location			Third Down Wind Location	
Time	10:20	10:40	11:15	11:30	11:40	13:20	13:40
Wind Speed (m/s)	3.8	2.8	2.0	1.2	5.2	3.8	2.8
Wind Direction	WNW	W	WNW	W	SW	WNW	W
PID (total VOCs) ppm	0	0	0	0	0	0	0
LEL	0	0	0	0	0	0	0
H_2S	0	0	0	0	0	0	0

Table 72 Static Shoreline Field Measurements – Bulk Sediment Excavation Trial

Parameter	Static Shoreline Location											
Time	9:45	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00	13:30	13:45	14:00
Wind Speed (m/s)	1.5	1.0	0	0.5	0.5	2.0	1.0	0.5	2.0	3.0	0	2.5
Wind Direction	NNE	NNE	Still	NNE	NE	E	E	E	NE	WSW	Still	SW
PID (total VOCs) ppm	0	0	0	0	0	0	0	0	0	0	0	0
LEL	0	0	0	0	0	0	0	0	0	0	0	0
H_2S	0	0	0	0	0	0	0	0	0	0	0	0

Table 73 Field Measurements (Excavation Barge) – Bulk Sediment Excavation Trial

Parameter	Minimum	Maximum
Temperature (ºC)	17.1	21.9
Wind Speed (m/s)	3.4	8.8 (gusts)

Analytical Results – Active Sampling Methods

SGS (2016) and SGS Analytical Report No. M161846 provide the results for this testing. Almost no VOCs were detected. **Tables 74** and **75** list the results.

Table 74 Air Quality Results (Active Sampling) (µg/m^3) – Bulk Sediment Excavation Trial

Analyte	Shoreline (8 Hour)	Shoreline (8 Hour) Duplicate	Down Wind (8 Hour)	Down Wind (Grab)
Acrolein	<4.3	<4.7	<9	<2.9
Acrylonitrile	<11	<12	<23	<7.4
tert-Amyl Methyl Ether	<3.7	<4.1	<7.7	<2.5
Benzene	<3.1	<3.4	<6.4	<2.1
Bromodichloromethane	<6.2	<6.8	<13	<4.1
Bromoform	<7.4	<8.1	<15	<5
Bromomethane	<5.6	<6.1	<12	<3.7
1,3-Butadiene	<1.9	<2	<3.9	<1.2
2-Butanone (Methyl Ethyl Ketone)	<3.1	<3.4	<6.4	<2.1
tert-Butyl Alcohol	<3.1	<3.4	<6.4	<2.1
n-Butylbenzene	<5	<5.4	<10	<3.3
sec-Butylbenzene	<5	<5.4	<10	<3.3
tert-Butylbenzene	<5	<5.4	<10	<3.3
Carbon Tetrachloride	<6.2	<6.8	<13	<4.1
Chlorobenzene	<3.7	<4.1	<7.7	<2.5
Chloroethane	<3.7	<4.1	<7.7	<2.5
Chloroform	<5.6	<6.1	<12	<3.7
Chloromethane	<4.3	<4.7	<9	<2.9
2-Chloroprene	<6.8	<7.4	<14	<4.5
3-Chloropropene	<4.3	<4.7	<9	<2.9
2-Chlorotoluene	<5.6	<6.1	<12	<3.7
alpha-Chlorotoluene	<4.3	<4.7	<9	<2.9
Cumene	<5	<5.4	<10	<3.3

Analyte	Shoreline (8 Hour)	Shoreline (8 Hour) Duplicate	Down Wind (8 Hour)	Down Wind (Grab)
Cyclohexane	<2.5	<2.7	<5.1	<1.7
o-Cymene	<5	<5.4	<10	<3.3
Dibromochloromethane	<7.4	<8.1	<15	<5
1,2-Dibromoethane (EDB)	<7.4	<8.1	<15	<5
1,2-Dichlorobenzene	<8	<8.8	<17	<5.4
1,3-Dichlorobenzene	<8	<8.8	<17	<5.4
1,4-Dichlorobenzene	<8	<8.8	<17	<5.4
1,1-Dichloroethane	<4.3	<4.7	<9	<2.9
1,2-Dichloroethane	<6.2	<6.8	<13	<4.1
1,1-Dichloroethene	<3.7	<4.1	<7.7	<2.5
cis-1,2-Dichloroethene	<5	<5.4	<10	<3.3
trans-1,2-Dichloroethene	<3.7	<4.1	<7.7	<2.5
1,2-Dichloropropane	<11	<12	<23	<7.4
cis-1,3-Dichloropropene	<3.7	<4.1	<7.7	<2.5
trans-1,3-Dichloropropene	<4.3	<4.7	<9	<2.9
Diisopropyl Ether	<4.3	<4.7	<9	<2.9
1,4-Dioxane	<3.7	<4.1	<7.7	<2.5
Ethyl Acetate	<5	<5.4	<10	<3.3
Ethyl Benzene	<3.7	<4.1	<7.7	<2.5
Ethyl tert-Butyl Ether	<3.1	<3.4	<6.4	<2.1
4-Ethyltoluene	<3.7	<4.1	<7.7	<2.5
Freon 11	<1.9	<2	<3.9	<1.2
Freon 113	<6.2	<6.8	<13	<4.1
Freon 114	<1.9	<2	<3.9	<1.2
Freon 12	<2.5	<2.7	<5.1	<1.7
Heptane	<4.3	<4.7	<9	<2.9
Hexachlorobutadiene	<12	<14	<26	<8.3
Hexane	<3.7	<4.1	<7.7	<2.5
2-Hexanone	<3.7	<4.1	<7.7	<2.5
m,p-Xylene	<8	<8.8	<17	<5.4
Methyl Methacrylate	<4.3	<4.7	<9	<2.9
Methyl tert-butyl ether	<3.7	<4.1	<7.7	<2.5
4-Methyl-2-pentanone	<3.7	<4.1	<7.7	<2.5
Naphthalene	<13	<14	<27	<8.7
2-Propanol (Isopropyl alcohol)	**230**	**180**	<130	<41
Propene	<6.2	<6.8	<13	<4.1
Propylbenzene	<4.3	<4.7	<9	<2.9
Styrene	<3.7	<4.1	<7.7	<2.5
1,1,1,2-Tetrachloroethane	<6.2	<6.8	<13	<4.1
1,1,2,2-Tetrachloroethane	<4.3	<4.7	<9	<2.9
Tetrachloroethene	<6.8	<7.4	<14	<4.5
Tetrahydrofuran	<2.5	<2.7	<5.1	<1.7
Toluene	<3.7	<4.1	**7.7**	**3.8**
1,2,4-Trichlorobenzene	<22	<24	<46	<15
1,1,1-Trichloroethane	<5	<5.4	<10	<3.3
1,1,2-Trichloroethane	<5	<5.4	<10	<3.3
Trichloroethene	<2.5	<2.7	<5.1	<1.7
1,2,4-Trimethylbenzene	<5	<5.4	<10	<3.3
1,3,5-Trimethylbenzene	<3.7	<4.1	<7.7	<2.5
2,2,4-Trimethylpentane	<5.6	<6.1	<12	<3.7
Vinyl Acetate	<4.3	<4.7	<9	<2.9
Vinyl Bromide	<5	<5.4	<10	<3.3
Vinyl Chloride	<2.5	<2.7	<5.1	<1.7
o-Xylene	<3.7	<4.1	<7.7	<2.5
TRH Aromatic EC5-7	<3.1	<3.4	<6.4	<2.1
TRH Aromatic EC>7-8	<3.7	<4.1	**7.7**	**3.8**
TRH Aromatic EC>8-10	<120	<140	<260	<83

Analyte	Shoreline (8 Hour)	Shoreline (8 Hour) Duplicate	Down Wind (8 Hour)	Down Wind (Grab)
TRH Aromatic EC>10-12	<120	<140	<260	<83
TRH Aliphatic EC5-6	<120	<140	<260	<83
TRH Aliphatic EC>6-8	<120	<140	<260	<83
TRH Aliphatic EC>8-10	<120	<140	<260	<83
TRH Aliphatic EC>10-12	<120	<140	<260	<83

Table 75 Air Quality Results (XAD Tube) (µg/m^3) – Bulk Sediment Excavation Trial

Analyte	Shoreline (8 Hour)	Shoreline (8 Hour) Duplicate	Down Wind (8 Hour)
Acenaphthene	<3	<3	<0.7
Acenaphthylene	<3	<3	<0.7
Anthracene	<3	<3	<0.7
Benzo(a)anthracene	<3	<3	<0.7
Benzo (a) pyrene	<3	<3	<0.7
Benzo (b) fluoranthene	<3	<3	<0.7
Benzo (ghi) perylene	<3	<3	<0.7
Benzo (k) fluoranthene	<3	<3	<0.7
Chrysene	<3	<3	<0.7
Dibenz (ah) anthracene	<3	<3	<0.7
7,12-Dimethylbenz(a)anthracene	<3	<3	<0.7
Fluoranthene	<3	<3	<0.7
Fluorene	<3	<3	<0.7
Indeno (1,2,3-cd) pyrene	<3	<3	<0.7
3-Methylcholanthrene	<3	<3	<0.7
Naphthalene	<3	<3	<0.7
Phenanthrene	<3	<3	<0.7
Pyrene	<3	<3	<0.7

Isopropanol (2-propanol) was detected in the shoreline samples.

Isopropanol is used to check for leaks in the sampling equipment and for other purposes around a laboratory. It is likely this detection is due to some part of the sampling procedure rather than actually being found in the air at the site.

Toluene was detected in the downwind samples.

Toluene is a common urban air contaminant, as discussed above. It is derived from combustion of fuel and a range of other sources (like paints and surface finishes). In a 5 year monitoring program in Sydney undertaken by the NSW EPA/OEH (and predecessors) toluene was detected in >90% of samples taken across the 5 sites being investigated including Sydney CBD. Toluene ranged from 4 to 40 µg/m^3 at the Sydney CBD site, from 1 to 60 µg/m^3 at the Rozelle site, from 1 to 12 µg/m^3 at St Marys and Wollongong site and 1 to 24 µg/m^3 at the Newcastle site (NSW DEC 2004). CRC CARE (2013) also reports similar concentrations of toluene in urban air in Sydney, Melbourne and Brisbane (CRC CARE 2013). The concentrations detected during the trial at this site are well within the normal range for air in Sydney (<10 µg/m^3) and so are not reflective of any emissions from the excavation trial.

TRH EC7-8 (aromatic) was the only other contaminant reporting a detection above the limit of reporting but this fraction includes toluene so this detection just reflects the detection of toluene.

No other contaminants were detected above the limit of reporting in these samples, including the PAHs present in gasworks waste.

Analytical Results – Passive Sampling Method

The results for the Radiello passive samplers support the USEPA TO15 results. The only contaminant that was reported was toluene. It was detected at a similar concentration to the USEPA TO15 results and, as discussed above, is a common urban air contaminant at this sort of concentration.

Table 76 Air Quality Results (Passive Sampling) (µg/m^3) – Bulk Sediment Excavation Trial

Analyte	Shoreline	Shoreline Duplicate
Benzene	<3.8	<3.8
Bromochloromethane	<4.4	<4.4
Butanol	<4.2	<4.2
2-Butoxyethanol	<5.5	<5.5
Butyl Acetate	<5.1	<5.1
Carbon Tetrachloride	<4.6	<4.6
Chlorobenzene	<4.5	<4.5
Chloroform (trichloromethane)	<4.1	<4.1
Cyclohexane	<5.7	<5.7
Cyclohexanone	<4.5	<4.5
n-Decane	<7.2	<7.2
1,4-Dichlorobenzene	<6	<6
1,2-Dichloroethane	<4	<4
1,2-Dichloropropane	<4.7	<4.7
Ethyl Acetate	<3.9	<3.9
Ethyl Benzene	<4.5	<4.5
2-Ethylhexanol	<7.2	<7.2
Ethyl tert-Butyl Ether	<5	<5
Heptane	<5.3	<5.3
Hexane	<4.7	<4.7
Isobutanol	<4	<4
Isooctane (2,2,4-Trimethylpentane)	<5.6	<5.6
Isopropylbenzene	<5.3	<5.3
1-Methoxy-2-propanol	<5.6	<5.6
1-Methoxy-2-propyl acetate	<5.1	<5.1
Methyl Methacrylate	<4.5	<4.5
Methylcyclohexane	<4.7	<4.7
Methylcyclopentane	<4.4	<4.4
Methylethylketone	<3.9	<3.9
Methylisobutylketone	<4.6	<4.6
2-Methylpentane	<4.4	<4.4
3-Methylpentane	<4.4	<4.4
Methyl tert-butyl ether	<4.7	<4.7
Naphthalene	<12	<12
n-Nonane	<6.4	<6.4
n-Octane	<5.8	<5.8
n-Propylbenzene	<5.4	<5.4
Styrene	<5	<5
Tetrachloroethene	<5.2	<5.2
Toluene	**4.2**	**4.6**
1,1,1-Trichloroethane	<5	<5
Trichloroethene	<4.5	<4.5
1,2,4-Trimethylbenzene	<6.2	<6.2
n-Undecane	<13	<13
m+p-Xylene	<4.7	<4.7
o-Xylene	<4.4	<4.4

10.4.3 Summary

The results from the bulk sediment excavation trial confirm the previous modelling undertaken for the remediation works in regard to odour and volatilisation of chemicals. It is not expected that any individual chemicals are likely to be present in areas where people could be exposed at levels that could pose a risk to human health during excavation of the sediments. The monitoring showed that no chemicals were detected above levels that are normally present in urban air.

Odours during the excavations may be possible. The potential for odours will depend on the remediation approach adopted so if there are only limited excavations then the potential for odours will be lower than has been modelled.

Once a remediation approach has been confirmed, the construction environment management plan should consider the potential for odours and outline odour control measures that will be used for the works.

Section 11. Conclusions

The HHRA presented in this report has addressed the presence of PAH contamination in sediments at the southern end of Kendall Bay, NSW (the "site").

Contamination is present in these sediments due to the presence of the former AGL Mortlake Gasworks. Activities at the site, loading and unloading at the wharf that was located nearby and discharges from the site through a large stormwater drain are likely to have resulted in the contamination found in the sediments. Contamination from the gasworks has included polycyclic aromatic hydrocarbons (PAHs) and other petroleum hydrocarbons. Metals have also been found to be present in the sediments which is likely to be due to historical activities along the Parramatta River and stormwater runoff from urban areas like roads.

Previous Investigations

Previous HHRAs have been undertaken for the site to determine if remediation was required and what areas needed to be remediated. These assessments identified that two areas required removal/remediation – Area A and Area B (**Figure 8**). Difficulties in implementation of the proposed remediation technologies have delayed works.

Additional Works – 2015-2017

Additional studies were undertaken between 2015 and 2017 to help to refine the remediation design including:

- Chemical analysis of sediments, surface waters, biota and odours
- Ecotoxicity testing of the sediments
- Bioaccessibility analysis
- Benthic ecology survey
- Black carbon (and other analyses) related to ecological assessment
- Review of a range of remedial methodologies to determine best practice options for the area
- Bulk sediment excavation trial.

Using these additional data, recent updates to national risk assessment guidance and consideration of the need (where possible) to retain mangroves, calculations have been undertaken to determine remediation criteria to be used in designing the remediation across Kendall Bay. The additional investigations have also resulted in changes to the areas to be remediated formerly known as Area A and B.

Proposed Remediation Criteria

Based on the exposure scenarios outlined in **Section 7** and the toxicity assessment in **Section 8**, remediation criteria have been determined that are protective of human health.

Table 77 Proposed Remediation Criteria

Location	Site-Specific Remediation Criteria
Beach Area	60 mg/kg
Central Mangrove Area	120 mg/kg
Western Corner of Kendall Bay	1 mg/kg

Application of Proposed Remediation Criteria

The basis of each of these proposed criteria has been assessed to determine the most appropriate criteria to apply in each of the newly identified remediation areas.

Table 78 Application of Proposed Remediation Criteria for Carcinogenic PAHs

Location	Site-Specific Remediation Criteria
Southern Remediation Area	
SA1	1 mg/kg
SA2	1 mg/kg
SA3 – western end adjacent to SA1	1 mg/kg
SA3 – rest of mangrove area	120 mg/kg
SA4	60 mg/kg
SA5	60 mg/kg
Northern Remediation Area	
NA1	1 mg/kg
NA2	Area submerged so ecological criteria more relevant
NA3	Area submerged so ecological criteria more relevant

Application of 1 mg/kg Criterion

It is proposed that the most stringent criterion is applied to areas with coal tars at or near the surface. This includes SA1, SA2, and NA1.

The RAP for the project outlines the intended remediation to be undertaken in SA1, SA2 and NA1. It includes in-situ stabilisation and capping.

Application of 60 and 120 mg/kg Criteria – Western edge of SA3

In the western end of the mangroves, there are several sites where the levels of PAHs exceed the adopted Human Health criteria of 1 mg/kg. Some of these are in Remediation area SA1 and will be remediated using in situ solidification. Several others are located in the western end of Remediation Area SA3 (such as sampling locations 16 and 23) but the highest levels in these areas are covered by the mangrove root mass which in this area can reach half a metre in depth.

The driver of risk in the calculation of the remediation criteria is dermal contact with the contaminated materials. It is assumed that a child may be come into direct contact with the sediments 20 days per year for 6 years in this part of the Bay and on each occasion lower arms, hands, lower legs and feet will be covered by the sediments. If such contact is prevented by the mangrove root mass or is, at least, greatly reduced due to the physical difficulty in reaching the contaminated materials, then the risk is much reduced and compliance with the remediation criteria is not strictly required.

Given the thickness of the overlaying dense root mat, the risk of human exposure in this western end of SA3 is deemed to be low and hence the adopted treatment in this area is to leave the mangrove root mass in place and ensure that any materials on the surface of the root mass are cleaned of any coke and coal washed onto the surface of the area as discussed below.

Application of 60 and 120 mg/kg Criteria – Rest of SA3, SA4 and SA5

The beach area and central mangrove area can be applied to the majority of SA3 as well as SA4 and SA5.

The RAP for the project outlines the intended remediation to be undertaken in SA3, SA4 and SA5. It is intended that all surface rubbish and weathered coal contamination will be removed to a nominal depth of 0.2 -0.3 m. The stormwater drain will be reengineered to better manage flow. Clean sand will be brought in to nourish all these areas and to provide a sufficient capping layer. As a result, little material currently at the surface will remain at the surface after the remediation is complete.

Remaining Areas

None of the health-based criteria need to be applied in areas NA2 and NA3 as these areas are submerged at all times and are not readily accessible to people. If people do access these areas, then any materials will be washed off immediately minimising any potential for dermal exposure. Remediation in these areas should be based on the ecological criteria developed by the CSIRO.

Other Exposure Pathways

Surface water sampling has demonstrated that concentrations for relevant chemicals are below relevant screening criteria.

Biota sampling has found that oysters and mussels collected in Kendall Bay did not contain any PAHs relevant to gasworks waste. The oyster samples did contain copper, cadmium and zinc. The concentrations were the same in the samples from all 3 Bays (Kendall, Majors and Exile Bays) indicating that the contamination was not related to the gasworks contamination. The levels of copper and zinc were above those that would be acceptable to consume on a regular long term basis. However, there is already an advisory in place for Sydney Harbour that recommends no seafood collected west of the Harbour Bridge should be consumed and a prohibition on the collection of oysters and mussels from the entire shoreline of Sydney Harbour. No further restrictions need to be implemented.

Potential Issues During Remediation

Odour modelling and modelling of evaporation of volatile chemicals has shown that none of the chemicals relevant to the gasworks waste are predicted to be present in shoreline locations even under worst case dispersion conditions at concentrations that are above conservative ambient air guidelines (protective of lifetime exposures). Odours have been predicted to be present, particularly under worst case dispersion conditions if no odour control measures are used, assuming that remediation occurs via bulk excavation. The bulk sediment excavation trial supported the findings of the modelling of odours and volatilisation of chemicals. If other remediation techniques are used that minimise how much of the surface of the sediments can be exposed to air the potential for odours will be reduced.

A range of odour control measures are proposed to be included in the project design. Additional odour control measures will be considered, if needed.

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Figures



Figure 1 Site Location



Legend

- HH Sediment Stage 1 (nc40)
- HH Sediment Stage 2 (nc29)
- HH Sediment Stage 3 (nc11)
- Ecological Sediment Sample (nc102)
- Ambient Water Sample (nc10)
- Oyster Sample (nc3)
- Beach Area
- Rocky Area
- Mangrove Area
- 200 m Voluntary Remediation Boundary
- 1.0 m LAT
- 0.0 m LAT

Client: AGL

URS

Project: Human Health Sediment Risk Assessment Former AGL Mortlake

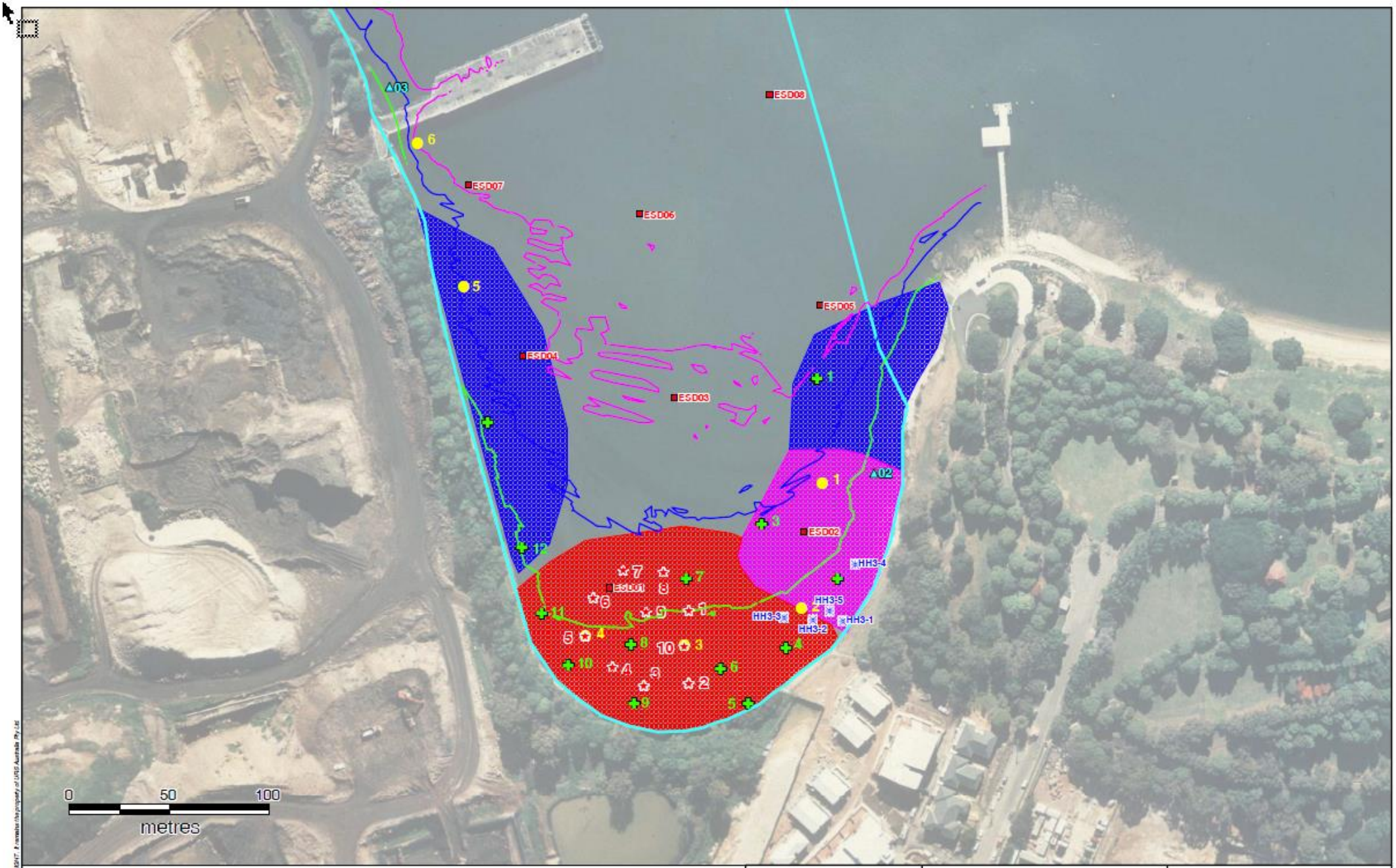
Drawn: AJW | Approved: DRAFT | Date: 17-05-06

Job No: 43217439 | File No: 43217439-048.wor

Title: Site Investigation Areas

Figure 2

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Client: AGL

Project: Human Health Sediment Risk Assessment Former AGL Mortlake

Title: Kendall Bay Sampling Locations

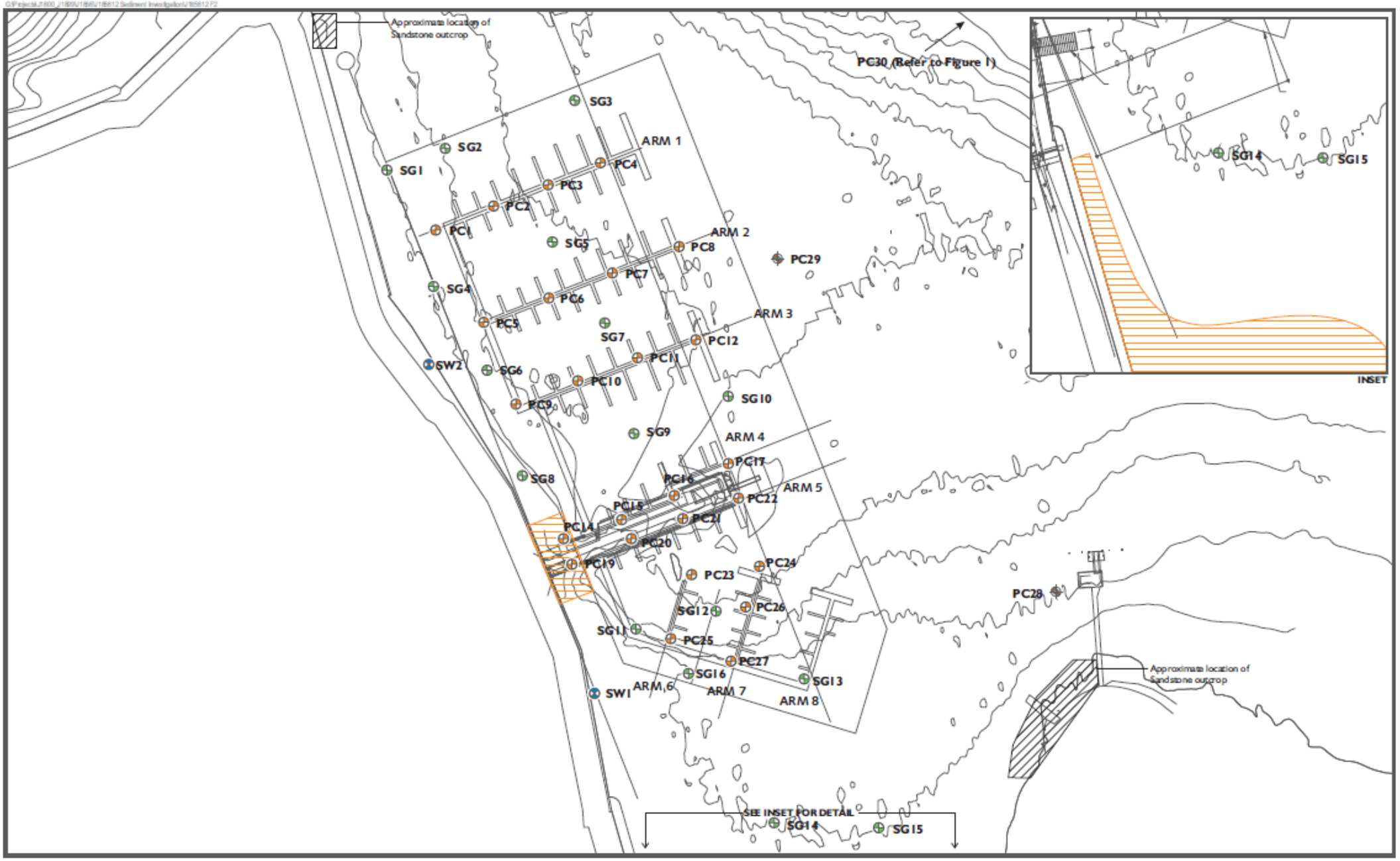
URS

Drawn: AJW | Approved: DRAFT | Date: 17-05-06

Job No: 43217439 | File No: 43217439-014.wor

Figure 3

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Site Layout and Sediment Investigation Sample Locations

Breakfast Point Pty Ltd

Sediment Investigation

Inner West Marina

Parramatta River, Sydney

Figure 4

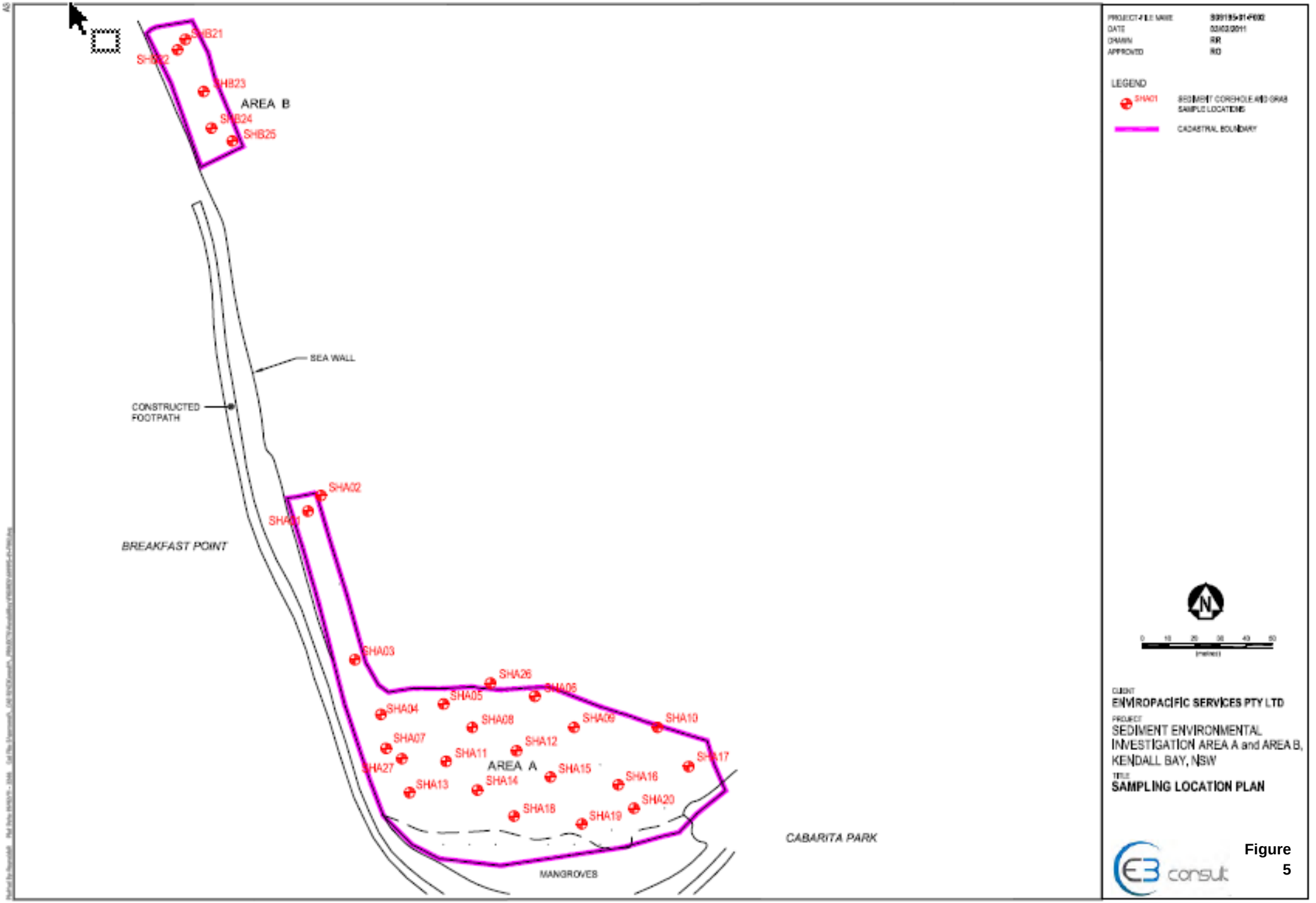
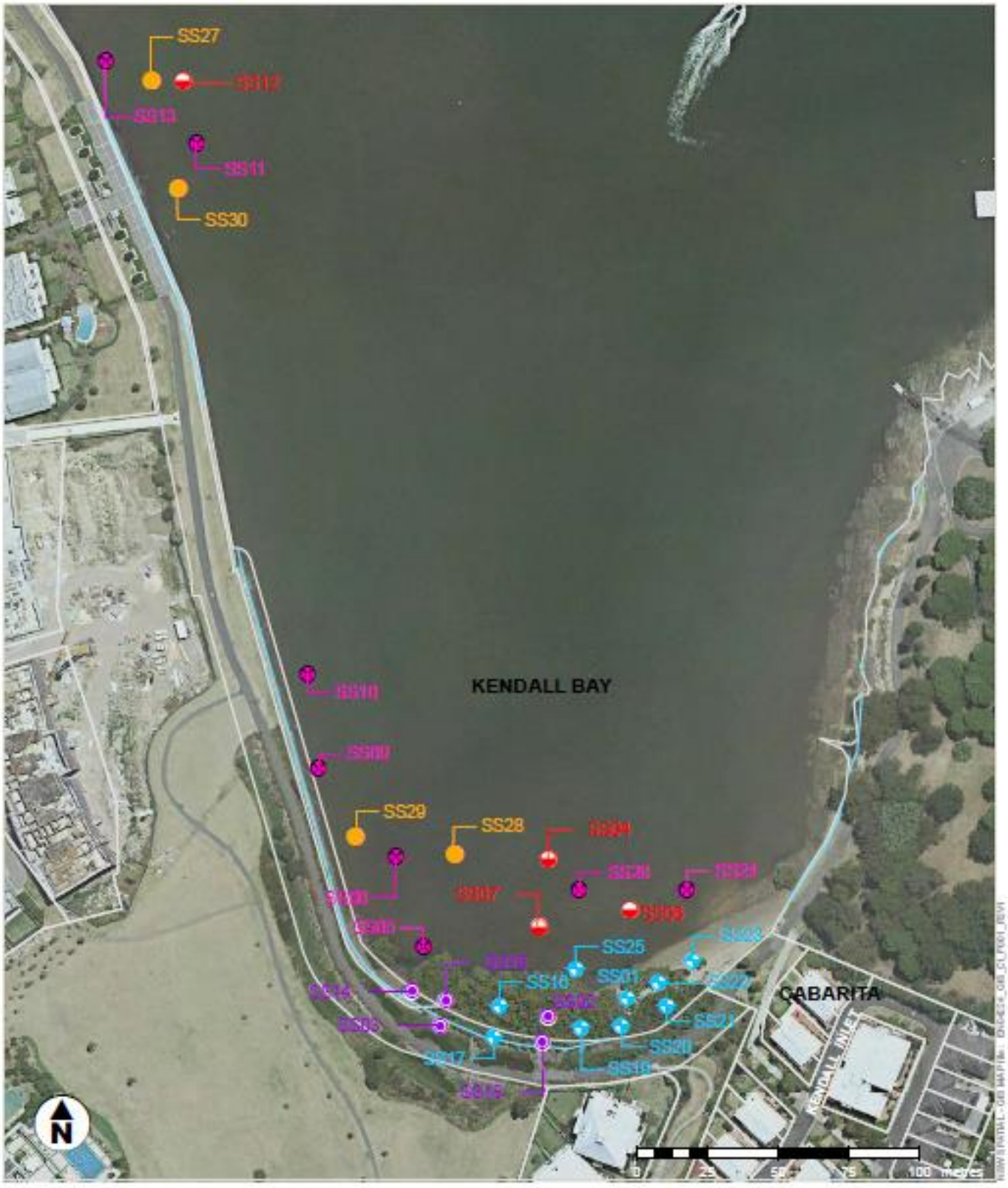

SHB21
SHB22
SHB23
AREA B
SHB24
SHB25
SEA WALL
CONSTRUCTED FOOTPATH
SHA02
SHA01
BREAKFAST POINT
SHA03
SHA26
SHA05
SHA06
SHA04
SHA08
SHA09
SHA10
SHA07
SHA12
SHA11
SHA17
SHA27
AREA A
SHA15
SHA16
SHA13
SHA14
SHA20
SHA18
SHA19
CABARITA PARK
MANGROVES
PROJECT FILE NAME 539195-01-F002
DATE 03/02/2011
DRAWN RR
APPROVED RD
LEGEND
SHA01 SEDIMENT CORE/HOLE AND GRAB SAMPLE LOCATIONS
CADASTRAL BOUNDARY
N
0 10 20 30 40 50
(metres)
CLIENT
ENVIROPACIFIC SERVICES PTY LTD
PROJECT
SEDIMENT ENVIRONMENTAL INVESTIGATION AREA A and AREA B, KENDALL BAY, NSW
TITLE
SAMPLING LOCATION PLAN
E3 consult

Figure 5



Sampling legend

- Type A – Hand Auger
- Type B – Hand Auger (Inc Shear Vane)
- Type C – Geotechnical Undisturbed Sampling (Incl 20 kg Bulk Sample and shear vane)
- Type D – Geotechnical Disturbed Sampling (Including Bulk Sample)
- Type E – Bulk (20 kg Samples)

SKM

SCALE	1:2,000 A4
SHEET	1 of 1
COORDINATE SYSTEM	GDA 1994 MGA Zone 56
TITLE	Figure 1 Geotechnical and Contamination Sediment Sampling Location Plan
PROJECT	Additional Geotechnical and Contamination Sediment Sampling - Kendall Bay
CLIENT	Jemena
DRAWN	KO
PROJECT #	EN04224
MAP #	F001
REV. VER.	
CHECK	BH
DATE	13/08/2013

Figure 6

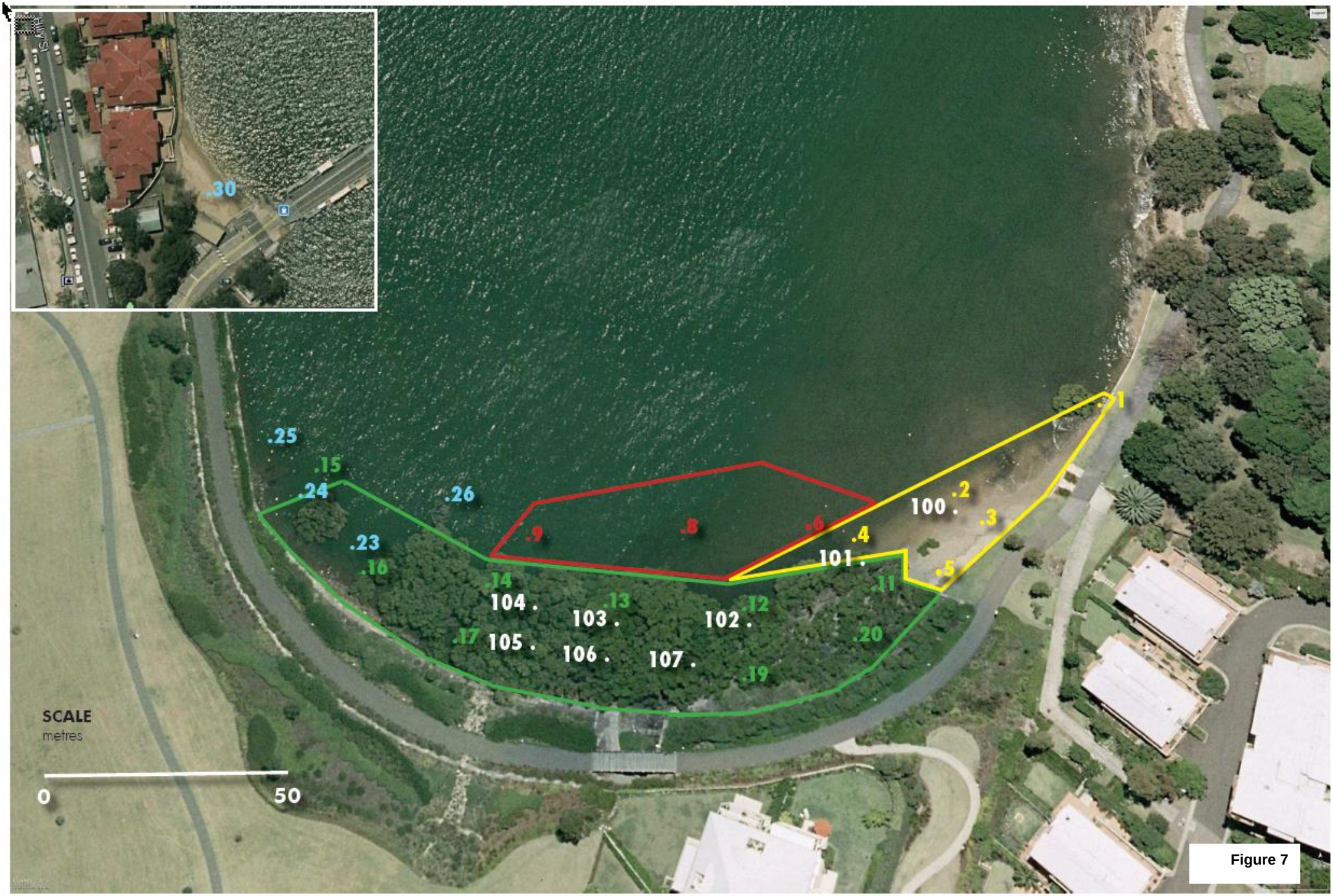
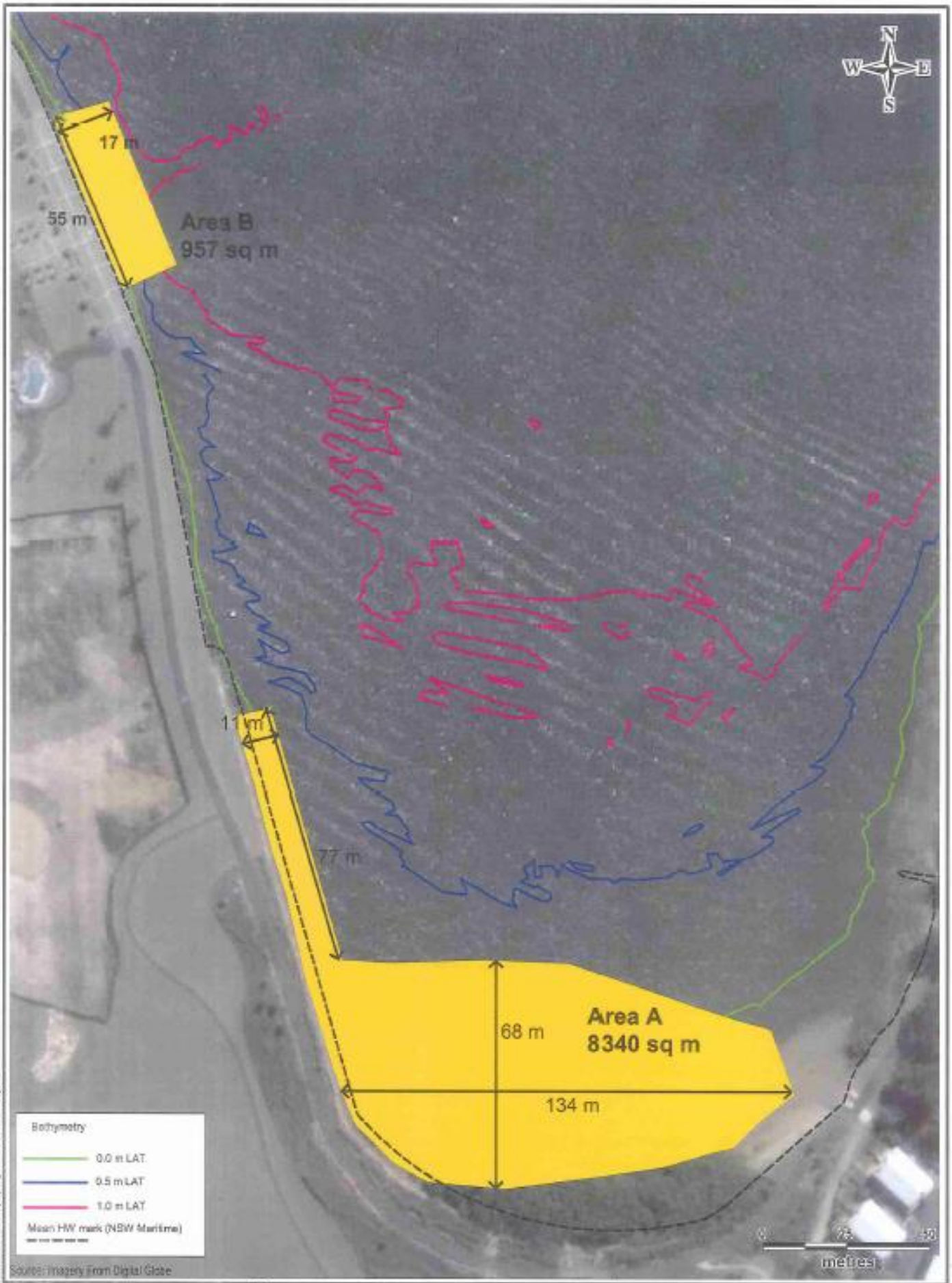

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100 .2
.3
101 .5
.11
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.13
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.17
105 .
106 .
107 .
.20
.19
SCALE
metres
0
50

Figure 7



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Client: JEMENA	Project: REMEDIATION ACTION PLAN KENDALL BAY SEDIMENTS	Title: REMEDIATION AREAS
URS	Drawn: SET · Approved: FM · Date: 09-09-2008	
	Job No: 43217727 · File No: 43217727.010.wor	Figure 8



Figure 9 Proposed Remediation Areas



Figure 10a Sediment Sampling Locations 2015-2017



Figure 10b Sediment Sampling Locations 2015-2017



Figure 11 Water Quality Sampling Locations 2016-2017



Figure 12 Oyster and Mussel Sampling Locations 2016



Figure 13 Bioaccessibility Sampling Locations

Appendix A Sediment, Surface Water, Biota Data

Appendix 2.1 Laboratory Sea Water Data January 2016

SITE REFERENCE JANUARY 2016	Sample	Sample No	Replicate	Date Sampled	TRH C6 - C9	TRH C6 - C10	TRH C6 - C10 less BTEX (F1)	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-xylene	Naphthalene	TRH C10 - C14	TRH C15 - C28	TRH C29 - C36	TRH >C10 - C16	TRH >C10 - C16 less Naphthalene (F2)	TRH >C16 - C34	TRH >C34 - C40	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Dibenzo(a,h)anthracene	Indeno(1,2,3-c,d)pyrene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's
				PQL	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
ANZECC 95%				Units	10	10	10	1	1	1	2	1	1	50	100	100	50	50	100	100	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.05	
Rec Water Quality (health)				ug/L									70								70																0.1
ADWG x 10				ug/L					1	800	300	600																				0.01					
Area B	KBWQ1	1	0	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.01
Area B	KBWQ1	1	1	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1																									
RPD/RSD					**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**																									
Area B	KBWQ2	2	0	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+)VE
Area B	KBWQ3	3	0	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.01
Area B	KBWQ3	3	1																																			
RPD/RSD				19/01/2016																																		
Area B	KBWQ4a	4	0	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	0.05	<0.01	<0.01	<0.01	<0.03	<0.01	0.01	0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.07
Area B	KBWQ4b	5	0	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.01
Area B	KBWQ4c	6	0	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.01	0.02	<0.01	<0.01	<0.02	0.01	<0.01	<0.01	<0.01	<0.05	0.04
Area B	KBWQ4c	6	1	19/01/2016	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**99.0**	**0.0**	**0.0**	**0.0**	**21.7**	**0.0**	**34.6**	**43.3**	**0.0**	**0.0**	**0.0**	**43.3**	**0.0**	**0.0**	**0.0**	**0.0**	**75.0**
RPD/RSD																																					
Area B	KBWQ5	7	0	19/01/2016	<10	<10	<10	<1	2	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	0.09	0.01	<0.01	<0.01	<0.03	<0.01	0.01	0.02	<0.01	<0.01	<0.02	0.01	<0.01	<0.01	<0.01	<0.05	0.14
Area B	KBWQ6	8	0	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	0.04	0.01	<0.01	<0.01	<0.03	<0.01	0.03	0.02	<0.01	<0.01	<0.02	0.01	<0.01	<0.01	<0.01	<0.05	0.11
Southern Bay	KBWQ7	9	0	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+)VE
Southern Bay	KBWQ8	10	0	19/01/2016	<10	<10	<10	<1	4	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	0.06	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.06
Southern Bay	KBWQ9	11	0	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	0.2	0.01	<0.01	<0.01	<0.03	<0.01	0.02	0.02	<0.01	0.01	<0.02	0.01	<0.01	<0.01	<0.01	<0.05	0.23
Southern Bay	KBWQ9	11	1	19/01/2016																																		
RPD/RSD																																					
Boat Ramp	KBWQ10	12	0	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	0.09	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.09
Ferry Terminal	KBWQ11	13	0	19/01/2016	<10	<10	<10	<1	1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	0.02	<0.01	<0.01	<0.02	<0.01	0.02	0.05	0.01	0.02	0.06	0.04	0.02	<0.01	0.02	<0.05	0.26
Ferry Terminal	KBWQ11	13	1	19/01/2016	<10	<10	<10	<1	1	<1	<2	<1	<1																									
RPD/RSD					**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**																									
Exile Inshore	KBWQ12	14	0	19/01/2016	<10	<10	<10	<1	3	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	0.02	0.01	<0.01	<0.02	<0.01	0.05	0.08	0.02	0.02	0.06	0.04	0.02	<0.01	0.02	<0.05	0.34
Exile Offshore	KBWQ13	15	0	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	0.03	0.02	<0.01	<0.03	<0.01	0.09	0.11	0.02	0.02	0.06	0.04	0.02	<0.01	0.02	<0.05	0.43
Area A	KBWQ14	16	0	19/01/2016	<10	<10	<10	<1	1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	0.02	<0.01	<0.01	0.06	0.01	0.14	0.15	0.07	0.1	0.2	0.12	0.09	0.02	0.09	<0.05	1.1
Area A	KBWQ14	16	1	19/01/2016																																		
RPD/RSD																																					
Area A	KBWQ15	17	0	19/01/2016	<10	<10	<10	<1	1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.02
Area A	KBWQ16	18	0	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+)VE
Majors Inshore	KBWQ17	19	0	19/01/2016	<10	<10	<10	<1	3	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	0.02	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.06
Majors Offshore	KBWQ18	20	0	19/01/2016	<10	<10	<10	<1	1	<1	<2	<1	<1	<50	<100	<100	<50	<50	100	<100	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+)VE
Majors Offshore	KBWQ18	20	1	19/01/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1																									
RPD/RSD					**0.0**	**0.0**	**0.0**	**0.0**	**66.7**	**0.0**	**0.0**	**0.0**	**0.0**																									
	TS	21	0	19/01/2016				92%	98%	99%	93%	94%																											
Trip Blank	TB	22	0	19/01/2016				<1	<1	<1	<2	<1																										

SITE REFERENCE JANUARY 2016	Sample	Sample No	Replicate	Date Sampled	HCB	alpha-BHC	gamma-BHC	beta-BHC	Heptachlor	delta-BHC	Aldrin	Heptachlor Epoxide	gamma-Chlordane	alpha-Chlordane	Endosulfan I	pp-DDE	Dieldrin	Endrin	pp-DDD	Endosulfan II	DDT	Endrin Aldehyde	Endosulfan Sulphate	Methoxychlor	Arsenic-Dissolved	Cadmium-Dissolved	Chromium-Dissolved	Copper-Dissolved	Lead-Dissolved	Mercury-Dissolved	Nickel-Dissolved	Zinc-Dissolved	Arsenic-Total	Cadmium-Total	Chromium-Total	Copper-Total	Lead-Total	Mercury-Total	Nickel-Total	Zinc-Total	Phosphorus - Total	pH	Electrical Conductivity	Total Suspended Solids	Total Dissolved Solids (grav)	Total Nitrogen in water	NOx as N in water	Ammonia as N in water	Phosphate as P in water
				PQL	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	pH Unit	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ANZECC 95%				Units	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	0.01	0.01	0.01	0.006	0.01	0.01	0.01	1	0.1	1	1	1	0.05	1	1	1	0.1	1	1	1	1	0.05	1	1	0.05		1	5	5	0.1	0.005	0.005	0.005
Rec Water Quality (health)				ug/L											0.01			0.01															ID	5.5	27.4	1.3	4.4	0.4	0.2	15	30	7 - 8.5				0.3		0.015	0.03
ADWG x 10				ug/L						3					30						20				70				10		20			2	50	200		1									50		
																																	100	20	500	20000	100	10	200	30000	6.8 - 8.5		6000			0.5	5	
Area B	KBWQ1	1	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	3	2	<0.1	3	11	2	<0.05	<1	7	<0.05	8	47000	10	31000	<0.1	0.005	<0.005	0.008
Area B	KBWQ1	1	1	19/01/2016																													2	<0.1	2	11	2		<1	7	<0.05	8	44000	12	31000	<0.1	0.007	<0.005	0.009
RPD/RSD																																	**0.0**	**0.0**	**40.0**	**0.0**	**0.0**		**0.0**	**0.0**	**0.0**	**0.0**	**6.6**	**-18.2**	**0.0**	**0.0**	**-33.3**	**0.0**	**-11.8**
Area B	KBWQ2	2	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	<1	2	<0.1	1	3	1	<0.05	<1	5	<0.05	8.1	45000	11	29000	<0.1	<0.005	<0.005	0.007
Area B	KBWQ3	3	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	<1	2	<0.1	<1	3	1	<0.05	<1	3	<0.05	8.2	44000	14	31000	<0.1	<0.005	<0.005	0.007
Area B	KBWQ3	3	1																																			<0.05												
RPD/RSD				19/01/2016																																		**0.0**												
Area B	KBWQ4a	4	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	1	2	<0.1	2	3	2	<0.05	<1	7	<0.05	8.1	46000	13	31000	<0.1	<0.005	<0.005	0.008
Area B	KBWQ4b	5	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	2	2	<0.1	<1	3	2	<0.05	<1	4	<0.05	8.1	45000	8	31000	<0.1	<0.005	<0.005	0.007
Area B	KBWQ4c	6	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	<1	2	<0.1	1	3	2	<0.05	<1	5	<0.05	8.2	44000	13	30000	<0.1	<0.005	<0.005	0.007
Area B	KBWQ4c	6	1	19/01/2016	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	2	<0.1	<1	2	<1	<0.05	<1	<1	**0.0**	**0.0**	**65.5**	**0.0**	**0.0**	**0.0**	**0.0**	**28.6**	**0.0**	**0.7**	**2.2**	**25.5**	**1.9**	**0.0**	**0.0**	**0.0**	**7.9**
RPD/RSD																									**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**70.7**						<0.05												
Area B	KBWQ5	7	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	<1	2	<0.1	1	3	2	<0.05	<1	4	<0.05	8.2	43000	14	30000	<0.1	<0.005	<0.005	0.007
Area B	KBWQ6	8	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	<1	2	<0.1	1	2	2	<0.05	<1	3	<0.05	8.2	44000	8	30000	<0.1	<0.005	<0.005	0.008
Southern Bay	KBWQ7	9	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	3	<1	<0.05	<1	1	2	<0.1	2	3	2	<0.05	<1	5	<0.05	8.2	43000	11	29000	<0.1	<0.005	<0.005	0.007
Southern Bay	KBWQ8	10	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	<1	2	<0.1	2	3	2	<0.05	<1	6	<0.05	8.2	44000	6	31000	<0.1	<0.005	<0.005	0.007
Southern Bay	KBWQ9	11	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	<1	2	<0.1	2	3	2	<0.05	<1	5	<0.05	8.1	42000	19	30000	<0.1	<0.005	<0.005	0.006
Southern Bay	KBWQ9	11	1	19/01/2016																					2	<0.1	1	3	2		<1	4	<0.05	8.1	44000	18	30000	<0.1	<0.005	<0.005	0.007
RPD/RSD																																	**0.0**	**0.0**	**66.7**	**0.0**	**0.0**		**0.0**	**22.2**	**0.0**	**0.0**	**-4.7**	**5.4**	**0.0**	**0.0**	**0.0**	**0.0**	**-15.4**
Boat Ramp	KBWQ10	12	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	<1	2	<0.1	1	3	2	<0.05	<1	3	<0.05	8.2	42000	7	30000	<0.1	<0.005	<0.005	0.007
Ferry Terminal	KBWQ11	13	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	<1	2	<0.1	1	3	2	<0.05	<1	3	<0.05	8.2	44000	<5	31000	<0.1	<0.005	<0.005	0.007
Ferry Terminal	KBWQ11	13	1	19/01/2016																																														
RPD/RSD																																						<0.05												
Exile Inshore	KBWQ12	14	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	<1	3	<0.1	3	6	5	<0.05	<1	9	<0.05	8.2	44000	11	30000	<0.1	<0.005	<0.005	<0.005
Exile Offshore	KBWQ13	15	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	3	<1	<0.05	<1	<1	2	<0.1	<1	3	2	<0.05	<1	3	<0.05	8.2	45000	6	28000	<0.1	<0.005	<0.005	<0.005
Area A	KBWQ14	16	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	<1	2	<0.1	2	3	3	<0.05	<1	5	<0.05	8.2	44000	9	30000	<0.1	<0.005	<0.005	0.008
Area A	KBWQ14	16	1	19/01/2016																					2	<0.1	<1	2	<1	<0.05	<1	<1																	
RPD/RSD																									**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**																	
Area A	KBWQ15	17	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	3	<1	<0.05	<1	1	2	<0.1	3	4	4	<0.05	<1	8	0.05	8.2	43000	11	29000	<0.1	<0.005	<0.005	0.009
Area A	KBWQ16	18	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	1	<1	2	<0.1	3	3	3	<0.05	1	9	<0.05	8.2	43000	11	30000	<0.1	<0.005	<0.005	0.01
Majors Inshore	KBWQ17	19	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	3	<0.1	5	6	7	0.08	2	16	14	0.5	75	51	100	0.37	7	250	0.6	8.2	41000	92	26000	<0.1	<0.005	<0.005	0.017
Majors Offshore	KBWQ18	20	0	19/01/2016	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	2	<0.1	<1	2	<1	<0.05	<1	<1	2	<0.1	9	4	3	<0.05	4	8	<0.05	8.3	40000	10	26000	<0.1	<0.005	<0.005	0.009
Majors Offshore	KBWQ18	20	1	19/01/2016																																														
RPD/RSD																																																		
	TS	21	0	19/01/2016																																														
Trip Blank	TB	22	0	19/01/2016																																														

Appendix 2.2 Laboratory Sea Water Data April 2016

SITE REFERENCE APRIL 2016	Sample Code	Sample Number	Replicate	Date Sampled	TRH C6 - C9	TRH C6 - C10	TRH C6 - C10 less BTEX (F1)	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-xylene	Naphthalene	TRH C10 - C14	TRH C15 - C28	TRH C29 - C36	TRH >C10 - C16	TRH >C10 - C16 less Naphthalene (F2	TRH >C16 - C34	TRH >C34 - C40	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Dibenzo(a,h)anthracene	Indeno(1,2,3-c,d)pyrene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's
				Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
				PQL	10	10	10	1	1	1	2	1	1	50	100	100	50	50	100	100	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.05	
ANZECC 95%												70									70																	0.1
Rec Water Quality (health)																																						
ADWG x 10								1	800	300	600																					0.01						
Kendall Bay	WQ1	1	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	0.01	0.01	0.01	0.05	<0.01	0.03	0.03	0.01	<0.01	<0.02	0.01	<0.01	<0.01	<0.01	<0.05	0.16
Kendall Bay	WQ1	1	1	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1																									
RPD					**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**																									
Kendall Bay	WQ2	2	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+)VE
Kendall Bay	WQ3	3	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+)VE
Kendall Bay	WQ4	4	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+)VE
Kendall Bay	WQ5	5	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.01	0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.02
Kendall Bay	WQ6	6	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.3	<0.01	0.01	0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.02
Kendall Bay	WQ7	7	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.04	0.04	<0.01	<0.01	<0.02	0.01	<0.01	<0.01	<0.01	<0.05	0.09
Kendall Bay	WQ8	8	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.3	<0.01	<0.01	0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.01
Kendall Bay	WQ9A	9	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+)VE
ALS	WQ9B				<20	<20	<20	<1	<2	<2	<2	<2	<5	<100	<100	<50		<100	<100	<100	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.005	<0.02	<0.02	<0.02	<0.005	<0.005
RPD					**-66.7**	**-66.7**	**-66.7**	**0.0**	**-66.7**	**-66.7**	**0.0**	**-66.7**	**-133.3**	**-66.7**	**0.0**	**66.7**		**-66.7**	**0.0**	**0.0**	**0.0**	**-66.7**	**-66.7**	**-66.7**	**40.0**	**-66.7**	**-66.7**	**-66.7**	**-66.7**	**-66.7**	**0.0**	**66.7**	**-66.7**	**-66.7**	**-66.7**	**163.6**	
Kendall Bay	WQ10	10	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+)VE
Kendall Bay	WQ11	11	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+)VE
Kendall Bay	WQ11	11	1	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1																									
RPD					**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**																									
Kendall Bay	WQ12	12	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.02	0.02	0.01	<0.01	0.02	0.02	0.01	<0.01	0.01	<0.05	0.11
Kendall Bay	WQ13	13	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.3	<0.01	0.02	0.02	0.01	0.01	0.03	0.02	0.01	<0.01	0.02	<0.05	0.14
Kendall Bay	WQ14	14	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	0.07	0.01	0.02	0.05	0.02	0.12	0.23	0.07	0.06	0.22	0.16	0.07	0.02	0.07	<0.05	1.2
Kendall Bay	WQ15	15	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	0.03	0.01	<0.01	0.05	0.01	0.09	0.11	0.03	0.03	0.08	0.06	0.03	<0.01	0.03	<0.05	0.56
Kendall Bay	WQ16	16	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	0.04	0.01	0.01	0.04	0.01	0.1	0.13	0.05	0.04	0.1	0.09	0.04	0.1	0.05	<0.05	0.83
Kendall Bay	WQ17	17	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.02	0.02	0.02	<0.01	0.03	0.02	0.01	<0.01	0.02	<0.05	0.14
Kendall Bay	WQ18	18	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	110	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.01	0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.02
Kendall Bay	WQ19A	19	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+)VE
ALS	WQ19B				<20	<20	<20	<1	<2	<2	<2	<2	<5	<50	<100	<50		<100	<100	<100	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.005	<0.02	<0.02	<0.02	<0.005	<0.005
Kendall Bay	WQ19A	19	1	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1	**0.0**	**0.0**	**66.7**		**-66.7**	**0.0**	**0.0**	**0.0**	**-66.7**	**-66.7**	**-66.7**	**0.0**	**-66.7**	**-66.7**	**-66.7**	**-66.7**	**-66.7**	**0.0**	**66.7**	**-66.7**	**-66.7**	**-66.7**	**163.6**	
RPD/RPS					**43.3**	**43.3**	**43.3**	**0.0**	**43.3**	**43.3**	**0.0**	**43.3**	**99.0**																									
Kendall Bay	TB	20	0	20/04/2016	<10	<10	<10	<1	<1	<1	<2	<1	<1																									
Kendall Bay	TS	21	0	20/04/2016				106%	102%	106%	108%	110%																										

SITE REFERENCE APRIL 2016	Sample Code	Sample Number	Replicate	Date Sampled	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	HCB	alpha-BHC	gamma-BHC	beta-BHC	Heptachlor	delta-BHC	Aldrin	Heptachlor Epoxide	gamma-Chlordane	alpha-Chlordane	Endosulfan I	pp-DDE	Dieldrin	Endrin	pp-DDD	Endosulfan II	DDT	Endrin Aldehyde	Endosulfan Sulphate	Methoxychlor	alpha-BHC
				Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
				PQL	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.5		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	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
ANZECC 95%																					0.1											0.01			0.01							
Rec Water Quality (health)																																										
ADWG x 10																0.01																						20					
Kendall Bay	WQ1	1	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.04	<0.01	0.02	0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	0.03	<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	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ1	1	1	20/04/2016																																							
RPD																																										
Kendall Bay	WQ2	2	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+	<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	<0.01	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ3	3	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+	<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	<0.01	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ4	4	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+	<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	<0.01	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ5	5	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+	<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	<0.01	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ6	6	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	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	<0.01	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ7	7	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.02	0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	0.03	<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	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ8	8	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+	<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	<0.01	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ9A	9	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+	<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	<0.01	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
ALS	WQ9B				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00	<0.02	<0.02	<0.02	<0.02	<0.02		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<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	<0.01	
RPD					**0.0**	**-66.7**	**-66.7**	**-66.7**	**40.0**	**-66.7**	**-66.7**	**-66.7**	**-66.7**	**-66.7**	**0.0**	**66.7**	**-66.7**	**-66.7**	**-66.7**	**184.6**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-133.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-50.0**	**0.0**	**0.0**	**0.0**			
Kendall Bay	WQ10	10	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+	<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	<0.01	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ11	11	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+	<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	<0.01	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ11	11	1	20/04/2016																																							
RPD																																										
Kendall Bay	WQ12	12	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+	<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	<0.01	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ13	13	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+	<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	<0.01	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ14	14	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.03	0.03	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	0.06	<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	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ15	15	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.03	0.03	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	0.06	<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	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ16	16	0	20/04/2016	<0.02	0.01	<0.01	<0.01	0.05	<0.01	0.06	0.05	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	0.17	<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	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ17	17	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	0.05	<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	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ18	18	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	0.05	<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	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
Kendall Bay	WQ19A	19	0	20/04/2016	<0.02	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	0.05	<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	<0.01	<0.01	<0.01	<0.00(	<0.01	<0.01	<0.01	<0.01
ALS	WQ19B				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.00	<0.02	<0.02	<0.02	<0.02	<0.02		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<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	<0.01	
Kendall Bay	WQ19A	19	1	20/04/2016	**0.0**	**-66.7**	**-66.7**	**-66.7**	**133.3**	**-66.7**	**-66.7**	**-66.7**	**-66.7**	**-66.7**	**0.0**	**66.7**	**-66.7**	**-66.7**	**-66.7**	**184.6**	**133.3**		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-133.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-50.0**	**0.0**	**0.0**	**0.0**			
RPD/RPS																																										
Kendall Bay	TB	20	0	20/04/2016																																							
Kendall Bay	TS	21	0	20/04/2016																																							

SITE REFERENCE APRIL 2016	Sample Code	Sample Number	Replicate	Date Sampled	Arsenic-Dissolved	Cadmium-Dissolved	Chromium-Dissolved	Copper-Dissolved	Lead-Dissolved	Mercury-Dissolved	Nickel-Dissolved	Zinc-Dissolved	Arsenic-Total	Cadmium-Total	Chromium-Total	Copper-Total	Lead-Total	Mercury-Total	Nickel-Total	Zinc-Total	Phosphorus - Total	Total Suspended Solids	Total Dissolved Solids	Nitrate as N in water	Nitrite as N in water	Ammonia as N in water	Total Nitrogen in water	Phosphate as P in water	Total Coliforms	Enterococci
				Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	FU/100m	FU/100m
				PQL	1	0.1	1	1	1	0.05	1	1	1	0.1	1	1	1	0.05	1	1	0.05	5	5	0.01	0.01	0.01	0.1	0.01		0
ANZECC 95% Rec Water Quality (health)													ID	5.5	27.4	1.3	4.4	0.4	0.2	15	30					0.15	0.3	0.03		
ADWG x 10					70				10		20			2	50	200		1						50						
Kendall Bay	WQ1	1	0	20/04/2016	2	<0.1	<1	5	<1	<0.05	<1	13	2	<0.1	1	9	2	<0.05	1	15	<0.25	13	42000	0.04	0.01	0.07	<2	0.03	20 A	32
Kendall Bay	WQ1	1	1	20/04/2016	2	<0.1	<1	5	<1	<0.05	1	12	2	<0.1	2	9	2	<0.05	1	15	<0.25	11	41000	0.04	<0.005	0.06	<2	0.04		
RPD					**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-66.7**	**8.0**	**0.0**	**0.0**	**-66.7**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**16.7**	**2.4**	**0.0**	**66.7**	**20.9**	**0.0**	**-8.5**		
Kendall Bay	WQ2	2	0	20/04/2016	2	<0.1	<1	2	<1	<0.05	<1	6	2	<0.1	<1	3	2	<0.05	<1	7	<0.25	8	42000	0.04	<0.005	0.06	<2	0.04	16 NBO	1A
Kendall Bay	WQ3	3	0	20/04/2016	2	<0.1	<1	4	<1	<0.05	2	17	2	<0.1	<1	3	2	<0.05	<1	11	<0.25	5	40000	0.03	<0.005	0.06	<2	0.04	10 NBO	<1
Kendall Bay	WQ4	4	0	20/04/2016	2	<0.1	<1	2	<1	<0.05	1	9	2	<0.1	<1	3	2	<0.05	<1	10	<0.25	<5	42000	0.02	<0.005	0.06	<2	0.04	14 NBO	<1
Kendall Bay	WQ5	5	0	20/04/2016	2	<0.1	<1	2	<1	<0.05	2	7	2	<0.1	<1	3	2	<0.05	<1	9	<0.25	14	41000	0.02	<0.005	0.05	<2	0.04	9 A NBC	3
Kendall Bay	WQ6	6	0	20/04/2016	2	<0.1	<1	3	2	<0.05	<1	8	2	<0.1	<1	6	<1	<0.05	<1	9	<0.25	<5	40000	0.03	<0.005	0.06	<2	0.04	8 A NBC	14
Kendall Bay	WQ7	7	0	20/04/2016	2	<0.1	<1	4	<1	<0.05	2	9	2	<0.1	<1	4	2	<0.05	<1	9	<0.25	8	41000	0.02	<0.005	0.06	<2	0.04	10 NBO	1A
Kendall Bay	WQ8	8	0	20/04/2016	2	<0.1	<1	2	<1	<0.05	<1	9	2	<0.1	<1	3	1	<0.05	<1	11	<0.25	5	40000	0.02	<0.005	0.05	<2	0.04	11 NBO	<1
Kendall Bay	WQ9A	9	0	20/04/2016	2	<0.1	<1	2	<1	<0.05	<1	7	2	<0.1	<1	3	2	<0.05	<1	10	<0.25	7	40000	0.03	<0.005	0.05	<2	0.04	1 A NBC	<1
ALS	WQ9B				2.1	0.2	<0.5	2	0.4	0	1.2	10	2.4	<0.2	1.3	3	2.5	<0.00	1.1	13		<5	42900			0.05	0.34	0.05	1	2
RPD					**-4.9**	**-120.0**	**66.7**	**0.0**	**22.2**	**199.4**	**-82.4**	**-35.3**	**-18.2**	**-66.7**	**-88.9**	**0.0**	**-22.2**	**199.7**	**-75.0**	**-26.1**		**94.7**	**-7.0**			**-4.2**	**98.5**	**-32.6**		**-120.0**
Kendall Bay	WQ10	10	0	20/04/2016	2	<0.1	<1	11	<1	<0.05	1	7	2	<0.1	<1	3	1	<0.05	<1	7	<0.25	14	40000	0.02	<0.005	0.05	<2	0.04	8 A NBC	<1
Kendall Bay	WQ11	11	0	20/04/2016	2	<0.1	<1	5	<1	<0.05	1	8	2	<0.1	1	6	2	<0.05	1	36	<0.25	5	40000	0.03	<0.005	0.03	<2	0.03	20 A NB	1A
Kendall Bay	WQ11	11	1	20/04/2016	2	<0.1	<1	5	<1	<0.05	1	7	2	<0.1	<1	6	2	<0.05	1	34	<0.25	7	40000	0.02	<0.005	0.03	<2	0.04		
RPD					**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**13.3**	**0.0**	**0.0**	**66.7**	**0.0**	**0.0**	**0.0**	**0.0**	**5.7**	**0.0**	**-33.3**	**0.0**	**40.0**	**0.0**	**3.1**	**0.0**	**-8.7**		
Kendall Bay	WQ12	12	0	20/04/2016	2	<0.1	<1	8	<1	<0.05	<1	8	2	<0.1	2	7	4	<0.05	<1	13	<0.25	21	41000	0.01	<0.005	<0.005	<2	0.02	18 NBO	<1
Kendall Bay	WQ13	13	0	20/04/2016	2	<0.1	<1	3	<1	<0.05	2	6	2	<0.1	1	4	4	<0.05	<1	11	<0.25	14	41000	0.01	<0.005	<0.005	<2	0.02	27 NBO	<1
Kendall Bay	WQ14	14	0	20/04/2016	2	<0.1	<1	5	<1	<0.05	<1	9	2	<0.1	2	5	3	<0.05	<1	15	<0.25	20	41000	0.03	0.01	0.09	<2	0.04	30 A	1A
Kendall Bay	WQ15	15	0	20/04/2016	2	<0.1	<1	2	<1	<0.05	1	6	2	<0.1	2	4	3	<0.05	<1	13	<0.25	10	40000	0.05	0.01	0.09	<2	0.04	6 A NBC	<1
Kendall Bay	WQ16	16	0	20/04/2016	2	<0.1	<1	6	<1	<0.05	2	11	4	<0.1	10	11	13	0.06	2	42	<0.25	22	41000	0.02	<0.005	0.07	<2	0.04	10 A NB	2
Kendall Bay	WQ17	17	0	20/04/2016	2	<0.1	<1	1	<1	<0.05	<1	6	3	<0.1	5	5	7	<0.05	<1	21	<0.25	63	40000	0.01	<0.005	0.01	<2	0.03	3 A NBC	3A
Kendall Bay	WQ18	18	0	20/04/2016	2	<0.1	<1	2	<1	<0.05	<1	6	2	<0.1	2	4	4	<0.05	<1	15	<0.25	24	40000	0.01	<0.005	<0.005	<2	0.03	10A	<1
Kendall Bay	WQ19A	19	0	20/04/2016	2	0.1	<1	3	<1	<0.05	1	9	2	<0.1	<1	3	1	<0.05	<1	8	<0.25	11	40000	0.03	<0.005	0.03	<2	0.04	10A	4A
ALS	WQ19B				2.1	0.2	<0.5	2	0.4	0	1.9	10	2.5	<0.2	0.7	3	1.8	<0.00	1.4	13		<5	44600			0.02	0.36	0.05	8.00	2.00
Kendall Bay	WQ19A	19	1	20/04/2016	**-4.9**	**-66.7**	**66.7**	**40.0**	**22.2**	**199.4**	**-62.1**	**-10.5**	**-22.2**	**-66.7**	**-33.3**	**0.0**	**-57.1**	**199.7**	**-94.7**	**-47.6**		**125.9**	**-10.9**			**24.0**	**94.1**	**-19.0**		
RPD/RPS																														
Kendall Bay	TB	20	0	20/04/2016																										
Kendall Bay	TS	21	0	20/04/2016																										

Appendix 2.3 Laboratory Sea Water Data October 2017

SITE REFERENCE OCTOBER 2017	Sample	Sample No	Replicate	TRH C6 - C9	TRH C6 - C10	TRH C6 - C10 less8TEX (F1)	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-xylene	Naphthalene	TRH C10 - C14	TRH C15 - C28	TRH C29 - C36	TRH >C10 - C16	TRH >C16 - C34	TRH >C34 - C40	Dissolved Naphthalene	Dissolved Acenaphthylene	Dissolved Acenaphthene	Fluorene	Dissolved Phenanthrene	Dissolved Anthracene	Fluoranthene	Dissolved Pyrene	Benzo(a)anthracene	Dissolved Chrysene	Benzo(b,j+k)fluoranthene	Dissolved Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Dissolved Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +vePAH's
	Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
	PQL			10	10	10	1	1	1	2	1	1	50	100	100	50	50	100	100	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.5	
ANZECC 95%	ug/L											70														70										0.1
Rec Water Quality (health)	ug/L																																			
ADWG x 10							1	800	300	600																				0.01						
Brays Bay	KBW1	1	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Brays Bay	KBW1	1	1	<10	<10	<10	<1	<1	<1	<2	<1	<1																								
RPD				**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**																									
Yaralla Bay	KBW2	2	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Majors Bay	KBW3	3	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Majors Bay	KBW4	4	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Canada Bay	KBW5	5	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Canada Bay	KBW5	5	1																																	
Exile Bay	KBW6	6	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Exile Bay	KBW7	7	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Parramatta River D/S Kendall Bay	KBW8	8	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Parramatta River U/S Kendall Bay	KBW9	9	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Parramatta River U/S Kendall Bay	KBW9	9	1																																	
Kendall Bay SW Side	KBW10	10	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	0.03	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	0.06
Kendall Bay South Mid	KBW11	11	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Kendall Bay South Mid	KBW11	11	1	<10	<10	<10	<1	<1	<1	<2	<1	<1																								
RPD				**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**																									
Kendall Bay South East Side	KBW12	12	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.02	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	0.04
Kendall Bay Centre West Side	KBW13	13	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Duplicate of KBW13	KBW19	14	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Kendall Bay Centre Mid	KBW14	16	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Duplicate of KBW14	KBW20	15	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.02	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	0.04
Duplicate of KBW14	KBW20	15	1																																	
RSD																																				
Kendall Bay Centre East Side	KBW15	1	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Kendall Bay Centre East Side	KBW15	1	1																																	
RPD																																				
Kendall Bay North West Side	KBW16	2	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Kendall Bay Morth Mid	KBW17	3	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Kendall Bay North East Side	KBW18	4	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
Kendall Bay North East Side	KBW18	4	1																																	
QC Rinsate	KBW21	5	0	<10	<10	<10	<1	<1	<1	<2	<1	<1	<50	<100	<100	<50	<50	<100	<100	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.5	NIL (+)VE
QC Rinsate	KBW21	5	1																																	
Trip Blank	TB	6	0	<10	<10		<1	<1	<1	<2	<1																									
	TS	7	0				101%	101%	100%	100%	100%																									
	TS	17	0				104%	105%	100%	102%	102%																									
Trip Blank	TB	18	0	<10	<10		<1	<1	<1	<2	<1																									

SITE REFERENCE OCTOBER 2017	Sample	Sample No	Replicate	Total Naphthalene	Acenaphthylene	Total Acenaphthene	Fluorene	Total Phenanthrene	Anthracene	Total Fluoranthene	Pyrene	Total Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Total Benzo(a)pyrene	Dibenzo(a,h)anthracene	Total Indeno(1,2,3-c,d)pyrene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +vePAH's	HCB	alpha-BHC	gamma-BHC	beta-BHC	Heptachlor	delta-BHC	Aldrin	Heptachlor Epoxide	gamma-Chlordane	alpha-Chlordane	Endosulfan I	pp-DDE	Dieldrin	Endrin	pp-DDD	Endosulfan II	DDT	Endrin Aldehyde	Endosulfan Sulphate	Methoxychlor
	Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
	PQL			0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.05		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	0.01	0.01	0.01	0.006	0.01	0.01	0.01
ANZECC 95%	ug/L			70																0.1											0.01			0.01						
Rec Water Quality (health)	ug/L																								3												20			
ADWG x 10																			0.01																						
Brays Bay	KBW1	1	0	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Brays Bay	KBW1	1	1																																						
RPD																																								
Yaralla Bay	KBW2	2	0	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Majors Bay	KBW3	3	0	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Majors Bay	KBW4	4	0	<0.02	<0.01	<0.01	<0.01	<0.04	<0.01	0.04	0.04	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.08	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Canada Bay	KBW5	5	0	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Canada Bay	KBW5	5	1																																						
Exile Bay	KBW6	6	0	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.02	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Exile Bay	KBW7	7	0	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	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	<0.01	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Parramatta River D/S Kendall Bay	KBW8	8	0	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Parramatta River U/S Kendall Bay	KBW9	9	0	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	0.04	0.04	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.08	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Parramatta River U/S Kendall Bay	KBW9	9	1																																						
Kendall Bay SW Side	KBW10	10	0	<0.02	<0.01	<0.01	<0.01	<0.04	<0.01	0.05	0.05	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.1	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Kendall Bay South Mid	KBW11	11	0	<0.02	<0.01	<0.01	<0.01	<0.05	<0.01	0.04	0.04	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.05	0.11	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Kendall Bay South Mid	KBW11	11	1																																						
RPD																																								
Kendall Bay South East Side	KBW12	12	0	<0.02	0.02	<0.01	0.06	0.1	0.02	0.08	0.08	<0.01	<0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.05	0.46	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Kendall Bay Centre West Side	KBW13	13	0	<0.02	<0.01	<0.01	<0.01	<0.04	<0.01	0.01	0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.02	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Duplicate of KBW13	KBW19	14	0	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.02	0.02	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.04	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Kendall Bay Centre Mid	KBW14	16	0	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Duplicate of KBW14	KBW20	15	0	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Duplicate of KBW14	KBW20	15	1																																						
RSD																																								
Kendall Bay Centre East Side	KBW15	1	0	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Kendall Bay Centre East Side	KBW15	1	1																																						
RPD																																								
Kendall Bay North West Side	KBW16	2	0	<0.02	<0.01	<0.01	<0.01	<0.04	<0.01	0.03	0.03	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	0.06	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Kendall Bay Morth Mid	KBW17	3	0	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Kendall Bay North East Side	KBW18	4	0	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
Kendall Bay North East Side	KBW18	4	1																																						
QC Rinsate	KBW21	5	0	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.05	NIL (+	<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	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01
QC Rinsate	KBW21	5	1																																						
Trip Blank	TB	6	0																																						
	TS	7	0																																						
	TS	17	0																																						
Trip Blank	TB	18	0																																						

SITE REFERENCE OCTOBER 2017	Sample	Sample No	Replicate	Arsenic-Dissolved	Cadmium-Dissolved	Chromium-Dissolved	Copper-Dissolved	Lead-Dissolved	Mercury-Dissolved	Nickel-Dissolved	Zinc-Dissolved	Arsenic-Total	Cadmium-Total	Chromium-Total	Copper-Total	Lead-Total	Mercury-Total	Nickel-Total	Zinc-Total	Phosphorus - Total	Total Suspended Solids	Total Dissolved Solids(grav)	Total Nitrogen in water	Nitrate as N in water	Nitrite as N in water	Ammonia as N in water	Phosphate as P in water	Chlorophyll a	Turbidity	Enterococci	Total Coliforms
	Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ng/m3	NTU	cfu/100mL	cfu/100mL
	PQL			1	0.1	1	1	1	0.05	1	1	1	0.1	1	1	1	0.05	1	1	0.05	5	5	0.1	0.005	0.005	0.005	0.005	5	0.1	0	
ANZECC 95%	ug/L											ID	5.5	27.4	1.3	4.4	0.4	0.2	15	30			0.3			0.02	0.03				
Rec Water Quality (health)	ug/L																														
ADWG x 10				70				10		20													50								
Brays Bay	KBW1	1	0	1	<0.1	<1	4	<1	<0.05	<1	10	1	<0.1	2	4	3	<0.0	<1	19	<0.05	15	34000	0.3	0.01	<0.005	0.06	0.03	<5	9.5	<10	80 A
Brays Bay	KBW1	1	1	1	<0.1	<1	4	<1	[NT]	<1	10	2	<0.1	2	3	3	[NT]	<1	17	0.06	13	34000	0.3	0.01	<0.005	0.06	0.03	[NT]	9.6		
RPD				**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**	**0.0**	**-66.7**	**0.0**	**0.0**	**28.6**	**0.0**		**0.0**	**11.1**	**-82.4**	**14.3**	**0.0**	**0.0**	**0.0**	**0.0**	**-7.0**	**-13.8**		**-1.0**		
Yaralla Bay	KBW2	2	0	1	<0.1	<1	2	<1	<0.05	1	11	2	<0.1	2	4	3	<0.0	<1	19	<0.05	64	36000	0.3	0.007	<0.005	0.04	0.02	<5	9.4	10 Approximate	6 A NBO
Majors Bay	KBW3	3	0	1	<0.1	<1	3	<1	<0.05	<1	9	2	<0.1	2	3	3	<0.0	<1	18	0.05	10	40000	0.3	0.006	<0.005	0.02	0.02	5	8.8	10 Approximate	11
Majors Bay	KBW4	4	0	<1	0.1	<1	4	<1	<0.05	1	11	3	0.1	8	7	12	<0.0	2	39	0.09	52	39000	0.4	0.009	<0.005	0.03	0.02	7	33	<10	<1 NBO
Canada Bay	KBW5	5	0	1	<0.1	<1	4	<1	<0.05	1	11	2	<0.1	2	6	4	<0.0	<1	18	<0.05	16	34000	0.3	<0.005	<0.005	0.01	0.01	8	12	<10	2
Canada Bay	KBW5	5	1	[NT]	[NT]	[NT]	[NT]	[NT]	<0.05	[NT]	[NT]																				
Exile Bay	KBW6	6	0	1	<0.1	<1	4	<1	<0.05	2	9	2	<0.1	1	5	5	<0.0	<1	20	<0.05	17	34000	0.3	<0.005	<0.005	0.01	0.02	6	8.8	<10	3 A NBO
Exile Bay	KBW7	7	0	1	<0.1	<1	5	<1	<0.05	2	8	1	<0.1	<1	4	3	<0.0	<1	12	<0.05	9	39000	0.2	<0.005	<0.005	0.01	0.02	5	5.6	<10	7 A NBO
Parramatta River D/S Kendall B	KBW8	8	0	1	<0.1	<1	4	<1	<0.05	1	7	1	<0.1	8	4	2	<0.0	<1	10	<0.05	10	39000	0.2	<0.005	<0.005	0.02	0.02	<5	3.8	10 Approximate	8
Parramatta River U/S Kendall B	KBW9	9	0	1	<0.1	<1	5	<1	<0.05	2	11	2	<0.1	<1	3	2	<0.0	<1	18	<0.05	6	39000	0.3	0.007	<0.005	0.02	0.02	<5	4.4	<10	10
Kendall Bay SW Side	KBW10	10	0	1	<0.1	<1	3	<1	<0.05	<1	9	1	<0.1	<1	3	2	<0.0	1	12	<0.05	6	40000	0.3	0.03	<0.005	0.07	0.02	<5	4.3	<10	40 A
Kendall Bay South Mid	KBW11	11	0	1	<0.1	<1	5	<1	<0.05	4	13	1	<0.1	<1	3	2	<0.0	<1	12	<0.05	8	38000	0.2	0.01	<0.005	0.03	0.02	<5	4.6	1 Approximate	8 NBO A
Kendall Bay South Mid	KBW11	11	1	<1	<0.1	<1	5	<1	[NT]	4	11	1	<0.1	<1	3	2	[NT]	<1	13	<0.05	<5	36000	0.3	0.01	<0.005	0.03	0.02	[NT]	4.5		
RPD				**66.7**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**	**16.7**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.0**	**-8.0**	**0.0**	**104.8**	**5.4**	**-40.0**	**0.0**	**0.0**	**0.0**	**-14.6**		**2.2**		
Kendall Bay South East Side	KBW12	12	0	1	<0.1	<1	3	<1	<0.05	1	9	2	<0.1	<1	3	2	<0.0	<1	15	<0.05	10	37000	0.3	<0.005	<0.005	0.01	0.02	<5	4.6	<1	3 NBO A
Kendall Bay Centre West Side	KBW13	13	0	1	<0.1	<1	3	<1	<0.05	<1	9	1	<0.1	<1	3	2	<0.0	<1	13	<0.05	<5	39000	0.3	<0.005	<0.005	0.01	0.02	<5	3.2	1 Approximate	1 A
Duplicate of KBW13	KBW19	14	0	1	<0.1	<1	5	<1	<0.05	4	12	1	<0.1	<1	3	2	<0.0	<1	11	<0.05	9	39000	0.2	<0.005	<0.005	0.01	0.02	<5	3.2	4 Approximate	1
RPD				**0.0**	**0.0**	**0.0**	**-50.0**	**0.0**	**0.0**	**-155.6**	**-28.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**16.7**	**0.0**	**-113.0**	**0.0**	**40.0**	**0.0**	**0.0**	**16.7**	**0.0**	**0.0**	**0.0**		**-184.0**
Kendall Bay Centre Mid	KBW14	16	0	1	<0.1	<1	3	<1	<0.05	2	9	2	<0.1	<1	3	2	<0.0	<1	9	<0.05	9	40000	0.3	<0.005	<0.005	0.01	0.02	<5	3.6	2 Approximate	5 A
Duplicate of KBW14	KBW20	15	0	2	<0.1	<1	5	<1	<0.05	2	10	2	<0.1	<1	3	2	<0.0	<1	12	0.05	11	40000	0.3	0.005	<0.005	0.01	0.02	<5	3.4	<1	<1
Duplicate of KBW14	KBW20	15	1	[NT]	[NT]	[NT]	[NT]	[NT]	<0.05	[NT]	[NT]																				
RSD				**47.1**	**0.0**	**0.0**	**35.4**	**0.0**	**0.0**	**0.0**	**7.4**																				
Kendall Bay Centre East Side	KBW15	1	0	1	<0.1	<1	4	<1	<0.05	2	9	1	<0.1	<1	3	2	<0.0	<1	15	<0.05	8	40000	0.2	0.008	<0.005	0.02	0.02	<5	3.5	1 Approximate	Approximate NBC
Kendall Bay Centre East Side	KBW15	1	1																		<10	40000	0.2	0.005	<0.005	0.02	0.03	[NT]	4		
RPD																					**46.2**	**0.0**	**0.0**	**46.2**	**0.0**	**4.3**	**-17.4**		**-13.3**		
Kendall Bay North West Side	KBW16	2	0	1	<0.1	<1	2	<1	<0.05	<1	7	1	<0.1	<1	3	2	<0.0	<1	11	<0.05	5	40000	0.2	0.007	<0.005	0.02	0.02	<5	2.7	<1	Approximate NBC
Kendall Bay Morth Mid	KBW17	3	0	1	<0.1	<1	2	<1	<0.05	<1	8	1	<0.1	<1	3	2	<0.0	<1	10	<0.05	7	42000	0.3	<0.005	<0.005	0.02	0.02	<5	3	1 Approximate	55
Kendall Bay North East Side	KBW18	4	0	1	<0.1	<1	3	<1	<0.05	2	10	1	<0.1	<1	3	2	<0.0	<1	10	<0.05	6	41000	0.2	0.005	<0.005	0.02	0.02	<5	1.2	4 Approximate	45
Kendall Bay North East Side	KBW18	4	1									1	<0.1	<1	3	2	[NT]	<1	9												
QC Rinsate	KBW21	5	0	<1	<0.1	<1	<1	<1	<0.05	<1	<1	<1	<0.1	<1	<1	<1	<0.0	<1	<1	<0.05	<5	26	0.2	0.02	<0.005	<0.005	<0.00	<5	<0.1	<1	<1
QC Rinsate	KBW21	5	1									[NT]	[NT]	[NT]	[NT]	[NT]	<0.0	[NT]	[NT]												

Table 5.2 Sediment Chemical Data Summary, Southern Investigation Area Kendall Bay (mg/kg except where noted otherwise)

Southern Investigation Area Sites – 0 to 300 mm																	
Analyte	**TRH >C10-C16**	**TRH >C16-C34**	**TRH >C34-C40**	**Sum C10 - C40**	**Naphthalene**	**Total +ve PAH's**	**TOC %**	**PAH Norm 1%**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Lead**	**Mercury**	**Nickel**	**Zinc**	**Total Cyanide**
Samples	94	94	94	94	94	92	88	90	94	94	94	94	94	94	94	94	72
Mean	658	4949	795	6402	18	411	16	80	17	0.4	145	49	110	0.6	50	309	87
Min	<50	<100	<100	<250	<0.01	0.12	0.06	1.3	2	<0.1	3	2	6.1	0.01	1	10	<0.5
Max	8000	46000	6800	57900	860	3600	57	2650	54	1.2	530	143	660	8.5	230	820	780
GV	–	–	–	**280**	–	–	–	**10**	**20**	**1.5**	**80**	**65**	**50**	**0.15**	**21**	**200**	–
300 to 600 mm																	
Analyte	**TRH >C10-C16**	**TRH >C16-C34**	**TRH >C34-C40**	**Sum C10 - C40**	**Naphthalene**	**Total +ve PAH's**	**TOC %**	**PAH Norm 1%**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Lead**	**Mercury**	**Nickel**	**Zinc**	**Total Cyanide**
Samples	60	60	60	60	60	56	59	59	60	60	60	60	60	60	60	60	58
Mean	769	3752	548	5069	27	456	8.5	68	25	0.4	119	49	157	0.8	38	256	127
Min	<50	<100	<100	<250	<0.01	0.74	0.2	0.2	3	<0.1	3	3	6.7	0.01	2	11	<0.5
Max	5100	22000	3100	29300	500	3300	61	673	64	2.1	570	140	1590	6.5	320	710	1191
GV	–	–	–	**280**	–	–	–	**10**	**20**	**1.5**	**80**	**65**	**50**	**0.15**	**21**	**200**	–
600 + mm																	
Analyte	**TRH >C10-C16**	**TRH >C16-C34**	**TRH >C34-C40**	**Sum C10 - C40**	**Naphthalene**	**Total +ve PAH's**	**TOC %**	**PAH Norm 1%**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Lead**	**Mercury**	**Nickel**	**Zinc**	**Total Cyanide**
No Samples	235	235	235	235	235	229	232	213	235	235	235	235	235	235	235	235	212
Mean	406	1264	188	1857	68	260	2.8	192	18	0.3	38	20	52	0.3	12	101	13
Min	<50	<100	<100	<250	<0.01	<0.1	0.02	0.1	0.25	<0.1	3	0.7	2	<0.01	0.8	1	<0.5
Max	4800	15000	2500	19200	1100	3100	49	4407	62	1.4	450	130	290	1.9	200	1400	430

GV	–	–	–	**280**	–	–	–	**10**	**20**	**1.5**	**80**	**65**	**50**	**0.15**	**21**	**200**	–

Table 5.3 Sediment Chemical Data Summary, Northern Investigation Area Kendall Bay (mg/kg except where noted otherwise)

Northern Investigation Area Sites – 0 to 300 mm

Analyte	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Sum C10 - C40	Naphthalene	Total +ve PAH's	TOC%	PAH Norm 1%	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total Cyanide
No Samples	52	52	52	53	52	52	51	51	54	54	54	54	54	54	54	54	32
Mean	1457	7107	1093	9475	75	720	13	82	17	0.4	89	165	205	1.2	14	375	17
Min	<50	<100	<100	<250	0.07	2	1.5	0.3	5.6	<0.1	9	3	8.4	0.02	4	15	<0.5
Max	22000	71000	7500	100500	2800	13000	44	1300	32.5	1.2	210	2800	860	3.2	40	706	510
GV	–	–	–	**280**	–	–	–	**10**	**20**	**1.5**	**80**	**65**	**50**	**0.15**	**21**	**200**	–

300 to 600 mm

Analyte	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Sum C10 - C40	Naphthalene	Total +ve PAH's	TOC %	PAH Norm 1%	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total Cyanide
No Samples	29	29	29	29	29	29	27	27	29	29	29	29	29	29	29	29	28
Mean	1637	4906	659	7201	209	909	9.0	153	21	0.5	71	82	309	0.9	13	314	2
Min	<50	<100	<100	<250	0.22	6.1	0.95	2.8	11	<0.1	11	8.5	24	0.14	4	39	<0.5
Max	14000	24000	2200	40200	3600	9900	34	1042	40.1	1.0	170	270	2300	1.8	38	670	10
GV	–	–	–	**280**	–	–	–	**10**	**20**	**1.5**	**80**	**65**	**50**	**0.15**	**21**	**200**	–

600 + mm

Analyte	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Sum C10 - C40	Naphthalene	Total +ve PAH's	TOC %	PAH Norm 1%	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total Cyanide
No Samples	73	73	73	73	73	72	71	71	74	74	74	74	74	74	74	74	73
Mean	900	2632	357	3888	84	444	5.7	296	16	0.3	55	40	87	0.5	9.5	176	41
Min	<50	<100	<100	<250	<0.01	0.44	0.03	0.1	0.5	<0.1	4	1	4	<0.01	0.7	3	<0.5
Max	8300	26000	2500	36800	1100	4200	57	4500	36	1.4	320	220	300	2.0	64	1070	1269
GV	–	–	–	**280**	–	–	–	**10**	**20**	**1.5**	**80**	**65**	**50**	**0.15**	**21**	**200**	–

Table 5.4 Sediment Chemical Data Summary, Background Areas (mg/kg except where noted otherwise)

Kendall Bay Background Sites – 0 to 300 mm																	
Analyte	**TRH >C10-C16**	**TRH >C16-C34**	**TRH >C34-C40**	**Sum C10 - C40**	**Naphthalene**	**Total +ve PAH's**	**TOC %**	**PAH Norm 1%**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Lead**	**Mercury**	**Nickel**	**Zinc**	**Total Cyanide**
No Samples	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	4
Mean	27	437	130	594	0.5	22	4.8	3.3	13	0.2	66	63	122	0.7	10	253	<0.5
Min	<50	<100	<100	<250	<0.01	0.2	0.08	0.64	4	<0.1	6.9	6.7	22	0.01	4	50	<0.5
Max	130	1800	390	2320	3.7	130	15	13	22	0.5	130	130	240	1.4	17	570	<0.5
GV	–	–	–	**280**	–	–	–	**10**	**20**	**1.5**	**80**	**65**	**50**	**0.15**	**21**	**200**	–
Exile Bay Sites – 0 to 300																	
Analyte	**TRH >C10-C16**	**TRH >C16-C34**	**TRH >C34-C40**	**Sum C10 - C40**	**Naphthalene**	**Total +ve PAH's**	**TOC %**	**PAH Norm 1%**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Lead**	**Mercury**	**Nickel**	**Zinc**	**Total Cyanide**
No Samples	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	2
Mean	25	127	67	219	0.1	7.3	1.5	4.2	14	0.4	53	82	115	0.4	6.5	250	<0.5
Min	<50	<100	<100	<250	0.01	1.2	0.6	1.9	4.0	<0.1	10	30	30	0.06	1.0	50	<0.5
Max	25	560	200	785	0.2	21	2.9	7.2	29	1.1	120	260	300	1.2	14	580	<0.5
GV	–	–	–	**280**	–	–	–	**10**	**20**	**1.5**	**80**	**65**	**50**	**0.15**	**21**	**200**	–
Majors Bay Sites – 0 to 300																	
Analyte	**TRH >C10-C16**	**TRH >C16-C34**	**TRH >C34-C40**	**Sum C10 - C40**	**Naphthalene**	**Total +ve PAH's**	**TOC %**	**PAH Norm 1%**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Lead**	**Mercury**	**Nickel**	**Zinc**	**Total Cyanide**
No Samples	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	1
Mean	25	355	145	526	0.1	10	2.9	7.4	17	1.1	124	91	182	0.6	13	426	
Min	<50	<100	<100	<250	0.01	1.3	0.44	1.02	6.9	<0.1	15	19	41	0.1	2	70	<0.5
Max	25	860	330	1215	0.17	22	6.3	49.5	23	2.0	230	140	250	0.84	24	760	<0.5
GV	–	–	–	**280**	–	–	–	**10**	**20**	**1.5**	**80**	**65**	**50**	**0.15**	**21**	**200**	–

Table 5.5 Southern Investigation Area Volatiles Data Summary (mg/kg)

0 – 300 mm Depth										
Analyte	**TRH C_6 - C_9**	**TRH C_6 - C_{10}**	**vTPH C_6 - C_{10} less BTEX (F1)**	**Benzene**	**Toluene**	**Ethylbenzene**	**m+p-Xylene**	**o-Xylene**	**Naphthalene**	***Surrogate***
No Samples	85	85	85	85	85	85	85	85	85	85
Mean	11.9	13.2	13.1	0.1	0.3	0.6	1.0	0.5	5.4	86
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	65
Max	12.5	49	45	0.5	1	3	1	2	220	105

300 – 600 Depth										
Analyte	**TRH C_6 - C_9**	**TRH C_6 - C_{10}**	**vTPH C_6 - C_{10} less BTEX (F1)**	**Benzene**	**Toluene**	**Ethylbenzene**	**m+p-Xylene**	**o-Xylene**	**Naphthalene**	***Surrogate***
No Samples	34	34	34	34	34	34	34	34	34	34
Mean	11.1	17.5	19.3	0.2	0.4	1.1	1.6	1.0	34	83
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	65
Max	59	140	99	2	4	7	16	10	400	104

>600										
Analyte	**TRH C_6 - C_9**	**TRH C_6 - C_{10}**	**vTPH C_6 - C_{10} less BTEX (F1)**	**Benzene**	**Toluene**	**Ethylbenzene**	**m+p-Xylene**	**o-Xylene**	**Naphthalene**	***Surrogate***
No Samples	240	240	240	240	240	240	240	240	240	240
Mean	9.4	21.3	25.1	0.8	0.7	1.2	2.5	1.7	72.7	84.8
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	61
Max	140	460	1,100	87	25	54	96	110	5,900	109

Table 5.6 Northern Investigation Area Volatiles Summary

0 – 300 mm Depth										
Analyte	**TRH C_6 - C_9**	**TRH C_6 - C_{10}**	**vTPH C_6 - C_{10} less BTEX (F1)**	**Benzene**	**Toluene**	**Ethylbenzene**	**m+p-Xylene**	**o-Xylene**	**Naphthalene**	***Surrogate***
No Samples	47	47	47	47	47	47	47	47	47	47
Mean	18	31	26	0.3	0.5	1.4	2.8	1.5	45	85
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	72
Max	160	430	330	6	8	13	55	26	1,000	108

300 – 600 mm Depth										
Analyte	**TRH C_6 - C_9**	**TRH C_6 - C_{10}**	**vTPH C_6 - C_{10} less BTEX (F1)**	**Benzene**	**Toluene**	**Ethylbenzene**	**m+p-Xylene**	**o-Xylene**	**Naphthalene**	***Surrogate***
No Samples	12	12	12	12	12	12	12	12	12	12
Mean	43.5	102	77	0.5	0.9	11.1	5.9	8.0	165	87
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	65
Max	260	670	480	4	5	96	31	59	1,100	96

>600 mm Depth										
Analyte	**TRH C_6 - C_9**	**TRH C_6 - C_{10}**	**vTPH C_6 - C_{10} less BTEX (F1)**	**Benzene**	**Toluene**	**Ethylbenzene**	**m+p-Xylene**	**o-Xylene**	**Naphthalene**	***Surrogate***
No Samples	82	82	82	82	82	82	82	82	82	82
Mean	33	61	47	1	1	3	7	4	125	89
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	61
Max	400	790	500	40	19	62	130	76	1,600	109

Table 5.7. Background Areas Volatiles Summary

Kendall Bay Outside Investigation Areas (0-300)										
Analyte	**TRH C_6 - C_9**	**TRH C_6 - C_{10}**	**vTPH C_6 - C_{10} less BTEX (F1)**	**Benzene**	**Toluene**	**Ethylbenzene**	**m+p-Xylene**	**o-Xylene**	**Naphthalene**	***Surrogate***
No Samples	14	14	14	14	14	14	14	14	14	14
Mean	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	90
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	68
Max	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	111

Exile Bay (0-300)										
Analyte	**TRH C_6 - C_9**	**TRH C_6 - C_{10}**	**vTPH C_6 - C_{10} less BTEX (F1)**	**Benzene**	**Toluene**	**Ethylbenzene**	**m+p-Xylene**	**o-Xylene**	**Naphthalene**	***Surrogate***
No Samples	4	4	4	4	4	4	4	4	4	4
Mean	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	111
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	107
Max	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	121

Majors Bay (0-300)										
Analyte	**TRH C_6 - C_9**	**TRH C_6 - C_{10}**	**vTPH C_6 - C_{10} less BTEX (F1)**	**Benzene**	**Toluene**	**Ethylbenzene**	**m+p-Xylene**	**o-Xylene**	**Naphthalene**	***Surrogate***
No Samples	10	10	10	10	10	10	10	10	10	10
Mean	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	90
Min	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	74
Max	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	105

DATA SPREADSHEETS

April 2015 Sediment Data

| Sample ID | SAMPLE | REPLICATE | Latitude | Longitude | Depth Top | Depth Bottom | TRH C6 - C9 | TRH C6 - C10 | TRH C6 - C10 less BTEX(F1) | TRH C_{10} - C_{14} | TRH>C10 - C16 less Naph(F2) | TRH C15 - C18 | TRH C15 - C28 | TRH C19 - C36 | TRH C29 - C36 | TRH >C_{10}-C_{16} | TRH >C_{16}-C_{34} | TRH >C_{34}-C_{40} | Sum C_{10} - C_{40} | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenz(a,h)anthracene | Benzo(g,h,i)perylene | Benzo(a)pyrene TEQ | Total +ve PAH's | Antimony | Arsenic | Cadmium | Chromium | Copper | Lead | Mercury | Nickel | Silver | Zinc | Total Cyanide | Free Cyanide in soil | pH | Total Organic Carbon | TOC | TOC% Norm 1% | PAH Norm 1% | Clay in soils <2um | Clay in soils 0.5um | Moisture | Total Phenol |
|---|---|---

| | | |

May 2015 Sediment Data

Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	TRH C_{10} - C_{14}	TRH C15 - C18	TRH C19 - C36	TRH >C_{10}-C_{16}	TRH >C_{16}-C_{34}	TRH >C_{34}-C_{40}	Sum C_{10} - C_{40}	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Antimony - low level	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	Total Cyanide	Free Cyanide in soil	pH	Total Organic Carbon	TOC% Norm 1%	PAH Norm 1%	Moisture
100	1	0	S 33° 50' 35.9"	E 151°06' 55.3"	0	300	<50	160	110	<50	250	<100	325	0.12	1	0.06	0.4	2.3	0.51	5.2	6.7	2.9	2.8	6	4.1	2.2	0.6	1.9	5.8	37	<1	11	<0.1	13	7.8	15	0.07	5	<0.5	36	<0.5	<0.5	7.3	23000	2.3	2.3	16.1	30
100	2	0	S 33° 50' 35.9"	E 151°06' 55.3"	0	300	<50	130	120	<50	220	<100	295	0.07	0.63	0.02	0.97	0.25	0.08	0.92	1.7	1.1	0.64	2.9	2.1	1.1	0.3	1	3	14	<1	8	0.2	41	27	49	0.16	11	<0.5	120	<0.5	<0.5	[NT]	24000	2.4	2.4	5.8	
101	3	0	S 33° 50' 35.9"	E 151°06' 54.5"	0	300	<50	<100	<100	<50	<100	<100	125	0.07	0.32	0.02	0.04	0.37	0.11	0.84	1.2	0.81	0.45	1.3	0.94	0.72	0.2	0.55	1.4	7.9	<1	5	<0.1	12	7.5	15	0.05	3	<0.5	41	<0.5	<0.5	8.1	3100	0.31	0.31	25.5	20
102	3	1	S 33° 50' 36.5"	E 151°06' 53.6"	0	300	<50	440	280	<50	650	140	815	1.1	2.9	0.19	0.57	1.7	0.92	5.9	12	4.1	4.4	12	8.8	4.1	1.3	3.7	12	63	<1	4	<0.1	19	9.6	16	0.35	5.3	<0.5	79	1.1	<0.5	7.9	150000	15	10	6.3	28
103	4	0	S 33° 50' 36.6"	E 151°06' 52.7"	0	300	<50	790	490	79	1100	250	1429	1.4	4.3	0.23	0.72	2.2	1.4	8.8	19	6.8	6.2	16	13	6.1	1.5	5.9	18	93	<1	15	0.4	100	47	95	0.37	26	<0.5	610	13	<0.5	7.2	220000	22	10	9.3	41
104	5	0	S 33° 50' 36.5"	E 151°06' 52.0"	0	300	<50	620	410	54	920	210	1184	0.92	3.6	0.2	0.66	2	1.1	6.2	13	3.8	4.2	12	9.4	4.4	1.5	4	13	67	<1	16	0.3	130	42	110	0.35	35	<0.5	620	21	<0.5	6.6	170000	17	10	6.7	40
105A	6	0	S 33° 50' 36.9"	E 151°06' 52.5"	0	300	220	2500	1100	460	3200	490	4150	22	14	5.3	13	53	17	53	52	23	19	37	26	13	2.5	10	36	360	<1	6.8	0.2	44	20	33	1	21	<0.5	140	500	<0.5	6.3	120000	12	10	36.0	25
106	7	0	S 33° 50' 36.8"	E 151°06' 53.1"	0	300	81	1600	790	190	2100	400	2690	2.3	7.6	1	2.9	14	5.8	26	37	16	14	24	19	7.7	2.1	6.6	26	190	<1	11	<0.1	40	16	26	0.09	20	<0.5	92	6	<0.5	8.1	170000	17	10	19.0	30
107A	8	0	S 33° 50' 36.7"	E 151°06' 53.4"	0	300	<50	360	240	<50	530	140	695	0.9	2.8	0.2	0.45	1.2	0.7	5.2	8.7	3.7	3.7	8.6	6.3	2.9	0.7	2.4	8.7	49	<1	5.4	<0.1	29	11	23	0.09	9.7	<0.5	74	5.6	<0.5	6.9	110000	11	10	4.9	23
108	9	0	S 33° 50' 34.4"	E 151°06' 54.1"	0	300	<50	1000	710	100	1600	380	2080	0.96	5.9	0.4	0.92	1.4	1.2	6.9	17	5.7	6.3	21	17	7.5	2.5	6.4	23	100	<1	25	0.5	120	100	140	0.77	24	<0.5	390	0.6	<0.5	7.4	140000	14	10	10.0	52
109	10	0	S 33° 50' 34.4"	E 151°06' 51.9"	0	300	300	7000	3800	750	9700	1700	12150	7.3	34	3.6	6	9.6	7.5	68	180	23	19	120	95	30	9.6	23	120	630	<1	15	0.4	120	50	91	8.5	29	<0.5	420	3.9	<0.5	7.4	340000	34	10	63.0	45
110	11	0	S 33° 50' 32.3"	E 151°06' 50.8"	0	300	81	1900	1400	190	2900	800	3890	3.5	12	0.9	2	3.3	2.6	11	27	9.3	9.7	36	29	12	4.3	10	40	170	<1	26	0.4	150	120	150	0.97	22	<0.5	420	<0.5	<0.5	7.7	140000	14	10	17.0	50
110	11	1	S 33° 50' 32.3"	E 151°06' 50.8"	0	300	71	1700	1200	160	2600	670	3430	3.1	12	0.72	1.8	2.6	2.2	10	28	8.8	7	35	29	12	1.7	9.8	36	160	<1	27	0.5	150	120	150	0.96	22	<0.5	430	<0.5	<0.5			0	0.2	800.0	
105B			S 33° 50' 36.9"	E 151°06' 52.5"	0	300	310	4900	2500	660	6600	1100	8360	22	26	8.1	14	53	25	97	100	46	38	81	56	23	5.3	18	77	610	<1	11	0.2	90	24	64	0.85	32	<0.5	270	10	<0.5	6.1	180000	18	10	61.0	29
107B			S 33° 50' 36.7"	E 151°06' 53.4"	0	300	<50	740	510	72	1100	300	1472	2.1	5.3	0.47	0.9	2.8	1.8	12	19	6.9	6.4	17	12	4.7	1.2	4.1	17	97	<1	12	0.2	78	26	60	0.24	25	<0.5	230	6.3	<0.5	6.9	250000	25	10	9.7	19

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July 9 2015 Sediment Data

Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	TRH C_{10} - C_{14}	TRH C15 - C18	TRH C19 - C36	TRH >C_{10}-C_{16}	TRH >C_{10}-C_{16}	TRH >C_{16}-C_{34}	Sum C_{10} - C_{40}	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,1,3-c,d)pyrene/Indeno	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Zinc - low level	Total Organic Carbon	Per Cent	TOC% Norm 1%	PAH Norm 1%	Moisture
202-A	1	0	S 33º 50' 34.3"	E 151º06' 51.8"	3500	3800	620	13000	4100	2500	15000	1700	19200	11	73	110	23	220	200	300	400	150	140	160	130	54	18	54	190	2000	13	0.3	210	30	94	0.21	65	220	460000	46	10	200.0	48
202-A	1	1	S 33º 50' 34.3"	E 151º06' 51.8"	3500	3800	610	13000	3800	2500	14000	1700	18200	13	82	120	24	250	210	310	410	160	150	160	140	55	19	55	200	2200	14	0.3	220	33	160	0.23	76	220	490000	49	10	220.0	
202B	2	0	S 33º 50' 34.3"	E 151º06' 51.8"	3500	3800	570	12000	3900	2300	13000	1700	17000	6.6	63	92	20	230	160	230	310	120	120	120	100	40	14	41	150	1700	17	0.5	180	37	110	0.24	53	440	460000	46	10	170.0	49
205	3	0	S 33º 50' 32.1"	E 151º06' 54.1"	2800	3100	<50	<100	<100	<50	<100	<100	125	0.09	0.51	0.03	0.08	0.33	0.14	1	1.4	0.79	0.93	3.8	2.8	1.2	0.4	1.1	3.8	15	17	<0.1	18	20	58	0.22	8.3	120	40000	4	4	3.8	43
204A	4	0	S 33º 50' 32.5"	E 151º06' 53.9"	2100	3400	<50	800	500	100	1100	240	1440	0.5	1.4	0.11	0.34	0.89	0.56	6.3	15	3.2	3.9	12	9.1	4.5	1.2	4.6	12	63	37	0.4	66	85	250	1	16	420	48000	4.8	4.8	13.1	57
204B	5	0	S 33º 50' 32.5"	E 151º06' 53.9"	2800	3100	<50	<100	<100	<50	<100	<100	125	0.02	0.03	<0.01	<0.01	0.05	0.02	0.1	0.13	0.07	0.08	0.21	0.16	0.07	0.02	0.08	0.2	1	14	<0.1	19	15	34	0.06	8.3	52	31000	3.1	3.1	0.3	43
203A	6	0	S 33º 50' 33.2"	E 151º06' 53.0"	2500	2700	100	1700	870	240	2200	430	2870	0.68	2.2	0.39	0.58	1.1	1.2	15	28	8	9.1	17	13	6.1	1.7	6.2	18	110	44	0.8	190	110	240	0.72	31	500	62000	6.2	6.2	17.7	64
203B	7	0	S 33º 50' 33.2"	E 151º06' 53.0"	3200	3500	<50	<100	<100	<50	<100	<100	125	0.02	0.04	<0.01	<0.01	0.05	0.01	0.09	0.19	0.06	0.06	0.51	0.39	0.17	0.04	0.19	0.5	1.8	18	<0.1	18	17	46	0.1	8.5	73	21000	2.1	2.1	0.9	44
203C	8	0	S 33º 50' 33.2"	E 151º06' 53.0"	3800	4100	<50	<100	<100	<50	<100	<100	125	0.04	0.07	<0.01	0.02	0.04	0.01	0.09	0.18	0.06	0.07	0.22	0.17	0.07	0.02	0.08	0.2	1.1	16	<0.1	12	3	9.8	<0.01	5	16	11000	1.1	1.1	1.0	32
202C	9	0	S 33º 50' 34.3"	E 151º06' 51.8"	4050	4300	990	3200	880	1500	3400	340	5240	490	94	16	67	200	55	120	110	40	37	51	38	19	4.4	19	54	1400	20	<0.1	13	3	9	<0.01	5.2	16	12000	1.2	1.2	1166.7	33
202D	10	0	S 33º 50' 34.3"	E 151º06' 51.8"	4050	4300	650	2000	580	970	2100	250	3320	270	49	8.7	37	110	35	63	59	22	20	26	19	9.2	2.2	9.5	27	740	22	<0.1	14	3	9.5	<0.01	5.3	17	29000	2.9	2.9	255.2	31
202E	11	0	S 33º 50' 34.3"	E 151º06' 51.8"	4300	4600	130	360	<100	200	360	<100	610	58	12	2.2	8.3	26	7.8	14	13	4.9	4.3	5.7	4.5	2.2	0.5	2.3	6.4	170	15	<0.1	10	3	7.6	<0.01	4	12	12000	1.2	1.2	141.7	29
202E	11	1	S 33º 50' 34.3"	E 151º06' 51.8"	4300	4600	130	370	<100	190	380	<100	620	56	12	2.2	8.3	25	7.5	13	13	4.6	4.1	5.5	4.2	2.2	0.5	2.2	6	160	14	<0.1	9.9	3	7.2	<0.01	4	11		0	0.2	800.0	
201A	12	0	S 33º 50' 35.4"	E 151º06' 50.5"	3700	4000	340	830	200	480	850	<100	1380	130	23	3.9	16	47	15	26	24	9.5	8.3	11	8.7	4.4	1.1	4.6	12	330	16	<0.1	12	2	6.9	<0.01	5	14	13000	1.3	1.3	253.8	28
201B	13	0	S 33º 50' 35.4"	E 151º06' 50.5"	3700	4000	1100	2900	810	1500	3000	350	4850	440	77	13	54	160	50	88	84	32	28	36	28	14	3.1	14	39	1100	14	<0.1	11	3	7.5	<0.01	4	14	17000	1.7	1.7	647.1	29
201C	14	0	S 33º 50' 35.4"	E 151º06' 50.5"	3700	4000	860	2200	580	1200	2300	240	3740	370	63	11	43	130	40	71	68	26	23	29	22	10	2.4	11	31	920	17	<0.1	12	3	7.4	<0.01	5	14	34000	3.4	3.4	270.6	27
201D	15	0	S 33º 50' 35.4"	E 151º06' 50.5"	5400	5700	290	850	240	430	890	110	1430	110	22	4.1	17	50	16	29	28	11	9.8	13	10	5.2	1.2	5.3	15	330	15	<0.1	12	3	8.6	<0.01	4	14	23000	2.3	2.3	143.5	30
201E	16	0	S 33º 50' 35.4"	E 151º06' 50.5"	7100	7400	<50	<100	<100	<50	<100	<100	125	0.57	0.06	0.01	0.04	0.18	0.06	0.15	0.15	0.05	0.04	0.07	0.05	0.02	<0.01	0.02	0.06	1.5	14	<0.1	13	4	11	<0.01	5	15	23000	2.3	2.3	0.7	30
201F	17	0	S 33º 50' 35.4"	E 151º06' 50.5"	7100	7400	<50	<100	<100	<50	<100	<100	125	0.34	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.36	15	<0.1	12	4	11	<0.01	5	14	11000	1.1	1.1	0.3	31
201G	18	0	S 33º 50' 35.4"	E 151º06' 50.5"	7100	7400	<50	<100	<100	<50	<100	<100	125	0.24	0.01	<0.01	0.01	0.06	0.02	0.04	0.04	0.01	0.01	<0.02	0.01	<0.01	<0.01	<0.01	0.01	0.45	13	<0.1	12	4	11	<0.01	4	14	9400	0.94	0.94	0.5	31
201H	19	0	S 33º 50' 35.4"	E 151º06' 50.5"	9100	9400	<50	<100	<100	<50	<100	<100	125	0.29	0.04	<0.01	0.03	0.1	0.02	0.06	0.06	0.02	0.02	0.02	0.01	<0.01	<0.01	<0.01	0.01	0.67	14	<0.1	12	4	11	<0.01	4	15	9800	0.98	0.98	0.7	31
201I	20	0	S 33º 50' 35.4"	E 151º06' 50.5"	9700	10000	<50	<100	<100	<50	<100	<100	125	1.1	0.24	0.05	0.21	0.7	0.26	0.48	0.48	0.16	0.16	0.2	0.14	0.06	0.01	0.07	0.2	4.4	7.9	<0.1	5.5	3	6.4	<0.01	2	10	23000	2.3	2.3	1.9	20

July 29 2015 Sediment Data

Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	TRH C_{10} - C_{14}	TRH >C10 - C16 less Naph(F2)	TRH C15 - C18	TRH $>C_{15}$-C_{16}	TRH $>C_{15}$-C_{44}	TRH $>C_{34}$-C_{40}	Sum c10 - C40	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1.1.3-c.d)pyrene	Dibenzo(a.h)anthracene	Benzo(g.h.i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Antimony - low level	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	Total Cyanide	Total Organic Carbon		TOC% Norm 1%	PAH Norm 1%
KB401	1	0	S33º 50' 35.01"	E151º 06' 10.54"	0	150	<50	<100	<100	<50	<100	<100	125	0.04	0.09	0.01	0.03	0.43	0.09	1.1	1.2	0.56	0.53	1.3	0.87	0.49	0.1	0.6	1	7.5	<1	17	1.1	72	54	120	0.4	8.8	<0.5	340	<0.5	19700	1.97	1.97	3.8
KB401	1	1	S33º 50' 35.01"	E151º 06' 10.54"	0	150	<50	<100	<100	<50	<100	<100	125	0.04	0.08	<0.01	0.03	0.49	0.12	1.3	1.4	0.67	0.58	1.4	0.95	0.55	0.1	0.68	1	8.4	<1	15	1	67	51	110	0.5	7.9	<0.5	310	<0.5	19700	1.97	1.97	4.3
KB405	2	0	S33º 50' 32.75"	E151º 06' 49.79"	0	150	53	1600	1100	150	2300	460	2910	2.4	7	0.91	1.4	3.8	1.4	12	26	7.3	9	32	22	8.1	2.5	7.4	29	140	<1	25	0.4	110	75	150	0.8	27	<0.5	370	2.9	123000	12.3	10	14.0
KB504 Dup	6	0	S33º 50' 32.75"	E151º 06' 49.79"	0	150			1100	<50	1300	890	2215	0.66	6.5	<0.5	0.84	1.3	2.2	12	26	5.2	7	28	24	9.2	3.1	11		130	<1	24	0.4	110	73	150	0.8	25	<0.5	370	2.6		0	0.2	650.0
KB407	3	0	S33º 50' 34.46"	E151º 06' 51.16"	0	150	54	1500	820	160	2000	370	2530	4.4	8.2	0.95	2	5.4	2.8	15	42	7.7	9.3	29	20	6.4	2.3	6.3	27	160	1	17	0.4	180	57	130	0.5	76	<0.5	500	13	174000	17.4	10	16.0
KB409	4	0	S33º 50' 35.01"	E151º 06' 10.54"	0	150	<50	170	220	<50	330	100	455	0.28	0.74	0.05	0.16	0.45	0.16	1.6	2.6	1.2	1.1	5.4	4.7	2.5	0.7	2.9	6.4	25	<1	22	0.2	110	96	200	1.3	14	<0.5	450	<0.5	48500	4.85	4.85	5.2
KB411	5	0	S33º 50' 25.82"	E151º 06' 49.63"	0	150	<50	280	330	<50	540	170	735	0.94	1.5	0.15	0.32	1.2	0.41	3.3	5.1	2	1.9	7.6	6	3.2	0.9	3.6	8.2	38	<1	23	0.4	140	160	260	1.7	18	0.8	610	<0.5	38200	3.82	3.82	9.9
NMI405			S33º 50' 32.75"	E151º 06' 49.79"	0	150	79	2300	1800	200	3500	1000	4700	0.66	6.5	<0.5	0.84	1.3	2.2	12	26	5.2	7	28	24	9.2	3.1	11				24	<0.5	120	83	140	0.71	30	<0.5	390	2.7	123000	12.3	10	0.0
KB402	25	0	S33º 50' 35.66"	E151º 06' 50.54"	0	300	25	1000	410	140	1300	160	1600	1.9	5.2	1.5	0.78	3.4	1.5	26	38	8.8	6.9	9.2	7.3	2	0.4	1.6	9.8	110	<1	15	0.1	95	20	63	0.1	31	<0.5	150		91300	9.13	9.13	12.0
KB403	26	0	S33º 50' 35.49"	E151º 06' 50.43"	0	300	1300	21000	7400	3100	25000	3200	31300	26	61	5.3	12	24	42	490	570	88	89	210	170	49	5	40	210	1900	<1	21	0.4	290	41	91	0.3	230	<0.5	340		275000	27.5	10	190.0
KB403	26	1	S33º 50' 35.49"	E151º 06' 50.43"	0	300	1400	23000	8000	3400	28000	3600	35000	31	75	6.6	16	29	45	600	680	150	130	240	190	56	6	44	240	2300	<1	20	0.4	280	37	91	0.3	220	<0.5	250		275000	27.5	10	230.0
KB403B	33	0	S33º 50' 35.49"	E151º 06' 50.43"	0	150	1200	15000	5300	2700	18000	2500	23200	25	45	5.4	10	31	62	280	330	86	76	110	87	25	5.4	20	120	1200	1	20	0.3	280	38	99	0.4	210	<0.5	200		275000	27.5	10	120.0
KB404	27	0	S33º 51' 25.07"	E151º 07' 09.65"	0	300	25	0.5	0.5	25	0.5	0.5	26	0.01	0.03	0.005	0.005	0.07	0.02	0.19	0.21	0.1	0.11	0.2	0.1	0.08	0.02	0.11	0.2	1.2	<1	4	<0.1	9.9	30	30	0.06	1	<0.5	50		6200	0.62	0.62	1.9
KB406A	28	0	S33º 50' 34.35"	E151º 06' 50.01"	0	150	190	5000	2700	510	6900	1300	8710	9.6	22	3.2	7.7	30	15	90	160	38	37	89	66	21	4.1	17	85	610	<1	23	0.4	160	61	130	0.6	42	<0.5	350		166000	16.6	10	61.0
KB406B	34	0	S33º 50' 34.35"	E151º 06' 50.01"	0	150	190	5100	2800	520	7000	1400	8920	5.6	18	2.4	3.7	9.9	5.9	83	140	37	35	73	56	17	3.4	14	72	500	<1	22	0.5	150	57	130	0.5	40	<0.5	330		166000	16.6	10	50.0
KB408A	29	0	S33º 50' 25.18"	E151º 06' 56.32"	0	150	25	180	250	25	380	120	525	0.17	0.51	0.06	0.12	0.5	0.23	1.5	2	1.1	0.74	2.5	1.9	0.81	0.1	0.85	2.5	13	<1	21	0.3	130	130	240	1.3	16	0.7	570		30500	3.05	3.05	4.3
KB410	30	0	S33º 50' 24.76"	E151º 06' 47.42"	0	150	380	8000	6200	850	13000	2700	16550	16	41	2.1	5.6	9.1	8.3	34	98	23	18	150	120	45	8.2	38	150	620	<1	21	0.4	100	99	190	1.2	14	<0.5	440		241000	24.1	10	62.0
KB412	31	0	S33º 51' 17.63"	E151º 07' 6.84"	0	150	25	270	370	25	560	200	785	0.18	0.44	0.04	0.12	1	0.39	2.9	3.3	2.1	1.2	3.9	2.7	1.3	0.4	1.3	3.9	21	<1	29	0.4	120	260	300	1.2	14	0.6	580		29300	2.93	2.93	7.2
KB413	32	0	S33º 50' 23.45"	E151º 06' 12.87"	0	150	25	240	350	25	520	160	705	0.11	0.36	0.03	0.09	0.49	0.19	1.5	1.6	1.1	0.63	2	1.3	0.63	0.1	0.67	2	11	<1	20	0.9	170	120	250	0.8	17	0.8	600		30300	3.03	3.03	3.6

Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	a-BHC	b-BHC	g-BHC	d-BHC	Heptachlor	Aldrin	Heptachlor Epoxide	g-Chlordane	a-Chlordane	Endosulfan I	p,p'-DDE	Dieldrin	Endrin	p,p'-DDD	Endosulfan II	Endrin Aldehyde	p,p'-DDT	Endosulfan Sulphate	HCB	Aroclor 1016	Aroclor 1111/Aroclor 1221	Aroclor 1131/Aroclor 1232	Aroclor 1141/Aroclor 1242	Aroclor 1148/Aroclor 1248	Aroclor 1154/Aroclor 1254	Aroclor 1160/Aroclor 1260
KB401	1	0	S33º 50' 35.01"	E151º 06' 10.54"	0	150	<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	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KB401	1	1	S33º 50' 35.01"	E151º 06' 10.54"	0	150	<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	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KB405	2	0	S33º 50' 32.75"	E151º 06' 49.79"	0	150	<0.01	<0.01	<0.01	<0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.06	<0.01	<0.02	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
KB504 Dup	6	0	S33º 50' 32.75"	E151º 06' 49.79"	0	150	<0.01	<0.01	<0.01	<0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.06	<0.01	<0.02	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
KB407	3	0	S33º 50' 34.46"	E151º 06' 51.16"	0	150	<0.01	<0.01	<0.01	<0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.06	<0.01	<0.02	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
KB409	4	0	S33º 50' 35.01"	E151º 06' 10.54"	0	150	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KB411	5	0	S33º 50' 25.82"	E151º 06' 49.63"	0	150	<0.02	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
NMI405			S33º 50' 32.75"	E151º 06' 49.79"	0	150										<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01								
KB402	25	0	S33º 50' 35.66"	E151º 06' 50.54"	0	300	<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	<0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
KB403	26	0	S33º 50' 35.49"	E151º 06' 50.43"	0	300	<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	<0.3	<0.1	<0.01	<0.3	<0.01	<0.03	<2	<2	<2	<2	<2	<2	<2
KB403	26	1	S33º 50' 35.49"	E151º 06' 50.43"	0	300	<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	<0.3	<0.1	<0.01	<0.3	<0.01	<0.03	<2	<2	<2	<2	<2	<2	<2
KB403B	33	0	S33º 50' 35.49"	E151º 06' 50.43"	0	150																										
KB404	27	0	S33º 51' 25.07"	E151º 07' 09.65"	0	300	<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	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KB406A	28	0	S33º 50' 34.35"	E151º 06' 50.01"	0	150	<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	<0.1	<0.01	<0.01	<0.05	<0.01	<0.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
KB406B	34	0	S33º 50' 34.35"	E151º 06' 50.01"	0	150																										
KB408A	29	0	S33º 50' 25.18"	E151º 06' 56.32"	0	150	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KB410	30	0	S33º 50' 24.76"	E151º 06' 47.42"	0	150	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	0.03	<0.01	<0.3	<0.01	<0.01	<0.1	<0.01	0.09	<1	<1	<1	<1	<1	<1	<1
KB412	31	0	S33º 51' 17.63"	E151º 07' 6.84"	0	150	<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	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
KB413	32	0	S33º 50' 23.45"	E151º 06' 12.87"	0	150	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

September 2015 Sediment Data

Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	TRH C_{10} - C_{14}	TRH C15 - C18	TRH C19 - C36/TRH C29 - C36	TRH $>C_{10}$-C_{16}	TRH $>C_{16}$-C_{34}	TRH $>C_{34}$-C_{40}	Sum C_{10} - C_{40}	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Antimony - low level	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	Total Cyanide	Total Organic Carbon	TOC% Norm 1%	PAH Norm 1%	Moisture
KB510-1	2	0	S 33º 50' 35.02"	E 151º06' 51.06"	3100	3400	280	4000	1400	720	4800	680	6200	4.6	7.6	7.3	4	15	16	64	66	29	25	29	23	9.5	3	11	33	310	0.5	55	0.8	160	110	280	1.5	38	0.25	560	41	61000	6.1	50.8	61
KB510-3	5	0	S 33º 50' 35.02"	E 151º06' 51.06"	7400	7700	25	50	50	25	50	50	125	0.14	0.02	0.005	0.02	0.08	0.02	0.04	0.04	0.01	0.02	0.01	0.01	0.005	0.005	0.005	0.01	0.4	0.5	16	0.5	15	5	12	0.02	5.2	0.25	16	0.25	4800	0.48	0.8	34
KB510-4	1	0	S 33º 50' 35.02"	E 151º06' 51.06"	8500	8800	25	50	50	25	50	50	125	0.17	0.03	0.005	0.03	0.13	0.04	0.07	0.06	0.02	0.03	0.03	0.02	0.005	0.005	0.005	0.03	0.63	0.5	16	0.5	13	4	11	0.01	5	0.25	15	0.25	5900	0.59	1.1	33
KB510-4	1	1	S 33º 50' 35.02"	E 151º06' 51.06"	8500	8800	25	50	50	25	50	50	125	0.11	0.02	0.005	0.02	0.08	0.03	0.04	0.04	0.01	0.02	0.01	0.005	0.005	0.005	0.005	0.005	0.37	0.5	15	0.5	13	5	12	0.01	5	0.25	15	0.25	6100	0.61	0.6	
KB514-2	6	0	S 33º 50' 35.11"	E 151º06' 51.83"	2400	2700	25	50	50	25	50	50	125	0.15	0.11	0.04	0.04	0.18	0.06	0.27	0.86	0.08	0.13	0.22	0.16	0.07	0.02	0.08	0.2	2.5	0.5	18	0.5	29	17	37	0.09	12	0.25	50	1.8	16000	1.6	1.6	47
KB514-4	3	0	S 33º 50' 35.11"	E 151º06' 51.83"	4800	5100	25	50	50	25	50	50	125	0.07	0.005	0.005	0.01	0.04	0.02	0.02	0.02	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.18	0.5	8.6	0.5	6.5	2	5.5	0.005	5	0.25	40	0.25	3200	0.32	0.6	20
KB510-2	8	0	S 33º 50' 35.02"	E 151º06' 51.06"	5300	5600	250	790	220	370	840	50	1260	94	20	4.2	15	49	15	29	28	11	9.2	12	9.4	3.7	1	4.2	13	300	0.5	17	0.5	14	3	8.5	0.005	5.2	0.25	15	0.25	21000	2.1	142.9	33
KB516-2	7	0	S 33º 50' 34.14"	E 151º06' 52.74"	1600	1900	25	240	220	25	410	50	485	0.36	1.2	0.15	0.24	1.3	0.58	3.5	4.5	2.6	3	9.2	6.5	2.9	0.9	3.1	8.9	40	0.5	23	0.2	35	76	170	1.3	13	0.25	300	1.5	21000	2.1	19.0	48
KB514-1	13	0	S 33º 50' 35.11"	E 151º06' 51.83"	1400	1700	25	120	50	25	170	50	245	0.68	0.91	0.24	0.37	1.1	0.47	2.3	6.7	1.2	1.3	3.2	2.2	0.77	0.2	0.85	2.9	23	0.5	34	0.3	130	70	200	1	42	0.25	360	65	58000	5.8	4.0	51
KB514-3	12	0	S 33º 50' 35.11"	E 151º06' 51.83"	3900	4200	260	1400	430	480	1600	210	2290	87	34	9.3	26	81	25	47	45	18	15	21	16	6.2	1.7	7	22	440	0.5	23	0.5	12	3	7.5	0.005	5.2	0.25	13	0.25	7300	0.73	602.7	28
KB515-1A	14	0	S 33º 50' 34.48"	E 151º06' 52.46"	125	400	25	230	110	62	290	50	402	5.2	1.1	2.5	2.2	7.3	2.8	4.2	6.6	2	2	3.8	2.7	0.9	0.1	0.99	3.6	44	0.5	41	0.5	110	95	240	1.9	19	0.25	430	14	36000	3.6	12.2	51
KB515-2	15	0	S 33º 50' 34.48"	E 151º06' 52.46"	1000	1300	71	350	110	140	370	50	560	12	2.6	6	6.3	17	5.7	7.7	10	4.1	3.7	4.3	3.2	1	0.3	1.1	4.5	86	0.5	32	0.3	86	72	190	1.3	23	0.25	340	36	31000	3.1	27.7	53
KB515-3	16	0	S 33º 50' 34.48"	E 151º06' 52.46"	2000	2300	25	50	50	25	50	50	125	0.25	1	0.74	1.3	3.7	1.3	1.5	2.1	0.78	0.83	0.81	0.62	0.17	0.05	0.21	0.9	15	0.5	20	0.5	21	21	56	0.3	9.5	0.25	92	1.4	26000	2.6	5.8	46
KB515-4	11	1	S 33º 50' 34.48"	E 151º06' 52.46"	3600	3900	25	50	50	25	50	50	125	0.005	0.005	0.005	0.005	0.015	0.005	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	NIL (+)VE	0.5	11	0.5	6.2	2	5	0.005	2	0.25	6.1	0.25	2600	0.26	0.26		21
KB515-4	11	0	S 33º 50' 34.48"	E 151º06' 52.46"	3600	3900	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.03	<0.01	0.02	0.02	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	<1	11	<0.1	6.1	2	4	<0.01	2	<0.5	6	<0.5		0	0.2	0.2	
KB516-1	10	0	S 33º 50' 34.14"	E 151º06' 52.74"	300	600	1000	9300	2900	2500	10000	1300	13800	49	19	110	70	310	110	160	190	82	70	73	61	20	7.7	21	87	1400	0.5	51	1.2	400	130	220	1.1	73	0.25	610	160	33000	3.3	424.2	71
KB516-3	9	0	S 33º 50' 34.14"	E 151º06' 52.74"	4000	4300	25	50	50	25	50	50	125	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	NIL (+)VE	0.5	6.1	0.5	5	1	4	0.005	2	0.25	5	0.25	1400	0.14	0.2		17
KB514-5	18	0	S 33º 50' 35.11"	E 151º06' 51.83"	5600	5900	25	50	50	25	50	50	125	0.05	0.02	0.005	0.02	0.1	0.04	0.08	0.16	0.03	0.05	0.06	0.04	0.02	0.005	0.02	0.05	0.69	0.5	7.1	0.5	13	5	6	0.005	1	0.25	6.3	0.25	200	0.02	0.2	3.5	14
KB515-5	17	0	S 33º 50' 34.48"	E 151º06' 52.46"	4400	4700	25	50	50	25	50	50	125	0.005	0.005	0.005	0.005	0.015	0.005	0.01	0.01	0.01	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.03	0.5	4	0.5	5.8	1	7	0.005	2	0.25	4	0.25	900	0.09	0.2	0.2	23
KB502-1	19	0	S 33º 50' 34.09"	E 151º06' 50.17"	1800	2100	110	400	100	180	410	50	640	34	10	2.6	8.4	27	7.5	14	14	5.2	4.4	5.6	4.2	1.4	0.4	1.6	5.8	140	0.5	13	0.5	15	5.6	11	0.02	5.9	0.25	20	0.25	12000	1.2	116.7	33
KB502-2	28	0	S 33º 50' 34.09"	E 151º06' 50.17"	2900	3200	160	290	50	210	270	50	530	60	11	1.8	6.6	21	6.6	10	9.9	3.4	2.9	3.5	2.4	0.8	0.2	0.9	3.4	140	0.5	22	0.5	12	3	8.8	0.005	4	0.25	13	0.25	8700	0.87	160.9	28
KB511-1	32	0	S 33º 50' 34.30"	E 151º06' 52.15"	100	400	4500	17000	4400	8000	17000	2000	27000	860	96	230	260	720	240	290	350	140	130	110	110	32	13	33	150	3600	0.5	54	0.8	360	100	220	1	72	0.25	510	100	34000	3.4	1058.8	68
KB511-3	30	0	S 33º 50' 34.30"	E 151º06' 52.15"	4500	4800	25	50	50	25	50	50	125	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	NIL (+)VE	0.5	19	0.5	12	3	7.4	0.01	5	0.25	15	0.25	7600	0.76	0.76		28
KB511-4	26	0	S 33º 50' 34.30"	E 151º06' 52.15"	5400	5700	25	50	50	25	50	50	125	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.01	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.01	0.5	11	0.5	6.8	2	5.6	0.005	2	0.25	6.8	0.25	2300	0.23	0.23	0.0	19
KB511-5	25	0	S 33º 50' 34.30"	E 151º06' 52.15"	400	700	840	5800	1800	1700	6400	880	8980	100	21	51	48	180	64	100	110	53	45	47	37	12	4.3	12	53	890	1	59	1.1	430	120	250	1.2	97	0.25	620	150	65000	6.5	136.9	71
KB511-6	29	0	S 33º 50' 34.30"	E 151º06' 52.15"	1000	1300	100	1200	470	240	1400	220	1860	0.71	2.1	1.9	0.84	3.1	3.7	13	18	6.6	6.8	8.5	6.5	2.1	0.7	2.3	8.9	76	0.5	45	0.6	150	120	270	1.8	24	0.25	520	16	31000	3.1	24.5	60
KB511-7C	23	0	S 33º 50' 34.30"	E 151º06' 52.15"	1400	1700	25	50	50	25	50	50	125	0.56	0.4	0.1	0.17	0.54	0.25	0.93	1.2	0.52	0.65	1.8	1.1	0.47	0.1	0.54	2	9.4	0.5	32	0.3	53	91	210	1.8	18	0.25	420	0.9	22000	2.2	4.3	49
KB512-2	21	0	S 33º 50' 34.07"	E 151º06' 52.63"	4500	4800	25	50	50	25	50	50	125	0.03	0.005	0.005	0.005	0.015	0.005	0.02	0.03	0.005	0.005	0.03	0.005	0.005	0.005	0.005	0.005	0.11	0.5	13	0.5	19	14	30	0.09	8.2	0.25	42	0.25	13000	1.3	0.1	39
KB512-2	21	1	S 33º 50' 34.07"	E 151º06' 52.63"	4500	4800	25	50	50	25	50	50	125	0.04	0.005	0.005	0.005	0.015	0.005	0.03	0.03	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.1	0.5	13	0.5	18	13	29	0.08	8	0.25	37	0.25	14000	1.4	0.1		
KB512-3	20	0	S 33º 50' 34.07"	E 151º06' 52.63"	6600	6900	25	50	50	25	50	50	125	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	NIL (+)VE	0.5	6.1	0.5	5	1	4	0.005	2	0.25	5	0.25	3700	0.37	0.37		20
KB515-1B	22	0	S 33º 50' 34.48"	E 151º06' 52.46"	125	400	160	1100	360	330	1200	150	1680	26	3.9	13	13	37	13	17	25	9	8.1	10	8.5	2.6	0.8	2.8	12	190	0.5	42	0.5	120	100	270	1.9	25	0.25	490	120	48000	4.8	39.6	56
KB515-1C	24	0	S 33º 50' 34.48"	E 151º06' 52.46"	125	400	54	430	260	96	600	120	816	11	1.6	3.1	2.7	8.4	2.9	5.7	8.3	3.4	3.2	6.9	4.6	1.8	0.5	2	6.4	66	0.5	36	0.5	95	97	260	1.8	19	0.25	470	54	40000	4	16.5	55
KB512-1	33	0	S 33º 50' 34.07"	E 151º06' 52.63"	500	800	1800	9600	2600	3700	10000	1200	14900	300	44	170	160	440	130	180	230	100	89	92	83	28	11	29	120	2100	0.5	55	1.1	400	120	240	1.2	80	0.25	600	300	63000	6.3	333.3	68
KB502-3	37	0	S 33º 50' 34.09"	E 151º06' 50.17"	3600	3900	280	560	120	370	560	50	980	120	18	2.9	12	33	11	17	17	5.9	5.3	6.4	5	2.1	0.5	2.3	7	250	0.5	21	0.5	16	4	10	0.005	6.2	0.25	17	0.25	12000	1.2	208.3	30
KB502-4	36	0	S 33º 50' 34.09"	E 151º06' 50.17"	4900	5200	110	150	50	140	130	50	320	41	6.6	1.1	4.7	13	3.9	6.1	5.8	1.8	1.7	1.9	1.3	0.6	0.1	0.7	2	90	0.5	16	0.5	13	3	8.6	0.005	5	0.25	14	0.25	8700	0.87	0.87	103.4	28
KB502-6	35	0	S 33º 50' 34.09"	E 151º06' 50.17"	6900	7200	25	50	50	25	50	50	125	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	NIL (+)VE	0.5	5.4	0.5	4	2	4	0.005	2	0.25	6.1	0.25	2900	0.29	0.29		17

Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	TRH C_{10} - C_{14}	TRH C15 - C18	TRH C19 - C36/TRH C29 - C36	TRH >C_{10}-C_{16}	TRH >C_{16}-C_{34}	TRH >C_{34}-C_{40}	Sum C_{10} - C_{40}	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Antimony - low level	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	Total Cyanide	Total Organic Carbon	TOC% Norm 1%	PAH Norm 1%	Moisture
KB511-7A	38	0	S 33º 50' 34.30"	E 151º06' 52.15"	1400	1700	25	50	50	25	50	50	125	0.47	0.34	0.08	0.16	0.55	0.22	1	1.3	0.51	0.68	1.6	0.98	0.53	0.2	0.61	1	9.2	0.5	27	0.2	48	88	210	1.3	16	0.25	360	0.8	22000	2.2	2.2	4.2	48
KB504-1	45	0	S 33º 50' 35.78"	E 151º06' 50.63"	800	1100	120	230	50	170	220	50	440	48	4.6	2	6.7	17	5	8.4	8	3.2	2.7	3.6	2.7	1.4	0.2	1.2	3.8	110	0.5	20	0.5	28	18	32	0.07	13	0.25	52	0.5	19000	1.9	1.9	57.9	48
KB504-2	43	0	S 33º 50' 35.78"	E 151º06' 50.63"	1900	2200	110	250	50	160	240	50	450	54	8.4	2.3	7.7	22	5.9	10	9.7	3.4	3	3.8	2.9	1.4	0.2	1.3	4	140	0.5	16	0.5	12	3	7.4	0.005	5	0.25	15	0.25	13000	1.3	1.3	107.7	28
KB504-3A	44	0	S 33º 50' 35.78"	E 151º06' 50.63"	3900	4200	57	50	50	76	50	50	176	27	3.9	0.5	2.8	7.8	2.2	3.3	3.1	1.1	0.97	1.2	0.89	0.47	0.05	0.42	1	55	0.5	17	0.5	15	3	9.5	0.005	6	0.25	17	0.25	7000	0.7	0.7	78.6	27
KB504.3B	42	0	S 33º 50' 35.78"	E 151º06' 50.63"	3900	4200	180	370	50	250	360	50	660	95	13	2.2	9.2	23	7.2	12	11	4.5	3.9	5	3.8	1.6	0.4	1.8	5.4	190	0.5	19	0.5	15	3	9.3	0.005	5.4	0.25	16	0.25	8500	0.85	0.85	223.5	28
KB505-1A	46	0	S 33º 50' 36.32"	E 151º06' 50.91"	1900	2200	25	50	50	25	50	50	125	0.05	0.03	0.005	0.02	0.1	0.02	0.12	0.18	0.11	0.05	0.1	0.07	0.03	0.005	0.02	0.1	0.92	0.5	33	0.2	24	7.3	18	0.05	9.9	0.25	39	0.25	18000	1.8	1.8	0.5	42
KB505-1B	48	0	S 33º 50' 36.32"	E 151º06' 50.91"	1900	2200	25	50	50	25	50	50	125	0.05	0.28	0.005	0.02	0.1	0.03	0.52	1.2	0.88	0.82	1.6	1.2	0.69	0.2	0.62	2	8.2	0.5	27	0.1	26	11	27	0.1	10	0.25	55	0.25	17000	1.7	1.7	4.8	41
KB505-1C	40	0	S 33º 50' 36.32"	E 151º06' 50.91"	1900	2200	25	50	50	25	50	50	125	0.44	0.21	0.03	0.1	0.31	0.07	0.32	0.58	0.43	0.51	0.63	0.4	0.2	0.08	0.25	0.6	4.6	0.5	31	0.1	28	11	27	0.1	12	0.25	59	0.25	19000	1.9	1.9	2.4	41
KB505-2	39	0	S 33º 50' 36.32"	E 151º06' 50.91"	2900	3200	25	50	50	25	50	50	125	0.005	0.005	0.005	0.005	0.005	0.015	0.005	0.02	0.04	0.005	0.03	0.005	0.005	0.005	0.005	0.01	0.09	0.5	13	0.5	8.9	2	5.4	0.005	3	0.25	10	0.25	6200	0.62	0.62	0.1	24
KB508.2A	41	0	S 33º 50' 33.79"	E 151º06' 51.72"	4000	4300	2400	7100	2100	3500	7800	880	12180	890	190	29	150	410	110	220	200	88	75	110	88	39	15	41	130	2700	0.5	22	0.5	17	4	11	0.01	6.2	0.25	18	0.25	15000	1.5	1.5	1800.0	34
KB508.2A	41	1	S 33º 50' 33.79"	E 151º06' 51.72"	4000	4300	1300	3900	1200	2000	4200	530	6730	500	100	17	82	210	61	120	110	47	39	54	43	20	5.6	21	62	1400	0.5	23	0.5	16	4	10	0.005	5.9	0.25	17	0.25	11000	1.1	1.1	1272.7	
KB508.5	47	0	S 33º 50' 33.79"	E 151º06' 51.72"	1500	1760	25	50	50	25	50	50	125	0.16	0.32	0.06	0.07	0.37	0.11	0.92	1.3	0.59	0.78	2	1.4	0.78	0.1	0.66	2	9.7	0.5	25	0.2	37	93	180	1.3	15	0.25	330	0.6	19000	1.9	1.9	5.1	48
KB508-1	52	0	S 33º 50' 33.79"	E 151º06' 51.72"	2000	2300	25	50	50	25	50	50	125	0.19	0.38	0.07	0.11	0.65	0.3	1.1	1.6	0.69	0.84	2.4	1.7	0.92	0.1	0.84	2.2	12	0.5	23	0.2	49	86	190	1.4	16	0.25	340	0.8	20000	2	2	6.0	48
KB508-2B	53	0	S 33º 50' 33.79"	E 151º06' 51.72"	4000	4300	1300	3400	910	1900	3500	400	5800	480	80	19	75	200	49	100	94	35	29	39	31	16	3.1	14	43	1300	0.5	21	0.5	17	4	10	0.005	6.3	0.25	18	0.25	12000	1.2	1.2	1083.3	33
KB508-2C	50	0	S 33º 50' 33.79"	E 151º06' 51.72"	4000	4300	340	980	260	520	1000	50	1570	130	25	4	20	56	14	26	24	10	8.4	11	8.9	4.7	0.6	4	12	340	0.5	20	0.5	16	4	9.9	0.01	5.8	0.25	16	0.25	9400	0.94	0.94	361.7	36
KB508-3	49	0	S 33º 50' 33.79"	E 151º06' 51.72"	5100	5400	25	50	50	25	50	50	125	1.1	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	1.1	0.5	15	0.5	15	5	12	0.01	5.3	0.25	15	0.25	5300	0.53	0.53	2.1	32
KB508-4	51	0	S 33º 50' 33.79"	E 151º06' 51.72"	900	1200	600	7000	2500	1500	8200	1100	10800	1.2	5.8	5.6	3.6	5.5	11	68	80	33	32	33	28	12	3.9	11	41	330	0.5	57	0.8	280	120	290	1.7	45	0.25	530	83	26000	2.6	2.6	126.9	66
KB508-4	51	1	S 33º 50' 33.79"	E 151º06' 51.72"	900	1200	370	4100	1600	870	4800	690	6360	0.96	4.1	3.7	2	4.4	7.2	47	55	23	21	24	20	9.8	1.6	9.2	28	230	0.5	55	0.8	290	120	280	1.2	48	0.25	540	99		0	0.2	1150.0	
KB501-1	63	0	S 33º 50' 34.88"	E 151º06' 50.19"	600	900	25	160	50	25	210	50	285	8.8	2.1	0.72	3	11	4	6	9.4	1.7	2.2	6.3	4.2	2.6	0.5	2.2	5.9	64	0.5	29	0.3	62	110	200	1.2	21	0.25	370	3.9	25000	2.5	2.5	25.6	53
KB501-2	59	0	S 33º 50' 34.88"	E 151º06' 50.19"	2400	2700	25	50	50	25	50	50	125	0.84	0.16	0.26	0.45	1.2	0.35	0.45	0.42	0.13	0.16	0.1	0.09	0.05	0.01	0.05	0.1	4.7	0.5	14	0.5	21	14	32	0.08	9.4	0.25	46	0.25	15000	1.5	1.5	3.1	40
KB501-4	55	0	S 33º 50' 34.88"	E 151º06' 50.19"	5500	5800	2500	6700	1900	3500	7100	740	11340	1100	160	19	140	380	100	190	170	76	61	79	60	32	5.5	28	85	2600	0.5	2	0.5	6.1	2	11	0.005	2	0.25	8.8	0.25	5900	0.59	0.59	4406.8	15
KB501.7	62	0	S 33º 50' 34.88"	E 151º06' 50.19"	7600	7900	1100	2900	810	1600	3100	360	5060	390	73	9.6	48	160	38	69	63	29	25	33	26	13	2	12	36	990	0.5	0.25	0.5	6.7	4	3	0.03	1	0.25	2	0.25	5100	0.51	0.51	1941.2	13
KB503-1	57	0	S 33º 50' 35.46"	E 151º06' 50.33"	600	900	890	2400	670	1300	2600	310	4210	340	53	10	47	140	32	59	54	24	20	28	21	11	2.2	9.9	30	850	0.5	19	0.5	21	20	58	0.3	11	0.25	120	0.25	37000	3.7	3.7	229.7	45
KB503-3	58	0	S 33º 50' 35.46"	E 151º06' 50.33"	3000	3300	25	50	50	25	50	50	125	15	1.6	0.24	0.98	2.4	0.77	0.9	0.93	0.18	0.18	0.26	0.18	0.06	0.02	0.08	0.2	23	0.5	16	0.5	14	3	9.6	0.005	5.1	0.25	15	1	5600	0.56	0.56	41.1	29
KB503-4	61	0	S 33º 50' 35.46"	E 151º06' 50.33"	5000	5300	25	50	50	25	50	50	125	4.9	0.57	0.18	0.23	0.29	0.04	0.09	0.1	0.04	0.03	0.03	0.02	0.005	0.005	0.005	0.03	6.5	0.5	16	0.5	16	4	12	0.01	5.8	0.25	16	1.9	5600	0.56	0.56	11.6	31
KB503-4	61	1	S 33º 50' 35.46"	E 151º06' 50.33"	5000	5300	25	50	50	25	50	50	125	4.1	0.38	0.19	0.22	0.2	0.03	0.06	0.07	0.02	0.01	0.02	0.01	0.005	0.005	0.005	0.01	5.3	0.5	17	0.5	16	4	12	0.01	5.6	0.25	16	2	6100	0.61	0.61	8.7	
KB503-5	56	0	S 33º 50' 35.46"	E 151º06' 50.33"	8000	8300	25	50	50	25	50	50	125	0.21	0.04	0.005	0.02	0.13	0.03	0.05	0.06	0.02	0.02	0.02	0.01	0.005	0.005	0.005	0.01	0.61	0.5	15	0.5	16	5.1	14	0.01	5.9	0.25	18	0.25	7000	0.7	0.7	0.9	32
KB503-5	56	1	S 33º 50' 35.46"	E 151º06' 50.33"	8000	8300																																					0	0.2	0.0	
KB504-3C	54	0	S 33º 50' 35.78"	E 151º06' 50.63"	3900	4200	61	50	50	80	50	50	180	29	4.1	0.67	2.9	8.1	2.2	3.1	2.9	1	0.91	1.2	0.91	0.48	0.05	0.4	1	58	0.5	20	0.5	16	4	10	0.005	5.9	0.25	16	0.25	8400	0.84	0.84	69.0	28
KB507-2A	60	0	S 33º 50' 34.64"	E 151º06' 51.04"	4300	4600	2300	6100	1800	3300	6600	760	10660	840	170	20	130	330	97	190	180	68	55	73	57	29	2.7	26	78	2300	0.5	17	0.5	16	4	10	0.005	6.1	0.25	18	0.25	31000	3.1	3.1	741.9	33
KB507.3	64	0	S 33º 50' 34.64"	E 151º06' 51.04"	5500	5800	25	50	50	25	50	50	125	2.7	0.02	0.05	0.02	0.04	0.005	0.02	0.02	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	2.9	0.5	14	0.5	15	4	12	0.005	5.4	0.25	15	0.25	5900	0.59	0.59	4.9	29
KB504-4	72	0	S 33º 50' 35.78"	E 151º06' 50.63"	5900	6200	25	50	50	25	50	50	125	1	0.01	0.005	0.01	0.04	0.005	0.02	0.02	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	1.1	0.5	14	0.5	12	4	9.9	0.005	4	0.25	13	0.25	5200	0.52	0.52	2.1	27
KB504.5	68	0	S 33º 50' 35.78"	E 151º06' 50.63"	6900	7200	25	50	50	25	50	50	125	0.02	0.005	0.005	0.02	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.04	0.5	9	0.5	5.8	2	5.2	0.005	2	0.25	6.4	0.25	6000	0.6	0.6	0.1	17
KB504-6	70	0	S 33º 50' 35.78"	E 151º06' 50.63"	7900	8200	25	50	50	25	50	50	125	0.03	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.03	0.5	4	0.5	8.9	3	5.6	0.005	1	0.25	3	0.25	600	0.06	0.2	0.2	15
KB507-1	66	0	S 33º 50' 34.64"	E 151º06' 51.04"	2700	2800	310	5800	2200	1000	6900	970	8870	6.8	23	26	16	120	64	140	140	59	51	63	47	24	2.6	20	65	800	0.5	20	0.2	150	42	120	0.6	67	0.25	210	77	200000	20	10	80.0	40
KB507-1	66	1	S 33º 50' 34.64"	E 151º06' 51.04"	2700	2800																																			260000	26	10	0.0	
KB507-2B	65	0	S 33º 50' 34.64"	E 151º06' 51.04"	4300	4600	710	1800	490	990	1900	230	3120	260	53	7.9	35	100	31	56	53	20	18	24	18	9.7	1.3	8.8	25	700	0.5	20	0.5	15	3	9.3	0.005	5.7	0.25	16	0.25	15000	1.5	1.5	466.7	32

Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	TRH C_{10} - C_{14}	TRH C15 - C18	TRH C19 - C36/TRH C29 - C36	TRH >C_{10}-C_{16}	TRH >C_{16}-C_{34}	TRH >C_{34}-C_{40}	Sum C_{10} - C_{40}	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Antimony - low level	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	Total Cyanide	Total Organic Carbon	TOC% Norm 1%	PAH Norm 1%	Moisture
KB507-2C	69	0	S 33º 50' 34.64"	E 151º06' 51.04"	4300	4600	880	2200	630	1200	2400	280	3880	300	66	9.6	41	120	39	66	62	26	22	30	23	12	1.7	11	32	830	0.5	18	0.5	15	4	9.5	0.01	5.7	0.25	16	0.25	15000	1.5	1.5	553.3	29
KB507-4	67	0	S 33º 50' 34.64"	E 151º06' 51.04"	6500	6800	25	50	50	25	50	50	125	0.05	0.02	0.005	0.03	0.1	0.05	0.07	0.07	0.03	0.02	0.03	0.02	0.005	0.005	0.01	0.03	0.5	0.5	17	0.5	17	5.5	18	0.01	6	0.25	18	0.25	5700	0.57	0.57	0.9	35
KB507-5	71	0	S 33º 50' 34.64"	E 151º06' 51.04"	8000	8300	25	50	50	25	50	50	125	0.12	0.02	0.02	0.05	0.15	0.08	0.1	0.1	0.03	0.03	0.04	0.03	0.005	0.005	0.01	0.04	0.78	0.5	8.7	0.5	7.8	3	7.8	0.005	3	0.25	9.9	0.25	6300	0.63	0.63	1.2	19
KB507-5	71	1	S 33º 50' 34.64"	E 151º06' 51.04"	8000	8300	25	50	50	25	50	50	125	0.03	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.03	0.5	8.9	0.5	7.5	3	8	0.005	3	0.25	9.8	0.25		0	0.2	0.2	
KB507-6	73	0	S 33º 50' 34.64"	E 151º06' 51.04"	400	700	2500	19000	5800	5100	21000	2400	28500	500	67	74	200	700	240	420	380	150	130	170	110	65	8.3	53	160	3300	0.5	46	0.5	100	99	270	0.4	28	0.25	480	82	49000	4.9	4.9	673.5	55
KB507-6	73	1	S 33º 50' 34.64"	E 151º06' 51.04"	400	700																																				49000	4.9	4.9	0.0	
KB501-3	74	0	S 33º 50' 34.88"	E 151º06' 50.19"	4500	4800	230	590	140	330	600	50	980	89	19	3	14	37	11	20	19	7.1	6.4	8.1	6.2	3.4	0.5	2.9	8.6	250	0.5	15	0.5	9.8	3	7.4	0.005	3	0.25	9.1	0.25	5400	0.54	0.54	463.0	24
KB501-5	76	0	S 33º 50' 34.88"	E 151º06' 50.19"	6500	6800	1100	2900	860	1600	3200	410	5210	460	79	11	46	160	51	86	81	31	28	37	28	15	2.8	13	40	1100	0.5	0.25	0.5	5.5	1	2	0.01	0.7	0.25	2	0.25	14000	1.4	1.4	785.7	15
KB503-2	75	0	S 33º 50' 35.46"	E 151º06' 50.33"	1700	2000	290	600	130	400	600	50	1050	110	20	3.1	14	37	11	19	18	7.1	6.2	8	5.9	3.3	0.4	2.7	8.3	270	0.5	18	0.5	12	3	7.3	0.005	5.1	0.25	13	0.7	11000	1.1	1.1	245.5	30
KB522-1	78	0	S 33º 50' 33.10"	E 151º06' 51.55"	1500	1800	25	340	110	62	400	50	512	0.28	0.97	0.92	0.34	0.97	1.3	9.3	10	4.1	4.5	4.6	3.6	1.7	0.2	1.4	4.9	44	0.5	50	0.7	240	130	270	1.3	35	0.25	520	27	24000	2.4	2.4	18.3	66
KB522-2	79	0	S 33º 50' 33.10"	E 151º06' 51.55"	3300	3600	25	50	50	58	50	50	158	24	2.6	0.37	1.5	3	1	0.98	0.92	0.26	0.26	0.29	0.2	0.11	0.02	0.08	0.3	36	0.5	18	0.5	14	3	7.8	0.005	5	0.25	16	0.25	10000	1	1	36.0	33
KB522-3	77	0	S 33º 50' 33.10"	E 151º06' 51.55"	5500	5800	25	50	50	25	50	50	125	0.39	0.04	0.01	0.03	0.12	0.04	0.06	0.06	0.01	0.02	0.02	0.01	0.005	0.005	0.005	0.01	0.81	0.5	17	0.5	16	5.4	14	0.02	5.6	0.25	16	0.25	5500	0.55	0.55	1.5	37
KB524-2	80	0	S 33º 50' 33.23"	E 151º06' 49.50"	2200	2500	25	50	50	25	50	50	125	0.005	0.005	0.005	0.005	0.01	0.005	0.02	0.02	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.04	0.5	10	0.5	7.7	2	4	0.005	3	0.25	8.6	0.25	5200	0.52	0.52	0.1	22
KB523-1	89	0	S 33º 50' 34.12"	E 151º06' 49.90"	1000	1300	25	50	50	25	50	50	125	0.01	0.05	0.08	0.23	0.94	0.33	0.36	0.33	0.14	0.12	0.2	0.14	0.05	0.005	0.06	0.2	3	0.5	20	0.5	13	3	8	0.005	5.1	0.25	16	0.25	8100	0.81	0.81	3.7	26
KB523-2	87	0	S 33º 50' 34.12"	E 151º06' 49.90"	2200	2500	25	50	50	25	50	50	125	13	2	0.33	1.3	3.3	1.1	1.3	1.2	0.39	0.39	0.44	0.28	0.18	0.02	0.18	0.4	26	0.5	17	0.5	11	3	7.6	0.005	4	0.25	11	0.25	6500	0.65	0.65	40.0	25
KB523-3	90	0	S 33º 50' 34.12"	E 151º06' 49.90"	3200	3500	25	50	50	25	50	50	125	0.03	0.03	0.1	0.03	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.19	0.5	7.5	0.5	5.2	2	4	0.005	2	0.25	5.2	0.25	1900	0.19	0.2	1.0	18
KB524-1	86	0	S 33º 50' 33.23"	E 151º06' 49.50"	300	600	25	50	50	25	50	50	125	0.03	0.22	0.005	0.03	0.08	0.05	0.33	0.76	0.29	0.49	1.9	1.3	0.73	0.1	0.56	2	6.9	0.5	29	0.1	23	14	34	0.2	9.2	0.25	65	0.25	17000	1.7	1.7	4.1	41
KB524-3	81	0	S 33º 50' 33.23"	E 151º06' 49.50"	3100	3400	25	50	50	25	50	50	125	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	NIL (+)VE	0.5	10	0.5	5.8	1	4	0.005	2	0.25	6	0.25	2800	0.28	0.28		19
KB524-3	81	1	S 33º 50' 33.23"	E 151º06' 49.50"	3100	3400	25	50	50	25	50	50	125	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	NIL (+)VE	0.5	8	0.5	5	0.9	3	0.005	2	0.25	4	0.25	2600	0.26	0.26		
KB506.1B	95	0	S 33º 50' 33.88"	E 151º06' 50.61"	1700	2000	410	2700	960	790	3100	410	4300	9.5	4.9	17	14	35	15	31	34	13	13	19	13	7.3	2.3	6.1	20	230	0.5	46	0.6	120	94	230	1	23	0.25	440	11	43000	4.3	4.3	53.5	47
KB506.1C	94	0	S 33º 50' 33.88"	E 151º06' 50.61"	1700	2000	480	3300	1200	980	3800	540	5320	10	6.1	18	16	44	17	35	40	16	16	23	17	9.1	1.4	7.7	23	280	0.5	54	0.7	150	120	280	1.4	28	0.25	600	8.3	42000	4.2	4.2	66.7	54
KB506-2	91	0	S 33º 50' 33.88"	E 151º06' 50.61"	3700	4000	1100	2700	750	1500	2900	320	4720	340	65	11	53	140	48	78	73	30	26	34	27	13	2.7	12	38	960	0.5	18	0.5	12	3	6.6	0.005	4	0.25	13	0.25	17000	1.7	1.7	564.7	31
KB506-2	91	1	S 33º 50' 33.88"	E 151º06' 50.61"	3700	4000	740	1900	500	1000	2000	200	3200	290	55	8.2	45	120	32	65	61	21	18	24	18	9.7	2	8.3	26	780	0.5	18	0.1	13	3	7	0.005	5	0.25	14	0.25		0	0.2	3900.0	
KB506-3	93	0	S 33º 50' 33.88"	E 151º06' 50.61"	5700	6000	25	50	50	25	50	50	125	0.06	0.005	0.005	0.005	0.015	0.005	0.005	0.005	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.06	0.5	16	0.5	14	5	12	0.01	5.1	0.25	15	0.25	5300	0.53	0.53	0.1	36
KB506-4	92	0	S 33º 50' 33.88"	E 151º06' 50.61"	7700	8000	25	50	50	25	50	50	125	0.03	0.005	0.005	0.005	0.01	0.005	0.02	0.02	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.07	0.5	10	0.5	5.5	2	6	0.01	2	0.25	9.1	0.25	4300	0.43	0.43	0.2	20
KB509-1B	88	0	S 33º 50' 33.49"	E 151º06' 52.20"	1000	1300	25	50	50	25	120	50	195	0.31	0.58	0.07	0.11	0.58	0.27	1.5	2.2	0.78	1	3.1	1.9	1.2	0.2	0.97	2.7	15	0.5	32	0.3	69	87	240	1.4	16	0.25	400	0.7	24000	2.4	2.4	6.3	50
KB509-2	85	0	S 33º 50' 33.49"	E 151º06' 52.20"	2000	2300	25	50	50	25	50	50	125	0.15	0.34	0.03	0.07	0.37	0.18	1	1.4	0.64	0.79	1.9	1.2	0.71	0.1	0.56	2	9.5	0.5	31	0.2	40	81	230	1.4	15	0.25	370	0.6	23000	2.3	2.3	4.1	49
KB509-3	82	0	S 33º 50' 33.49"	E 151º06' 52.20"	4000	4300	820	5700	1800	1700	6300	780	8780	35	100	21	110	320	100	190	170	67	60	80	60	30	3	29	82	1400	0.5	18	0.5	15	4	9.7	0.01	5	0.25	15	0.25	87000	8.7	8.7	160.9	31
KB509-4	84	0	S 33º 50' 33.49"	E 151º06' 52.20"	5500	5800	25	50	50	25	50	50	125	0.005	0.005	0.005	0.005	0.015	0.005	0.02	0.02	0.005	0.005	0.01	0.005	0.005	0.005	0.005	0.005	0.04	0.5	9.3	0.5	6.2	2	5.5	0.005	2	0.25	6.7	0.25	2600	0.26	0.26	0.2	23
KB506.1A	96	0	S 33º 50' 33.88"	E 151º06' 50.61"	1700	2000	170	1200	480	340	1500	220	2060	4	2.5	7.3	6.8	20	8.1	14	16	6	6.1	9	6.3	3.5	1	2.9	9.3	110	0.5	37	0.5	120	89	210	1	22	0.25	420	14	54000	5.4	5.4	20.4	45
KB510-5	4	0	S 33º 50' 35.02"	E 151º06' 51.06"	9400	9700	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	<1	8.4	<0.1	7.4	3	7.2	0.01	3	<0.5	10	<0.5	4500	0.45	0.45		19
KB511-7B	27	0	S 33º 50' 34.30"	E 151º06' 52.15"	1400	1700	<50	170	130	<50	260	<100	335	0.53	0.61	0.16	0.23	1	0.4	1.6	2.1	0.98	1.1	3.2	2	0.81	0.2	0.88	2.7	16	<1	23	0.2	39	83	190	1.2	14	<0.5	330	0.8	22000	2.2	2.2	7.3	48
KB502-5	34	0	S 33º 50' 34.09"	E 151º06' 50.17"	5800	6100	<50	<100	<100	<50	<100	<100	125	1.1	0.02	0.02	0.01	0.06	<0.01	0.02	0.02	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	1.2	<1	18	<0.1	15	5	12	0.01	5.4	<0.5	16	0.5	4800	0.48	0.48	2.5	28
KB509-1A	83	0	S 33º 50' 33.49"	E 151º06' 52.20"	1000	1300	<50	<100	<100	<50	<100	<100	125	0.23	0.62	0.07	0.31	1	0.47	1.4	1.8	0.62	0.78	2.1	1.4	0.82	0.1	0.66	2	12	<1	30	0.2	53	82	230	1.7	15	<0.5	380	1.1	28000	2.8	2.8	4.3	50
KB511-2	31	0	S 33º 50' 34.30"	E 151º06' 52.15"	3400	3700	<50	<100	<100	<50	<100	<100	125	0.11	0.16	0.02	0.04	0.23	0.07	0.43	1.3	0.23	0.42	1.2	0.69	0.2	0.1	0.23	1	5.5	<1	21	0.1	24	25	74	0.6	11	<0.5	130	<0.5	15000	1.5	1.5	3.7	45
KB511-2	31	1	S 33º 50' 34.30"	E 151º06' 52.15"	3400	3700	<50	<100	<100	<50	<100	<100	125	0.16	0.2	0.04	0.07	0.22	0.08	0.47	1.7	0.27	0.46	1.6	0.94	0.31	0.2	0.32	1	7	<1	19	<0.1	23	20	59	0.4	10	<0.5	110	<0.5		0	0.2	35.0	
KB509.1C	97	0	S 33º 50' 33.49"	E 151º06' 52.20"	1000	1300	<50	160	180	<50	290	110	425	0.49	0.95	0.11	0.26	0.95	0.6	2.4	3.1	1.4	1.6	5.1	3.2	2.1	0.3	1.7	4.4	24	<1	32	0.2	52	83	230	1.4	16	<0.5	390	1.1	32000	3.2	3.2	7.5	49

Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	TRH C_{10} - C_{14}	TRH C15 - C28	TRH C19 - C36/TRH C29 - C36	TRH >C_{10}-C_{16}	TRH >C_{10}-C_{16} C_{34}	TRH >C_{16}-C_{34} C_{40}	Sum C_{10} - C_{40}	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Antimony - low level	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	Total Cyanide	Total Organic Carbon	TOC% Norm 1%	PAH Norm 1%	Moisture
KB509.1C	97	1	S 33º 50' 33.49"	E 151º06' 52.20"	1000	1300																																		23000	2.3	2.3	0.0	

October 2015 Sediment Data

Sample ID	Sample ID	SAMPLE	REPLICATE	Lattitude	Longitude	Depth Top	Depth Bottom	TRH C_{10} - C_{14}	TRH C15 - C18	TRH C19 - C36/TRH C29 - C36	TRH >C_{10}-C_{16}	TRH >C_{16}-C_{34}	TRH >C_{34}-C_{40}	Sum C_{10} - C_{40}	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Zinc - low level	Total Cyanide	Total Organic Carbon		TOC% Norm 1%	PAH Norm 1%	Moisture
KB517-1	KB517-1	1	0	S 33º 50' 35.63"	E 151º06' 51.60"	0	300	320	4100	1700	720	5000	760	6480	5.8	13	1.5	2.8	10	4.5	100	160	42	47	60	45	16	4.5	20	62	530	23	0.4	310	43	160	0.48	170	230	160	340000	34	10	53.0	51
KB517-1	KB517-1	1	1	S 33º 50' 35.63"	E 151º06' 51.60"	0	300	340	4400	1800	760	5400	850	7010	8	11	2	3.2	12	6.5	78	130	39	43	52	37	13	4.4	17	53	450	19	0.5	280	42	130	0.63	130	240	140	340000	34	10	45.0	
KB517-2	KB517-2	2	0	S 33º 50' 35.63"	E 151º06' 51.60"	2200	2500	<50	<100	<100	<50	<100	<100	125	0.05	0.06	0.01	0.02	0.1	0.03	0.32	0.62	0.1	0.12	0.26	0.2	0.07	0.02	0.08	0.3	2.1	12	<0.1	13	5	7.4	<0.01	2	2	1.3	1200	0.12	0.2	10.5	15
KB518-1	KB518-1	3	0	S 33º 50' 34.68"	E 151º06' 52.44"	1800	2100	<50	150	<100	<50	210	<100	285	0.1	0.64	0.04	0.07	0.22	0.13	8.7	8.5	2.8	2.9	2.9	2.3	1.1	0.3	1.2	3.3	32	3	<0.1	6.9	1	9	0.03	3	7.3	<0.5	66000	6.6	6.6	4.8	22
KB519-1A	KB519-1A	4	0	S 33º 50' 34.27"	E 151º06' 52.59"	400	700	<50	190	140	<50	290	<100	365	0.28	0.65	0.08	0.11	0.63	0.17	2.5	4.9	2	1.3	4.8	3.5	1.7	0.5	2.1	4.9	25	22	0.3	46	53	150	0.98	13	280	5.4	39000	3.9	3.9	6.4	38
KB519-1B	KB519-1B	5	0	S 33º 50' 34.27"	E 151º06' 52.59"	400	700	<50	120	100	<50	200	<100	275	0.27	0.56	0.1	0.11	0.69	0.22	2.3	3.9	2	1.4	4.7	3.4	1.6	0.7	2	5	24	21	0.2	42	37	100	0.66	12	200	4.3	31000	3.1	3.1	7.7	36
KB519-1C	KB519-1C	6	0	S 33º 50' 34.27"	E 151º06' 52.59"	400	700	<50	<100	<100	<50	<100	<100	125	0.16	0.28	0.06	0.06	0.39	0.17	1	1.4	0.76	0.65	2	1.4	0.7	0.2	0.86	2	10	19	0.1	29	29	73	0.49	10	140	1.9	23000	2.3	2.3	4.3	39
KB519-2	KB519-2	7	0	S 33º 50' 34.27"	E 151º06' 52.59"	1600	1900	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	5.2	<0.1	8.7	1	5	<0.01	3	6.2	<0.5	5900	0.59	0.59		19
KB519-3	KB519-3	8	0	S 33º 50' 34.27"	E 151º06' 52.59"	2600	2900	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	1	<0.1	6.3	1	5.3	0.01	1	3	<0.5	200	0.02	0.2		14
KB520-1	KB520-1	9	0	S 33º 50' 34.09"	E 151º06' 53.14"	400	700	<50	<100	<100	<50	110	<100	185	0.16	0.35	0.05	0.06	0.32	0.19	2.7	3.8	1.7	1.2	2.6	2	0.97	0.2	1.2	2.8	18	19	0.2	29	47	150	1.1	12	270	5.5	29000	2.9	2.9	6.2	35
KB520-2	KB520-2	10	0	S 33º 50' 34.09"	E 151º06' 53.14"	1500	1800	<50	<100	<100	<50	<100	<100	125	0.03	0.04	0.01	0.01	0.04	0.02	0.08	0.18	0.07	0.07	0.2	0.13	0.05	0.02	0.05	0.2	0.98	8.7	<0.1	7.5	2	5.7	0.01	4	8.7	<0.5	2700	0.27	0.27	3.6	22
KB525-1	KB525-1	11	0	S 33º 50' 34.60"	E 151º06' 49.73"	200	440	<50	<100	<100	<50	<100	<100	125	0.04	0.01	<0.01	<0.01	0.09	0.03	0.13	0.12	0.05	0.04	0.09	0.06	0.03	<0.01	0.03	0.07	0.74	17	<0.1	18	5	13	0.02	9.5	30	<0.5	21000	2.1	2.1	0.4	39
KB525-1	KB525-1	11	1	S 33º 50' 34.60"	E 151º06' 49.73"	200	440	<50	<100	<100	<50	<100	<100	125	0.36	0.07	<0.01	<0.01	0.08	0.06	0.25	0.39	0.09	0.12	0.51	0.36	0.14	0.04	0.15	0.5	2.6	24	<0.1	20	5	14	0.03	15	40	0.6		0	0.2	13.0	
KB525-2	KB525-2	12	0	S 33º 50' 34.60"	E 151º06' 49.73"	2900	3200	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	16	<0.1	17	4	12	0.01	8.5	29	<0.5	19000	1.9	1.9		38
KB525-3	KB525-3	13	0	S 33º 50' 34.60"	E 151º06' 49.73"	3900	4200	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	13	<0.1	11	3	8	0.01	5.4	18	<0.5	13000	1.3	1.3		28
KB525-4	KB525-4	14	0	S 33º 50' 34.60"	E 151º06' 49.73"	4900	5200	<50	<100	<100	<50	<100	<100	125	0.01	<0.01	0.03	0.06	0.08	0.02	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.21	14	<0.1	10	3	7.3	0.01	5	17	<0.5	7300	0.73	0.73	0.3	25
KB525-5	KB525-5	15	0	S 33º 50' 34.60"	E 151º06' 49.73"	5900	6200	180	470	120	270	490	<100	810	99	16	2.6	15	33	21	23	22	5.4	7.1	7.4	4.8	2.7	0.5	2.8	7	260	14	<0.1	12	3	8	<0.01	5.1	15	<0.5	8100	0.81	0.81	321.0	24
KB525-6	KB525-6	16	0	S 33º 50' 34.60"	E 151º06' 49.73"	6600	6900	<50	130	<100	<50	120	<100	195	0.28	3.1	1.3	2.9	11	4.1	5.5	5.7	2	1.8	2.2	1.4	0.81	0.2	1	2.1	43	5.5	<0.1	8.8	4	5.8	<0.01	3	12	<0.5	2300	0.23	0.23	187.0	18
KB525-7	KB525-7	17	0	S 33º 50' 34.60"	E 151º06' 49.73"	7600	7900	<50	<100	<100	<50	<100	<100	125	0.02	0.02	0.03	0.03	0.1	0.03	0.06	0.06	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.33	5.3	<0.1	8	2	15	0.01	3	32	<0.5	2100	0.21	0.21	1.6	19
KB525-8	KB525-8	18	0	S 33º 50' 34.60"	E 151º06' 49.73"	8600	8900	<50	<100	<100	<50	<100	<100	125	0.04	0.02	<0.01	<0.01	0.08	0.02	0.05	0.05	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.25	1	<0.1	9.5	2	5	0.02	2	10	<0.5	500	0.05	0.2	1.3	13
KB526-1	KB526-1	19	0	S 33º 50' 33.99"	E 151º06' 49.92"	1000	1290	<50	<100	<100	<50	<100	<100	125	0.05	0.07	0.03	0.04	0.7	0.21	0.89	0.86	0.34	0.28	0.5	0.31	0.19	0.04	0.24	0.5	4.8	0.9	<0.1	7	1	5	0.03	5	12	1.7	2800	0.28	0.28	17.1	12
KB526-2A	KB526-2A	20	0	S 33º 50' 33.99"	E 151º06' 49.92"	3400	3700	<50	<100	<100	<50	<100	<100	125	0.45	0.12	0.07	0.17	0.6	0.17	0.31	0.29	0.09	0.1	0.1	0.09	0.04	<0.01	0.04	0.1	2.7	13	<0.1	9.3	2	5.3	<0.01	4	12	<0.5	9700	0.97	0.97	2.8	22
KB526-2B	KB526-2B	21	0	S 33º 50' 33.99"	E 151º06' 49.92"	3400	3700	200	1400	440	410	1600	180	2190	45	25	6.4	27	80	50	48	52	35	15	24	20	9.8	2.5	11	30	450	13	<0.1	8.7	2	5.4	<0.01	4	12	<0.5	45000	4.5	4.5	100.0	23
KB526-2B	KB526-2B	21	1	S 33º 50' 33.99"	E 151º06' 49.92"	3400	3700	470	3100	1100	930	3500	460	4890	99	49	13	53	200	100	130	130	78	33	56	46	21	6	26	68	1000	13	<0.1	8.4	2	5.4	<0.01	4	12	<0.5	39000	3.9	3.9	256.4	
KB526-2C	KB526-2C	22	0	S 33º 50' 33.99"	E 151º06' 49.92"	3400	3700	88	620	210	180	700	110	990	15	8.1	2.1	8.5	29	15	17	18	10	5.1	7.6	6.1	2.7	0.6	3.3	8.9	150	13	<0.1	8.3	2	5.5	<0.01	4	12	<0.5	8100	0.81	0.81	185.2	23
KB526-3	KB526-3	23	0	S 33º 50' 33.99"	E 151º06' 49.92"	4400	4700	<50	<100	<100	<50	<100	<100	125	1.8	0.45	0.19	0.34	1.1	0.32	0.42	0.39	0.17	0.14	0.2	0.13	0.06	0.01	0.06	0.2	5.8	9.5	<0.1	6.5	2	6.2	<0.01	3	8.7	<0.5	9000	0.9	0.9	6.4	19
KB526-4	KB526-4	24	0	S 33º 50' 33.99"	E 151º06' 49.92"	5400	5700	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	2	<0.1	5.9	2	5.7	<0.01	2	6.8	<0.5	1100	0.11	0.2		19
KB526-5	KB526-5	25	0	S 33º 50' 33.99"	E 151º06' 49.92"	6200	6500	<50	<100	<100	<50	<100	<100	125	0.01	0.01	<0.01	0.01	0.09	0.04	0.06	0.06	0.02	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.02	0.36	8.2	<0.1	17	3	14	0.02	3	13	<0.5	500	0.05	0.2	1.8	16
KB527-1	KB527-1	26	0	S 33º 50' 33.64"	E 151º06' 50.75"	500	800	<50	250	220	<50	420	<100	495	0.44	1.4	0.09	0.25	1.3	0.44	3.3	6.5	3	2.2	9.7	7.2	3.4	1	3.8	9.8	44	17	0.2	22	31	89	0.94	13	220	0.5	26000	2.6	2.6	16.9	43
KB527-2	KB527-2	27	0	S 33º 50' 33.64"	E 151º06' 50.75"	2500	2800	<50	<100	<100	<50	<100	<100	125	7.3	0.14	0.41	0.16	0.3	0.07	0.16	0.16	0.05	0.06	0.07	0.05	0.02	<0.01	0.02	0.06	8.9	11	<0.1	11	4	11	0.01	5.3	15	<0.5	6300	0.63	0.63	14.1	23
KB527-3	KB527-3	28	0	S 33º 50' 33.64"	E 151º06' 50.75"	4500	4800	<50	<100	<100	<50	<100	<100	125	0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	12	<0.1	12	4	13	0.02	5.9	19	<0.5	7300	0.73	0.73	0.0	30
KB527-4	KB527-4	29	0	S 33º 50' 33.64"	E 151º06' 50.75"	6200	6500	<50	<100	<100	<50	<100	<100	125	0.11	0.04	0.04	0.05	0.26	0.09	0.19	0.23	0.07	0.08	0.1	0.08	0.03	<0.01	0.03	0.1	1.4	2	<0.1	11	3	11	0.03	2	9.1	<0.5	5400	0.54	0.54	2.6	24
KB527-5	KB527-5	30	0	S 33º 50' 33.64"	E 151º06' 50.75"	7500	7800	<50	<100	<100	<50	<100	<100	125	0.28	0.15	0.06	0.15	0.5	0.18	0.43	0.52	0.16	0.15	0.24	0.18	0.06	<0.01	0.08	0.2	3.1	1	<0.1	5.6	2	12	0.02	2	5	<0.5	1900	0.19	0.2	15.5	15
KB528-1	KB528-1	31	0	S 33º 50' 32.75"	E 151º06' 51.26"	500	800	<50	240	140	<50	320	<100	395	0.3	0.79	0.33	0.26	0.96	0.5	3.4	5.4	1.6	1.1	3.7	2.8	1.3	0.3	1.5	3.8	24	33	0.4	87	77	220	1.3	17	410	23	44000	4.4	4.4	5.5	46
KB528-1	KB528-1	31	1	S 33º 50' 32.75"	E 151º06' 51.26"	500	800	<50	380	220	54	530	<100	634	0.56	1.1	0.52	0.35	0.99	0.92	4.9	8.1	2.4	2.8	6.7	4.6	2	0.4	2.4	6.1	39	30	0.3	67	69	210	1.4	18	390	23		0	0.2	195.0	
KB528-2	KB528-2	32	0	S 33º 50' 32.75"	E 151º06' 51.26"	2900	3200	<50	<100	<100	<50	<100	<100	125	3.7	0.05	0.09	0.02	<0.03	<0.01	0.01	0.02	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	3.9	12	<0.1	12	4	12	0.02	5.3	16	<0.5	6200	0.62	0.62	6.3	30
KB528-3	KB528-3	33	0	S 33º 50' 32.75"	E 151º06' 51.26"	6900	7200	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	8.1	<0.1	6.6	4	8.9	0.01	4	15	<0.5	7100	0.71	0.71		22
KB528-4	KB528-4	34	0	S 33º 50' 32.75"	E 151º06' 51.26"	8700	900	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	0.8	<0.1	10	3	39	0.02	4	15	<0.5	14000	1.4	1.4		18
KB528-5	KB528-5	35	0	S 33º 50' 32.75"	E 151º06' 51.26"	9700	10000	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	5	<0.1	8.9	2	15	0.01	3	12	<0.5	2600	0.26	0.26		19
KB529-1A	KB529-1A	36	0	S 33º 50' 32.42"	E 151º06' 51.83"	400	700	<50	510	260	100	650	130	880	0.63	1.3	0.7	0.36	1.2	0.86	6.9	9	2.9	3	6.5	4.4	1.8	0.3	2.3	5.9	42	31	0.4	72	77	230	1.4	17	440	2.5	51000	5.1	5.1	8.2	47
KB529-1B	KB529-1B	37	0	S 33º 50' 32.42"	E 151º06' 51.83"	400	700	56	810	450	150	1100	220	1470	0.96	2.1	0.9	0.59	2	2	12	15	5.3	5	11	8.2	3.7	1	4.5	11	75	23	0.3	52	73	230	1.6	15	430	1.5	43000	4.3	4.3	17.4	53
KB529-1C	KB529-1C	38	0	S 33º 50' 32.42"	E 151º06' 51.83"	400	700	<50	250	110	58	290	<100	398	0.29	0.67	0.34	0.16	0.58	0.53	5.2	5.8	2.2	2.2	3.3	2.3	0.96	0.2	1.2	3.2	26	21	0.3	41	65	230	1.8	15	400	1.2	39000	3.9	3.9	6.7	50
KB529-2A	KB529-2A	39	0	S 33º 50' 32.42"	E 151º06' 51.83"	1900	2200	<50	<100	<100	<50	<100	<100	125	0.18	0.07	<0.01	<0.01	0.05	0.03	0.19	0.4	0.07	0.07	0.31	0.23	0.08	0.02	0.11	0.3	1.8	16	<0.1	12	3	9.2	0.02	5.1	16	<0.5	8900	0.89	0.89	2.0	31
KB529-2B	KB529-2B	40	0	S 33º 50' 32.42"	E 151º06' 51.83"	1900	2200	<50	<100	<100	<50	<100	<100	125	0.03	0.02	<0.01	<0.01	<0.03	<0.01	0.04	0.08	0.01	0.02	0.06	0.04	0.02	<0.01	0.02	0.05	0.36	17	<0.1	12	3	9.8	0.02	5.2	16	<0.5	7600	0.76	0.76	0.5	30
KB529-2C	KB529-2C	41	0	S 33º 50' 32.42"	E 151º06' 51.83"	1900	2200	<50	<100	<100	<50	<100	<100	125	0.01	0.01	<0.01	<0.01	<0.04	<0.01	0.05	0.08	0.03	0.02	0.05	0.04	0.02	<0.01	0.02	0.05	0.34	22	<0.1	13	3	9.8	0.01	6	18	<0.5	8700	0.87	0.87	0.4	33
KB529-2C	KB529-2C	41	1	S 33º 50' 32.42"	E 151º06' 51.83"	1900	2200	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.04	<0.01	0.03	0.05	0.02	0.02	0.03	0.02	<0.01	<0.01	<0.01	0.02	0.18	17	<0.1	13	3	11	0.01	5.6	18	<0.5	8700	0.87	0.87	0.2	
KB529-3	KB529-3	42	0	S 33º 50' 32.42"	E 151º06' 51.83"	2900	4200	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	26	<0.1	20	7.5	11	0.02	6.7	23	<0.5	7400	0.74	0.74		33
KB529-4	KB529-4	43	0	S 33º 50' 32.42"	E 151º06' 51.83"	4900	5200	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	7.7	<0.1	6.3	3	7.3	0.01	3	10	<0.5	5700	0.57	0.57		22
KB529-5	KB529-5	44	0	S 33º 50' 32.42"	E 151º06' 51.83"	5900	6200	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	5	<0.1	8.3	4	33	0.04	3	21	<0.5	5100	0.51	0.51		27
KB530-1	KB530-1	45	0	S 33º 50' 33.86"	E 151º06' 50.38"	400	700	<50	<100	<100	<50	<100	<100	125	0.03	0.05	<0.01	0.01	0.07	0.02	0.09	0.37	0.11	0.08	0.33	0.24	0.09	0.03	0.11	0.3	1.6	9.3	<0.1	10	8.3	25	0.14	5.8	51	<0.5	19000	1.9	1.9	0.8	33
KB530-2	KB530-2	46	0	S 33º 50' 33.86"	E 151º06' 50.38"	1400	1700	<50	<100	<100	<50	<100	<100	125	5.5	1.2	0.27	0.82	2.8	0.41	0.87	0.81	0.29	0.2	0.29	0.22	0.09	0.02	0.12	0.3	14	8.5	<0.1	9.9	4	9.8	0.02	5	14	0.7	6900	0.69	0.69	20.3	28
KB530-3	KB530-3	47	0	S 33º 50' 33.86"	E 151º06' 50.38"	3400	3700	<50	<100	<100	<50	<100	<100	125	0.09	0.02	<0.01	<0.01	0.09	0.02	0.03	0.04	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.29	9.3	<0.1	8.9	3	10	0.02	4	14	<0.5	6900	0.69	0.69	0.4	31
KB530-4	KB530-4	48	0	S 33º 50' 33.86"	E 151º06' 50.38"	5400	5700	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	0.6	<0.1	4	2	11	0.02	3	24	<0.5	700	0.07	0.2		15
KB530-5	KB530-5	49	0	S 33º 50' 33.86"	E 151º06' 50.38"	6000	6300	<50	<100	<100	<50	<100	<100	125	0.01	0.02	0.02	0.01	0.13	0.04	0.1	0.14	0.05	0.04	0.06	0.04	0.16	<0.01	0.02	0.06	0.83	2	<0.1	8.2	6.3	13	0.06	19	19	<0.5	2100	0.21	0.21	4.0	18
KB533-1A	KB533-1A	50	0	S 33º 50' 34.76"	E 151º06' 50.19"	3500	3800	130	280	<100	180	270	<100	500	61	10	2.3	9.3	25	7.4	13	12	4.5	4.7	5.1	3.9	2.8	0.7	3.2	5.9	160	18	<0.1	13	3	9.4	0.01	5.9	17	<0.5	10000	1	1	160.0	32
KB533-1B	KB533-1B	51	0	S 33º 50' 34.76"	E 151º06' 50.19"	3500	3800	100	190	<100	150	170	<100	370	52	9.9	1.8	8	21	5.9	10	9.8	3.6	3.6	3.8	2.9	2.1	0.5	2.4	4.4	140	20	<0.1	12	3	8.6	<0.01	5.1	15	<0.5	7600	0.76	0.76	184.2	29
KB533-1B	KB533-1B	51	1	S 33º 50' 34.76"	E 151º06' 50.19"	3500	3800	59	<100	<100	81	<100	<100	181	30	5.1	0.94	4	11	3	4.8	4.6	1.5	1.6	1.6	1.2	0.84	0.2	0.95	2	71	14	<0.1	11	3	10	0.01	5	14	<0.5		0	0.2	355.0	
KB533-1C	KB533-1C	52	0	S 33º 50' 34.76"	E 151º06' 50.19"	3500	3800	<50	<100	<100	<50	<100	<100	125	10	1.5	0.19	0.8	3	0.41	0.58	0.49	0.1	0.07	0.09	0.06	0.03	<0.01	0.03	0.09	18	14	<0.1	9.8	2	7.6	<0.01	4	13	<0.5	6700	0.67	0.67	26.9	28
KB533-2	KB533-2	53	0	S 33º 50' 34.76"	E 151º06' 50.19"	4500	4800	530	1400	380	780	1500	160	2440	260	52	8.4	39	100	32	55	52	19	20	21	16	11	2.6	13	24	700	6	<0.1	9.5	3	11	0.01	0.7	4	<0.5	1200	0.12	0.2	3500.0	14
KB533A-1	KB533A-1	54	0	S 33º 50' 34.76"	E 151º06' 50.19"	400	700	310	1300	360	520	1400	150	2070	96	28	7.8	30	88	25	53	50	20	20	15	16	10	3.2	12	24	480	13	<0.1	12	14	43	0.27	7.5	93	<0.5	28000	2.8	2.8	171.4	35

Sample ID	Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	TRH C_{10} - C_{14}	TRH C15 - C18	TRH C19 - C36/TRH C29 - C36	TRH >C_{16}-C_{34}	TRH >C_{16}-C_{36}	TRH >C_{34}-C_{40}	Sum C_{10} - C_{40}	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Zinc - low level	Total Cyanide	Total Organic Carbon		TOC% Norm 1%	PAH Norm 1%	Moisture
KB533A-2	KB533A-2	55	0	S 33º 50' 34.76"	E 151º06' 50.19"	2200	2500	110	200	<100	150	180	<100	380	42	5.9	1.1	3.7	13	3.6	5.3	5.2	2.4	1.5	2.3	1.8	0.84	0.2	0.97	2.6	90	19	<0.1	12	3	9.7	0.01	5.5	17	<0.5	11000	1.1	1.1	81.8	30
KB557-1	KB557-1	56	0	S 33º 50' 26.99"	E 151º06' 48.63"	100	400	<50	<100	110	<50	150	<100	225	0.64	0.73	0.07	0.19	0.52	0.23	1	1.8	0.6	0.82	2.5	1.9	1.5	0.5	1.8	2.9	15	17	0.7	130	110	250	1.2	21	580	<0.5	33000	3.3	3.3	4.5	47
KB557-2	KB557-2	57	0	S 33º 50' 26.99"	E 151º06' 48.63"	1700	2000	<50	<100	<100	<50	<100	<100	125	0.14	0.19	0.03	0.05	0.19	0.09	0.4	1	0.22	0.34	0.9	0.66	0.53	0.1	0.62	0.9	5.5	15	0.6	130	66	160	0.75	15	390	2.2	19000	1.9	1.9	2.9	25
KB557-3	KB557-3	58	0	S 33º 50' 26.99"	E 151º06' 48.63"	2900	3200	<50	<100	<100	<50	<100	<100	125	0.04	0.02	<0.01	0.01	0.11	0.03	0.06	0.07	0.03	0.02	0.03	0.02	<0.01	<0.01	0.01	0.03	0.44	0.6	<0.1	6.3	1	4	0.01	0.8	5.2	<0.5	400	0.04	0.2	2.2	13
KB513-1	KB513-1	59	0	S 33º 50' 34.42"	E 151º06' 50.39"	3700	4000	950	2800	830	1400	2900	380	4680	400	81	15	65	180	49	100	96	35	35	40	30	22	5.3	25	46	1200	10	<0.1	35	9.3	51	0.06	26	32	2.2	35000	3.5	3.5	342.9	40
KB513-2	KB513-2	60	0	S 33º 50' 34.42"	E 151º06' 50.39"	4700	5000	3200	8500	2500	4800	9000	940	14740	1100	200	41	170	480	160	260	240	81	95	65	75	55	9.4	61	110	3100	13	<0.1	12	3	8.8	0.01	5.7	17	<0.5	28000	2.8	2.8	1107.1	22
KB513-3	KB513-3	61	0	S 33º 50' 34.42"	E 151º06' 50.39"	5900	6200	<50	<100	<100	<50	<100	<100	125	0.44	0.1	0.02	0.08	0.38	0.12	0.21	0.2	0.06	0.06	0.08	0.05	0.03	<0.01	0.03	0.07	1.9	18	<0.1	12	4	12	0.01	6.1	14	<0.5	6500	0.65	0.65	2.9	26
KB513-3	KB513-3	61	1	S 33º 50' 34.42"	E 151º06' 50.39"	5900	6200	<50	<100	<100	<50	<100	<100	125	0.74	0.02	<0.01	0.02	0.12	0.03	0.06	0.05	0.02	0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	1.1	16	<0.1	10	4	11	0.01	5	15	<0.5	6500	0.65	0.65	1.7	
KB513-4	KB513-4	62	0	S 33º 50' 34.42"	E 151º06' 50.39"	6500	6800	<50	<100	<100	<50	<100	<100	125	0.13	0.07	0.02	0.08	0.44	0.09	0.22	0.23	0.06	0.06	0.08	0.06	0.02	<0.01	0.02	0.08	1.6	0.6	<0.1	4	2	4	<0.01	0.8	1	<0.5	400	0.04	0.2	8.0	14
KB513-5C	KB513-5C	63	0	S 33º 50' 34.42"	E 151º06' 50.39"	550	850	<50	330	140	51	420	<100	521	0.77	0.88	0.83	0.4	2.9	1.5	5.4	6.7	2	2.5	3.5	2.3	1.6	0.4	1.9	3.4	33	34	0.4	160	57	200	0.89	110	340	240	150000	15	10	3.3	47
KB513-5A	KB513-5A	64	0	S 33º 50' 34.42"	E 151º06' 50.39"	550	850	<50	610	300	93	810	130	1033	1.3	1.3	0.93	0.61	4.6	2.5	7.9	9.2	3.3	3.8	5.3	3.7	2.8	0.7	3.2	5.5	51	44	0.6	110	78	240	1.1	60	480	81	140000	14	10	5.1	55
KB513-5B	KB513-5B	65	0	S 33º 50' 34.42"	E 151º06' 50.39"	550	850	<50	380	180	65	490	<100	605	0.84	1	0.91	0.5	4	1.9	7.2	8	2.8	3.4	4.2	2.8	2.1	0.5	2.3	4.2	43	45	0.5	200	64	240	1	130	380	150	170000	17	10	4.3	50
KB540-1	KB540-1	66	0	S 33º 50' 34.44"	E 151º06' 50.28"	0	200	920	12000	5300	2500	15000	2300	19800	17	28	47	11	58	79	340	340	140	140	160	110	76	22	81	170	1700	14	0.3	220	24	87	0.39	110	140	54	570000	57	10	170.0	38
KB540-2	KB540-2	67	0	S 33º 50' 34.44"	E 151º06' 50.28"	2100	2400	50	720	280	130	870	130	1130	8.7	3.2	3.3	4.3	12	6.3	19	19	7.1	7.5	8.6	6.1	4	1.1	4.4	9.3	110	12	0.1	49	15	45	0.52	30	98	14	30000	3	3	36.7	31
KB540-3A	KB540-3A	68	0	S 33º 50' 34.44"	E 151º06' 50.28"	2700	3000	250	630	160	370	650	<100	1070	96	16	3.4	14	40	13	21	20	7.3	7.3	8.1	6.1	4.3	0.7	4.6	8.8	260	13	<0.1	8.7	2	5.8	<0.01	4	12	<0.5	11000	1.1	1.1	236.4	22
KB540-3B	KB540-3B	69	0	S 33º 50' 34.44"	E 151º06' 50.28"	2700	3000	230	520	130	320	530	<100	900	98	16	3.3	13	38	12	19	15	6.9	7	7.6	5.7	3.9	1	4.3	8.7	250	15	<0.1	9.1	2	6.1	0.01	4	12	<0.5	9800	0.98	0.98	255.1	20
KB540-3C	KB540-3C	70	0	S 33º 50' 34.44"	E 151º06' 50.28"	2700	3000	76	120	<100	110	100	<100	260	31	4.4	0.76	3.1	7.7	2.3	2.6	2.5	1.1	0.72	1.1	0.86	0.37	0.08	0.45	1	59	19	<0.1	9	2	6.4	0.01	4	12	0.6	9700	0.97	0.97	60.8	16
KB540-4	KB540-4	71	0	S 33º 50' 34.44"	E 151º06' 50.28"	5300	5600	<50	<100	<100	<50	<100	<100	125	1.9	0.2	0.03	0.14	0.51	0.1	0.26	0.24	0.08	0.06	0.08	0.05	0.02	<0.01	0.02	0.07	3.7	12	<0.1	10	4	11	0.02	5	15	<0.5	5600	0.56	0.56	6.6	22
KB540-4	KB540-4	71	1	S 33º 50' 34.44"	E 151º06' 50.28"	5300	5600	<50	<100	<100	<50	<100	<100	125	1.2	0.11	<0.01	0.07	0.37	0.08	0.15	0.15	0.04	0.03	0.04	0.02	0.01	<0.01	0.01	0.03	2.3	11	<0.1	9.1	3	9.7	0.01	4	14	<0.5		0	0.2	11.5	
KB540-5	KB540-5	72	0	S 33º 50' 34.44"	E 151º06' 50.28"	6400	6700	<50	<100	<100	<50	<100	<100	125	0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	3	<0.1	3	1	3	<0.01	0.9	4	<0.5	4800	0.48	0.48	0.0	22
KB550-1	KB550-1	73	0	S 33º 50' 25.76"	E 151º06' 47.98"	1600	1800	210	730	200	350	760	<100	1160	38	6.9	4.9	11	25	7.7	12	13	5.2	5.4	5	3.8	2.4	0.7	2.6	5.9	140	11	<0.1	21	12	32	0.2	12	56	3.6	34000	3.4	3.4	41.2	36
KB551-1	KB551-1	74	0	S 33º 50' 25.58"	E 151º06' 49.03"	1300	1600	120	970	410	260	1200	170	1630	2.5	2.8	6.1	9.9	29	10	18	19	7.7	8.3	8.6	6.5	4.3	1.3	4.9	10	140	21	1.1	250	120	210	1.1	18	620	220	40000	4	4	35.0	35
KB551-2	KB551-2	75	0	S 33º 50' 25.58"	E 151º06' 49.03"	2400	2700	740	3100	970	1300	3400	400	5100	180	49	21	44	120	34	71	66	24	24	26	19	12	3	12	28	700	26	0.9	140	99	200	1.2	17	490	76	100000	10	10	70.0	37
KB554-1	KB554-1	76	0	S 33º 50' 26.62"	E 151º06' 50.15"	6000	6125	<50	530	290	92	730	110	932	6.3	2.4	1.4	2.7	5.7	2.3	5.1	15	3.6	4.3	10	6.9	4.7	1.3	4.9	10	77	4	<0.1	36	7.8	25	0.29	26	20	0.7	270000	27	10	7.7	17
KB555-1	KB555-1	77	0	S 33º 50' 25.34"	E 151º06' 48.60"	1500	1800	<50	170	200	<50	330	110	465	0.63	1	0.16	0.3	0.83	0.39	1.4	4	0.87	1.2	3.7	2.8	2.1	0.6	2.3	4.1	22	18	0.8	140	95	220	1	19	560	12	35000	3.5	3.5	6.3	39
KB555-2A	KB555-2A	78	0	S 33º 50' 25.34"	E 151º06' 48.60"	2500	2800	110	570	320	180	750	160	1090	27	1.4	2.7	4.2	14	4.2	8.6	11	3.3	3.8	4.9	3.5	2.5	0.7	2.9	5.3	95	19	0.9	170	100	210	0.99	18	550	430	70000	7	7	13.6	29
KB555-2B	KB555-2B	79	0	S 33º 50' 25.34"	E 151º06' 48.60"	2500	2800	190	720	320	300	870	140	1310	50	2	3.9	7.8	27	7.3	13	16	5	5.8	6.3	4.4	3.1	0.8	3.5	6.7	160	19	0.9	160	91	190	1.2	16	670	1269	75000	7.5	7.5	21.3	29
KB560-1	KB560-1	81	0	S 33º 50' 26.25"	E 151º06' 49.08"	400	700	2300	8100	2100	4100	8100	820	13020	180	58	18	58	130	36	61	61	25	24	22	16	9.1	2.7	8.8	25	710	25	0.4	59	74	300	0.94	12	340	6.1	150000	15	10	71.0	33
KB560-1	KB560-1	81	1	S 33º 50' 26.25"	E 151º06' 49.08"	400	700	2200	8200	2000	4300	8000	770	13070	380	130	35	110	250	78	130	120	52	51	49	36	22	6.1	21	55	1500	24	0.4	53	65	190	0.92	12	330	4.3	170000	17	10	150.0	
KB560-2	KB560-2	82	0	S 33º 50' 26.25"	E 151º06' 49.08"	2400	2700	<50	620	420	78	920	210	1208	2.2	3.7	0.83	1.1	2.3	1.1	7.9	19	4.4	5.7	15	11	7.2	2.2	7.6	16	91	19	0.3	21	93	190	1.5	14	330	<0.5	190000	19	10	9.1	32
KB560-3	KB560-3	83	0	S 33º 50' 26.25"	E 151º06' 49.08"	3700	4000	2900	12000	3000	5200	12000	1200	18400	840	300	78	340	870	240	410	400	140	150	150	120	69	21	72	180	4200	13	0.2	13	33	93	0.68	8.3	180	5.1	120000	12	10	420.0	41
KB560-4	KB560-4	84	0	S 33º 50' 26.25"	E 151º06' 49.08"	4700	5000	<50	<100	<100	<50	<100	<100	125	8.4	1.8	0.35	1.7	4.1	1.4	1.8	1.6	0.97	0.51	0.68	0.5	0.2	0.05	0.25	0.7	24	5	<0.1	4	1	5	0.01	2	6.1	<0.5	2500	0.25	0.25	96.0	17
KB560-5	KB560-5	85	0	S 33º 50' 26.25"	E 151º06' 49.08"	5000	5300	<50	<100	<100	<50	<100	<100	125	0.42	0.16	0.07	0.21	0.64	0.18	0.39	0.47	0.17	0.11	0.2	0.13	0.04	0.02	0.06	0.2	3.2	1	<0.1	5.5	2	9.3	0.01	6.2	19	<0.5	900	0.09	0.2	16.0	12
KB561-1	KB561-1	86	0	S 33º 50' 26.61"	E 151º06' 48.62"	200	400	1300	6500	2100	2400	7200	780	10380	200	33	90	96	250	77	130	140	54	59	54	43	26	7.6	25	65	1300	18	0.6	64	83	190	1.1	21	450	10	340000	34	10	130.0	39
KB561-2	KB561-2	87	0	S 33º 50' 26.61"	E 151º06' 48.62"	1900	2200	680	9800	4700	1800	13000	2500	17300	26	36	21	14	110	72	240	290	98	110	120	91	56	17	61	140	1400	13	0.6	44	64	200	1.1	18	380	3.5	570000	57	10	140.0	45
KB561-3	KB561-3	88	0	S 33º 50' 26.61"	E 151º06' 48.62"	2250	2500	<50	<100	<100	<50	<100	<100	125	0.5	0.22	0.07	0.23	0.63	0.17	0.4	0.42	0.18	0.12	0.2	0.11	0.04	<0.01	0.05	0.1	3.3	27	<0.1	17	1	8.1	0.02	2	6.9	<0.5	800	0.08	0.2	16.5	23
KB562-1	KB562-1	89	0	S 33º 50' 25.89"	E 151º06' 50.50"	2100	2400	630	2700	690	1100	2800	240	4140	110	40	14	34	88	25	48	46	16	17	17	13	7.6	1.4	8	18	490	26	0.4	84	87	200	1.1	13	320	2.2	99000	9.9	9.9	49.5	37
KB562-2	KB562-2	90	0	S 33º 50' 25.89"	E 151º06' 50.50"	3000	3300	57	370	150	110	440	<100	600	12	4.1	6.3	6.9	14	4	8.2	13	4.2	4.7	7.1	5.4	2.9	1	3	7.8	96	12	0.2	21	27	80	1.1	13	150	<0.5	300000	30	10	9.6	28
KB562-3	KB562-3	91	0	S 33º 50' 25.89"	E 151º06' 50.50"	4800	5100	<50	<100	<100	<50	<100	<100	125	1.8	0.52	1.2	0.93	3.5	1.3	1.5	1.8	1.4	0.57	0.88	0.72	0.26	0.09	0.3	1	17	9.9	<0.1	7.6	3	9.2	0.07	4	11	<0.5	5200	0.52	0.52	32.7	26
KB562-3	KB562-3	91	1	S 33º 50' 25.89"	E 151º06' 50.50"	4800	5100	<50	<100	<100	<50	<100	<100	125	3.5	0.59	1.5	1.1	3.9	1.3	1.7	2.5	1.6	0.7	1.1	0.9	0.3	0.05	0.34	1	21	12	<0.1	7.3	4	11	0.08	5.6	15	<0.5		0	0.2	105.0	
KB601	KB601	92	0	S 33º 50' 22.376"	E 151º06' 44.42"	0	150	<50	<100	<100	<50	<100	<100	125	0.01	0.02	<0.01	<0.01	0.08	0.02	0.15	0.18	0.17	0.08	0.2	0.12	0.07	<0.01	0.09	0.2	1.2	5	<0.1	7.5	6.7	22	0.03	5.4	53	<0.5	9300	0.93	0.93	1.3	15
KB602	KB602	93	0	S 33º 50' 22.14"	E 151º06' 44.35"	0	150	<50	<100	<100	<50	<100	<100	125	0.02	0.02	<0.01	<0.01	0.08	0.02	0.24	0.3	0.24	0.09	0.24	0.15	0.08	<0.01	0.11	0.2	1.6	5.2	<0.1	11	9.2	23	0.03	7.6	50	<0.5	15000	1.5	1.5	1.1	11
KB555-3	KB555-3	95	0	S 33º 50' 25.34"	E 151º06' 48.60"	3400	3700	650	3700	1300	1200	4100	590	5890	120	13	29	62	180	59	100	100	37	39	37	28	16	4.5	17	42	840	20	0.9	170	110	220	1.4	21	660	330	180000	18	10	84.0	41
NMI KB519-1C				S 33º 50' 34.27"	E 151º06' 52.59"	400	700	<50	170	120	<50	270	<100	345	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.56	0.89	<0.5	<0.5	1.2	1	<0.5	<0.5	0.52			30	<0.5	60	82	150	1.1	16	310	3.4	23000	2.3	2.3	0.0	
NMI KB526-2C				S 33º 50' 33.99"	E 151º06' 49.92"	3400	3700	56	450	130	110	520	<100	680	6.4	4	1.4	4.8	16	7	10	9.7	4.2	3.5	4.8	4.6	1.7	0.6	1.8			15	<0.5	10	2.6	5.5	<0.2	3.8	14	<0.5	8100	0.81	0.81	0.0	
NMI KB529-1C				S 33º 50' 32.42"	E 151º06' 51.83"	400	700	<50	530	350	55	810	140	1005	<0.5	0.79	<0.5	<0.5	<0.5	<0.5	1.7	2	0.94	0.91	2.7	2.4	1	<0.5	1.1			31	<0.5	61	98	240	1.6	19	430	<0.5	39000	3.9	3.9	0.0	
NMI KB529-2C				S 33º 50' 32.42"	E 151º06' 51.83"	1900	2200	<50	<100	<100	<50	<100	<100	125	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5			21	<0.5	20	6	12	<0.2	7.1	22	<0.5	8700	0.87	0.87	0.0	
NMI KB533-1C				S 33º 50' 34.76"	E 151º06' 50.19"	3500	3800	<50	<100	<100	55	<100	<100	155	4.6	0.6	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5			23	<0.5	16	4.2	9.5	<0.2	5.9	18	<0.5	6700	0.67	0.67	0.0	
NMI KB513-5C				S 33º 50' 34.42"	E 151º06' 50.39"	550	850	190	2300	920	410	2900	390	3700	0.56	1.4	0.64	<0.5	3	2.4	6.6	6.9	2.6	2.5	4	3.5	1.5	<0.5	1.5			37	<0.5	450	79	190	0.83	200	370	24	150000	15	10	0.0	
NMI KB540-3C				S 33º 50' 34.44"	E 151º06' 50.28"	2700	3000	910	3200	900	1400	3500	390	5290	220	57	11	44	120	51	69	69	27	22	31	30	11	3.3	12			21	<0.5	16	3.9	8.8	<0.2	6	18	<0.5	9700	0.97	0.97	0.0	
NMI KB555-2C				S 33º 50' 25.34"	E 151º06' 48.60"	2500	2800	660	3600	1700	1100	4700	870	6670	23	3.9	2.8	3.2	15	7.8	10	13	4.6	4.4	6.3	6.2	2.3	0.84	2.6			33	1.4	320	220	300	2	29	1070	270	54000	5.4	5.4	0.0	

January 2016 Sediment Data

Sample ID	SAMPLE	REPLICATE	Lattitude	Longitude	Depth Top	Depth Bottom	TRH C6 - C9	TRH C6 - C10	TRH C6 - C10 less BTEX(F1)	TRH C_{10} - C_{14}	TRH C15 - C18	TRH C19 - C36/TRH C29 - C36	TRH >C_{10}-C_{16}	TRH >C_{16}-C_{34}	TRH >C_{34}-C_{40}		Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(k)pyrene	Indeno(1,1,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	Total Organic Carbon		TOC% Norm 1%	PAH Norm 1%	Moisture	Phenol
MB1	1	0	S 33º 50' 26.29"	E 151º 06' 48.58"	0	150				430	4100	1600	880	5000	710	6590	14	37	20	34	150	47	150	140	51	50	55	40	19	4.7	19	58	830	8.8	0.3	33	290	860	0.71	18		210	260000	26	10	83.0	40	<5
MB1	1	1	S 33º 50' 26.29"	E 151º 06' 48.58"	0	150				510	4900	1900	990	6000	890	7880	20	45	22	37	130	51	140	150	63	59	69	51	24	7.8	23	75	890	8.7	0.3	26	2800	290	0.52	14		260	260000	26	10	89.0		<5
MB2	2	0	S 33º 50' 26.58"	E 151º 06' 48.88"	0	150				78	1300	820	150	1900	410	2460	3.5	6.1	0.78	1.4	2.9	1.6	9.9	31	5.9	7.7	31	22	10	2.7	10	30	150	10	0.1	34	65	270	0.34	15		130	15000	1.5	1.5	100.0	43	<5
MB3	3	0	S 33º 50' 25.25"	E 151º 06' 48.97"	0	150				350	4700	2700	690	6600	1300	8590	7.6	16	2.6	3.4	4.1	4.6	54	75	22	26	60	48	21	5.7	21	65	370	28	1	140	140	240	2	17		420	420000	42	10	37.0	60	<5
MB4	4	0	S 33º 50' 24.61"	E 151º 06' 50.79"	0	150				<50	<100	<100	<50	<100	<100	125	0.12	0.16	0.03	0.05	0.1	0.06	0.38	0.55	0.19	0.24	0.59	0.42	0.22	0.05	0.22	0.6	3.4	18	0.3	120	120	240	1.6	15		460	45000	4.5	4.5	0.8	56	<5
MB5	5	0	S 33º 50' 27.07"	E 151º 06' 50.70"	0	150				<50	<100	<100	<50	<100	<100	125	0.33	0.78	0.06	0.2	0.69	0.31	1.7	2.6	0.88	1.4	3.4	2.3	1.2	0.4	1.4	3.3	18	21	0.2	110	110	220	1.3	14		410	37000	3.7	3.7	4.9	66	<5
MB6	6	0	S 33º 50' 27.03"	E 151º 06' 48.79"	0	150				<50	720	690	61	1300	370	1731	1.4	2.6	0.23	0.68	1.5	0.9	2.8	6	2	2.7	9.8	7.4	3.7	1	3.9	10	47	17	0.4	110	130	250	1.6	15		440	51000	5.1	5.1	9.2	55	<5
MB15	7	0	S 33º 50' 34.80"	E 151º 06' 50.36"	0	150				140	2500	790	370	2900	390	3660	2.9	5.5	3.3	2.1	5.3	3.5	65	77	28	31	27	22	7.1	1.9	6.9	30	290	25	0.7	310	67	110	0.83	88		290	200000	20	10	29.0	66	<5
MB20	8	0	S 33º 50' 34.81"	E 151º 06' 50.68"	0	150				730	12000	4600	1800	15000	2100	18900	15	28	7.5	10	17	16	300	310	120	130	130	100	30	8.6	28	140	1300	33	1.2	530	76	170	0.9	200		820	450000	45	10	130.0	72	<5
MB7	9	0	S 33º 50' 31.14"	E 151º 06' 51.13"	0	150				<50	550	460	<50	900	260	1185	1.1	2.5	0.17	0.42	1.1	0.57	2.6	6.5	2.1	2.9	9.9	7.4	3.2	1	3.3	10	45	20	0.4	120	110	200	1.3	16		420	74000	7.4	7.4	6.1	51	<5
MB21	10	0	S 33º 50' 31.37"	E 151º 06' 51.74"	0	150				<50	<100	<100	<50	<100	<100	125	0.16	0.3	0.03	0.06	0.13	0.07	0.28	0.61	0.22	0.24	0.93	0.74	0.33	0.1	0.37	1	4.6	22	0.4	120	110	200	1.4	16		400	72000	7.2	7.2	0.6	54	<5
MB8	11	0	S 33º 50' 30.49"	E 151º 06' 55.09"	0	150				<50	570	520	<50	960	290	1275	0.54	1.7	0.12	0.36	0.73	0.43	2.1	4.2	1.7	2.4	7.8	5.6	2.7	0.8	2.8	7.7	34	18	0.3	99	95	200	1.4	14		370	62000	6.2	6.2	5.5	50	<5
MB8	11	1	S 33º 50' 30.49"	E 151º 06' 55.09"	0	150				<50	530	500	<50	910	280	1215	0.43	1.7	0.11	0.27	0.67	0.37	1.9	3.8	1.5	2.1	7.3	5.4	2.7	0.8	2.7	7.4	32	17	0.3	99	95	200	1.4	14		370	62000	6.2	6.2	5.2		<5
MB9	12	0	S 33º 50' 32.91"	E 151º 06' 54.90"	0	150				<50	440	330	<50	690	170	885	0.92	1.9	0.11	0.33	0.98	0.48	2.7	5.6	2	2.9	7.9	6	2.6	0.8	2.6	8.1	38	18	0.3	89	80	160	0.89	15		300	140000	14	10	3.8	45	<5
MB10	13	0	S 33º 50' 28.95"	E 151º 06' 56.32"	0	150				<50	220	240	<50	410	120	555	0.3	0.85	0.07	0.16	0.53	0.23	1.6	2.6	1.3	1.6	4.5	3.2	1.6	0.4	1.7	4.5	21	18	0.2	69	74	150	0.97	11		290	59000	5.9	5.9	3.6	45	<5
MB11	14	0	S 33º 50' 24.98"	E 151º 07' 2.61"	0	150				<50	190	270	<50	410	150	585	0.14	0.43	0.08	0.08	0.51	0.22	1.1	1.4	0.66	0.92	2.6	1.6	0.94	0.3	1	2.4	12	14	0.1	76	72	160	0.9	9.9		300	39000	3.9	3.9	3.1	50	<5
MB16	15	0	S 33º 50' 35.17"	E 151º 06' 50.43"	0	150				<50	420	150	53	520	<100	623	2.4	1.3	0.38	0.91	2.4	1.3	12	16	3.5	4.2	6.5	4.5	1.6	0.4	1.5	6.1	59	21	0.6	380	59	120	0.87	160		340	270000	27	10	5.9	68	<5
MB14A	16	0	S 33º 50' 34.39"	E 151º 06' 50.91"	0	150				390	7600	2500	1200	8900	1200	11300	4.8	24	18	10	8.7	6.8	210	280	110	110	84	75	20	7.1	19	100	990	20	0.6	230	59	150	0.81	52		320	320000	32	10	99.0	62	<5
MB12	17	0	S 33º 51' 23.77"	E 151º 07' 9.02"	0	150				<50	<100	<100	<50	<100	<100	125	0.02	0.09	0.02	0.02	0.1	0.03	0.41	0.46	0.32	0.32	0.46	0.31	0.18	0.04	0.21	0.4	3	9.1	<0.1	19	47	54	0.17	3		88	7300	0.73	0.73	4.1	29	<5
MB13	18	0	S 33º 51' 14.11"	E 151º 07' 8.12"	0	150				<50	<100	<100	<50	<100	<100	125	0.02	0.07	<0.01	0.01	0.11	0.03	0.35	0.38	0.21	0.25	0.56	0.34	0.22	0.05	0.26	0.5	2.9	12	<0.1	28	52	78	0.26	4		130	7700	0.77	0.77	3.8	35	<5
MB26	19	0	S 33º 50' 22.30"	E 151º 06' 47.14"	0	150				<50	1000	960	82	1800	510	2392	0.75	3	0.16	0.46	0.96	0.62	2.6	6.9	1.9	2.6	14	11	5.3	1.4	5.4	14	57	20	0.3	120	100	210	1.2	14		390	75000	7.5	7.5	7.6	53	<5
MB17A	20	0	S 33º 50' 33.76"	E 151º 06' 9.39"	0	150				<50	300	380	<50	600	240	865	0.1	0.35	0.03	0.08	0.74	0.27	2	2.2	1	1.4	2.9	1.8	1.2	0.4	1.4	2.7	16	20	1.7	150	80	190	0.61	15		460	47000	4.7	4.7	3.4	58	<5
MB17B	21	0	S 33º 50' 33.76"	E 151º 06' 9.39"	0	150				<50	440	530	<50	860	330	1215	0.17	0.44	0.04	0.14	1.3	0.45	2.9	3.2	1.4	1.9	4	2.4	1.6	0.4	1.8	3.5	22	21	1.6	160	110	230	0.81	17		510	63000	6.3	6.3	3.5	61	<5
MB17B	21	1	S 33º 50' 33.76"	E 151º 06' 9.39"	0	150				<50	120	180	<50	270	120	415	0.09	0.19	0.02	0.06	0.49	0.15	1.3	1.5	0.64	0.88	1.8	1	0.67	0.1	0.8	2	9.9	22	1.8	170	110	250	0.83	18		560		0	0.2	49.5		<5
MB18	22	0	S 33º 50' 21.22"	E 151º 06' 10.85"	0	150				<50	210	290	<50	430	180	635	0.11	0.31	0.11	0.29	1.4	0.52	1.7	1.8	0.69	1	1.9	1.1	0.73	0.2	0.87	2	13	19	0.8	140	100	220	0.78	15		440	40000	4	4	3.3	60	<5
MB14B	23	0	S 33º 50' 34.39"	E 151º 06' 50.91"	0	150				860	13000	4700	2200	16000	2300	20500	18	50	38	16	28	18	240	360	130	140	140	120	33	14	33	170	1400	25	0.6	240	66	160	0.75	65		440	250000	25	10	140.0	63	<5
LAB NO 24	24	0			0	150				<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	NIL (+)VE	4	<0.1	2	<0.5	0.6	<0.01	0.9		2		0	0.2			<5
LAB NO 25	25	0			0	150										0																	7.8	0.2	26	810	77	0.54	15		200		0	0.2	0.0		
MB14C			S 33º 50' 34.39"	E 151º 06' 50.91"	0	150	<25	<25	<25	1500	38000	15000	5100	46000	6800	57900	3.7	91	27	18	16	59	490	590	210	220	190	200	54	21	59	270	2249	24	0.82	450	87	150	1.5	230		490	320000	32	10	224.9		<1
MB17C			S 33º 50' 33.76"	E 151º 06' 9.39"	0	150	<25	<25	<25	<50	150	160	<50	260	<100	335	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	1.2	0.53	<0.5	1	0.71	<0.5	<0.5	<0.5	1	4.5	23	2	230	140	240	0.84	24		760	44000	4.4	4.4	1.0		<1

February 2016 Sediment Data

| Sample ID | Sample ID | SAMPLE | REPLICATE | Latitude | Longitude | Depth Top | Depth Bottom | TRH C_{10} - C_{14} | TRH C15 - C18 | TRH C19 - C36/TRH C29 - C36 | TRH $>C_{10}$-C_{16} | TRH $>C_{10}$-C_{16}/$>C_{34}$ | TRH $>C_{16}$-C_{34}/$>C_{40}$ | Sum C_{10} - C_{40} | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Benzo(a)pyrene TEQ | Total +ve PAH's | Arsenic - low level | Cadmium - low level | Chromium - low level | Copper - low level | Lead - low level | Mercury - low level | Nickel - low level | Zinc - low level | Total Cyanide | Total Organic Carbon | TOC% Norm 1% | PAH Norm 1% | Moisture | Phenol | Bis-(1-chloroethyl) ether | 1-Chlorophenol/2-Chlorophenol | 1-Methylphenol/2-Methylphenol | 3/4-Methylphenol | 1,4-Dimethylphenol/2,4- Dimethylphenol | 1-Nitrophenol/2-Nitrophenol | 1,4-Dichlorophenol/2,4-Dichlorophenol | 4-Chloro-3-methylphenol | 1,4,6-trichlorophenol/2,4,6-Trichlorophenol | 1,4,5-trichlorophenol/2,4,5-Trichlorophenol | 4-nitrophenol | pentachlorophenol | 1,6-dichlorophenol/2,6-Dichlorophenol | 1,3,4,6-tetrachlorophenol/2,3,4,6- Tetrachlorophenol |
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| Sample ID | Sample ID | SAMPLE | REPLICATE | Latitude | Longitude | Depth Top | Depth Bottom | TRH C_{10} - C_{14} | TRH C15 - C18 | TRH C19 - C36/TRH C29 - C36 | TRH >C_{10}-C_{16} | TRH >C_{10}-C_{16}-C_{34} | TRH >C_{16}-C_{34} | Sum C_{10} - C_{40} | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,1,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Benzo(a)pyrene TEQ | Total +ve PAH's | Arsenic - low level | Cadmium - low level | Chromium - low level | Copper - low level | Lead - low level | Mercury - low level | Nickel - low level | Zinc - low level | Total Cyanide | Total Organic Carbon | TOC% Norm 1% | PAH Norm 1% | Moisture | Phenol | Bis-(1-chloroethyl) ether | 1-Chlorophenol/2-Chlorophenol | 1-Methylphenol/2-Methylphenol | 3/4-Methylphenol | 1,4-Dimethylphenol/2,4 -Dimethylphenol | 1-Nitrophenol/2-Nitrophenol | 1,4-Dichlorophenol/2,4-Dichlorophenol | 4-Chloro-3-methylphenol | 1,4,6-trichlorophenol/2,4,6-Trichlorophenol | 1,4,5-trichlorophenol/2,4,5-Trichlorophenol | 4-nitrophenol | pentachlorophenol | 1,6-dichlorophenol/2,6-Dichlorophenol | 1,3,4,6-tetrachlorophenol/2,3,4,6-Tetrachlorophenol |
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| Sample ID | Sample ID | SAMPLE | REPLICATE | Latitude | Longitude | Depth Top | Depth Bottom | TRH C_{10} - C_{14} | TRH C15 - C18 | TRH C19 - C36/TRH C29 - C36 | TRH >C_{10}-C_{16} | TRH >C_{10}-C_{16}-C_{34} | TRH >C_{16}-C_{34} | Sum C_{10} - C_{40} | Naphthalene | Acenaphthylene | Acenaphthene | Fluorene | Phenanthrene | Anthracene | Fluoranthene | Pyrene | Benzo(a)anthracene | Chrysene | Benzo(b,j+k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-c,d)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | Benzo(a)pyrene TEQ | Total +ve PAH's | Arsenic - low level | Cadmium - low level | Chromium - low level | Copper - low level | Lead - low level | Mercury - low level | Nickel - low level | Zinc - low level | Total Cyanide | Total Organic Carbon | TOC% Norm 1% | PAH Norm 1% | Moisture | Phenol | Bis-(1-chloroethyl) ether | 1-Chlorophenol/2-Chlorophenol | 1-Methylphenol/2-Methylphenol | 3/4-Methylphenol | 1,4-Dimethylphenol/2,4 -Dimethylphenol | 1-Nitrophenol/2-Nitrophenol | 1,4-Dichlorophenol/2,4-Dichlorophenol | 4-Chloro-3-methylphenol | 1,4,6-trichlorophenol/2,4,6-Trichlorophenol | 1,4,5-trichlorophenol/2,4,5-Trichlorophenol | 4-nitrophenol | pentachlorophenol | 1,6-dichlorophenol/2,6-Dichlorophenol | 1,3,4,6-tetrachlorophenol/2,3,4,6-Tetrachlorophenol |
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March 2016 Sediment Data

Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	TRH C6 - C9	TRH C6 - C10	TRH C_{10} - C_{14}	TRH C15 - C18	TRH C19 - C36/TRH C29 - C36		TRH $>C_{10}$-C_{16}	TRH $>C_{16}$-C_{34}	TRH $>C_{34}$-C_{40}	Sum C_{10} - C_{40}	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	Total Cyanide	Total Organic Carbon		TOC% Norm 1%	PAH Norm 1%	Fines <0.063mm	Moisture
KB801-1	1	0	S 33º 50' 22.97"	E 151º06' 47.80"	0	300			67	1400	940			150	2100	430	2680	1.8	4.2	0.6	0.95	2.5	2.4	10	21	9	11	17	17	6.6	2	7.2	22	110	22	0.6	90	120	230	0.96	12		310	<0.5	380000	38	10	11.0	40	57
KB801-1	1	1	S 33º 50' 22.97"	E 151º06' 47.80"	0	300			73	1500	1000			160	2300	510	2970	2.2	4.9	0.75	1	2.5	1.9	11	24	11	11	19	19	7.6	2.2	8.1	26	130	19	0.3	70	72	250	0.76	10		280	<0.5	440000	44	10	13.0		
KB801-1 TRIPLICATE	54	0	S 33º 50' 22.97"	E 151º06' 47.80"	0	300																												14	<0.1	9	3	8.4	0.02	4		15							
KB801-2	2	0	S 33º 50' 22.97"	E 151º06' 47.80"	300	600			990	11000	4200			2300	13000	1600	16900	5.3	18	35	22	89	41	160	180	75	87	64	67	16	4.1	16	88	880	20	0.9	76	94	250	1.4	13		340	1	140000	14	10	88.0	57	55
KB801-3	3	0	S 33º 50' 22.97"	E 151º06' 47.80"	2300	2600			540	4100	1400			1200	4600	620	6420	17	13	35	26	73	33	150	170	33	33	26	25	8.3	2.6	8.3	35	650	27	0.6	82	87	240	1.1	10		310	2.9	98000	9.8	9.8	66.3	71	48
KB802-1	4	0	S 33º 50' 22.69"	E 151º06' 47.56"	0	300			64	1400	900			150	2000	420	2570	0.49	1.9	0.45	0.64	0.83	0.87	12	21	2.5	4.3	13	13	4.8	0.9	5.1	16	81	20	0.7	140	110	250	1.1	14		440	<0.5	54000	5.4	5.4	15.0	92	51
KB802-2A	5	0	S 33º 50' 22.69"	E 151º06' 47.56"	300	600			200	2900	1100			430	3600	440	4470	1.9	6.5	1.7	3.2	3.4	3.6	50	70	31	31	28	29	9.3	2	9.5	38	280	28	0.5	100	80	240	1.2	10		300	<0.5	32000	3.2	3.2	87.5	70	54
KB802-2B	6	0	S 33º 50' 22.69"	E 151º06' 47.56"	300	600			51	1100	500			110	1400	250	1760	0.42	3.7	0.64	0.94	1.1	1.5	15	36	13	14	16	17	5.2	1.5	5.4	22	130	26	0.5	82	67	200	1.1	9.3		270	<0.5	40000	4	4	32.5	67	53
KB802-3	7	0	S 33º 50' 22.69"	E 151º06' 47.56"	1500	1800			110	280	<100			170	220	<100	440	18	6.1	2.3	6.7	14	4.8	5.9	9.7	4.3	4	2	2.6	0.56	0.2	0.61	3.5	82	13	<0.1	9.9	5	13	0.03	4		17	<0.5	9000	0.9	0.9	91.1	52	37
KB803-1	8	0	S 33º 50' 22.17"	E 151º06' 49.00"	0	300			<50	950	710			95	1500	360	1955	0.34	1.8	0.16	0.4	0.53	0.62	13	19	2.5	4.1	11	12	4.4	1	4.7	15	75	24	0.5	110	96	250	1.3	12		400	<0.5	34000	3.4	3.4	22.1	89	53
KB803-2	9	0	S 33º 50' 22.17"	E 151º06' 49.00"	300	600			<50	260	120			<50	330	<100	405	0.44	2.1	0.78	1.1	2.6	1.4	6.2	21	4.4	6.1	9.1	8.9	2.7	0.8	2.6	11	70	18	0.2	20	32	110	0.88	7.5		160	<0.5	22000	2.2	2.2	31.8	92	51
KB803-3	10	0	S 33º 50' 22.17"	E 151º06' 49.00"	1500	1800			79	260	<100			150	200	<100	400	7.6	5.4	4.1	8.4	18	5.2	5.2	8.4	3.4	3.2	1.5	2.1	0.41	0.2	0.48	2.8	74	10	<0.1	14	11	29	0.07	6		29	<0.5	17000	1.7	1.7	43.5	93	45
KB803-4	11	0	S 33º 50' 22.17"	E 151º06' 49.00"	3450	3750			1300	2800	470			1900	2500	200	4600	310	54	17	60	150	38	52	65	33	29	17	21	5.8	1.8	6.1	29	860	13	<0.1	7.5	2	6.2	<0.01	3		8.1	<0.5	24000	2.4	2.4	358.3	47	31
KB803-4	11	1	S 33º 50' 22.17"	E 151º06' 49.00"	3450	3750			1500	3100	530			2100	2800	250	5150	330	54	17	61	150	40	55	70	35	31	19	23	5.8	1.4	6.5	30	900	10	<0.1	5.8	1	5	<0.01	2		6.1	<0.5		0	0.2	4500.0		
KB803-5	12	0	S 33º 50' 22.17"	E 151º06' 49.00"	4200	4500			<50	<100	<100			<50	<100	<100	125	2.2	0.06	0.03	0.08	0.19	0.07	0.07	0.08	0.03	0.04	<0.02	0.02	<0.01	<0.01	<0.01	0.02	2.8	13	<0.1	9.8	4	13	0.01	4		11	<0.5	5700	0.57	0.57	4.9	83	35
KB804-1	13	0	S 33º 50' 23.35"	E 151º06' 49.14"	0	300			93	1900	1200			230	2800	520	3550	0.87	3.7	0.54	1.1	1.1	1.9	16	32	7	9	21	21	7.9	1.4	8.6	26	130	26	0.5	110	100	240	1.2	13		400	<0.5	52000	5.2	5.2	25.0	82	55
KB804-2	14	0	S 33º 50' 23.35"	E 151º06' 49.14"	300	600			410	3200	950			860	3500	360	4720	40	24	29	24	67	39	75	80	41	39	29	29	9.1	2.7	9.2	40	540	26	0.4	73	61	190	1.1	9.1		270	2.3	57000	5.7	5.7	94.7	84	54
KB804-3	15	0	S 33º 50' 23.35"	E 151º06' 49.14"	2100	2400			<50	880	640			91	1300	300	1691	50	9.2	3.1	10	19	5.8	5.6	8.8	3.8	3.1	1.5	2	0.4	0.1	0.45	2.7	120	19	<0.1	13	4	12	0.01	5.3		17	<0.5	16000	1.6	1.6	75.0	82	40
KB804-4	16	0	S 33º 50' 23.35"	E 151º06' 49.14"	3000	3400			540	1100	160			770	1000	<100	1820	130	29	7.4	30	69	21	28	35	15	15	8.5	10	2.9	0.8	3.1	14	410	12	<0.1	8.3	2	6.6	<0.01	3		9	<0.5	30000	3	3	136.7	49	34
KB804-5	17	0	S 33º 50' 23.35"	E 151º06' 49.14"	4000	4300			<50	<100	<100			<50	<100	<100	125	5.4	0.45	0.1	0.24	0.33	0.09	0.12	0.15	0.05	0.07	0.03	0.04	0.01	<0.01	0.01	0.05	7.1	12	<0.1	8.3	3	11	0.01	3		9.5	<0.5	4900	0.49	0.49	14.5	74	30
KB805-1	18	0	S 33º 50' 26.10"	E 151º06' 50.10"	0	300			<50	960	690			100	1500	310	1910	0.86	1.6	0.34	0.6	1.2	1	3.1	16	2.5	4.1	9.9	9.9	3.6	0.7	3.8	12	59	11	0.5	87	150	110	0.46	8.5		250	<0.5	110000	11	10	5.9	55	51
KB805-2A	19	0	S 33º 50' 26.10"	E 151º06' 50.10"	300	600			150	2400	1200			370	3200	500	4070	3	5.9	4.7	3.3	11	7	26	40	13	16	18	18	6.3	1.3	6.7	23	180	23	0.9	170	160	380	1.2	38		370	0.5	200000	20	10	18.0	61	49
KB805-2B	20	0	S 33º 50' 26.10"	E 151º06' 50.10"	300	600			170	2200	950			390	2800	430	3620	5.1	7.4	7.1	4.5	18	10	31	40	15	17	15	16	5.3	1	5.6	20	200	23	0.6	77	190	230	0.88	13		340	<0.5	130000	13	10	20.0	55	42
KB805-3	21	0	S 33º 50' 26.10"	E 151º06' 50.10"	700	1000			140	1500	660			300	1900	280	2480	13	6.6	7.6	4.6	13	4.8	18	19	7.9	9.4	13	9.3	5.1	0.9	5.3	13	140	18	0.3	110	55	180	0.89	64		190	0.6	130000	13	10	14.0	52	34
KB805-3	21	1	S 33º 50' 26.10"	E 151º06' 50.10"	700	1000			130	920	360			230	1100	170	1500	21	6.5	7.4	4.6	11	3.7	12	13	4.7	5.3	5.7	5.4	2.9	0.7	3	7.5	110	19	0.2	48	84	170	0.91	20		190	0.8	130000	13	10	11.0		
KB805-3 TRIPLICATE	55	0	S 33º 50' 26.10"	E 151º06' 50.10"	700	1000																												16	<0.1	9.6	4	9.6	0.02	4		17							
KB805-4	22	0	S 33º 50' 26.10"	E 151º06' 50.10"	1800	2100			3800	25000	6700			8300	26000	2500	36800	230	180	87	170	480	160	270	290	93	38	26	27	26	5.1	26	47	2100	29	0.6	92	100	240	1.1	14		310	3.4	150000	15	10	210.0	63	53
KB805-5	23	0	S 33º 50' 26.10"	E 151º06' 50.10"	2700	3000			<50	440	300			<50	680	<100	755	0.81	2.1	0.34	0.5	1.2	0.79	3.8	8.4	3.1	3.9	8.1	7.4	4.3	1.1	4.4	10	50	18	0.2	32	180	170	1.3	18		240	0.9	190000	19	10	5.0	45	44
KB805-6	24	0	S 33º 50' 27.05"	E 151º06' 50.48"	4000	4300			230	3000	1100			640	3500	440	4580	8.7	11	28	28	100	28	61	68	25	29	25	26	12	2.7	12	35	470	15	0.2	51	60	120	0.99	25		150	1.8	69000	6.9	6.9	68.1	45	32
KB806-1	25	0	S 33º 50' 27.05"	E 151º06' 50.48"	0	300			<50	390	510			<50	790	270	1085	1.5	1.3	0.29	0.56	2.2	0.83	2.6	3.7	1.4	2	3.8	3.4	2.2	0.5	2.3	4.7	29	21	0.2	120	130	250	1.1	15		510	<0.5	32000	3.2	3.2	9.1	95	62
KB806-2	26	0	S 33º 50' 27.05"	E 151º06' 50.48"	300	600			<50	170	210			<50	340	120	485	0.45	0.68	0.11	0.13	0.6	0.29	1.3	1.8	0.78	1.1	2.1	2.1	1.3	0.3	1.4	2.9	15	17	0.2	120	130	260	1.4	15		510	<0.5	30000	3	3	5.0	95	54
KB806-3	27	0	S 33º 50' 27.05"	E 151º06' 50.48"	1600	1900			<50	<100	<100			<50	<100	<100	125	0.19	0.17	0.03	0.05	0.21	0.09	0.29	0.41	0.16	0.25	0.27	0.51	0.3	0.06	0.35	0.6	3.3	16	0.9	120	92	240	0.84	15		460	<0.5	25000	2.5	2.5	1.3	96	51
KB806-4	28	0	S 33º 50' 27.05"	E 151º06' 50.48"	2900	3200			<50	340	330			<50	580	150	755	0.12	0.56	0.33	0.15	1.1	0.65	1.5	2.9	0.68	1	2.2	2.2	1.3	0.3	1.5	2.9	16	25	1.3	210	120	270	1.4	18		600	2.9	27000	2.7	2.7	5.9	95	55
KB807-1	29	0	S 33º 50' 35.13"	E 151º06' 53.46"	0	300			180	2600	1100			420	3300	480	4200	0.67	3	1.1	1.7	1.7	2.2	30	42	15	19	17	17	8.2	1.7	8.5	23	170	28	0.7	230	92	210	0.9	49		440	53	110000	11	10	17.0	57	64
KB807-2	30	0	S 33º 50' 35.13"	E 151º06' 53.46"	300	600			<50	800	440			91	1100	210	1401	0.44	1.2	0.19	0.33	0.9	0.71	2.1	11	1.9	4	5.7	6.2	3.1	0.8	3.3	8.1	42	32	0.5	110	62	170	0.85	22		270	9.5	37000	3.7	3.7	11.4	53	44
KB807-3	31	0	S 33º 50' 35.13"	E 151º06' 53.46"	2300	2600			<50	<100	<100			<50	<100	<100	125	0.07	0.08	0.02	0.03	0.1	0.07	0.39	0.63	0.2	0.27	0.1	0.29	0.11	0.03	0.1	0.4	2.5	11	<0.1	7.9	2	5.6	<0.01	3		9.6	0.7	5300	0.53	0.53	4.7	30	23
KB807-3	31	1	S 33º 50' 35.13"	E 151º06' 53.46"	2300	2600			<50	<100	<100			<50	<100	<100	125	0.03	0.05	<0.01	0.02	0.05	0.03	0.29	0.49	0.15	0.21	0.1	0.19	0.07	0.02	0.05	0.2	1.7	9.5	<0.1	8.5	2	6.2	0.01	3		11	<0.5	5200	0.52	0.52	3.3		

Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	TRH C6 - C9	TRH C6 - C10	TRH C_{10} - C_{14}	TRH C15 - C18	TRH C19 - C36/TRH C29 - C36			TRH >C_{10}-C_{16}	TRH >C_{16}-C_{34}	TRH >C_{34}-C_{40}	Sum C_{10} - C_{40}	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Silver - low level	Zinc - low level	Total Cyanide	Total Organic Carbon		TOC% Norm 1%	PAH Norm 1%	Fines <0.063mm	Moisture
KB808-1	32	0	S 33º 50' 33.89"	E 151º06' 53.49"	0	300			<50	<100	<100			<50	<100	<100	125	0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.03	0.01	0.02	<0.02	0.02	<0.01	<0.01	<0.01	0.02	0.12	28	1	200	110	240	1.1	31		570	12	200000	20	10	0.0	72	62
KB808-2A	33	0	S 33º 50' 33.89"	E 151º06' 53.49"	300	600			170	4100	2400			500	5700	1200	7400	2.5	13	2.5	3	4.3	4.5	34	54	22	31	37	41	17	5.2	18	54	290	42	0.6	140	91	240	1.3	19		390	50	54000	5.4	5.4	53.7	78	58
KB808-2B	34	0	S 33º 50' 33.89"	E 151º06' 53.49"	300	600			93	1400	550			220	1700	200	2120	0.3	2.4	0.64	0.94	1.3	1.3	18	25	9.7	12	12	12	6	1.6	6.3	17	110	35	0.5	84	85	250	1.3	16		390	13	53000	5.3	5.3	20.8	92	57
KB808-3	35	0	S 33º 50' 33.89"	E 151º06' 53.49"	700	1000			<50	490	300			<50	720	<100	795	0.58	2.1	0.66	0.55	1.3	1.4	6.4	12	4.3	6	8.7	9	4.6	1.3	4.7	12	64	25	0.3	49	57	150	0.97	11		270	11	48000	4.8	4.8	13.3	60	44
KB808-4	36	0	S 33º 50' 33.89"	E 151º06' 53.49"	2000	2300			<50	<100	<100			<50	<100	<100	125	0.03	0.06	<0.01	0.01	0.08	0.03	0.18	0.22	0.13	0.19	0.1	0.27	0.14	0.03	0.13	0.3	1.6	16	<0.1	13	9.5	24	0.07	5.7		33	<0.5	16000	1.6	1.6	1.0	59	38
KB808-5	37	0	S 33º 50' 33.89"	E 151º06' 53.49"	3000	3300			1300	9000	2600			3100	9400	1200	13700	170	44	93	90	250	98	130	160	77	92	22	30	10	3.5	11	45	1300	15	<0.1	7.3	2	5.9	<0.01	3		7.9	<0.5	5500	0.55	0.55	2363.6	38	22
KB809-1	38	0	S 33º 50' 33.62"	E 151º06' 52.13"	0	300			330	6500	3400			920	8700	1800	11420	3.8	21	6.2	6	6.4	7.9	86	140	53	60	43	49	18	5.1	19	66	520	27	1.2	270	110	220	1.2	30		750	4.8	220000	22	10	52.0	70	58
KB809-2	39	0	S 33º 50' 33.62"	E 151º06' 52.13"	300	600			180	3800	2100			460	5200	960	6620	1.8	7	1.2	1.9	3.8	3.6	11	54	9.7	21	25	26	12	3.3	13	34	190	36	1.2	400	100	190	1.2	45		500	750	130000	13	10	19.0	47	70
KB809-2	39	1	S 33º 50' 33.62"	E 151º06' 52.13"	300	600																																						140000	14	10	0.0		
KB809-3	40	0	S 33º 50' 33.62"	E 151º06' 52.13"	2000	2300			<50	150	160			<50	280	<100	355	0.22	0.71	0.07	0.13	1	0.34	2	2.4	1.3	1.9	4.8	3.1	1.9	0.5	1.9	4.5	22	26	0.2	33	72	200	1.4	12		280	1.8	36000	3.6	3.6	6.1	96	50
KB809-4	41	0	S 33º 50' 33.62"	E 151º06' 52.13"	4000	4300			<50	<100	<100			<50	<100	<100	125	0.03	0.21	0.91	0.15	0.98	0.3	0.11	0.08	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	2.8	16	<0.1	10	3	8.4	<0.01	4		11	<0.5	8300	0.83	0.83	3.4	76	32
KB809-4	41	1	S 33º 50' 33.62"	E 151º06' 52.13"	4000	4300			<50	<100	<100			<50	<100	<100	125	0.05	0.24	0.9	0.15	1.5	0.44	0.24	0.18	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	3.7	20	<0.1	12	3	10	<0.01	5		14	<0.5		0	0.2	18.5		
KB811-1	42	0	S 33º 50' 34.83"	E 151º06' 54.39"	0	300			<50	<100	<100			<50	<100	<100	125	1.4	0.46	0.14	0.28	1	0.37	0.97	1.5	0.45	0.66	0.93	0.95	0.42	0.1	0.43	1	10	17	0.1	20	15	36	0.16	5.1		75	<0.5	30000	3	3	3.3	37	29
KB811-2	43	0	S 33º 50' 34.83"	E 151º06' 54.39"	300	600			<50	<100	<100			<50	<100	<100	125	0.48	0.12	0.03	0.11	0.28	0.09	0.17	0.17	0.07	0.11	0.05	0.11	0.04	<0.01	0.04	0.1	1.9	14	<0.1	9	3	8.4	0.02	4		15	<0.5	16000	1.6	1.6	1.2	46	32
KB811-2	44	0	S 33º 50' 34.83"	E 151º06' 54.39"	300	600			<50	<100	<100			<50	<100	<100	125	0.43	0.09	0.02	0.07	0.16	0.07	0.15	0.18	0.08	0.11	0.07	0.15	0.06	0.01	0.06	0.2	1.7	16	<0.1	9.6	4	9.6	0.02	4		17	<0.5	14000	1.4	1.4	1.2	45	33
KB811-3	45	0	S 33º 50' 34.83"	E 151º06' 54.39"	1600	1900			<50	<100	<100			<50	<100	<100	125	0.02	<0.01	<0.01	<0.01	0.02	<0.01	0.02	0.02	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.08	11	<0.1	6.8	1	4	<0.01	2		6.7	<0.5	5000	0.5	0.5	0.2	29	23
KB810-1	46	0	S 33º 50' 33.73"	E 151º06' 50.87"	0	300			300	6200	2400			1100	7400	1300	9800	5.5	18	36	30	130	46	89	130	50	53	38	44	17	4.8	17	60	710	23	0.6	240	70	140	0.64	32		420	760	130000	13	10	71.0	51	61
KB810-2	47	0	S 33º 50' 33.73"	E 151º06' 50.87"	300	600			1600	19000	6600			4200	22000	3100	29300	11	29	93	51	420	160	300	300	130	170	89	87	38	12	39	130	1900	64	2.1	360	120	240	1.4	84		710	700	180000	18	10	190.0	43	75
KB810-3A	48	0	S 33º 50' 33.73"	E 151º06' 50.87"	1700	2000			820	4800	1600			1600	5300	600	7500	8.2	12	36	28	88	32	61	64	24	32	24	23	11	2.2	4.3	32	450	54	0.8	190	110	280	1.4	28		470	16	140000	14	10	45.0	50	68
KB810-3B	49	0	S 33º 50' 33.73"	E 151º06' 50.87"	1700	2000			530	3800	1500			1200	4400	680	6280	4.2	7.2	24	16	49	20	38	44	17	20	19	18	8.7	1.6	8.9	24	290	37	0.5	150	79	190	0.93	20		330	13	3900	0.39	0.39	743.6	58	54
KB810-4	50	0	S 33º 50' 33.73"	E 151º06' 50.87"	2500	2800			<50	<100	<100			<50	<100	<100	125	0.06	0.06	0.07	0.1	0.35	0.12	0.39	0.43	0.19	0.25	0.1	0.25	0.11	0.02	0.1	0.3	2.6	16	<0.1	16	17	53	0.21	7.3		74	0.5	22000	2.2	2.2	1.2	93	47
KB810-5	51	0	S 33º 50' 33.73"	E 151º06' 50.87"	3000	3300			350	1400	350			600	1500	120	2220	120	26	7.1	22	72	19	35	34	14	16	11	11	5.3	0.9	5.5	15	400	12	<0.1	12	5	12	0.02	5		18	<0.5	18000	1.8	1.8	222.2	83	37
KB810-5	51	1	S 33º 50' 33.73"	E 151º06' 50.87"	3000	3300			290	980	240			460	990	<100	1500	110	21	5.5	17	53	14	27	25	10	12	7.8	8	3.7	0.9	3.9	11	320	15	<0.1	12	4	12	0.02	5		18	<0.5		0	0.2	1600.0		
KB812-1	52	0	S 33º 50' 26.33"	E 151º06' 48.77"	0	300			410	5300	2800			860	7200	1400	9460	3.5	10	2.2	3.4	3.2	4.2	110	130	40	44	59	40	22	4.1	22	57	500	20	0.4	29	67	420	1.5	15		480	1.2	19000	1.9	1.9	263.2	53	53
KB812-2	53	0	S 33º 50' 26.33"	E 151º06' 48.77"	300	600			540	5600	2300			1200	6900	1000	9100	10	19	41	15	40	33	140	130	47	50	59	40	19	3.5	19	57	660	30	0.5	25	70	2300	1.5	13		650	3.6	17000	1.7	1.7	388.2	53	50
KB802-2C			S 33º 50' 22.69"	E 151º06' 47.56"	300	600	<10	<10	60	2720	1240	4020	4320	240	3450	630	4320	3.45	8.36	0.45	2.02	3.34	3.82	53.6	69.7	31.3	28.8	9.52	28.1	10.4	3.96	12.5	40.2	295.82	40.1	0.2	70.1	60.4	184	1.2	14.5		241	<1	4.29	4.29	4.29	69.0		60.3
KB805-2C			S 33º 50' 26.10"	E 151º06' 50.10"	300	600	<10	<10	120	2600	1180	3900	4230	400	3180	650	4230	37.4	29.7	14.7	11.9	39.4	29.3	104	120	44.8	40	14.4	36	14.2	5.35	16.1	52.8	592.25	35.7	1	150	270	1840	1.1	26.9		522	1	22.6	22.6	10	59.2		50.9
KB 808-2C			S 33º 50' 33.89"	E 151º06' 53.49"	300	600	<10	<10	<50	2120	930	3050	3360	210	2620	530	3360	2.6	9.14	0.75	1.72	2.64	4.04	46.6	64.7	29.7	27.9	11.2	29.8	10.5	4.22	12.2	42.2	284.21	53.4	0.6	185	126	227	1.5	23.7		509	34	7.9	7.9	7.9	36.0		62.2
KB 811-2C			S 33º 50' 34.83"	E 151º06' 54.39"	300	600	<10	<10	<50	<100	<100	<50	<50	<50	<100	<100	125	1.54	0.5	0.13	0.46	1.62	0.44	1.14	1.23	0.53	0.47	0.3	0.73	0.26	0.1	0.32	1.02	10.48	30	<0.1	16.2	5.1	10.4	<0.1	6.4		24	<1	1.5	1.5	1.5	7.0		33.2
KB 810-3C			S 33º 50' 33.73"	E 151º06' 50.87"	1700	2000	<10	29	1150	8370	2460	12000	12400	2520	8650	1280	12450	15.4	31.1	47	48.4	168	59.3	112	118	47.3	50.4	15.1	42	14.6	5.3	17	59.6	829.7	61.9	0.8	260	126	247	1.6	36.7		526	27	5.56	5.56	5.56	149.2		72.1

Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	Phenol	1-Chlorophenol/2-Chlorophenol	1-Methylphenol/2-Methylphenol	3/4-Methylphenol	1,4-Dimethylphenol/2,4 -Dimethylphenol	1-Nitrophenol/2-Nitrophenol	1,4-Dichlorophenol/2,4-Dichlorophenol	4-Chloro-3-methylphenol	1,4,6-trichlorophenol/2,4,6-Trichlorophenol	1,4,5-trichlorophenol/2,4,5-Trichlorophenol	1,4-dinitrophenol/2,4-Dinitrophenol	4-nitrophenol	1-methyl-4,6-dinitrophenol/2-methyl-4,6-Dinitrophenol	pentachlorophenol	1,6-dichlorophenol/2,6-Dichlorophenol	1,3,4,6-tetrachlorophenol/2,3,4,6-Tetrachlorophenol
KB801-1	1	0	S 33º 50' 22.97"	E 151º06' 47.80"	0	300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB801-1	1	1	S 33º 50' 22.97"	E 151º06' 47.80"	0	300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB801-1 TRIPLICATE	54	0	S 33º 50' 22.97"	E 151º06' 47.80"	0	300																
KB801-2	2	0	S 33º 50' 22.97"	E 151º06' 47.80"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB801-3	3	0	S 33º 50' 22.97"	E 151º06' 47.80"	2300	2600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB802-1	4	0	S 33º 50' 22.69"	E 151º06' 47.56"	0	300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB802-2A	5	0	S 33º 50' 22.69"	E 151º06' 47.56"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB802-2B	6	0	S 33º 50' 22.69"	E 151º06' 47.56"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB802-3	7	0	S 33º 50' 22.69"	E 151º06' 47.56"	1500	1800	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB803-1	8	0	S 33º 50' 22.17"	E 151º06' 49.00"	0	300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB803-2	9	0	S 33º 50' 22.17"	E 151º06' 49.00"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB803-3	10	0	S 33º 50' 22.17"	E 151º06' 49.00"	1500	1800	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB803-4	11	0	S 33º 50' 22.17"	E 151º06' 49.00"	3450	3750	<0.2	<0.2	<0.2	<0.4	1	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB803-4	11	1	S 33º 50' 22.17"	E 151º06' 49.00"	3450	3750	<0.2	<0.2	<0.2	<0.4	2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB803-5	12	0	S 33º 50' 22.17"	E 151º06' 49.00"	4200	4500	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB804-1	13	0	S 33º 50' 23.35"	E 151º06' 49.14"	0	300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB804-2	14	0	S 33º 50' 23.35"	E 151º06' 49.14"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB804-3	15	0	S 33º 50' 23.35"	E 151º06' 49.14"	2100	2400	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB804-4	16	0	S 33º 50' 23.35"	E 151º06' 49.14"	3000	3400	<0.2	<0.2	0.3	<0.4	2.4	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB804-5	17	0	S 33º 50' 23.35"	E 151º06' 49.14"	4000	4300	<0.2	<0.2	0.7	<0.4	1	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB805-1	18	0	S 33º 50' 26.10"	E 151º06' 50.10"	0	300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB805-2A	19	0	S 33º 50' 26.10"	E 151º06' 50.10"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB805-2B	20	0	S 33º 50' 26.10"	E 151º06' 50.10"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB805-3	21	0	S 33º 50' 26.10"	E 151º06' 50.10"	700	1000	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB805-3	21	1	S 33º 50' 26.10"	E 151º06' 50.10"	700	1000	<0.2	<0.2	<0.2	<0.4	0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB805-3 TRIPLICATE	55	0	S 33º 50' 26.10"	E 151º06' 50.10"	700	1000																
KB805-4	22	0	S 33º 50' 26.10"	E 151º06' 50.10"	1800	2100	<2	<2	<2	<4	<2	<2	<2	<10	<2	<2	<40	<40	<20	<10	<2	<2
KB805-5	23	0	S 33º 50' 26.10"	E 151º06' 50.10"	2700	3000	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB805-6	24	0	S 33º 50' 27.05"	E 151º06' 50.48"	4000	4300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB806-1	25	0	S 33º 50' 27.05"	E 151º06' 50.48"	0	300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB806-2	26	0	S 33º 50' 27.05"	E 151º06' 50.48"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB806-3	27	0	S 33º 50' 27.05"	E 151º06' 50.48"	1600	1900	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB806-4	28	0	S 33º 50' 27.05"	E 151º06' 50.48"	2900	3200	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB807-1	29	0	S 33º 50' 35.13"	E 151º06' 53.46"	0	300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB807-2	30	0	S 33º 50' 35.13"	E 151º06' 53.46"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2

Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	Phenol	1-Chlorophenol/2-Chlorophenol	1-Methylphenol/2-Methylphenol	3/4-Methylphenol	1,4-Dimethylphenol/2,4 -Dimethylphenol	1-Nitrophenol/2-Nitrophenol	1,4-Dichlorophenol/2,4-Dichlorophenol	4-Chloro-3-methylphenol	1,4,6-trichlorophenol/2,4,6-Trichlorophenol	1,4,5-trichlorophenol/2,4,5-Trichlorophenol	1,4-dinitrophenol/2,4-Dinitrophenol	4-nitrophenol	1-methyl-4,6-dinitrophenol/2-methyl-4,6-Dinitrophenol	pentachlorophenol	1,6-dichlorophenol/2,6-Dichlorophenol	1,3,4,6-tetrachlorophenol/2,3,4,6-Tetrachlorophenol
KB807-3	31	0	S 33º 50' 35.13"	E 151º06' 53.46"	2300	2600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB807-3	31	1	S 33º 50' 35.13"	E 151º06' 53.46"	2300	2600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB808-1	32	0	S 33º 50' 33.89"	E 151º06' 53.49"	0	300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB808-2A	33	0	S 33º 50' 33.89"	E 151º06' 53.49"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB808-2B	34	0	S 33º 50' 33.89"	E 151º06' 53.49"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB808-3	35	0	S 33º 50' 33.89"	E 151º06' 53.49"	700	1000	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB808-4	36	0	S 33º 50' 33.89"	E 151º06' 53.49"	2000	2300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB808-5	37	0	S 33º 50' 33.89"	E 151º06' 53.49"	3000	3300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB809-1	38	0	S 33º 50' 33.62"	E 151º06' 52.13"	0	300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB809-2	39	0	S 33º 50' 33.62"	E 151º06' 52.13"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB809-2	39	1	S 33º 50' 33.62"	E 151º06' 52.13"	300	600																
KB809-3	40	0	S 33º 50' 33.62"	E 151º06' 52.13"	2000	2300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB809-4	41	0	S 33º 50' 33.62"	E 151º06' 52.13"	4000	4300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB811-1	42	0	S 33º 50' 34.83"	E 151º06' 54.39"	0	300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB811-2	43	0	S 33º 50' 34.83"	E 151º06' 54.39"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB811-2	44	0	S 33º 50' 34.83"	E 151º06' 54.39"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB811-3	45	0	S 33º 50' 34.83"	E 151º06' 54.39"	1600	1900	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB810-1	46	0	S 33º 50' 33.73"	E 151º06' 50.87"	0	300	<0.2	<0.2	<0.2	<0.4	0.4	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB810-2	47	0	S 33º 50' 33.73"	E 151º06' 50.87"	300	600	<0.4	<0.4	<0.4	<0.8	1	<0.4	<0.4	<2	<0.4	<0.4	<8	<8	<4	<2	<0.4	<0.4
KB810-3A	48	0	S 33º 50' 33.73"	E 151º06' 50.87"	1700	2000	<0.4	<0.4	<0.4	<0.8	<0.4	<0.4	<0.4	<2	<0.4	<0.4	<8	<8	<4	<2	<0.4	<0.4
KB810-3B	49	0	S 33º 50' 33.73"	E 151º06' 50.87"	1700	2000	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB810-4	50	0	S 33º 50' 33.73"	E 151º06' 50.87"	2500	2800	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB810-5	51	0	S 33º 50' 33.73"	E 151º06' 50.87"	3000	3300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB810-5	51	1	S 33º 50' 33.73"	E 151º06' 50.87"	3000	3300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB812-1	52	0	S 33º 50' 26.33"	E 151º06' 48.77"	0	300	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB812-2	53	0	S 33º 50' 26.33"	E 151º06' 48.77"	300	600	<0.2	<0.2	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<4	<4	<2	<1	<0.2	<0.2
KB802-2C			S 33º 50' 22.69"	E 151º06' 47.56"	300	600	<0.8	<0.8	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8				<2	<0.8	
KB805-2C			S 33º 50' 26.10"	E 151º06' 50.10"	300	600	<0.8	<0.8	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8				<2	<0.8	
KB 808-2C			S 33º 50' 33.89"	E 151º06' 53.49"	300	600	<0.8	<0.8	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8				<2	<0.8	
KB 811-2C			S 33º 50' 34.83"	E 151º06' 54.39"	300	600	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				<2	<0.5	
KB 810-3C			S 33º 50' 33.73"	E 151º06' 50.87"	1700	2000	<0.8	<0.8	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8				<2	<0.8	

April 2016 Sediment Data

Sample ID	Sample ID	SAMPLE	REPLICATE	Latitude	Longitude	Depth Top	Depth Bottom	TRH C_{10} - C_{14}	TRH C15 - C18	TRH C19 - C36/TRH C29 - C36	TRH >C_{10}-C_{16}	TRH >C_{16}-C_{34}	TRH >C_{34}-C_{40}	Sum C_{10} - C_{40}	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ	Total +ve PAH's	Arsenic - low level	Cadmium - low level	Chromium - low level	Copper - low level	Lead - low level	Mercury - low level	Nickel - low level	Zinc - low level	Total Organic Carbon	TOC% Norm 1%	PAH Norm 1%	Clay in soils 0.5um	Moisture
MB30	MB30	1	0	S 33º 50' 24.21"	E 151º 06' 47.28"	0	150	71	1800	1500	180	2900	700	3780	5.3	12	0.93	2	4	2.3	12	25	8.6	6.8	37	27	17	2.7	13	36	180	19	0.4	110	140	220	1.2	14	450	120000	12	10	18.0	86	51
MB30	MB30	1	1	S 33º 50' 24.21"	E 151º 06' 47.28"	0	150	89	2200	1800	220	3500	850	4570	5.5	12	0.85	2	3.9	2.1	12	24	7.8	6.5	39	28	16	2.7	12	38	170	19	0.3	110	140	210	1.2	14	450	120000	12	10	17.0		
MB31	MB31	2	0	S 33º 50' 23.17"	E 151º 06' 48.60"	0	150	<50	500	610	<50	970	340	1335	0.88	1.9	0.11	0.3	0.8	0.34	1.8	4.8	1.1	1	13	9.7	6.8	1.3	5.7	13	49	17	0.2	87	110	180	0.79	11	370	51000	5.1	5.1	9.6	86	44
MB32	MB32	3	0	S 33º 50' 22.39"	E 151º 06' 50.27"	0	150	<50	740	740	<50	1300	360	1685	0.86	2.9	0.18	0.34	0.83	0.48	3.2	13	2.8	2.5	19	14	9.4	1.8	7.5	19	79	18	0.2	68	90	160	0.91	8.9	320	41000	4.1	4.1	19.3	74	40
MB33	MB33	4	0	S 33º 50' 23.85"	E 151º 06' 51.29"	0	150	<50	<100	<100	<50	<100	<100	125	0.16	0.32	0.03	0.06	0.33	0.1	0.8	1.6	0.53	0.62	1.9	1.3	0.55	0.02	0.57	2	9	10	0.2	64	93	150	0.69	8.1	290	20000	2	2	4.5	95	33
MB34A	MB34A	5	0	S 33º 50' 27.15"	E 151º 06' 51.80"	0	150	<50	<100	<100	<50	100	<100	175	0.15	0.29	0.04	0.07	0.29	0.11	0.95	1.5	0.46	0.48	1.7	1.1	0.46	0.2	0.51	2	8.4	11	0.2	64	90	140	0.68	8.2	290	19000	1.9	1.9	4.4	97	34
MB34B	MB34B	6	0	S 33º 50' 27.15"	E 151º 06' 51.80"	0	150	<50	<100	<100	<50	<100	<100	125	0.19	0.41	0.06	0.08	0.33	0.1	1.1	1.8	0.56	0.7	2	1.4	0.62	0.2	0.62	2	10	17	0.2	95	150	220	1.1	12	420	30000	3	3	3.3	96	60
MB35	MB35	7	0	S 33º 50' 27.73"	E 151º 06' 47.64"	0	150	50	1100	680	120	1500	310	1930	4	8	1.3	1.8	7.8	4	22	26	11	10	23	16	9.2	1.9	7.3	22	150	13	<0.1	18	74	140	0.18	9.2	140	140000	14	10	15.0	7	27
MB36	MB36	8	0	S 33º 50' 25.66"	E 151º 06' 46.88"	0	150	320	4700	2300	690	6200	1100	7990	4.5	17	4.8	3.6	9.6	7.1	130	140	57	45	70	46	22	3.9	16	66	570	18	0.2	16	55	77	3	10	160	100000	10	10	57.0	8	29
MB37	MB37	9	0	S 33º 50' 32.46"	E 151º 06' 51.19"	0	150	<50	1200	800	130	1800	390	2320	3.7	8	0.65	1.6	3.6	2.1	10	24	7.5	6.7	24	20	9.2	2	6.9	26	130	21	0.5	120	110	170	0.81	17	400	150000	15	10	13.0	68	46
MB38	MB38	10	0	S 33º 50' 31.02"	E 151º 06' 52.97"	0	150	<50	240	240	<50	430	130	585	0.86	1.8	0.13	0.33	0.97	0.51	2.4	5.7	1.6	1.4	6.8	5.1	2.9	0.7	2.5	7	34	17	0.3	100	120	180	0.95	13	390	45000	4.5	4.5	7.6	93	43
MB39	MB39	11	0	S 33º 50' 32.35"	E 151º 06' 53.67"	0	150	<50	580	470	54	940	250	1244	1.4	3.6	0.23	0.63	1.6	0.95	4	9.9	2.9	2.7	12	8.9	5	1.3	3.9	12	59	20	0.4	130	150	220	1.2	17	480	64000	6.4	6.4	9.2	93	52
MB39	MB39	11	1	S 33º 50' 32.35"	E 151º 06' 53.67"	0	150	<50	760	620	69	1200	330	1599	1.8	4.4	0.33	0.79	2	1.2	5	12	3.8	3.6	15	11	6	1.6	4.7	15	73	20	0.4	130	150	220	1.1	17	480	64000	6.4	6.4	11.4		
MB40A	MB40A	12	0	S 33º 50' 33.69"	E 151º 06' 54.12"	0	150	<50	1300	940	130	2000	470	2600	2.7	7.3	0.47	1.2	2.5	1.7	8.2	23	6.4	5.9	26	18	8.6	1.7	6	24	120	20	0.5	120	120	190	0.99	18	430	150000	15	10	12.0	86	51
MB40B	MB40B	13	0	S 33º 50' 33.69"	E 151º 06' 54.12"	0	150	75	1900	1300	200	2800	670	3670	3.1	9	0.71	1.6	3.2	2.1	12	30	8.7	7.6	33	24	11	2.3	8.1	32	160	19	0.5	110	120	190	0.97	16	400	150000	15	10	16.0	86	51
MB41	MB41	14	0	S 33º 50' 33.80"	E 151º 06' 52.75"	0	150	<50	1100	660	100	1600	280	1980	2.1	6.1	0.46	1.1	2.3	1.3	8.4	22	6.5	5.5	21	16	6.4	1.3	4.8	20	110	17	0.6	100	83	150	0.76	19	400	200000	20	10	11.0	67	40
MB42A	MB42A	15	0	S 33º 50' 34.40"	E 151º 06' 52.01"	0	150	85	2100	1300	240	3000	660	3900	4.2	9.3	1.2	2	5.1	3.1	19	49	9.8	8.4	34	26	9.8	2.2	7.3	34	190	15	0.3	160	61	120	0.45	34	290	280000	28	10	19.0	42	40
MB42B	MB42B	16	0	S 33º 50' 34.40"	E 151º 06' 52.01"	0	150	<50	1300	750	140	1800	370	2310	3.2	6.2	0.96	1.4	4.4	2.3	14	36	7.4	6.6	22	16	6.7	1.3	4.6	21	130	14	0.3	110	50	110	0.44	29	260	210000	21	10	13.0	57	32
MB43	MB43	17	0	S 33º 50' 34.74"	E 151º 06' 53.39"	0	150	120	3100	1500	360	4000	760	5120	3.6	11	3.7	3.1	8.6	4.4	60	110	24	20	46	35	14	2.9	10	47	360	17	0.4	120	72	120	0.51	24	320	160000	16	10	36.0	52	51
MB44	MB44	18	0	S 33º 50' 30.90"	E 151º 06' 10.93"	0	150	<50	370	510	<50	770	320	1115	0.11	0.38	0.04	0.08	1	0.23	2.9	3.3	1.5	1.4	3.6	2.2	1.6	0.3	1.3	3.2	20	20	1.7	160	120	230	0.73	16	580	36000	3.6	3.6	5.6	95	57
MB45	MB45	19	0	S 33º 50' 23.18"	E 151º 06' 15.75"	0	150	<50	<100	<100	<50	<100	<100	125	0.04	0.09	<0.01	0.02	0.23	0.07	0.83	0.96	0.35	0.39	0.9	0.55	0.27	0.06	0.29	0.8	5	13	0.5	63	83	140	0.43	7.2	260	19000	1.9	1.9	2.6	62	42
MB46	MB46	20	0	S 33º 50' 10.37"	E 151º 06' 14.23"	0	150	<50	<100	<100	<50	<100	<100	125	0.01	0.04	<0.01	<0.01	0.05	0.2	0.12	0.13	0.09	0.04	0.24	0.17	0.11	0.03	0.11	0.2	1.3	6.9	<0.1	15	19	41	0.1	2	70	4400	0.44	0.44	3.0	19	23
MB47	MB47	21	0	S 33º 50' 14.89"	E 151º 06' 0.78"	0	150	<50	<100	<100	<50	<100	<100	125	0.03	0.09	<0.01	0.02	0.17	0.03	0.63	0.76	0.28	0.36	0.89	0.53	0.28	0.07	0.3	0.7	4.4	13	0.3	53	60	100	0.42	6.8	220	15000	1.5	1.5	2.9	71	40
MB47	MB47	21	1	S 33º 50' 14.89"	E 151º 06' 0.78"	0	150	<50	<100	<100	<50	<100	<100	125	0.03	0.08	<0.01	0.02	0.17	0.05	0.65	0.76	0.29	0.26	0.87	0.49	0.26	0.06	0.28	0.7	4.3	13	0.3	54	62	110	0.41	6.9	230	16000	1.6	1.6	2.7		
KB901-1	KB901-1	22	0	S 33º 50' 34.63"	E 151º 06' 53.66"	0	300	<50	970	540	98	1300	260	1658	1.1	3.2	0.25	0.65	1.6	1	8.5	29	4.3	3.5	16	12	5.4	1.1	4.2	16	92	17	0.5	140	69	140	0.54	31	260	80000	8	8	11.5	77	50
KB901-2	KB901-2	23	0	S 33º 50' 34.63"	E 151º 06' 53.66"	300	600	<50	660	400	58	960	190	1208	0.2	1.2	0.06	0.17	0.71	0.56	2	9.1	1.9	2.1	10	7.2	3.6	0.9	2.7	9.7	43	37	0.5	83	73	160	0.81	15	260	41000	4.1	4.1	10.5	77	50
KB902-1	KB902-1	24	0	S 33º 50' 34.13"	E 151º 06' 54.68"	0	300	<50	490	370	<50	780	190	995	1	2.7	0.18	0.49	1.1	0.78	3.6	9.3	2.6	2.8	11	8.2	4.4	1.2	3.3	11	53	16	0.4	76	68	130	0.6	14	290	87000	8.7	8.7	6.1	46	40
KB902-2	KB902-2	25	0	S 33º 50' 34.13"	E 151º 06' 54.68"	300	600	<50	230	190	<50	380	110	515	0.17	0.91	0.11	0.12	0.46	0.21	1.4	3.3	0.95	0.97	5.8	4	2.1	0.4	1.6	5.3	23	24	0.2	24	15	35	0.16	7	65	30000	3	3	7.7	29	40
KB902-3	KB902-3	26	0	S 33º 50' 34.13"	E 151º 06' 54.68"	600	900	<50	<100	<100	<50	<100	<100	125	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.03	<0.01	<0.01	0.04	0.02	0.02	<0.01	0.02	0.03	0.14	19	<0.1	15	5.3	12	0.01	6.3	21	21000	2.1	2.1	0.1	75	42
KB903-1	KB903-1	27	0	S 33º 50' 26.50"	E 151º 06' 47.42"	0	300	<50	<100	<100	<50	<100	<100	125	0.07	0.12	<0.01	0.02	0.09	0.04	0.17	1.3	0.13	0.07	0.42	0.34	0.16	0.04	0.18	0.4	3.2	10	<0.1	9.3	25	28	0.07	5.2	58	21000	2.1	2.1	1.5	17	30
KB903-2	KB903-2	28	0	S 33º 50' 26.50"	E 151º 06' 47.42"	300	600	<50	1500	850	140	2100	400	2640	1.3	5.2	0.48	0.78	2.1	1.8	7.3	50	15	8.6	20	15	6.4	1.1	5.3	20	140	12	0.5	27	15	73	0.34	12	120	220000	22	10	14.0	14	33
KB904-1	KB904-1	29	0	S 33º 50' 34.74"	E 151º 06' 53.39"	0	300	210	4600	2400	540	6200	1100	7840	2	11	1.3	2.2	3.6	3.1	52	110	22	19	59	43	16	3.6	12	57	370	30	0.7	190	82	150	0.79	41	350	120000	12	10	37.0	80	56
KB904-1	KB904-1	29	1	S 33º 50' 34.74"	E 151º 06' 53.39"	0	300																																					

October 2017 Sediment Data

Sample	Replicate	TRH C6 - C9	TRH C6 - C10	BTEX (F1) vTPH C6 - C10 less	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-Xylene	Total +ve Xylenes	naphthalene	TRH C10 - C14	TRH C15 - C28	TRH C29 - C36	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Sum C10 - C40	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ calc (zero)	Benzo(a)pyrene TEQ calc(half)	Benzo(a)pyrene TEQ calc(PQL)	PAHs +ve Total	PAHs, Norm 1%	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Moisture	(Combustion) Total Organic Carbon*	TOC	TOC Norm to 1%	Fines <0.063mm
KBR1	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	<100	<50	<100	<100	125	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.3	0.4	0.2	0.2	0.5	0.3	0.2	<0.1	0.2	<0.5	<0.5	<0.5	2.5	1.79	17	<0.4	76	74	110	0.5	10	270	53	14000	1.4	1.4	78
KBR1	1											<50	<100	<100	<50	<100	<100	125	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	<0.1	0.1	0.3	0.2	0.1	<0.1	0.1	<0.5	<0.5	<0.5	1.2	0.80	16	<0.4	78	76	110	0.5	10	270		15000	1.5	1.5	
KBR2A	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	<100	<50	<100	<100	125	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.3	0.1	0.2	0.4	0.3	0.2	<0.1	0.2	<0.5	<0.5	<0.5	1.8	1.29	15	<0.4	69	72	100	0.5	9	250	41	14000	1.4	1.4	61
KBR2B	0											<50	<100	<100	<50	120	<100	195	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.3	0.4	0.2	0.2	0.6	0.3	0.2	<0.1	0.2	<0.5	<0.5	<0.5	2.5	2.08	16	<0.4	65	70	97	0.5	8	230	40	12000	1.2	1.2	60
KBR3	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	<100	<50	<100	<100	125	<0.1	0.1	<0.1	<0.1	0.8	0.2	1.3	1.3	0.6	0.6	1	0.77	0.4	<0.1	0.4	1	1	1	7.8	2.44	15	0.8	84	81	110	0.5	10	310	38	32000	3.2	3.2	64
KBR4A	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	180	180	<50	310	<100	385	0.3	1	<0.1	0.2	0.6	0.3	2	3.1	1.4	1.6	5.3	3.9	1.9	0.3	1.9	5.1	5.1	5.1	24	3.04	14	<0.4	62	88	100	0.8	8	230	32	79000	7.9	7.9	54
KBR4B	0											<50	330	330	<50	580	140	745	0.7	1.4	0.2	0.4	2.4	1	4.8	6	2.4	2.7	8	5.9	2.9	0.6	2.8	7.9	7.9	7.9	42	5.53	17	<0.4	89	120	140	1.1	12	340	46	76000	7.6	7.6	52
KBR4C		<25	<25	<25					<0.5			<0.5	490	550	<0.5	1200	310	1510	1.8	1.7	<0.5	<0.5	1	0.7	2.9	5.8	2.4	1.7	10	4.6	1.7	0.51	2.5	7.6	7.6	7.6	37	4.11	18	<0.5	92	100	150	1.1	14	440		90000	9	9	
KBR5A	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	<100	<50	<100	<100	125	0.2	0.3	<0.1	<0.1	0.3	0.1	0.8	1.1	0.5	0.6	2	1.4	0.8	0.1	0.8	1.9	1.9	1.9	9.2	2.04	21	<0.4	100	130	160	1.2	13	380	49	45000	4.5	4.5	63
KBR5B	0											<50	150	190	<50	280	<100	355	0.3	0.8	<0.1	0.1	0.6	0.3	1.5	2.4	1.1	1.3	4.4	3.1	1.6	0.4	1.5	4.2	4.2	4.2	20	3.45	20	<0.4	89	110	140	1.1	12	340	47	58000	5.8	5.8	33
KBR6	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	160	170	<50	280	<100	355	0.3	0.8	<0.1	0.2	0.4	0.2	0.9	2.3	0.8	0.7	3.8	2.8	1.4	0.2	1.4	3.7	3.7	3.7	16	3.40	24	<0.4	110	140	180	1.3	16	420	51	47000	4.7	4.7	80
KBR7	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	120	<50	160	<100	235	0.2	0.4	<0.1	<0.1	0.4	0.1	0.9	1.2	0.5	0.6	2	1.4	0.8	0.1	0.8	1.8	1.8	1.8	9.2	3.41	21	<0.4	130	170	200	1.4	17	480	57	27000	2.7	2.7	95
KBR8A	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	<100	<50	<100	<100	125	0.1	0.2	<0.1	<0.1	0.2	0.1	0.5	0.7	0.3	0.4	1	0.73	0.4	<0.1	0.4	0.9	0.9	0.9	5.2	1.79	15	<0.4	93	130	150	1	12	350	43	29000	2.9	2.9	98
KBR8B		<25	<25	<25					<0.5			<0.5	260	460	<0.5	520	320	840	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.67	0.94	<0.5	<0.5	2	0.84	<0.5	<0.5	0.6	1.2	1.6	1.9	5.1	1.65	25	<0.5	160	190	270	1.5	23	740		31000	3.1	3.1	
KBR9	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	150	190	<50	290	<100	365	0.5	0.7	<0.1	0.1	0.4	0.2	0.9	1.5	0.7	0.7	4.7	3.5	1.8	0.4	1.8	4.6	4.6	4.6	18	6.92	24	<0.4	100	140	170	1.5	13	380		26000	2.6	2.6	75
KBR10A	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	<100	<50	<100	<100	125	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.4	0.5	0.2	0.2	0.6	0.3	0.2	<0.1	0.2	<0.5	<0.5	<0.5	2.9	1.04	17	1	100	110	140	0.6	12	400	46	28000	2.8	2.8	83
KBR10A	1											<50	<100	<100	<50	120	<100	195	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.5	0.6	0.2	0.3	0.7	0.4	0.2	<0.1	0.2	0.5	0.5	0.5	3.4	1.21	18	1	100	110	140	0.7	12	410		28000	2.8	2.8	
KBR10C		<25	<25	<25					<0.5			<0.5	160	300	<0.5	370	240	610	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	0	0.8	1.5	0	0.00	19	1.4	120	110	160	0.68	15	570		33000	3.3	3.3	
KBR11	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	120	150	<50	220	<100	295	0.3	0.7	<0.1	0.1	0.4	0.2	1.2	1.9	0.9	1	3.5	2.6	1.3	0.2	1.3	3.4	3.4	3.4	16	5.71	22	<0.4	120	150	180	1.4	15	440		28000	2.8	2.8	89
KBR12	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	160	200	<50	310	<100	385	0.2	0.8	<0.1	0.1	0.6	0.3	1.6	2.3	1.2	1.3	4.6	3.3	1.6	0.3	1.6	4.4	4.4	4.4	20	30.77	20	<0.4	87	110	140	1.2	12	340	47	6500	0.65	0.65	13
KBR13	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	<100	<50	<100	<100	125	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.2	<0.1	0.1	0.2	0.2	0.1	<0.1	0.1	<0.5	<0.5	<0.5	0.97	0.54	8	<0.4	23	27	41	0.2	3	94	25	18000	1.8	1.8	61
KBR14	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	<100	<50	<100	<100	125	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.4	0.5	0.2	0.2	0.5	0.3	0.2	<0.1	0.2	<0.5	<0.5	<0.5	2.7	1.08	16	<0.4	93	100	130	0.6	11	310	48	25000	2.5	2.5	100
KBR15	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	130	<50	170	<100	245	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	0.8	0.8	0.3	0.4	1	0.68	0.4	<0.1	0.4	0.9	0.9	0.9	5.3	1.66	23	0.4	150	540	280	0.9	15	580	56	32000	3.2	3.2	97
KBR16	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	<100	<50	<100	<100	125	<0.1	<0.1	<0.1	<0.1	0.3	0.1	0.8	0.9	0.4	0.4	1	0.66	0.3	<0.1	0.4	0.8	0.8	0.8	5.4	2.35	18	<0.4	100	330	180	0.8	11	400	47	23000	2.3	2.3	96
KBR16B		<25	<25	<25					<0.5			<0.5	200	380	<0.5	480	290	770	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	1	0.56	0.53	2.1	0.77	<0.5	<0.5	0.56	1.3	1.6	1.9	6.4	2.13	28	<0.5	150	370	260	0.93	18	680		30000	3	3	
KBR17	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	<100	<50	110	<100	185	<0.1	<0.1	<0.1	<0.1	0.4	0.1	1	1.1	0.5	0.5	1	0.74	0.4	<0.1	0.4	1	1	1	6.4	2.78	26	0.7	130	380	290	1.3	16	570		23000	2.3	2.3	95
KBRMB18	0	<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1	<50	<100	<100	<50	<100	<100	125	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.4	0.4	0.2	0.2	0.4	0.3	0.1	<0.1	0.1	<0.5	<0.5	<0.5	2.4	0.96	17	0.7	160	150	190	0.8	16	470	56	25000	2.5	2.5	95
KBRMB18	1											<50	<100	<100	<50	<100	<100	125	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	0.8	0.9	0.4	0.4	1	0.66	0.4	<0.1	0.4	0.8	0.8	0.8	5.3	2.21	17	0.7	160	150	190	0.8	17	480		24000	2.4	2.4	
Rinsate	0											<50	<100	<100	<50	<100	<100	125	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	<0.05		<4	<0.4	3	2	2	<0.1	<1	2	11	<100	#VALUE!	#VALUE!	2
TS	0				93%	104%	88%	94%	89%	[NT]																																											
TB	0	<25	<25		<0.2	<0.5	<1	<2	<1	<1																																										
TB		<25	<25	<25	<0.2	<0.5	<1	<2	<1	<1	<1																																								

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CERTIFICATE OF ANALYSIS 143671

Client:
Synnot & Wilkinson
PO Box 20
Strathbogie
VIC 3666

Attention: Russell Synnot

Sample log in details:

Your Reference:	**Kendall Bay Marine Tissue**
No. of samples:	6 marine tissue
Date samples received / completed instructions received	22/03/16 / 22/03/16

Results are reported `wet, as received'.

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

Report Details:

Date results requested by: / Issue Date:	4/04/16 / 4/04/16
Date of Preliminary Report:	Not Issued

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

Results Approved By:

Jacinta Hurst
Laboratory Manager

svTRH (C10-C40) in Soil						
Our Reference:	UNITS	143671-1	143671-2	143671-3	143671-4	143671-5
Your Reference	---------- -	KBM Kendall Bay Mussels	EBM Exile Bay Mussels	MBM Majors Bay Mussels	KBO Kendall Oysters	EBO Exile Bay Oysters
Date Sampled	----------	22/03/2016	22/03/2016	22/03/2016	22/03/2016	22/03/2016
Type of sample		tissue	tissue	tissue	tissue	tissue
Date extracted	-	1/04/2016	1/04/2016	1/04/2016	1/04/2016	1/04/2016
Date analysed	-	02/04/2016	02/04/2016	02/04/2016	02/04/2016	02/04/2016
TRHC$_{10}$ - C$_{14}$	mg/kg	<50	<50	<50	<50	<50
TRHC$_{15}$ - C$_{28}$	mg/kg	220	180	220	210	290
TRHC$_{29}$ - C$_{36}$	mg/kg	270	310	250	360	470
TRH>C$_{10}$-C$_{16}$	mg/kg	<50	<50	<50	<50	<50
TRH>C$_{16}$-C$_{34}$	mg/kg	460	450	430	530	680
TRH>C$_{34}$-C$_{40}$	mg/kg	140	200	170	210	280
Surrogate o-Terphenyl	%	#	131	111	116	125

svTRH (C10-C40) in Soil		
Our Reference:	UNITS	143671-6
Your Reference	---------- -	MBO Majors Bay Oysters
Date Sampled	----------	22/03/2016
Type of sample		tissue
Date extracted	-	1/04/2016
Date analysed	-	02/04/2016
TRHC$_{10}$ - C$_{14}$	mg/kg	<50
TRHC$_{15}$ - C$_{28}$	mg/kg	130
TRHC$_{29}$ - C$_{36}$	mg/kg	290
TRH>C$_{10}$-C$_{16}$	mg/kg	<50
TRH>C$_{16}$-C$_{34}$	mg/kg	340
TRH>C$_{34}$-C$_{40}$	mg/kg	240
Surrogate o-Terphenyl	%	79

PAHs in Soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- - ---------- 	143671-1 KBM Kendall Bay Mussels 22/03/2016 tissue	143671-2 EBM Exile Bay Mussels 22/03/2016 tissue	143671-3 MBM Majors Bay Mussels 22/03/2016 tissue	143671-4 KBO Kendall Oysters 22/03/2016 tissue	143671-5 EBO Exile Bay Oysters 22/03/2016 tissue
Date extracted	-	01/04/2016	01/04/2016	01/04/2016	01/04/2016	01/04/2016
Date analysed	-	01/04/2016	01/04/2016	01/04/2016	01/04/2016	01/04/2016
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	0.06	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total Positive PAHs	mg/kg	NIL (+)VE	NIL (+)VE	NIL (+)VE	0.060	NIL (+)VE
Surrogate p-Terphenyl-d14	%	106	102	104	101	95

PAHs in Soil		
Our Reference:	UNITS	143671-6
Your Reference	----------	MBO Majors Bay Oysters
	-	
Date Sampled	----------	22/03/2016
Type of sample		tissue
Date extracted	-	01/04/2016
Date analysed	-	01/04/2016
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	<0.1
Pyrene	mg/kg	<0.1
Benzo(a)anthracene	mg/kg	<0.1
Chrysene	mg/kg	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5
Total Positive PAHs	mg/kg	NIL (+)VE
Surrogate p-Terphenyl-d14	%	117

Acid Extractable metals in soil						
Our Reference:	UNITS	143671-1	143671-2	143671-3	143671-4	143671-5
Your Reference	----------	KBM Kendall Bay Mussels	EBM Exile Bay Mussels	MBM Majors Bay Mussels	KBO Kendall Oysters	EBO Exile Bay Oysters
	-					
Date Sampled	----------	22/03/2016	22/03/2016	22/03/2016	22/03/2016	22/03/2016
Type of sample		tissue	tissue	tissue	tissue	tissue
Date prepared	-	01/04/2016	01/04/2016	01/04/2016	01/04/2016	01/04/2016
Date analysed	-	01/04/2016	01/04/2016	01/04/2016	01/04/2016	01/04/2016
Arsenic	mg/kg	<2	<2	<2	<2	<2
Cadmium	mg/kg	<0.2	<0.2	<0.2	0.7	0.6
Chromium	mg/kg	<1	<1	<1	<1	<1
Copper	mg/kg	<1	<1	<1	180	190
Lead	mg/kg	<1	<1	<1	<1	<1
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	<1	<1	<1	<1	<1
Zinc	mg/kg	17	14	18	1,100	1,000

Acid Extractable metals in soil		
Our Reference:	UNITS	143671-6
Your Reference	----------	MBO Majors Bay Oysters
	-	
Date Sampled	----------	22/03/2016
Type of sample		tissue
Date prepared	-	01/04/2016
Date analysed	-	01/04/2016
Arsenic	mg/kg	<2
Cadmium	mg/kg	1
Chromium	mg/kg	<1
Copper	mg/kg	170
Lead	mg/kg	<1
Mercury	mg/kg	<0.1
Nickel	mg/kg	<1
Zinc	mg/kg	1,900

Method ID	Methodology Summary
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'TEQ PQL' values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'TEQ zero' values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'TEQ half PQL' values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PAHs" is simply a sum of the positive individual PAHs.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			01/04/2016	[NT]	[NT]	LCS-11	01/04/2016
Date analysed	-			02/04/2016	[NT]	[NT]	LCS-11	02/04/2016
TRHC$_{10}$ - C$_{14}$	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-11	113%
TRHC$_{15}$ - C$_{28}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-11	117%
TRHC$_{29}$ - C$_{36}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-11	111%
TRH>C$_{10}$-C$_{16}$	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-11	113%
TRH>C$_{16}$-C$_{34}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-11	117%
TRH>C$_{34}$-C$_{40}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-11	111%
Surrogate o-Terphenyl	%		Org-003	91	[NT]	[NT]	LCS-11	106%
QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			01/04/2016	[NT]	[NT]	LCS-11	01/04/2016
Date analysed	-			01/04/2016	[NT]	[NT]	LCS-11	01/04/2016
Naphthalene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	LCS-11	94%
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	LCS-11	91%
Phenanthrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	LCS-11	90%
Anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	LCS-11	90%
Pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	LCS-11	97%
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	LCS-11	99%
Benzo(b,j +k)fluoranthene	mg/kg	0.2	Org-012	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	[NT]	[NT]	LCS-11	112%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012	100	[NT]	[NT]	LCS-11	110%

Client Reference: Kendall Bay Marine Tissue

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			01/04/2016	[NT]	[NT]	LCS-1	01/04/2016
Date analysed	-			01/04/2016	[NT]	[NT]	LCS-1	01/04/2016
Arsenic	mg/kg	2	Metals-020 ICP-AES	<4	[NT]	[NT]	LCS-1	99%
Cadmium	mg/kg	0.2	Metals-020 ICP-AES	<0.4	[NT]	[NT]	LCS-1	103%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	92%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	94%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	101%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	LCS-1	78%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	96%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	98%

Report Comments:

Samples were freeze dried by NMI, then the dry sample was analysed by Envirolab.
Reported results have been corrected for the drying process, ie results are reported `wet, as received'.

TRH_S_NEPM: # Percent recovery is not possible to report as the high concentration of analytes in the sample/s have caused interference.

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

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

Quality Control Definitions

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

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

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

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

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

Laboratory Acceptance Criteria

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

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

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

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

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

Table 4 Sediment Analytical Results
ERA- Sediment sampling
AGL Mortlake January/February 2006

Sample Location	ESD01	ESD01	ESD01	ESD02	ESD02	ESD02	ESD03	ESD03	ESD03	ESD03	ESD04	ESD04	ESD04	ESD04	ESD05	ESD05
Depth	0.00-0.02	0.02-0.10	0.10-0.20	0.00-0.02	0.02-0.20	0.20-0.30	0.00-0.02	0.02-0.10	0.20-0.30	0.40-0.50	0.00-0.02	0.02-0.10	0.20-0.40	0.40-0.50	0.00-0.02	0.02-0.10
Sample ID	ESD01_0.00-0.02	ESD01_0.02-0.10	ESD01_0.10-0.20	ESD01_0.00-0.02	ESD02_0.02-0.20	ESD02_0.20-0.30	ESD03_0.00-0.02	ESD03_0.02-0.10	ESD03_0.20-0.30	ESD03_0.40-0.50	ESD04_0.00-0.02	ESD04_0.02-0.10	ESD04_0.20-0.40	ESD04_0.40-0.50	ESD05_0.00-0.02	ESD05_0.02-0.10
Date Sampled	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006

Analyte	LOR	Units	ANZECC/ARMCANZ (2000) ISQG Low	ANZECC/ARMCANZ (2000) ISQG High														
Total Petroleum Hydrocarbons																		
C6-C9 Fraction	2	mg/kg	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
C10-C14 Fraction	50	mg/kg	--	--	530	1410	1340	<50	<50	<50	<50	<50	70	<50	70	130	90	<50	<50	<50
C15-C28 Fraction	100	mg/kg	--	--	8970	18000	15400	<100	<100	120	620	770	1300	1260	1720	1790	2440	<100	320	<100
C29-C36 Fraction	100	mg/kg	--	--	3500	6450	5000	<100	<100	<100	600	540	920	460	1440	1400	1340	<100	330	240
C10 - C36 Fraction			--	--	13000	25860	21740	--	--	120	1220	1310	2290	1720	3230	3320	3870	--	650	240
BTEX Compounds																		
Benzene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
m&p-Xylene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-Xylene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Xylenes	-	mg/kg	--	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polynuclear Aromatic Hydrocarbons																		
Acenaphthene	0.5	mg/kg	--	--	4.07	9.33	7.2	0.05	<0.05	<0.05	0.24	0.34	1.01	23.4	0.25	0.32	0.35	<0.05	0.36	0.14
Acenaphthylene	0.5	mg/kg	--	--	48.2	88.4	63.6	0.96	0.76	0.56	4.3	6.12	4.98	32.1	4.8	4.7	11.9	0.2	7.37	3.07
Anthracene	0.5	mg/kg	--	--	11.9	26.6	26.6	0.34	0.26	0.19	1.18	1.45	3.37	49.1	1.33	1.46	4.18	0.08	1.91	0.93
Benzo(a)anthracene	0.5	mg/kg	--	--	75.6	148	124	1.03	0.55	0.54	2.2	2.98	3.59	35.9	2.01	2.08	4.85	0.38	4.08	1.74
Benzo(a)pyrene	0.5	mg/kg	--	--	58.7	101	69.8	1.83	1.22	1.21	6.32	8.12	8.47	27.3	9.23	7.71	19.2	0.61	9.09	4.79
Benzo(b)fluoranthene	0.5	mg/kg	--	--	36.3	82	52.3	1.5	0.93	0.9	4.82	6.68	7.3	17.6	7.87	7.54	20.1	0.33	7.89	4.1
Benzo(g,h,i)perylene	0.5	mg/kg	--	--	23.1	35	24.8	0.94	0.66	0.67	3.49	3.7	3.6	9.51	4.17	3.45	6.2	0.22	4.05	2.37
Benzo(k)fluoranthene	0.5	mg/kg	--	--	51.4	79.2	64.6	1.35	1.06	1.08	5.27	4.77	6.91	22.2	6.5	5.08	8.69	0.46	8.29	3.89
Chrysene	0.5	mg/kg	--	--	71.2	138	113	1.1	0.63	0.58	2.42	3.39	4.16	34.3	2.84	2.77	9.09	0.39	4.49	1.91
Dibenzo(a,h)anthracene	0.5	mg/kg	--	--	8.4	12.4	10.1	0.33	0.22	0.23	1.11	1.14	1.08	3.77	1.34	1.08	2.94	0.07	1.36	0.81
Fluoranthene	0.5	mg/kg	--	--	166	324	243	1.39	0.78	0.75	2.68	5.23	6.07	63.7	2.61	2.84	4.5	0.28	5.47	2.06
Fluorene	0.5	mg/kg	--	--	1.07	1.89	1.8	<0.05	<0.05	<0.05	0.17	0.18	0.74	25	0.17	0.26	0.34	<0.05	0.25	0.14
Indeno(1,2,3,cd)pyrene	0.5	mg/kg	--	--	22.4	35.4	24.8	0.88	0.6	0.63	3.28	3.58	3.53	8.96	4.21	3.45	7.27	0.22	4.04	2.28
Naphthalene	0.5	mg/kg	--	--	7.85	19.6	13	0.14	0.13	0.06	0.89	0.95	5.3	3.67	0.94	1.97	2.09	<0.05	1.26	0.82
Phenanthrene	0.5	mg/kg	--	--	7.7	15.7	46.7	0.28	0.23	0.16	0.99	1.04	1.38	105	0.75	1.1	1.32	0.08	1.48	0.79
Pyrene	0.5	mg/kg	--	--	222	394	285	2.13	1.32	1.04	5.93	11.2	14.1	92.1	9.86	10.1	41.4	0.55	10.1	4.19
Total PAHs		mg/kg	--	--	816	1509	1170	14	9	9	45	61	76	554	59	56	144	4	71	34
Major Ions																		
Free Cyanide	1	mg/kg	--	--	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cyanide	1	mg/kg	--	--	36.9	14.2	70.1	<1.0	<1.0	<1.0	<1.0	<1.0	2.2	7.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Organic Carbon	0.5	%	--	--	3.8	10.3	5.0	0.6	1.4	1.4	2.9	3.1	4.4	4.3	2.3	2.1	3.1	2.0	3.3	2.9
Total Cyanide - normalised to 1	0.5	mg/kg	25*	--	9.71	1.42	14.02	-	-	-	-	-	0.5	1.79	-	-	-	-	-	-
Polynuclear Aromatic Hydrocarbons - Normalised to 1%TOC																		
Acenaphthene	0.05	mg/kg	0.016	0.500	1.07	0.93	1.44	0.08	<0.05	<0.05	0.08	0.11	0.23	5.44	0.11	0.15	0.11	<0.05	0.11	0.05
Acenaphthylene	0.05	mg/kg	0.044	0.640	12.68	8.64	12.72	1.60	0.54	0.40	1.48	1.97	1.13	7.47	2.09	2.24	3.84	0.10	2.23	1.06
Anthracene	0.05	mg/kg	0.085	1.100	3.13	2.66	5.32	0.57	0.19	0.14	0.41	0.47	0.77	11.42	0.58	0.70	1.35	0.04	0.58	0.32
Benzo(a)anthracene	0.05	mg/kg	0.261	1.600	19.89	14.80	24.80	1.72	0.39	0.39	0.76	0.93	0.82	8.35	0.87	0.99	1.56	0.19	1.24	0.60
Benzo(a)pyrene	0.05	mg/kg	0.430	1.600	15.45	10.10	13.96	3.05	0.87	0.86	2.18	2.62	1.93	6.35	4.01	3.67	6.19	0.31	2.75	1.65
Benzo(b)fluoranthene	0.05	mg/kg	--	--	9.55	8.20	10.46	2.50	0.66	0.64	1.66	2.15	1.66	4.09	3.42	3.59	6.48	0.17	2.39	1.41
Benzo(g,h,i)perylene	0.05	mg/kg	--	--	6.08	3.50	4.96	1.57	0.47	0.48	1.20	1.19	0.82	2.21	1.81	1.64	2.00	0.11	1.23	0.82
Benzo(k)fluoranthene	0.05	mg/kg	--	--	13.53	7.92	12.92	2.25	0.76	0.77	1.82	1.54	1.57	5.16	2.83	2.42	2.80	0.23	2.51	1.34
Chrysene	0.05	mg/kg	0.384	2.800	18.74	13.80	22.60	1.83	0.45	0.41	0.83	1.09	0.95	7.98	1.23	1.32	2.93	0.20	1.36	0.65
Dibenzo(a,h)anthracene	0.05	mg/kg	0.063	0.260	2.21	1.24	2.02	0.55	0.16	0.16	0.38	0.37	0.25	0.68	0.58	0.51	0.95	0.04	0.41	0.28
Fluoranthene	0.05	mg/kg	0.600	5.100	43.68	32.40	48.60	2.32	0.56	0.54	0.92	1.69	1.38	14.81	1.13	1.35	1.45	0.14	1.66	0.71
Fluorene	0.05	mg/kg	0.019	0.540	0.28	0.19	0.36	<0.05	<0.05	<0.05	0.06	0.06	0.17	5.81	0.07	0.12	0.11	<0.05	0.08	0.05
Indeno(1,2,3,cd)pyrene	0.05	mg/kg	--	--	5.89	3.54	4.96	1.47	0.43	0.45	1.13	1.15	0.80	2.08	1.83	1.04	2.35	0.11	1.22	0.79
Naphthalene	0.05	mg/kg	0.160	2.100	2.07	1.96	2.60	0.23	0.09	0.04	0.31	0.31	1.20	0.85	0.41	0.94	0.67	<0.05	0.36	0.28
Phenanthrene	0.05	mg/kg	0.240	1.500	2.03	1.57	9.34	0.47	0.16	0.11	0.34	0.34	0.31	24.42	0.33	0.52	0.43	0.04	0.45	0.27
Pyrene	0.05	mg/kg	0.665	2.600	58.42	39.40	57.00	3.55	0.94	0.74	2.04	3.61	3.20	21.42	4.29	4.81	13.35	0.28	3.06	1.44
Low Molecular Weight PAHs			0.552	3.160	21.3	16.0	31.8	2.950	1.0	0.7	2.7	3.3	3.8	55.4	3.6	4.7	6.5	0.2	3.8	2.0
High Molecular Weight PAHs			1.700	9.600	158.4	111.7	169.0	13.017	3.4	3.1	7.1	10.3	8.5	59.8	12.1	12.7	26.4	1.1	10.5	5.3
Total PAHs			4.000	45.000	214.7	150.9	234.1	23.760	6.7	6.1	15.6	19.6	17.2	128.7	25.6	26.6	46.6	1.9	21.7	11.7

Denotes the concentration exceeds the ANZECC/ARMCANZ (2000) ISQG Low Value.
Denotes the concentration exceeds the ANZECC/ARMCANZ (2000) ISQG High Value.
25* Sediment Quality Value is derived from Chronic marine EqP threshold, at 1% TOC (Bolton et al., 1985, cited in MacDonald et al., 1999) ANZECC ISQG Value not available.

Table 4 Sediment Analytical Results
ERA- Sediment sampling
AGL Mortlake January/February 2006

Sample Location	ESD05	ESD05	ESD06	ESD06	ESD06	ESD07	ESD07	ESD07	ESD08	ESD08	ESD08	ESD08	ESD09	ESD09	ESD09	ESD10
Depth	0.30-0.40	0.40-0.50	0.00-0.02	0.02-0.10	6_0.3-0.4	0.00-0.02	0.02-0.10	0.15-0.25	0.00-0.02	0.02-0.10	0.20-0.30	0.30-0.35	0.00-0.02	0.02-0.10	0.30-0.50	0.00-0.02
Sample ID	ESD05_0.30-0.40	ESD05_0.40-0.50	ESD06_0.00-0.02	ESD06_0.02-0.10	ESD06_0.3-0.4	ESD07_0.00-0.02	ESD07_0.02-0.10	ESD07_0.15-0.25	ESD08_0.00-0.02	ESD08_0.02-0.10	ESD08_0.20-0.30	ESD08_0.30-0.35	ESD09_0.00-0.02	ESD09_0.02-0.10	ESD09_0.30-0.50	ESD10_0.00-0.02
Date Sampled	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006

Analyte	LOR	Units	ANZECC/ARMCANZ (2000) ISQG Low	ANZECC/ARMCANZ (2000) ISQG High															
Total Petroleum Hydrocarbons																			
C6-C9 Fraction	2	mg/kg	--	--	<2	<2	<2	<2	<2	<2	5	<2	<2	<2	4	<2	<2	7	210	<2
C10-C14 Fraction	50	mg/kg	--	--	<50	<50	<50	<50	<50	60	<50	60	<50	<50	<50	<50	570	1180	8640	<50
C15-C28 Fraction	100	mg/kg	--	--	640	280	<100	370	520	850	700	1150	<100	100	320	960	7920	13400	33400	<100
C29-C36 Fraction	100	mg/kg	--	--	440	260	230	350	500	710	630	880	250	240	370	650	5300	7480	9170	140
C10 - C36 Fraction			--	--	1080	520	230	720	1020	1620	1330	2090	250	340	690	1610	13790	22060	51210	140
BTEX Compounds																				
Benzene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**14.2**	<0.2
Toluene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**22.8**	<0.2
Ethylbenzene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**0.2**	**0.3**	**35.7**	<0.2
m&p-Xylene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**0.2**	<0.2	<0.2	<0.2	<0.2	<0.2	**0.3**	**0.3**	**47.6**	<0.2
o-Xylene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**33.6**	<0.2
Total Xylenes	-	mg/kg	--	--	-	-	-	-	-	-	**0.2**	-	-	-	-	-	**0.3**	**0.3**	**81.2**	-
Polynuclear Aromatic Hydrocarbons																				
Acenaphthene	0.5	mg/kg	--	--	0.15	0.06	0.14	0.12	0.24	0.36	0.22	0.57	<0.08	0.09	<0.05	0.16	6.65	5.59	100	0.08
Acenaphthylene	0.5	mg/kg	--	--	4.15	1.36	2.56	2.28	6.12	4.25	2.88	9.16	1.42	1.57	0.88	5.29	72.2	57.3	533	0.92
Anthracene	0.5	mg/kg	--	--	1.17	0.56	0.92	0.92	2.19	1.4	0.88	2.33	0.47	0.57	0.32	2.04	20.7	18.2	424	0.36
Benzo(a)anthracene	0.5	mg/kg	--	--	2.22	1.27	1.62	1.83	3.51	1.63	1.32	2.56	0.79	1.2	0.58	4.97	35.8	43.6	250	0.64
Benzo(a)pyrene	0.5	mg/kg	--	--	7.12	3.28	3.69	3.26	9.49	5.21	4.2	14	2.43	3.42	1.8	13	80.6	64.5	163	1.16
Benzo(b)fluoranthene	0.5	mg/kg	--	--	6.56	2.35	2.24	2.44	7.59	3.55	2.7	11.2	1.82	2.52	1.4	12.3	53.8	40	112	0.83
Benzo(g,h,i)perylene	0.5	mg/kg	--	--	3.03	1.57	1.63	1.41	3.76	2.23	1.75	5.42	1.21	1.9	0.92	4.92	29	20.2	47.4	0.52
Benzo(k)fluoranthene	0.5	mg/kg	--	--	6.52	2.74	2.89	2.53	8.28	4.66	3.28	12.4	1.65	2.69	1.59	12.7	60.3	47.8	125	0.95
Chrysene	0.5	mg/kg	--	--	2.56	1.42	1.69	1.86	3.45	1.81	1.54	3.46	0.89	1.22	0.59	6.06	40.8	45.9	238	0.7
Dibenzo(a,h)anthracene	0.5	mg/kg	--	--	0.9	0.52	0.55	0.5	1.38	0.8	0.59	1.79	0.31	0.54	0.24	1.3	10	6.21	17.4	0.14
Fluoranthene	0.5	mg/kg	--	--	2.53	1.59	2.1	2.22	4.06	2.33	1.97	6.42	1.2	1.74	0.88	2.76	79.5	99.9	595	1.04
Fluorene	0.5	mg/kg	--	--	0.16	0.09	0.12	0.12	0.18	0.48	0.19	0.59	<0.08	0.1	<0.05	0.43	4.84	2.65	375	0.1
Indeno(1,2,3,cd)pyrene	0.5	mg/kg	--	--	3.03	1.58	1.55	1.33	3.78	2.13	1.67	5.38	1.13	1.56	0.83	4.9	26.6	20.1	47.8	0.47
Naphthalene	0.5	mg/kg	--	--	0.68	0.24	0.66	0.69	0.8	2.26	1.19	6.11	0.36	0.55	0.22	1.54	28.6	16.1	1490	0.51
Phenanthrene	0.5	mg/kg	--	--	0.85	0.54	0.71	0.65	0.94	1.78	0.8	1.75	0.47	0.67	0.35	1.11	16.6	10.3	1140	0.5
Pyrene	0.5	mg/kg	--	--	7.78	3.9	3.92	4.16	8.82	5.86	4.66	20.8	1.88	2.95	1.35	38.1	116	130	662	1.51
Total PAHs		mg/kg	--	--	49	23	27	26	65	41	30	104	16	23	12	112	682	626	6320	10
Major Ions																				
Free Cyanide	1	mg/kg	--	--	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cyanide	1	mg/kg	--	--	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2	<1.0	2.1	<1.0
Total Organic Carbon	0.5	%	--	--	3.1	1.8	3.1	2.9	3.0	2.4	3.0	1.9	2.5	2.6	2.8	3.2	3.8	4.2	5.0	3.0
Total Cyanide - normalised to 1	0.5	mg/kg	25*	--	-	-	-	-	-	-	-	-	-	-	-	-	0.53	-	0.42	-
Polynuclear Aromatic Hydrocarbons - Normalised to 1%TOC																				
Acenaphthene	0.05	mg/kg	0.016	0.500	0.05	0.03	0.05	0.04	0.08	0.15	0.07	0.30	<0.05	0.03	<0.05	0.05	1.75	1.33	20.00	0.03
Acenaphthylene	0.05	mg/kg	0.044	0.640	1.34	0.76	0.83	0.79	2.04	1.77	0.96	4.82	0.57	0.60	0.31	1.65	19.00	13.64	106.60	0.31
Anthracene	0.05	mg/kg	0.085	1.100	0.38	0.31	0.30	0.32	0.73	0.58	0.29	1.23	0.19	0.22	0.11	0.64	5.45	3.86	84.80	0.12
Benzo(a)anthracene	0.05	mg/kg	0.261	1.600	0.72	0.71	0.52	0.63	1.17	0.68	0.44	1.35	0.32	0.46	0.21	1.55	9.42	10.38	50.00	0.21
Benzo(a)pyrene	0.05	mg/kg	0.430	1.600	2.30	1.82	1.19	1.12	3.16	2.17	1.40	7.37	0.97	1.32	0.64	4.06	21.21	15.36	32.60	0.39
Benzo(b)fluoranthene	0.05	mg/kg	--	--	2.12	1.31	0.72	0.84	2.53	1.48	0.90	5.89	0.73	0.97	0.50	3.84	14.16	9.52	22.40	0.28
Benzo(g,h,i)perylene	0.05	mg/kg	--	--	0.98	0.87	0.53	0.49	1.25	0.93	0.68	2.85	0.48	0.73	0.33	1.54	7.63	4.81	9.48	0.17
Benzo(k)fluoranthene	0.05	mg/kg	--	--	2.10	1.52	0.93	0.87	2.76	1.94	1.09	6.53	0.74	1.03	0.57	3.97	15.87	11.38	25.00	0.32
Chrysene	0.05	mg/kg	0.384	2.800	0.83	0.79	0.55	0.64	1.15	0.75	0.51	1.82	0.36	0.47	0.21	1.89	10.74	10.93	47.60	0.23
Dibenzo(a,h)anthracene	0.05	mg/kg	0.063	0.260	0.29	0.29	0.18	0.17	0.46	0.33	0.20	0.94	0.12	0.21	0.09	0.41	2.63	1.48	3.48	0.05
Fluoranthene	0.05	mg/kg	0.600	5.100	0.82	0.88	0.68	0.77	1.35	0.97	0.66	3.38	0.48	0.67	0.31	0.88	20.92	23.79	119.00	0.35
Fluorene	0.05	mg/kg	0.019	0.540	0.05	0.05	0.04	0.04	0.06	0.20	0.06	0.31	<0.05	0.04	<0.05	0.13	1.27	0.63	75.00	0.03
Indeno(1,2,3,cd)pyrene	0.05	mg/kg	--	--	0.98	0.88	0.50	0.46	1.26	0.89	0.56	2.83	0.45	0.60	0.30	1.53	7.00	4.79	9.56	0.16
Naphthalene	0.05	mg/kg	0.160	2.100	0.22	0.13	0.21	0.24	0.27	0.94	0.40	3.22	0.14	0.21	0.08	0.48	7.53	3.83	298.00	0.17
Phenanthrene	0.05	mg/kg	0.240	1.500	0.27	0.30	0.23	0.22	0.31	0.74	0.27	0.92	0.19	0.26	0.13	0.35	4.37	2.45	228.00	0.17
Pyrene	0.05	mg/kg	0.665	2.600	2.51	2.17	1.26	1.43	2.94	2.44	1.55	10.95	0.79	1.13	0.48	11.91	30.53	30.95	132.40	0.50
Low Molecular Weight PAHs			0.552	3.160	2.3	1.6	1.6	1.6	3.5	4.4	2.1	10.8	1.1	1.4	0.6	3.3	39.4	25.7	812.4	0.8
High Molecular Weight PAHs			1.700	9.600	7.6	6.7	4.4	4.8	10.2	7.4	4.8	25.8	3.0	4.3	1.9	20.7	95.4	92.9	385.1	1.7
Total PAHs			4.000	45.000	15.9	12.8	8.7	9.1	21.6	17.0	9.9	54.7	6.5	9.0	4.3	34.9	179.5	149.1	1263.9	3.5

Denotes the concentration exceeds the ANZECC/ARM
Denotes the concentration exceeds the ANZECC/ARM
25* Sediment Quality Value is derived from Chronic marine

Table 4 Sediment Analytical Results
ERA- Sediment sampling
AGL Mortlake January/February 2006

Sample Location	ESD10	ESD10	ESD10	ESD11	ESD11	ESD11	ESD11	ESD12	ESD12	ESD12	ESD12	ESD13	ESD13	ESD13	ESD14	ESD14
Depth	0.02-0.10	0.20-0.30	0.40-0.50	0.00-0.02	0.02-0.10	1_0.2-0.4	1_0.4-0.5	0.00-0.02	0.02-0.10	0.20-0.40	0.50-0.60	0.00-0.02	0.02-0.10	0.30-0.40	0.00-0.02	0.02-0.10
Sample ID	ESD10_0.02-0.10	ESD10_0.20-0.30	ESD10_0.40-0.50	ESD11_0.00-0.02	ESD11_0.02-0.10	ESD11_0.2-0.4	ESD11_0.4-0.5	ESD12_0.00-0.02	ESD12_0.02-0.10	ESD12_0.20-0.40	ESD12_0.50-0.60	ESD13_0.00-0.02	ESD13_0.02-0.10	ESD13_0.30-0.40	ESD14_0.00-0.02	ESD14_0.02-0.10
Date Sampled	1/02/2006	1/02/2006	1/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	14/02/2006	14/02/2006

Analyte	LOR	Units	ANZECC/ARMCANZ (2000) ISQG Low	ISQG High															
Total Petroleum Hydrocarbons																			
C6-C9 Fraction	2	mg/kg	–	–	<2	<2	<2	<2	<2	<2	<2	<2	<2	13	<2	<2	<2	<2	<2
C10-C14 Fraction	50	mg/kg	–	–	<50	<50	<50	<50	<50	<50	<50	440	1270	390	<50	<50	<50	<50	<50
C15-C28 Fraction	100	mg/kg	–	–	<100	140	690	<100	<100	<100	<100	5630	15300	3480	<100	280	550	1260	<100
C29-C36 Fraction	100	mg/kg	–	–	<100	290	430	<100	<100	220	260	3280	7230	1480	<100	470	620	850	220
C10 - C36 Fraction			–	–	–	430	1120	–	–	220	260	9350	23800	5350	–	750	1170	2110	220
BTEX Compounds																			
Benzene	0.2	mg/kg	–	–	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.2	mg/kg	–	–	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	0.2	mg/kg	–	–	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.1	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
m&p-Xylene	0.2	mg/kg	–	–	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.6	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-Xylene	0.2	mg/kg	–	–	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.4	0.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Xylenes	-	mg/kg	–	–	-	-	-	-	-	-	-	1	1.5	-	-	-	-	-	-
Polynuclear Aromatic Hydrocarbons																			
Acenaphthene	0.5	mg/kg	–	–	<0.08	<0.08	0.43	<0.05	<0.05	0.08	<0.05	4.6	38.2	2.53	0.44	0.2	0.14	0.16	0.1
Acenaphthylene	0.5	mg/kg	–	–	1	0.64	7.95	0.64	0.62	0.92	0.38	32.1	144	15.1	0.49	2.65	2.29	3.75	1.19
Anthracene	0.5	mg/kg	–	–	0.39	0.26	4.34	0.28	0.3	0.52	0.22	13.7	82.1	7.85	0.52	0.96	0.82	1.42	0.49
Benzo(a)anthracene	0.5	mg/kg	–	–	0.74	0.44	13.4	0.65	0.61	1.38	0.44	22	78	22.1	0.15	1.36	1.25	2.34	1.12
Benzo(a)pyrene	0.5	mg/kg	–	–	1.48	0.95	13.6	1.3	1.22	2.08	0.91	38.6	72.5	23.3	<0.05	5.1	4.1	8.98	2.6
Benzo(b)fluoranthene	0.5	mg/kg	–	–	1.09	0.65	9.62	1.13	1.37	1.89	0.94	31.6	58.1	15.2	<0.05	2.97	2.89	5.76	2.94
Benzo(g,h,i)perylene	0.5	mg/kg	–	–	0.69	0.47	5.21	0.98	0.9	1.31	0.71	14.7	25	6.9	<0.05	2.71	2.13	3.59	1.69
Benzo(k)fluoranthene	0.5	mg/kg	–	–	1.15	0.68	10.5	0.74	0.42	1.05	0.48	13.6	55.2	15.9	<0.05	3.65	3.31	7.4	0.76
Chrysene	0.5	mg/kg	–	–	0.82	0.5	12.1	0.65	0.53	1.13	0.36	21	69.2	20.5	0.15	1.45	1.32	3.1	0.91
Dibenzo(a,h)anthracene	0.5	mg/kg	–	–	0.18	0.13	1.36	0.2	0.22	0.33	0.16	4.8	9.04	2.09	<0.05	0.75	0.51	1.09	0.37
Fluoranthene	0.5	mg/kg	–	–	1.25	0.78	28.3	1.1	1.08	1.85	0.64	67.4	240	42.8	0.4	2.29	1.87	7.42	1.74
Fluorene	0.5	mg/kg	–	–	<0.08	<0.08	1.18	0.11	0.1	0.15	<0.05	6.42	61.7	2.85	0.67	0.24	0.19	0.25	0.17
Indeno(1,2,3,cd)pyrene	0.5	mg/kg	–	–	0.62	0.41	5.18	0.74	0.74	1.1	0.56	15.1	23.7	6.33	<0.05	2.22	1.73	3.42	1.43
Naphthalene	0.5	mg/kg	–	–	0.36	0.22	4.92	0.24	0.23	0.22	0.12	17.4	60.7	21.1	0.99	1.74	1.29	1.37	0.5
Phenanthrene	0.5	mg/kg	–	–	0.5	0.32	2.66	0.45	0.43	0.48	0.33	23	209	10.2	1.57	1.12	0.87	0.93	0.66
Pyrene	0.5	mg/kg	–	–	1.84	1.07	44.2	1.47	1.44	2.39	0.88	69.9	216	68.4	0.66	4.33	3.77	16.9	2.47
Total PAHs		mg/kg	–	–	12	8	165	11	10	17	7	396	1442	283	6	34	28	68	19
Major Ions																			
Free Cyanide	1	mg/kg	–	–	<1.0	<1.0	<1.0	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
Total Cyanide	1	mg/kg	–	–	<1.0	<1.0	<1.0	<1	<1	<1	<1	<1.0	<1.0	<1.0	1.7	<1.0	<1.0	<1.0	<1
Total Organic Carbon	0.5	%	–	–	2.8	2.6	2.8	3.1	3.0	3.1	3.1	2.1	5.1	2.1	3.5	2.8	3.1	1.8	2.9
Total Cyanide - normalised to 1	0.5	mg/kg	25*	–	-	-	-	-	-	-	-	-	-	-	0.49	-	-	-	-
Polynuclear Aromatic Hydrocarbons - Normalised to 1%TOC																			
Acenaphthene	0.05	mg/kg	0.016	0.500	<0.08	<0.08	0.15	<0.05	<0.05	0.03	<0.05	2.19	7.49	1.20	0.13	0.07	0.05	0.09	0.03
Acenaphthylene	0.05	mg/kg	0.044	0.640	0.36	0.25	2.84	0.21	0.21	0.30	0.12	15.29	28.24	7.19	0.14	1.02	0.74	2.08	0.41
Anthracene	0.05	mg/kg	0.085	1.100	0.14	0.10	1.55	0.09	0.10	0.17	0.07	6.52	16.10	3.74	0.15	0.34	0.26	0.79	0.17
Benzo(a)anthracene	0.05	mg/kg	0.261	1.600	0.26	0.17	4.79	0.21	0.20	0.45	0.14	10.48	15.29	10.52	0.04	0.49	0.40	1.30	0.39
Benzo(a)pyrene	0.05	mg/kg	0.430	1.600	0.53	0.37	4.86	0.42	0.41	0.67	0.29	18.38	14.22	11.10	<0.05	1.82	1.32	4.99	0.90
Benzo(b)fluoranthene	0.05	mg/kg	–	–	0.39	0.25	3.44	0.36	0.46	0.61	0.30	15.05	11.39	7.24	<0.05	1.06	0.93	3.20	1.01
Benzo(g,h,i)perylene	0.05	mg/kg	–	–	0.25	0.18	1.86	0.32	0.30	0.42	0.23	7.00	4.90	3.29	<0.05	0.97	0.69	1.99	0.58
Benzo(k)fluoranthene	0.05	mg/kg	–	–	0.41	0.26	3.75	0.24	0.14	0.34	0.15	6.48	10.82	7.57	<0.05	1.30	1.07	4.11	0.26
Chrysene	0.05	mg/kg	0.384	2.800	0.29	0.19	4.32	0.21	0.18	0.36	0.12	10.00	13.57	9.76	0.04	0.52	0.43	1.72	0.31
Dibenzo(a,h)anthracene	0.05	mg/kg	0.063	0.260	0.06	0.05	0.49	0.06	0.07	0.11	0.05	2.19	1.77	1.00	<0.05	0.27	0.16	0.61	0.13
Fluoranthene	0.05	mg/kg	0.600	5.100	0.45	0.30	10.11	0.35	0.36	0.60	0.21	32.10	47.06	20.29	0.11	0.82	0.60	4.12	0.60
Fluorene	0.05	mg/kg	0.019	0.540	<0.08	<0.08	0.42	0.04	0.03	0.05	<0.05	3.06	12.10	1.36	0.19	0.09	0.06	0.14	0.06
Indeno(1,2,3,cd)pyrene	0.05	mg/kg	–	–	0.22	0.16	1.85	0.24	0.25	0.35	0.18	7.19	4.65	3.01	<0.05	0.79	0.56	1.80	0.49
Naphthalene	0.05	mg/kg	0.160	2.100	0.13	0.08	1.76	0.08	0.08	0.07	0.04	8.29	11.90	10.05	0.28	0.62	0.42	0.76	0.17
Phenanthrene	0.05	mg/kg	0.240	1.500	0.18	0.12	0.95	0.15	0.14	0.15	0.11	10.95	40.98	4.86	0.45	0.40	0.28	0.52	0.23
Pyrene	0.05	mg/kg	0.665	2.600	0.66	0.41	15.79	0.47	0.48	0.77	0.28	33.29	42.35	32.57	0.19	1.55	1.22	9.39	0.85
Low Molecular Weight PAHs			0.552	3.160	0.8	0.6	7.7	0.6	0.6	0.8	0.3	46.3	116.8	28.4	1.3	2.5	1.8	4.4	1.1
High Molecular Weight PAHs			1.700	9.600	2.3	1.5	40.3	1.7	1.7	3.0	1.1	106.4	134.3	85.2	0.4	5.5	4.1	22.1	3.2
Total PAHs			4.000	45.000	4.3	2.9	58.9	3.4	3.4	5.4	2.3	188.4	282.8	134.7	1.7	12.1	9.2	37.7	6.6

Denotes the concentration exceeds the ANZECC/ARM
Denotes the concentration exceeds the ANZECC/ARM
25* Sediment Quality Value is derived from Chronic marine

Table 4 Sediment Analytical Results
ERA- Sediment sampling
AGL Mortlake January/February 2006

Sample Location	ESD14	ESD15	ESD15	ESD15	ESD16	ESD16	ESD16	ESD17	ESD17	ESD18	ESD18	ESD18	ESD19	ESD19	ESD20	ESD20
Depth	_0.3-0.50	0.00-0.02	0.02-0.10	5_0.2-0.3	0.00-0.02	0.02-0.10	0.25-0.45	0.00-0.02	0.02-0.10	0.00-0.02	0.02-0.10	0.25-0.40	0.00-0.02	0.02-0.06	0.00-0.02	0.02-0.10
Sample ID	ESD14_0.3-0.50	ESD15_0.00-0.02	ESD15_0.02-0.10	ESD15_0.2-0.3	ESD16_0.00-0.02	ESD16_0.02-0.10	ESD16_0.25-0.45	ESD17_0.00-0.02	ESD17_0.02-0.10	ESD18_0.00-0.02	ESD18_0.02-0.10	ESD18_0.25-0.40	ESD19_0.00-0.02	ESD19_0.02-0.06	ESD20_0.00-0.02	ESD20_0.02-0.10
Date Sampled	14/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006	14/02/2006

Analyte	LOR	Units	ANZECC/ARMCANZ (2000) ISQG Low	ANZECC/ARMCANZ (2000) ISQG High															
Total Petroleum Hydrocarbons																			
C6-C9 Fraction	2	mg/kg	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
C10-C14 Fraction	50	mg/kg	--	--	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	50
C15-C28 Fraction	100	mg/kg	--	--	<100	<100	120	<100	<100	250	<100	<100	130	<100	<100	110	190	240	260
C29-C36 Fraction	100	mg/kg	--	--	180	370	260	<100	<100	370	240	370	170	<100	<100	100	120	220	170	250
C10 - C36 Fraction			--	--	180	370	380	--	--	620	240	370	300	--	--	210	310	460	410	560
BTEX Compounds																			
Benzene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
m&p-Xylene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-Xylene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Xylenes	-	mg/kg	--	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polynuclear Aromatic Hydrocarbons																			
Acenaphthene	0.5	mg/kg	--	--	<0.05	0.12	0.09	0.2	0.16	0.17	0.11	0.3	0.21	0.06	0.08	<0.05	0.08	0.14	0.05	<0.05
Acenaphthylene	0.5	mg/kg	--	--	0.49	1.58	1.33	1.87	2.28	2.47	1.98	3.3	2.04	0.82	0.98	0.22	0.83	1.86	0.58	0.56
Anthracene	0.5	mg/kg	--	--	0.19	0.63	0.49	0.85	0.9	0.95	0.74	1.36	1.07	0.29	0.35	0.05	0.34	0.46	0.34	0.29
Benzo(a)anthracene	0.5	mg/kg	--	--	0.53	1.35	1.08	1.48	2.35	2.45	2.15	3.41	2.43	0.69	1.04	0.24	1.05	1.47	0.8	0.67
Benzo(a)pyrene	0.5	mg/kg	--	--	1.08	2.53	2.2	3.45	4.23	5.07	4.32	5.72	3.82	1.29	1.59	0.49	1.42	2.67	1.27	1.18
Benzo(b)fluoranthene	0.5	mg/kg	--	--	1.24	3.48	3.06	3.96	4.2	5.94	5.17	7.24	4.41	1.57	1.68	0.6	1.89	3.04	1.7	1.58
Benzo(g,h,i)perylene	0.5	mg/kg	--	--	0.71	1.62	1.43	1.91	2.17	2.22	1.9	1.99	1.44	0.65	0.74	0.33	0.71	1.14	0.74	0.69
Benzo(k)fluoranthene	0.5	mg/kg	--	--	0.44	1.26	0.98	2.25	2.74	2.55	1.59	1.44	1.31	0.4	0.59	0.3	0.49	1.16	0.41	0.33
Chrysene	0.5	mg/kg	--	--	0.54	1.14	0.9	1.16	1.6	1.91	1.57	2.9	1.98	0.57	0.87	0.19	0.88	1.26	0.73	0.63
Dibenzo(a,h)anthracene	0.5	mg/kg	--	--	0.15	0.46	0.41	0.5	0.55	0.7	0.61	0.58	0.4	0.19	0.19	0.07	0.19	0.29	0.19	0.15
Fluoranthene	0.5	mg/kg	--	--	0.84	2.04	1.66	2.45	2.67	3.06	2.46	6.85	3.91	1	1.5	0.29	1.46	2.59	1.29	1.1
Fluorene	0.5	mg/kg	--	--	0.06	0.21	0.17	0.31	0.32	0.34	0.23	0.5	0.39	0.1	0.12	<0.05	0.06	0.2	0.06	0.08
Indeno(1,2,3,cd)pyrene	0.5	mg/kg	--	--	0.57	1.44	1.22	1.73	1.98	2.08	1.8	1.92	1.39	0.59	0.68	0.26	0.63	1.05	0.66	0.61
Naphthalene	0.5	mg/kg	--	--	0.06	0.77	0.48	0.82	0.81	0.84	0.37	1.77	1.5	0.33	0.29	<0.05	0.27	0.3	0.24	0.25
Phenanthrene	0.5	mg/kg	--	--	0.3	0.82	0.63	1.36	0.94	1.03	0.76	1.78	1.4	0.42	0.48	0.07	0.45	0.7	0.52	0.48
Pyrene	0.5	mg/kg	--	--	1	3.07	2.48	3.46	4.74	5.24	3.73	10.9	6.73	1.5	2.32	0.39	2.24	3.82	1.63	1.43
Total PAHs		mg/kg	--	--	8	23	19	28	33	37	29	52	34	10	14	4	13	22	11	10
Major Ions																			
Free Cyanide	1	mg/kg	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Cyanide	1	mg/kg	--	--	<1	<1	<1	<1	<1	<1	<1	<1	1.2	<1	<1	<1	1.1	<1	<1	<1
Total Organic Carbon	0.5	%	--	--	2.6	3.0	3.1	2.9	3.2	2.9	2.2	1.6	1.8	1.7	1.4	1.2	2.2	2.1	3.1	3.5
Total Cyanide - normalised to 1	0.5	mg/kg	25*	--	-	-	-	-	-	-	-	-	0.67	-	-	-	0.50	-	-	-
Polynuclear Aromatic Hydrocarbons - Normalised to 1%TOC																			
Acenaphthene	0.05	mg/kg	0.016	0.500	<0.05	0.04	0.03	0.07	0.05	0.06	0.05	0.19	0.12	0.04	0.06	<0.05	0.04	0.07	0.02	<0.05
Acenaphthylene	0.05	mg/kg	0.044	0.640	0.19	0.53	0.43	0.64	0.71	0.85	0.90	2.06	1.13	0.48	0.70	0.18	0.38	0.89	0.19	0.16
Anthracene	0.05	mg/kg	0.085	1.100	0.07	0.21	0.16	0.29	0.28	0.33	0.34	0.85	0.59	0.17	0.25	0.04	0.15	0.22	0.11	0.08
Benzo(a)anthracene	0.05	mg/kg	0.261	1.600	0.20	0.45	0.35	0.50	0.73	0.84	0.98	2.13	1.35	0.41	0.74	0.20	0.48	0.70	0.26	0.19
Benzo(a)pyrene	0.05	mg/kg	0.430	1.600	0.42	0.84	0.71	1.19	1.32	1.75	1.96	3.58	2.12	0.76	1.14	0.41	0.65	1.27	0.41	0.34
Benzo(b)fluoranthene	0.05	mg/kg	--	--	0.48	1.16	0.99	1.37	1.31	2.05	2.35	4.53	2.45	0.92	1.20	0.50	0.86	1.45	0.55	0.45
Benzo(g,h,i)perylene	0.05	mg/kg	--	--	0.27	0.54	0.45	0.66	0.68	0.77	0.86	1.24	0.80	0.38	0.53	0.28	0.32	0.54	0.24	0.20
Benzo(k)fluoranthene	0.05	mg/kg	--	--	0.17	0.42	0.32	0.78	0.86	0.88	0.72	0.90	0.73	0.24	0.42	0.25	0.22	0.55	0.13	0.09
Chrysene	0.05	mg/kg	0.384	2.800	0.21	0.38	0.29	0.40	0.50	0.66	0.71	1.81	1.19	0.34	0.62	0.16	0.40	0.60	0.24	0.18
Dibenzo(a,h)anthracene	0.05	mg/kg	0.063	0.260	0.08	0.15	0.13	0.17	0.17	0.24	0.28	0.36	0.22	0.11	0.14	0.06	0.09	0.14	0.06	0.04
Fluoranthene	0.05	mg/kg	0.600	5.100	0.32	0.68	0.54	0.84	0.90	1.06	1.12	4.28	2.17	0.59	1.07	0.24	0.68	1.23	0.42	0.31
Fluorene	0.05	mg/kg	0.019	0.540	0.02	0.07	0.05	0.11	0.10	0.12	0.10	0.31	0.22	0.06	0.09	<0.05	0.04	0.10	0.02	0.02
Indeno(1,2,3,cd)pyrene	0.05	mg/kg	--	--	0.22	0.48	0.39	0.60	0.62	0.72	0.82	1.20	0.77	0.35	0.49	0.22	0.29	0.50	0.21	0.17
Naphthalene	0.05	mg/kg	0.160	2.100	0.02	0.26	0.15	0.28	0.25	0.29	0.17	1.11	0.83	0.19	0.21	<0.05	0.12	0.14	0.08	0.07
Phenanthrene	0.05	mg/kg	0.240	1.500	0.12	0.27	0.20	0.47	0.29	0.36	0.35	1.11	0.78	0.25	0.34	0.06	0.20	0.33	0.17	0.14
Pyrene	0.05	mg/kg	0.665	2.600	0.38	1.02	0.80	1.19	1.48	1.81	1.70	6.81	3.74	0.88	1.66	0.33	1.02	1.82	0.53	0.41
Low Molecular Weight PAHs			0.552	3.160	0.4	1.4	1.0	1.9	1.7	2.0	1.9	5.6	3.7	1.2	1.6	0.3	0.9	1.7	0.6	0.5
High Molecular Weight PAHs			1.700	9.600	1.6	3.5	2.8	4.3	5.1	6.4	6.7	19.0	10.7	3.1	5.4	1.4	3.3	5.8	1.9	1.5
Total PAHs			4.000	45.000	3.2	7.5	6.0	9.6	10.3	12.8	13.4	32.5	19.1	6.2	9.6	2.9	5.9	10.5	3.6	2.9

Denotes the concentration exceeds the ANZECC/ARM
Denotes the concentration exceeds the ANZECC/ARM
25* Sediment Quality Value is derived from Chronic marine

Table 4 Sediment Analytical Results
ERA- Sediment sampling
AGL Mortlake January/February 2006

Sample Location	ESD21	ESD21	ESD22	ESD22	ESD23	ESD23	ESD24	ESD24	ESD26	ESD26	ESD26	ESD27	ESD27	ESD28	ESD28	ESD29
Depth	0.00-0.02	0.02-0.10	0.00-0.02	0.02-0.10	0.00-0.02	0.02-0.10	0.00-0.02	0.02-0.10	0.00-0.02	0.02-0.10	0.35-0.50	0.00-0.02	0.02-0.10	0.00-0.02	0.02-0.10	0.00-0.02
Sample ID	ESD21_0.00-0.02	ESD21_0.02-0.10	ESD22_0.00-0.02	ESD22_0.02-0.10	ESD23_0.00-0.02	ESD23_0.02-0.10	ESD24_0.00-0.02	ESD24_0.02-0.10	ESD26_0.00-0.02	ESD26_0.02-0.10	ESD26_0.35-0.50	ESD27_0.00-0.02	ESD27_0.02-0.10	ESD28_0.00-0.02	ESD28_0.02-0.10	ESD29_0.00-0.02
Date Sampled	14/02/2006	14/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	1/02/2006	1/02/2006	1/02/2006	13/02/2006	13/02/2006	1/02/2006	1/02/2006	1/02/2006

Analyte	LOR	Units	ANZECC/ARMCANZ (2000) ISQG Low	ISQG High															
Total Petroleum Hydrocarbons																			
C6-C9 Fraction	2	mg/kg	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
C10-C14 Fraction	50	mg/kg	--	--	70	80	<50	<50	<50	<50	<50	<50	<50	50	<50	<50	<50	<50	120
C15-C28 Fraction	100	mg/kg	--	--	660	620	230	<100	230	<100	<100	<100	740	<100	1120	<100	<100	<100	2600
C29-C36 Fraction	100	mg/kg	--	--	510	540	160	<100	190	<100	<100	<100	620	<100	850	<100	<100	<100	2240
C10 - C36 Fraction			--	--	1240	1240	390	--	420	--	--	--	1360	--	2020	--	--	--	4960
BTEX Compounds																			
Benzene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
m&p-Xylene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-Xylene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Xylenes	-	mg/kg	--	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polynuclear Aromatic Hydrocarbons																			
Acenaphthene	0.5	mg/kg	--	--	0.21	0.19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.36	0.24	0.52	<0.05	<0.05	<0.08	<0.08	0.54
Acenaphthylene	0.5	mg/kg	--	--	3.98	3.08	0.4	0.32	0.34	0.28	0.24	0.29	3.85	2.16	4.85	0.34	0.33	0.54	0.63	16.8
Anthracene	0.5	mg/kg	--	--	0.91	0.74	0.25	0.17	0.2	0.18	0.12	0.12	2.32	1.71	2.39	0.21	0.21	0.35	0.3	3.24
Benzo(a)anthracene	0.5	mg/kg	--	--	3.2	2.63	0.62	0.39	0.45	0.39	0.27	0.29	5.52	4.31	4.26	0.68	0.9	0.65	0.59	9.54
Benzo(a)pyrene	0.5	mg/kg	--	--	7.01	5.1	0.99	0.73	0.8	0.68	0.51	0.52	7.54	5.37	7.57	0.84	1	1.05	1.09	23
Benzo(b)fluoranthene	0.5	mg/kg	--	--	11.3	6.87	1.68	1.05	1.26	1.13	0.85	0.89	6.16	4.24	6.47	1.11	1.29	0.64	0.71	19.9
Benzo(g,h,i)perylene	0.5	mg/kg	--	--	3.76	2.86	0.82	0.6	0.65	0.55	0.42	0.41	3.33	2.47	3.14	0.34	0.37	0.64	0.66	10
Benzo(k)fluoranthene	0.5	mg/kg	--	--	2.26	2.61	0.6	0.57	0.54	0.45	0.24	0.23	6.3	3.57	6.54	0.52	0.54	0.98	0.98	18.4
Chrysene	0.5	mg/kg	--	--	2.36	1.82	0.6	0.38	0.44	0.4	0.24	0.24	5.81	4.43	4.6	0.52	0.7	0.74	0.67	9.3
Dibenzo(a,h)anthracene	0.5	mg/kg	--	--	1.02	0.62	0.18	0.13	0.12	0.11	0.1	0.08	0.97	0.64	0.84	0.09	0.09	0.2	0.14	2.55
Fluoranthene	0.5	mg/kg	--	--	4.68	4.54	1.14	0.68	0.8	0.73	0.45	0.45	10.8	8.42	8.45	1.3	1.66	1.27	1.1	16.7
Fluorene	0.5	mg/kg	--	--	0.34	0.3	0.07	<0.05	0.05	<0.05	<0.05	<0.05	0.38	0.24	0.58	0.05	0.05	<0.08	<0.08	0.21
Indeno(1,2,3,cd)pyrene	0.5	mg/kg	--	--	3.15	2.34	0.62	0.46	0.5	0.42	0.32	0.32	3.14	2.18	2.94	0.31	0.34	0.46	0.58	9.76
Naphthalene	0.5	mg/kg	--	--	1.14	0.98	0.21	0.16	0.14	0.11	0.11	0.1	1.38	1.09	3.68	0.13	0.11	0.34	0.2	0.85
Phenanthrene	0.5	mg/kg	--	--	0.87	0.87	0.34	0.21	0.25	0.31	0.21	0.14	4.07	4.23	3.74	0.26	0.34	0.52	0.4	2.89
Pyrene	0.5	mg/kg	--	--	9.29	7.74	1.41	0.84	1	0.89	0.6	0.64	15.8	10.8	14.8	1.6	2.06	1.46	1.47	29.1
Total PAHs		mg/kg	--	--	55	43	10	7	8	7	5	5	78	56	75	8	10	10	10	173
Major Ions																			
Free Cyanide	1	mg/kg	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1	<1	<1.0	<1.0	<1.0
Total Cyanide	1	mg/kg	--	--	1.7	2.6	<1	<1	<1	<1	<1	<1	<1.0	2.2	3.5	<1	<1	<1.0	<1.0	1.4
Total Organic Carbon	0.5	%	--	--	2.9	2.5	3.4	3.4	2.6	2.7	3.5	1.7	1.0	3.4	2.8	2.0	1.8	3.2	3.3	2.7
Total Cyanide - normalised to 1	0.5	mg/kg	25*	--	0.59	1.04	-	-	-	-	-	-	-	0.65	1.25	-	-	-	-	0.52
Polynuclear Aromatic Hydrocarbons - Normalised to 1%TOC																			
Acenaphthene	0.05	mg/kg	0.016	0.500	0.07	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.36	0.07	0.19	<0.05	<0.05	<0.08	<0.08	0.20
Acenaphthylene	0.05	mg/kg	0.044	0.640	1.37	1.23	0.12	0.09	0.13	0.10	0.07	0.17	3.85	0.64	1.73	0.17	0.18	0.17	0.19	6.22
Anthracene	0.05	mg/kg	0.085	1.100	0.31	0.30	0.07	0.05	0.08	0.07	0.03	0.07	2.32	0.50	0.85	0.11	0.12	0.11	0.09	1.20
Benzo(a)anthracene	0.05	mg/kg	0.261	1.600	1.10	1.05	0.18	0.11	0.17	0.14	0.08	0.17	5.52	1.27	1.52	0.34	0.50	0.20	0.18	3.53
Benzo(a)pyrene	0.05	mg/kg	0.430	1.600	2.42	2.04	0.29	0.21	0.31	0.25	0.15	0.31	7.54	1.58	2.70	0.42	0.56	0.33	0.33	8.52
Benzo(b)fluoranthene	0.05	mg/kg	--	--	3.90	2.75	0.49	0.31	0.48	0.42	0.24	0.52	6.16	1.25	2.31	0.66	0.72	0.20	0.22	7.37
Benzo(g,h,i)perylene	0.05	mg/kg	--	--	1.30	1.14	0.24	0.18	0.25	0.20	0.12	0.24	3.33	0.73	1.12	0.17	0.21	0.20	0.20	3.70
Benzo(k)fluoranthene	0.05	mg/kg	--	--	0.78	1.04	0.18	0.17	0.21	0.17	0.07	0.14	6.30	1.05	2.34	0.28	0.30	0.31	0.30	6.81
Chrysene	0.05	mg/kg	0.384	2.800	0.81	0.73	0.18	0.11	0.17	0.15	0.07	0.14	5.81	1.30	1.64	0.26	0.39	0.23	0.20	3.44
Dibenzo(a,h)anthracene	0.05	mg/kg	0.063	0.260	0.35	0.25	0.05	0.04	0.05	0.04	0.03	0.05	0.97	0.19	0.30	0.05	0.05	0.06	0.04	0.94
Fluoranthene	0.05	mg/kg	0.600	5.100	1.61	1.62	0.34	0.20	0.31	0.27	0.13	0.26	10.80	2.48	3.02	0.65	0.92	0.40	0.33	6.19
Fluorene	0.05	mg/kg	0.019	0.540	0.12	0.12	0.02	<0.05	0.02	<0.05	<0.05	<0.05	0.38	0.07	0.21	0.03	0.03	<0.08	<0.08	0.08
Indeno(1,2,3,cd)pyrene	0.05	mg/kg	--	--	1.09	0.94	0.18	0.14	0.19	0.16	0.09	0.19	3.14	0.64	1.05	0.16	0.19	0.14	0.18	3.61
Naphthalene	0.05	mg/kg	0.160	2.100	0.39	0.39	0.06	0.05	0.05	0.04	0.03	0.06	1.38	0.32	1.31	0.07	0.06	0.11	0.06	0.31
Phenanthrene	0.05	mg/kg	0.240	1.500	0.30	0.35	0.10	0.06	0.10	0.11	0.06	0.06	4.07	1.24	1.34	0.13	0.19	0.16	0.12	1.07
Pyrene	0.05	mg/kg	0.665	2.600	3.20	3.10	0.41	0.25	0.38	0.33	0.17	0.38	15.80	3.18	5.29	0.80	1.14	0.46	0.45	10.78
Low Molecular Weight PAHs			0.552	3.160	2.6	2.6	0.4	0.3	0.4	0.3	0.2	0.4	12.4	2.8	5.6	0.5	0.6	0.5	0.5	9.1
High Molecular Weight PAHs			1.700	9.600	9.5	9.0	1.5	0.9	1.4	1.2	0.6	1.3	46.4	10.0	14.5	2.5	3.6	1.7	1.5	33.4
Total PAHs			4.000	45.000	19.1	17.3	2.9	2.0	2.9	2.5	1.3	2.8	77.7	16.5	26.9	4.2	5.6	3.1	2.9	64.0

Denotes the concentration exceeds the ANZECC/ARM
Denotes the concentration exceeds the ANZECC/ARM
25* Sediment Quality Value is derived from Chronic marine

Table 4 Sediment Analytical Results
ERA- Sediment sampling
AGL Mortlake January/February 2006

Sample Location	ESD29	ESD29	ESD29	ESD30	ESD30	ESD31	ESD31	ESD31	ESD31	ESD32	ESD32	ESD32	ESD32	ESD33	ESD33	ESD33
Depth	0.02-0.10	0.10-0.20	0.35-0.50	0.00-0.02	0.02-0.10	0.00-0.02	0.02-0.10	0.10-0.25	0.35-0.45	0.00-0.02	0.02-0.10	0.10-0.20	2_0.3-0.4	0.00-0.02	0.02-0.10	3_0.2-0.4
Sample ID	ESD29_0.02-0.10	ESD29_0.10-0.20	ESD29_0.35-0.50	ESD30_0.00-0.02	ESD30_0.02-0.10	ESD31_0.00-0.02	ESD31_0.02-0.10	ESD31_0.10-0.25	ESD31_0.35-0.45	ESD32_0.00-0.02	ESD32_0.02-0.10	ESD32_0.10-0.20	ESD32_0.3-0.4	ESD33_0.00-0.02	ESD33_0.02-0.10	ESD33_0.2-0.4
Date Sampled	1/02/2006	1/02/2006	1/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006

Analyte	LOR	Units	ANZECC/ARMCANZ (2000) ISQG Low	ISQG High														
Total Petroleum Hydrocarbons																		
C6-C9 Fraction	2	mg/kg	–	–	<2	10	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
C10-C14 Fraction	50	mg/kg	–	–	90	900	90	<50	60	<50	60	<50	<50	<50	<50	<50	<50	<50
C15-C28 Fraction	100	mg/kg	–	–	2670	12000	2740	<100	<100	<100	<100	<100	<100	450	520	1130	2420	1210	1110	400
C29-C36 Fraction	100	mg/kg	–	–	1980	5760	1680	<100	<100	<100	<100	<100	<100	640	730	1090	2480	1100	1240	400
C10 - C36 Fraction			–	–	4740	18660	4510	–	60	–	60	–	–	1090	1250	2220	4900	2310	2350	800
BTEX Compounds																		
Benzene	0.2	mg/kg	–	–	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.2	mg/kg	–	–	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	0.2	mg/kg	–	–	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
m&p-Xylene	0.2	mg/kg	–	–	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-Xylene	0.2	mg/kg	–	–	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Xylenes	-	mg/kg	–	–	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polynuclear Aromatic Hydrocarbons																		
Acenaphthene	0.5	mg/kg	–	–	1.36	19	<0.20	0.05	0.07	0.07	0.06	0.05	<0.05	0.2	0.16	0.15	0.3	0.45	0.39	0.19
Acenaphthylene	0.5	mg/kg	–	–	23.5	51	3.52	0.39	0.62	0.64	0.54	0.48	0.33	3.26	2.65	3.35	7.67	8.47	8.02	4.01
Anthracene	0.5	mg/kg	–	–	6.76	18.2	0.6	0.17	0.33	0.33	0.3	0.28	0.19	1.1	0.92	1.23	2.96	3.07	2.85	1.34
Benzo(a)anthracene	0.5	mg/kg	–	–	16.3	46.2	3.1	0.56	0.75	0.78	0.68	0.57	0.4	1.79	1.44	1.37	3.62	3.42	3.44	2.65
Benzo(a)pyrene	0.5	mg/kg	–	–	31.6	54.4	6	0.89	1.31	1.28	1.12	0.96	0.7	4.51	3.57	5.05	13.6	10.6	11.3	7.11
Benzo(b)fluoranthene	0.5	mg/kg	–	–	27.8	41.9	3.7	1.3	1.92	1.9	1.83	1.51	1.12	8.13	5.07	7.09	14.1	13.9	12.8	10.9
Benzo(g,h,i)perylene	0.5	mg/kg	–	–	12	21.3	2.16	0.66	0.98	0.91	0.8	0.68	0.51	2.32	1.85	2.11	5.35	4.15	3.94	2.22
Benzo(k)fluoranthene	0.5	mg/kg	–	–	17.8	43.2	4.48	0.59	1.13	0.85	0.72	0.78	0.59	2.08	2.87	2.92	10.8	7.97	7.25	3.09
Chrysene	0.5	mg/kg	–	–	17.4	42	3.45	0.53	0.76	0.72	0.6	0.48	0.42	1.38	1.07	1.33	3.43	3.38	2.9	2.32
Dibenzo(a,h)anthracene	0.5	mg/kg	–	–	3.7	7.02	0.9	0.14	0.2	0.21	0.16	0.14	0.11	0.65	0.5	0.66	1.67	1.28	1.41	0.73
Fluoranthene	0.5	mg/kg	–	–	27	144	5.79	0.77	1.38	1.37	1.2	1.12	0.82	2.76	2.25	2.41	6.88	7.46	6.46	5.69
Fluorene	0.5	mg/kg	–	–	0.34	1.95	<0.20	0.07	0.1	0.1	0.09	0.08	0.05	0.33	0.27	0.34	0.78	0.71	0.8	0.36
Indeno(1,2,3,cd)pyrene	0.5	mg/kg	–	–	12.3	18.9	2.02	0.53	0.79	0.73	0.65	0.56	0.41	2.1	1.66	1.95	5.32	3.69	3.88	2.29
Naphthalene	0.5	mg/kg	–	–	0.86	4.87	<0.20	0.2	0.29	0.28	0.26	0.2	0.14	0.54	0.52	0.39	0.8	0.95	0.79	0.61
Phenanthrene	0.5	mg/kg	–	–	4.69	6.61	0.37	0.32	0.57	0.57	0.52	0.44	0.35	0.65	0.8	1.08	1.67	1.18	0.87	0.95
Pyrene	0.5	mg/kg	–	–	62	152	10.5	0.97	1.83	1.8	1.58	1.43	1.01	4.98	4.37	5.06	16.7	13.4	11.2	12.6
Total PAHs		mg/kg	–	–	265	673	47	8	13	13	11	10	7	37	30	36	96	84	78	57
Major Ions																		
Free Cyanide	1	mg/kg	–	–	<1.0	<1.0	<1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Cyanide	1	mg/kg	–	–	1.4	1.4	<1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.3	<1	<1	<1
Total Organic Carbon	0.5	%	–	–	2.5	5.0	2.0	3.1	3.3	3.4	3.5	3.5	3.3	3.7	3.2	3.4	3.5	2.1	1.5	1.2
Total Cyanide - normalised to 1	0.5	mg/kg	25*	–	0.56	0.28	-	-	-	-	-	-	-	-	-	-	0.37	-	-	-
Polynuclear Aromatic Hydrocarbons - Normalised to 1%TOC																		
Acenaphthene	0.05	mg/kg	0.016	0.500	0.54	3.80	<0.20	0.02	0.02	0.02	0.02	0.01	<0.05	0.05	0.05	0.04	0.09	0.22	0.26	0.16
Acenaphthylene	0.05	mg/kg	0.044	0.640	9.40	10.20	1.76	0.13	0.19	0.19	0.15	0.14	0.10	0.88	0.83	0.99	2.19	4.03	5.35	3.34
Anthracene	0.05	mg/kg	0.085	1.100	2.70	3.64	0.30	0.05	0.10	0.10	0.09	0.08	0.06	0.30	0.29	0.36	0.85	1.46	1.90	1.12
Benzo(a)anthracene	0.05	mg/kg	0.261	1.600	6.52	9.24	1.55	0.18	0.23	0.23	0.19	0.16	0.12	0.48	0.45	0.40	1.03	1.63	2.29	2.21
Benzo(a)pyrene	0.05	mg/kg	0.430	1.600	12.64	10.88	3.00	0.29	0.40	0.38	0.32	0.27	0.21	1.22	1.12	1.49	3.89	5.05	7.53	5.93
Benzo(b)fluoranthene	0.05	mg/kg	–	–	11.12	8.38	1.85	0.42	0.58	0.56	0.52	0.43	0.34	2.20	1.58	2.09	4.03	6.62	8.53	9.08
Benzo(g,h,i)perylene	0.05	mg/kg	–	–	4.80	4.26	1.08	0.21	0.30	0.27	0.23	0.19	0.15	0.63	0.58	0.62	1.53	1.98	2.63	1.85
Benzo(k)fluoranthene	0.05	mg/kg	–	–	7.12	8.64	2.24	0.19	0.34	0.25	0.21	0.22	0.18	0.56	0.90	0.86	3.09	3.80	4.83	2.58
Chrysene	0.05	mg/kg	0.384	2.800	6.96	8.40	1.73	0.17	0.23	0.21	0.17	0.14	0.13	0.37	0.33	0.39	0.98	1.61	1.93	1.93
Dibenzo(a,h)anthracene	0.05	mg/kg	0.063	0.260	1.48	1.40	0.45	0.05	0.06	0.06	0.05	0.04	0.03	0.18	0.16	0.19	0.48	0.61	0.94	0.61
Fluoranthene	0.05	mg/kg	0.600	5.100	10.80	28.80	2.90	0.25	0.42	0.40	0.34	0.32	0.25	0.75	0.70	0.71	1.97	3.55	4.31	4.74
Fluorene	0.05	mg/kg	0.019	0.540	0.14	0.39	<0.20	0.02	0.03	0.03	0.03	0.02	0.02	0.09	0.08	0.10	0.22	0.34	0.53	0.30
Indeno(1,2,3,cd)pyrene	0.05	mg/kg	–	–	4.92	3.78	1.01	0.17	0.24	0.21	0.19	0.16	0.12	0.57	0.52	0.57	1.52	1.76	2.59	1.91
Naphthalene	0.05	mg/kg	0.160	2.100	0.34	0.97	<0.20	0.06	0.09	0.08	0.07	0.06	0.04	0.15	0.16	0.11	0.23	0.45	0.53	0.51
Phenanthrene	0.05	mg/kg	0.240	1.500	1.88	1.32	0.19	0.10	0.17	0.17	0.15	0.13	0.11	0.18	0.25	0.32	0.48	0.56	0.58	0.79
Pyrene	0.05	mg/kg	0.665	2.600	24.80	30.40	5.25	0.31	0.55	0.53	0.45	0.41	0.31	1.35	1.37	1.49	4.77	6.38	7.47	10.50
Low Molecular Weight PAHs			0.552	3.160	15.0	20.3	2.2	0.4	0.6	0.6	0.5	0.4	0.3	1.6	1.7	1.9	4.1	7.1	9.1	6.2
High Molecular Weight PAHs			1.700	9.600	63.2	89.1	14.9	1.2	1.9	1.8	1.5	1.3	1.0	4.3	4.1	4.7	13.1	18.8	24.5	25.9
Total PAHs			4.000	45.000	106.2	134.5	23.3	2.6	3.9	3.7	3.2	2.8	2.2	9.9	9.4	10.7	27.3	40.0	52.2	47.6

Denotes the concentration exceeds the ANZECC/ARM
Denotes the concentration exceeds the ANZECC/ARM
25* Sediment Quality Value is derived from Chronic marine

Table 4 Sediment Analytical Results
ERA- Sediment sampling
AGL Mortlake January/February 2006

Sample Location	ESD33	ESD34	ESD34	ESD34	ESD35	ESD35
Depth	0.45-0.55	0.00-0.02	0.02-0.10	0.20-0.40	0.00-0.02	0.02-0.10
Sample ID	ESD33_0.45-0.55	ESD34_0.00-0.02	ESD34_0.02-0.10	ESD34_0.20-0.40	ESD35_0.00-0.02	ESD35_0.02-0.10
Date Sampled	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006	13/02/2006

Analyte	LOR	Units	ANZECC/ARMCANZ (2000)							
Total Petroleum Hydrocarbons			ISQG Low	ISQG High						
C6-C9 Fraction	2	mg/kg	--	--	<2	<2	<2	<2	<2	<2
C10-C14 Fraction	50	mg/kg	--	--	<50	<50	<50	<50	<50	<50
C15-C28 Fraction	100	mg/kg	--	--	190	<100	250	<100	<100	<100
C29-C36 Fraction	100	mg/kg	--	--	220	260	400	<100	120	<100
C10 - C36 Fraction			--	--	410	260	650	--	120	--
BTEX Compounds										
Benzene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
m&p-Xylene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-Xylene	0.2	mg/kg	--	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Xylenes	-	mg/kg	--	--	-	-	-	-	-	-
Polynuclear Aromatic Hydrocarbons										
Acenaphthene	0.5	mg/kg	--	--	0.17	0.11	0.06	<0.05	0.06	<0.05
Acenaphthylene	0.5	mg/kg	--	--	1.44	1.51	0.56	0.42	0.52	0.41
Anthracene	0.5	mg/kg	--	--	0.95	0.42	0.28	0.21	0.3	0.21
Benzo(a)anthracene	0.5	mg/kg	--	--	1.9	0.93	0.66	0.44	0.64	0.49
Benzo(a)pyrene	0.5	mg/kg	--	--	2.92	2.11	1.08	0.75	1.05	0.86
Benzo(b)fluoranthene	0.5	mg/kg	--	--	4.15	3.25	1.51	1	1.44	1.19
Benzo(g,h,i)perylene	0.5	mg/kg	--	--	0.85	0.87	0.46	0.33	0.48	0.39
Benzo(k)fluoranthene	0.5	mg/kg	--	--	1	1.31	0.69	0.61	0.84	0.64
Chrysene	0.5	mg/kg	--	--	1.7	0.74	0.51	0.36	0.57	0.42
Dibenzo(a,h)anthracene	0.5	mg/kg	--	--	0.25	0.25	0.12	0.08	0.12	0.09
Fluoranthene	0.5	mg/kg	--	--	3.66	1.5	1.3	0.73	1.23	0.88
Fluorene	0.5	mg/kg	--	--	0.15	0.14	0.05	<0.05	0.08	0.06
Indeno(1,2,3,cd)pyrene	0.5	mg/kg	--	--	0.79	0.82	0.42	0.29	0.43	0.35
Naphthalene	0.5	mg/kg	--	--	0.16	0.33	0.21	0.15	0.23	0.15
Phenanthrene	0.5	mg/kg	--	--	0.72	0.6	0.31	0.22	0.38	0.25
Pyrene	0.5	mg/kg	--	--	7.1	2.07	1.74	0.95	1.62	1.19
Total PAHs		mg/kg	--	--	28	17	10	7	10	8
Major Ions										
Free Cyanide	1	mg/kg	--	--	<1	<1	<1	<1	<1	<1
Total Cyanide	1	mg/kg	--	--	<1	<1	<1	<1	<1	<1
Total Organic Carbon	0.5	%	--	--	1.4	2.9	3.2	2.8	2.3	2.9
Total Cyanide - normalised to 1	0.5	mg/kg	25*	--	-	-	-	-	-	-
Polynuclear Aromatic Hydrocarbons - Normalised to 1%TOC										
Acenaphthene	0.05	mg/kg	0.016	0.500	0.12	0.04	0.02	<0.05	0.03	<0.05
Acenaphthylene	0.05	mg/kg	0.044	0.640	1.03	0.52	0.18	0.15	0.23	0.14
Anthracene	0.05	mg/kg	0.085	1.100	0.68	0.14	0.09	0.08	0.13	0.07
Benzo(a)anthracene	0.05	mg/kg	0.261	1.600	1.36	0.32	0.21	0.16	0.28	0.17
Benzo(a)pyrene	0.05	mg/kg	0.430	1.600	2.09	0.73	0.34	0.27	0.46	0.30
Benzo(b)fluoranthene	0.05	mg/kg	--	--	2.96	1.12	0.47	0.36	0.63	0.41
Benzo(g,h,i)perylene	0.05	mg/kg	--	--	0.61	0.36	0.14	0.12	0.21	0.13
Benzo(k)fluoranthene	0.05	mg/kg	--	--	0.71	0.45	0.22	0.22	0.37	0.22
Chrysene	0.05	mg/kg	0.384	2.800	1.21	0.26	0.16	0.13	0.25	0.14
Dibenzo(a,h)anthracene	0.05	mg/kg	0.063	0.260	0.18	0.09	0.04	0.03	0.05	0.03
Fluoranthene	0.05	mg/kg	0.600	5.100	2.61	0.52	0.41	0.26	0.53	0.30
Fluorene	0.05	mg/kg	0.019	0.540	0.11	0.05	0.02	<0.05	0.03	0.02
Indeno(1,2,3,cd)pyrene	0.05	mg/kg	--	--	0.56	0.28	0.13	0.10	0.18	0.12
Naphthalene	0.05	mg/kg	0.160	2.100	0.11	0.11	0.07	0.05	0.10	0.05
Phenanthrene	0.05	mg/kg	0.240	1.500	0.51	0.21	0.10	0.08	0.16	0.09
Pyrene	0.05	mg/kg	0.665	2.600	5.07	0.71	0.54	0.34	0.70	0.41
Low Molecular Weight PAHs			0.552	3.160	2.6	1.1	0.5	0.4	0.7	0.4
High Molecular Weight PAHs			1.700	9.600	12.5	2.6	1.7	1.2	2.3	1.4
Total PAHs			4.000	45.000	19.9	5.8	3.1	2.3	4.3	2.6

Denotes the concentration exceeds the ANZECC/ARM
Denotes the concentration exceeds the ANZECC/ARM
25* Sediment Quality Value is derived from Chronic marine

Table 5 Water Analytical Results
ERA- Near bottom water sampling
AGL Mortlake January 2006

Sample ID	DW01	DW02	DW03	DW04	QC02	DW05	DW06	DW07	DW08
Date Sampled	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006	1/02/2006
Sample Type	Primary Sample	Primary Sample	Primary Sample	Primary Sample	Duplicate Sample	Primary Sample	Primary Sample	Primary Sample	Primary Sample
Analyte	**LOR**	**Units**	**ANZECC 2000 - Marine Water - 95%**								
Total Petroleum Hydrocarbons											
C6-C9 fraction	20	µg/L		<20	<20	<20	<20	<20	<20	<20	<20
C10-C14 fraction	50	µg/L		<50	<50	<50	<50	<50	<50	<50	<50
C15-C28 fraction	100	µg/L		<100	<100	<100	<100	<100	<100	<100	<100
C29-C36 fraction	50	µg/L		<50	<50	<50	<50	<50	<50	<50	<50
Total C10-C36 fraction		µg/L		-	-	-	-	-	-	-	-
BTEX Compounds											
Benzene	1	µg/L	700	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	2	µg/L	*180*	<2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	2	µg/L	*5*	<2	<2	<2	<2	<2	<2	<2	<2
m&p-Xylene	2	µg/L	*75*	<2	<2	<2	<2	<2	<2	<2	<2
o-Xylene	2	µg/L	*350*	<2	<2	<2	<2	<2	<2	<2	<2
Polynuclear Aromatic Hydrocarbons											
Acenaphthene	0.5	µg/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Acenaphthylene	0.5	µg/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Anthracene	0.5	µg/L	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	0.3	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(b)fluoranthene	0.5	µg/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(g,h,i)perylene	0.5	µg/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(k)fluoranthene	0.5	µg/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chrysene	0.5	µg/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Dibenzo(a,h)anthracene	1	µg/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fluoranthene	0.5	µg/L	1.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fluorene	0.5	µg/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Indeno(1,2,3,cd)pyrene	1	µg/L		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	0.5	µg/L	70	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Phenanthrene	0.5	µg/L	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Pyrene	0.5	µg/L		0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total PAH				-	-	-	-	-	-	-	-
Major Ions											
Free Cyanide	0.005	mg/L	0.004	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Cyanide	0.005	mg/L	0.004	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Legend:

Exceeds the ANZECC/ARMCANZ 2000 Trigger values for marine water ecosystems - Level of protection 95% species

Values in italics denote that Indicative Interim Working Levels (IIWLs) have been used in the absence of 95% Trigger Values

Table C2
HHRA Sediment Sample Results Beach Areas
AGL Mortlake January 2006

Analyte	LOR	Units	NEPM E	NSW EPA	USEPA Region 9	HSD01_0.0-0.1	HSD01_0.1-0.2	HSD02_0.0-0.1	HSD02_0.1-0.2	HSD03_0.0-0.1	QC05	HSD03_0.1-0.2	QC04	HSD14_0.0-0.1	HSD14_0.1-0.2	HSD15_0.0-0.1	HSD15_0.1-0.2	HSD16_0.0-0.1	HSD16_0.1-0.2
Sample ID						HSD01_0.0-0.1	HSD01_0.1-0.2	HSD02_0.0-0.1	HSD02_0.1-0.2	HSD03_0.0-0.1	QC05	HSD03_0.1-0.2	QC04	HSD14_0.0-0.1	HSD14_0.1-0.2	HSD15_0.0-0.1	HSD15_0.1-0.2	HSD16_0.0-0.1	HSD16_0.1-0.2
Date Sampled						20/01/2006	20/01/2006	19/01/2006	19/01/2006	20/01/2006	20/01/2006	20/01/2006	20/01/2006	19/01/2006	19/01/2006	19/01/2006	19/01/2006	19/01/2006	19/01/2006
Sample Type						Primary Sample	Primary Sample	Primary Sample	Primary Sample	Primary Sample	FD HSD03_0.0-0.1	Primary Sample	FD HSD03_0.1-0.2	Primary Sample	Primary Sample	Primary Sample	Primary Sample	Primary Sample	Primary Sample
Total Petroleum Hydrocarbons																			
C6-C9 fraction	2	mg/kg		65		<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
C10-C14 fraction	50	mg/kg				<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
C15-C28 fraction	100	mg/kg				360	<100	180	120	400	230	640	1100	<100	<100	<100	<100	<100	<100
C29-C36 fraction	100	mg/kg				320	<100	140	120	300	230	520	890	<100	<100	<100	<100	<100	<100
Sum C10-C36	calculated	mg/kg		1000		700	-	320	240	700	460	1160	1990	-	-	-	-	-	-
BTEX Compounds																			
Benzene	0.2	mg/kg		1	0.64	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.2	mg/kg		130	520	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	0.2	mg/kg		50	400	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
m&p-Xylene	0.2	mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-Xylene	0.2	mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total BTEX	1	mg/kg				-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Xylenes	0.4	mg/kg		25	270	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polynuclear Aromatic Hydrocarbons																			
Acenaphthene	0.5	mg/kg			3700	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	0.5	mg/kg			3700	2	1.8	0.8	1.4	2.6	3.6	5.9	8.1	<0.5	<0.5	<0.5	<0.5	0.6	<0.5
Anthracene	0.5	mg/kg			22000	0.6	<0.5	<0.5	0.5	0.8	1.2	1.8	2.8	<0.5	<0.5	<0.5	<0.5	0.7	<0.5
Benzo(a)anthracene	0.5	mg/kg			0.62	1.3	0.6	1.2	1.4	1.6	2	3.2	5	<0.5	<0.5	0.6	<0.5	1.8	0.9
Benzo(a)pyrene	0.5	mg/kg	2		0.062	3.7	2.4	2.2	3.2	4.8	7.1	10.9	15.3	<0.5	<0.5	0.8	<0.5	1.8	1
Benzo(b)fluoranthene	0.5	mg/kg			0.62	2.5	1.6	1.5	2.3	2.6	4.4	7.2	9.9	<0.5	<0.5	0.6	<0.5	1.6	0.8
Benzo(g,h,i)perylene	0.5	mg/kg			0.062	1.9	1.2	1.1	1.6	1.9	3.4	4.8	7.1	<0.5	<0.5	0.5	<0.5	1	0.6
Benzo(k)fluoranthene	0.5	mg/kg			6.2	3.7	1.9	2	3.1	3.7	5.7	9.3	13.5	<0.5	<0.5	0.8	<0.5	1.8	0.9
Chrysene	0.5	mg/kg			62	1.6	0.7	1.4	1.8	2	2.6	4	6.5	<0.5	<0.5	0.6	<0.5	1.9	1
Dibenzo(a,h)anthracene	0.5	mg/kg			0.062	<0.5	<0.5	<0.5	<0.5	0.5	1.2	1.3	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	0.5	mg/kg			2300	1.6	0.6	1.9	2.1	2	2.7	4	6.6	<0.5	0.8	0.9	<0.5	4.2	2
Fluorene	0.5	mg/kg			2700	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3,cd)pyrene	0.5	mg/kg			0.62	1.7	1.1	0.9	1.4	1.8	3	4.4	6.5	<0.5	<0.5	<0.5	<0.5	0.8	0.5
Naphthalene	0.5	mg/kg			56	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	1.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	0.5	mg/kg			3700	0.5	<0.5	<0.5	<0.5	0.6	1	1.3	2.4	<0.5	<0.5	<0.5	<0.5	2.2	1.1
Pyrene	0.5	mg/kg			2300	3	1.5	2.7	3.5	4.7	6.4	10.9	15.6	0.5	0.9	1.2	<0.5	4.7	2.2
Total PAH	calculated	mg/kg		20		24.1	13.4	15.7	22.3	29.1	44.9	70.2	103	0.5	1.7	6	-	23.5	11
Major Ions																			
Free Cyanide	1	mg/kg	500		1200	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Cyanide	1	mg/kg	1000			<1	<1	<1	<1	1.2	<1	<1	<1	<1	<1	<1	<1	<1	<1
Miscellaneous																			
1,2-Dichloroethane-D4	0.2	%				-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Tribromophenol	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorophenol-D4	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Fluorobiphenyl	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Fluorophenol	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Bromofluorobenzene	0.2	%				-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Terphenyl-d14	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene-d10	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol-d6	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene-D8	0.2	%				-	-	-	-	-	-	-	-	-	-	-	-	-	-
Moisture Content																			
Moisture Content	1	%				44.6	41.7	23.9	37.4	48.7	48.6	47.6	50.5	21.2	23.6	27.2	22.6	20.3	20.9

Legend

Exceeds the National Environment Protection Measure (NEPM) Human Investigation
Exceeds the NSW EPA 1994 Guidelines for assessing service stations
Exceeds the US EPA Region IX Preliminary Remediation Goals, 2004

FD - Field Duplicate

Table C2
HHRA Sediment Sample Results Beach Areas
AGL Mortlake January 2006

Analyte	LOR	Units	NEPM E	NSW EPA	USEPA Region 9	HSD17_0.0-0.1	HSD17_0.1-0.2	HSD18_0.0-0.1	HSD18_0.1-0.2	HH3_1_0.0-0.1	HH3_2_0.0-0.1	HH3_2_0.1-0.2	HH3_2_0.2-0.3	HH3_4_0.0-0.1	HH3_4_0.1-0.2	HH3_5_0.0-0.1	HH3_5_0.1-0.2
Sample ID																	
Date Sampled						19/01/2006	19/01/2006	19/01/2006	19/01/2006	5/06/2007	5/06/2007	5/06/2007	5/06/2007	5/06/2007	5/06/2007	5/06/2007	5/06/2007
Sample Type						Primary Sample	Primary Sample	Primary Sample	Primary Sample	Primary Sample	Primary Sample	Primary Sample	Primary Sample	Primary Sample	Primary Sample	Primary Sample	Primary Sample
Total Petroleum Hydrocarbons																	
C6-C9 fraction	2	mg/kg		65		<2	<2	<2	<2	<10	<10	<10	<10	<10	<10	<10	<10
C10-C14 fraction	50	mg/kg				<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
C15-C28 fraction	100	mg/kg				<100	<100	590	830	<100	270	370	<100	380	120	250	860
C29-C36 fraction	100	mg/kg				<100	<100	430	510	<100	200	290	<100	210	140	190	660
Sum C10-C36	calculated	mg/kg		1000		-	-	1020	1340	-	470	660	-	590	260	440	1520
BTEX Compounds																	
Benzene	0.2	mg/kg		1	0.64	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.2	mg/kg		130	520	<0.2	<0.2	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.2	mg/kg		50	400	<0.2	<0.2	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
m&p-Xylene	0.2	mg/kg				<0.2	<0.2	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
o-Xylene	0.2	mg/kg				<0.2	<0.2	<0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total BTEX	1	mg/kg				-	-	-	-	-	-	-	-	-	-	-	-
Total Xylenes	0.4	mg/kg		25	270	-	-	-	-	-	-	-	-	-	-	-	-
Polynuclear Aromatic Hydrocarbons																	
Acenaphthene	0.5	mg/kg			3700	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	0.5	mg/kg			3700	<0.5	<0.5	3.4	4.3	<0.5	1.3	2	<0.5	0.8	<0.5	1.5	6.8
Anthracene	0.5	mg/kg			22000	<0.5	<0.5	1.3	1.3	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	1.3
Benzo(a)anthracene	0.5	mg/kg			0.62	<0.5	<0.5	2	1.5	<0.5	1	2.1	0.6	1.5	<0.5	1.1	3.2
Benzo(a)pyrene	0.5	mg/kg	2		0.062	<0.5	<0.5	6.6	7.8	<0.5	2.6	4.2	1	2.3	0.6	2.5	9.7
Benzo(b)fluoranthene	0.5	mg/kg			0.62	<0.5	<0.5	5.6	6.3	<0.5	2.8	4.5	1.2	2.3	0.7	2.5	12.3
Benzo(g,h,i)perylene	0.5	mg/kg			0.062	<0.5	<0.5	3.6	4.6	<0.5	1.5	2.4	0.6	1.1	<0.5	1.3	5.5
Benzo(k)fluoranthene	0.5	mg/kg			6.2	<0.5	<0.5	6.8	7.3	<0.5	1.1	2.1	0.5	1	<0.5	1.1	4.2
Chrysene	0.5	mg/kg			62	<0.5	<0.5	2.7	2.6	<0.5	1.4	2.3	0.7	1.4	<0.5	1.2	4.2
Dibenzo(a,h)anthracene	0.5	mg/kg			0.062	<0.5	<0.5	1	1.3	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	0.5	mg/kg			2300	<0.5	<0.5	3.2	1.6	<0.5	1.9	3	0.7	1.9	<0.5	1.4	4
Fluorene	0.5	mg/kg			2700	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3,cd)pyrene	0.5	mg/kg			0.62	<0.5	<0.5	3.2	4	<0.5	1.2	2	0.5	1	<0.5	1.1	4.9
Naphthalene	0.5	mg/kg			56	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	0.5	mg/kg			3700	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	0.5	mg/kg			2300	<0.5	<0.5	10.6	15.1	0.7	4.1	7.3	1.3	3.5	0.8	2.7	16.9
Total PAH	calculated	mg/kg		20		-	-	50.5	57.7	0.7	18.9	33	7.1	16.8	2.1	16.4	73
Major Ions																	
Free Cyanide	1	mg/kg	500		1200	<1	<1	<1	<1	-	-	-	-	-	-	-	-
Total Cyanide	1	mg/kg	1000			<1	<1	<1	1.2	-	-	-	-	-	-	-	-
Miscellaneous																	
1,2-Dichloroethane-D4	0.2	%				-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Tribromophenol	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorophenol-D4	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-
2-Fluorobiphenyl	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-
2-Fluorophenol	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-
4-Bromofluorobenzene	0.2	%				-	-	-	-	-	-	-	-	-	-	-	-
4-Terphenyl-d14	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-
Anthracene-d10	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-
Phenol-d6	0.5	%				-	-	-	-	-	-	-	-	-	-	-	-
Toluene-D8	0.2	%				-	-	-	-	-	-	-	-	-	-	-	-
Moisture Content																	
Moisture Content	1	%				21.9	22.5	48.1	51.9	14.3	21.5	22.9	36.5	27.2	39.5	26.9	21.6

Legend

Exceeds the National Environment Protection Measure (NEPM) Human Investigation

Exceeds the NSW EPA 1994 Guidelines for assessing service stations

Exceeds the US EPA Region IX Preliminary Remediation Goals, 2004

FD - Field Duplicate

Table T1 - Sediment Corehole Sample Analytical Results - ISQG-high values

Borehole/Test Pit ID				SHA01		SHA01		SHA01		SHA02		SHA02		SHA02		SHA02		SHA03		SHA03		SHA03		SHA03		SHA04		SHA04		SHA04		SHA05				SHA05		SHA05	
Sample ID				SHA01_0.2-0.3		SHA01_1.0-1.1		SHA01_1.5-1.6		SHA02_0.5-0.6		SHA02_1.0-1.1		QC201		SHA02_2.0-2.1		SHA03_1.0-1.1		SHA03_1.5-1.6		SHA03_3.0-3.1		SHA03_4.0-4.1		SHA04_1.5-1.6		SHA04_2.5-2.6		SHA04_3.0-3.1		SHA05_4.3-4.4		QC205		SHA05_5.3-5.4		SHA05_6.0-6.1	
Depth (mBSWI)				0.2-0.3		1.0-1.1		1.5-1.6		0.5-0.6		1.0-1.1				2.0-2.1		1.0-1.1		1.5-1.6		3.0-3.1		4.0-4.1		1.5-1.6		2.5-2.6		3.0-3.1		4.3-4.4				5.3-5.4		6.0-6.1	
Sample Description				Clayey Silt		Sandy Clay		Sandy Clay		Clayey Silt		Silt to Silty Clay				Silty Clay		Silty Clay		Silty Clay		Clayey Sand		Sand		Silty Clay		Sandy Clay		Clay		Silty Clay				Silty Clay		Silty Clay	
PID				1.8		1.4		1.4		0.4		1.7				1.5		1.7		1.5		2.1		1.5		5.8		3.3		3.7		7.6				4.3		4.3	
Date Sampled				8/12/2010		8/12/2010		8/12/2010		8/12/2010		8/12/2010				8/12/2010		8/12/2010		8/12/2010		8/12/2010		8/12/2010		8/12/2010		8/12/2010		8/12/2010		9/12/2010				9/12/2010		9/12/2010	
Analytes	EQL	Low Level ISQG	High Level ISQG																																				
TPHs																																							
TPH C6 - C9	25	-	-	<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<250		<25		<25		<25	
TPH C10 - C14	50	-	-	<50		<50		<50		220		<50		<50		<50		<50		<50		<50		<50		390		<50		<50		160		880		<50		<50	
TPH C15 - C28	100	-	-	320		<100		<100		3500		<100		<100		<100		<100		<100		<100		<100		1200		<100		<100		500		2500		<100		<100	
TPH C29-C36	100	-	-	170		<100		<100		1500		<100		<100		<100		<100		<100		<100		<100		310		<100		<100		<100		610		<100		<100	
TPH+C10 - C36 (Sum of total)		-	-	490		NC		NC		5220		NC		NC		NC		NC		NC		NC		NC		1900		NC		NC		660		3990		NC		NC	
BTEX																																							
Benzene	0.5	-	-	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		3.1		<0.5		<0.5		6.8		1.7		<0.5		<0.5	
Ethylbenzene	0.5	-	-	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		1.6		<0.5		<0.5		<5		1		<0.5		<0.5	
Toluene	1	-	-	<1		<1		<1		<1		<1		<1		<1		<1		<1		<1		<1		1.1		<1		<1		<10		<1		<1		<1	
Xylene (m & p)	2	-	-	<2		<2		<2		<2		<2		<2		<2		<2		<2		<2		<2		6.6		<2		<2		23		5.3		<2		<2	
Xylene (o)	1	-	-	<1		<1		<1		<1		<1		<1		<1		<1		<1		<1		<1		3.5		<1		<1		14		3		<1		<1	
Xylene Total		-	-	NC		NC		NC		NC		NC		NC		NC		NC		NC		NC		NC		10.1		NC		NC		37		8.3		NC		NC	
PAHs				Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected
Acenaphthene	0.1	0.016	0.5	1	0.6	<0.1	NRC	<0.1	NRC	16	5.7	0.2	0.1	0.6	0.4	<0.1	NRC	0.3	0.3	<0.1	NRC	0.4	NRC	<0.1	NRC	21.0	NRC	<0.1	NRC	<0.1	NRC	9.7	NRC	71.0	NRC	<0.1	NRC	<0.1	NRC
Acenaphthylene	0.1	0.044	0.64	0.1	0.1	<0.1	NRC	<0.1	NRC	5.5	2.0	<0.1	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.3	NRC	<0.1	NRC	3.6	NRC	<0.1	NRC	<0.1	NRC	1.9	NRC	9.8	NRC	0.1	NRC	<0.1	NRC
Anthracene	0.1	0.085	1.1	0.4	0.2	<0.1	NRC	<0.1	NRC	29	10.4	0.1	0.1	0.2	0.1	<0.1	NRC	0.8	0.7	<0.1	NRC	<0.1	NRC	<0.1	NRC	14.0	NRC	<0.1	NRC	<0.1	NRC	6.7	NRC	32.0	NRC	<0.1	NRC	<0.1	NRC
Benz(a)anthracene	0.1	0.261	1.6	1.6	0.9	<0.1	NRC	<0.1	NRC	39	13.9	0.3	0.2	0.7	0.5	<0.1	NRC	0.7	0.6	<0.1	NRC	<0.1	NRC	<0.1	NRC	8.7	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	25.0	NRC	<0.1	NRC	<0.1	NRC
Benzo(a) pyrene	0.05	0.43	1.6	3.4	1.9	<0.05	NRC	<0.05	NRC	39	13.9	1	0.7	2.2	1.5	<0.05	NRC	1.1	0.9	0.1	NRC	<0.05	NRC	<0.05	NRC	8.7	NRC	<0.05	NRC	<0.05	NRC	4.4	NRC	25.0	NRC	0.1	NRC	<0.05	NRC
Benzo(b)&(k)fluoranthene	0.2	-	-	4.6	2.6	<0.2	NRC	<0.2	NRC	55	19.6	1.3	0.9	2.9	1.9	<0.2	NRC	1.6	1.3	<0.2	NRC	<0.2	NRC	<0.2	NRC	11.0	NRC	<0.2	NRC	<0.2	NRC	5.4	NRC	29.0	NRC	<0.2	NRC	<0.2	NRC
Benzo(g,h,i)perylene	0.1	-	-	1.8	1.0	<0.1	NRC	<0.1	NRC	11	3.9	0.3	0.2	0.6	0.4	<0.1	NRC	0.4	0.3	<0.1	NRC	<0.1	NRC	<0.1	NRC	3.3	NRC	<0.1	NRC	<0.1	NRC	1.7	NRC	8.0	NRC	<0.1	NRC	<0.1	NRC
Chrysene	0.1	0.384	2.8	2.1	1.2	<0.1	NRC	<0.1	NRC	37	13.2	0.5	0.4	1	0.7	<0.1	NRC	0.8	0.7	<0.1	NRC	<0.1	NRC	<0.1	NRC	8.7	NRC	<0.1	NRC	<0.1	NRC	4.2	NRC	21.0	NRC	<0.1	NRC	<0.1	NRC
Dibenz(a,h)anthracene	0.1	0.063	0.26	0.9	0.5	<0.1	NRC	<0.1	NRC	3.2	1.1	0.1	0.1	0.2	0.1	<0.1	NRC	0.1	0.1	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.8	NRC	<0.1	NRC	<0.1	NRC	0.4	NRC	1.5	NRC	<0.1	NRC	<0.1	NRC
Fluoranthene	0.1	0.6	5.1	2.9	1.6	<0.1	NRC	<0.1	NRC	150	53.6	0.4	0.3	0.7	0.5	<0.1	NRC	1.9	1.6	0.1	NRC	<0.1	NRC	<0.1	NRC	22.0	NRC	0.1	NRC	<0.1	NRC	13.0	NRC	75.0	NRC	0.1	NRC	<0.1	NRC
Fluorene	0.1	0.19	0.54	0.2	0.1	<0.1	NRC	<0.1	NRC	19	6.8	<0.1	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.2	NRC	<0.1	NRC	10.0	NRC	<0.1	NRC	<0.1	NRC	9.5	NRC	38.0	NRC	<0.1	NRC	<0.1	NRC
Indeno(1,2,3-c,d)pyrene	0.1	-	-	1.8	1.0	<0.1	NRC	<0.1	NRC	16	5.7	0.4	0.3	0.8	0.5	<0.1	NRC	0.5	0.4	<0.1	NRC	<0.1	NRC	<0.1	NRC	3.8	NRC	<0.1	NRC	<0.1	NRC	1.8	NRC	9.3	NRC	<0.1	NRC	<0.1	NRC
Naphthalene	0.1	0.16	2.1	0.5	0.3	<0.1	NRC	<0.1	NRC	7.2	2.6	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.1	0.1	<0.1	NRC	3.9	NRC	<0.1	NRC	150.0	NRC	0.7	NRC	<0.1	NRC	49.0	NRC	370.0	NRC	5.9	NRC	0.7	NRC
Phenanthrene	0.1	0.24	1.5	0.5	0.3	<0.1	NRC	<0.1	NRC	170	60.7	0.1	0.1	0.2	0.1	<0.1	NRC	1.5	1.3	<0.1	NRC	0.2	NRC	<0.1	NRC	44.0	NRC	0.1	NRC	<0.1	NRC	25.0	NRC	140.0	NRC	0.3	NRC	<0.1	NRC
Pyrene	0.1	0.665	2.6	4.4	2.4	<0.1	NRC	<0.1	NRC	140	50.0	0.6	0.4	1.1	0.7	<0.1	NRC	2	1.7	0.1	NRC	<0.1	NRC	<0.1	NRC	21.0	NRC	0.1	NRC	<0.1	NRC	12.0	NRC	71.0	NRC	0.1	NRC	<0.1	NRC
Low Molecular Weight PAHs (Sum)[2]		0.552	3.16	2.7	1.5	NC	NRC	NC	NRC	246.7	88.1	0.4	0.3	1	0.7	NC	NRC	2.7	2.3	NC	NRC	5.0	NRC	NC	NRC	247.6	NRC	0.8	NRC	NC	NRC	101.8	NRC	660.8	NRC	6.3	NRC	0.7	NRC
High Molecular Weight PAHs (Sum)[3]		1.7	9.6	15.3	8.5	NC	NRC	NC	NRC	408.2	145.8	2.9	2.1	5.9	3.9	NC	NRC	6.6	5.5	0.3	NRC	NC	NRC	NC	NRC	69.9	NRC	0.2	NRC	NC	NRC	34.0	NRC	218.5	NRC	0.3	NRC	NC	NRC
PAHs (Sum of total)		4	45	26.2	14.6	NC	NRC	NC	NRC	736.9	263.2	5.3	3.8	11.2	7.5	NC	NRC	11.8	9.8	0.3	NRC	5.0	NRC	NC	NRC	335.6	NRC	1.0	NRC	NC	NRC	144.7	NRC	925.6	NRC	6.6	NRC	0.7	NRC
Metals																																							
Arsenic	4	20	70	39		8		<4		21		33		24		9		20		22		13		<4		21		<4		<4		19		22		17		18	
Cadmium	0.5	1.5	10	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5	
Chromium (III+VI)	1	80	370	31		10		5		98		22		19		6		21		18		9		6		19		6		8		13		11		14		16	
Copper	1	65	270	18		1		<1		54		13		18		1		30		8		3		1		7		2		3		3		3		5		6	
Lead	1	50	220	34		5		3		140		26		37		3		48		14		7		5		14		6		15		7		8		10		12	
Mercury	0.1	0.15	1	0.3		<0.1		<0.1		0.5		0.2		0.2		<0.1		0.4		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	
Nickel	1	21	52	11		1		<1		29		10		8		2		9		8		4		<1		10		2		1		5		4		5		6	
Zinc	1	200	410	80		3		2		210		57		77		7		110		28		10		4		23		4		6		14		13		15		17	
Other																																							
Total Cyanide	0.5	-	-	<0.5		<0.5		NA		<0.5		<0.5		<0.5		NA		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		NA		<0.5		<0.5		<0.5		NA	
Total Organic Carbon	100	-	-	18000		900		NA		28000		14000		15000		NA		12000		NA		3200		NA		9400		700		NA		8600		8600		3500		NA	
Total Organic Carbon %	0.01	-	-	1.8		0.09		NC		2.8		1.4		1.5		NC		1.2		NC		0.32		NC		0.94		0.07		NC		0.86		0.86		0.35		NC	
Moisture	0.1	-	-	45		17		13		48		47		25		21		39		38		23		15		32		17		16		33		30		32		34	

NOTES:

465 Concentrations greater than adopted investigation criteria

Investigation Criteria shown in Red - High level Interim Sediment Quality Guidelines (ISQGs. ANZECC&ARMCANZ 2000)

All concentrations are in mg/kg

1 - Low molecular weight PAHs are the sum of concentrations of acenaphthene, acenaphthalene, anthracene, fluorene, 2-methylnaphthalene, naphthalene and phenanthrene

2 -High molecular weight PAHs are the sum of concentrations of benzo(a)anthracene,benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and pyrene.

EQL - laboratory Estimated Quantitation Limit

"-" indicates that the criteria is not applicable for these analytes

< Value = Concentration less than laboratory EQL

NC - Non Calculable

NA - Not Analysed

NRC - No Required Correction for TOC

mBSWI - metres below sediment/water interface

Intra Dup - Intra-laboratory duplicate sample

Inter Dup - Inter-laboratory duplicate sample

Table T1 - Sediment Corehole Sample Analytical Results - ISQG-high values

Borehole/Test Pit ID			SHA06		SHA06		SHA07		SHA07		SHA07		SHA07		SHA08		SHA08		SHA09		SHA09		SHA09		SHA10		SHA10		SHA11		SHA11	
Sample ID			SHA06_1.5-1.6		SHA06_2.0-2.1		SHA07_3.5-3.6		SHA07_3.8-3.9		QC209		SHA07_5.0-5.1		SHA07_6.0-6.1		SHA08_3.0-3.1		SHA08_5.0-5.1		SHA09_2.0-2.1		QC203		SHA09_3.0-3.1		SHA10_1.5-1.6		SHA10_2.0-2.1		SHA11_5.0-5.1		SHA11_6.2-6.3	
Depth (mBSWI)			1.5-1.6		2.0-2.1		3.5-3.6		3.8-3.9				5.0-5.1		6.0-6.1		3.0-3.1		5.0-5.1		2.0-2.1				3.0-3.1		1.5-1.6		2.0-2.1		5.0-5.1		6.2-6.3	
Sample Description			Sandy Clay		Clay		Gravelly Sand		Silty Clay				Clayey Silt		Clayey Silt		Silty Clay		Clay		Silty Clay				Sandy Clay		Sandy Clay		Sandy Clay		Gravelly Sand		Clay	
PID			1.8		1.4		8.6		9.3				2.6		1.8		1.6		0.8		1.8				1.9		1.2		1.4		0.4		0.4	
Date Sampled			8/12/2010		8/12/2010		13/12/2010		13/12/2010				13/12/2010		13/12/2010		10/12/2010		10/12/2010		9/12/2010				9/12/2010		9/12/2010		9/12/2010		10/12/2010		10/12/2010	
Analytes	**EQL**	**Low Level ISQG**																																
TPHs																																		
TPH C6 - C9	25	-	<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<25	
TPH C10 - C14	50	-	<50		<50		790		140		110		<50		<50		230		<50		<50		<50		<50		<50		<50		310		<50	
TPH C15 - C28	100	-	<100		<100		13000		620		330		<100		<100		1300		<100		<100		<100		<100		<100		<100		4900		<100	
TPH C29-C36	100	-	<100		<100		4900		450		<100		<100		<100		400		<100		<100		<100		<100		<100		<100		2100		<100	
TPH+C10 - C36 (Sum of total)		-	NC		NC		18690		1210		440		NC		NC		1930		NC		NC		NC		NC		NC		NC		7310		NC	
BTEX																																		
Benzene	0.5	-	<0.5		<0.5		0.6		2.1		1.4		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5	
Ethylbenzene	0.5	-	<0.5		<0.5		1.1		1.1		0.63		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5	
Toluene	1	-	<1		<1		1.5		1.7		1.1		<1		<1		1.7		<1		<1		<1		<1		<1		<1		<1		<1	
Xylene (m & p)	2	-	<2		<2		2.2		<2		<2		<2		<2		<2		<2		<2		<2		<2		<2		<2		<2		<2	
Xylene (o)	1	-	<1		<1		1.8		2.2		1.3		<1		<1		<1		<1		<1		<1		<1		<1		<1		<1		<1	
Xylene Total		-	NC		NC		4		2.2		1.3		NC		NC		NC		NC		NC		NC		NC		NC		NC		NC		NC	
PAHs			Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected
Acenaphthene	0.1	0.016	0.3	NRC	<0.1	NRC	57	16.3	6.9	4.6	5.4	4.2	0.5	NRC	0.2	NRC	25.0	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.4	0.2	<0.1	NRC	18	3.1	0.3	NRC		
Acenaphthylene	0.1	0.044	0.3	NRC	<0.1	NRC	10	2.9	1.8	1.2	1.7	1.3	0.3	NRC	<0.1	NRC	5.6	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	3.5	0.6	<0.1	NRC		
Anthracene	0.1	0.085	0.4	NRC	<0.1	NRC	41	11.7	7.3	4.9	4.4	3.4	0.2	NRC	<0.1	NRC	17.0	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.1	0.1	<0.1	NRC	16	2.7	0.2	NRC		
Benz(a)anthracene	0.1	0.261	0.5	NRC	<0.1	NRC	140	40.0	5	3.3	3.1	2.4	0.3	NRC	0.1	NRC	12.0	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.4	0.2	<0.1	NRC	34	5.8	0.5	NRC		
Benzo(a) pyrene	0.05	0.43	0.4	NRC	<0.05	NRC	140	40.0	4.6	3.1	2.5	1.9	0.2	NRC	0.1	NRC	12.0	NRC	<0.05	NRC	<0.05	NRC	<0.05	NRC	1.1	0.6	0.1	NRC	41	6.9	0.5	NRC		
Benzo(b)&(k)fluoranthene	0.2	-	0.5	NRC	<0.2	NRC	160	45.7	6.2	4.1	3.1	2.4	0.3	NRC	<0.2	NRC	15.0	NRC	<0.2	NRC	<0.2	NRC	<0.2	NRC	1.6	0.8	<0.2	NRC	52	8.8	0.6	NRC		
Benzo(g,h,i)perylene	0.1	-	0.1	NRC	<0.1	NRC	44	12.6	2	1.3	0.7	0.5	<0.1	NRC	<0.1	NRC	4.6	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.4	0.2	<0.1	NRC	13	2.2	0.1	NRC		
Chrysene	0.1	0.384	0.5	NRC	<0.1	NRC	140	40.0	4.7	3.1	2.6	2.0	0.3	NRC	0.1	NRC	11.0	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.5	0.3	<0.1	NRC	36	6.1	0.5	NRC		
Dibenz(a,h)anthracene	0.1	0.063	<0.1	NRC	<0.1	NRC	13	3.7	0.5	0.3	0.1	0.1	<0.1	NRC	<0.1	NRC	1.0	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.1	0.1	<0.1	NRC	3.7	0.6	<0.1	NRC		
Fluoranthene	0.1	0.6	1.0	NRC	<0.1	NRC	330	94.3	14	9.3	8	6.2	0.8	NRC	0.3	NRC	32.0	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.5	0.3	<0.1	NRC	100	16.9	1.0	NRC		
Fluorene	0.1	0.19	0.4	NRC	<0.1	NRC	17	4.9	7.9	5.3	5.5	4.2	0.4	NRC	0.1	NRC	20.0	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	5.1	0.9	0.1	NRC		
Indeno(1,2,3-c,d)pyrene	0.1	-	0.1	NRC	<0.1	NRC	53	15.1	2.2	1.5	0.9	0.7	<0.1	NRC	<0.1	NRC	5.6	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.4	0.2	<0.1	NRC	15	2.5	0.2	NRC		
Naphthalene	0.1	0.16	2.5	NRC	<0.1	NRC	93	26.6	47	31.3	44	33.8	4.8	NRC	1.0	NRC	50.0	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.2	0.1	<0.1	NRC	12	2.0	0.5	NRC		
Phenanthrene	0.1	0.24	0.9	NRC	<0.1	NRC	31	8.9	25	16.7	15	11.5	1.0	NRC	0.4	NRC	72.0	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	0.2	0.1	<0.1	NRC	18	3.1	0.4	NRC		
Pyrene	0.1	0.665	1.6	NRC	0.1	NRC	370	105.7	13	8.7	7.7	5.9	0.8	NRC	0.4	NRC	31.0	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	1.4	0.7	<0.1	NRC	130	22.0	1.8	NRC		
Low Molecular Weight PAHs (Sum)[2]		0.552	4.8	NRC	NC	NRC	249	71.1	95.9	63.9	76	58.5	7.2	NRC	1.7	NRC	189.6	NRC	NC	NRC	NC	NRC	NC	NRC	NC	NRC	NC	NRC	72.6	12.3	1.5	NRC		
High Molecular Weight PAHs (Sum)[3]		1.7	4.0	NRC	0.1	NRC	1133	323.7	41.8	27.9	24	18.5	2.4	NRC	1.0	NRC	99.0	NRC	NC	NRC	NC	NRC	NC	NRC	NC	NRC	4	2.1	0.1	NRC	344.7	58.4	4.3	NRC		
PAHs (Sum of total)		4	9.5	NRC	0.1	NRC	1639.0	468.3	148.1	98.7	104.7	80.5	9.9	NRC	2.7	NRC	313.8	NRC	NC	NRC	NC	NRC	NC	NRC	NC	NRC	7.3	3.8	0.1	NRC	497.3	84.3	6.7	NRC		
Metals																																		
Arsenic	4	20	NA		<4		21		16		12		18		19		16		9		23		24		13		17		16		18		<4	
Cadmium	0.5	1.5	NA		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		0.5		<0.5	
Chromium (III+VI)	1	80	NA		6		100		21		16		19		18		14		16		21		22		8		12		11		300		11	
Copper	1	65	NA		1		40		17		12		7		7		4		4		7		6		2		9		5		36		3	
Lead	1	50	NA		8		80		28		19		17		16		8		8		13		15		5		15		8		98		22	
Mercury	0.1	0.15	NA		<0.1		0.8		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		0.6		<0.1	
Nickel	1	21	NA		1		57		10		7		7		7		5		1		9		9		3		14		4		140		4	
Zinc	1	200	NA		3		170		45		28		27		24		18		3		28		28		9		35		19		150		10	
Other																																		
Total Cyanide	0.5	-	NA		<0.5		37		<0.5		<0.5		NA		NA		<0.5		NA		<0.5		<0.5		NA		NA		NA		43		NA	
Total Organic Carbon	100	-	600		NA		35000		15000		13000		NA		NA		8500		NA		15000		15000		NA		19000		NA		59000		NA	
Total Organic Carbon %	0.01	-	0.06		NC		3.5		1.5		1.3		NC		NC		0.85		NC		1.5		1.5		NC		1.9		NC		5.9		NC	
Moisture	0.1	-	14		14		41		44		25		30		29		27		18		45		30		22		32		30		36		19	

NOTES:

465 Concentrations greater than adopted investigation criteria

Investigation Criteria shown in Red - High level Interim Sediment Quality Guidelines (ISQGs, ANZECC&ARMCANZ 2000)

All concentrations are in mg/kg

1 - Low molecular weight PAHs are the sum of concentrations of acenaphthene, acenaphthalene, anthracene, fluorene, 2-methylnaphthalene, naphthalene and phenanthrene

2 -High molecular weight PAHs are the sum of concentrations of benzo(a)anthracene,benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and pyrene.

EQL - laboratory Estimated Quantitation Limit

"-" indicates that the criteria is not applicable for these analytes

< Value = Concentration less than laboratory EQL

NC - Non Calculable

NA - Not Analysed

NRC - No Required Correction for TOC

mBSWI - metres below sediment/water interface

Intra Dup - Intra-laboratory duplicate sample

Inter Dup - Inter-laboratory duplicate sample

Table T1 - Sediment Corehole Sample Analytical Results - ISQG-high values

Borehole/Test Pit ID			SHA12		SHA12	SHA13	SHA13		SHA13		SHA13	SHA13	SHA14	SHA14	SHA15	SHA15	SHA16	SHA16	SHA17
Sample ID			SHA12_2.0-2.1	QC204	QC304	SHA12_2.5-2.6	SHA13_2.0-2.1	SHA13_3.5-3.6	QC208	QC308	SHA13_4.5-4.6	SHA13_5.0-5.1	SHA14_2.2-2.3	SHA14_3.0-3.1	SHA15_1.5-1.6	SHA15_3.5-3.6	SHA16_1.7-1.8	SHA16_2.0-2.1	SHA17_1.2-1.3
Depth (mBSWI)			2.0-2.1			2.5-2.6	2.0-2.1	3.5-3.6			4.5-4.6	5.0-5.1	2.2-2.3	3.0-3.1	1.5-1.6	3.5-3.6	1.7-1.8	2.0-2.1	1.2-1.3
Sample Description			Silt			Silty Clay	Silt	Silty Clay			Silty Clay	Silty Clay	Silt	Silty Clay	Gravelly Sand	Clayey Silt	Clayey Sand	Clay	Sand
PID			1.3			1.2	8.4	7.8			1.4	1.2	1.4	0.9	2.3	1.6	1.5	0.8	1.2
Date Sampled			9/12/2010			9/12/2010	10/12/2010	10/12/2010			10/12/2010	10/12/2010	10/12/2010	10/12/2010	9/12/2010	9/12/2010	9/12/2010	9/12/2010	8/12/2010
Analytes	**EQL**	**Low Level ISQG**																	
TPHs																			
TPH C6 - C9	25	-	<25	<25	<10	<25	<25	<25	<250	22	<25	<25	<25	<25	<25	<25	<25	<25	<25
TPH C10 - C14	50	-	<50	<50	<50	<50	<50	620	470	250	<50	<50	120	<50	130	<50	<50	<50	<50
TPH C15 - C28	100	-	290	<100	740	<100	<100	3300	2800	1430	<100	<100	2400	<100	3100	<100	1100	<100	<100
TPH C29-C36	100	-	<100	<100	300	<100	<100	880	780	430	<100	<100	930	<100	1300	<100	600	<100	<100
TPH+C10 - C36 (Sum of total)		-	290	NC	1040	NC	NC	4800	4050	2132	NC	NC	3450	NC	4530	NC	1700	NC	NC
BTEX																			
Benzene	0.5	-	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	1.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	1	-	<1	<1	<0.5	<1	<1	2.2	<10	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1
Xylene (m & p)	2	-	<2	<2	<0.5	<2	<2	<2	<20	0.8	<2	<2	<2	<2	<2	<2	<2	<2	<2
Xylene (o)	1	-	<1	<1	<0.5	<1	<1	2.2	<10	1.4	<1	<1	<1	<1	<1	<1	<1	<1	<1
Xylene Total		-	NC	NC	NC	NC	NC	2.2	NC	2.2	NC	NC	NC	NC	NC	NC	NC	NC	NC
PAHs			Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected
Acenaphthene	0.1	0.016	0.9	0.4	0.3	0.1	4.6	**1.0**	**<0.1**	NRC	0.6	0.4	**81.0**	NRC	**69.0**	NRC	5.8	**0.6**	**1.9**	NRC	0.1	NRC	8.9	**0.8**	**<0.1**	NRC	8.7	**1.4**	**<0.1**	NRC	5.8	**0.7**	0.1	NRC	**<0.1**	NRC
Acenaphthylene	0.1	0.044	2	**0.9**	0.8	0.3	2	0.4	**<0.1**	NRC	0.5	0.3	**15.0**	NRC	**13.0**	NRC	26.4	**2.6**	0.5	NRC	**<0.1**	NRC	0.9	0.0	**<0.1**	NRC	1.5	0.2	**<0.1**	NRC	0.8	0.1	**<0.1**	NRC	**<0.1**	NRC
Anthracene	0.1	0.085	2.4	1.0	0.9	0.4	5.7	**1.2**	**<0.1**	NRC	1.5	0.9	**51.0**	NRC	**36.0**	NRC	16.9	**1.7**	0.8	NRC	**<0.1**	NRC	3.9	0.2	**<0.1**	NRC	7.3	**1.1**	**<0.1**	NRC	2.8	0.3	**<0.1**	NRC	**<0.1**	NRC
Benz(a)anthracene	0.1	0.261	2.4	1.0	1.1	0.4	5.5	1.2	0.1	NRC	0.9	0.5	**37.0**	NRC	**30.0**	NRC	12.3	1.2	0.6	NRC	0.1	NRC	18	**3.2**	**<0.1**	NRC	28	**4.4**	**<0.1**	NRC	6.6	0.8	0.1	NRC	**<0.1**	NRC
Benzo(a) pyrene	0.05	0.43	2.6	1.1	0.6	0.2	3.7	0.8	0.1	NRC	0.9	0.5	**35.0**	NRC	**29.0**	NRC	9.6	1.0	0.5	NRC	0.1	NRC	24	**5.8**	**<0.05**	NRC	30	**4.7**	0.1	NRC	15	**1.7**	0.2	NRC	**<0.05**	NRC
Benzo(b)&(k)fluoranthene	0.2	-	3.2	1.4	0.9	0.4	4.6	1.0	**<0.2**	NRC	1.1	0.6	44.0	NRC	34.0	NRC	12.1	1.2	0.6	NRC	**<0.2**	NRC	25	6.3	**<0.2**	NRC	36	5.6	**<0.2**	NRC	18	2.0	0.3	NRC	**<0.2**	NRC
Benzo(g,h,i)perylene	0.1	-	0.7	0.3	0.2	0.1	1.1	0.2	**<0.1**	NRC	0.3	0.2	13.0	NRC	9.1	NRC	3.6	0.4	0.2	NRC	**<0.1**	NRC	6.3	0.4	**<0.1**	NRC	9.2	1.4	**<0.1**	NRC	4.8	0.5	**<0.1**	NRC	**<0.1**	NRC
Chrysene	0.1	0.384	2.7	1.2	1	0.4	5	1.1	0.1	NRC	0.9	0.5	**36.0**	NRC	**24.0**	NRC	11	1.1	0.5	NRC	0.2	NRC	16	2.6	**<0.1**	NRC	25	**3.9**	**<0.1**	NRC	7.1	0.8	0.2	NRC	**<0.1**	NRC
Dibenz(a,h)anthracene	0.1	0.063	0.1	0.0	<0.1	NRC	<0.8	NRC	**<0.1**	NRC	<0.1	NRC	**3.0**	NRC	**1.9**	NRC	0.7	0.1	**<0.1**	NRC	**<0.1**	NRC	1.5	0.0	**<0.1**	NRC	2	**0.3**	**<0.1**	NRC	1	0.1	**<0.1**	NRC	**<0.1**	NRC
Fluoranthene	0.1	0.6	5.3	2.3	2.1	0.8	11.4	2.5	0.2	NRC	3.5	2.1	**100.0**	NRC	**86.0**	NRC	32.8	3.3	1.7	NRC	0.3	NRC	43	**18.5**	**<0.1**	NRC	53	**8.3**	0.1	NRC	10	1.1	0.2	NRC	**<0.1**	NRC
Fluorene	0.1	0.19	0.6	0.3	0.3	0.1	1.7	0.4	**<0.1**	NRC	1.2	**0.7**	**63.0**	NRC	**54.0**	NRC	20.6	**2.1**	**1.3**	NRC	**<0.1**	NRC	2	0.0	**<0.1**	NRC	2.3	0.4	**<0.1**	NRC	1.4	0.2	**<0.1**	NRC	**<0.1**	NRC
Indeno(1,2,3-c,d)pyrene	0.1	-	0.8	0.3	0.2	0.1	0.9	0.2	**<0.1**	NRC	0.3	0.2	15.0	NRC	11.0	NRC	2.9	0.3	0.2	NRC	**<0.1**	NRC	8	0.6	**<0.1**	NRC	11	1.7	**<0.1**	NRC	5.5	0.6	**<0.1**	NRC	**<0.1**	NRC
Naphthalene	0.1	0.16	0.9	0.4	0.4	0.2	2.6	0.6	**<0.1**	NRC	1.1	0.6	**110.0**	NRC	**63.0**	NRC	25.9	**2.6**	**11.0**	NRC	**3.0**	NRC	4.1	0.2	**<0.1**	NRC	4.8	0.8	**<0.1**	NRC	3.9	0.4	**<0.1**	NRC	**<0.1**	NRC
Phenanthrene	0.1	0.24	5.9	**2.6**	2.4	1.0	14.6	**3.2**	**<0.1**	NRC	5.3	**3.1**	**190.0**	NRC	**160.0**	NRC	61.4	**6.1**	**3.5**	NRC	0.3	NRC	4.6	0.2	**<0.1**	NRC	7.6	1.2	**<0.1**	NRC	4.8	0.5	**<0.1**	NRC	**<0.1**	NRC
Pyrene	0.1	0.665	6	**2.6**	2.5	1.0	12.6	**2.7**	0.2	NRC	3.7	2.2	**95.0**	NRC	**82.0**	NRC	32.4	**3.2**	1.6	NRC	0.4	NRC	53	**28.1**	**<0.1**	NRC	59	**9.2**	0.2	NRC	18	2.0	0.3	NRC	**<0.1**	NRC
Low Molecular Weight PAHs (Sum)[2]		0.552	12.7	**5.5**	5.1	2.0	31.2	**6.8**	**NC**	NRC	10.2	**6.0**	**510.0**	NRC	**385.0**	NRC	157	**15.7**	**19.0**	NRC	**3.4**	NRC	24.4	**6.0**	**NC**	NRC	32.2	**5.0**	**NC**	NRC	19.5	2.2	0.1	NRC	**NC**	NRC
High Molecular Weight PAHs (Sum)[3]		1.7	19.1	8.3	7.3	2.9	38.2	8.3	0.7	NRC	9.9	5.8	**306.0**	NRC	**252.9**	NRC	98.8	**9.9**	4.9	NRC	1.1	NRC	155.5	**241.8**	**NC**	NRC	197	**30.8**	0.4	NRC	57.7	6.6	1.0	NRC	**NC**	NRC
PAHs (Sum of total)		4	36.5	15.9	13.7	5.5	76.0	16.5	0.7	NRC	21.8	12.8	**888.0**	NRC	**692.0**	NRC	274.4	27.4	24.9	NRC	4.5	NRC	219.2	**480.5**	**NC**	NRC	285.4	44.6	0.4	NRC	105.5	12.0	1.4	NRC	**NC**	NRC
Metals																			
Arsenic	4	20	27		21		44		16		19		13		18		19		15		17		15		27		24		31		14		6		**<4**	
Cadmium	0.5	1.5	**<0.5**		**<0.5**		**<1**		**<0.5**		**<0.5**		**<0.5**		**<0.5**		**<1**		**<0.5**		**<0.5**		**<0.5**		**<0.5**		**<0.5**		**<0.5**		**<0.5**		**<0.5**	
Chromium (III+VI)	1	80	28		20		46		12		20		6		10		12		11		14		150		14		66		18		81		33		8	
Copper	1	65	10		5		14		3		18		2		3		**<5**		3		5		36		3		22		1		47		2		2	
Lead	1	50	21		13		30		8		35		5		7		6		8		13		60		10		41		16		85		10		10	
Mercury	0.1	0.15	**<0.1**		**<0.1**		**<0.1**		**<0.1**		0.1		**<0.1**		**<0.1**		**<0.1**		**<0.1**		**<0.1**		0.3		**<0.1**		0.4		**<0.1**		0.3		**<0.1**		**<0.1**	
Nickel	1	21	10		8		16		5		10		2		4		4		4		5		48		5		27		2		20		4		4	
Zinc	1	200	42		25		64		16		63		8		11		13		11		15		130		16		100		8		260		15		35	
Other																			
Total Cyanide	0.5	-	0.7		<0.5		50		NA		<0.5		<0.5		<0.5		<1		NA		NA		0.9		NA		2.8		NA		<0.5		NA		<0.5	
Total Organic Carbon	100	-	23000		25000		NA		NA		17000		6900		7500		NA		NA		NA		100000		NA		64000		NA		88000		NA		800	
Total Organic Carbon %	0.01	-	2.3		2.5		4.6		NC		1.7		0.69		0.75		<0.5		NC		NC		10		NC		6.4		NC		8.8		NC		0.08	
Moisture	0.1	-	32		30		53.2		24		34		26		21		31.6		18		25		22		54		30		17		29		20		17	

NOTES:

465 Concentrations greater than adopted investigation criteria

Investigation Criteria shown in Red - High level Interim Sediment Quality Guidelines (ISQGs, ANZECC&ARMCANZ 2000)
All concentrations are in mg/kg
1 - Low molecular weight PAHs are the sum of concentrations of acenaphthene, acenaphthalene, anthracene, fluorene, 2-methylnaphthalene, naphthalene and phenanthrene
2 -High molecular weight PAHs are the sum of concentrations of benzo(a)anthracene,benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and pyrene.
EQL - laboratory Estimated Quantitation Limit
"-" indicates that the criteria is not applicable for these analytes
< Value = Concentration less than laboratory EQL
NC - Non Calculable
NA - Not Analysed
NRC - No Required Correction for TOC
mBSWI - metres below sediment/water interface
Intra Dup - Intra-laboratory duplicate sample
Inter Dup - Inter-laboratory duplicate sample

Table T1 - Sediment Corehole Sample Analytical Results - ISQG-high values

Borehole/Test Pit ID			SHA18			SHA18	SHA18	SHA19	SHA20	SHB21	SHB21		SHB21	SHB22	SHB22	SHB23	SHB24	SHB25	SHB25
Sample ID			SHA18_1.7-1.8	QC206	QC306	SHA18_2.0-2.1	SHA18_3.0-3.1	SHA19_2.8-2.9	SHA20_0.2-0.4	SHB21_3.2-3.3	SHB21_4.0-4.1	QC207	SHB21_4.5-4.6	SHB22_2.5-2.6	SHB22_3.0-3.1	SHB23_4.5-4.6	SHB24_2.0-2.1	SHB25_1.5-1.6	SHB25_2.0-2.1
Depth (mBSWI)			1.7-1.8			2.0-2.1	3.0-3.1	2.8-2.9	0.2-0.4	3.2-3.3	4.0-4.1		4.5-4.6	2.5-2.6	3.0-3.1	4.5-4.6	2.0-2.1	1.5-1.6	2.0-2.1
Sample Description			Clayey Sand			Silty Clay	Sandy Clay	Sand	Silty Sand	Gravelly Sand	Gravelly Sand		Clay	Gravelly Sand	Clayey Sand	Clay	Sand	Gravelly Sand	Clay
PID			1.2			-	1.8	1.4	0.8	1.4	3.4		1.2	3.4	2.6	1.6	1.9	2.1	1.2
Date Sampled			10/12/2010			10/12/2010	10/12/2010	9/12/2010	8/12/2010	10/12/2010	10/12/2010		10/12/2010	13/12/2010	13/12/2010	13/12/2010	13/12/2010	13/12/2010	13/12/2010
Analytes	**EQL**	**Low Level ISQG**																	
TPHs																			
TPH C6 - C9	25	-	<25	<25	<10	<25	<25	<25	<25	<25	<25	<250	<25	<250	<250	<25	<25	<25	<25
TPH C10 - C14	50	-	<50	<50	<50	<50	<50	<50	170	2600	220	790	<50	2400	3700	<50	190	<50	<50
TPH C15 - C28	100	-	270	120	270	<100	<100	<100	2900	39000	2500	7700	<100	8400	33000	<100	3100	670	<100
TPH C29-C36	100	-	120	<100	150	<100	<100	<100	170	14000	950	2500	<100	1700	12000	<100	1700	520	<100
TPH+C10 - C36 (Sum of total)		-	390	120	420	NC	NC	NC	3240	55600	3670	10990	NC	12500	48700	NC	4990	1190	NC
BTEX																			
Benzene	0.5	-	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<5	<0.5	5.1	<5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	10	<5	<0.5	<0.5	<0.5	<0.5
Toluene	1	-	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<10	<1	22	<10	<1	<1	<1	<1
Xylene (m & p)	2	-	<2	<2	<0.5	<2	<2	<2	<2	<2	<2	<20	<2	62	<20	<2	<2	<2	<2
Xylene (o)	1	-	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<10	<1	30	<10	<1	<1	<1	<1
Xylene Total		-	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	92	NC	NC	NC	NC	NC
PAHs			Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected
Acenaphthene	0.1	0.016	1.1	**0.8**	0.5	0.1	<0.5	NRC	**<0.1**	NRC	**<0.1**	NRC	**<0.1**	NRC	18	**1.8**	180	**18.0**	**17.0**	NRC	**61.0**	NRC	0.2	NRC	**160.0**	NRC	**100.0**	NRC	**0.7**	NRC	29	**2.9**	5.8	**0.7**	0.1	NRC
Acenaphthylene	0.1	0.044	0.2	0.1	<0.1	NRC	1	0.3	**<0.1**	NRC	**<0.1**	NRC	**<0.1**	NRC	1.5	0.2	200	**20.0**	**6.9**	NRC	**24.0**	NRC	**<0.1**	NRC	**26.0**	NRC	**80.0**	NRC	0.5	NRC	5.7	0.6	0.9	0.1	**<0.1**	NRC
Anthracene	0.1	0.085	0.6	0.4	0.3	0.1	0.6	0.2	**<0.1**	NRC	**<0.1**	NRC	**<0.1**	NRC	6.2	0.6	190	**19.0**	**15.0**	NRC	**56.0**	NRC	0.2	NRC	**100.0**	NRC	**280.0**	NRC	0.7	NRC	15	**1.5**	2.7	0.3	**<0.1**	NRC
Benz(a)anthracene	0.1	0.261	1.2	0.9	0.6	0.2	1.1	0.4	**<0.1**	NRC	**<0.1**	NRC	**<0.1**	NRC	19	**1.9**	380	**38.0**	**20.0**	NRC	**65.0**	NRC	0.2	NRC	**75.0**	NRC	**210.0**	NRC	0.6	NRC	29	**2.9**	2.4	0.3	**<0.1**	NRC
Benzo(a) pyrene	0.05	0.43	2.9	**2.1**	0.9	0.3	1.6	0.6	**<0.05**	NRC	**<0.05**	NRC	**<0.05**	NRC	42	**4.2**	330	**33.0**	**17.0**	NRC	**57.0**	NRC	0.1	NRC	**52.0**	NRC	**180.0**	NRC	0.5	NRC	46	**4.6**	12	1.4	**<0.05**	NRC
Benzo(b)&(k)fluoranthene	0.2	-	3.3	2.4	1.2	0.3	1.9	0.7	**<0.2**	NRC	**<0.2**	NRC	**<0.2**	NRC	49	4.9	330	33.0	20.0	NRC	64.0	NRC	**<0.2**	NRC	62.0	NRC	200.0	NRC	0.7	NRC	54	5.4	15	1.7	**<0.2**	NRC
Benzo(g,h,i)perylene	0.1	-	0.8	0.6	0.3	0.1	<0.5	NRC	**<0.1**	NRC	**<0.1**	NRC	**<0.1**	NRC	13	1.3	78	7.8	4.8	NRC	13.0	NRC	**<0.1**	NRC	16.0	NRC	49.0	NRC	0.2	NRC	14	1.4	3.8	0.4	**<0.1**	NRC
Chrysene	0.1	0.384	1.5	1.1	0.7	0.2	1	0.3	**<0.1**	NRC	**<0.1**	NRC	**<0.1**	NRC	20	2.0	330	**33.0**	**17.0**	NRC	**65.0**	NRC	0.2	NRC	**68.0**	NRC	**190.0**	NRC	0.6	NRC	26	2.6	2.8	0.3	**<0.1**	NRC
Dibenz(a,h)anthracene	0.1	0.063	0.2	0.1	<0.1	NRC	<0.5	NRC	**<0.1**	NRC	**<0.1**	NRC	**<0.1**	NRC	2.9	**0.3**	20	**2.0**	**1.0**	NRC	**3.4**	NRC	**<0.1**	NRC	**4.3**	NRC	**11.0**	NRC	**<0.1**	NRC	3.2	**0.3**	0.7	0.1	**<0.1**	NRC
Fluoranthene	0.1	0.6	2.4	1.7	1	0.3	1.7	0.6	**<0.1**	NRC	**<0.1**	NRC	**<0.1**	NRC	25	2.5	590	**59.0**	**36.0**	NRC	**130.0**	NRC	0.4	NRC	**140.0**	NRC	**400.0**	NRC	1.5	NRC	51	**5.1**	5.2	0.6	**<0.1**	NRC
Fluorene	0.1	0.19	0.4	0.3	0.2	0.1	<0.5	NRC	**<0.1**	NRC	**<0.1**	NRC	**<0.1**	NRC	3.7	0.4	48	**4.8**	**13.0**	NRC	**39.0**	NRC	0.2	NRC	**150.0**	NRC	**180.0**	NRC	**0.8**	NRC	13	**1.3**	2.5	0.3	**<0.1**	NRC
Indeno(1,2,3-c,d)pyrene	0.1	-	1	0.7	0.3	0.1	<0.5	NRC	**<0.1**	NRC	**<0.1**	NRC	**<0.1**	NRC	17	1.7	94	9.4	5.6	NRC	16.0	NRC	**<0.1**	NRC	17.0	NRC	58.0	NRC	0.2	NRC	19	1.9	4.7	0.5	**<0.1**	NRC
Naphthalene	0.1	0.16	0.9	0.6	0.7	0.2	0.8	0.3	**<0.1**	NRC	**<0.1**	NRC	**<0.1**	NRC	11	1.1	37	**3.7**	**19.0**	NRC	**83.0**	NRC	0.4	NRC	**600.0**	NRC	**90.0**	NRC	2.0	NRC	34	**3.4**	9	1.0	**<0.1**	NRC
Phenanthrene	0.1	0.24	1.2	0.9	0.6	0.2	0.9	0.3	**<0.1**	NRC	**<0.1**	NRC	**<0.1**	NRC	8.7	0.9	54	**5.4**	**28.0**	NRC	**110.0**	NRC	0.5	NRC	**360.0**	NRC	**490.0**	NRC	**2.4**	NRC	34	**3.4**	5.5	0.6	**<0.1**	NRC
Pyrene	0.1	0.665	5	**3.6**	2.2	0.6	3.7	1.3	0.1	NRC	0.1	NRC	**<0.1**	NRC	45	**4.5**	690	**69.0**	**41.0**	NRC	**150.0**	NRC	0.4	NRC	**160.0**	NRC	**440.0**	NRC	1.5	NRC	53	**5.3**	17	2.0	0.1	NRC
Low Molecular Weight PAHs (Sum)[2]		0.552	4.4	3.1	2.3	0.7	3.3	1.1	**NC**	NRC	**NC**	NRC	**NC**	NRC	49.1	**4.9**	709	**70.9**	**98.9**	NRC	**373.0**	NRC	1.5	NRC	**1396.0**	NRC	**1220.0**	NRC	**7.1**	NRC	130.7	**13.1**	26.4	3.0	0.1	NRC
High Molecular Weight PAHs (Sum)[3]		1.7	13.2	9.4	5.4	1.5	9.1	3.1	0.1	NRC	0.1	NRC	**NC**	NRC	153.9	**15.4**	2340	**234.0**	**132.0**	NRC	**470.4**	NRC	1.3	NRC	**499.3**	NRC	**1431.0**	NRC	4.7	NRC	208.2	**20.8**	40.1	4.6	0.1	NRC
PAHs (Sum of total)		4	22.7	16.2	9.5	2.7	14.3	4.9	0.1	NRC	0.1	NRC	**NC**	NRC	282.0	28.2	3551.0	**355.1**	**261.3**	NRC	**936.4**	NRC	2.8	NRC	**1990.3**	NRC	**2958.0**	NRC	12.9	NRC	425.9	42.6	90.0	10.3	0.2	NRC
Metals																			
Arsenic	4	20	18	24	30	29	19	5	13	5	**<4**	5	**<4**	23	**<4**	13	16	14	25
Cadmium	0.5	1.5	**<0.5**	**<0.5**	**<1**	**<0.5**	**<0.5**	**<0.5**	0.5	**<0.5**	**<0.5**	**<0.5**	**<0.5**	0.8	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**
Chromium (III+VI)	1	80	22	28	42	10	10	5	62	25	6	13	9	19	16	22	33	38	28
Copper	1	65	7	10	15	3	2	1	43	38	**<1**	8	**<1**	11	23	3	140	55	**<1**
Lead	1	50	15	22	31	7	7	3	76	75	4	21	4	29	48	20	120	180	13
Mercury	0.1	0.15	0.1	**<0.1**	**<0.1**	**<0.1**	**<0.1**	**<0.1**	0.3	**1.7**	**<0.1**	0.2	**<0.1**	0.2	0.5	**<0.1**	0.5	**2**	**<0.1**
Nickel	1	21	8	10	13	4	3	4	14	12	1	4	**<1**	6	11	2	20	7	2
Zinc	1	200	34	52	86	11	10	18	200	260	6	36	3	48	130	6	320	140	7
Other																			
Total Cyanide	0.5	-	<0.5	<0.5	4	NA	NA	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	NA	NA	<0.5	<0.5	NA
Total Organic Carbon	100	-	14000	35000	NA	NA	NA	NA	140000	470000	NA	4800	NA	7100	NA	NA	150000	87000	NA
Total Organic Carbon %	0.01	-	1.4	3.5	2.9	NC	NC	NC	14	47	NC	0.48	NC	0.71	NC	NC	15	8.7	NC
Moisture	0.1	-	26	35	45.5	22	26	22	33	32	19	18	12	19	30	16	24	32	20

NOTES:

465 Concentrations greater than adopted investigation criteria

Investigation Criteria shown in Red - High level Interim Sediment Quality Guidelines (ISQGs, ANZECC&ARMCANZ 2000)
All concentrations are in mg/kg
1 - Low molecular weight PAHs are the sum of concentrations of acenaphthene, acenaphthalene, anthracene, fluorene, 2-methylnaphthalene, naphthalene and phenanthrene
2 -High molecular weight PAHs are the sum of concentrations of benzo(a)anthracene,benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and pyrene.
EQL - laboratory Estimated Quantitation Limit
"-" indicates that the criteria is not applicable for these analytes
< Value = Concentration less than laboratory EQL
NC - Non Calculable
NA - Not Analysed
NRC - No Required Correction for TOC
mBSWI - metres below sediment/water interface
Intra Dup - Intra-laboratory duplicate sample
Inter Dup - Inter-laboratory duplicate sample

Table T2 - Sediment Grab Sample Analytical Results - ISQG-high values

Borehole/Test Pit ID				SHA01		SHA01		SHA01		SHA05		SHA09				SHA11		SHA11		SHA13		SHA14		SHA14		SHA15		SHA15		SHA16	
Sample ID				SHA01 PP		SHA01 PP		QC210		SHA05 PP-2		SHA09 PP		QC211		SHA11 PP		SHA11 PP-2		SHA13 PP		SHA14 PP		SHA14 PP-2		SHA15 PP-2		SHA15 PP-2		SHA16 PP-2	
Depth (mBSWI)				0.0-0.2		0.0-0.2		0.0-0.2		0.0-0.2		0.0-0.2				0.0-0.2		0.0-0.2		0.0-0.2		0.0-0.2		0.0-0.2		0.0-0.2		0.0-0.2		0.0-0.2	
Date Sampled				17/12/2010		17/12/2010		17/12/2010		17/12/2010		17/12/2010				17/12/2010		17/12/2010		17/12/2010		17/12/2010		17/12/2010		17/12/2010		17/12/2010		17/12/2010	
Compounds	**EQL**	**Low Level ISQG**	**High Level ISQG**																												
TPHs																															
TPH C6 - C9	25	-	-	<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		<25		NA		<25	
TPH C10 - C14	50	-	-	<50		<50		<50		56		<50		<50		160		530		<50		130		140		<50		<50		<50	
TPH C15 - C28	100	-	-	630		700		790		2000		920		1200		4500		13000		750		3800		5300		1400		1000		540	
TPH C29-C36	100	-	-	400		450		520		1000		590		740		1800		5800		490		1900		2300		830		660		390	
TPH+C10 - C36 (Sum of total)		-	-	1030		1150		1310		3056		1510		1940		6460		19330		1240		5830		7740		2230		1660		930	
BTEX																															
Benzene	0.5	-	-	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		NA		<0.5	
Ethylbenzene	0.5	-	-	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		NA		<0.5	
Toluene	1	-	-	<1		<1		<1		<1		<1		<1		<1		<1		<1		<1		<1		<1		NA		<1	
Xylene (m & p)	2	-	-	<2		<2		<2		<2		<2		<2		<2		<2		<2		<2		<2		<2		NA		<2	
Xylene (o)	1	-	-	<1		<1		<1		<1		<1		<1		<1		<1		<1		<1		<1		<1		NA		<1	
Xylene Total		-	-	NC		NC		NC		NC		NC		NC		NC		NC		NC		NC		NC		NC		NC		NC	
PAHs				Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected
Acenaphthene	0.1	0.016	0.5	<0.1	NRC	<0.1	NRC	0.1	0.0	0.4	0.1	0.1	0.0	0.1	0.0	4.7	1.2	6.1	1.2	0.2	0.1	3.6	0.5	2.1	0.4	0.3	0.1	0.2	0.1	<0.1	NRC
Acenaphthylene	0.1	0.044	0.64	1.6	0.7	2.2	1.0	2.4	0.9	9.3	2.2	4.2	1.0	5.7	1.2	26	6.7	83	16.6	5.7	2.1	41	5.8	39	8.1	6	2.1	4.6	1.7	2.5	1.5
Anthracene	0.1	0.085	1.1	0.4	0.2	0.6	0.3	0.7	0.3	1.5	0.3	0.6	0.1	0.9	0.2	17	4.4	24	4.8	1.1	0.4	12	1.7	9.8	2.0	1.1	0.4	0.7	0.3	0.6	0.4
Benz(a)anthracene	0.1	0.261	1.6	1.5	0.6	2.1	0.9	2.3	0.9	7	1.6	4.7	1.1	5.9	1.3	42	10.8	78	15.6	4	1.5	27	3.8	38	7.9	7.3	2.6	5.4	2.0	3.5	2.1
Benzo(a) pyrene	0.05	0.43	1.6	7.3	3.0	9.1	4.0	9.9	3.7	25	5.8	14	3.3	18	3.9	53	13.6	190	38.0	10	3.7	100	14.1	120	25.0	18	6.4	14	5.2	7.5	4.4
Benzo(b)&(k)fluoranthene	0.2	-	-	7.8	3.3	10	4.3	11	4.1	25	5.8	14	3.3	19	4.1	55	14.1	190	38.0	11	4.1	100	14.1	110	22.9	19	6.8	15	5.6	9.1	5.4
Benzo(g,h,i)perylene	0.1	-	-	2.9	1.2	3.8	1.7	3.9	1.4	7.8	1.8	4.7	1.1	6.1	1.3	12	3.1	44	8.8	3.1	1.1	24	3.4	25	5.2	4.9	1.8	3.9	1.4	2.4	1.4
Chrysene	0.1	0.384	2.8	1.6	0.7	1.8	0.8	2.3	0.9	5.9	1.4	3.5	0.8	4.8	1.0	44	11.3	63	12.6	2.9	1.1	25	3.5	32	6.7	5.6	2.0	4.4	1.6	4	2.4
Dibenz(a,h)anthracene	0.1	0.063	0.26	0.4	0.2	0.6	0.3	0.7	0.3	1.6	0.4	1	0.2	1.4	0.3	2.1	0.5	7.3	1.5	0.7	0.3	4.6	0.6	5.2	1.1	1.3	0.5	1	0.4	0.5	0.3
Fluoranthene	0.1	0.6	5.1	2.3	1.0	2.9	1.3	3.2	1.2	13	3.0	4.7	1.1	6.7	1.5	95	24.4	310	62.0	7.2	2.7	95	13.4	120	25.0	10	3.6	6.9	2.6	4.6	2.7
Fluorene	0.1	0.19	0.54	<0.1	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	<0.1	NRC	6.7	1.7	6.2	1.2	0.2	0.1	2.7	0.4	1.8	0.4	0.2	0.1	0.2	0.1	<0.1	NRC
Indeno(1,2,3-c,d)pyrene	0.1	-	-	3.6	1.5	5	2.2	5.2	1.9	11	2.6	6.5	1.5	8.5	1.8	15	3.8	56	11.2	4.4	1.6	31	4.4	32	6.7	7.3	2.6	5.6	2.1	3.8	2.2
Naphthalene	0.1	0.16	2.1	0.3	0.1	0.4	0.2	0.6	0.2	1	0.2	0.3	0.1	0.4	0.1	19	4.9	55	11.0	0.7	0.3	24	3.4	14	2.9	0.9	0.3	0.5	0.2	0.4	0.2
Phenanthrene	0.1	0.24	1.5	0.6	0.3	0.9	0.4	1.1	0.4	1.7	0.4	0.6	0.1	0.9	0.2	27	6.9	30	6.0	1.8	0.7	17	2.4	12	2.5	1.4	0.5	0.8	0.3	1	0.6
Pyrene	0.1	0.665	2.6	6.2	2.6	6.9	3.0	7.8	2.9	34	7.9	12	2.8	17	3.7	160	41.0	520	104.0	17	6.3	260	36.6	320	66.7	23	8.2	18	6.7	8.6	5.1
Low Molecular Weight PAHs (Sum)[2]		0.552	3.16	2.9	1.2	4.1	1.8	4.9	1.8	13.9	3.2	5.8	1.3	8	1.7	100.4	25.7	204.3	40.9	9.7	3.6	100.3	14.1	78.7	16.4	9.9	3.5	7	2.6	4.5	2.6
High Molecular Weight PAHs (Sum)[3]		1.7	9.6	19.3	8.0	23.4	10.2	26.2	9.7	86.5	20.1	39.9	9.3	53.8	11.7	396.1	101.6	1168.3	233.7	41.8	15.5	511.6	72.1	635.2	132.3	65.2	23.3	49.7	18.4	28.7	16.9
PAHs (Sum of total)		4	45	36.5	15.2	46.3	20.1	51.2	19.0	144.2	33.5	70.9	16.5	95.4	20.7	578.5	148.3	1662.6	332.5	70.0	25.9	766.9	108.0	880.9	183.5	106.3	38.0	81.2	30.1	48.5	28.5
Metals																															
Arsenic	4	20	70	16		16		18		21		14		13		NA		15		12		20		16		17		15		14	
Cadmium	0.5	1.5	10	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		NA		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5	
Chromium (III+VI)	1	80	370	80		81		71		230		95		73		NA		280		290		260		250		99		110		68	
Copper	1	65	270	59		59		50		57		60		41		NA		36		51		68		42		50		54		46	
Lead	1	50	220	89		90		81		110		93		71		NA		92		91		110		90		80		87		87	
Mercury	0.1	0.15	1	0.5		0.5		0.4		0.5		0.5		0.3		NA		0.4		0.2		0.6		0.3		0.5		0.4		0.3	
Nickel	1	21	52	17		17		15		50		18		15		NA		88		100		61		65		22		24		14	
Zinc	1	200	410	260		260		220		500		310		200		NA		210		230		390		270		280		300		210	
Additional Analyses																															
Total Cyanide	0.5	-	-	<0.5		<0.5		<0.5		1.2		<0.5		<0.5		NA		11		2.5		<0.5		<0.5		<0.5		NA		<0.5	
Total Organic Carbon	100	-	-	24000		23000		27000		43000		43000		46000		39000		50000		27000		71000		48000		28000		27000		17000	
Total Organic Carbon %	0.01	-	-	2.4		2.3		2.7		4.3		4.3		4.6		3.9		5		2.7		7.1		4.8		2.8		2.7		1.7	
Moisture	0.1	-	-	34		NA		30		42		23		34		43		43		26		50		44		41		NA		35	

NOTES:

465 Concentrations greater than adopted investigation criteria

Investigation Criteria shown in Red - High level Interim Sediment Quality Guidelines (ISQGs, ANZECC&ARMCANZ 2000)

All concentrations are in mg/kg

1 - Low molecular weight PAHs are the sum of concentrations of acenaphthene, acenaphthalene, anthracene, fluorene, 2-methylnaphthalene, naphthalene and phenanthrene

2 -High molecular weight PAHs are the sum of concentrations of benzo(a)anthracene,benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and pyrene.

EQL - laboratory Estimated Quantitation Limit

"-" Indicates that the criteria is not applicable for these analytes

< Value = Concentration less than laboratory EQL

NC - Non Calculable

NA - Not Analysed

NRC - No Required Correction for TOC

mBSWI - metres below sediment/water interface

Intra Dup - Intra-laboratory duplicate sample

Inter Dup - Inter-laboratory duplicate sample

Table T2 - Sediment Grab Sample Analytical Results - ISQG-high values

Borehole/Test Pit ID				SHA16		SHA17		SHA18		SHA19		SHB21		SHB23				SHB24	
Sample ID				SHA17 PP		SHA17 PP-2		SHA18 PP-2		SHA19 PP-2		SHB21 PP-2		SHB23 PP		QC212		SHB24 PP-2	
Depth (mBSWI)				0.0-0.2		0.0-0.2		0.0-0.2		0.0-0.2		0.0-0.2		0.0-0.2				0.0-0.2	
Date Sampled				17/12/2010		17/12/2010		17/12/2010		17/12/2010		17/12/2010		17/12/2010				17/12/2010	
Compounds	**EQL**	**Low Level ISQG**	**High Level ISQG**																
TPHs																			
TPH C6 - C9	25	-	-	<25		<25		<25		<25		<25		<25		<25		<25	
TPH C10 - C14	50	-	-	<50		<50		<50		<50		170		69		69		120	
TPH C15 - C28	100	-	-	430		<100		2100		2000		3400		2000		1800		3800	
TPH C29-C36	100	-	-	290		<100		1100		1100		1900		1200		960		2200	
TPH+C10 - C36 (Sum of total)		-	-	720		NC		3200		3100		5470		3269		2829		6120	
BTEX																			
Benzene	0.5	-	-	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5	
Ethylbenzene	0.5	-	-	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5	
Toluene	1	-	-	<1		<1		<1		<1		<1		<1		<1		<1	
Xylene (m & p)	2	-	-	<2		<2		<2		<2		<2		<2		<2		<2	
Xylene (o)	1	-	-	<1		<1		<1		<1		<1		<1		<1		<1	
Xylene Total		-	-	NC		NC		NC		NC		NC		NC		NC		NC	
PAHs				Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected	Reported	Corrected
Acenaphthene	0.1	0.016	0.5	<0.1	NRC	<0.1	NRC	0.3	0.1	0.6	0.4	4.4	1.3	1.3	0.8	1.9	1.5	1.2	0.2
Acenaphthylene	0.1	0.044	0.64	1.9	NRC	0.3	0.2	7.3	2.1	9.3	5.5	22	6.7	12	7.5	10	7.7	23	3.7
Anthracene	0.1	0.085	1.1	0.5	NRC	0.1	0.1	1.3	0.4	5.6	3.3	17	5.2	6.6	4.1	11	8.5	5.5	0.9
Benz(a)anthracene	0.1	0.261	1.6	2.8	NRC	0.5	0.4	4.9	1.4	19	11.2	29	8.8	18	11.3	16	12.3	31	5.0
Benzo(a) pyrene	0.05	0.43	1.6	5.8	NRC	1	0.7	23	6.8	24	14.1	43	13.0	26	16.3	19	14.6	56	9.0
Benzo(b)&(k)fluoranthene	0.2	-	-	6.9	NRC	1.4	1.0	24	7.1	28	16.5	48	14.5	30	18.8	22	16.9	64	10.3
Benzo(g,h,i)perylene	0.1	-	-	1.8	NRC	0.4	0.3	5.7	1.7	6.8	4.0	13	3.9	7.4	4.6	5.5	4.2	15	2.4
Chrysene	0.1	0.384	2.8	2.4	NRC	0.4	0.3	3.5	1.0	18	10.6	24	7.3	18	11.3	14	10.8	29	4.7
Dibenz(a,h)anthracene	0.1	0.063	0.26	0.4	NRC	<0.1	NRC	1.6	0.5	1.5	0.9	1.8	0.5	1.6	1.0	1.2	0.9	3.8	0.6
Fluoranthene	0.1	0.6	5.1	3.6	NRC	0.6	0.4	5.4	1.6	28	16.5	60	18.2	31	19.4	31	23.8	50	8.1
Fluorene	0.1	0.19	0.54	<0.1	NRC	<0.1	NRC	<0.2	NRC	0.2	0.1	9.4	2.8	2	1.3	4.4	3.4	1.4	0.2
Indeno(1,2,3-c,d)pyrene	0.1	-	-	2.5	NRC	0.5	0.4	8.5	2.5	10	5.9	15	4.5	11	6.9	8.3	6.4	25	4.0
Naphthalene	0.1	0.16	2.1	0.3	NRC	<0.1	NRC	0.9	0.3	1.9	1.1	39	11.8	4.7	2.9	6.3	4.8	3.7	0.6
Phenanthrene	0.1	0.24	1.5	0.7	NRC	0.2	0.1	1.4	0.4	7.8	4.6	30	9.1	8.9	5.6	27	20.8	7.5	1.2
Pyrene	0.1	0.665	2.6	6.6	NRC	1.3	0.9	41	12.1	39	22.9	65	19.7	33	20.6	31	23.8	65	10.5
Low Molecular Weight PAHs (Sum)[2]		0.552	3.16	3.4	NRC	0.6	0.4	11.2	3.3	25.4	14.9	121.8	36.9	35.5	22.2	60.6	46.6	42.3	6.8
High Molecular Weight PAHs (Sum)[3]		1.7	9.6	21.6	NRC	3.8	2.7	79.4	23.4	129.5	76.2	222.8	67.5	127.6	79.8	112.2	86.3	234.8	37.9
PAHs (Sum of total)		4	45	36.2	NRC	6.7	4.8	128.8	37.9	199.7	117.5	420.6	127.5	211.5	132.2	208.6	160.5	381.1	61.5
Metals																			
Arsenic	4	20	70	6		10		18		12		13		15		14		13	
Cadmium	0.5	1.5	10	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5	
Chromium (III+VI)	1	80	370	15		49		160		65		20		19		20		52	
Copper	1	65	270	12		41		51		20		72		89		100		76	
Lead	1	50	220	22		66		91		54		66		97		78		100	
Mercury	0.1	0.15	1	<0.1		0.3		0.5		0.2		0.3		0.8		2.1		0.6	
Nickel	1	21	52	3		8		40		17		13		11		12		14	
Zinc	1	200	410	55		170		440		180		300		200		210		250	
Additional Analyses																			
Total Cyanide	0.5	-	-	<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5		<0.5	
Total Organic Carbon	100	-	-	2600		14000		34000		17000		33000		16000		13000		62000	
Total Organic Carbon %	0.01	-	-	0.26		1.4		3.4		1.7		3.3		1.6		1.3		6.2	
Moisture	0.1	-	-	23		33		39		38		36		34		32		38	

NOTES:
465 Concentrations greater than adopted investigation criteria
Investigation Criteria shown in Red - High level Interim Sediment Quality Guidelines (ISQGs, ANZECC&ARMCANZ 2000)
All concentrations are in mg/kg
1 - Low molecular weight PAHs are the sum of concentrations of acenaphthene, acenaphthalene, anthracene, fluorene, 2-methylnaphthalene, naphthalene and phenanthrene
2 -High molecular weight PAHs are the sum of concentrations of benzo(a)anthracene,benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and pyrene.
EQL - laboratory Estimated Quantitation Limit
"-" indicates that the criteria is not applicable for these analytes
< Value = Concentration less than laboratory EQL
NC - Non Calculable
NA - Not Analysed
NRC - No Required Correction for TOC
mBSWI - metres below sediment/water interface
Intra Dup - Intra-laboratory duplicate sample
Inter Dup - Inter-laboratory duplicate sample

TABLE D - Analytical Summary
Additional Sediment Investigation - Kendall Bay Remediation Project

		Reference	94013	94013	94013	94013	94013	94013	94013	94013	94013	94385	94385	94385	94385	94385	94385	93942	93942	93942	93942	93942
		Sample	SS01 A	SS01 B	SS01 C	SS02 A	SS02 B	SS02 C	SS03 A	SS03 B	SS03 C	SS04 A	SS04 B	SS04 C	SS06 A	SS06 B	SS06 C	SS14 A	SS14 B	SS14 C	SS15 A	SS15 B
		Depth	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6
		Date Sampled	17/7/13	17/7/13	17/7/13	17/7/13	17/7/13	17/7/13	17/7/13	17/7/13	17/7/13	19/7/13	19/7/13	19/7/13	22/7/13	22/7/13	22/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13
		Type of sample	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Total Organic Carbon	mg/kg	100	1200	3000	3400	18000	41000	38000	22000	51000	76000	370000	75000	88000	18000	11000	5700	32000	49000	49000	15000	20000
Moisture	%	0.1	7.9	18	26	24	53	30	23	49	60	39	71	70	39	31	21	52	39	46	38	36
Arsenic	mg/kg	4	<4	<4	7	7	19	15	10	19	42	15	40	40	17	20	12	25	13	20	14	10
Cadmium	mg/kg	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.8	0.8	0.7	1	1	<0.4	<0.4	<0.4	0.6	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	1	3	6	28	32	140	28	90	120	160	230	320	360	25	14	7	300	110	99	110	77
Copper	mg/kg	1	2	4	13	9	140	28	22	58	83	47	140	130	16	6	2	72	24	59	44	30
Lead	mg/kg	1	6	9	26	27	72	66	62	99	130	92	250	230	25	10	4	130	60	130	96	67
Mercury	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	0.6	0.3	0.2	0.5	0.5	0.5	1.5	1.3	0.2	<0.1	<0.1	0.6	0.3	1	0.3	0.2
Nickel	mg/kg	1	2	2	15	8	75	20	33	320	340	84	53	91	7	5	2	77	260	45	33	44
Zinc	mg/kg	1	14	19	81	65	300	190	400	870	3200	440	510	470	61	24	7	520	190	290	480	920
Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.6	<0.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.5	<1.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<3	<3	<1	<1	<1	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<6	<6	<2	<2	<2	<2	<2	<2	<2	<2
o-Xylene	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<3	<3	<1	<1	<1	<1	<1	<1	<1	<1
Total Xylene	mg/kg	3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<9	<9	<3	<3	<3	<3	<3	<3	<3	<3
naphthalene	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<3	<3	<1	<1	<1	<1	<1	<1	<1	<1
TRH C_6 - C_9	mg/kg	25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<75	<75	<25	<25	<25	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<75	<75	<25	<25	<25	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} (less BTEX F1)	mg/kg	25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	NA*	NA*	<25	<25	<25	<25	<25	<25	<25	<25
TRH C_{10} - C_{14}	mg/kg	50	<50	<50	<50	<50	90	<50	<50	270	360	68	220	230	<50	<50	<50	72	130	110	<50	<50
TRH C_{15} - C_{28}	mg/kg	100	<100	<100	380	1500	3200	890	380	8500	10000	2200	4800	2900	<100	<100	<100	1700	2300	2800	690	1300
TRH C_{29} - C_{36}	mg/kg	100	<100	<100	280	940	1800	610	350	3300	5000	1200	2000	1800	<100	<100	<100	710	960	1500	440	600
Sum C_{10} - C_{35}	mg/kg	/	<250	<250	660	2440	5090	1500	730	12070	15360	3468	7020	4930	<250	<250	<250	2482	3390	4410	1130	1900
TRH >C_{10} - C_{16} less Napthalene (F2)	mg/kg	50	<50	<50	<50	120	270	61	<50	920	990	200	NA*	NA*	<50	<50	<50	200	300	300	52	120
TRH >C_{10}-C_{16}	mg/kg	50	<50	<50	<50	120	270	61	<50	920	990	200	620	370	<50	<50	<50	200	300	300	52	120
TRH >C_{16}-C_{34}	mg/kg	100	<100	140	590	2200	4400	1300	630	11000	14000	3000	6000	4000	<100	<100	<100	2100	2900	3800	1000	1700
TRH >C_{34}-C_{40}	mg/kg	100	<100	<100	<100	400	850	290	200	1500	2200	450	600	1100	<100	<100	<100	200	320	510	110	160
Sum C_{10} - C_{40}	mg/kg	/	<250	140	590	2720	5520	1651	830	13420	17190	3650	7220	5470	<250	<250	<250	2500	3520	4610	1162	1980
Naphthalene	mg/kg	0.1	<0.1	0.1	0.3	1.9	1.5	0.5	0.5	2.2	3.2	4	0.6	0.4	<0.1	<0.1	<0.1	1.2	2.6	7.7	0.8	0.7
Acenaphthylene	mg/kg	0.1	<0.1	0.9	1.9	11	12	2.7	2	26	21	17	4	2.7	<0.1	0.1	0.1	6.1	6	12	4.3	5.3
Acenaphthene	mg/kg	0.1	<0.1	<0.1	<0.1	0.6	0.7	0.2	0.2	5.6	1.1	1.6	0.4	0.2	<0.1	<0.1	<0.1	0.5	1.5	3.7	0.3	0.4
Fluorene	mg/kg	0.1	<0.1	0.1	0.3	1.6	2.4	0.5	0.4	5.5	4.2	4.1	0.9	0.4	<0.1	<0.1	0.2	1	1.2	2.5	0.8	0.8
Phenanthrene	mg/kg	0.1	<0.1	0.2	0.5	2.8	5.2	1.4	1.1	12	11	7.6	1.2	1	<0.1	0.1	0.5	3.1	6.6	5.3	1.9	2.4
Anthracene	mg/kg	0.1	<0.1	0.1	0.4	1.8	5.5	1.4	0.6	18	11	4.6	1.7	1.1	<0.1	<0.1	0.2	2	5.9	21	1.1	2.1
Fluoranthene	mg/kg	0.1	<0.1	1.1	2.1	19	51	11	3.4	150	100	36	20	15	0.2	0.2	0.2	22	33	89	7.8	26
Pyrene	mg/kg	0.1	0.2	2.1	4.8	25	61	13	7.6	170	130	89	62	20	0.4	0.3	0.3	31	34	90	14	32
Benzo(a)anthracene	mg/kg	0.1	<0.1	0.6	1.6	10	16	4.7	1.8	65	19	18	16	7.2	0.1	0.1	0.1	7.6	15	33	4.3	8.9
Chrysene	mg/kg	0.1	<0.1	0.6	1.7	11	19	5.3	1.7	61	18	18	19	9.2	0.2	0.1	0.1	5.7	14	34	4.8	9.1
Benzo(b+k)fluoranthene	mg/kg	0.2	<0.2	2	6.4	26	34	13	6.1	77	79	49	29	11	0.4	0.4	<0.2	19	17	51	12	17
Benzo(a)pyrene	mg/kg	0.05	0.12	1.5	5.3	22	30	9.4	4.9	69	67	43	25	9.1	0.28	0.3	0.08	14	13	39	9.2	14
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	<0.1	0.9	3	11	14	5.9	2.7	31	35	14	9.8	3.1	0.1	0.1	<0.1	6.4	5.8	22	3.8	5.3
Dibenzo(a,h)anthracene	mg/kg	0.1	<0.1	0.2	0.7	2.9	3.8	1.2	0.6	7.8	8.2	4.2	2.8	0.9	<0.1	<0.1	<0.1	2	1.6	4.6	1.3	1.9
Benzo(g,h,i)perylene	mg/kg	0.1	<0.1	0.7	2.5	8.9	11	4.7	2.1	21	28	13	9.5	3	0.1	0.1	<0.1	6.5	5.7	18	3.8	4.8
Total +ve PAHs	mg/kg		0.28	11	32	160	270	75	36	720	540	320	200	84	1.8	1.9	1.8	130	160	430	70	130
Benzo(a)pyrene TEQ	mg/kg	0.5	<0.5	2	7	29	40	13	7	95	89	55	34	12	<0.5	<0.5	<0.5	19	18	55	13	19

Notes	
	TRH_S (SEMI VOL): PQL has been raised due to the high moisture content in the sample/s, resulting in a high dilution factor.
NA*	Total Recoverable Hydrocarbons in soil (NEPM):# Percent recovery is not possible to report as the high concentration of analytes in the sample/s have caused interference.
NIL (+) VE	NIL positive PAHs recorded
NT	Not Tested / Not Part of Sampling Suite

Analytical Summary
Sediment Investigation - Kendall Bay Remediation Project

		Reference	93942	93942	93942	94013	93942	93942	93942	93942	93942	93942	93942	93942	93942	93942	93942	93942	93942	93942	93942	93942
		Sample	SS15 C	SS16 A	SS16 B	SS16 C	SS17 A	SS17 B	SS17 C	SS18 A	SS18 B	SS18 C	SS19 A	SS19 B	SS19 C	SS20 A	SS20 B	SS20 C	SS21 A	SS21 B	SS21 C	SS22 A	SS22 B
		Depth	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6
		Date Sampled	12/7/13	12/7/13	12/7/13	17/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13	12/7/13
		Type of sample	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Total Organic Carbon	mg/kg	100	30000	8600	11000	40000	13000	9300	7600	7400	57000	50000	1200	29000	24000	<1000	<1000	12000	1600	1800	17000	1200	5600
Moisture	%	0.1	30	8.7	22	37	13	23	23	25	53	53	5.8	36	35	5	6.1	25	7.5	7.2	27	9.3	18
Arsenic	mg/kg	4	10	14	8	17	9	7	7	5	32	25	<4	7	6	<4	<4	6	<4	<4	6	<4	4
Cadmium	mg/kg	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.8	0.6	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	1	67	93	77	54	48	71	57	27	210	150	4	42	39	4	6	25	4	7	21	3	12
Copper	mg/kg	1	26	29	26	62	16	21	25	9	67	54	2	17	14	2	2	13	2	4	9	2	6
Lead	mg/kg	1	53	53	67	40	63	30	48	22	150	140	6	54	33	8	6	29	8	10	29	5	16
Mercury	mg/kg	0.1	0.2	<0.1	0.4	0.3	0.2	0.1	0.2	<0.1	0.7	0.6	<0.1	0.6	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
Nickel	mg/kg	1	36	32	25	53	15	22	24	9	68	52	1	11	16	2	2	9	2	3	7	<1	3
Zinc	mg/kg	1	530	150	160	52	88	430	190	150	930	350	17	75	180	16	16	88	16	21	60	10	32
Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
o-Xylene	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Xylene	mg/kg	3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
naphthalene	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
TRH C_6 - C_9	mg/kg	25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} (less BTEX F1)	mg/kg	25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH C_{10} - C_{14}	mg/kg	50	<50	<50	<50	<50	<50	<50	<50	<50	120	180	<50	78	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	100	1000	210	860	1200	1100	510	180	390	4000	4800	<100	2600	970	<100	<100	820	<100	<100	460	<100	<100
TRH C_{29} - C_{36}	mg/kg	100	520	130	460	880	680	360	130	250	1800	2300	<100	1800	570	<100	<100	540	<100	<100	300	<100	<100
Sum C_{10} - C_{35}	mg/kg	/	1520	340	1320	2080	1780	870	310	640	5920	7280	<250	4478	1540	<250	<250	1360	<250	<250	760	<250	<250
TRH >C_{10} - C_{16} less Napthalene (F2)	mg/kg	50	84	<50	55	87	86	<50	<50	<50	350	450	<50	190	81	<50	<50	<50	<50	<50	<50	<50	<50
TRH >C_{10}-C_{16}	mg/kg	50	84	<50	55	87	86	<50	<50	<50	350	450	<50	190	81	<50	<50	<50	<50	<50	<50	<50	<50
TRH >C_{16}-C_{34}	mg/kg	100	1400	300	1200	1800	1600	750	280	560	5200	6400	<100	3900	1400	<100	<100	1200	<100	<100	680	<100	130
TRH >C_{34}-C_{40}	mg/kg	100	120	<100	110	450	210	120	<100	<100	590	760	<100	560	160	<100	<100	170	<100	<100	<100	<100	<100
Sum C_{10} - C_{40}	mg/kg	/	1604	300	1365	2337	1896	870	280	560	6140	7610	<250	4650	1641	<250	<250	1370	<250	<250	680	<250	130
Naphthalene	mg/kg	0.1	0.7	0.4	1.7	1	2.1	1	0.5	0.6	5.1	3	<0.1	3.2	1.6	<0.1	<0.1	0.7	<0.1	0.1	0.8	<0.1	<0.1
Acenaphthylene	mg/kg	0.1	3.5	1.9	6.1	2.7	6.7	4.4	2	2.5	16	13	<0.1	9.7	5.2	<0.1	0.1	3.1	<0.1	0.5	3.2	<0.1	0.5
Acenaphthene	mg/kg	0.1	0.3	0.1	0.6	0.4	0.5	0.2	0.1	0.1	1.8	1.6	<0.1	1.1	0.6	<0.1	<0.1	1.2	<0.1	<0.1	0.1	<0.1	<0.1
Fluorene	mg/kg	0.1	0.6	0.3	5.1	0.9	1.3	0.7	0.4	0.5	3.4	2.3	<0.1	2.5	1.6	<0.1	<0.1	0.8	<0.1	<0.1	0.6	<0.1	<0.1
Phenanthrene	mg/kg	0.1	1.7	0.9	32	4.5	4.2	1.5	1.8	1.2	7.1	4.8	<0.1	15	8	<0.1	<0.1	5.8	<0.1	0.2	2.7	<0.1	0.3
Anthracene	mg/kg	0.1	1.4	0.5	10	2.4	2.2	0.8	1	0.7	8.4	7.3	<0.1	7	3.7	<0.1	<0.1	3	<0.1	0.1	0.9	<0.1	0.1
Fluoranthene	mg/kg	0.1	18	3	29	15	13	5	4.9	3.5	79	90	0.1	39	17	<0.1	0.2	15	<0.1	0.7	5.6	<0.1	1
Pyrene	mg/kg	0.1	21	5.2	27	16	21	8.7	6.7	8.2	130	130	0.2	51	21	<0.1	0.3	19	<0.1	1.1	8.2	<0.1	1.5
Benzo(a)anthracene	mg/kg	0.1	4.6	1.4	16	4.7	8.3	4.9	3.8	2.3	18	9.7	<0.1	23	9.7	<0.1	0.1	9.2	<0.1	0.5	4	<0.1	0.7
Chrysene	mg/kg	0.1	4.3	1.6	14	4.9	9.1	5	3.8	2.7	16	7.8	<0.1	22	9.1	<0.1	0.2	8.4	<0.1	0.5	4.1	<0.1	0.7
Benzo(b+k)fluoranthene	mg/kg	0.2	13	3.9	23	16	20	10	7.9	7.2	60	60	<0.2	45	18	<0.2	0.3	17	<0.2	1.3	11	<0.2	2
Benzo(a)pyrene	mg/kg	0.05	10	2.9	16	12	16	7.3	5.8	5.6	51	50	0.08	31	14	<0.05	0.22	13	0.06	0.92	8.2	<0.05	1.5
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	4.2	1.2	7.7	7.5	7.1	3.6	2.7	2.2	23	22	<0.1	14	7.2	<0.1	0.1	6.7	<0.1	0.6	5.3	<0.1	1
Dibenzo(a,h)anthracene	mg/kg	0.1	1.4	0.4	2.2	1.8	2.2	1.2	0.9	0.8	4.7	5.2	<0.1	3.8	2	<0.1	<0.1	1.7	<0.1	0.1	1	<0.1	0.2
Benzo(g,h,i)perylene	mg/kg	0.1	4.1	1.2	7.1	5.9	6.9	3.4	2.7	2.1	17	17	<0.1	13	7	<0.1	0.1	6.3	<0.1	0.5	4.3	<0.1	0.8
Total +ve PAHs	mg/kg		90	25	200	96	120	58	45	40	440	430	0.35	280	130	NIL (+)VE	1.7	110	0.06	7.4	60	NIL (+)VE	11
Benzo(a)pyrene TEQ	mg/kg	0.5	14	4	23	17	22	10	8	8	66	65	<0.5	44	19	<0.5	<0.5	18	<0.5	1	11	<0.5	2

Notes	
	TRH_S (SEMI VOL): PQL has been r
NA*	Total Recoverable Hydrocarbons i
NIL (+) VE	NIL positive PAHs recorded
NT	Not Tested / Not Part of Sampling

Analytical Summary
Sediment Investigation - Kendall Bay Remediation Project

		Reference	93942	93942	93942	93942	94385	94385	94385	93942	93942	93942	94385	94385	94385	93942	93942	93942	94013	94013	94013	94385	94385
		Sample	SS22 C	SS23 A	SS23 B	SS23 C	SS24 A	SS24 B	SS24 C	SS25 A	SS25 B	SS25 C	SS26 A	SS26 B	SS26 C	DUP A	DUP B	DUP C	DUP D	TB	TS	Trip Blank	Trip Spike
		Depth	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	0.0 - 0.1	0.5 - 0.6	1.0 - 1.1	SS21B	SS14C	SS25B	SS03B	/	/	/	/
		Date Sampled	12/7/13	12/7/13	12/7/13	12/7/13	18/7/13	18/7/13	18/7/13	12/7/13	12/7/13	12/7/13	22/7/13	22/7/13	22/7/13	12/7/13	12/7/13	12/7/13	17/7/13	17/7/13	17/7/13	18/7/13	18/7/13
		Type of sample	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Total Organic Carbon	mg/kg	100	5600	1600	2200	1800	29000	14000	9200	6800	4700	5900	8300	7200	11000	NT	NT	NT	NT	NT	NT	NT	NT
Moisture	%	0.1	22	13	19	18	25	26	28	23	21	23	27	30	29	11	46	23	52	NT	NT	NT	NT
Arsenic	mg/kg	4	5	<4	<4	<4	11	15	20	<4	5	5	10	10	12	<4	20	5	25	NT	NT	NT	NT
Cadmium	mg/kg	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	1.2	NT	NT	NT	NT
Chromium	mg/kg	1	13	4	8	5	26	12	12	13	20	24	10	11	11	6	100	19	140	NT	NT	NT	NT
Copper	mg/kg	1	8	2	5	4	22	6	3	5	7	6	4	4	5	3	61	6	54	NT	NT	NT	NT
Lead	mg/kg	1	21	8	13	9	33	11	6	13	16	17	7	7	10	9	130	16	120	NT	NT	NT	NT
Mercury	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	1	<0.1	0.5	NT	NT	NT	NT
Nickel	mg/kg	1	4	2	3	2	6	4	4	4	5	5	4	4	4	2	50	5	340	NT	NT	NT	NT
Zinc	mg/kg	1	43	14	40	21	80	26	12	41	49	56	18	16	24	18	300	48	1400	NT	NT	NT	NT
Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	113%	<0.2	101%
Toluene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	113%	<0.5	101%
Ethylbenzene	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	115%	<1	100%
m+p-xylene	mg/kg	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	87%	<2	100%
o-Xylene	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	115%	<1	101%
Total Xylene	mg/kg	3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	NT	<3	NT
naphthalene	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NT	NT	NT	NT
TRH C_6 - C_9	mg/kg	25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	NT	NT	NT	NT
TRH C_6 - C_{10}	mg/kg	25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	NT	NT	NT	NT
vTPH C_6 - C_{10} (less BTEX F1)	mg/kg	25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	NT	NT	NT	NT
TRH C_{10} - C_{14}	mg/kg	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	130	<50	170	NT	NT	NT	NT
TRH C_{15} - C_{28}	mg/kg	100	310	<100	<100	<100	330	<100	<100	670	320	320	<100	<100	<100	<100	2500	190	6500	NT	NT	NT	NT
TRH C_{29} - C_{36}	mg/kg	100	200	<100	<100	<100	250	<100	<100	320	180	200	<100	<100	<100	<100	1100	130	3300	NT	NT	NT	NT
Sum C_{10} - C_{35}	mg/kg	/	510	<250	<250	<250	580	<250	<250	990	500	520	<250	<250	<250	<250	3730	320	9970	NT	NT	NT	NT
TRH >C_{10} - C_{16} less Napthalene (F2)	mg/kg	50	<50	<50	<50	<50	<50	<50	<50	55	<50	<50	<50	<50	<50	<50	300	<50	540	NT	NT	NT	NT
TRH >C_{10}-C_{16}	mg/kg	50	<50	<50	<50	<50	<50	<50	<50	55	<50	<50	<50	<50	<50	<50	300	<50	540	NT	NT	NT	NT
TRH >C_{16}-C_{34}	mg/kg	100	470	<100	<100	<100	510	<100	<100	900	450	470	<100	<100	<100	<100	3200	280	8800	NT	NT	NT	NT
TRH >C_{34}-C_{40}	mg/kg	100	<100	<100	<100	<100	120	<100	<100	<100	<100	<100	<100	<100	<100	<100	280	<100	1500	NT	NT	NT	NT
Sum C_{10} - C_{40}	mg/kg	/	470	<250	<250	<250	630	<250	<250	955	450	470	<250	<250	<250	<250	3780	280	10840	NT	NT	NT	NT
Naphthalene	mg/kg	0.1	0.3	0.1	0.1	<0.1	0.2	<0.1	<0.1	0.9	0.5	0.6	<0.1	<0.1	<0.1	<0.1	2	0.2	1.1	NT	NT	NT	NT
Acenaphthylene	mg/kg	0.1	2.3	0.3	0.6	0.3	1.5	0.1	<0.1	5.1	2.6	2.2	0.1	<0.1	<0.1	0.3	8.3	1.3	13	NT	NT	NT	NT
Acenaphthene	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.2	0.1	<0.1	<0.1	<0.1	<0.1	1.6	<0.1	1.5	NT	NT	NT	NT
Fluorene	mg/kg	0.1	0.3	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	0.8	0.3	0.3	0.2	<0.1	<0.1	<0.1	1.9	0.2	2.9	NT	NT	NT	NT
Phenanthrene	mg/kg	0.1	1	0.1	0.2	0.1	1	<0.1	<0.1	1.4	0.9	0.7	0.6	<0.1	<0.1	<0.1	5.2	0.4	4.3	NT	NT	NT	NT
Anthracene	mg/kg	0.1	0.5	<0.1	0.1	<0.1	0.6	<0.1	<0.1	1	0.5	0.5	0.2	<0.1	<0.1	<0.1	7.8	0.3	4.8	NT	NT	NT	NT
Fluoranthene	mg/kg	0.1	5.8	0.6	0.8	0.6	4	0.3	<0.1	9.7	3.7	3.3	0.3	0.1	0.1	0.3	46	2	71	NT	NT	NT	NT
Pyrene	mg/kg	0.1	9	1.1	1.4	1	7.6	1.5	<0.1	16	6.8	6.2	0.4	0.2	0.2	0.5	52	4.1	86	NT	NT	NT	NT
Benzo(a)anthracene	mg/kg	0.1	2.9	0.5	0.7	0.5	2.8	0.2	<0.1	6	2.1	1.9	0.2	0.1	0.1	0.2	19	1.3	39	NT	NT	NT	NT
Chrysene	mg/kg	0.1	4	0.4	0.7	0.5	2.8	0.2	<0.1	6	2	1.7	0.2	0.1	0.2	0.2	19	1.2	35	NT	NT	NT	NT
Benzo(b+k)fluoranthene	mg/kg	0.2	8.5	1.1	1.7	1.2	8	0.9	<0.2	13	6.2	6.3	0.2	0.2	0.6	0.7	28	3.9	45	NT	NT	NT	NT
Benzo(a)pyrene	mg/kg	0.05	6.6	0.83	1.4	0.86	6.3	0.66	<0.05	11	5.1	5.4	0.19	0.17	0.41	0.48	23	3.3	37	NT	NT	NT	NT
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	4.1	0.5	0.8	0.5	2.8	0.2	<0.1	5.6	2.8	3.2	<0.1	<0.1	0.2	0.3	12	1.8	15	NT	NT	NT	NT
Dibenzo(a,h)anthracene	mg/kg	0.1	0.8	0.1	0.2	0.1	0.7	<0.1	<0.1	1.4	0.6	0.5	<0.1	<0.1	<0.1	<0.1	3	0.4	4.8	NT	NT	NT	NT
Benzo(g,h,i)perylene	mg/kg	0.1	3.3	0.4	0.7	0.4	2.5	0.2	<0.1	4.5	2.2	2.5	<0.1	<0.1	0.2	0.3	9.6	1.4	12	NT	NT	NT	NT
Total +ve PAHs	mg/kg		49	6.1	9.5	6.1	41	4.3	NIL (+)VE	83	37	35	2.6	1	2.1	3.2	240	22	370	NT	NT	NT	NT
Benzo(a)pyrene TEQ	mg/kg	0.5	9	1	2	1	8	1	<0.5	15	7	7	<0.5	<0.5	1	1	32	4	52	NT	NT	NT	NT

Notes

	TRH_S (SEMI VOL): PQL has been r
NA*	Total Recoverable Hydrocarbons i
NIL (+) VE	NIL positive PAHs recorded
NT	Not Tested / Not Part of Sampling

Analytical Summary
Sediment Investigation - Kendall Bay Remediation Project

		Reference Sample Depth Date Sampled Type of sample	93942 Trip Blank / 12/7/13 Sediment	93942 Trip Spike / 12/7/13 Sediment
Total Organic Carbon	mg/kg	100	NT	NT
Moisture	%	0.1	NT	NT
Arsenic	mg/kg	4	NT	NT
Cadmium	mg/kg	0.4	NT	NT
Chromium	mg/kg	1	NT	NT
Copper	mg/kg	1	NT	NT
Lead	mg/kg	1	NT	NT
Mercury	mg/kg	0.1	NT	NT
Nickel	mg/kg	1	NT	NT
Zinc	mg/kg	1	NT	NT
Benzene	mg/kg	0.2	<0.2	95%
Toluene	mg/kg	0.5	<0.5	95%
Ethylbenzene	mg/kg	1	<1	94%
m+p-xylene	mg/kg	2	<2	94%
o-Xylene	mg/kg	1	<1	94%
Total Xylene	mg/kg	3	<3	NT
naphthalene	mg/kg	1	NT	NT
TRH C_6 - C_9	mg/kg	25	NT	NT
TRH C_6 - C_{10}	mg/kg	25	NT	NT
vTPH C_6 - C_{10} (less BTEX F1)	mg/kg	25	NT	NT
TRH C_{10} - C_{14}	mg/kg	50	NT	NT
TRH C_{15} - C_{28}	mg/kg	100	NT	NT
TRH C_{29} - C_{36}	mg/kg	100	NT	NT
Sum C_{10} - C_{35}	mg/kg	/	NT	NT
TRH >C_{10} - C_{16} less Napthalene (F2)	mg/kg	50	NT	NT
TRH >C_{10}-C_{16}	mg/kg	50	NT	NT
TRH >C_{16}-C_{34}	mg/kg	100	NT	NT
TRH >C_{34}-C_{40}	mg/kg	100	NT	NT
Sum C_{10} - C_{40}	mg/kg	/	NT	NT
Naphthalene	mg/kg	0.1	NT	NT
Acenaphthylene	mg/kg	0.1	NT	NT
Acenaphthene	mg/kg	0.1	NT	NT
Fluorene	mg/kg	0.1	NT	NT
Phenanthrene	mg/kg	0.1	NT	NT
Anthracene	mg/kg	0.1	NT	NT
Fluoranthene	mg/kg	0.1	NT	NT
Pyrene	mg/kg	0.1	NT	NT
Benzo(a)anthracene	mg/kg	0.1	NT	NT
Chrysene	mg/kg	0.1	NT	NT
Benzo(b+k)fluoranthene	mg/kg	0.2	NT	NT
Benzo(a)pyrene	mg/kg	0.05	NT	NT
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	NT	NT
Dibenzo(a,h)anthracene	mg/kg	0.1	NT	NT
Benzo(g,h,i)perylene	mg/kg	0.1	NT	NT
Total +ve PAHs	mg/kg		NT	NT
Benzo(a)pyrene TEQ	mg/kg	0.5	NT	NT

Notes	
	TRH_S (SEMI VOL): PQL has been r
NA*	Total Recoverable Hydrocarbons i
NIL (+) VE	NIL positive PAHs recorded
NT	Not Tested / Not Part of Sampling

Table 5.1 Range of PAHs in Water, Kendall Bay and Background Areas, January 2016

Location	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Total Positive PAHs
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Assessment Criteria	70	NA	NA	NA	2	0.4	1.4	NA	NA	NA	NA	0.2	NA	NA	NA	NA
PQL	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	
Kendall Bay Area B	<0.02-0.09	<0.01	<0.01	<0.01	<0.02-<0.03	<0.01	<0.01-0.03	<0.01-0.02	<0.01	<0.01	<0.02	<0.01-0.01	<0.01	<0.01	<0.01	NIL – 0.14
Kendall Bay Area A	<0.02-0.02	<0.01-0.02	<0.01	<0.01	<0.02-0.06	<0.01	<0.01-0.14	<0.01-0.15	<0.01-0.07	<0.01-0.1	<0.02-0.2	<0.01-0.12	<0.01-0.02	<0.01-0.09	<0.01-0.09	NIL – 1.1
Kendall Bay Background	<0.02-0.09	<0.01-0.02	<0.01	<0.01	<0.02	<0.01	<0.01-0.02	<0.01-0.05	<0.01-0.01	<0.01-0.02	<0.02-0.06	<0.01-0.04	<0.01	<0.01-0.02	<0.01-0.02	NIL – 0.26
Exile Bay Background	<0.02	<0.02-0.03	0.01-0.02	<0.01	<0.02-<0.03	<0.01	<0.05-0.09	<0.08-0.11	<0.01-0.02	0.2	0.06	0.04	<0.01	0.02	0.02	NIL - 0.43
Majors Bay Background	<0.02	<0.01	<0.01	<0.01-0.02	<0.02-0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	NIL – 0.06

NA: No criteria available

Table 5.2 Range of PAHs in Water, Kendall Bay and Background Areas, April 2016

Location	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Total Positive PAHs
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Assessment Criteria	70	NA	NA	NA	2	0.4	1.4	NA	NA	NA	NA	0.2	NA	NA	NA	NA
PQL	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	
Kendall Bay Area B	<0.02	<0.01	<0.01	<0.01	<0.03-<0.3	<0.01	<0.01-0.01	<0.01-0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	NIL – 0.02
Kendall Bay Area A	<0.02	<0.01	<0.01	<0.01	<0.03-<0.0.05	<0.01	<0.01-0.12	<0.01-0.23	<0.01-0.07	<0.01-0.06	<0.02-0.22	<0.01-0.16	<0.01-0.02	<0.01-0.07	<0.01-0.07	NIL – 1.2
Kendall Bay Background	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	NIL
Exile Bay Background	<0.02	<0.01	0.01	<0.01	<0.03-<0.3	<0.01	0.02	<0.02	<0.01-0.02	<0.01-0.01	0.02-0.03	0.02	<0.01	0.01	0.01-0.02	0.11-0.14
Majors Bay Background	<0.02	<0.01	<0.01	<0.01	<0.03	<0.01	0.01	0.01-0.02	<0.01	<0.01	<0.02-0.03	<0.01-0.02	<0.01	<0.01-0.01	<0.01-0.02	0.02-0.14

NA: No criteria available

Table 5.3 Range of Dissolved Metals in Water, Kendall Bay and Background Areas, January 2016

	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
PQL	1	0.1	1	1	1	0.05	1	1
Assessment Criteria	2.3	0.7	27	1.3	4.4	0.1	7	15
Kendall Bay Area B	2	<0.1	<1	**2**	<1	<0.05	<1	<1-2
Kendall Bay Area A	2	<0.1	<1	**2-3**	<1	<0.05	<1	<1-1
Kendall Bay Background	2	<0.1	<1	**2-3**	<1	<0.05	<1	<1-1
Exile Bay Background	2	<0.1	<1	**2-3**	<1	<0.05	<1	<1
Majors Bay Background	2-**3**	<0.1	<1-5	**2-6**	<1-**7**	<0.05-0.08	1-2	<1-**16**

Note: Results that exceed the Assessment Criteria are in bold.

Table 5.4 Range of Dissolved Metals in Water, Kendall Bay and Background Areas, April 2016

	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
PQL	1	0.1	1	1	1	0.05	1	1
Assessment Criteria	2.3	0.7	27	1.3	4.4	0.1	7	15
Kendall Bay Area B	2	<0.1	<1	**2-5**	<1-2	<0.05	<1-2	6-**17**
Kendall Bay Area A	2	<0.1	<1	**2-6**	<1	<0.05	<1-2	6-11
Kendall Bay Background	2	<0.1	<1	**5-11**	<1	<0.05	1	7-8
Exile Bay Background	2	<0.1	<1	**3-8**	<1	<0.05	<1-2	6-8
Majors Bay Background	2	<0.1	<1	**1-2**	<1	<0.05	<1	6

Note: Results that exceed the Assessment Criteria are in bold.

Table 5.5 Range of Nutrients and Other Parameters in Water, Kendall Bay and Background Areas, January 2016

	TSS	pH	Conductivity	Total P	Phosphate P	Total N	NOx as N	Ammonia as N
Units	mg/L	pH units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L
PQL	0.05	0.1	1	0.05	0.005	0.1	0.005	0.005
Assessment Criteria	-	7-8.5	-	0.03	0.03?	0.3	0.015	0.9
Kendall Bay Area B	8-14	8-8.2	43,000-47,000	<0.05	0.007-0.009	<0.1	<0.005-0.007	<0.005
Kendall Bay Area A	9-11	8.2	43,000-44,000	<0.05-0.05	0.008-0.01	<0.1	<0.005	<0.005
Kendall Bay Background	<5-19	8.1-8.2	42,000-44,000	<0.05	0.006-0.007	<0.1	<0.005	<0.005
Exile Bay Background	6-9	8.2	44,000-45,000	<0.05	<0.005-0.008	<0.1	<0.005	<0.005
Majors Bay Background	10-92	8.2-8.3	40,000-41,000	<0.05-0.06	0.009-0.017	<0.1	<0.005	<0.005

TSS: Total suspended solids

Note: Results that exceed the Assessment Criteria are in bold.

Table 5.6 Range of Nutrients and Other Parameters in Water, Kendall Bay and Background Areas, April 2016

	TSS	pH	Conductivity	Total P	Phosphate P	Total N	Nitrate as N	Nitrite as N	Ammonia as N
Units	mg/L	pH units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
PQL	0.05	0.1	1	0.05-0.25	0.005	0.1-2	0.005	0.005	0.005
Assessment Criteria	-	7-8.5	-	0.03	0.03?	0.3	0.015	0.015	0.9?
Kendall Bay Area B	<5-14	NT	40,000-42,000	<0.25	**0.034-0.038**	<2	<0.02-0.04	<0.005-0.005	<0.054-0.074
Kendall Bay Area A	10-22	NT	40,000-42,900	<0.25	**0.035-0.036**	<2	<0.02-0.05	<0.005-0.007	<0.047-0.09
Kendall Bay Background	5-14	NT	40,000	<0.25	**0.033-0.037**	<2	<0.02-0.03	<0.005	<0.032-0.049
Exile Bay Background	14-21	NT	41,000	<0.25	<0.02-0.021	<2	<0.009-0.01	<0.005	<0.005
Majors Bay Background	24-63	NT	40,000	<0.25	0.028-**0.03**	<2	<0.006-0.01	<0.005	<0.005-0.005

TSS: Total suspended solids
NT: Not tested
Note: Results that exceed the Assessment Criteria are in bold.

Table 5.2 PAHs in Oyster and Mussel Tissue, Kendall Bay and Background Areas

	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	Benzo(a)pyrene TEQ calc (zero)	Benzo(a)pyrene TEQ calc(half)	Benzo(a)pyrene TEQ calc(PQL)	Total Positive PAHs
Sample Description	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Assessment Criteria	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
PQL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.05	0.1	0.1	0.1	0.5	0.5	0.5	
KBM Kendall Bay Mussels	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	NIL (+)VE
EBM Exile Bay Mussels	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	NIL (+)VE
MBM Majors Bay Mussels	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	NIL (+)VE
KBO Kendall Oysters	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	0.06	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	0.06
EBO Exile Bay Oysters	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	NIL (+)VE
MBO Majors Bay Oysters	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	NIL (+)VE

NC: No Criteria

Table 5.3 Metals in Oyster and Mussel Tissue, Kendall Bay and Background Areas (coloured values exceed the assessment criteria)

	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
Sample Description	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
PQL	2	0.2	1	1	1	0.1	1	1
Assessment Criteria	NC	MRL 2.0 mg/kg	NC	GEL 5 mg/kg Median 30 mg/kg 90% UCL	NC	NC	NC	GEL 130 mg/kg Median 290 mg/kg 90% UCL
KBM Kendall Bay Mussels	<2	<0.2	<1	<1	<1	<0.1	<1	17
EBM Exile Bay Mussels	<2	<0.2	<1	<1	<1	<0.1	<1	14
MBM Majors Bay Mussels	<2	<0.2	<1	<1	<1	<0.1	<1	18
KBO Kendall Oysters	<2	0.7	<1	**180**	<1	<0.1	<1	**1100**
EBO Exile Bay Oysters	<2	0.6	<1	**190**	<1	<0.1	<1	**1000**
MBO Majors Bay Oysters	<2	1	<1	**170**	<1	<0.1	<1	**1900**

Notes:
GEL – Generally Expected Levels
MRL – Maximum Residue Limit
Results that exceed the Assessment Criteria are in bold and shaded.
NC – No Criteria
UCL – Upper Confidence Limit

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Appendix B Risk Calculations

Primary Calculations

Exposure to Chemicals via Incidental Ingestion of Soil - Beach Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	10%	Relevant for PAHs in sediments in beach area
Exposure Frequency (EF, days/year)	40	2 per week 5 months of year; 1 per fortnight rest of year (70% of time at low tide)
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				60	1.0E-06	2.2E-06	2.3E-7	--
							TOTAL	**2.3E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Beach Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Surface Area (SAs, cm^2)		Based on hands, feet, lower legs and lower arms getting dirty
arms	350	lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	300	enHealth Exposure Factors Guide Table 3.2.5
legs	700	lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	400	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	9097	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	40	2 per week 5 months of year, 1 per fortnight rest of year (70% visits at low tide
Exposure Duration (ED, years)	6	Exposures occur from areas 0 to 5 years
Body Weight (BW, kg)	15	As per ASC NEPM and enHealth 2012
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	60	3.6E-05		8.4E-6	--
								TOTAL	8.4E-6	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	20%	Relevant for PAHs in sediments in central mangrove area
Exposure Frequency (EF, days/year)	20	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				120	2.0E-06	4.4E-06	4.6E-7	--
							TOTAL	**4.6E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Surface Area (SAs, cm^2)		Based on hands, feet, lower legs and lower arms getting dirty
arms	350	lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	300	enHealth Exposure Factors Guide Table 3.2.5
legs	700	lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	400	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	9097	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	20	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from areas 0 to 5 years
Body Weight (BW, kg)	15	As per ASC NEPM and enHealth 2012
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	120	3.6E-05		8.4E-6	--
								TOTAL	8.4E-6	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Western Mangrove Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	100%	Relevant for PAHs in sediments in central mangrove area
Exposure Frequency (EF, days/year)	20	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				1	8.3E-08	1.8E-07	1.9E-8	--
							TOTAL	**1.9E-8**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Western Mangrove Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Surface Area (SAs, cm^2)		Based on hands, feet, lower legs and lower arms getting dirty
arms	350	lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	300	enHealth Exposure Factors Guide Table 3.2.5
legs	700	lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	400	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	9097	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	20	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from areas 0 to 5 years
Body Weight (BW, kg)	15	As per ASC NEPM and enHealth 2012
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.5E+01				0.06	1	3.0E-07	6.6E-07	7.5E-6	--
								TOTAL	**7.5E-6**	

Shaded cells include age dependent adjustment weighting factor

Sensitivity Analysis – Bioavailability

Exposure to Chemicals via Incidental Ingestion of Soil - Beach Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	20%	Relevant for PAHs in sediments in beach area
Exposure Frequency (EF, days/year)	40	2 per week 5 months of year; 1 per fortnight rest of year (70% of time at low tide)
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				60	2.0E-06	4.4E-06	4.6E-7	--
							TOTAL	**4.6E-7**	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Beach Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	30%	Relevant for PAHs in sediments in beach area
Exposure Frequency (EF, days/year)	40	2 per week 5 months of year; 1 per fortnight rest of year (70% of time at low tide)
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				60	3.0E-06	6.6E-06	7.0E-7	--
							TOTAL	**7.0E-7**	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Beach Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	40%	Relevant for PAHs in sediments in beach area
Exposure Frequency (EF, days/year)	40	2 per week 5 months of year; 1 per fortnight rest of year (70% of time at low tide)
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				60	4.0E-06	8.8E-06	9.3E-7	--
							TOTAL	**9.3E-7**	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Beach Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	50%	Relevant for PAHs in sediments in beach area
Exposure Frequency (EF, days/year)	40	2 per week 5 months of year; 1 per fortnight rest of year (70% of time at low tide)
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				60	5.0E-06	1.1E-05	1.2E-6	--
							TOTAL	**1.2E-6**	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	30%	Relevant for PAHs in sediments in central mangrove area
Exposure Frequency (EF, days/year)	20	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				120	3.0E-06	6.6E-06	7.0E-7	--
							TOTAL	**7.0E-7**	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	40%	Relevant for PAHs in sediments in central mangrove area
Exposure Frequency (EF, days/year)	20	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				120	4.0E-06	8.8E-06	9.3E-7	--
							TOTAL	**9.3E-7**	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	50%	Relevant for PAHs in sediments in central mangrove area
Exposure Frequency (EF, days/year)	20	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				120	5.0E-06	1.1E-05	1.2E-6	--
							TOTAL	**1.2E-6**	

Shaded cells include age dependent adjustment weighting factor

Sensitivity Analysis – Exposure Frequency

Young Child

Exposure to Chemicals via Incidental Ingestion of Soil - Beach Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	10%	Relevant for PAHs in sediments in beach area
Exposure Frequency (EF, days/year)	60	
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				40	1.0E-06	2.2E-06	2.3E-7	--
							TOTAL	**2.3E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Beach Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Surface Area (SAs, cm^2)		Based on hands, feet, lower legs and lower arms getting dirty
arms	350	lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	300	enHealth Exposure Factors Guide Table 3.2.5
legs	700	lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	400	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	9097	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	60	
Exposure Duration (ED, years)	6	Exposures occur from areas 0 to 5 years
Body Weight (BW, kg)	15	As per ASC NEPM and enHealth 2012
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	40	3.6E-05		8.4E-6	--
								TOTAL	8.4E-6	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Beach Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	10%	Relevant for PAHs in sediments in beach area
Exposure Frequency (EF, days/year)	80	
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				30	1.0E-06	2.2E-06	2.3E-7	--
							TOTAL	**2.3E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Beach Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Surface Area (SAs, cm^2)		Based on hands, feet, lower legs and lower arms getting dirty
arms	350	lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	300	enHealth Exposure Factors Guide Table 3.2.5
legs	700	lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	400	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	9097	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	80	
Exposure Duration (ED, years)	6	Exposures occur from areas 0 to 5 years
Body Weight (BW, kg)	15	As per ASC NEPM and enHealth 2012
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	30	3.6E-05		8.4E-6	--
								TOTAL	8.4E-6	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Beach Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	10%	Relevant for PAHs in sediments in beach area
Exposure Frequency (EF, days/year)	100	
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				25	1.0E-06	2.3E-06	2.4E-7	--
							TOTAL	**2.4E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Beach Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Surface Area (SAs, cm^2)		Based on hands, feet, lower legs and lower arms getting dirty
arms	350	lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	300	enHealth Exposure Factors Guide Table 3.2.5
legs	700	lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	400	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	9097	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	100	
Exposure Duration (ED, years)	6	Exposures occur from areas 0 to 5 years
Body Weight (BW, kg)	15	As per ASC NEPM and enHealth 2012
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	25	3.7E-05		8.7E-6	--
								TOTAL	8.7E-6	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	20%	Relevant for PAHs in sediments in central mangrove area
Exposure Frequency (EF, days/year)	30	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				85	2.1E-06	4.7E-06	4.9E-7	--
							TOTAL	**4.9E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Surface Area (SAs, cm^2)		Based on hands, feet, lower legs and lower arms getting dirty
arms	350	lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	300	enHealth Exposure Factors Guide Table 3.2.5
legs	700	lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	400	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	9097	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	30	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from areas 0 to 5 years
Body Weight (BW, kg)	15	As per ASC NEPM and enHealth 2012
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	85	3.8E-05		8.9E-6	--
								TOTAL	8.9E-6	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	20%	Relevant for PAHs in sediments in central mangrove area
Exposure Frequency (EF, days/year)	40	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				65	2.2E-06	4.7E-06	5.0E-7	--
							TOTAL	**5.0E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Surface Area (SAs, cm^2)		Based on hands, feet, lower legs and lower arms getting dirty
arms	350	lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	300	enHealth Exposure Factors Guide Table 3.2.5
legs	700	lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	400	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	9097	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	40	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from areas 0 to 5 years
Body Weight (BW, kg)	15	As per ASC NEPM and enHealth 2012
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	65	3.9E-05		9.1E-6	--
								TOTAL	9.1E-6	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	20%	Relevant for PAHs in sediments in central mangrove area
Exposure Frequency (EF, days/year)	50	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from ages 0 to 5 years
Body Weight (BW, kg)	15	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				50	2.1E-06	4.6E-06	4.8E-7	--
							TOTAL	**4.8E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Surface Area (SAs, cm^2)		Based on hands, feet, lower legs and lower arms getting dirty
arms	350	lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	300	enHealth Exposure Factors Guide Table 3.2.5
legs	700	lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	400	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	9097	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	50	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from areas 0 to 5 years
Body Weight (BW, kg)	15	As per ASC NEPM and enHealth 2012
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	50	3.7E-05		8.7E-6	--
								TOTAL	8.7E-6	

Shaded cells include age dependent adjustment weighting factor

Older Child

Exposure to Chemicals via Incidental Ingestion of Soil - Beach Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	10%	Relevant for PAHs in sediments in beach area
Exposure Frequency (EF, days/year)	40	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				65	7.7E-07	1.0E-06	1.8E-7	--
							TOTAL	**1.8E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Beach Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Surface Area (SAs, cm^2)		Based on hands and 75% of feet getting dirty
arms		lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	540	enHealth Exposure Factors Guide Table 3.2.5
legs		lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	585	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	12550	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	40	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	65	3.8E-05		8.9E-6	--
								TOTAL	8.9E-6	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Beach Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	10%	Relevant for PAHs in sediments in beach area
Exposure Frequency (EF, days/year)	60	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				45	8.0E-07	1.1E-06	1.9E-7	--
							TOTAL	**1.9E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Beach Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Surface Area (SAs, cm^2)		Based on hands and 75% of feet getting dirty
arms		lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	540	enHealth Exposure Factors Guide Table 3.2.5
legs		lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	585	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	12550	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	60	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	45	4.0E-05		9.3E-6	--
								TOTAL	**9.3E-6**	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Beach Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	10%	Relevant for PAHs in sediments in beach area
Exposure Frequency (EF, days/year)	80	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				33	7.8E-07	1.0E-06	1.8E-7	--
							TOTAL	**1.8E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Beach Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Surface Area (SAs, cm^2)		Based on hands and 75% of feet getting dirty
arms		lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	540	enHealth Exposure Factors Guide Table 3.2.5
legs		lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	585	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	12550	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	80	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	33	3.9E-05		9.1E-6	--
								TOTAL	**9.1E-6**	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Beach Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	10%	Relevant for PAHs in sediments in beach area
Exposure Frequency (EF, days/year)	100	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				27	8.0E-07	1.1E-06	1.9E-7	--
							TOTAL	**1.9E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Beach Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Surface Area (SAs, cm^2)		Based on hands and 75% of feet getting dirty
arms		lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	540	enHealth Exposure Factors Guide Table 3.2.5
legs		lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	585	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	12550	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	100	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	27	4.0E-05		9.3E-6	--
								TOTAL	9.3E-6	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	20%	Relevant for PAHs in sediments in central mangrove area
Exposure Frequency (EF, days/year)	20	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				130	1.5E-06	2.0E-06	3.6E-7	--
							TOTAL	**3.6E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Surface Area (SAs, cm^2)		Based on hands and 75% of feet getting dirty, NEPM
arms		lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	540	enHealth Exposure Factors Guide Table 3.2.5
legs		lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	585	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	12550	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	20	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	130	3.8E-05		8.9E-6	--
								TOTAL	8.9E-6	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	20%	Relevant for PAHs in sediments in central mangrove area
Exposure Frequency (EF, days/year)	30	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				90	1.6E-06	2.1E-06	3.7E-7	--
							TOTAL	**3.7E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Surface Area (SAs, cm^2)		Based on hands and 75% of feet getting dirty, NEPM
arms		lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	540	enHealth Exposure Factors Guide Table 3.2.5
legs		lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	585	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	12550	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	30	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	90	4.0E-05		9.3E-6	--
								TOTAL	9.3E-6	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	20%	Relevant for PAHs in sediments in central mangrove area
Exposure Frequency (EF, days/year)	40	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				68	1.6E-06	2.1E-06	3.8E-7	--
							TOTAL	**3.8E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Surface Area (SAs, cm^2)		Based on hands and 75% of feet getting dirty, NEPM
arms		lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	540	enHealth Exposure Factors Guide Table 3.2.5
legs		lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	585	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	12550	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	40	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	68	4.0E-05		9.3E-6	--
								TOTAL	9.3E-6	

Shaded cells include age dependent adjustment weighting factor

Exposure to Chemicals via Incidental Ingestion of Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{IS} = C_S \bullet \frac{IR_S \bullet FI \bullet CF \bullet B \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Ingestion Rate (IRs, mg/day)	50	As per ASC NEPM Schedule B7 soil ingestion rate for young child recreational
Fraction Ingested from Source (FI, unitless)	100%	Assumed to be 100%
Bioavailability (B)	20%	Relevant for PAHs in sediments in central mangrove area
Exposure Frequency (EF, days/year)	50	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Conversion Factor (CF)	1.00E-06	conversion from mg to kg
Averaging Time - NonThreshold (Atc, days)	25550	ASC NEPM
Averaging Time - Threshold (Atn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data				Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)		NonThreshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				55	1.6E-06	2.2E-06	3.8E-7	--
							TOTAL	**3.8E-7**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Older Children		
Surface Area (SAs, cm^2)		Based on hands and 75% of feet getting dirty, NEPM
arms		lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	540	enHealth Exposure Factors Guide Table 3.2.5
legs		lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	585	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	12550	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	50	
Exposure Duration (ED, years)	10	Exposures occur from ages 5 to 15 years
Body Weight (BW, kg)	35	As per enHealth (2012)
Age Dependent Adjustment Weighting Factor	3	3 fold for 5 to 15 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	3650	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	55	4.0E-05		9.4E-6	--
								TOTAL	9.4E-6	

Shaded cells include age dependent adjustment weighting factor

Sensitivity Assessment – Skin Surface Area (Young Child)

Dermal Exposure to Chemicals via Contact with Soil - Beach Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Surface Area (SAs, cm^2)		Based on hands, feet, lower legs and lower arms getting dirty
arms	400	lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	400	enHealth Exposure Factors Guide Table 3.2.5
legs	800	lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	500	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	11324	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	40	
Exposure Duration (ED, years)	6	Exposures occur from areas 0 to 5 years
Body Weight (BW, kg)	15	As per ASC NEPM and enHealth 2012
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	60	4.5E-05		1.0E-5	--
								TOTAL	**1.0E-5**	

Shaded cells include age dependent adjustment weighting factor

Dermal Exposure to Chemicals via Contact with Soil - Central Mangrove Area

$$Daily\ Chemical\ Intake_{DS} = C_S \bullet \frac{SA_S \bullet AF \bullet FE \bullet ABS \bullet CF \bullet EF \bullet ED}{BW \bullet AT} \quad \text{(mg/kg/day)}$$

Parameters Relevant to Quantification of Exposure by Young Children		
Surface Area (SAs, cm^2)		Based on hands, feet, lower legs and lower arms getting dirty
arms	400	lower arms - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
hands	400	enHealth Exposure Factors Guide Table 3.2.5
legs	800	lower legs - 50% of value - enHealth Exposure Factors Guide Table 3.2.5
feet	500	enHealth Exposure Factors Guide Table 3.2.5
Adherence Factor (AF, mg/cm^2)		
arms	0.17	USEPA Child Specific Exposure Factors Handbook Table ES-1
hands	0.49	USEPA Child Specific Exposure Factors Handbook Table ES-1
legs	0.7	USEPA Child Specific Exposure Factors Handbook Table ES-1
feet	21	USEPA Child Specific Exposure Factors Handbook Table ES-1
Combined SA and AF (mg)	11324	
Fraction of Day Exposed (FE)	0.33	Assume sediment remains on the child for 8 hours before being washed off
Conversion Factor (CF)	1.E-06	Conversion of units
Dermal absorption (ABS, unitless)	Chemical-specific (as below)	
Exposure Frequency (EF, days/yr)	20	50% of time visit the beach enter the mangrove area
Exposure Duration (ED, years)	6	Exposures occur from areas 0 to 5 years
Body Weight (BW, kg)	15	As per ASC NEPM and enHealth 2012
Age Dependent Adjustment Weighting Factor	5.3	10 fold for first 2 years of life and 3 fold for next 4 years
Averaging Time - NonThreshold (ATc, days)	25550	ASC NEPM
Averaging Time - Threshold (ATn, days)	2190	ASC NEPM

Key Chemical	Toxicity Data					Concentration in Sediments (Cs)	Daily Intake		Calculated Risk	
	Non-Threshold Slope Factor	Threshold TDI	Background Intake (% TDI)	TDI Allowable for Assessment (TDI-Background)	Dermal Absorption (ABS)		Non-Threshold	Threshold	Non-Threshold Risk	Chronic Hazard Quotient
	$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)		(mg/kg)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
Benzo[a]pyrene TEQs	2.3E-01				0.06	120	4.5E-05		1.0E-5	--
								TOTAL	**1.0E-5**	

Shaded cells include age dependent adjustment weighting factor

Appendix C Bioaccessibility Study Report

University of South Australia

Assessment of PAH bioaccessibility in contaminated sediment – Kendall Bay

Prepared for: Environmental Risk Sciences Pty Ltd

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INTRODUCTION

This report was prepared for Environmental Risk Sciences Pty Ltd to assess PAH bioaccessibility in impacted soil. The bioaccessibility testing was conducted at the Future Industries Institute, based at the Mawson Lakes Campus of the University of South Australia (UniSA). UniSA's Flagship Institute focuses on building knowledge and capacity in core research strengths of physical chemistry and environmental science and management. The Institute has four distinct yet inter-related strands: Minerals and Resources; Energy and Advanced Manufacturing; Environmental Science and Engineering; and Bioengineering and Nanomedicine. The Institute aggregates and builds upon existing expertise and infrastructure from the Ian Wark Research Institute, the Mawson Institute and the Centre for Environmental Risk Assessment and Remediation. The vision for the Future Industries Institute aligns strongly with South Australian and National economic and research priorities by building a critical mass of trans-disciplinary research capacity focused on pressing real-world challenges.

OBJECTIVES

The objective of this assessment was to:

- Determine PAH bioaccessibility in 2 sediment samples supplied by Synnot Wilkinson.

OUTCOMES AND DELIVERABLES

The expected outcome from this assessment was:

- A report assessing the bioaccessibility of PAHs in impacted sediment. The report was to include;
    - Assessment of PAH concentration in the < 250 µm particle size fraction;
    - Assessment of PAH bioaccessibility in the < 250 µm particle size fraction using an vitro method;
    - Methodology procedures; and
    - QA/QC protocols

PROJECT BACKGROUND

Testing was initiated at the invitation of Environmental Risk Sciences Pty Ltd for an assessment of PAH bioaccessibility in 2 sediment samples. Human exposure to a contaminant may be through a number of pathways including inhalation, dermal absorption and ingestion. For PAHs, significant exposure pathways are via soil ingestion and dermal absorption. Generally, soil ingestion results from the

accidental or, in the case of children less than 5 years old, the incidental ingestion of soil (< 250 μm particle size fraction) via hand-to-mouth contact (Basta et al., 2001). When assessing risk to humans associated with exposure to PAH-contaminated soil, a major unknown is quantifying the dose that has been absorbed into the systemic circulation (i.e. the bioavailable fraction). It is often assumed that the contaminant is 100% bioavailable, however, it is generally accepted that contaminant bioavailability in soil may be less than 100%. As a consequence, incorporating PAH bioavailability into human health risk assessment may reduce the uncertainty in estimating exposure associated with incidental ingestion and dermal pathways.

Determination of PAH bioavailability is challenging due to the complexity of in vivo PAH metabolism, distribution and excretion. For example, following ingestion, PAHs that are absorbed across the intestinal epithelium may enter hepatic portal circulation and be transported to the liver (first pass effect) where PAH metabolism may occur as a result of cytochrome P450 monooxygenase activity (Ramesh et al., 2004; Shimada, 2006). From hepatic portal circulation, metabolised and non-metabolised PAHs may enter the systemic circulation via hepatic veins whereas a proportion of metabolised PAHs may be excreted in the faeces via the bile (Ramesh et al., 2004). Non-absorbed PAHs in the gastrointestinal tract are also excreted via the faeces. Assessment of PAH bioavailability is complicated by the fact that PAHs may be absorbed from the gastrointestinal tract and transformed in the hepatic portal system but may not reach the systemic circulation (due to biliary excretion) which by definition is the bioavailable fraction. Conversely, transformed PAHs may enter the systemic circulation, however, this may not be taken into consideration for PAH bioavailability estimations if only the concentration of the parent compound is determined.

Although in vivo studies utilising animal models are an appropriate method for determination of PAH bioavailability in contaminated soil for inclusion in human health exposure assessment, the time required for in vivo studies and the expense of animal trials preclude their use as routine relative bioavailability assessment tools. As a result, rapid, cost effective in vitro methods simulating human gastrointestinal conditions have been developed in order to estimate contaminant bioavailability. These assays determine PAH concentrations that are mobilised following gastrointestinal extraction (i.e. the bioaccessible fraction) and are therefore potentially available for absorption into the systemic circulation. Assays such as the organic Physiologically Based Extraction Test (PBET; Ruby et al., 2002), Fed ORganic Estimation human Simulation Test (FOREhST; Cave et al., 2010), Colon-extended PBET (Tilston et al., 2011) have been used to assess PAH bioaccessibility in contaminated soils, however, as detailed by Collins et al. (2013), many of these methods may underestimate PAH bioaccessibility due to limiting partitioning of PAHs into gastrointestinal fluid (i.e. solubility constraints). To overcome these limitations, silicone cord (poly[dimethylsiloxane]) has been suggested to be included in the in vitro assay as a sorption sink due to its compatibility with extracting solutions and its well suited partitioning properties and low internal diffusive resistance for hydrophobic organic contaminants (Gouliarmou et al., 2013). The inclusion of the sorption sink simulates passive molecular diffusion across the small intestinal epithelium which causes disequilibrium in the digestive fluid and therefore creates a gradient for further diffusive mobilisation of contaminants from the soil matrix (Gouliarmou et al., 2013). Without mimicking uptake, in vitro models may underestimate PAH bioaccessibility due to the finite capacity of the in vitro fluid to accommodate desorbable PAHs (Juhasz et al., 2016).

FINDINGS

The concentration of PAHs in samples KBR2A and KBR2B is shown in Table 1 while PAH bioaccessibility results are shown in Tables 2-4.

- The concentration of PAHs (Σ16 PAHs half LOR) in the < 250 µm particle size fraction was 31.4 and 502 mg kg^{-1} for KBR2A and KBR2B with BaP_{TEQ} (half LOR) of 5.3 and 63.7 mg kg^{-1} respectively (Table 1).

- In KBR2A, PAH bioaccessibility ranged from <0.28 (acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, benz[a]anthracene, chrysene, indeno[1,2,3-c,d]pyrene, dibenz[a,h]anthracene and benzo[g,h,i]perylene) to 0.61 mg kg^{-1} (benzo[b+j]fluoranthene) (Table 2) with percent bioaccessibility ranging from 13.0% (benzo[a]pyrene) to 18.6% (pyrene). Using half LOR, Σ16 PAHs and BaP_{TEQ} bioaccessibility was 14.6% and 14.5% respectively (Table 4).

- In KBR2B, PAH bioaccessibility ranged from <0.28 (acenaphthene, fluorene, anthracene) to 50.8 mg kg^{-1} (pyrene) (Table 3) with percent bioaccessibility ranging from 6.1% (acenaphthylene) to 32.5% (fluoranthene). Using half LOR, Σ16 PAHs and BaP_{TEQ} bioaccessibility was 25.3% and 27.0% respectively (Table 4).

- The concentration of PAHs in the assay blank were below the level of reporting with the exception of naphthalene (0.29 µg l^{-1}).

Table 1. PAH concentration in samples KBR2A and KBR2B (< 250 µm particle size fraction).

PAH	KBR2A (mg kg^{-1})			KBR2B (mg kg^{-1})		
	250A	**250B**	**Av. 250**	**250A**	**250B**	**Av. 250**
Naphthalene	<0.5	<0.5	<0.5	4.5	4.0	4.3
Acenaphthylene	2.3	2.5	2.4	25.7	24.0	24.9
Acenaphthene	<0.5	<0.5	<0.5	2.1	2.0	2.1
Fluorene	<0.5	<0.5	<0.5	4.1	3.5	3.8
Phenanthrene	0.7	0.8	0.8	8.2	7.1	7.7
Anthracene	0.7	0.8	0.8	12.4	11.6	12.0
Fluoranthene	2.4	2.7	2.6	95.0	90.3	92.7
Pyrene	6.6	7.2	6.9	169	161	165
Benz(a)anthracene	1.4	1.6	1.5	16.2	15.8	16.0
Chrysene	1.7	2.0	1.9	23.0	19.3	21.2
Benzo(b+j)fluoranthene	4.2	4.6	4.4	52.3	48.3	50.3
Benzo(k)fluoranthene	1.5	1.6	1.6	16.3	17.4	16.9
Benzo(a)pyrene	3.8	4.1	4.0	50.0	45.7	47.9
Indeno(1.2.3.cd)pyrene	1.6	1.7	1.7	15.7	14.7	15.2
Dibenz(a.h)anthracene	0.6	<0.5	<0.6	5.8	5.4	5.6
Benzo(g.h.i)perylene	1.9	2.1	2.0	17.8	16.2	17.0
Σ16 PAHs (zero LOR)	29.4	31.7	30.6	518	486	502
BaP TEQ (zero LOR)	5.3	5.1	5.2	66.3	61.1	63.7
Σ16 PAHs (half LOR)	30.2	32.7	31.4	518	486	502
BaP TEQ (half LOR)	5.3	5.3	5.3	66.3	61.1	63.7

*Average concentration of duplicate analysis.

Table 2. Assessment of PAH bioaccessibility in sample KBR2A (< 250 µm particle size fraction).

PAH	KBR2A-1			KBR2A-2			Av. Bioaccessible PAHs (mg kg^{-1})‡
	PAH conc. in Extract (µg/l)	PAH in Extract (µg)*	Bioaccessible PAHs (mg kg^{-1})	PAH conc. in Extract (µg/l)	PAH in Extract (µg)†	Bioaccessible PAHs (mg kg^{-1})	
Naphthalene	3.1	0.28	0.35	3.8	0.34	0.43	0.39
Acenaphthylene	<2.5	<0.23	<0.28	<2.5	<0.23	<0.28	<0.28
Acenaphthene	<2.5	<0.23	<0.28	<2.5	<0.23	<0.28	<0.28
Fluorene	<2.5	<0.23	<0.28	<2.5	<0.23	<0.28	<0.28
Phenanthrene	<2.5	<0.23	<0.28	<2.5	<0.23	<0.28	<0.28
Anthracene	<2.5	<0.23	<0.28	<2.5	<0.23	<0.28	<0.28
Fluoranthene	<2.5	<0.23	<0.28	<2.5	<0.23	<0.28	<0.28
Pyrene	10.6	0.95	1.19	12.1	1.09	1.37	1.28
Benz(a)anthracene	<2.5	<0.23	<0.28	<2.5	<0.23	<0.28	<0.28
Chrysene	<2.5	<0.23	<0.28	<2.5	<0.23	<0.28	<0.28
Benzo(b+j)fluoranthene	3.7	0.33	0.42	7.1	0.64	0.80	0.61
Benzo(k)fluoranthene	<2.5	<0.23	<0.28	2.6	0.24	0.29	0.29
Benzo(a)pyrene	3.3	0.30	0.37	5.9	0.53	0.67	0.52
Indeno(1.2.3.cd)pyrene	<2.5	<0.23	<0.28	<2.5	<0.23	<0.28	<0.28
Dibenz(a.h)anthracene	<2.5	<0.23	<0.28	<2.5	<0.23	<0.28	<0.28
Benzo(g.h.i)perylene	<2.5	<0.23	<0.28	<2.5	<0.23	<0.28	<0.28
Σ16 PAHs (zero LOR)	20.7	1.86	2.3	31.5	2.85	3.6	2.9
BaP TEQ (zero LOR)	3.7	0.33	0.41	6.9	0.62	0.78	0.59
Σ16 PAHs (half LOR)	35.7	3.2	4.0	45.3	4.1	5.1	4.6
BaP TEQ (half LOR)	5.3	0.48	0.60	8.4	0.76	0.95	0.77

*Extract volume was 90.0 ml. †Extract volume was 90.5 ml. ‡Average concentration of duplicate analysis.

Table 3. Assessment of PAH bioaccessibility in sample KBR2B (< 250 µm particle size fraction).

PAH	KBR2B-1			KBR2B-2			Av. Bioaccessible PAHs (mg kg^{-1})[‡]
	PAH conc. in Extract (µg/l)	PAH in Extract (µg)*	Bioaccessible PAHs (mg kg^{-1})	PAH conc. in Extract (µg/l)	PAH in Extract (µg)[†]	Bioaccessible PAHs (mg kg^{-1})	
Naphthalene	4.2	0.38	0.47	3.8	0.34	0.43	0.45
Acenaphthylene	13.7	1.23	1.54	13.1	1.18	1.47	1.51
Acenaphthene	<2.5	<0.22	<0.28	<2.5	<0.22	<0.28	<0.28
Fluorene	<2.5	<0.22	<0.28	<2.5	<0.22	<0.28	<0.28
Phenanthrene	4.3	0.39	0.48	<2.5	<0.22	<0.28	0.48
Anthracene	<2.5	<0.22	<0.28	<2.5	<0.22	<0.28	<0.28
Fluoranthene	280	25.2	31.44	255	22.9	28.66	30.1
Pyrene	475	42.7	53.34	430	38.7	48.34	50.8
Benz(a)anthracene	25.6	2.30	2.87	25.3	2.28	2.84	2.86
Chrysene	20.0	1.80	2.25	18.9	1.70	2.12	2.19
Benzo(b+j)fluoranthene	134	12.0	15.05	113	10.2	12.70	13.9
Benzo(k)fluoranthene	53.7	4.82	6.03	40.7	3.66	4.58	5.30
Benzo(a)pyrene	134	12.0	15.05	112	10.1	12.59	13.8
Indeno(1.2.3.cd)pyrene	19.3	1.73	2.17	18.1	1.63	2.03	2.10
Dibenz(a.h)anthracene	8.8	0.79	0.99	7.3	0.66	0.82	0.90
Benzo(g.h.i)perylene	21.0	1.89	2.36	19.0	1.71	2.14	2.25
Σ16 PAHs (zero LOR)	1194	107	134	1056	95.0	119	126
BaP TEQ (zero LOR)	166	15.0	18.7	139	12.5	15.7	17.2
Σ16 PAHs (half LOR)	1197	108	134	1061	95.4	119	127
BaP TEQ (half LOR)	166	15.0	18.7	139	12.5	15.7	17.2

*Extract volume was 89.8 ml. [†]Extract volume was 89.9 ml. [‡]Average concentration of duplicate analysis.

Table 4. Total PAH concentration and bioaccessible PAHs in samples KBR2A and KBR2B (< 250 µm particle size fraction).

PAH	KBR2A			KBR2B		
	PAHs (mg kg^{-1})	Bioaccessible PAH (mg kg^{-1})	PAH Bioaccessibility (%)	PAHs (mg kg^{-1})	Bioaccessible PAH (mg kg^{-1})	PAH Bioaccessibility (%)
Naphthalene	<0.5	0.39	-	4.3	0.45	10.5
Acenaphthylene	2.4	<0.28	<11.7	24.9	1.51	6.1
Acenaphthene	<0.5	<0.28	-	2.1	<0.28	<13.3
Fluorene	<0.5	<0.28	-	3.8	<0.28	<7.4
Phenanthrene	0.8	<0.28	<35.0	7.7	0.48	6.2
Anthracene	0.8	<0.28	<35.0	12.0	<0.28	<2.3
Fluoranthene	2.6	<0.28	<10.8	92.7	30.1	32.5
Pyrene	6.9	1.28	18.6	165	50.8	30.8
Benz(a)anthracene	1.5	<0.28	<18.7	16.0	2.86	17.9
Chrysene	1.9	<0.28	<14.7	21.2	2.19	10.3
Benzo(b+j)fluoranthene	4.4	0.61	13.9	50.3	13.9	27.6
Benzo(k)fluoranthene	1.6	0.29	18.1	16.9	5.30	31.4
Benzo(a)pyrene	4.0	0.52	13.0	47.9	13.8	28.8
Indeno(1.2.3.cd)pyrene	1.7	<0.28	<16.5	15.2	2.10	13.8
Dibenz(a.h)anthracene	<0.6	<0.28	-	5.6	0.90	16.1
Benzo(g.h.i)perylene	2.0	<0.28	<14.0	17.0	2.25	13.2
Σ16 PAHs (zero LOR)	30.6	2.9	9.5	502	126	25.1
BaP TEQ (zero LOR)	5.2	0.59	11.3	63.7	17.2	27.0
Σ16 PAHs (half LOR)	31.4	4.6	14.6	502	127	25.3
BaP TEQ (half LOR)	5.3	0.77	14.5	63.7	17.2	27.0

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CONFIDENTIALITY

We acknowledge the confidential nature of the results of this project and will treat the results and project reports with appropriate confidentiality and security.

APPENDIX 1 - METHODOLOGY

Samples

The samples, supplied by Synnot Wilkinson, were oven-dried at 40°C for 96 hours and sieved to recover the < 250 µm particle size fraction. This particle size fraction was used to assess PAH bioaccessibility.

Assessment of PAH concentration in the <250 µm particle size fraction

PAH concentration in the < 250 µm particle size fraction was determined by ALS Laboratories. A copy of the ALS analytical report is included in Appendix 3.

Assessment of PAH bioaccessibility in the <250 µm particle size fraction

PAH bioaccessibility was assessed using the organic Physiologically Based extraction Test (org-PBET) (Ruby et al., 2002) with minor modifications. Gastric phase solution was prepared by dissolving glycine (15.0 g l^{-1}), sodium chloride (8.8 g l^{-1}), pepsin (1.0 g l^{-1}), bovine serum albumin (5.0 g l^{-1}) and mucine (2.5 g l^{-1}) in MilliQ water and adjusting the pH to 1.5 ± 0.05 through the addition of concentrated hydrochloric acid. When gastric phase conditions were transitioned into the intestinal phase, the pH was adjusted to 7.2 ± 0.2 using sodium hydroxide (50% w/v) and porcine pancreatin (0.6 g l^{-1}) and bovine bile (4.0 g l^{-1}) were added. PAH bioaccessibility assays were conducted using 0.8 g of PAH-contaminated soil and 80 ml of org-PBET solution in the presence of silicone cord (diameter of 3 mm; 8 g m^{-1}). A silicone mass of approximately 100 times that of the soil organic matter content was added to gastrointestinal fluid. Suspensions were incubated at 37°C and 40 rpm on a Ratek suspension mixer. Following a 1 hr gastric phase, in vitro conditions were modified to the intestinal phase and incubation continued for a further 16 hr. At the end of the incubation period, the silicone cord was removed, rinsed with MilliQ water, gently wiped with lint free tissue and extracted with acetone (2 x 50 ml) (Gouliarmou et al., 2013). PAHs recovered from silicone cord extracts were designated as the bioaccessible fraction.

QA/QC procedures

ALS laboratories conducted the analysis for total and bioaccessible PAH concentrations for all samples. ALS Laboratories are a NATA accredited laboratory for the chemical testing of environmental materials. Quality Control results are reported in Appendix 3. An additional sample was included in bioaccessibility assays for quality assurance and quality control. The sample consisted of a blank control (i.e. org-PBET solution without soil addition).

APPENDIX 2 – CHAIN OF CUSTODY FORMS

CHAIN OF CUSTODY

Client:.**Jemena** Location: **Kendall Bay**
Quote Number: .....COC No:**701/18**

Synnot Wilkinson
STRATEGIC ENVIRONMENTAL CONSULTING

Date: 21-1 /2018 Page 1 .. of 1 ...
Sample Preservation: **Cooler Blocks**
Turnaround Time: **Standard**

To Albert Juhasz
Future Industries Institute
University of South Australia
Building X, X1-17
Mawson Lakes Campus
Mawson Lakes SA 5095

Contact: Russell Synnot - Phone: 0418 582 990

Container Size (ml):

Preservation Code:
Type (**P** Neutral Plastic, **N** Nitric Acid Preserved, **C** Sodium Hydroxide Preserved, **J** Solvent Washed Acid Rinsed Jar, **S** solvent Washed Acid Rinsed Glass Bottle, **VC** Hydrochloric Acid Preserved Vial, **M** Methanol Preserved Vial)

Metals : Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, Zn.
Hydrocarbons: As Listed
Other: As Listed

Lab No.	Date	Sample	Preservation Code	Sample Number and Depth	Requested Analytes (µg/kg unless otherwise stated)										Comments
					Metals	Cyanide	Total PAHs	Total Phenols	TRH	BTEX	pH	TOC	Bioaccessibility	HOLD	
		1		KBR 2 A 0-150 mm									X		
		2		KBR2 B 150 – 300 mm									X		

Samples prepared by:..... (Signed) Print Name..A. HUNT Date:21-1-18
Received at Lab by:..... (Signed) Print Name..ALBERT JUHASZ Date:23/1/18.....
Please e-mail signed Transmission Form immediately on receipt to Synnot & Wilkinson Pty Ltd. Ph: (0418 582 990) mail@baarrooka.com.au

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ **Sydney:** 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ **Newcastle:** 5 Rosegum Rd, Warabrook NSW 2304 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com
☐ **Brisbane:** 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ **Townsville:** 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
☐ **Melbourne:** 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ **Adelaide:** 2-[illegible] Rd, [illegible] SA 5095 Ph: 08 835[illegible] E: [illegible]@alsenviro.com
☐ **Perth:** 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ **Launceston:** 27 Wellington St, Launceston TAS 7250 Ph. 03 6331 2158 E: launceston@alsenviro.com

URGENT FREIGHT

CLIENT:	University of South Australia	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT **(List due date):** ☒ Non Standard or urgent TAT **(List due date):** 3 day TAT
OFFICE:	Mawson Lakes Campus X1-17		
PROJECT:	KBR PAH BioAcc	**ALS QUOTE NO.:**	
ORDER NUMBER:			
PROJECT MANAGER:	Albert Juhasz	**CONTACT PH: 08 8302 5045**	
SAMPLER:	Albert Juhasz	**SAMPLER MOBILE: 0418 818 121**	
COC emailed to ALS? (NO)		**EDD FORMAT (or default):**	
Email Reports to (will default to PM if no other addresses are listed): Albert.Juhasz@unisa.edu.au			
Email Invoice to (will default to PM if no other addresses are listed): Albert.Juhasz@unisa.edu.au			

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)

Custody seal intact? Yes / No / N/A
Free ice / frozen ice bricks present upon receipt? Yes / No / N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Albert Juhasz			NPNA (CAW
DATE/TIME: 8/2/18	DATE/TIME:	DATE/TIME:	DATE/TIME: 9/2, 10-50

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL BOTTLES	PAHs							5	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	KBR2A-250A	8/02/2018	S	AV	1	1								Samples have been dried and sieved
	KBR2A-250B	8/02/2018	S	AV	1	1								
	KBR2B-250A	8/02/2018	S	AV	1	1								
	KBR2B-250B	8/02/2018	S	AV	1	1								
	KBR2A-1	8/02/2018	W	AG	1	1								Samples are in acetone
	KBR2A-2	8/02/2018	W	AG	1	1								
	KBR2B-1	8/02/2018	W	AG	1	1								
	KBR2B-2	8/02/2018	W	AG	1	1								
	QC1	8/02/2018	W	AG	1	1								
				TOTAL	9	9								

Environmental Division
Melbourne
Work Order Reference
EM1802767

Telephone : + 61-3-8549 9600

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

APPENDIX 3 – ANALYTICAL RESULTS AND QA/QC

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM1802767**	Page	: 1 of 5
Client	: **UNISA - CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION**	Laboratory	: Environmental Division Melbourne
Contact	: MR ALBERT JUHASZ	Contact	: Customer Services EM
Address	: UNIVERSITY OF SOUTH AUSTRALIA CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION BUILDING X MAWSON LAKES CAMPUS MAWSON LAKES SOUTH AUSTRALIA 5095	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 08 8302 6273	Telephone	: +61-3-8549 9600
Project	: KBR PAH BioAcc	Date Samples Received	: 09-Feb-2018 10:50
Order number	: ----	Date Analysis Commenced	: 09-Feb-2018
C-O-C number	: ----	Issue Date	: 14-Feb-2018 14:17
Sampler	: ALBERT JUHASZ		
Site	: ----		
Quote number	: ADBQ/011/10		
No. of samples received	: 9		
No. of samples analysed	: 9		

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*
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

General Comments

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

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

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

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

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

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

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

- EP075(SIM): Particular samples (EM1802767) required dilution prior to analysis due to sample matrix interferences. LOR values have been adjusted accordingly.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	KBR2A-250A	KBR2A-250B	KBR2B-250A	KBR2B-250B	----
			Client sampling date / time	08-Feb-2018 00:00	08-Feb-2018 00:00	08-Feb-2018 00:00	08-Feb-2018 00:00	----
Compound	CAS Number	LOR	Unit	EM1802767-001	EM1802767-002	EM1802767-003	EM1802767-004	--------
				Result	Result	Result	Result	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	**4.5**	**4.0**	----
Acenaphthylene	208-96-8	0.5	mg/kg	**2.3**	**2.5**	**25.7**	**24.0**	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	**2.1**	**2.0**	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	**4.1**	**3.5**	----
Phenanthrene	85-01-8	0.5	mg/kg	**0.7**	**0.8**	**8.2**	**7.1**	----
Anthracene	120-12-7	0.5	mg/kg	**0.7**	**0.8**	**12.4**	**11.6**	----
Fluoranthene	206-44-0	0.5	mg/kg	**2.4**	**2.7**	**95.0**	**90.3**	----
Pyrene	129-00-0	0.5	mg/kg	**6.6**	**7.2**	**169**	**161**	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	**1.4**	**1.6**	**16.2**	**15.8**	----
Chrysene	218-01-9	0.5	mg/kg	**1.7**	**2.0**	**23.0**	**19.3**	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	**4.2**	**4.6**	**52.3**	**48.3**	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	**1.5**	**1.6**	**16.3**	**17.4**	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	**3.8**	**4.1**	**50.0**	**45.7**	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	**1.6**	**1.7**	**15.7**	**14.7**	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	**0.6**	<0.5	**5.8**	**5.4**	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	**1.9**	**2.1**	**17.8**	**16.2**	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**103**	**109**	**113**	**102**	----
2-Chlorophenol-D4	93951-73-6	0.5	%	**103**	**108**	**111**	**103**	----
2.4.6-Tribromophenol	118-79-6	0.5	%	**93.0**	**96.7**	**100**	**93.5**	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**106**	**111**	**114**	**106**	----
Anthracene-d10	1719-06-8	0.5	%	**112**	**117**	**113**	**106**	----
4-Terphenyl-d14	1718-51-0	0.5	%	**99.0**	**103**	**105**	**99.2**	----

Analytical Results

Sub-Matrix: SOLVENT (Matrix: WATER)				Client sample ID	KBR2A-1	KBR2A-2	KBR2B-1	KBR2B-2	QC1
				Client sampling date / time	08-Feb-2018 00:00	08-Feb-2018 00:00	08-Feb-2018 00:00	08-Feb-2018 00:00	08-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		EM1802767-005	EM1802767-006	EM1802767-007	EM1802767-008	EM1802767-009
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		3.1	3.8	4.2	3.8	2.9
Acenaphthylene	208-96-8	1.0	µg/L		<2.5	<2.5	13.7	13.1	<2.5
Acenaphthene	83-32-9	1.0	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Fluorene	86-73-7	1.0	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Phenanthrene	85-01-8	1.0	µg/L		<2.5	<2.5	4.3	<2.5	<2.5
Anthracene	120-12-7	1.0	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Fluoranthene	206-44-0	1.0	µg/L		<2.5	<2.5	280	255	<2.5
Pyrene	129-00-0	1.0	µg/L		10.6	12.1	475	430	<2.5
Benz(a)anthracene	56-55-3	1.0	µg/L		<2.5	<2.5	25.6	25.3	<2.5
Chrysene	218-01-9	1.0	µg/L		<2.5	<2.5	20.0	18.9	<2.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		3.7	7.1	134	113	<2.5
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<2.5	2.6	53.7	40.7	<2.5
Benzo(a)pyrene	50-32-8	0.5	µg/L		3.3	5.9	134	112	<2.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<2.5	<2.5	19.3	18.1	<2.5
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<2.5	<2.5	8.8	7.3	<2.5
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<2.5	<2.5	21.0	19.0	<2.5
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		58.7	75.4	71.4	65.8	76.7
2-Chlorophenol-D4	93951-73-6	1.0	%		56.7	74.1	70.1	63.6	74.1
2.4.6-Tribromophenol	118-79-6	1.0	%		60.4	81.4	75.4	66.3	64.7
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		68.0	83.5	77.4	73.3	83.6
Anthracene-d10	1719-06-8	1.0	%		73.3	86.4	80.3	71.7	87.5
4-Terphenyl-d14	1718-51-0	1.0	%		75.7	92.2	88.4	81.5	89.2

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	54	125
2-Chlorophenol-D4	93951-73-6	65	123
2.4.6-Tribromophenol	118-79-6	34	122
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	61	125
Anthracene-d10	1719-06-8	62	130
4-Terphenyl-d14	1718-51-0	67	133

Sub-Matrix: SOLVENT		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	46
2-Chlorophenol-D4	93951-73-6	23	104
2.4.6-Tribromophenol	118-79-6	28	130
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	36	114
Anthracene-d10	1719-06-8	51	119
4-Terphenyl-d14	1718-51-0	49	127

QUALITY CONTROL REPORT

Work Order	: **EM1802767**	Page	: 1 of 4
Client	: **UNISA - CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION**	Laboratory	: Environmental Division Melbourne
Contact	: MR ALBERT JUHASZ	Contact	: Customer Services EM
Address	: UNIVERSITY OF SOUTH AUSTRALIA CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION BUILDING X MAWSON LAKES CAMPUS MAWSON LAKES SOUTH AUSTRALIA 5095	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 08 8302 6273	Telephone	: +61-3-8549 9600
Project	: KBR PAH BioAcc	Date Samples Received	: 09-Feb-2018
Order number	: ----	Date Analysis Commenced	: 09-Feb-2018
C-O-C number	: ----	Issue Date	: 14-Feb-2018
Sampler	: ALBERT JUHASZ		
Site	: ----		
Quote number	: ADBQ/011/10		
No. of samples received	: 9		
No. of samples analysed	: 9		

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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

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*
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1426491)									
EM1802743-001	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1426491)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	110	75	131
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	111	70	132
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	109	80	128
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	105	70	128
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	109	80	128
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	1.8 mg/kg	114	72	126
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	111	70	128
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	113	80	125
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	104	70	130
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	112	80	126
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	106	71	124
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	104	75	125
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	98.7	70	125
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	105	71	128
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	104	72	126
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	103	68	127

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1423427)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<2.5	5 µg/L	68.6	48	110
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<2.5	5 µg/L	67.2	49	124
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<2.5	5 µg/L	67.6	53	117
EP075(SIM): Fluorene	86-73-7	1	µg/L	<2.5	5 µg/L	68.8	54	118
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<2.5	5 µg/L	78.4	57	119
EP075(SIM): Anthracene	120-12-7	1	µg/L	<2.5	2.5 µg/L	69.6	51	113
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<2.5	5 µg/L	84.0	59	123
EP075(SIM): Pyrene	129-00-0	1	µg/L	<2.5	5 µg/L	84.4	58	123
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<2.5	5 µg/L	75.2	52	126
EP075(SIM): Chrysene	218-01-9	1	µg/L	<2.5	5 µg/L	82.4	55	123
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<2.5	5 µg/L	74.8	52	131
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<2.5	5 µg/L	80.5	57	126

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	LCS: Spike Recovery (%)	Recovery Limits (%): Low	Recovery Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1423427) - continued								
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<2.5	5 µg/L	71.8	56	126
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<2.5	5 µg/L	73.1	53	123
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<2.5	5 µg/L	71.8	53	125
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<2.5	5 µg/L	75.8	53	125

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1426491)							
EM1802743-001	Anonymous	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	110	67	117
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	112	52	148

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM1802767**	Page	: 1 of 5
Client	: **UNISA - CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION**	Laboratory	: Environmental Division Melbourne
Contact	: MR ALBERT JUHASZ	Telephone	: +61-3-8549 9600
Project	: KBR PAH BioAcc	Date Samples Received	: 09-Feb-2018
Site	: ----	Issue Date	: 14-Feb-2018
Sampler	: ALBERT JUHASZ	No. of samples received	: 9
Order number	: ----	No. of samples analysed	: 9

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Regular Sample Surrogates

Sub-Matrix: **SOLVENT**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP075(SIM)S: Phenolic Compound Surrogates	EM1802767-005	KBR2A-1	**Phenol-d6**	13127-88-3	58.7 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1802767-006	KBR2A-2	**Phenol-d6**	13127-88-3	75.4 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1802767-007	KBR2B-1	**Phenol-d6**	13127-88-3	71.4 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1802767-008	KBR2B-2	**Phenol-d6**	13127-88-3	65.8 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1802767-009	QC1	**Phenol-d6**	13127-88-3	76.7 %	10-46 %	**Recovery greater than upper data quality objective**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	5	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	5	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

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

Method / *Container* / Client Sample ID(s)	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	Due for extraction	Evaluation	*Date analysed*	Due for analysis	Evaluation
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
KBR2A-250A, KBR2A-250B, KBR2B-250A, KBR2B-250B	**08-Feb-2018**	**12-Feb-2018**	22-Feb-2018	✓	**12-Feb-2018**	24-Mar-2018	✓

Matrix: **WATER**

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

Method / *Container* / Client Sample ID(s)	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	Due for extraction	Evaluation	*Date analysed*	Due for analysis	Evaluation

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM))							
KBR2A-1, KBR2A-2, KBR2B-1, KBR2B-2, QC1	**08-Feb-2018**	**09-Feb-2018**	15-Feb-2018	✓	**09-Feb-2018**	21-Mar-2018	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
PAH/Phenols (SIM)	EP075(SIM)	1	5	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	5	0.00	10.00	×	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	5	0.00	5.00	×	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270D. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container.

University of South Australia

Assessment of oral PAH bioaccessibility in contaminated sediment – Kendall Bay Phase 2

Prepared for: Environmental Risk Sciences Pty Ltd

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Date of issue: 5 November 2017

Important Notice

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INTRODUCTION

This report was prepared for Environmental Risk Sciences Pty Ltd to assess PAH bioaccessibility in impacted sediment. The bioaccessibility testing was conducted at the Future Industries Institute, based at the Mawson Lakes Campus of the University of South Australia (UniSA). UniSA's Flagship Institute focuses on building knowledge and capacity in core research strengths of physical chemistry and environmental science and management. The Institute has four distinct yet inter-related strands: Minerals and Resources; Energy and Advanced Manufacturing; Environmental Science and Engineering; and Bioengineering and Nanomedicine. The Institute aggregates and builds upon existing expertise and infrastructure from the Ian Wark Research Institute, the Mawson Institute and the Centre for Environmental Risk Assessment and Remediation. The vision for the Future Industries Institute aligns strongly with South Australian and National economic and research priorities by building a critical mass of trans-disciplinary research capacity focused on pressing real-world challenges.

OBJECTIVES

The objective of this assessment was to:

- Determine PAH bioaccessibility in 5 samples supplied by Synnot Wilkinson.

OUTCOMES AND DELIVERABLES

The expected outcome from this assessment was:

- A report assessing the bioaccessibility of PAHs in impacted sediment. The report was to include;
    - Assessment of PAH concentration in the < 250 µm particle size fraction;
    - Assessment of PAH bioaccessibility in the < 250 µm particle size fraction using an vitro method;
    - Methodology procedures; and
    - QA/QC protocols

PROJECT BACKGROUND

Testing was initiated at the invitation of Environmental Risk Sciences Pty Ltd for an assessment of PAH bioaccessibility in 5 sediment samples (duplicate analysis). Human exposure to a contaminant may be through a number of pathways including inhalation, dermal absorption and ingestion. For many contaminants, a significant exposure pathway is via soil ingestion. Generally, soil ingestion results from

the accidental or, in the case of children less than 5 years old, the incidental ingestion of soil (< 250 μm particle size fraction) via hand-to-mouth contact (Basta et al., 2001). When assessing risk to humans associated with the incidental ingestion of contaminated soil, a major unknown is quantifying the dose that has been solubilised in the gastrointestinal tract and absorbed into the systemic circulation (i.e. the bioavailable fraction). It is often assumed that the contaminant is 100% bioavailable, however, it is generally accepted that contaminant bioavailability in soil may be less than 100%. As a consequence, incorporating PAH bioavailability into human health risk assessment may reduce the uncertainty in estimating exposure associated with the incidental ingestion of contaminated soil.

Determination of PAH bioavailability is challenging due to the complexity of in vivo PAH metabolism, distribution and excretion. Following ingestion, PAHs that are absorbed across the intestinal epithelium may enter hepatic portal circulation and be transported to the liver (first pass effect) where PAH metabolism may occur as a result of cytochrome P450 monooxygenase activity (Ramesh et al., 2004; Shimada, 2006). From hepatic portal circulation, metabolised and non-metabolised PAHs may enter the systemic circulation via hepatic veins whereas a proportion of metabolised PAHs may be excreted in the faeces via the bile (Ramesh et al., 2004). Non-absorbed PAHs in the gastrointestinal tract are also excreted via the faeces. Assessment of PAH bioavailability is complicated by the fact that PAHs may be absorbed from the gastrointestinal tract and transformed in the hepatic portal system but may not reach the systemic circulation (due to biliary excretion) which by definition is the bioavailable fraction. Conversely, transformed PAHs may enter the systemic circulation, however, this may not be taken into consideration for PAH bioavailability estimations if only the concentration of the parent compound is determined.

Although in vivo studies utilising animal models are an appropriate method for determination of PAH bioavailability in contaminated soil for inclusion in human health exposure assessment, the time required for in vivo studies and the expense of animal trials preclude their use as routine relative bioavailability assessment tools. As a result, rapid, cost effective in vitro methods simulating human gastrointestinal conditions have been developed in order to estimate contaminant bioavailability. These assays determine PAH concentrations that are mobilised following gastrointestinal extraction (i.e. the bioaccessible fraction) and are therefore potentially available for absorption into the systemic circulation. Assays such as the organic Physiologically Based Extraction Test (PBET; Ruby et al., 2002), Fed ORganic Estimation human Simulation Test (FOREhST; Cave et al., 2010), Colon-extended PBET (Tilston et al., 2011) have been used to assess PAH bioaccessibility in contaminated soils, however, as detailed by Collins et al. (2013), many of these methods may underestimate PAH bioaccessibility due to limiting partitioning of PAHs into gastrointestinal fluid (i.e. solubility constraints). To overcome these limitations, silicone cord (poly[dimethylsiloxane]) has been suggested to be included in the in vitro assay as a sorption sink due to its compatibility with extracting solutions and its well suited partitioning properties and low internal diffusive resistance for hydrophobic organic contaminants (Gouliarmou et al., 2013). The inclusion of the sorption sink simulates passive molecular diffusion across the small intestinal epithelium which causes disequilibrium in the digestive fluid and therefore creates a gradient for further diffusive mobilisation of contaminants from the soil matrix (Gouliarmou et al., 2013). Without mimicking uptake, in vitro models may underestimate PAH bioaccessibility due to the finite capacity of the in vitro fluid to accommodate desorbable PAHs.

FINDINGS

The concentration of PAHs in each sample is shown in Tables 1 and 2 while PAH bioaccessibility results are shown in Tables 3-10.

- The concentration of PAHs (Σ16 PAHs $_{\text{half LOR}}$) in the < 250 µm particle size fraction ranged from 8.8 mg kg^{-1} (EN3) to 795 mg kg^{-1} (EN1A) with $BaP_{TEQ(\text{half LOR})}$ ranging from 1.5 mg kg^{-1} (EN3) to 87.2 mg kg^{-1} (EN1A) (Tables 1 and 2).

- In sample EN1A (0-150 mm, sand, shell, coal), PAH bioaccessibility ranged from < 1.38 (naphthalene, acenaphthene,) to 117 mg kg^{-1} (pyrene) (Table 3) with percent bioaccessibility ranging from 15.1% (acenaphthylene) to 56.5% (fluoranthene). Using half LOR, Σ16 PAHs and BaP_{TEQ} bioaccessibility was 43.8% and 32.5% respectively (Table 8).

- In sample EN1B (150-300 mm, black oily mud), PAH bioaccessibility ranged from < 1.28 (naphthalene, indeno[1,2,3-c,d]pyrene, dibenz[a,h]anthracene) to 13.7 mg kg^{-1} (pyrene) (Table 4) with percent bioaccessibility ranging from 13.9% (benzo[a]pyrene) to 35.0% (pyrene). Using half LOR, Σ16 PAHs and BaP_{TEQ} bioaccessibility was 23.0% and 16.3% respectively (Table 8).

- In sample EN2, PAH bioaccessibility ranged was < 1.27 mg kg^{-1} for all PAHs with the exception of pyrene (2.43 mg kg^{-1}; 19.8%). Using half LOR, Σ16 PAHs and BaP_{TEQ} bioaccessibility was 16.6% and 12.7% respectively (Table 9).

- In sample EN3, PAH bioaccessibility was < 1.32 mg kg^{-1} for all PAHs (Table 6). Using half LOR, Σ16 PAHs and BaP_{TEQ} bioaccessibility was approximately 100% (Table 9).

- In sample EN4, PAH bioaccessibility was < 1.23 mg kg^{-1} for all PAHs (Table 7). Using half LOR, Σ16 PAHs and BaP_{TEQ} bioaccessibility was 31.6% and 27.8% respectively (Table 10).

- The concentration of PAHs in the assay blank (QC1) was below the level of reporting (< 2.5 µg l^{-1}).

Table 1. PAH concentration in samples EN1A, EN1B and EN2 (< 250 µm particle size fraction).

PAH	EN1A (mg kg^{-1})†			EN1B (mg kg^{-1})‡			EN2 (mg kg^{-1})		
	250A	250B	Av. 250	250A	250B	Av. 250	250A	250B	Av. 250
Naphthalene	4.6	4.5	4.6	<2.4	<2.3	<2.4	<2.4	<2.4	<2.4
Acenaphthylene	32.3	33.1	32.7	13.5	13.2	13.4	5.7	5.4	5.6
Acenaphthene	<2.4	<2.4	<2.4	<2.4	<2.3	<2.4	<2.4	<2.4	<2.4
Fluorene	5.8	5.4	5.6	<2.4	<2.3	<2.4	<2.4	<2.4	<2.4
Phenanthrene	13.6	12.7	13.2	3.1	3.1	3.1	<2.4	<2.4	<2.4
Anthracene	17.3	17.4	17.4	3.1	3.0	3.1	<2.4	<2.4	<2.4
Fluoranthene	196	190	193	16.0	15.8	15.9	7.1	6.8	7.0
Pyrene	247	240	244	38.9	38.9	38.9	12.6	12.0	12.3
Benz(a)anthracene	45.3	44.2	44.8	6.6	6.7	6.7	4.7	4.8	4.8
Chrysene	40.2	37.8	39.0	4.9	4.8	4.9	4.1	4.0	4.1
Benzo(b+j)fluoranthene	67.6	67.4	67.5	22.6	23.8	23.2	10.3	9.7	10.0
Benzo(k)fluoranthene	25.6	23.2	24.4	7.6	7.4	7.5	4.4	3.8	4.1
Benzo(a)pyrene	66.8	64.9	65.9	19.7	19.9	19.8	8.6	8.0	8.3
Indeno(1.2.3.cd)pyrene	17.2	17.5	17.4	7.3	7.4	7.4	3.4	3.2	3.3
Dibenz(a.h)anthracene	5.5	5.3	5.4	<2.4	<2.3	<2.4	<2.4	<2.4	<2.4
Benzo(g.h.i)perylene	20.4	19.6	20.0	9.0	9.1	9.1	4.2	3.9	4.1
Σ16 PAHs (half LOR)	806	784	795	157	158	158	72.3	68.8	70.6
BaP TEQ (half LOR)	88.5	86.0	87.2	25.4	25.8	25.6	12.2	11.4	11.8
Σ16 PAHs (zero LOR)	805	783	794	152	153	153	65.1	61.6	63.4
BaP TEQ (zero LOR)	88.5	86.0	87.2	24.2	24.6	24.4	11.0	10.2	10.6

*Average concentration of duplicate analysis

†EN1A (0-150 mm, sand, shell, coal) – samples labelled ‘EN1c’

‡EN1B (150-300 mm, black oily mud) – samples labelled ‘EN1m’

Table 2. PAH concentration in samples EN3 and EN4 (< 250 µm particle size fraction).

PAH	EN3 (mg kg^{-1})			EN4 (mg kg^{-1})		
	250A	**250B**	**Av. 250**	**250A**	**250B**	**Av. 250**
Naphthalene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	0.7	0.7	0.7	1.8	1.5	1.7
Acenaphthene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	0.7	0.7	0.7	1.8	1.5	1.7
Pyrene	1.9	1.8	1.9	3.8	3.2	3.5
Benz(a)anthracene	0.5	0.5	0.5	1.2	1.0	1.1
Chrysene	<0.5	<0.5	<0.5	1.0	0.8	0.9
Benzo(b+j)fluoranthene	1.3	1.2	1.3	3.0	2.8	2.9
Benzo(k)fluoranthene	<0.5	0.6	0.6	1.4	1.0	1.2
Benzo(a)pyrene	1.0	1.0	1.0	2.5	2.1	2.3
Indeno(1.2.3.cd)pyrene	<0.5	<0.5	<0.5	1.0	0.8	0.9
Dibenz(a.h)anthracene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	0.5	<0.5	<0.5	1.2	1.0	1.1
Σ16 PAHs (half LOR)	8.9	8.8	8.8	20.2	17.2	18.7
BaP TEQ (half LOR)	1.5	1.5	1.5	3.4	2.9	3.2
Σ16 PAHs (zero LOR)	6.6	6.5	6.6	18.7	15.7	17.2
BaP TEQ (zero LOR)	1.2	1.2	1.2	3.2	2.7	2.9

*Average concentration of duplicate analysis

Table 3. Assessment of PAH bioaccessibility in sample EN1A (< 250 µm particle size fraction).

PAH	EN1-1c			EN1-2c			Av. Bioaccessible PAHs (mg kg^{-1})[‡]
	PAH conc. in Extract (µg/l)	PAH in Extract (µg)*	Bioaccessible PAHs (mg kg^{-1})	PAH conc. in Extract (µg/l)	PAH in Extract (µg)[†]	Bioaccessible PAHs (mg kg^{-1})	
Naphthalene	<12.5	<1.10	<1.38	<12.5	<1.05	<1.31	<1.38
Acenaphthylene	46.4	4.09	5.12	45.6	3.82	4.77	4.95
Acenaphthene	<12.5	<1.10	<1.38	<12.5	<1.05	<1.31	<1.38
Fluorene	13.8	1.22	1.52	13.0	1.09	1.36	1.44
Phenanthrene	39.3	3.47	4.33	38.1	3.19	3.99	4.2
Anthracene	81.5	7.19	8.99	75.3	6.31	7.88	8.44
Fluoranthene	1020	90.0	112	999	83.7	105	109
Pyrene	1100	97.1	121	1070	89.6	112	117
Benz(a)anthracene	160	14.1	17.6	157	13.1	16.4	17.0
Chrysene	167	14.7	18.4	161	13.5	16.9	17.6
Benzo(b+j)fluoranthene	252	22.2	27.8	220	18.4	23.0	25.4
Benzo(k)fluoranthene	96.2	8.49	10.6	91.1	7.63	9.54	10.1
Benzo(a)pyrene	196	17.3	21.6	192	16.1	20.1	20.9
Indeno(1.2.3.cd)pyrene	39.2	3.46	4.32	39.7	3.32	4.16	4.24
Dibenz(a.h)anthracene	14.2	1.25	1.57	14.7	1.23	1.54	1.55
Benzo(g.h.i)perylene	51.6	4.55	5.69	53.2	4.46	5.57	5.63
Σ16 PAHs (half LOR)	3290	290	363	3182	267	333	348
BaP TEQ (half LOR)	267	23.6	29.5	260	21.7	27.2	28.3
Σ16 PAHs (zero LOR)	3277	289	361	3170	265	332	347
BaP TEQ (zero LOR)	267	23.6	29.5	260	21.7	27.2	28.3

*Extract volume was 88.2 ml. [†]Extract volume was 83.8 ml. [‡]Average concentration of duplicate analysis.

Table 4. Assessment of PAH bioaccessibility in sample EN1B (< 250 µm particle size fraction).

PAH	EN1-1m			EN1-2m			Av. Bioaccessible PAHs (mg kg^{-1})‡
	PAH conc. in Extract (µg/l)	PAH in Extract (µg)*	Bioaccessible PAHs (mg kg^{-1})	PAH conc. in Extract (µg/l)	PAH in Extract (µg)†	Bioaccessible PAHs (mg kg^{-1})	
Naphthalene	<12.5	<1.02	<1.28	<12.5	<0.96	<1.20	<1.28
Acenaphthylene	<12.5	<1.02	<1.28	<12.5	<0.96	<1.20	<1.28
Acenaphthene	<12.5	<1.02	<1.28	<12.5	<0.96	<1.20	<1.28
Fluorene	<12.5	<1.02	<1.28	<12.5	<0.96	<1.20	<1.28
Phenanthrene	<12.5	<1.02	<1.28	<12.5	<0.96	<1.20	<1.28
Anthracene	<12.5	<1.02	<1.28	<12.5	<0.96	<1.20	<1.28
Fluoranthene	47.3	3.86	4.83	49.2	3.77	4.71	4.77
Pyrene	133	10.9	13.6	144	11.0	13.8	13.7
Benz(a)anthracene	<12.5	<1.02	<1.28	<12.5	<0.96	<1.20	<1.28
Chrysene	14.2	1.16	1.45	14.9	1.14	1.43	1.44
Benzo(b+j)fluoranthene	44.4	3.62	4.53	42.2	3.23	4.04	4.29
Benzo(k)fluoranthene	20.6	1.68	2.10	19.0	1.46	1.82	1.96
Benzo(a)pyrene	32.0	2.61	3.27	23.4	1.79	2.24	2.75
Indeno(1.2.3.cd)pyrene	12.5	1.02	1.28	<12.5	<0.96	<1.20	<1.28
Dibenz(a.h)anthracene	<12.5	<1.02	<1.28	<12.5	<0.96	<1.20	<1.28
Benzo(g.h.i)perylene	14.1	1.15	1.44	16.1	1.23	1.54	1.49
Σ16 PAHs (half LOR)	368	30.0	37.6	365	28.0	35.0	36.3
BaP TEQ (half LOR)	46.9	3.83	4.79	37.3	2.86	3.58	4.18
Σ16 PAHs (zero LOR)	318	26.0	32.5	309	23.7	29.6	31.0
BaP TEQ (zero LOR)	40.0	3.27	4.09	29.8	2.29	2.86	3.47

*Extract volume was 81.6 ml. †Extract volume was 76.6 ml. ‡Average concentration of duplicate analysis.

Table 5. Assessment of PAH bioaccessibility in sample EN2 (< 250 µm particle size fraction).

PAH	EN2-1			EN2-2			Av. Bioaccessible PAHs (mg kg^{-1})[‡]
	PAH conc. in Extract (µg/l)	PAH in Extract (µg)*	Bioaccessible PAHs (mg kg^{-1})	PAH conc. in Extract (µg/l)	PAH in Extract (µg)[†]	Bioaccessible PAHs (mg kg^{-1})	
Naphthalene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Acenaphthylene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Acenaphthene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Fluorene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Phenanthrene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Anthracene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Fluoranthene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Pyrene	24.1	1.87	2.34	24.8	2.01	2.52	2.43
Benz(a)anthracene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Chrysene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Benzo(b+j)fluoranthene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Benzo(k)fluoranthene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Benzo(a)pyrene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Indeno(1.2.3.cd)pyrene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Dibenz(a.h)anthracene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Benzo(g.h.i)perylene	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27
Σ16 PAHs (half LOR)	118	9.2	11.4	119	9.6	12.0	11.7
BaP TEQ (half LOR)	15.1	1.17	1.47	15.1	1.23	1.54	1.50
Σ16 PAHs (zero LOR)	24.1	1.9	2.34	24.8	2.0	2.52	2.43
BaP TEQ (zero LOR)	<12.5	<0.97	<1.21	<12.5	<1.02	<1.27	<1.27

*Extract volume was 77.7 ml. [†]Extract volume was 81.2 ml. [‡]Average concentration of duplicate analysis.

Table 6. Assessment of PAH bioaccessibility in sample EN3 (< 250 µm particle size fraction).

PAH	EN3-1			EN3-2			Av. Bioaccessible PAHs (mg kg^{-1})[ǂ]
	PAH conc. in Extract (µg/l)	PAH in Extract (µg)*	Bioaccessible PAHs (mg kg^{-1})	PAH conc. in Extract (µg/l)	PAH in Extract (µg)[†]	Bioaccessible PAHs (mg kg^{-1})	
Naphthalene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Acenaphthylene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Acenaphthene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Fluorene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Phenanthrene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Anthracene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Fluoranthene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Pyrene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Benz(a)anthracene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Chrysene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Benzo(b+j)fluoranthene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Benzo(k)fluoranthene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Benzo(a)pyrene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Indeno(1.2.3.cd)pyrene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Dibenz(a.h)anthracene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Benzo(g.h.i)perylene	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
Σ16 PAHs (half LOR)	100	8.4	10.5	100	7.8	9.7	10.1
BaP TEQ (half LOR)	15.1	1.27	1.59	15.1	1.17	1.47	1.53
Σ16 PAHs (zero LOR)	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32
BaP TEQ (zero LOR)	<12.5	<1.05	<1.32	<12.5	<0.97	<1.21	<1.32

*Extract volume was 84.2 ml. [†]Extract volume was 77.6 ml. [ǂ]Average concentration of duplicate analysis

Table 7. Assessment of PAH bioaccessibility in sample EN4 (< 250 µm particle size fraction).

PAH	EN4-1			EN4-2			Av. Bioaccessible PAHs (mg kg^{-1})[ǂ]
	PAH conc. in Extract (µg/l)	PAH in Extract (µg)*	Bioaccessible PAHs (mg kg^{-1})	PAH conc. in Extract (µg/l)	PAH in Extract (µg)[†]	Bioaccessible PAHs (mg kg^{-1})	
Naphthalene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Acenaphthylene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Acenaphthene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Fluorene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Phenanthrene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Anthracene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Fluoranthene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Pyrene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Benz(a)anthracene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Chrysene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Benzo(b+j)fluoranthene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Benzo(k)fluoranthene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Benzo(a)pyrene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Indeno(1.2.3.cd)pyrene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Dibenz(a.h)anthracene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Benzo(g.h.i)perylene	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
Σ16 PAHs (half LOR)	20.0	1.56	1.96	100	7.8	9.8	5.9
BaP TEQ (half LOR)	3.0	0.24	0.30	15.1	1.19	1.48	0.89
Σ16 PAHs (zero LOR)	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23
BaP TEQ (zero LOR)	<2.5	<0.20	<0.24	<12.5	<0.98	<1.23	<1.23

*Extract volume was 78.2 ml. [†]Extract volume was 78.4 ml. [ǂ]Average concentration of duplicate analysis.

Table 8. Total PAH concentration and bioaccessible PAHs in samples EN1A and EN1B (< 250 µm particle size fraction).

PAH	EN1A			EN1B		
	PAHs (mg kg^{-1})	Bioaccessible PAH (mg kg^{-1})	PAH Bioaccessibility (%)	PAHs (mg kg^{-1})	Bioaccessible PAH (mg kg^{-1})	PAH Bioaccessibility (%)
Naphthalene	4.6	<1.38	<30.0	<2.4	<1.28	-
Acenaphthylene	32.7	4.95	15.1	13.4	<1.28	<9.6
Acenaphthene	<2.4	<1.38	-	<2.4	<1.28	-
Fluorene	5.6	1.44	25.7	<2.4	<1.28	-
Phenanthrene	13.2	4.2	31.8	3.1	<1.28	<41.3
Anthracene	17.4	8.44	48.5	3.1	<1.28	<41.3
Fluoranthene	193	109	56.5	15.9	4.77	30.0
Pyrene	244	117	48.0	38.9	13.7	35.2
Benz(a)anthracene	44.8	17.0	37.9	6.7	<1.28	<19.1
Chrysene	39.0	17.6	45.1	4.9	1.44	29.4
Benzo(b+j)fluoranthene	67.5	25.4	37.6	23.2	4.29	18.5
Benzo(k)fluoranthene	24.4	10.1	41.4	7.5	1.96	26.1
Benzo(a)pyrene	65.9	20.9	31.7	19.8	2.75	13.9
Indeno(1.2.3.cd)pyrene	17.4	4.24	24.4	7.4	<1.28	<17.3
Dibenz(a.h)anthracene	5.4	1.55	28.7	<2.4	<1.28	-
Benzo(g.h.i)perylene	20.0	5.63	28.2	9.1	1.49	16.4
Σ16 PAHs (half LOR)	795	348	43.8	158	36.3	23.0
BaP TEQ (half LOR)	87.2	28.3	32.5	25.6	4.18	16.3
Σ16 PAHs (zero LOR)	794	347	43.7	153	31.0	20.3
BaP TEQ (zero LOR)	87.2	28.3	32.5	24.4	3.47	14.2

Table 9. Total PAH concentration and bioaccessible PAHs in samples EN2 and EN3 (< 250 µm particle size fraction).

PAH	EN2			EN3		
	PAHs (mg kg^{-1})	Bioaccessible PAH (mg kg^{-1})	PAH Bioaccessibility (%)	PAHs (mg kg^{-1})	Bioaccessible PAH (mg kg^{-1})	PAH Bioaccessibility (%)
Naphthalene	<2.4	<1.27	-	<0.5	<1.32	-
Acenaphthylene	5.6	<1.27	<22.7	0.7	<1.32	<100
Acenaphthene	<2.4	<1.27	-	<0.5	<1.32	-
Fluorene	<2.4	<1.27	-	<0.5	<1.32	-
Phenanthrene	<2.4	<1.27	-	<0.5	<1.32	-
Anthracene	<2.4	<1.27	-	<0.5	<1.32	-
Fluoranthene	7.0	<1.27	<18.1	0.7	<1.32	<100
Pyrene	12.3	2.43	19.8	1.9	<1.32	<69.5
Benz(a)anthracene	4.8	<1.27	<26.5	0.5	<1.32	<100
Chrysene	4.1	<1.27	<31.0	<0.5	<1.32	-
Benzo(b+j)fluoranthene	10.0	<1.27	<12.7	1.3	<1.32	<100
Benzo(k)fluoranthene	4.1	<1.27	<31.0	0.6	<1.32	<100
Benzo(a)pyrene	8.3	<1.27	<15.3	1.0	<1.32	<100
Indeno(1.2.3.cd)pyrene	3.3	<1.27	<38.5	<0.5	<1.32	-
Dibenz(a.h)anthracene	<2.4	<1.27	-	<0.5	<1.32	-
Benzo(g.h.i)perylene	4.1	<1.27	<31.0	<0.5	<1.32	-
Σ16 PAHs (half LOR)	70.6	11.7	16.6	8.8	10.1	<100
BaP TEQ (half LOR)	11.8	1.50	12.7	1.5	1.53	<100
Σ16 PAHs (zero LOR)	63.4	2.43	3.8	6.6	<1.32	20.0
BaP TEQ (zero LOR)	10.6	<1.27	<12.0	1.2	<1.32	<100

Table 10. Total PAH concentration and bioaccessible PAHs in sample EN4 (< 250 µm particle size fraction).

PAH	EN4		
	PAHs (mg kg^{-1})	Bioaccessible PAH (mg kg^{-1})	PAH Bioaccessibility (%)
Naphthalene	<0.5	<1.23	-
Acenaphthylene	1.7	<1.23	<72.4
Acenaphthene	<0.5	<1.23	-
Fluorene	<0.5	<1.23	-
Phenanthrene	<0.5	<1.23	-
Anthracene	<0.5	<1.23	-
Fluoranthene	1.7	<1.23	<72.4
Pyrene	3.5	<1.23	<35.1
Benz(a)anthracene	1.1	<1.23	<100
Chrysene	0.9	<1.23	<100
Benzo(b+j)fluoranthene	2.9	<1.23	<42.4
Benzo(k)fluoranthene	1.2	<1.23	<100
Benzo(a)pyrene	2.3	<1.23	<53.5
Indeno(1.2.3.cd)pyrene	0.9	<1.23	<100
Dibenz(a.h)anthracene	<0.5	<1.23	-
Benzo(g.h.i)perylene	1.1	<1.23	<100
Σ16 PAHs (half LOR)	18.7	5.9	31.6
BaP TEQ (half LOR)	3.2	0.89	27.8
Σ16 PAHs (zero LOR)	17.2	<1.23	<7.2
BaP TEQ (zero LOR)	2.9	<1.23	<42.4

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CONFIDENTIALITY

We acknowledge the confidential nature of the results of this project and will treat the results and project reports with appropriate confidentiality and security.

APPENDIX 1 - METHODOLOGY

Samples

The samples, supplied by Synnot Wilkinson, were oven-dried at 40°C for 96 hours and sieved to recover the < 250 µm particle size fraction. This particle size fraction was used to assess PAH bioaccessibility.

Assessment of PAH concentration in the <250 µm particle size fraction

PAH concentration in the < 250 µm particle size fraction was determined by ALS Laboratories. A copy of the ALS analytical report is included in Appendix 3.

Assessment of PAH bioaccessibility in the <250 µm particle size fraction

PAH bioaccessibility was assessed using the organic Physiologically Based extraction Test (org-PBET) (Ruby et al., 2002) with minor modifications. Gastric phase solution was prepared by dissolving glycine (15.0 g l^{-1}), sodium chloride (8.8 g l^{-1}), pepsin (1.0 g l^{-1}), bovine serum albumin (5.0 g l^{-1}) and mucine (2.5 g l^{-1}) in MilliQ water and adjusting the pH to 1.5 ± 0.05 through the addition of concentrated hydrochloric acid. When gastric phase conditions were transitioned into the intestinal phase, the pH was adjusted to 7.2 ± 0.2 using sodium hydroxide (50% w/v) and porcine pancreatin (0.6 g l^{-1}) and bovine bile (4.0 g l^{-1}) were added. PAH bioaccessibility assays were conducted using 0.8 g of PAH-contaminated soil and 80 ml of org-PBET solution in the presence of silicone cord (diameter of 3 mm; 8 g m^{-1}). A silicone mass of approximately 100 times that of the soil organic matter content was added to gastrointestinal fluid. Suspensions were incubated at 37°C and 40 rpm on a Ratek suspension mixer. Following a 1 hr gastric phase, in vitro conditions were modified to the intestinal phase and incubation continued for a further 16 hr. At the end of the incubation period, the silicone cord was removed, rinsed with MilliQ water, gently wiped with lint free tissue and extracted with acetone (2 x 50 ml) (Gouliarmou et al., 2013). PAHs recovered from silicone cord extracts were designated as the bioaccessible fraction.

QA/QC procedures

ALS laboratories conducted the analysis for total and bioaccessible PAH concentrations for all samples. ALS Laboratories are a NATA accredited laboratory for the chemical testing of environmental materials. Quality Control results are reported in Appendix 3. An additional sample was included in bioaccessibility assays for quality assurance and quality control. The sample consisted of a blank control (i.e. org-PBET solution without soil addition).

APPENDIX 2 – CHAIN OF CUSTODY FORMS

CHAIN OF CUSTODY

Synnot Wilkinson
STRATEGIC ENVIRONMENTAL CONSULTING

Date: 12/10/2017 Page 1 of 1

Client: **Jemena** Location: **Kendall Bay Phase 2**
Quote Number: .....COC No: **704/17**

Sample Preservation: **Cooler Blocks**
Turnaround Time: **Standard**

Contact: Russell Synnot - Phone: 0418 582 990

Container Size (ml): 300 mM x 150 mm tube, CAPPED

Preservation Code:
Type (**P** Neutral Plastic, **N** Nitric Acid Preserved, **C** Sodium Hydroxide Preserved, **J** Solvent Washed Acid Rinsed Jar, **S** solvent Washed Acid Rinsed Glass Bottle, **VC** Hydrochloric Acid Preserved Vial, **M** Methanol Preserved Vial)

Metals : As, Cd, Cr, Cu, Pb, Hg, Ni, Zn.
Hydrocarbons: As Listed
Other: As Listed

SEDIMENT (MARINE) BIOACCESSIBILITY TESTING

Lab No.	Date	Sample	Preservation Code	Sample Number and Depth	Requested Analytes (µg/kg unless otherwise stated)										Comments
					AS PER QUOTE										
					Metals	Cyanide	Total PAHs	Total Phenols	TRH	BTEX	pH	TOC		HOLD	
	12/10/17	EN1	Cooler Blocks	EN1A, 0-150 mm (sand, shell, coal)											
				EN1B, 150-300 mm (black oily mud)											
		EN2		EN2 0-300 mm (sand + gravel)											
		EN3		EN3 " " (sand)											
		EN4	↓	EN4 " " (sand)											

Samples prepared by:..... (Signed) Print Name: IAN IRVINE Date: 12/10/17

Received at Lab by:..... (Signed) Print Name: ALBERT JUHASZ Date: 16/10/17

Please e-mail signed Transmission Form immediately on receipt to Synnot & Wilkinson Pty Ltd. Ph: 0418 582 990 mail@baarrooka.com.au

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ **Sydney:** 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ **Newcastle:** 5 Rosegum Rd, Warabrook NSW 2304 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com
☐ **Brisbane:** 32 Shand St, Stafford QLD 4053 Ph.07 3243 7222 E:samples.brisbane@alsenviro.com
☐ **Townsville:** 14-15 Desma Ct, Bohle QLD 4818 Ph.07 4796 0600 E: townsville.environmental@alsenviro.com
☐ **Melbourne:** 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ **Adelaide:** 2-1 Bur[illegible] Ph: 08 8359 0890 E:[illegible]
☐ **Perth:** 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E:samples.perth@alsenviro.com
☐ **Launceston:** 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

FREIGHT

CLIENT:	University of South Australia	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☒ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	Mawson Lakes Campus X1-17		
PROJECT:	EnR PAH BioAcc	**ALS QUOTE NO.:**	
ORDER NUMBER:			
PROJECT MANAGER:	Albert Juhasz	**CONTACT PH: 08 8302 5045**	
SAMPLER:	Albert Juhasz	**SAMPLER MOBILE: 0418 818 121**	
COC emailed to ALS? (NO)		**EDD FORMAT (or default):**	
Email Reports to (will default to PM if no other addresses are listed): Albert.Juhasz@unisa.edu.au			
Email Invoice to (will default to PM if no other addresses are listed): Albert.Juhasz@unisa.edu.au			

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

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

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Albert Juhasz			[illegible] (ALS)
DATE/TIME: 30/10/17	DATE/TIME:	DATE/TIME:	DATE/TIME: 31/10 11:00

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL BOTTLES	PAHs								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	EN1c-250A	30/10/2017	S	AV	1	1								Samples have been dried and sieved
2	EN1c-250B	30/10/2017	S	AV	1	1								
3	EN1m-250A	30/10/2017	S	AV	1	1								
4	EN1m-250B	30/10/2017	S	AV	1	1								
5	EN2-250A	30/10/2017	S	AV	1	1								
6	EN2-250B	30/10/2017	S	AV	1	1								
7	EN3-250A	30/10/2017	S	AV	1	1								
8	EN3-250B	30/10/2017	S	AV	1	1								
9	EN4-250A	30/10/2017	S	AV	1	1								
10	EN4-250B	30/10/2017	S	AV	1	1								
				TOTAL	10	10								

Environmental Division
Melbourne
Work Order Reference
EM1714932

Telephone : +61-3-8549 9600

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

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ **Sydney:** 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ **Newcastle:** 5 Rosegum Rd, Warabrook NSW 2304 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com
☐ **Brisbane:** 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ **Townsville:** 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
☐ **Melbourne:** 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ **Adelaide:** 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E:adelaide@alsenviro.com
☐ **Perth:** 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ **Launceston:** 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2153 E: launceston@alsenviro.com

CLIENT:	**University of South Australia**	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☒ Standard TAT **(List due date):** ☐ Non Standard or urgent TAT **(List due date):**
OFFICE:	**Mawson Lakes Campus X1-17**		
PROJECT:	**EnR PAH BioAcc**	**ALS QUOTE NO.:**	
ORDER NUMBER:			
PROJECT MANAGER:	**Albert Juhasz**	**CONTACT PH: 08 8302 5045**	
SAMPLER:	**Albert Juhasz**	**SAMPLER MOBILE: 0418 818 121**	
COC emailed to ALS? (NO)		**EDD FORMAT (or default):**	

COC SEQUENCE NUMBER (Circle)

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

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt	°C		
Other comments:			

Email Reports to (will default to PM if no other addresses are listed): Albert.Juhasz@unisa.edu.au

Email Invoice to (will default to PM if no other addresses are listed): Albert.Juhasz@unisa.edu.au

RELINQUISHED BY:	**RECEIVED BY:**	**RELINQUISHED BY:**	**RECEIVED BY:**
Albert Juhasz			
DATE/TIME: 30/10/17	DATE/TIME:	DATE/TIME:	DATE/TIME: 31/10 11:00

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL BOTTLES	PAHs								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
11	EN1-1c	30/10/2017	W	AG	1	1								
12	EN1-2c	30/10/2017	W	AG	1	1								Samples are in acetone
13	EN1-1m	30/10/2017	W	AG	1	1								
14	EN1-2m	30/10/2017	W	AG	1	1								
15	EN2-1	30/10/2017	W	AG	1	1								
16	EN2-2	30/10/2017	W	AG	1	1								
17	EN3-1	30/10/2017	W	AG	1	1								
18	EN3-2	30/10/2017	W	AG	1	1								
19	EN4-1	30/10/2017	W	AG	1	1								
20	EN4-2	30/10/2017	W	AG	1	1								
21	QC1	30/10/2017	W	AG	1	1								
				TOTAL	11	11								

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

APPENDIX 3 – ANALYTICAL RESULTS AND QA/QC

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM1714932**	Page	: 1 of 8
Client	: **UNISA - CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION**	Laboratory	: Environmental Division Melbourne
Contact	: MR ALBERT JUHASZ	Contact	:
Address	: UNIVERSITY OF SOUTH AUSTRALIA CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION BUILDING X MAWSON LAKES CAMPUS MAWSON LAKES SOUTH AUSTRALIA 5095	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 08 8302 6273	Telephone	: +61-3-8549 9600
Project	: EnR PAH BioAcc	Date Samples Received	: 31-Oct-2017 11:00
Order number	: ----	Date Analysis Commenced	: 01-Nov-2017
C-O-C number	: ----	Issue Date	: 03-Nov-2017 15:50
Sampler	: ALBERT JUHASZ		
Site	: ----		
Quote number	: ADBQ/011/10		
No. of samples received	: 21		
No. of samples analysed	: 21		

ilac-MRA NATA
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*
Nancy Wang	Senior Semivolatile Instrument Chemist	Melbourne Organics, Springvale, VIC

General Comments

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

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

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

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

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

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

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

- EP075(SIM): Particular samples (EM1714932) required dilution due to the presence of high level contaminants. LOR values have been adjusted accordingly.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	EN1c-250a	EN1c-250B	EN1m-250A	EN1m-250B	EN2-250A
				Client sampling date / time	30-Oct-2017 00:00	30-Oct-2017 00:00	30-Oct-2017 00:00	30-Oct-2017 00:00	30-Oct-2017 00:00
Compound	CAS Number	LOR	Unit		EM1714932-001	EM1714932-002	EM1714932-003	EM1714932-004	EM1714932-005
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		4.6	4.5	<2.4	<2.3	<2.4
Acenaphthylene	208-96-8	0.5	mg/kg		32.3	33.1	13.5	13.2	5.7
Acenaphthene	83-32-9	0.5	mg/kg		<2.4	<2.4	<2.4	<2.3	<2.4
Fluorene	86-73-7	0.5	mg/kg		5.8	5.4	<2.4	<2.3	<2.4
Phenanthrene	85-01-8	0.5	mg/kg		13.6	12.7	3.1	3.1	<2.4
Anthracene	120-12-7	0.5	mg/kg		17.3	17.4	3.1	3.0	<2.4
Fluoranthene	206-44-0	0.5	mg/kg		196	190	16.0	15.8	7.1
Pyrene	129-00-0	0.5	mg/kg		247	240	38.9	38.9	12.6
Benz(a)anthracene	56-55-3	0.5	mg/kg		45.3	44.2	6.6	6.7	4.7
Chrysene	218-01-9	0.5	mg/kg		40.2	37.8	4.9	4.8	4.1
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		67.6	67.4	22.6	23.8	10.3
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		25.6	23.2	7.6	7.4	4.4
Benzo(a)pyrene	50-32-8	0.5	mg/kg		66.8	64.9	19.7	19.9	8.6
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		17.2	17.5	7.3	7.4	3.4
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		5.5	5.3	<2.4	<2.3	<2.4
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		20.4	19.6	9.0	9.1	4.2
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		81.0	79.7	74.8	76.7	81.3
2-Chlorophenol-D4	93951-73-6	0.5	%		72.8	72.9	74.1	75.1	72.2
2.4.6-Tribromophenol	118-79-6	0.5	%		74.3	70.8	75.9	75.1	43.7
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		80.8	78.7	79.4	80.6	80.1
Anthracene-d10	1719-06-8	0.5	%		93.5	109	112	98.2	101
4-Terphenyl-d14	1718-51-0	0.5	%		104	99.9	93.9	95.6	95.9

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	EN2-250B	EN3-250A	EN3-250B	EN4-250A	EN4-250B
				Client sampling date / time	30-Oct-2017 00:00	30-Oct-2017 00:00	30-Oct-2017 00:00	30-Oct-2017 00:00	30-Oct-2017 00:00
Compound	CAS Number	LOR	Unit		EM1714932-006	EM1714932-007	EM1714932-008	EM1714932-009	EM1714932-010
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<2.4	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		**5.4**	**0.7**	**0.7**	**1.8**	**1.5**
Acenaphthene	83-32-9	0.5	mg/kg		<2.4	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<2.4	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<2.4	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<2.4	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		**6.8**	**0.7**	**0.7**	**1.8**	**1.5**
Pyrene	129-00-0	0.5	mg/kg		**12.0**	**1.9**	**1.8**	**3.8**	**3.2**
Benz(a)anthracene	56-55-3	0.5	mg/kg		**4.8**	**0.5**	**0.5**	**1.2**	**1.0**
Chrysene	218-01-9	0.5	mg/kg		**4.0**	<0.5	<0.5	**1.0**	**0.8**
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		**9.7**	**1.3**	**1.2**	**3.0**	**2.8**
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		**3.8**	<0.5	**0.6**	**1.4**	**1.0**
Benzo(a)pyrene	50-32-8	0.5	mg/kg		**8.0**	**1.0**	**1.0**	**2.5**	**2.1**
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		**3.2**	<0.5	<0.5	**1.0**	**0.8**
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<2.4	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		**3.9**	**0.5**	<0.5	**1.2**	**1.0**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**81.4**	**90.6**	**90.1**	**91.6**	**75.5**
2-Chlorophenol-D4	93951-73-6	0.5	%		**71.4**	**84.9**	**84.2**	**85.3**	**74.9**
2.4.6-Tribromophenol	118-79-6	0.5	%		**42.6**	**77.3**	**77.9**	**79.0**	**66.1**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		**79.7**	**90.6**	**90.8**	**91.2**	**80.7**
Anthracene-d10	1719-06-8	0.5	%		**101**	**106**	**106**	**107**	**89.6**
4-Terphenyl-d14	1718-51-0	0.5	%		**95.1**	**105**	**105**	**106**	**86.2**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	EN1-1c	EN1-2c	EN1-1m	EN1-2m	EN2-1
				Client sampling date / time	30-Oct-2017 00:00	30-Oct-2017 00:00	30-Oct-2017 00:00	30-Oct-2017 00:00	30-Oct-2017 00:00
Compound	CAS Number	LOR	Unit		EM1714932-011	EM1714932-012	EM1714932-013	EM1714932-014	EM1714932-015
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<12.5	<12.5	<12.5	<12.5	<12.5
Acenaphthylene	208-96-8	1.0	µg/L		**46.4**	**45.6**	<12.5	<12.5	<12.5
Acenaphthene	83-32-9	1.0	µg/L		<12.5	<12.5	<12.5	<12.5	<12.5
Fluorene	86-73-7	1.0	µg/L		**13.8**	**13.0**	<12.5	<12.5	<12.5
Phenanthrene	85-01-8	1.0	µg/L		**39.3**	**38.1**	<12.5	<12.5	<12.5
Anthracene	120-12-7	1.0	µg/L		**81.5**	**75.3**	<12.5	<12.5	<12.5
Fluoranthene	206-44-0	1.0	µg/L		**1020**	**999**	**47.3**	**49.2**	<12.5
Pyrene	129-00-0	1.0	µg/L		**1100**	**1070**	**133**	**144**	**24.1**
Benz(a)anthracene	56-55-3	1.0	µg/L		**160**	**157**	<12.5	<12.5	<12.5
Chrysene	218-01-9	1.0	µg/L		**167**	**161**	**14.2**	**14.9**	<12.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		**252**	**220**	**44.4**	**42.2**	<12.5
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		**96.2**	**91.1**	**20.6**	**19.0**	<12.5
Benzo(a)pyrene	50-32-8	0.5	µg/L		**196**	**192**	**32.0**	**23.4**	<12.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		**39.2**	**39.7**	**12.5**	<12.5	<12.5
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		**14.2**	**14.7**	<12.5	<12.5	<12.5
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		**51.6**	**53.2**	**14.1**	**16.1**	<12.5
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**83.2**	**85.5**	**81.0**	**61.5**	**103**
2-Chlorophenol-D4	93951-73-6	1.0	%		**81.2**	**85.1**	**90.6**	**89.5**	**86.1**
2.4.6-Tribromophenol	118-79-6	1.0	%		**87.0**	**80.7**	**82.5**	**83.3**	**76.0**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**92.0**	**88.6**	**91.1**	**87.7**	**88.5**
Anthracene-d10	1719-06-8	1.0	%		**95.4**	**81.9**	**66.5**	**60.2**	**69.0**
4-Terphenyl-d14	1718-51-0	1.0	%		**91.5**	**84.9**	**87.9**	**92.5**	**96.3**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	EN2-2	EN3-1	EN3-2	EN4-1	EN4-2
				Client sampling date / time	30-Oct-2017 00:00	30-Oct-2017 00:00	30-Oct-2017 00:00	30-Oct-2017 00:00	30-Oct-2017 00:00
Compound	CAS Number	LOR	Unit		EM1714932-016	EM1714932-017	EM1714932-018	EM1714932-019	EM1714932-020
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Acenaphthylene	208-96-8	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Acenaphthene	83-32-9	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Fluorene	86-73-7	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Phenanthrene	85-01-8	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Anthracene	120-12-7	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Fluoranthene	206-44-0	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Pyrene	129-00-0	1.0	µg/L		**24.8**	<12.5	<12.5	<2.5	<12.5
Benz(a)anthracene	56-55-3	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Chrysene	218-01-9	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Benzo(a)pyrene	50-32-8	0.5	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<12.5	<12.5	<12.5	<2.5	<12.5
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**106**	**70.4**	**81.2**	**64.1**	**64.4**
2-Chlorophenol-D4	93951-73-6	1.0	%		**87.8**	**83.2**	**93.6**	**65.9**	**67.4**
2.4.6-Tribromophenol	118-79-6	1.0	%		**77.4**	**74.3**	**79.4**	**64.4**	**84.1**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**92.6**	**89.6**	**90.7**	**67.2**	**89.5**
Anthracene-d10	1719-06-8	1.0	%		**89.6**	**60.1**	**80.2**	**73.1**	**119**
4-Terphenyl-d14	1718-51-0	1.0	%		**101**	**97.5**	**103**	**54.4**	**78.1**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC1	----	----	----	----
				Client sampling date / time	30-Oct-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM1714932-021	--------	--------	--------	--------
					Result	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<2.5	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<2.5	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<2.5	----	----	----	----
Fluorene	86-73-7	1.0	µg/L		<2.5	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<2.5	----	----	----	----
Anthracene	120-12-7	1.0	µg/L		<2.5	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<2.5	----	----	----	----
Pyrene	129-00-0	1.0	µg/L		<2.5	----	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<2.5	----	----	----	----
Chrysene	218-01-9	1.0	µg/L		<2.5	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<2.5	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<2.5	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<2.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<2.5	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<2.5	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<2.5	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**56.9**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		**60.2**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		**41.1**	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**58.2**	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%		**74.1**	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		**87.0**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	54	125
2-Chlorophenol-D4	93951-73-6	65	123
2.4.6-Tribromophenol	118-79-6	34	122
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	61	125
Anthracene-d10	1719-06-8	62	130
4-Terphenyl-d14	1718-51-0	67	133

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	46
2-Chlorophenol-D4	93951-73-6	23	104
2.4.6-Tribromophenol	118-79-6	28	130
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	36	114
Anthracene-d10	1719-06-8	51	119
4-Terphenyl-d14	1718-51-0	49	127

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM1714932**	Page	: 1 of 5
Client	: **UNISA - CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION**	Laboratory	: Environmental Division Melbourne
Contact	: MR ALBERT JUHASZ	Contact	:
Address	: UNIVERSITY OF SOUTH AUSTRALIA CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION BUILDING X MAWSON LAKES CAMPUS MAWSON LAKES SOUTH AUSTRALIA 5095	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 08 8302 6273	Telephone	: +61-3-8549 9600
Project	: EnR PAH BioAcc	Date Samples Received	: 31-Oct-2017
Order number	: ----	Date Analysis Commenced	: 01-Nov-2017
C-O-C number	: ----	Issue Date	: 03-Nov-2017
Sampler	: ALBERT JUHASZ		
Site	: ----		
Quote number	: ADBQ/011/10		
No. of samples received	: 21		
No. of samples analysed	: 21		

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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

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*
Nancy Wang	Senior Semivolatile Instrument Chemist	Melbourne Organics, Springvale, VIC

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1213281)									
EM1714932-008	EN3-250B	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	0.7	0.6	27.1	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	0.7	0.7	0.00	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	1.8	1.7	0.00	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	0.5	<0.5	0.00	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	1.2	1.1	0.00	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	0.6	<0.5	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	1.0	0.9	0.00	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EM1714932-009	EN4-250A	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	1.8	1.4	29.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	1.8	1.4	23.5	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	3.8	3.0	23.7	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1213281) - continued									
EM1714932-009	EN4-250A	EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	1.2	1.0	21.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	1.0	0.8	20.8	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	3.0	2.3	25.9	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	1.4	0.9	40.9	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	2.5	1.9	27.2	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	1.0	0.8	28.5	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	1.2	0.9	28.1	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1213281)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	104	80	121
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	102	70	130
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	104	80	120
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	102	70	124
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	109	80	122
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	1.5 mg/kg	104	80	126
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	104	70	128
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	107	80	125
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	96.5	70	130
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	106	80	126
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	91.4	70	124
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	114	75	125
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	85.9	65	125
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	90.8	65	128
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	87.4	65	126
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	89.3	65	127

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1210788)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<2.5	5 µg/L	80.1	39	110
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<2.5	5 µg/L	89.8	40	124
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<2.5	5 µg/L	84.0	47	117
EP075(SIM): Fluorene	86-73-7	1	µg/L	<2.5	5 µg/L	86.9	51	118
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<2.5	5 µg/L	91.6	53	119
EP075(SIM): Anthracene	120-12-7	1	µg/L	<2.5	2.5 µg/L	98.2	51	113
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<2.5	5 µg/L	97.1	59	123
EP075(SIM): Pyrene	129-00-0	1	µg/L	<2.5	5 µg/L	87.5	58	123
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<2.5	5 µg/L	78.9	52	126
EP075(SIM): Chrysene	218-01-9	1	µg/L	<2.5	5 µg/L	110	55	123
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<2.5	5 µg/L	61.6	52	131
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<2.5	5 µg/L	101	57	126

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1210788) - continued								
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<2.5	5 µg/L	87.5	56	126
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<2.5	5 µg/L	70.0	53	123
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<2.5	5 µg/L	67.2	53	125
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<2.5	5 µg/L	80.7	53	125

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1213281)							
EM1714932-010	EN4-250B	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	93.1	67	117
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	114	52	148

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM1714932**	Page	: 1 of 5
Client	: **UNISA - CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION**	Laboratory	: Environmental Division Melbourne
Contact	: MR ALBERT JUHASZ	Telephone	: +61-3-8549 9600
Project	: EnR PAH BioAcc	Date Samples Received	: 31-Oct-2017
Site	: ----	Issue Date	: 03-Nov-2017
Sampler	: ALBERT JUHASZ	No. of samples received	: 21
Order number	: ----	No. of samples analysed	: 21

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Regular Sample Surrogates

Sub-Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP075(SIM)S: Phenolic Compound Surrogates	EM1714932-011	EN1-1c	**Phenol-d6**	13127-88-3	83.2 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1714932-012	EN1-2c	**Phenol-d6**	13127-88-3	85.5 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1714932-013	EN1-1m	**Phenol-d6**	13127-88-3	81.0 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1714932-014	EN1-2m	**Phenol-d6**	13127-88-3	61.5 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1714932-015	EN2-1	**Phenol-d6**	13127-88-3	103 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1714932-016	EN2-2	**Phenol-d6**	13127-88-3	106 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1714932-017	EN3-1	**Phenol-d6**	13127-88-3	70.4 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1714932-018	EN3-2	**Phenol-d6**	13127-88-3	81.2 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1714932-019	EN4-1	**Phenol-d6**	13127-88-3	64.1 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1714932-020	EN4-2	**Phenol-d6**	13127-88-3	64.4 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1714932-021	QC1	**Phenol-d6**	13127-88-3	56.9 %	10-46 %	**Recovery greater than upper data quality objective**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	17	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	17	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP075(SIM))								
EN1c-250a,	EN1c-250B,	**30-Oct-2017**	**01-Nov-2017**	13-Nov-2017	✓	**01-Nov-2017**	11-Dec-2017	✓
EN1m-250A,	EN1m-250B,							
EN2-250A,	EN2-250B,							
EN3-250A,	EN3-250B,							
EN4-250A,	EN4-250B							

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP075(SIM))								
EN1-1c,	EN1-2c,	**30-Oct-2017**	**02-Nov-2017**	06-Nov-2017	✓	**02-Nov-2017**	12-Dec-2017	✓
EN1-1m,	EN1-2m,							
EN2-1,	EN2-2,							
EN3-1,	EN3-2,							
EN4-1,	EN4-2,							
QC1								

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
PAH/Phenols (SIM)	EP075(SIM)	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	17	0.00	10.00	×	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	17	0.00	5.00	×	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270D. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container.

University of South Australia



Assessment of PAH bioaccessibility in contaminated sediments

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INTRODUCTION

This report was prepared for Environmental Risk Sciences Pty Ltd to assess PAH bioaccessibility in 4 sediment samples. The bioaccessibility testing was conducted by the Centre for Environmental Risk Assessment and Remediation (CERAR), an established research centre based at the Mawson Lakes Campus of the University of South Australia. The Centre brings together the best of Australia's researchers in environmental risk assessment and remediation with project managers fully familiar with the complexities of managing small and large projects.

OBJECTIVES

The objective of this assessment was to:

- Determine PAH bioaccessibility in 4 sediment samples supplied by Synnot and Wilkinson Pty Ltd.

OUTCOMES AND DELIVERABLES

The expected outcome from this assessment was:

- A report assessing the bioaccessibility of PAH in impacted sediments. The report was to include;
    - Assessment of PAH concentration in the < 250 µm particle size fraction;
    - Assessment of PAH bioaccessibility in the < 250 µm particle size fraction using an vitro method;
    - Methodology procedures; and
    - QA/QC protocols

PROJECT BACKGROUND

Testing was initiated at the invitation of Environmental Risk Sciences Pty Ltd for an assessment of PAH bioaccessibility in 4 sediment samples. Human exposure to a contaminant may be through a number of pathways including inhalation, dermal absorption and ingestion. For many contaminants, a significant exposure pathway is via soil ingestion. Generally, soil ingestion results from the accidental or, in the case of children less than 5 years old, the incidental ingestion of soil (< 250 µm particle size fraction) via hand-to-mouth contact (Basta et al., 2001). When assessing risk to humans associated with the incidental ingestion of contaminated soil, a major unknown is quantifying the dose that has been solubilised in the

gastrointestinal tract and absorbed into the systemic circulation (i.e. the bioavailable fraction). It is often assumed that the contaminant is 100% bioavailable, however, it is generally accepted that contaminant bioavailability in soil may be less than 100%. As a consequence, incorporating PAH bioavailability into human health risk assessment may reduce the uncertainty in estimating exposure associated with the incidental ingestion of contaminated soil.

Determination of PAH bioavailability is challenging due to the complexity of in vivo PAH metabolism, distribution and excretion. Following ingestion, PAHs that are absorbed across the intestinal epithelium may enter hepatic portal circulation and be transported to the liver (first pass effect) where PAH metabolism may occur as a result of cytochrome P450 monooxygenase activity (Ramesh et al., 2004; Shimada, 2006). From hepatic portal circulation, metabolised and non-metabolised PAHs may enter the systemic circulation via hepatic veins whereas a proportion of metabolised PAHs may be excreted in the faeces via the bile (Ramesh et al., 2004). Non-absorbed PAHs in the gastrointestinal tract are also excreted via the faeces. Assessment of PAH bioavailability is complicated by the fact that PAHs may be absorbed from the gastrointestinal tract and transformed in the hepatic portal system but may not reach the systemic circulation (due to biliary excretion) which by definition is the bioavailable fraction. Conversely, transformed PAHs may enter the systemic circulation, however, this may not be taken into consideration for PAH bioavailability estimations if only the concentration of the parent compound is determined.

Although in vivo studies utilising animal models are an appropriate method for determination of PAH bioavailability in contaminated soil for inclusion in human health exposure assessment, the time required for in vivo studies and the expense of animal trials preclude their use as routine relative bioavailability assessment tools. As a result, rapid, cost effective in vitro methods simulating human gastrointestinal conditions have been developed in order to estimate contaminant bioavailability. These assays determine PAH concentrations that are mobilised following gastrointestinal extraction (i.e. the bioaccessible fraction) and are therefore potentially available for absorption into the systemic circulation. Assays such as the organic Physiologically Based Extraction Test (PBET; Ruby et al., 2002), Fed ORganic Estimation human Simulation Test (FOREhST; Cave et al., 2010), Colon-extended PBET (Tilston et al., 2011) have been used to assess PAH bioaccessibility in contaminated soils, however, as detailed by Collins et al. (2013), many of these methods may underestimate PAH bioaccessibility due to limiting partitioning of PAHs into gastrointestinal fluid (i.e. solubility constraints). To overcome these limitations, silicone cord (poly[dimethylsiloxane]) has been suggested to be included in the in vitro assay as a sorption sink due to its compatibility with extracting solutions and its well suited partitioning properties and low internal diffusive resistance for hydrophobic organic contaminants (Gouliarmou et al., 2013). The inclusion of the sorption sink simulates passive molecular diffusion across the small intestinal epithelium which causes disequilibrium in the digestive fluid and therefore creates a gradient for further diffusive mobilisation of contaminants from the soil matrix (Gouliarmou et al., 2013). Without mimicking uptake, in vitro models may underestimate PAH bioaccessibility due to the finite capacity of the in vitro fluid to accommodate desorbable PAHs.

FINDINGS

The concentration of PAHs in each sample is shown in Tables 1 and 2 while PAH bioaccessibility results are shown in Tables 3-8.

- The concentration of PAHs (Σ16 PAHs) in the < 250 µm particle size fraction ranged from 3.1 (#101) to 82.9 mg kg^{-1} (#103) with BaP_{TEQ} (zero) ranging from 0.8 (#101) to 13.4 mg kg^{-1} (#103) (Tables 1 and 2).

- The bioaccessible fraction of PAHs in samples #100 and #101 was <0.34 and <0.29 mg kg^{-1} respectively for individual compounds (Tables 3 and 4).

- In sample #102, the bioaccessible fraction of chrysene, benzo(b+j)fluoranthene, benzo(k)fluoranthene and benzo(a)pyrene ranged from 0.46 to 0.63 mg kg^{-1} (Table 5) with percent bioaccessibility ranging from 6.3 (benzo(b+j)fluoranthene) to 18.0% (benzo(k)fluoranthene) (Table 8).

- In sample #103, the bioaccessible fraction of fluoranthene, chrysene, benzo(b+j)fluoranthene, benzo(k)fluoranthene and benzo(a)pyrene ranged from 0.34 to 0.88 mg kg^{-1} (Table 6) with percent bioaccessibility ranging from 4.3 (fluoranthene) to 18.1% (benzo(k)fluoranthene) (Table 8).

- The concentration of PAHs in the assay blank (QC1) was below the level of reporting.

Table 1. PAH concentration in samples 100 (0-300 mm) and 101 (0-300 mm) (< 250 µm particle size fraction).

PAH	Sample #100 (0-300 mm) (mg kg^{-1})			Sample #101 (0-300 mm) (mg kg^{-1})		
	100-250A	100-250B	Av. 100-250*	101-250A	101-250B	Av. 101-250*
Naphthalene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	0.7	0.6	0.7	<0.5	<0.5	<0.5
Acenaphthene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	1.4	1.3	1.4	0.6	0.6	0.6
Pyrene	2.1	2.0	2.1	1.0	1.0	1.0
Benz(a)anthracene	0.8	0.8	0.8	<0.5	<0.5	<0.5
Chrysene	1.0	1.0	1.0	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	2.1	2.1	2.1	0.8	0.8	0.8
Benzo(k)fluoranthene	1.1	1.0	1.1	<0.5	<0.5	<0.5
Benzo(a)pyrene	1.9	1.8	1.9	0.7	0.7	0.7
Indeno(1.2.3.cd)pyrene	0.9	0.9	0.9	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	1.0	0.9	1.0	<0.5	<0.5	<0.5
Σ16 PAHs	13	12.4	12.7	3.1	3.1	3.1
BaP TEQ (zero)	2.4	2.3	2.4	0.8	0.8	0.8

*Average concentration of duplicate analysis

Table 2. PAH concentration in samples 102 (0-300 mm) and 103 (0-300 mm) (< 250 µm particle size fraction).

PAH	Sample #102 (0-300 mm) (mg kg^{-1})			Sample #103 (0-300 mm) (mg kg^{-1})		
	102-250A	102-250B	Av. 102-250*	103-250A	103-250B	Av. 103-250*
Naphthalene	0.7	0.9	0.8	2.3	2.4	2.4
Acenaphthylene	3.4	3.8	3.6	6.2	5.6	5.9
Acenaphthene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	1.7	2.0	1.9	3.9	3.9	3.9
Anthracene	1.2	1.7	1.5	2.5	2.5	2.5
Fluoranthene	4.5	5.2	4.9	6.8	9.0	7.9
Pyrene	9.3	10.6	10.0	13.6	17.6	15.6
Benz(a)anthracene	3.2	3.8	3.5	4.8	6.6	5.7
Chrysene	3.9	4.4	4.2	4.8	7.1	6.0
Benzo(b+j)fluoranthene	7.8	8.2	8.0	10.7	10.2	10.5
Benzo(k)fluoranthene	2.6	3.3	3.0	4.4	4.2	4.3
Benzo(a)pyrene	6.4	7.0	6.7	10	9.3	9.7
Indeno(1.2.3.cd)pyrene	2.7	3.1	2.9	3.8	3.6	3.7
Dibenz(a.h)anthracene	0.8	0.9	0.9	1.2	1.2	1.2
Benzo(g.h.i)perylene	2.8	3.1	3.0	3.8	3.7	3.8
Σ16 PAHs	51.0	58.0	54.5	78.8	86.9	82.9
BaP TEQ (zero)	8.9	9.8	9.4	13.7	13.1	13.4

*Average concentration of duplicate analysis

Table 3. Assessment of PAH bioaccessibility in sample 100 (0-300 mm) (< 250 µm particle size fraction).

PAH	Sample #100-1			Sample #100-2			Av. Bioaccessible PAHs (mg kg^{-1})[‡]
	PAH conc. in Extract (µg/l)	PAH in Extract (µg)*	Bioaccessible PAHs (mg kg^{-1})	PAH conc. in Extract (µg/l)	PAH in Extract (µg)[†]	Bioaccessible PAHs (mg kg^{-1})	
Naphthalene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Acenaphthylene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Acenaphthene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Fluorene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Phenanthrene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Anthracene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Fluoranthene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Pyrene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Benz(a)anthracene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Chrysene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Benzo(b+j)fluoranthene	<2.5	<0.17	<0.28	2.9	0.21	**0.34**	<0.34
Benzo(k)fluoranthene	<2.5	<0.17	<0.28	2.9	0.21	**0.34**	<0.34
Benzo(a)pyrene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Indeno(1.2.3.cd)pyrene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Dibenz(a.h)anthracene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Benzo(g.h.i)perylene	<2.5	<0.17	<0.28	<2.5	<0.18	<0.30	<0.30
Σ16 PAHs	<5.0	<0.34	<0.56	5.8	0.41	0.69	<0.69
BaP TEQ (zero)	<5.0	<0.34	<0.56	<5.0	<0.36	<0.59	<0.59

*Extract volume was 67.8 ml. [†]Extract volume was 71.2 ml. [‡]Average concentration of duplicate analysis

Table 4. Assessment of PAH bioaccessibility in sample 101 (0-300 mm) (< 250 µm particle size fraction).

PAH	Sample #101-1			Sample #101-2			Av. Bioaccessible PAHs (mg kg^{-1})[‡]
	PAH conc. in Extract (µg/l)	PAH in Extract (µg)*	Bioaccessible PAHs (mg kg^{-1})	PAH conc. in Extract (µg/l)	PAH in Extract (µg)[†]	Bioaccessible PAHs (mg kg^{-1})	
Naphthalene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Acenaphthylene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Acenaphthene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Fluorene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Phenanthrene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Anthracene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Fluoranthene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Pyrene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Benz(a)anthracene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Chrysene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Benzo(b+j)fluoranthene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Benzo(k)fluoranthene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Benzo(a)pyrene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Indeno(1.2.3.cd)pyrene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Dibenz(a.h)anthracene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Benzo(g.h.i)perylene	<2.5	<0.17	<0.29	<2.5	<0.18	<0.29	<0.29
Σ16 PAHs	<5.0	<0.35	<0.58	<5.0	<0.35	<0.58	<0.58
BaP TEQ (zero)	<5.0	<0.35	<0.58	<5.0	<0.35	<0.58	<0.58

*Extract volume was 69.9 ml. [†]Extract volume was 70.3 ml. [‡]Average concentration of duplicate analysis

Table 5. Assessment of PAH bioaccessibility in sample 102 (0-300 mm) (< 250 µm particle size fraction).

PAH	Sample #102-1			Sample #102-2			Av. Bioaccessible PAHs (mg kg^{-1})*
	PAH conc. in Extract (µg/l)	PAH in Extract (µg)*	Bioaccessible PAHs (mg kg^{-1})	PAH conc. in Extract (µg/l)	PAH in Extract (µg)†	Bioaccessible PAHs (mg kg^{-1})	
Naphthalene	<2.5	<0.17	<0.29	<2.5	<0.17	<0.28	<0.29
Acenaphthylene	<2.5	<0.17	<0.29	<2.5	<0.17	<0.28	<0.29
Acenaphthene	<2.5	<0.17	<0.29	<2.5	<0.17	<0.28	<0.29
Fluorene	<2.5	<0.17	<0.29	<2.5	<0.17	<0.28	<0.29
Phenanthrene	<2.5	<0.17	<0.29	<2.5	<0.17	<0.28	<0.29
Anthracene	<2.5	<0.17	<0.29	<2.5	<0.17	<0.28	<0.29
Fluoranthene	<2.5	<0.17	<0.29	2.6	0.17	**0.29**	<0.29
Pyrene	<2.5	<0.17	<0.29	<2.5	<0.17	<0.28	<0.29
Benz(a)anthracene	<2.5	<0.17	<0.29	<2.5	<0.17	<0.28	<0.29
Chrysene	3.8	0.26	**0.43**	4.4	0.29	**0.49**	**0.46**
Benzo(b+j)fluoranthene	3.4	0.23	**0.39**	5.5	0.37	**0.61**	**0.50**
Benzo(k)fluoranthene	5.3	0.36	**0.60**	4.3	0.29	**0.48**	**0.54**
Benzo(a)pyrene	5.1	0.35	**0.58**	6.0	0.40	**0.67**	**0.63**
Indeno(1.2.3.cd)pyrene	<2.5	<0.17	<0.29	<2.5	<0.17	<0.28	<0.29
Dibenz(a.h)anthracene	<2.5	<0.17	<0.29	<2.5	<0.17	<0.28	<0.29
Benzo(g.h.i)perylene	<2.5	<0.17	<0.29	<2.5	<0.17	<0.28	<0.29
Σ16 PAHs	17.6	1.20	2.01	2.8	1.52	2.53	2.27
BaP TEQ (zero)	6.0	0.41	0.68	7.0	0.47	0.78	0.73

*Extract volume was 68.5 ml. †Extract volume was 66.5 ml. ‡Average concentration of duplicate analysis

Table 6. Assessment of PAH bioaccessibility in sample 103 (0-300 mm) (< 250 µm particle size fraction).

PAH	Sample #103-1			Sample #103-2			Av. Bioaccessible PAHs (mg kg^{-1})[‡]
	PAH conc. in Extract (µg/l)	PAH in Extract (µg)*	Bioaccessible PAHs (mg kg^{-1})	PAH conc. in Extract (µg/l)	PAH in Extract (µg)[†]	Bioaccessible PAHs (mg kg^{-1})	
Naphthalene	<2.5	<0.18	<0.30	<2.5	<0.17	<0.28	<0.30
Acenaphthylene	<2.5	<0.18	<0.30	2.6	0.18	**0.30**	<0.30
Acenaphthene	<2.5	<0.18	<0.30	<2.5	<0.17	<0.28	<0.30
Fluorene	<2.5	<0.18	<0.30	<2.5	<0.17	<0.28	<0.30
Phenanthrene	<2.5	<0.18	<0.30	<2.5	<0.17	<0.28	<0.30
Anthracene	<2.5	<0.18	<0.30	<2.5	<0.17	<0.28	<0.30
Fluoranthene	2.7	0.19	**0.32**	3.2	0.22	**0.36**	**0.34**
Pyrene	<2.5	<0.18	<0.30	<2.5	<0.17	<0.28	<0.30
Benz(a)anthracene	<2.5	<0.18	<0.30	<2.5	<0.17	<0.28	<0.30
Chrysene	4.2	0.30	**0.50**	4.9	0.33	**0.56**	**0.52**
Benzo(b+j)fluoranthene	4.4	0.31	**0.52**	8.1	0.55	**0.92**	**0.72**
Benzo(k)fluoranthene	6.9	0.49	**0.81**	6.5	0.44	**0.74**	**0.78**
Benzo(a)pyrene	6.5	0.46	**0.77**	8.6	0.59	**0.98**	**0.88**
Indeno(1.2.3.cd)pyrene	<2.5	<0.18	<0.30	<2.5	<0.17	<0.28	<0.30
Dibenz(a.h)anthracene	<2.5	<0.18	<0.30	<2.5	<0.17	<0.28	<0.30
Benzo(g.h.i)perylene	<2.5	<0.18	<0.30	<2.5	<0.17	<0.28	<0.30
Σ16 PAHs	24.7	1.75	2.92	33.9	2.31	3.85	3.39
BaP TEQ (zero)	7.7	0.55	0.91	10.1	0.69	1.15	1.03

*Extract volume was 70.8 ml. [†]Extract volume was 68.1 ml. [‡]Average concentration of duplicate analysis

Table 7. Total PAH concentration and bioaccessible PAHs in samples 100 (0-300 mm) and 101 (0-300 mm) (< 250 µm particle size fraction).

PAH	Sample #100 (0-300 mm)			Sample #101 (0-300 mm)		
	PAHs (mg kg^{-1})	Bioaccessible PAH (mg kg^{-1})	PAH Bioaccessibility (%)	PAHs (mg kg^{-1})	Bioaccessible PAH (mg kg^{-1})	PAH Bioaccessibility (%)
Naphthalene	<0.5	<0.30	-	<0.5	<0.29	-
Acenaphthylene	0.7	<0.30	-	<0.5	<0.29	-
Acenaphthene	<0.5	<0.30	-	<0.5	<0.29	-
Fluorene	<0.5	<0.30	-	<0.5	<0.29	-
Phenanthrene	<0.5	<0.30	-	<0.5	<0.29	-
Anthracene	<0.5	<0.30	-	<0.5	<0.29	-
Fluoranthene	1.4	<0.30	-	0.6	<0.29	-
Pyrene	2.1	<0.30	-	1.0	<0.29	-
Benz(a)anthracene	0.8	<0.30	-	<0.5	<0.29	-
Chrysene	1.0	<0.30	-	<0.5	<0.29	-
Benzo(b+j)fluoranthene	2.1	<0.34	-	0.8	<0.29	-
Benzo(k)fluoranthene	1.1	<0.34	-	<0.5	<0.29	-
Benzo(a)pyrene	1.9	<0.30	-	0.7	<0.29	-
Indeno(1.2.3.cd)pyrene	0.9	<0.30	-	<0.5	<0.29	-
Dibenz(a.h)anthracene	<0.5	<0.30	-	<0.5	<0.29	-
Benzo(g.h.i)perylene	1.0	<0.30	-	<0.5	<0.29	-
Σ16 PAHs	12.7	<0.69	-	3.1	<0.58	-
BaP TEQ (zero)	2.4	<0.36	-	0.8	<0.58	-

Table 8. Total PAH concentration and bioaccessible PAHs in samples 102 (0-300 mm) and 103 (0-300 mm) (< 250 µm particle size fraction).

PAH	Sample #102 (0-300 mm)			Sample #103 (0-300 mm)		
	PAHs (mg kg^{-1})	Bioaccessible PAH (mg kg^{-1})	PAH Bioaccessibility (%)	PAHs (mg kg^{-1})	Bioaccessible PAH (mg kg^{-1})	PAH Bioaccessibility (%)
Naphthalene	0.8	<0.29	-	2.4	<0.30	-
Acenaphthylene	3.6	<0.29	-	5.9	<0.30	-
Acenaphthene	<0.5	<0.29	-	<0.5	<0.30	-
Fluorene	<0.5	<0.29	-	<0.5	<0.30	-
Phenanthrene	1.9	<0.29	-	3.9	<0.30	-
Anthracene	1.5	<0.29	-	2.5	<0.30	-
Fluoranthene	4.9	<0.29	-	7.9	**0.34**	4.3
Pyrene	10.0	<0.29	-	15.6	<0.30	-
Benz(a)anthracene	3.5	<0.29	-	5.7	<0.30	-
Chrysene	4.2	**0.46**	11.0	6.0	**0.52**	8.7
Benzo(b+j)fluoranthene	8.0	**0.50**	6.3	10.5	**0.72**	6.9
Benzo(k)fluoranthene	3.0	**0.54**	18.0	4.3	**0.78**	18.1
Benzo(a)pyrene	6.7	**0.63**	9.4	9.7	**0.88**	9.1
Indeno(1.2.3.cd)pyrene	2.9	<0.29	-	3.7	<0.30	-
Dibenz(a.h)anthracene	0.9	<0.29	-	1.2	<0.30	-
Benzo(g.h.i)perylene	3.0	<0.29	-	3.8	<0.30	-
Σ16 PAHs	54.5	2.27	4.2	82.9	3.39	4.1
BaP TEQ (zero)	9.4	0.73	7.8	13.4	1.03	7.7

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CONFIDENTIALITY

We acknowledge the confidential nature of the results of this project and will treat the results and project reports with appropriate confidentiality and security.

APPENDIX 1 - METHODOLOGY

Samples

The samples, supplied by Synnot and Wilkinson Pty Ltd, were oven-dried at 40°C for 96 hours and sieved to recover the < 250 µm particle size fraction. This particle size fraction was used to assess PAH bioaccessibility.

Assessment of PAH concentration in the <250 µm particle size fraction

PAH concentration in the < 250 µm particle size fraction was determined by ALS Laboratories. A copy of the ALS analytical report is included in Appendix 3.

Assessment of PAH bioaccessibility in the <250 µm particle size fraction

PAH bioaccessibility was assessed using the organic Physiologically Based extraction Test (org-PBET) (Ruby et al., 2002) with minor modifications. Gastric phase solution was prepared by dissolving glycine (15.0 g l^{-1}), sodium chloride (8.8 g l^{-1}), pepsin (1.0 g l^{-1}), bovine serum albumin (5.0 g l^{-1}) and mucine (2.5 g l^{-1}) in MilliQ water and adjusting the pH to 1.5 ± 0.05 through the addition of concentrated hydrochloric acid. When gastric phase conditions were transitioned into the intestinal phase, the pH was adjusted to 7.2 ± 0.2 using sodium hydroxide (50% w/v) and porcine pancreatin (0.6 g l^{-1}) and bovine bile (4.0 g l^{-1}) were added. PAH bioaccessibility assays were conducted using 0.6 g of PAH-contaminated soil and 60 ml of org-PBET solution in the presence of silicone cord (diameter of 3 mm; 8 g m^{-1}). A silicone mass of approximately 100 times that of the soil organic matter content was added to gastrointestinal fluid. Suspensions were incubated at 37°C and 40 rpm on a Ratek suspension mixer. Following a 1 hr gastric phase, in vitro conditions were modified to the intestinal phase and incubation continued for a further 16 hr. At the end of the incubation period, the silicone cord was removed, rinsed with MilliQ water, gently wiped with lint free tissue and extracted with acetone (2 x 40 ml) (Gouliarmou et a., 2013). PAHs recovered from silicone cord extracts were designated as the bioaccessible fraction.

QA/QC procedures

ALS laboratories conducted the analysis for total and bioaccessible PAH concentrations for all samples. ALS Laboratories are a NATA accredited laboratory for the chemical testing of environmental materials. Quality Control results are reported in Appendix 3. An additional sample was included in bioaccessibility assays for quality assurance and quality control. The sample consisted of a blank control (i.e. org-PBET solution without soil addition).

APPENDIX 2 – CHAIN OF CUSTODY FORMS

CHAIN OF CUSTODY

Synnot Wilkinson

Client: Jemena Location: Kendall Bay
Quote Number: ..... COC No: 704/15 Turnaround Time: Standard
Preservation: Cooler Blocks

Date: 28/5/2015 Page 1 of 1

ALBERT JUHASZ

Sample

Contact: Russell Synnot - Phone: 0418 582 990

BIOACCESSIBILITY TESTING

Container Size (ml): .

Preservation Code:

Type (P Neutral Plastic, N Nitric Acid Preserved, C Sodium Hydroxide Preserved, J Solvent Washed Acid Rinsed Jar, S solvent Washed Acid Rinsed Glass Bottle, VC Hydrochloric Acid Preserved Vial, M Methanol Preserved Vial)

Metals : Sb, As, Cd, Cr, Cu, Pb, Hg, Ni, Ag, Zn.
Hydrocarbons: As Listed
Other: As Listed

Lab No.	Date	Sample	Preservation Code	Sample Number and Depth (mm)	Requested Analytes (µg/kg unless otherwise stated)										Comments
					Metals	Cyanide	Total PAHs	Total Phenols	TRH	BTEX	pH	TOC		HOLD	
	28/5/15	100	cool	100 - 0-300											
	"	101	"	101 - "											
	"	102	"	102 "											
	"	103	"	103 "											

Samples prepared by: IAN IRVINE (Signed) Print Name: ..... Date: 28.5.2015

Received at Lab by: ALBERT JUHASZ (Signed) Print Name: ..... Date: 29/5/15

Please e-mail signed Transmission Form immediately on receipt to Synnot & Wilkinson Pty Ltd. Ph: (03) 5790 5288 mail@baarrooka.com.au

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 0555 E:samples.sydney@alsenviro.com
☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com
☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	CERAR University of South Australia	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☒ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	Mawson Lakes Campus X1-17		
PROJECT:	PAH Marine Samples	ALS QUOTE NO.:	
ORDER NUMBER:			
PROJECT MANAGER:	Albert Juhasz	CONTACT PH: 08 8302 5045	
SAMPLER:	Albert Juhasz	SAMPLER MOBILE: 0418 818 121	
COC emailed to ALS? (NO)		EDD FORMAT (or default):	
Email Reports to (will default to PM if no other addresses are listed): Albert.Juhasz@unisa.edu.au			
Email Invoice to (will default to PM if no other addresses are listed): Albert.Juhasz@unisa.edu.au			

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

FOR LABORATORY USE ONLY (Circle)
Custody seal intact? Yes / No
Free ice / frozen ice bricks present upon receipt? Yes / No
Random Sample Temperature on Receipt:
Other comments:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Albert Juhasz	i2a1		
DATE/TIME: 3/6/15	DATE/TIME: 4/6 11:40 a.m.	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL BOTTLES	PAHs	Total Organic Carbon							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	100-250A	3/06/2015	S	AV	1	1	1							
2	100-250B	3/06/2015	S	AV	1	1	-							Samples have been dried and sieved
3	101-250A	3/06/2015	S	AV	1	1	1							
4	101-250B	3/06/2015	S	AV	1	1	-							
5	102-250A	3/06/2015	S	AV	1	1	1							
6	102-250B	3/06/2015	S	AV	1	1	-							
7	103-250A	3/06/2015	S	AV	1	1	1							
8	103-250B	3/06/2015	S	AV	1	1	-							
				TOTAL	8	8	4							

Environmental Division
Melbourne
Work Order Reference
EM1510617

Telephone : +61-3-8549 9600

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

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E:adelaide@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2150 E: launceston@alsenviro.com

CLIENT:	CERAR University of South Australia	TURNAROUND REQUIREMENTS : ☒ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE:	Mawson Lakes Campus X1-17	(Standard TAT may be longer for some tests e.g., Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes / No / N/A
PROJECT:	PAH Marine Samples 2	ALS QUOTE NO.:	Free ice or cooling media present upon receipt? Yes / No
ORDER NUMBER:			Random Sample Temperature on Receipt:
PROJECT MANAGER:	Albert Juhasz	CONTACT PH: 08 8302 5045	Other Comments:
SAMPLER:	Albert Juhasz	SAMPLER MOBILE: 0418 818 121	
COC emailed to ALS? (NO)		EDD FORMAT (or default):	
Email Reports to (will default to PM if no other addresses are listed): Albert.Juhasz@unisa.edu.au			
Email Invoice to (will default to PM if no other addresses are listed): Albert.Juhasz@unisa.edu.au			

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

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Albert Juhasz			[signature]
DATE/TIME: 15/6/15	DATE/TIME:	DATE/TIME:	DATE/TIME: 16/6, 11:30

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL BOTTLES	PAHs								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	KB 100-1	15/06/2015	W	AG	1	1								Sample are in acetone
2	KB 100-2	15/06/2015	W	AG	1	1								
3	KB 101-1	15/06/2015	W	AG	1	1								
4	KB 101-2	15/06/2015	W	AG	1	1								
5	KB 102-1	15/06/2015	W	AG	1	1								
6	KB 102-2	15/06/2015	W	AG	1	1								
7	KB 103-1	15/06/2015	W	AG	1	1								
8	KB 103-2	15/06/2015	W	AG	1	1								
9	QC1-1	15/06/2015	W	AG	1	1								
10	QC1-2	15/06/2015	W	AG	1	1								
				TOTAL:	10	10								

Environmental Division
Melbourne
Work Order Reference
EM1510955

Telephone : +61-3-8549 9600

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

APPENDIX 3 – ANALYTICAL RESULTS AND QA/QC

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM1510617**	Page	: 1 of 4
Client	: **UNISA - CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION**	Laboratory	: Environmental Division Melbourne
Contact	: MR ALBERT JUHASZ	Contact	:
Address	: UNIVERSITY OF SOUTH AUSTRALIA CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION BUILDING X MAWSON LAKES CAMPUS MAWSON LAKES SOUTH AUSTRALIA 5095	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: albert.juhasz@unisa.edu.au	E-mail	:
Telephone	: +61 08 8302 6273	Telephone	: +61-3-8549 9600
Facsimile	: ---	Facsimile	: +61-3-8549 9601
Project	: PAH Marine Samples	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ---	Date Samples Received	: 04-Jun-2015 11:40
C-O-C number	: ----	Date Analysis Commenced	: 05-Jun-2015
Sampler	: ALBERT JUHASZ	Issue Date	: 15-Jun-2015 14:30
Site	: ----		
		No. of samples received	: 8
Quote number	: ---	No. of samples analysed	: 8

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils
Steven McGrath	Technical Manager - Client Services	Melbourne Organics

General Comments

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

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

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

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

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

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

- TOC (EP003) conducted by ALS Brisbane, NATA Site No. 818.
- 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	100-250A	100-250B	101-250A	101-250B	102-250A
			Client sampling date / time	[03-Jun-2015]	[03-Jun-2015]	[03-Jun-2015]	[03-Jun-2015]	[03-Jun-2015]
Compound	CAS Number	LOR	Unit	EM1510617-001	EM1510617-002	EM1510617-003	EM1510617-004	EM1510617-005
				Result	Result	Result	Result	Result
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	---	0.02	%	1.34	---	0.83	---	7.34
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	0.7
Acenaphthylene	208-96-8	0.5	mg/kg	0.7	0.6	<0.5	<0.5	3.4
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	1.7
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	1.2
Fluoranthene	206-44-0	0.5	mg/kg	1.4	1.3	0.6	0.6	4.5
Pyrene	129-00-0	0.5	mg/kg	2.1	2.0	1.0	1.0	9.3
Benz(a)anthracene	56-55-3	0.5	mg/kg	0.8	0.8	<0.5	<0.5	3.2
Chrysene	218-01-9	0.5	mg/kg	1.0	1.0	<0.5	<0.5	3.9
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	2.1	2.1	0.8	0.8	7.8
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	1.1	1.0	<0.5	<0.5	2.6
Benzo(a)pyrene	50-32-8	0.5	mg/kg	1.9	1.8	0.7	0.7	6.4
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	0.9	0.9	<0.5	<0.5	2.7
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	0.8
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	1.0	0.9	<0.5	<0.5	2.8
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	99.8	90.6	101	106	96.2
2-Chlorophenol-D4	93951-73-6	0.5	%	102	95.8	102	99.8	102
2.4.6-Tribromophenol	118-79-6	0.5	%	101	104	81.8	109	83.0
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	103	91.1	96.6	102	95.4
Anthracene-d10	1719-06-8	0.5	%	113	109	121	115	96.8
4-Terphenyl-d14	1718-51-0	0.5	%	99.3	90.3	100	104	90.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	102-250B	103-250A	103-250B	----	----
			Client sampling date / time	[03-Jun-2015]	[03-Jun-2015]	[03-Jun-2015]	----	----
Compound	CAS Number	LOR	Unit	EM1510617-006	EM1510617-007	EM1510617-008	----	----
				Result	Result	Result	Result	Result
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	----	8.98	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	0.9	2.3	2.4	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	3.8	6.2	5.6	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Phenanthrene	85-01-8	0.5	mg/kg	2.0	3.9	3.9	----	----
Anthracene	120-12-7	0.5	mg/kg	1.7	2.5	2.5	----	----
Fluoranthene	206-44-0	0.5	mg/kg	5.2	6.8	9.0	----	----
Pyrene	129-00-0	0.5	mg/kg	10.6	13.6	17.6	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	3.8	4.8	6.6	----	----
Chrysene	218-01-9	0.5	mg/kg	4.4	4.8	7.1	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	8.2	10.7	10.2	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	3.3	4.4	4.2	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	7.0	10.0	9.3	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	3.1	3.8	3.6	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	0.9	1.2	1.2	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	3.1	3.8	3.7	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	102	83.6	105	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%	103	99.9	104	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%	91.3	85.4	98.3	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	101	95.3	84.4	----	----
Anthracene-d10	1719-06-8	0.5	%	104	96.7	103	----	----
4-Terphenyl-d14	1718-51-0	0.5	%	95.7	90.3	110	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM1510617**	Page	: 1 of 4
Client	: **UNISA - CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION**	Laboratory	: Environmental Division Melbourne
Contact	: MR ALBERT JUHASZ	Contact	:
Address	: UNIVERSITY OF SOUTH AUSTRALIA CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION BUILDING X MAWSON LAKES CAMPUS MAWSON LAKES SOUTH AUSTRALIA 5095	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: albert.juhasz@unisa.edu.au	E-mail	:
Telephone	: +61 08 8302 6273	Telephone	: +61-3-8549 9600
Facsimile	: ---	Facsimile	: +61-3-8549 9601
Project	: PAH Marine Samples	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ---	Date Samples Received	: 04-Jun-2015
C-O-C number	: ---	Date Analysis Commenced	: 05-Jun-2015
Sampler	: ALBERT JUHASZ	Issue Date	: 15-Jun-2015
Site	: ---	No. of samples received	: 8
Quote number	: ---	No. of samples analysed	: 8

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA

WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils
Steven McGrath	Technical Manager - Client Services	Melbourne Organics

General Comments

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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:0% - 20%.

Sub-Matrix: SOIL

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 124342)									
EM1510617-001	100-250A	EP003: Total Organic Carbon	----	0.02	%	1.34	1.40	4.37	0% - 20%
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 120539)									
EM1510646-001	Anonymous	EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EM1510646-003	Anonymous	EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: SOIL

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 124342)								
EP003: Total Organic Carbon	—	0.02	%	<0.02	100 %	99.3	70	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 120539)								
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	97.9	68	114
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	100	61	125
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	3 mg/kg	104	68	116
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	104	62	116
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	106	64	114
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	106	64	114
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	108	59	117
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	104	67	115
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	101	63	119
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	103	62	114
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	101	67	115
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	98.3	62	120
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	103	62	116
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	101	65	119
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	104	69	113
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	108	66	116

Matrix Spike (MS) Report

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

Sub-Matrix: SOIL

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 120539)							
EM1510646-002	Anonymous	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	100	67	117
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	123	52	148

ALS Environmental

QA/QC Compliance Assessment for DQO Reporting

Work Order	: EM1510617	Page	: 1 of 4
Client	: UNISA - CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION	Laboratory	: Environmental Division Melbourne
Contact	: MR ALBERT JUHASZ	Telephone	: +61-3-8549 9600
Project	: PAH Marine Samples	Date Samples Received	: 04-Jun-2015
Site	: ---	Issue Date	: 15-Jun-2015
Sampler	: ALBERT JUHASZ	No. of samples received	: 8
Qrder number	: ---	No. of samples analysed	: 8

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach , ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content								
Soil Glass Jar - Unpreserved (EA055-103)								
100-250A,	100-250B,	**03-Jun-2015**	---	---	---	**05-Jun-2015**	17-Jun-2015	✓
101-250A,	101-250B,							
102-250A,	102-250B,							
103-250A,	103-250B							
EP003: Total Organic Carbon (TOC) in Soil								
Pulp Bag (EP003)								
100-250A,	101-250A,	**03-Jun-2015**	**12-Jun-2015**	01-Jul-2015	✓	**12-Jun-2015**	01-Jul-2015	✓
102-250A,	103-250A							
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP075(SIM))								
100-250A,	100-250B,	**03-Jun-2015**	**09-Jun-2015**	17-Jun-2015	✓	**10-Jun-2015**	19-Jul-2015	✓
101-250A,	101-250B,							
102-250A,	102-250B,							
103-250A,	103-250B							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
PAH/Phenols (SIM)	EP075(SIM)	2	17	**11.76**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	1	4	**25.00**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	17	**5.88**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	1	4	**25.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	17	**5.88**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	1	4	**25.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	17	**5.88**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Organic Carbon	EP003	SOIL	In-house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automaticaly measured by infra-red detector.
PAH/Phenols (SIM)	EP075(SIM)	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)

Preparation Methods	Method	Matrix	Method Descriptions
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
Tumbler Extraction of Solids	ORG17	SOIL	In-house, Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM1510955**	Page	: 1 of 4
Client	: **UNISA - CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION**	Laboratory	: Environmental Division Melbourne
Contact	: MR ALBERT JUHASZ	Contact	:
Address	: UNIVERSITY OF SOUTH AUSTRALIA CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION BUILDING X MAWSON LAKES CAMPUS MAWSON LAKES SOUTH AUSTRALIA 5095	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: albert.juhasz@unisa.edu.au	E-mail	:
Telephone	: +61 08 8302 6273	Telephone	: +61-3-8549 9600
Facsimile	: ----	Facsimile	: +61-3-8549 9601
Project	: PAH Marine Samples 2	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: —	Date Samples Received	: 16-Jun-2015 11:30
C-O-C number	: —	Date Analysis Commenced	: 17-Jun-2015
Sampler	: ALBERT JUHASZ	Issue Date	: 18-Jun-2015 15:59
Site	: ----		
		No. of samples received	: 10
Quote number	: —	No. of samples analysed	: 10

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

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

Signatories	*Position*	*Accreditation Category*
Xing Lin	Senior Organic Chemist	Melbourne Organics

General Comments

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

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

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

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

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

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

- EP075(SIM): Particular samples (EM1510955) required dilution prior to analysis due to matrix interferences. LOR values have been adjusted accordingly.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KB 100-1	KB 100-2	KB 101-1	KB 101-2	KB 102-1
				Client sampling date / time	[15-Jun-2015]	[15-Jun-2015]	[15-Jun-2015]	[15-Jun-2015]	[15-Jun-2015]
Compound	CAS Number	LOR	Unit		EM1510955-001	EM1510955-002	EM1510955-003	EM1510955-004	EM1510955-005
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Acenaphthylene	208-96-8	1	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Acenaphthene	83-32-9	1	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Fluorene	86-73-7	1	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Phenanthrene	85-01-8	1	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Anthracene	120-12-7	1	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Fluoranthene	206-44-0	1	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Pyrene	129-00-0	1	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Benz(a)anthracene	56-55-3	1	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Chrysene	218-01-9	1	µg/L		<2.5	<2.5	<2.5	<2.5	3.8
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L		<2.5	2.9	<2.5	<2.5	3.4
Benzo(k)fluoranthene	207-08-9	1	µg/L		<2.5	2.9	<2.5	<2.5	5.3
Benzo(a)pyrene	50-32-8	0.5	µg/L		<2.5	<2.5	<2.5	<2.5	5.1
Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Dibenz(a.h)anthracene	53-70-3	1	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
Benzo(g.h.i)perylene	191-24-2	1	µg/L		<2.5	<2.5	<2.5	<2.5	<2.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<5.0	5.8	<5.0	<5.0	17.6
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<5.0	<5.0	<5.0	<5.0	6.0
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1	%		97.8	98.9	94.5	95.6	93.6
2-Chlorophenol-D4	93951-73-6	1	%		82.4	83.6	78.6	80.6	79.4
2.4.6-Tribromophenol	118-79-6	1	%		49.2	52.8	43.3	46.7	44.4
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1	%		77.6	81.6	75.7	78.5	75.8
Anthracene-d10	1719-06-8	1	%		79.0	79.8	74.5	75.0	73.8
4-Terphenyl-d14	1718-51-0	1	%		88.4	87.8	75.7	78.0	77.0

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KB 102-2	KB 103-1	KB 103-2	QC1-1	QC1-2
			Client sampling date / time	[15-Jun-2015]	[15-Jun-2015]	[15-Jun-2015]	[15-Jun-2015]	[15-Jun-2015]
Compound	CAS Number	LOR	Unit	EM1510955-006	EM1510955-007	EM1510955-008	EM1510955-009	EM1510955-010
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5
Acenaphthylene	208-96-8	1	µg/L	<2.5	<2.5	2.6	<2.5	<2.5
Acenaphthene	83-32-9	1	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5
Fluorene	86-73-7	1	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5
Phenanthrene	85-01-8	1	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5
Anthracene	120-12-7	1	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5
Fluoranthene	206-44-0	1	µg/L	2.6	2.7	3.2	<2.5	<2.5
Pyrene	129-00-0	1	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5
Benz(a)anthracene	56-55-3	1	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5
Chrysene	218-01-9	1	µg/L	4.4	4.2	4.9	<2.5	<2.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	5.5	4.4	8.1	<2.5	<2.5
Benzo(k)fluoranthene	207-08-9	1	µg/L	4.3	6.9	6.5	<2.5	<2.5
Benzo(a)pyrene	50-32-8	0.5	µg/L	6.0	6.5	8.6	<2.5	<2.5
Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5
Dibenz(a.h)anthracene	53-70-3	1	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5
Benzo(g.h.i)perylene	191-24-2	1	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	22.8	24.7	33.9	<5.0	<5.0
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	7.0	7.7	10.1	<5.0	<5.0
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	1	%	106	93.9	108	102	97.3
2-Chlorophenol-D4	93951-73-6	1	%	90.3	79.7	90.9	87.1	82.6
2.4.6-Tribromophenol	118-79-6	1	%	51.7	44.6	50.4	44.4	46.0
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	1	%	86.8	73.6	83.6	79.2	75.8
Anthracene-d10	1719-06-8	1	%	81.8	71.8	83.2	78.5	75.1
4-Terphenyl-d14	1718-51-0	1	%	85.2	72.2	86.9	84.9	77.5

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM1510955**	Page	: 1 of 4
Client	: **UNISA - CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION**	Laboratory	: Environmental Division Melbourne
Contact	: MR ALBERT JUHASZ	Contact	:
Address	: UNIVERSITY OF SOUTH AUSTRALIA CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION BUILDING X MAWSON LAKES CAMPUS MAWSON LAKES SOUTH AUSTRALIA 5095	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: albert.juhasz@unisa.edu.au	E-mail	:
Telephone	: +61 08 8302 6273	Telephone	: +61-3-8549 9600
Facsimile	: ---	Facsimile	: +61-3-8549 9601
Project	: PAH Marine Samples 2	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ---	Date Samples Received	: 16-Jun-2015
C-O-C number	: ---	Date Analysis Commenced	: 17-Jun-2015
Sampler	: ALBERT JUHASZ	Issue Date	: 18-Jun-2015
Site	: ---	No. of samples received	: 10
Quote number	: ---	No. of samples analysed	: 10

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA

WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Xing Lin	Senior Organic Chemist	Melbourne Organics

General Comments

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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:0% - 20%.

- **No Laboratory Duplicate (DUP) Results are required to be reported.**

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 127984)								
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<2.5	5 µg/L	96.8	46	120
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<2.5	5 µg/L	74.5	40	124
EP075(SIM): Anthracene	120-12-7	1	µg/L	<2.5	5 µg/L	70.6	53	127
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<2.5	5 µg/L	71.6	52	136
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<2.5	5 µg/L	85.7	55	133
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<2.5	5 µg/L	84.4	48	142
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<2.5	5 µg/L	90.2	52	142
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<2.5	5 µg/L	101	54	134
EP075(SIM): Chrysene	218-01-9	1	µg/L	<2.5	5 µg/L	81.1	54	132
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<2.5	5 µg/L	88.1	52	142
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<2.5	5 µg/L	76.5	56	130
EP075(SIM): Fluorene	86-73-7	1	µg/L	<2.5	5 µg/L	70.2	47	125
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<2.5	5 µg/L	88.0	49	143
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<2.5	5 µg/L	80.6	39	115
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<2.5	5 µg/L	73.4	55	125
EP075(SIM): Pyrene	129-00-0	1	µg/L	<2.5	5 µg/L	84.5	56	132

Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

ALS Environmental

QA/QC Compliance Assessment for DQO Reporting

Work Order	: **EM1510955**	Page	: 1 of 5
Client	: **UNISA - CENTRE FOR ENVIRONMENT RISK ASSESSMENT & REMEDIATION**	Laboratory	: Environmental Division Melbourne
Contact	: MR ALBERT JUHASZ	Telephone	: +61-3-8549 9600
Project	: PAH Marine Samples 2	Date Samples Received	: 16-Jun-2015
Site	: ----	Issue Date	: 18-Jun-2015
Sampler	: ALBERT JUHASZ	No. of samples received	: 10
Order number	: ----	No. of samples analysed	: 10

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Regular Sample Surrogates

Sub-Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP075(SIM)S: Phenolic Compound Surrogates	EM1510955-001	KB 100-1	**Phenol-d6**	13127-88-3	97.8 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1510955-002	KB 100-2	**Phenol-d6**	13127-88-3	98.9 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1510955-003	KB 101-1	**Phenol-d6**	13127-88-3	94.5 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1510955-004	KB 101-2	**Phenol-d6**	13127-88-3	95.6 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1510955-005	KB 102-1	**Phenol-d6**	13127-88-3	93.6 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1510955-006	KB 102-2	**Phenol-d6**	13127-88-3	106 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1510955-007	KB 103-1	**Phenol-d6**	13127-88-3	93.9 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1510955-008	KB 103-2	**Phenol-d6**	13127-88-3	108 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1510955-009	QC1-1	**Phenol-d6**	13127-88-3	102 %	10-46 %	**Recovery greater than upper data quality objective**
EP075(SIM)S: Phenolic Compound Surrogates	EM1510955-010	QC1-2	**Phenol-d6**	13127-88-3	97.3 %	10-46 %	**Recovery greater than upper data quality objective**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	12	0.00	10.00	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	12	0.00	5.00	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

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

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP075(SIM))								
KB 100-1,	KB 100-2,	**15-Jun-2015**	**17-Jun-2015**	22-Jun-2015	✓	**17-Jun-2015**	27-Jul-2015	✓
KB 101-1,	KB 101-2,							
KB 102-1,	KB 102-2,							
KB 103-1,	KB 103-2,							
QC1-1,	QC1-2							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	12	**0.00**	**10.00**	✗	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	12	**8.33**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	12	**8.33**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	12	**0.00**	**5.00**	✗	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)

Appendix D Report – Todoroski Air Sciences (2018)

AIR QUALITY IMPACT ASSESSMENT

KENDALL BAY REMEDIATION PROJECT

Jemena

28 June 2018

Job Number 15110512B

Prepared by
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Air Quality Impact Assessment
Kendall Bay Remediation Project

DOCUMENT CONTROL

Report Version	Date	Prepared by	Reviewed by
DRAFT – 001	22/06/2018	P Henschke & A Todoroski	A. Todoroski
FINAL – 001	26/06/2018	P Henschke & A Todoroski	
FINAL – 002	28/06/2018	P Henschke & A Todoroski	

This report has been prepared in accordance with the scope of works between Todoroski Air Sciences Pty Ltd (TAS) and the client. TAS relies on and presumes accurate the information (or lack thereof) made available to it to conduct the work. If this is not the case, the findings of the report may change. TAS has applied the usual care and diligence of the profession prevailing at the time of preparing this report and commensurate with the information available. No other warranty or guarantee is implied in regard to the content and findings of the report. The report has been prepared exclusively for the use of the client, for the stated purpose and must be read in full. No responsibility is accepted for the use of the report or part thereof in any other context or by any third party.

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1 INTRODUCTION

Todoroski Air Sciences has prepared this report for Jemena (hereafter referred to as the Proponent). It presents an assessment of the potential air quality impacts associated with the proposed sediment remediation works in Kendall Bay, New South Wales (NSW) (hereafter referred to as the Project).

The Project essentially seeks to remediate the contaminated sediment in two areas of Kendall Bay. Former activities associated with the Mortlake Gasworks including the loading and unloading of coal and other materials and other activity is the likely cause of the contamination.

To assess the potential air quality impacts associated with the Project, this report incorporates the following aspects:

- A background and description of the Project;
- A summary of air emission sampling of contaminated material at the Project;
- A review of the existing meteorological and air quality environment surrounding the Project;
- A description of the dispersion modelling approach used to assess potential air quality impacts;
- Presentation of the predicted results and discussion of the potential air quality impacts; and,
- Discussion on potential mitigation and management measures as required.

2 LOCAL SETTING

The Project is located approximately 10 kilometres (km) west of Sydney Central Business District (CBD) and approximately 11km east-southeast of Parramatta CBD. The proposed remediation areas are situated on the south side of the Parramatta River and located directly to the east of the Breakfast Point residential development and northwest of Cabarita.

The land use in the surrounding area is characterised by predominantly dense residential areas with some light industrial and commercial operations at Mortlake. Public access parklands are located to the south and the east of the remediation areas with a pedestrian pathway leading along the perimeter of Kendall Bay.

Figure 2-1 presents the location of the Project and selected sensitive receptor locations considered in this study. **Appendix A** provides a detailed list of the receptors assessed.

Figure 2-2 presents a pseudo three-dimensional visualisation of the topography in the general vicinity of the Project area. The area near the Project site can be characterised as relatively flat with the surrounding terrain generally sloping towards the Parramatta River within the numerous bays along the water's edge. The areas to the north of the Parramatta River are typically more elevated than the areas to the south. The local terrain and other features in this area would have an effect on wind patterns and also the dispersion of air emissions.

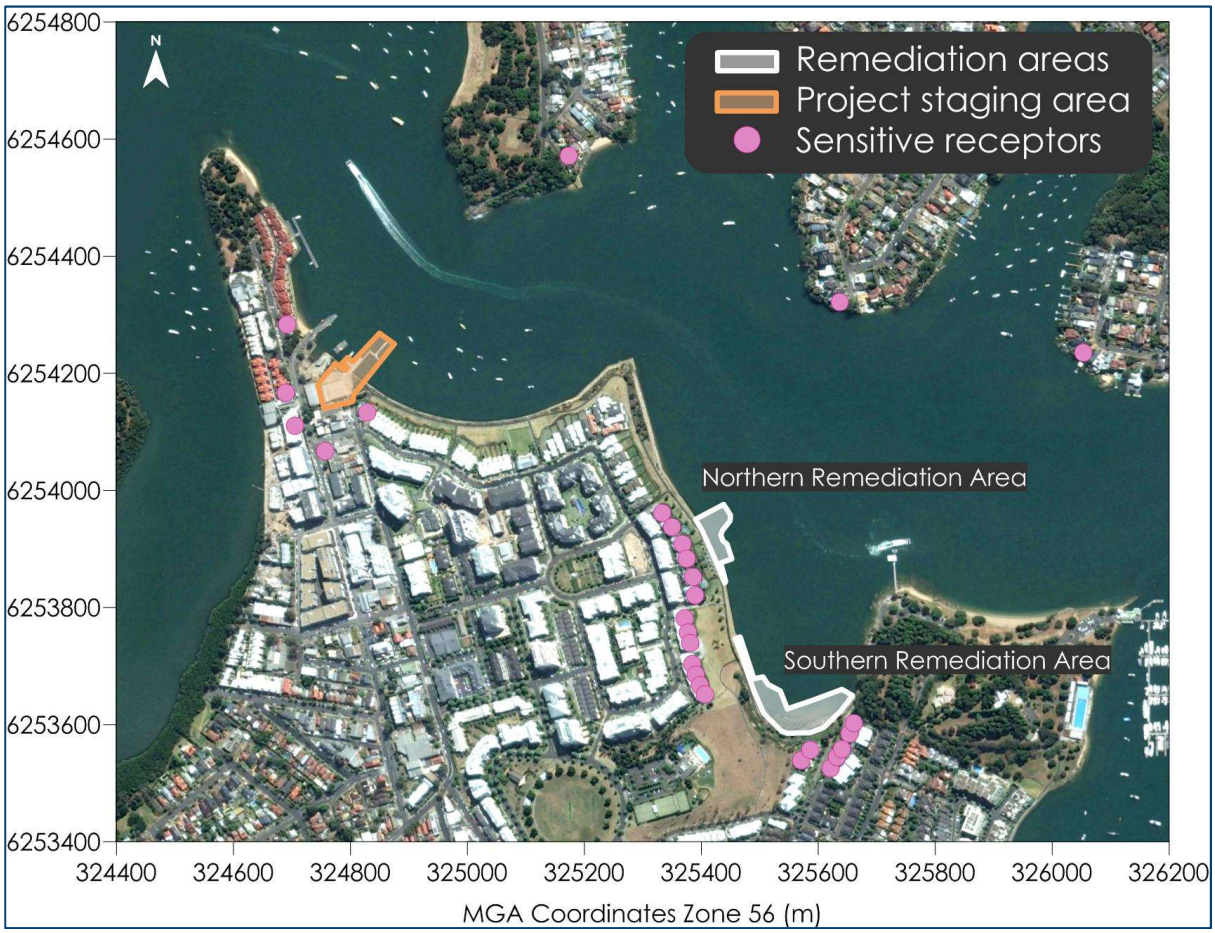


Figure 2-1: Project location

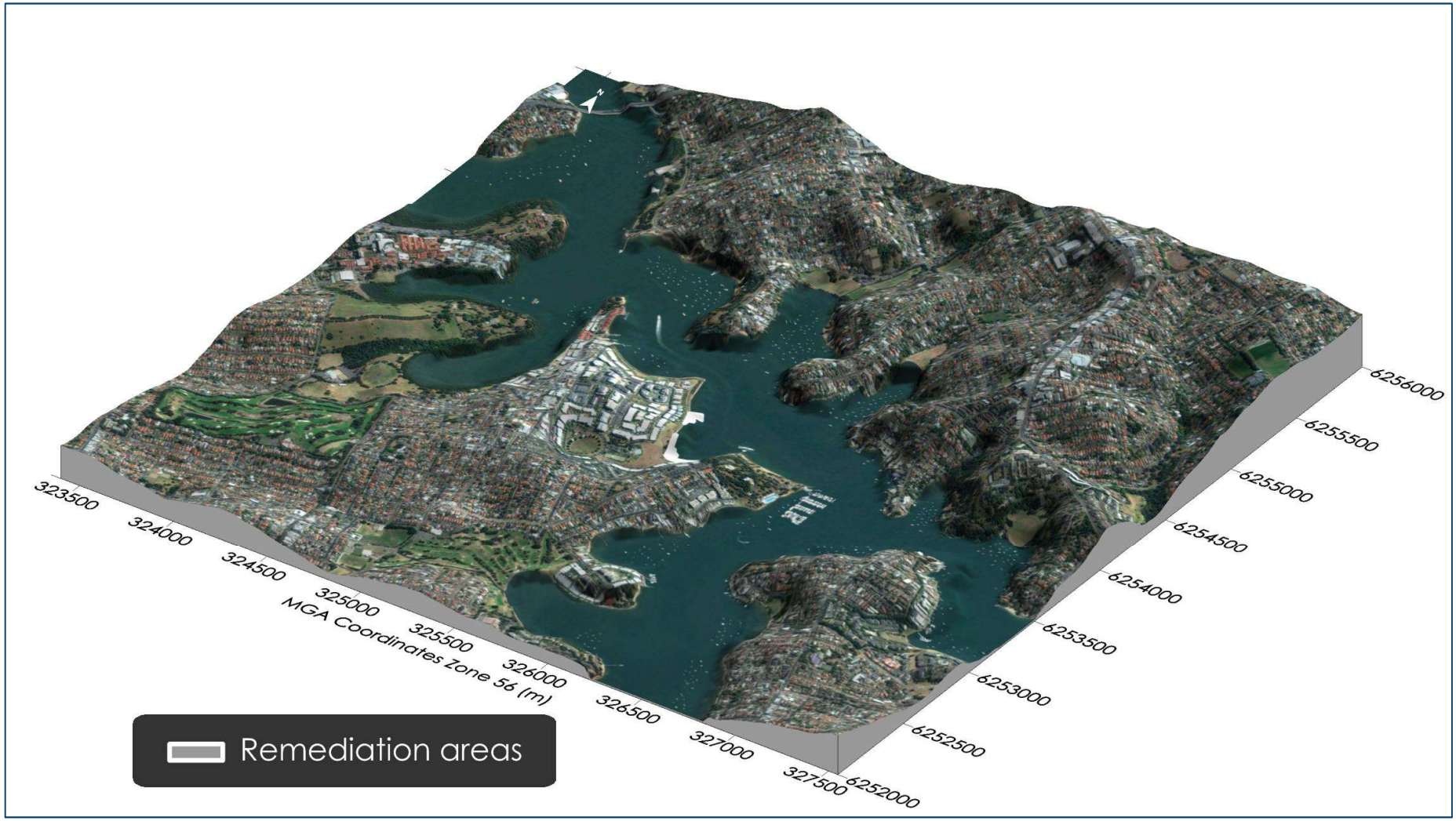


Figure 2-2: Representative view of the topography surrounding the Project location

3 PROJECT DESCRIPTION

3.1 Project area

The proposed remediation works will occur in two separate areas, the Southern Remediation Area (formerly Area A) and the Northern Remediation Area (formerly Area B) (see **Figure 2-1**).

The Southern Remediation Area occupies an area of approximately 8,500m^2 and is situated within the southern portion of Kendall Bay, extending into the southern and western shoreline areas. The Northern Remediation, located adjacent to the western shoreline of Kendall Bay, occupies an area of approximately 4,000m^2.

The staging area at Tennyson Road provides direct access to Parramatta River to enable ready barge access to Kendall Bay allowing for the contaminated materials to be transported off-site.

3.2 Remediation methodology

The key activities to remediate the site include:

- The excavation of contaminated sediment materials using an excavator on a floating barge.
- Excavated material will be placed by the excavator directly into bins positioned on a separate floating barge. Small bins would be used to minimise the potentially exposed surface area at any one time (approx. 2.5m^2). Care will be taken to place material carefully in bins and avoid spillage.
- Bins will have close fitting, essentially airtight lids. The contaminated material would be thus sealed in the bins.
- The barge holding the bins will be transported over water to the staging area where the sealed bins are transferred to land.
- Exterior of the bins will be washed down on the barge and any wash water collected within the bunds of the barge. This water is periodically sucked out by vacuum tanker and disposed off-site to a licenced water treatment plant.
- Sealed bins will be transferred to trucks for transport off-site to a licenced facility for further treatment (if required) and disposed at licenced landfill facility.

Excavation activity is proposed to occur from 7:00am to 5:00pm Monday to Friday and 8:00am to 1:00pm on Saturday.

4 POLLUTANT SAMPLING

The activities associated with the proposed remediation works have the potential to emit a range of odorous and volatile substances due to the nature of the contaminated materials.

Site specific sampling of the contaminated silt material was conducted in order to characterise the potential air emissions that may arise during the proposed remediation works.

This section outlines the results of the site specific sampling undertaken and characterises the likely air pollutants that may arise from the proposed remediation activity at the Project.

4.1 Odour sampling

Site specific odour sampling was conducted using isolation flux hoods on 15 February, 16 February, 9 March and 10 March, 2016.

Odour measurements were performed at various locations across the Project site (see **Figure 4-1**). The odour sampling included sampling of the water surface, the exposed shoreline before and after disturbance and of core samples extracted from the contaminated areas.



Figure 4-1: Sampling locations

The measured odour sampling data are presented in **Table 4-1**. Significant variation in the measured odour emissions can be observed, dependent on the sampling location. This is likely to be due to two

key factors, variable levels of contamination in the remediation areas associated with different activity occurring in the past and water and soil movements, but also difficulties encountered in collecting the material due to very soft sediment.

Table 4-1: Odour sampling data for the remediation areas

Sample ID	Sample location	Type	SOER (OU.m³/m²/s)
15201A	Southern	Water surface	0.099
16206A	Southern	Shoreline – undisturbed	0.1
16207A	Southern	Shoreline – disturbed	0.46
09303A	Southern	Sediment	1.3
09304A	Southern	Sediment	0.59
09305A	Southern	Sediment	0.3
09306A	Southern	Sediment	3.4
09307A	Southern	Sediment	0.25
15203B	Northern	Sediment	3.1
15202Bw	Northern	Water surface	0.17
15204Bw	Northern	Water surface	0.26
15205B	Northern	Sediment	0.43
9301B	Northern	Sediment	0.93
9302B	Northern	Sediment	2.0
09308B	Northern	Sediment	0.16
10309B	Northern	Sediment	8.9
10310B	Northern	Sediment	8.1

SOER = specific odour emission rate

Observations during the site sampling confirm that the most contaminated material has a mothball-like odour which is typical of gas works remediation sites. This odour is recognisable as a chemical odour, and could at times be detected near the shore at low tide (without any activity occurring).

Figure 4-2 shows the variation in the measured odour concentrations in the sampled sediment material (baseline water surface and shoreline samples excluded). The data show a large spatial variability, and it needs to be noted that it was not possible to obtain samples in deeper water away from the shoreline, nor at every point where it was attempted to collect a sample.

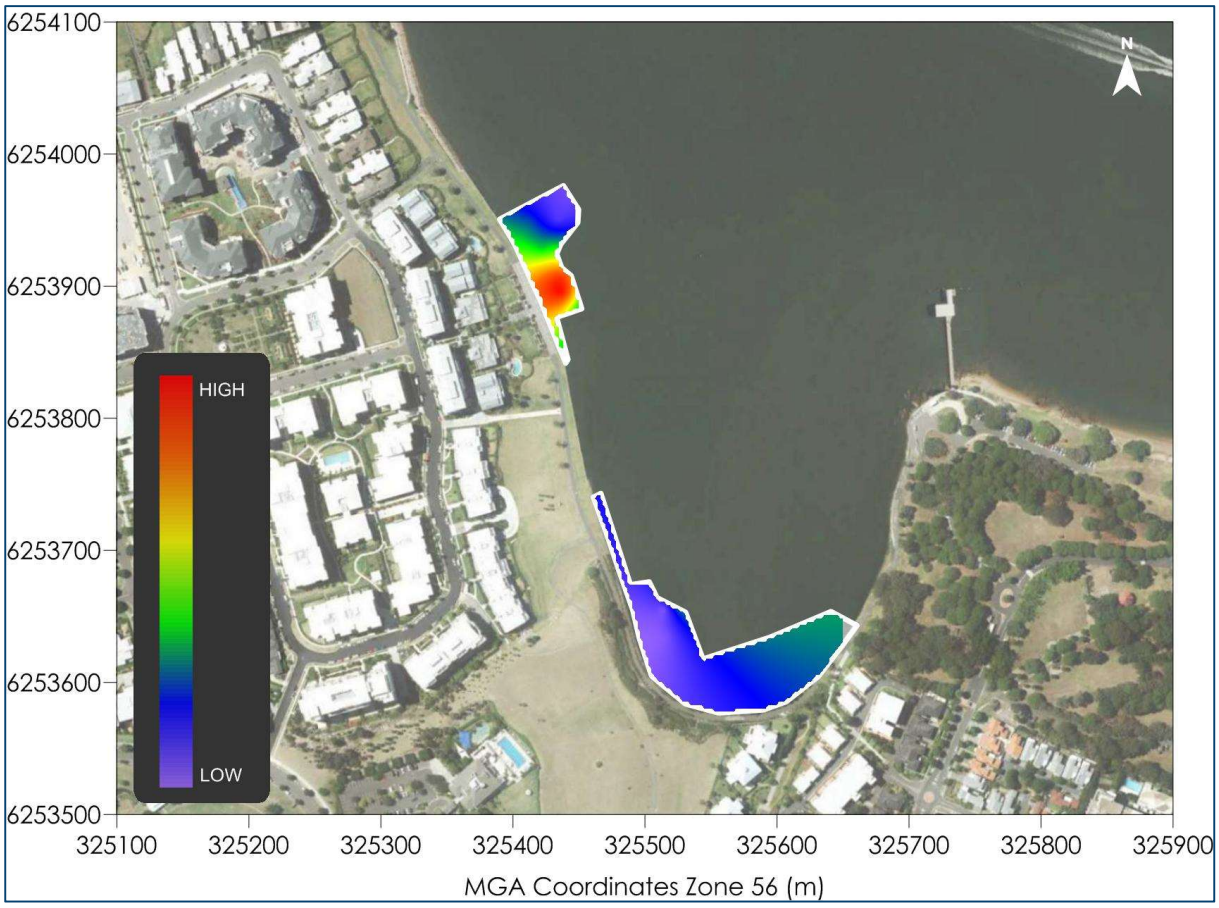


Figure 4-2: Estimated spatial variation in the measured odour concentrations (sediment only).

4.2 Other pollutant sampling

Core sampling of the sediment material was conducted between April 2015 and April 2016.

A total of 594 samples were collected and analysed at various core depths over the Project area.

Table 4-2 presents the mean value for the measured concentration in the sediment of the key volatile pollutants relevant to this study. These pollutants are relevant as they have a sufficiently high vapour pressure to be potentially released into the air form the water saturated sediment during handling. Other pollutants, such as metals and PAH's with low and very low inherent vapour pressure would not be released in any tangible quantity, as confirmed by screening the measured data per a soil vapour pressure model (and conservatively assuming the sediment material is not water saturated).

Table 4-2: Summary of other pollutant sampling (mg/kg of sediment)

Pollutant	Average
Benzene	0.8
Toluene	1.5
Ethyl Benzene	1.4
m, p - Xylene	2.7
o - Xylene	1.6

5 AIR QUALITY ASSESSMENT CRITERIA

5.1 Preamble

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the potential air emissions generated by the Project and the applicable air quality criteria.

5.2 Odour

5.2.1 Introduction

Odour in a regulatory context needs to be considered in two similar, but different ways depending on the situation.

NSW legislation (*Protection of the Environment Operations Act, 1997)* prohibits emissions that cause offensive odour to occur at any off-site receptor. Offensive odour is evaluated in the field by authorised officers, who are obliged to consider the odour in the context of its receiving environment, frequency, duration, character and so on and to determine whether the odour would interfere with the comfort and repose of the normal person unreasonably. In this context, the concept of offensive odour is applied to operational facilities and relates to actual emissions in the air.

However, in the approval and planning process for proposed new operations or modifications to existing projects, no actual odour exists and it is necessary to consider hypothetical odour. In this context, odour concentrations are used and are defined in odour units. The number of odour units represents the number of times that the odour would need to be diluted to reach a level that is just detectable to the human nose. Thus by definition, odour less than one odour unit (1 OU), would not be detectable to most people.

The range of an individual's ability to detect odour varies greatly in the population, as does their sensitivity to the type of odour. The wide ranging response in how any particular odour is perceived by any individual poses specific challenges in the assessment of odour impacts and the application of specific air quality goals related to odour. The NSW Odour Policy (**NSW DEC, 2006**) sets out a framework specifically to deal with such issues.

It needs to be noted that the term odour refers to complex mixtures of odours, and not "pure" odour arising from a single chemical. Odour from a single, known chemical very rarely occurs (when it does, it is best to consider that specific chemical in terms of its concentration in the air). In most situations odour will be comprised of a cocktail of many substances that is referred to as a complex mixture of odour, or more simply odour.

For activities with potential to release significant odour it may be necessary to predict the likely odour impact which may arise. This is done by using air dispersion modelling which can calculate the level of dilution of odours emitted from the source at the point that such odour reaches surrounding receptors. This approach allows the air dispersion model to produce results in terms of odour units.

The NSW criteria for acceptable levels of odour range from 2 to 7 OU, with the more stringent 2 OU criteria applicable to densely populated urban areas and the 7 OU criteria applicable to sparsely populated rural areas, as outlined below.

5.2.2 Complex Mixtures of Odorous Air Pollutants

Table 5-1 presents the assessment criteria as outlined in the NSW EPA document *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW EPA, 2017**). This criterion has been refined to take into account the population densities of specific areas and is based on a 99th percentile of dispersion model predictions calculated as 1-second averages (nose-response time).

Table 5-1: Impact assessment criteria for complex mixtures of odorous air pollutants (nose-response-time average, 99th percentile)

Population of affected community	Impact assessment criteria for complex mixtures of odorous air pollutants (OU)
Urban (≥~2000) and/or schools and hospitals	2.0
~500	3.0
~125	4.0
~30	5.0
~10	6.0
Single rural residence (≤~2)	7.0

Source: NSW DEC, 2005

The NSW odour goals are based on the risk of odour impact within the general population of a given area. In sparsely populated areas the criteria assume there is a lower risk that some individuals within the community would find the odour unacceptable, hence higher criteria apply.

However, the NSW EPA has recently been requesting that the odour criteria be determined on the basis of the number of receptors within the modelled 2 OU contour line. Hence it is not possible to establish criteria before conducting the modelling assessment. The applicable criteria in this case are thus outlined as part of the modelling results.

5.2.3 Peak to mean factors

Peak-to-mean factors are applied to account for any odour fluctuation above and below the mean odour level of the 1-hour averaging time. The criteria in **Table 5-1** are compared with modelled results that include peaking factors to account for the time-averaging limitations of air dispersion models. The peak-to-mean factors developed by **Katestone Scientific Pty Ltd (1995, 1998)** for NSW EPA are applied to convert the modelled (1-hour) averaging time to 1-second peak concentrations which are appropriate.

A summary of the peak-to-mean values is provided in **Table 5-2**.

Table 5-2: Peak-to-mean ratios

Source Type	Pasquill-Gifford stability class	Near field P/M 60*	Far field P/M 60*
Area	A, B, C, D	2.5	2.5
	E, F	2.3	1.9
Line	A-F	6	6
Surface point	A, B, C	12	4
	D, E, F	25	7
Tall wake-free point	A, B, C	17	3
	D, E, F	35	6
Wake-affected point	A-F	2.3	2.3
Volume	A-F	2.3	2.3

*Ratio of peak 1-second average concentrations

5.3 Other pollutants

The other pollutants identified in the contaminated material which have potential to be released have impact assessment criteria set out in the NSW EPA document *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW EPA, 2017**), as outlined in **Table 5-3**.

Table 5-3: Impact assessment criteria for other pollutants

Substance	Averaging period	Impact assessment criteria (µg/m³)
Benzene	1 hour	29
Ethylbenzene	1 hour	8000
Toluene	1 hour	360
Xylenes	1 hour	190

Source: NSW EPA, 2017

6 EXISTING ENVIRONMENT

This section describes the existing environment including the climate and ambient air quality in the area surrounding the Project.

6.1 Local climatic conditions

Long-term climatic data from the Bureau of Meteorology (BoM) weather station at Sydney Olympic Park (Site No. 066195) were used to characterise the local climate in the proximity of the Project. The Sydney Olympic Park station is located approximately 4km west-southwest of the Project.

Table 6-1 and **Figure 6-1** present a summary of data from the Sydney Olympic Park weather station collected over a 14 to 16-year period for the various meteorological parameters.

The data indicate that January is the hottest month with a mean maximum temperature of 28.4 degrees Celsius (ºC) and July as the coldest month with a mean minimum temperature of 7.8ºC.

Rainfall peaks during the months of summer and autumn and declines during late winter and early spring. The data indicate that February is the wettest month with an average rainfall of 109.8millimetres (mm) over 7.7 days and September is the driest month with an average rainfall of 52.7mm over 5.5 days. Average annual rainfall for the station is 911.8 mm occurring over an average of 82.3 days.

Humidity levels exhibit little variability and seasonal flux across the year. Mean 9am humidity levels range from 56 per cent (%) in October to 72% in February and March. Mean 3pm humidity levels range from 41% in August to 55% in February.

Wind speeds during the warmer months tend to have a greater spread between the 9am and 3pm conditions compared to the colder months. Mean 9am wind speeds range from 8.4 kilometres per hour (km/h) in March to 11.9km/h in September. Mean 3pm wind speeds range from 12.5km/h in June to 19.4km/h in December.

Table 6-1: Monthly climate statistics summary – Sydney Olympic Park weather station

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Temperature													
Mean max. temp. (ºC)	28.4	28.1	26.6	23.9	20.8	18.3	17.6	19.5	22.5	24.3	25.3	27.4	23.6
Mean min. temp. (ºC)	19.3	19.4	17.8	14.3	11.2	8.9	7.8	8.7	11.6	13.7	15.8	17.9	13.9
Rainfall													
Rainfall (mm)	84.4	109.8	66.0	89.2	88.2	75.8	63.5	56.7	52.7	64.9	76.2	58.0	911.8
No. of rain days (≥1mm)	7.6	7.7	7.6	6.9	7.7	6.9	6.3	4.4	5.5	7.1	7.8	6.8	82.3
9am conditions													
Mean temp. (ºC)	22.3	21.9	20.3	18.0	14.6	12.0	11.2	12.9	16.4	18.7	19.6	21.5	17.4
Mean R.H. (%)	67	72	72	68	70	71	68	61	57	56	64	64	66
Mean W.S. (km/h)	9.6	9.3	8.4	9.5	10.5	10.9	11.0	11.6	11.9	11.1	11.4	10.0	10.4
3pm conditions													
Mean temp. (ºC)	26.3	26.1	24.9	22.4	19.5	17.3	16.6	18.1	20.6	22.1	23.2	25.3	21.9
Mean R.H. (%)	53	55	53	51	51	52	48	41	43	45	51	50	49
Mean W.S. (km/h)	19.0	17.3	16.0	14.2	12.6	12.5	13.5	15.8	17.6	18.6	19.3	19.4	16.3

Source: **Bureau of Meteorology, 2018 (accessed June 2018)**

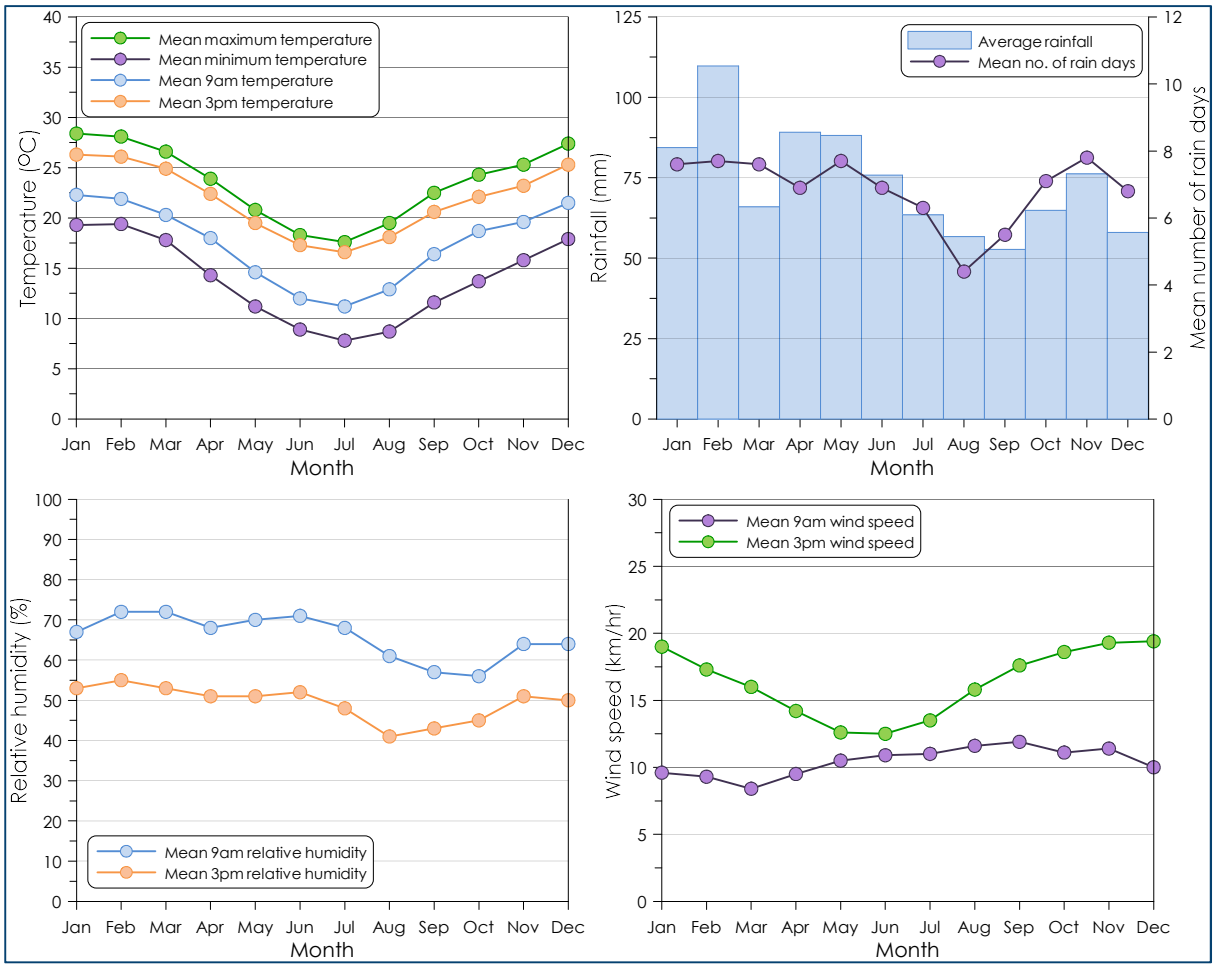


Figure 6-1: Monthly climate statistics summary – Sydney Olympic Park weather station

6.2 Local meteorological conditions

The Sydney Olympic Park AWS has been used to represent local meteorological conditions that would be experienced at the Project site. Annual and seasonal windroses prepared from data collected from the 2012 calendar year are presented in **Figure 6-2**. The 2012 calendar year was selected as the meteorological year for the dispersion modelling based on analysis of long-term data trends in meteorological data recorded for the area as outlined in **Appendix A**.

On an annual basis, the highest portion of winds originate from the west-northwest and northwest, followed by winds from the east. In summer, winds are typically from the east and southeast quadrant. The autumn and winter distributions are similar to the annual distribution with predominate winds from west-northwest and northwest. During spring, winds occur from the west-northwest and east, with fewer winds from the southeast.



Figure 6-2: Annual and seasonal windroses for Sydney Olympic Park AWS (2012)

7 DISPERSION MODELLING APPROACH

7.1 Introduction

The following sections are included to provide the reader with an understanding of the model and modelling approach applied for the assessment. CALPUFF is an advanced air dispersion model which can deal with the effects of complex local terrain on the dispersion meteorology over the modelling domain in a three-dimensional, hourly varying time step.

The model was setup in general accord with the methods provided in the NSW EPA document *Generic Guidance and Optimum Model Setting for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'* (**TRC**, **2011**).

7.2 Modelling methodology

Modelling was undertaken using a combination of the CALPUFF Modelling System and The Air Pollution Model (TAPM). The CALPUFF Modelling System includes three main components: CALMET, CALPUFF and CALPOST and a large set of pre-processing programs designed to interface the model to standard, routinely available meteorological and geophysical datasets.

TAPM is a prognostic air model used to simulate the upper air data for CALMET input. The meteorological component of TAPM is an incompressible, non-hydrostatic, primitive equation model with a terrain-following vertical coordinate for three-dimensional simulations. The model predicts the flows important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analysis.

The CALMET meteorological model uses the geophysical information and observed/simulated surface and upper air data as inputs to develop wind and temperature fields on a three-dimensional gridded modelling domain. CALPUFF is a transport and dispersion model that advects "puffs" of material emitted from modelled sources, simulating dispersion processes along the way. It uses the three dimensional meteorological field generated by CALMET. CALPOST is at tool used to process the output of the model and produce tabulations that summarise the results of the simulation.

7.2.1 Meteorological modelling

The TAPM model was applied to generate a meteorological data for use in CALMET. The centre of analysis for the TAPM modelling used is 33deg 50.5min south and 151deg 6.5min east. The simulation involved an outer grid of 30km, with three nested grids of 10km, 3km and 1km with 35 vertical grid levels.

The CALMET domain was run initially on a 50 x 50km grid with a 1km grid resolution with input meteorological data from TAPM and refined for a 10 x 10km grid with a 0.1km grid resolution. The 2012 calendar year is selected as the period for modelling based on an analysis of long-term data trends in the available recorded meteorological data in **Appendix B**.

Local land use and detailed topographical information was included to produce realistic fine scale flow fields (such as terrain forced flows) in surrounding areas, as shown in **Figure 7-1**.

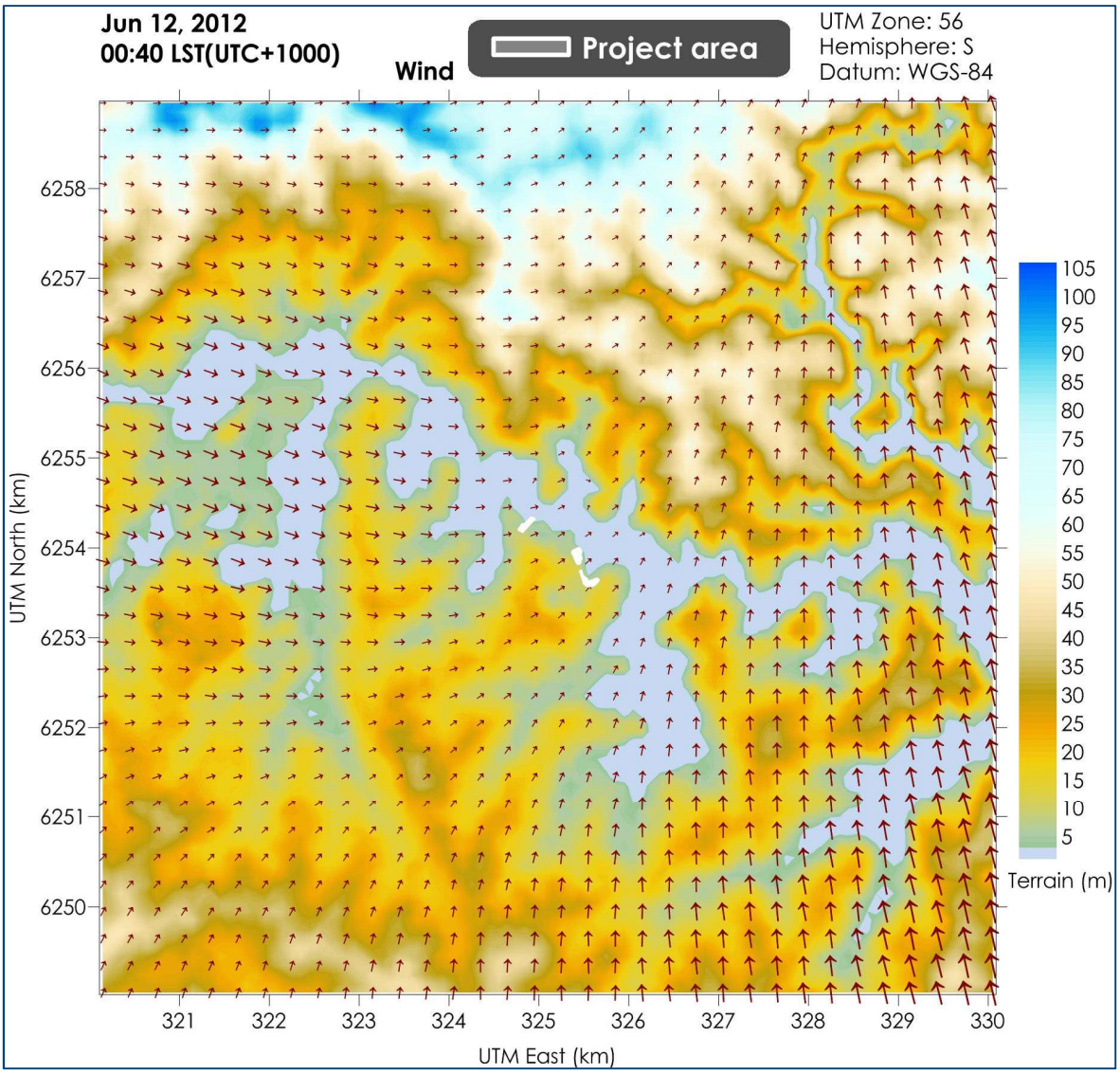


Figure 7-1: Representative 1-hour average snapshot of wind field for the Project

CALMET generated meteorological data were extracted from a point within the CALMET domain and are graphically represented in **Figure 7-2** and **Figure 7-3**.

Figure 7-2 presents annual and seasonal windroses extracted from one point in the CALMET domain. On an annual basis, winds from the west-northwest most frequent. During summer, winds from the northeast and southeast quadrants are most dominant. In autumn winds tend to occur from the west-northwest. The winter wind distribution has a high proportion of winds from west-northwest. The spring distribution is varied, typically dominated by winds from the west-northwest.

Overall, the windroses generated in the CALMET modelling reflect the expected wind distribution patterns of the area as determined based on the available measured data and the expected effects of the terrain and local features influencing the prevailing wind flows.

Figure 7-3 includes graphs of the temperature, wind speed, mixing height and stability classification over the modelling period and shows sensible trends considered to be representative of the area.

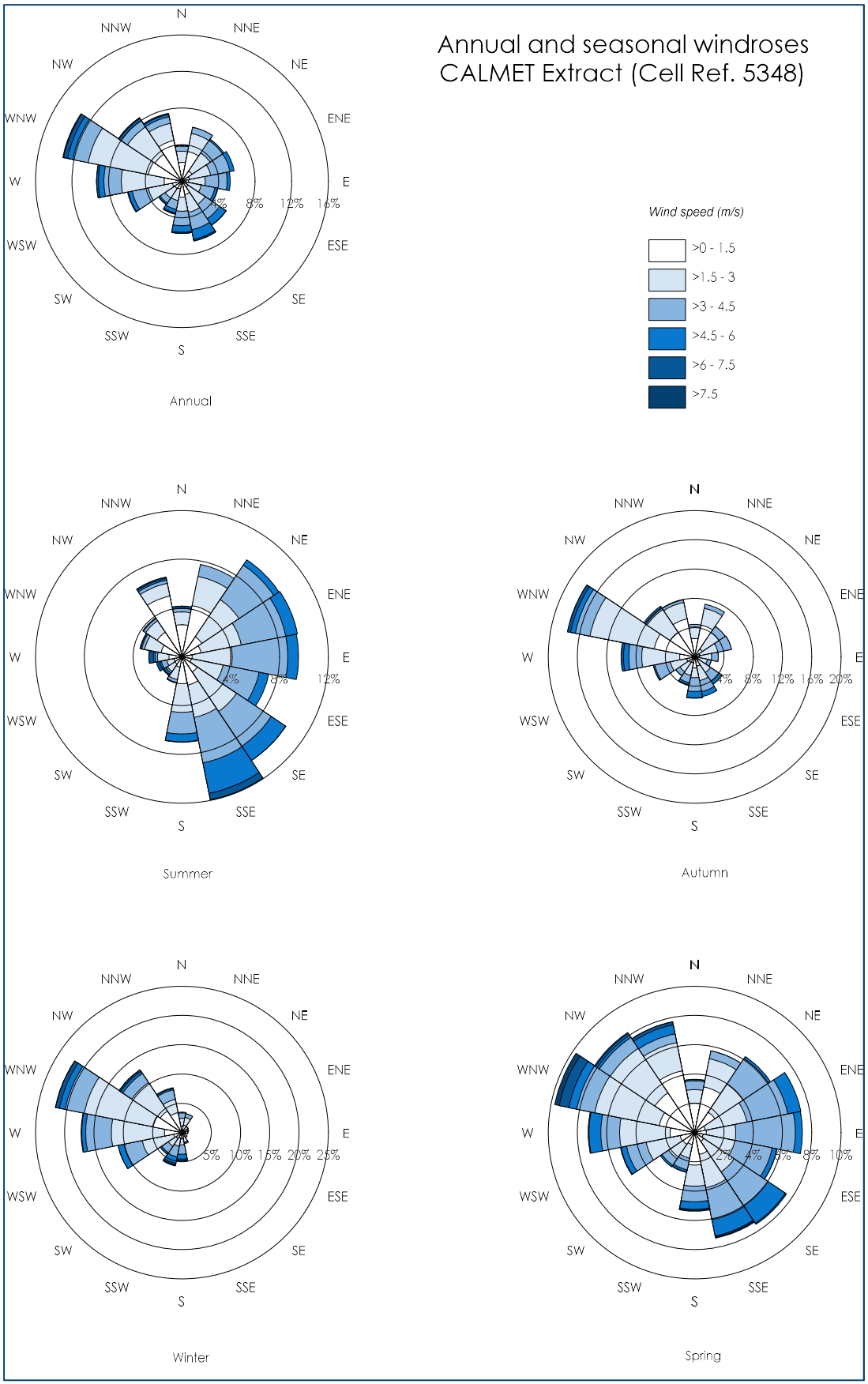


Figure 7-2: Annual and seasonal windroses from CALMET (Cell ref 5348)

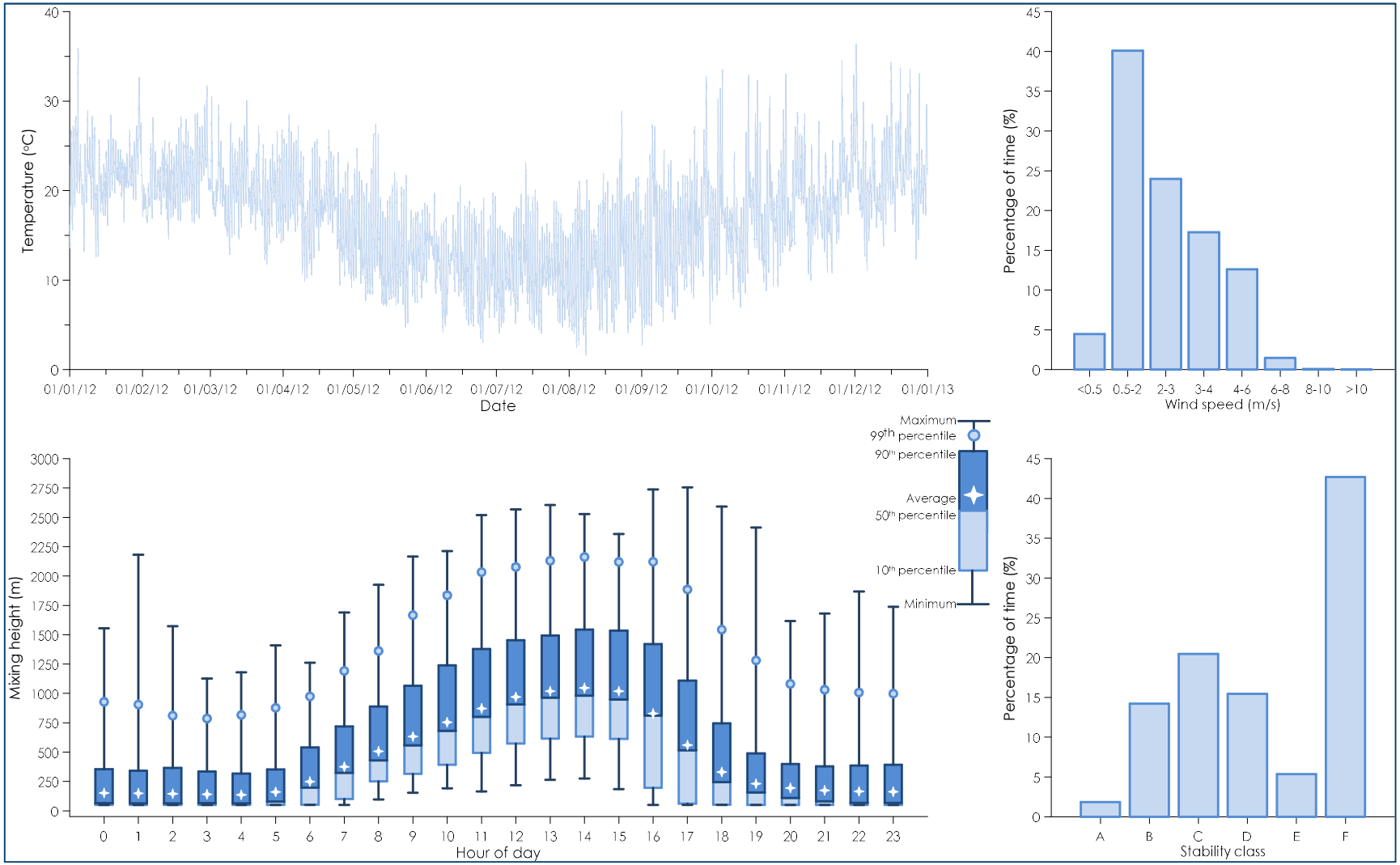


Figure 7-3: Meteorological analysis of CALMET (Cell Ref 5348)

7.2.2 Dispersion modelling

Air dispersion modelling of the key air emission sources was conducted to predict the potential air quality impacts in the surrounding environment.

The modelled odour emissions are based on the proposed remediation methodology for the Project and are represented by a series of area and volume sources. **Figure 7-4** outlines the remediation areas, and two indicative source locations which represent potential worst-case operating locations in terms potential to impact on the closest sensitive receptor locations.

The modelling was conducted for the two remediation areas (Northern and Southern), the average odour emission rate from the area and also the maximum measured odour emission rates were considered in the modelling.

It was assumed that the odour is emitted from a 400m^2 (20m x 20m) area source representing the active working area and barge, a volume source approximately 13m x 8m x 8m high representing the working excavator on a barge and another volume source representing the barge at the staging area. This is conservative as only approximately 2.5m^2 of odorous sediment material surface area would be exposed to the air at any one time.

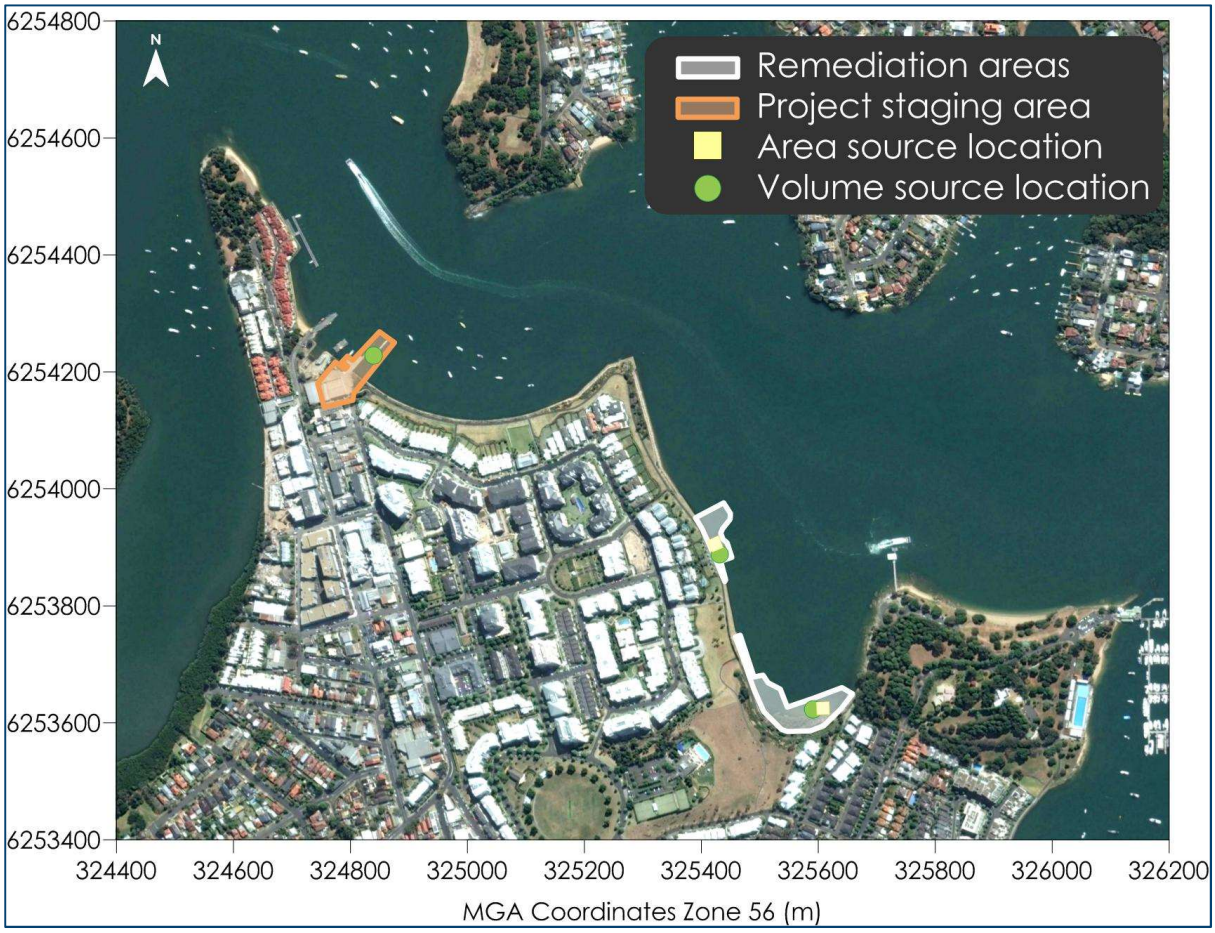


Figure 7-4: Modelled source locations

7.3 Emission estimation

7.3.1 Odour emissions

The odour emission rates for the Project were estimated on the basis of measured odour data and consideration of the proposed remediation methodology.

Odour may emanate from a number of sources including; the excavation of the material from the bay, the volatilisation from the exposed material excavated, from any soiling of the work area, and from the equipment at the staging area.

A summary of the odour emissions applied in the dispersion modelling is shown in **Table 7-1**. The barge at the staging area is assumed to have an emission rate of equivalent to 10% of the working excavator on a barge.

Table 7-1: Summary odour emissions applied in modelling scenarios

Area	Source	Maximum level	Average level	Units
Southern	Working area	0.1	0.1	$OU.m^3/m^2/s$
	Excavator and barge	926	255	OUV/s
	Barge at staging area	93	26	OUV/s
Northern	Working area	0.3	0.2	$OU.m^3/m^2/s$
	Excavator and barge	926	255	OUV/s
	Barge at staging area	93	26	OUV/s

7.3.2 Other pollutants

For the other pollutants, emission rates were estimated using a mass balance calculation based on the measured concentration of the pollutant in the sediment soil.

The remediation methodology involves the excavating of the sediment material and placing it in bins on the barge. The excavated material has a bulk density of 1.4 tonnes per cubic metre. Each bin is to be filled to a capacity of approximately $2m^3$ and each bin is sealed as soon as it is filled. An example calculation for Benzene is set out as follows:

The measured level of Benzene in the sediment is 0.79mg/kg, there is up to 2,800 kg of sediment available to be exposed to the air at any one time ($1.4t/m^3$ x $2m^3$).

The barge holds up to 8 bins but only one is open at any one time, and no more than one barge load can be made in an hour. (i.e. there is only ever up to one open bin for up to approximately an hour).

It is assumed that all the pollutant present in the sediment soil would be released into the surrounding air over the one hour period of handling (or alternatively that each bin releases 1/8 of all of the pollutant in the sediment in approximately 6 minutes of time that the bin is being filled and is not sealed).

Thus the available amount of benzene that can be released is 0.79mg/kg x 2,800kg = 2.2g/hr, or 6.1E-04g/s.

Table 7-2 presents the estimated emission rate for the other pollutants, calculated per the same approach.

Table 7-2: Estimated emission rates for the other pollutants

Pollutant	Estimated emission rate (g/s)
Benzene	6.1E-04
Toluene	1.1E-03
Ethyl Benzene	1.1E-03
m, p - Xylene	2.1E-03
o - Xylene	1.3E-03

8 DISPERSION MODELLING RESULTS

8.1 Odour

The spatial distribution of the dispersion modelling predictions for the worst case modelled odour sources are presented as isopleth diagrams showing the 99th percentile nose-response ground level odour concentrations.

Figure 8-1 and **Figure 8-2** show the predicted odour levels for the Southern Remediation Area for the maximum and average scenarios, respectively. **Figure 8-3** and **Figure 8-4** show the predicted odour levels for the Northern Remediation Area for the maximum and average scenarios, respectively.

Table 8-1 presents the discrete dispersion modelling results at each of the assessed sensitive receptor locations.

The results indicate that odour levels due the Project will be below the applicable criteria at all assessed sensitive receiver locations.

Table 8-1: 99th percentile nose-response average ground level odour concentrations (OU)

Receptor ID	Southern Remediation Area		Northern Remediation Area		Criteria
	Maximum	Average	Maximum	Average	
R1	0.0	0.0	0.0	0.0	2
R2	0.0	0.0	0.0	0.0	2
R3	0.0	0.0	0.1	0.0	2
R4	0.0	0.0	0.0	0.0	2
R5	0.0	0.0	0.0	0.0	2
R6	0.1	0.0	0.3	0.2	2
R7	0.1	0.0	0.4	0.2	2
R8	0.1	0.0	0.7	0.3	2
R9	0.1	0.0	0.9	0.3	2
R10	0.1	0.0	1.0	0.3	2
R11	0.1	0.0	1.2	0.4	2
R12	0.1	0.0	0.4	0.1	2
R13	0.1	0.0	0.3	0.1	2
R14	0.1	0.0	0.2	0.1	2
R15	0.1	0.0	0.1	0.1	2
R16	0.1	0.0	0.1	0.0	2
R17	0.1	0.0	0.1	0.0	2
R18	0.1	0.0	0.1	0.0	2
R19	0.4	0.1	0.1	0.0	2
R20	0.7	0.2	0.1	0.0	2
R21	0.4	0.1	0.1	0.0	2
R22	0.5	0.2	0.1	0.0	2
R23	0.7	0.2	0.1	0.0	2
R24	1.5	0.4	0.1	0.0	2
R25	2.0	0.6	0.2	0.1	2
R26	0.0	0.0	0.0	0.0	2
R27	0.0	0.0	0.1	0.0	2
R28	0.0	0.0	0.0	0.0	2



Figure 8-1: Predicted 99th percentile nose-response average ground level odour concentrations – Southern Remediation Area (Maximum)



Figure 8-2: Predicted 99th percentile nose-response average ground level odour concentrations – Southern Remediation Area (Average)



Figure 8-3: Predicted 99th percentile nose-response average ground level odour concentrations – Northern Remediation Area (Maximum)



Figure 8-4: Predicted 99th percentile nose-response average ground level odour concentrations – Northern Remediation Area (Average)

8.2 Other pollutants

Table 8-2 presents the predicted maximum impact at the worst affected sensitive receptors for each remediation area.

The results indicate the maximum contribution from the Project at the sensitive receptor locations would be below the relevant criteria for each of the assessed pollutants.

Table 8-2: Predicted maximum impact at the worst affected sensitive receptor for other pollutants (µg/m³)

Pollutant	Averaging period	Maximum impact at the most affected receptor		Criteria
		Southern Remediation Area	Northern Remediation Area	
Benzene	1-hour	0.9	0.7	29
Toluene	1-hour	1.7	1.4	360
Ethyl Benzene	1-hour	1.6	1.3	8000
m, p - Xylene	1-hour	3.2	2.5	190
o - Xylene	1-hour	1.9	1.5	190

9 MITIGATION MEASURES

The site observations confirm typical gas work remediation site odours are present in the sediment material. The odour is a chemical, moth-ball-like odour, and was detected on the shore without activity occurring, thus it is certain to be detectable during the remediation process. The measurements and modelling results indicate that the odour levels would be within the EPA criteria, but it is important to observe that even though this odour will be detectable, the levels would be well below levels that may cause health impacts.

Thus the above is an important message to provide to the community prior to and during the remediation activity, i.e. the chemical, moth-ball like odour will be detectable but will not occur at harmful levels. Obviously it is best to remediate this contamination, cleaning up the bay for future generations, and in the interim there will be some odour generated during the remediation process.

To adequately control the potential odour, it is necessary to put in place mitigation measures during remediation activities. Potential measures to consider include the following:

- Limiting remediation activity to daytime hours.
- Limiting remediation activity on the contamination "hotspot" area to periods when the wind blows from the western quadrant (on a case by case basis if necessary).
- Only excavating/ exposing the minimum area of sediment material necessary at any one time.
- Covering each bin of excavated material immediately once filled.
- Minimising the drop height of the excavator (i.e. limiting the height through which material is dropped into the bin).
- Regularly (e.g. daily or per shift) cleaning of the excavator arm and any surfaces soiled with potentially odorous material.
- Washing outside of bins at berth prior to loading from the barge to remove any material on the surface of the bins.
- A plan for complaints management that includes a provision for a staff member or other person that is not regularly on site to come to the site at short notice to investigate any odour complaint.

10 SUMMARY AND CONCLUSIONS

This report has assessed the potential worst-case air quality impacts associated with the proposed remediation of Kendall Bay.

Air dispersion modelling using the CALPUFF model was used to predict the potential for off-site air quality impacts in the surrounding area due to proposed activity at the Project. The modelling applies estimated pollutant emission rates with local sources of meteorological data.

The results show that the predicted impacts from the proposed operations are low and would be within the relevant air quality criterion for each of the assessable air pollutants at the assessed sensitive receptor locations.

Overall, the assessment demonstrates that the Project can operate without causing any significant air quality impact at sensitive receptor locations in the surrounding environment at any time.

However, as is common with gas-works remediation sites, the odour that will be generated is a chemical, moth-ball like odour. This odour will be detectable, but will not occur at harmful levels. This is a very important message to communicate to the potential nearby receptors prior to and during the remediation process.

11 REFERENCES

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Appendix A

Sensitive Receptor Locations



Figure A-1: Location of sensitive receptors assessed in this study

Appendix B

Selection of Meteorological Year

Selection of meteorological year

A statistical analysis of five years of meteorological data from the Sydney Olympic Park weather station is presented in **Table B-1**. The standard deviation of the five years of meteorological data spanning 2012 to 2017 was analysed against the long term average mean measured wind speed, temperature and relative humidity.

The analysis indicates that 2012 is closest to the average for wind speed, temperature and for relative humidity.

Figure B-1 shows the frequency distributions for wind speed, wind direction, temperature and relative humidity of the 2012 year compared with the mean of the latest five years data set. The 2012 year data appears to be well aligned with the mean data.

Therefore, based on this analysis it was determined that 2012 is generally representative of the long-term trends compared to other years and is thus suitable for the purpose of modelling.

Table B-1: Statistical analysis of meteorological data from Bankstown Airport AWS

Year	Wind speed	Temperature	Relative humidity
2012	0.3	0.5	4.1
2013	0.3	0.8	4.8
2014	0.3	0.7	6.0
2015	0.4	0.8	4.7
2016	0.4	0.9	4.3

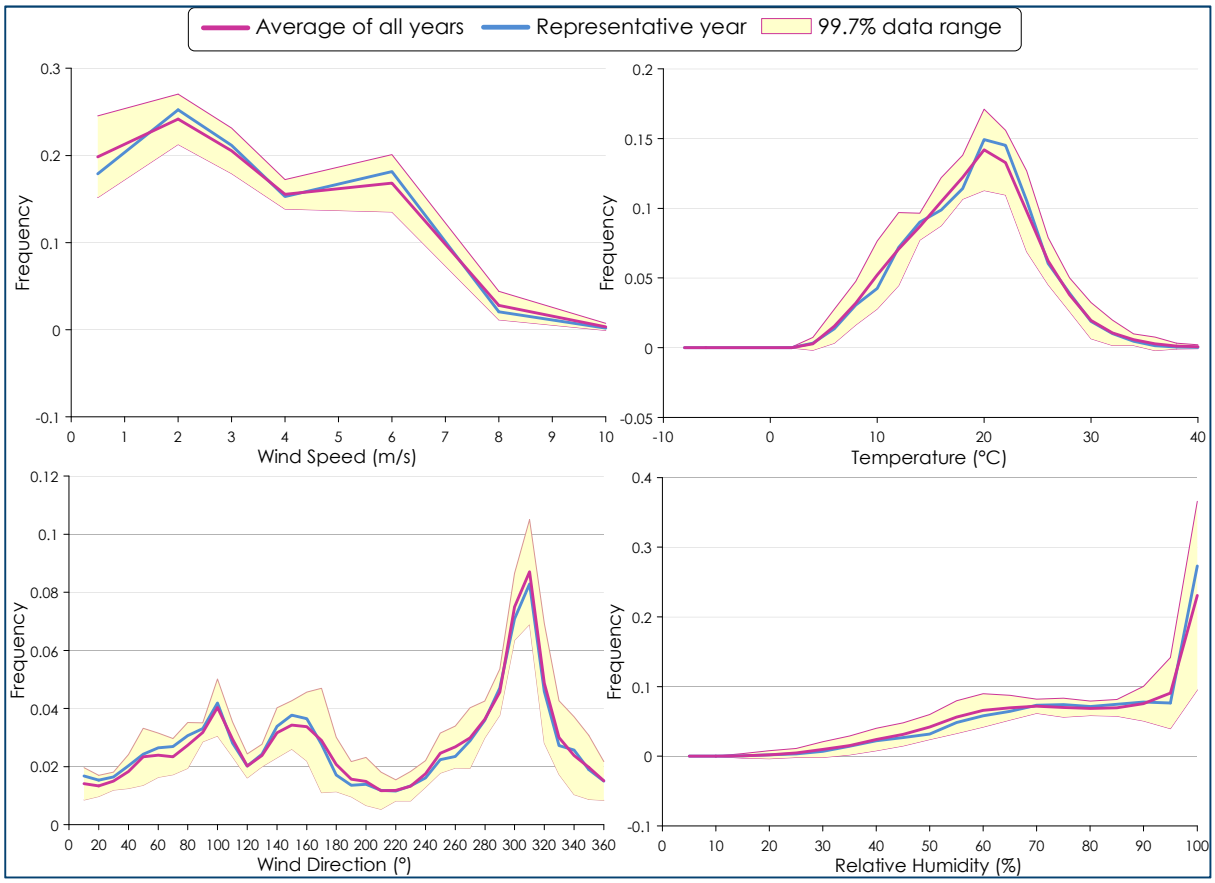


Figure B-1: Frequency distributions for wind speed, wind direction, temperature and relative humidity

Appendix E Reports – Bulk Sediment Excavation Trial



REPORT FOR SYNNOT & WILKINSON

AIR SAMPLING & ANALYSIS DURING KENDALL BAY DREDGE TRIAL, SEPTEMBER 2016

PREPARED FOR:

RUSSELL SYNNOT

SGS

PROJECT QA/QC

Rev.	Date	Prepared	Reviewed	Approved
00	7/10/2016	KH	DE	BS
01				
02				
03				

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1. INTRODUCTION AND BACKGROUND

On September 22, 2016, SGS Australia Pty Ltd (EH&S division) was commissioned by Synnot & Wilkinson to undertake ambient air and odour sampling during the dredging trial of Kendall Bay NSW.

Kendall Bay is located in Sydney Harbour on the Parramatta River and is approximately 10km from the Sydney CBD located between the suburbs of Cabarita and Breakfast Point.

The dredging trial took place as a result of historic industrial discharges from the former Mortlake Gasworks.

The aim was to engage the community to experience what conditions could be encountered should a large scale dredging and remediation program take place on Kendall Bay.

2. SCOPE OF WORK

Synnott & Wilkinson engaged SGS EH&S to conduct ambient air and odour monitoring upwind and downwind of the dredging on Kendall Bay that took place on the 22nd September 2016.

These locations were sampled for Volatile Organic Compounds (VOCs), Total Petroleum Hydrocarbon Criteria Working Group fractions (TPHCWG) and Polycyclic Aromatic Hydrocarbons (PAHs) with field measurements taken throughout the day for Total VOC and gas detection for Lower Explosive Limit (LEL) and Hydrogen Sulphide (H_2S).

Wind direction and speed was also measured at each location and from a weather station mounted to the top of the barge support boat to capture peak wind speed throughout the day.

Ektimo Pty Ltd was contracted to undertake the odour sampling and analysis of samples by their internal panel of odour consultants.

A grab sample for GCMS analysis was collected at the strongest odour point downwind of the dredging in addition to the Odour samples.

A duplicate pair of passive samplers (Radiello) for VOCs were placed near the residential apartments closest to the dredge sites.

3. SAMPLING METHODOLOGY

The wind direction on the day of the 22nd September 2016 determined the most suitable upwind and downwind sampling locations for the trial.

The upwind location was based on the Shoreline of the bay in front of the residential grounds of the Breakfast Point development. At this location, samples were collected in duplicate for VOCs, TPHCWG fractions, PAHs and field measurements for Total VOC, LEL, H_2S, wind speed and direction.

Behind the Shoreline sample locations, 2 x Passive Radiello samplers were placed on a tripod to enable passive sample collection of VOCs close to the nearest residential apartments to the dredge site.

Downwind sampling locations changed as the dredge moved to each location. Samples for VOCs, TPHCWG fractions, PAHs and field measurements for Total VOC, LEL, H_2S, wind speed and direction were collected from a row boat without an outboard motor to exlude any influences on air quality from fuel storage or exhaust fumes during sampling.

Samples for VOCs and TPHCWG fractions were collected in individually cleaned, certified and evacuated 6L canisters coupled with 8hr Mass flow controllers. A grab sample was also collected without the flow controller fitted at one of the odour sampling points down wind of the barge.

Analysis was performed by gas chromatography mass selective detector (GC-MS) based on USEPA TO15 – “Determination of Volatile Organic Compounds in Air Collected in specially prepared canisters and Analysed by GC-MS” It is from the US EPA Compendium of methods for the determination of Toxic Organic Compounds in Air.

The samples collected for PAH analyses were collected onto sorbent tubes containing XAD resin based on NIOSH method 5506.

Air was drawn through the tubes using SKC PCXR Series sampling pumps and low flow adaptors. The low flow adaptors were adjusted once the tube was fitted to maintain a constant flow rate for sampling.

The tubes were then extracted and solutions analysed for PAH by high pressure liquid chromatography (HPLC)

The passive sampling locations for VOCs utilized the Radiello passive sampling system.

Charcoal sorbent wrapped in a stainless steel mesh is loaded into a diffusive sampling body and VOCs then migrate through this diffusive body and onto the sorbent. Each individual compound reported has a known uptake rate which is then used to calculate the mass of each analyte on the sorbent and then reported as a time weighted average after analysis.

The charcoal sorbents are desorbed in a solvent and then analysed by gas chromatography mass selective detector (GC-MS).

Samples for Odour panel assessment were collected and analysed by Ektimo (EML). Ektimo were chosen to collect the samples for odour assessment as they are NATA accredited for this analysis and being based locally, could assess the odour samples shortly after they were collected on site.

In addition to the laboratory analysis, SGS also collected field measurements for Total VOC by PID, LEL and H2S using a multi gas detector and wind speed using a hand held anemometers. A wireless weather station was also mounted to the top of the barge support boat to record the minimum and maximum wind speeds on the day.

Specifications on this equipment are:

PID – MiniRAE 3000 PID

Gas detector – Impact Pro Multi-Gas Detector

Anemometer - Kestrel 1000

Weather station – IC0346 Wireless Weather Station

Calibration certificates for the Gas detectors and PIDs are located in the appendix of this report.

All of the samples with the exception of the odour panel samples were sent the SGS EH&S laboratory in Notting Hill, Melbourne for analysis.

4. FIELD MEASURMENTS

The tables below outline the field results collected throughout the day. The following wind speed readings were recorded from each location using a hand held anemometer and compass to identify the peak wind speed and direction at the time of recording. This data varies to the bureau data from the 22nd September 2016 and identifies the speed and direction of gusts at the times recorded.

1st Downwind sampling location between 10:20am – 10:55am

Date	22/9/16	22/9/16
Time	10:20am	10:40am
Coordinates	E:325486 N:6253910	
PID (ppm)	0	0
LEL	0	0
H2S	0	0
Wind Direction	WNW	W
Wind Speed	3.8 m/s	2.8 m/s

2nd Downwind sampling location between 11:15am – 11:45am

Date	22/9/16	22/9/16	22/9/16
Time	11:15am	11:30am	11:40am
Coordinates	E:325483 N:6253913		
PID (ppm)	0	0	0
LEL	0	0	0
H2S	0	0	0
Wind Direction	WNW	W	SW
Wind Speed	2.0 m/s	1.2 m/s	5.2 m/s

3rd Downwind sampling location between 1:20pm- 2:15pm

Date	22/9/16	22/9/16
Time	10:20am	10:40am
Coordinates	E:325542 N:6253690	
PID (ppm)	0	0
LEL	0	0
H2S	0	0
Wind Direction	WNW	W
Wind Speed	3.8 m/s	2.8 m/s

Onshore static sampling location 9:45am – 2:00pm

Date	22/9/16	22/9/16	22/9/16	22/9/16
Time	9:45am	10:15am	10:30am	10:45am
PID (ppm)	0	0	0	0
LEL	0	0	0	0
H2S	0	0	0	0
Wind Direction	NNE Gusting	NNE Gusting	Still	NNE Gusting
Wind Speed	1.5 m/s	1.0 m/s	0 m/s	0.5 m/s

Onshore static sampling location 9:45am – 2:00pm

Date	22/9/16	22/9/16	22/9/16	22/9/16
Time	11:00am	11:15am	11:30am	11:45am
PID (ppm)	0	0	0	0
LEL	0	0	0	0
H2S	0	0	0	0
Wind Direction	NE Gusting	E Gusting	E Gusting	E Gusting
Wind Speed	0.5 m/s	2.0 m/s	1.0 m/s	0.5 m/s

Date	22/9/16	22/9/16	22/9/16	22/9/16
Time	12:00pm	1:30pm	1:45pm	2:00pm
PID (ppm)	0	0	0	0
LEL	0	0	0	0
H2S	0	0	0	0
Wind Direction	NE Gusting	WSW Gusting	Still	SW Gusting
Wind Speed	2.0 m/s	3.0 m/s	0 m/s	2.5 m/s

Weather station data recorded from barge support vessel.

Date	22/9/16	
Temperature	Min 17.1°C	Max 21.9°C
Wind Speed	Min 12.2 km/h	Max 31.7 km/h

Weather observations from the Bureau of Meteorology Olympic park site recorded wind direction as WNW at 13km/h at 9:00am and W at 3:00pm on the day of sampling. Maximum wind gusts recorded at Sydney Olympic Park weather station where was from the W at 39km/h .

5. CONCLUSION

In the analysis conducted, there were no significant detections from all sample methods used on the day.

The compounds that were reported at detectable concentrations are typically found in ambient air in urban environments.

Laboratory reports are attached in Appendix I

APPENDIX I Laboratory Reports

SGS Analytical report M161846

Ektimo (EML) Analytical report R003361

APPENDIX II Sample Location Photos



Figure 1: "Shoreline" Sample Location showing duplicate sampling of VOCs in canisters and PAHs on sorbent tubes.



Figure 2: Air and odour sampling boat without motor to eliminate any interference from fuels and exhaust emissions.



Figure 3: Odour and grab sample location (in row boat) downwind from barge



Figure 4: Radiello passive sampling undertaken out the front of these properties.

APPENDIX III Calibration Certificates

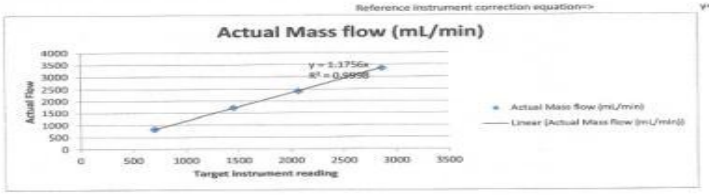
Calibration certificate for SGS Flow Meter "FM 1" used to set and adjust flows for the sorbent tube sampling.

Date:	29/06/2016
Analyst:	MJ

Reference instrument ID	FM16
Target instrument ID	FM1
Target instrument Max flow	4000
Temperature (Degrees C)	20
Pressure (Kpa)	101.3

Target flow	Flow (mL/min)	Target instrument reading	Reference instrument reading	Actual Mass flow (mL/min)	Approximate reference reading
High range (80% of max flow)	3200	2865	3348	3360.67706	3200
Mid range 1 (60% of max flow)	2400	2070	2416	2425.148081	2400
Mid range 2 (40% of max flow)	1600	1450	1720	1726.512707	1600
Low range (20% of max flow)	800	700	829.9	833.042381	800

Reference instrument correction equation=> y= 1 x + 0



PF-AU-ENV-MIT-QU-133a.xls / Ver 1 / 26.10.2012 / Page 1 of 1

Calibration certificates for PID's and Gas detectors from Thermo Fisher Scientific.

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RENTALS

Equipment Certification Report - Impact Pro Multi-Gas Detector

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
O_2	Fresh Air	20.9 %	14.6 %	30708IC8	☑
CO	100 ppm	0 ppm	100 ppm	— " —	☑
H_2S	40 ppm	0 ppm	40.0 ppm	— " —	☑
LEL	50 % CH_4	0 %	50 %	— " —	☑

☑ Battery Status 100 %
☑ 10 minute test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

☑ Filters checked
☑ Spare Battery (Min 4.2 volts)
☑ Pump test

Tag No: 000807
Valid to: 01/11/2016
Date: 20/09/2016
Signed: Li Jenks

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Impact Pro Gas Detector
☑	☐	Performance check / Battery 100 % METHANE
☑	☐	Monitor setup for (Correction Factor)
☑	☐	Power supply 240/12v with base station
☑	☐	Flow adaptor (Grey) for calibration with hose
☑	☐	Pump adaptor (Black) with hose and Inline filter
☑	☐	Battery Cases with 4 Alkaline Batteries
☑	☐	Allen Key located back of Instrument to open battery
☑	☐	Spare inline filters 1
☑	☐	Instruction Manual behind foam on the lid of case
☑	☐	Quick Use Guide behind foam on the lid of case
☑	☐	Carry Case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 20/09/2016
Signed: Li Jenks

TFS Reference	CS005499	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	IMPPRO-1.5	Condition on return:	
Equipment Serial No.	2EC1402404		

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Issue 8 Oct 12 G0492

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RENTALS

Equipment Certification Report - Impact Pro Multi-Gas Detector

This Gas Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Zero	Span	Traceability Lot #	Pass?
O_2	Fresh Air	20.9 %	14.7 %	30708IC8	☑
CO	100 ppm	0 ppm	100 ppm	—11—	☑
H_2S	40 ppm	0 ppm	40.0 ppm	—11—	☑
LEL	50 % CH_4	0 %	50 %	—11—	☑

☑ Battery Status 100%
☑ 10 minute test complete
☑ Electrical Safety Tag attached (AS/NZS 3760)

☑ Filters checked
☑ Spare Battery (Min 4.2 volts)
☑ Pump test

Tag No: 000833
Valid to: 26/11/2016

Date: 20/09/2016
Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	Impact Pro Gas Detector
☑	☐	Performance check / Battery 100%
☑	☐	Monitor setup for (Correction Factor) METHANE
☑	☐	Power supply 240/12v with base station
☑	☐	Flow adaptor (Grey) for calibration with hose
☑	☐	Pump adaptor (Black) with hose and Inline filter
☑	☐	Battery Cases with 4 Alkaline Batteries
☑	☐	Allen Key located back of Instrument to open battery
☑	☐	Spare inline filters
☑	☐	Instruction Manual behind foam on the lid of case
☑	☐	Quick Use Guide behind foam on the lid of case
☑	☐	Carry Case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 20/09/2016
Signed: [signature]

TFS Reference	CS005499	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	HIRE-5	Condition on return:	
Equipment Serial No.	ZEL0906690		

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Equipment Report - MiniRAE 3000 PID

This Gas Meter has been performance checked and calibrated as follows:

Lamp	Compound	Concentration	Zero	Span	Traceability Lot #	Pass?
10.6 eV	Isobutylene	100 ppm	0.0 ppm	100.0 ppm	389261 Cyl 2	☑

Alarm Limits

High	100 ppm
Low	50 ppm

Bump Test

Date	Target Gas	Reading	Pass?
20/09/2016	100 ppm	99.8 ppm	☑

☑ Battery Status 100%
☐ 10 minutes test complete
☑ Spare battery status (Min 5.5 volts)
☑ Electrical Safety Tag attached (AS/NZS 3760)

☑ Performance check (pump, lamp, sensor)
☑ Data cleared
☑ Filters checked

Tag No: 000867
Valid to: 20/12/2016
Date: 20/09/2016
Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	MiniRAE 2000 PID / Operational Check / Battery Status 100%
☑	☐	Lamp 10.6 eV, Compound Set to: ISOBUTYLENE Cfactor: 1
☑	☐	Protective yellow rubber boot
☑	☐	Inlet probe (attached to PID)
☑	☐	Spare water trap filter(s) Qty 1
☑	☐	Charger 240V to 12V1250mA
☑	☐	Cradle and Travel Charger
☑	☐	Instruction Manual behind foam on the lid of case
☑	☐	Quick Guide Sheet behind foam on the lid of case
☑	☐	Spare Alkaline Battery Compartment with batteries
☑	☐	Inline Moisture trap Filter Guide Laminated
☒	☐	Calibration regulator & tubing (optional)
☒	☐	Data cable and Software CD (optional)
☑	☐	Carry Case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 20/09/2016
Signed: [signature]

TFS Reference	CS0054 99	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	PID3000-50	Condition on return:	
Equipment Serial No.	592916990		

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Issue 6 Nov 12 G0555

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RENTALS

Equipment Report - MiniRAE 3000 PID

This Gas Meter has been performance checked and calibrated as follows:

Lamp	Compound	Concentration	Zero	Span	Traceability Lot #	Pass?
10.6 eV	Isobutylene	100 ppm	0.0 ppm	100.0 ppm	389261 Cyl 2	☑

Alarm Limits

High	100 ppm
Low	50 ppm

Bump Test

Date	Target Gas	Reading	Pass?
20/09/2016	100 ppm	100.0 ppm	☑

☑ Battery Status
☑ 10 minutes test complete
☑ Spare battery status (Min 5.5 volts)
☑ Electrical Safety Tag attached (AS/NZS 3760)

☑ Performance check (pump, lamp, sensor)
☑ Data cleared
☑ Filters checked

Tag No: 000868
Valid to: 20/02/2016
Date: 20/09/2016
Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	MiniRAE 2000 PID / Operational Check / Battery Status 100%
☑	☐	Lamp 10.6 eV, Compound Set to: ISOBUTYLENE Correction factor:
☑	☐	Protective yellow rubber boot
☑	☐	Inlet probe (attached to PID)
☑	☐	Spare water trap filter(s) Qty 1
☑	☐	Charger 240V to 12V1250mA
☑	☐	Cradle and Travel Charger
☑	☐	Instruction Manual behind foam on the lid of case
☑	☐	Quick Guide Sheet behind foam on the lid of case
☑	☐	Spare Alkaline Battery Compartment with batteries
☑	☐	Inline Moisture trap Filter Guide Laminated
☑	☐	Calibration regulator & tubing (optional)
☑	☐	Data cable and Software CD (optional)
☑	☐	Carry Case
☑	☐	Check to confirm electrical safety (tag must be valid)

Date: 20/09/2016
Signed: [signature]

TFS Reference	CS005499	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	PID 3000-51	Condition on return:	
Equipment Serial No.	592916967		

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Issue 6 Nov 12 G0555

A.B.N. 44 000 964 278
10 / 585 Blackburn Road
Notting Hill, Vic, 3168
Telephone: (03) 9574 3200

Chartered Chemists

6-Oct-2016

REPORT NUMBER: M161846
Site/Client Ref: Kendall Bay
Order No: KB-022

Synnot Wilkinson
172 Coach Rd
Strathbogie

Victoria 3666
Attention: Russell Synnot

CERTIFICATE OF ANALYSIS

SAMPLES:	Eleven samples were received for analysis
DATE RECEIVED:	**26-Sep-2016**
DATE COMMENCED:	**26-Sep-2016**
METHODS:	See Attached Results
RESULTS:	Please refer to attached pages for results.

Note: Results are based on samples as received at SGS laboratories

Please note: No other VOC's compounds were detected above detection limits,

REPORTED BY:

Michael Jeddou
Senior Chemist

NATA Accredited Laboratory Number: 14429

Accredited for compliance with ISO/IEC 17025.

The sampling for the samples in this report was carried out in accordance with SGS's NATA accredited sampling methods

ANALYTICAL RESULTS

Matrix: Canister
Method: TO-15.04 Receipt Vacuum / Pressure
Units as Listed - ^^ Vacuum reported as inches of Mercury below standard atmospheric pressure

Test Started: 28/09/2016

Analyte Name		Leeder ID	2016024444	2016024445	2016024446	2016024447
		Client ID	Shoreline L4294	Shoreline Field Dup L4550	Downwind L4547	GRAB sample L4606
		Sampled Date	22/09/2016	22/09/2016	22/09/2016	
		PQL				
Receipt Pressure (PSIA)			9.50	8.00	3.60	14.0
Receipt Vacuum (inch Hg) ^^			10.4	13.5	22.4	1.22

ANALYTICAL RESULTS

Matrix: Canister
Method: TO-15.02 Volatile Organics (w/v)
Sample units are expressed in µg/m³ Test Started: 28/09/2016

Analyte Name	Sampled Date / PQL	Leeder ID: 2016024444 Client ID: Shoreline L4294 22/09/2016	Leeder ID: 2016024445 Client ID: Shoreline Field Dup L4550 22/09/2016	Leeder ID: 2016024446 Client ID: Downwind L4547 22/09/2016	Leeder ID: 2016024447 Client ID: GRAB sample L4606	Leeder ID: 2016024448 Client ID: Shoreline L4294 Duplicate	Leeder ID: 2016024449 Client ID: Method Blank
Acrolein		<4.3	<4.7	<9	<2.9	<4.3	<1.4
Acrylonitrile		<11	<12	<23	<7.4	<11	<3.6
tert-Amyl Methyl Ether		<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
Benzene		<3.1	<3.4	<6.4	<2.1	<3.1	<1
Bromodichloromethane		<6.2	<6.8	<13	<4.1	<6.2	<2
Bromoform		<7.4	<8.1	<15	<5	<7.4	<2.4
Bromomethane		<5.6	<6.1	<12	<3.7	<5.6	<1.8
1,3-Butadiene		<1.9	<2	<3.9	<1.2	<1.9	<0.6
2-Butanone (Methyl Ethyl		<3.1	<3.4	<6.4	<2.1	<3.1	<1
tert-Butyl Alcohol		<3.1	<3.4	<6.4	<2.1	<3.1	<1
n-Butylbenzene		<5	<5.4	<10	<3.3	<5	<1.6
sec-Butylbenzene		<5	<5.4	<10	<3.3	<5	<1.6
tert-Butylbenzene		<5	<5.4	<10	<3.3	<5	<1.6
Carbon Tetrachloride		<6.2	<6.8	<13	<4.1	<6.2	<2
Chlorobenzene		<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
Chloroethane		<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
Chloroform		<5.6	<6.1	<12	<3.7	<5.6	<1.8
Chloromethane		<4.3	<4.7	<9	<2.9	<4.3	<1.4
2-Chloroprene		<6.8	<7.4	<14	<4.5	<6.8	<2.2
3-Chloropropene		<4.3	<4.7	<9	<2.9	<4.3	<1.4
2-Chlorotoluene		<5.6	<6.1	<12	<3.7	<5.6	<1.8
alpha-Chlorotoluene		<4.3	<4.7	<9	<2.9	<4.3	<1.4
Cumene		<5	<5.4	<10	<3.3	<5	<1.6
Cyclohexane		<2.5	<2.7	<5.1	<1.7	<2.5	<0.8
o-Cymene		<5	<5.4	<10	<3.3	<5	<1.6
Dibromochloromethane		<7.4	<8.1	<15	<5	<7.4	<2.4
1,2-Dibromoethane (EDB)		<7.4	<8.1	<15	<5	<7.4	<2.4
1,2-Dichlorobenzene		<8	<8.8	<17	<5.4	<8	<2.6
1,3-Dichlorobenzene		<8	<8.8	<17	<5.4	<8	<2.6
1,4-Dichlorobenzene		<8	<8.8	<17	<5.4	<8	<2.6
1,1-Dichloroethane		<4.3	<4.7	<9	<2.9	<4.3	<1.4
1,2-Dichloroethane		<6.2	<6.8	<13	<4.1	<6.2	<2
1,1-Dichloroethene		<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
cis-1,2-Dichloroethene		<5	<5.4	<10	<3.3	<5	<1.6
trans-1,2-Dichloroethene		<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
1,2-Dichloropropane		<11	<12	<23	<7.4	<11	<3.6
cis-1,3-Dichloropropene		<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
trans-1,3-Dichloropropene		<4.3	<4.7	<9	<2.9	<4.3	<1.4
Diisopropyl Ether		<4.3	<4.7	<9	<2.9	<4.3	<1.4
1,4-Dioxane		<3.7	<4.1	<7.7	<2.5	<3.7	<1.2

ANALYTICAL RESULTS

Matrix: Canister
Method: TO-15.02 Volatile Organics (w/v)
Sample units are expressed in µg/m³

Test Started: 28/09/2016

Analyte Name	Sampled Date / PQL	Leeder ID	2016024444	2016024445	2016024446	2016024447	2016024448	2016024449
		Client ID	Shoreline L4294	Shoreline Field Dup L4550	Downwind L4547	GRAB sample L4606	Shoreline L4294	Method
		Sampled Date	22/09/2016	22/09/2016	22/09/2016			
		PQL					Duplicate	Blank
Ethyl Acetate			<5	<5.4	<10	<3.3	<5	<1.6
Ethyl Benzene			<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
Ethyl tert-Butyl Ether			<3.1	<3.4	<6.4	<2.1	<3.1	<1
4-Ethyltoluene			<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
Freon 11			<1.9	<2	<3.9	<1.2	<1.9	<0.6
Freon 113			<6.2	<6.8	<13	<4.1	<6.2	<2
Freon 114			<1.9	<2	<3.9	<1.2	<1.9	<0.6
Freon 12			<2.5	<2.7	<5.1	<1.7	<2.5	<0.8
Heptane			<4.3	<4.7	<9	<2.9	<4.3	<1.4
Hexachlorobutadiene			<12	<14	<26	<8.3	<12	<4
Hexane			<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
2-Hexanone			<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
m,p-Xylene			<8	<8.8	<17	<5.4	<8	<2.6
Methyl Methacrylate			<4.3	<4.7	<9	<2.9	<4.3	<1.4
Methyl tert-butyl ether			<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
4-Methyl-2-pentanone			<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
Naphthalene			<13	<14	<27	<8.7	<13	<4.2
2-Propanol			230	180	<130	<41	230	<20
Propene			<6.2	<6.8	<13	<4.1	<6.2	<2
Propylbenzene			<4.3	<4.7	<9	<2.9	<4.3	<1.4
Styrene			<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
1,1,1,2-Tetrachloroethane			<6.2	<6.8	<13	<4.1	<6.2	<2
1,1,2,2-Tetrachloroethane			<4.3	<4.7	<9	<2.9	<4.3	<1.4
Tetrachloroethene			<6.8	<7.4	<14	<4.5	<6.8	<2.2
Tetrahydrofuran			<2.5	<2.7	<5.1	<1.7	<2.5	<0.8
Toluene			<3.7	<4.1	7.7	3.8	<3.7	<1.2
1,2,4-Trichlorobenzene			<22	<24	<46	<15	<22	<7.2
1,1,1-Trichloroethane			<5	<5.4	<10	<3.3	<5	<1.6
1,1,2-Trichloroethane			<5	<5.4	<10	<3.3	<5	<1.6
Trichloroethene			<2.5	<2.7	<5.1	<1.7	<2.5	<0.8
1,2,4-Trimethylbenzene			<5	<5.4	<10	<3.3	<5	<1.6
1,3,5-Trimethylbenzene			<3.7	<4.1	<7.7	<2.5	<3.7	<1.2
2,2,4-Trimethylpentane			<5.6	<6.1	<12	<3.7	<5.6	<1.8
Vinyl Acetate			<4.3	<4.7	<9	<2.9	<4.3	<1.4
Vinyl Bromide			<5	<5.4	<10	<3.3	<5	<1.6
Vinyl Chloride			<2.5	<2.7	<5.1	<1.7	<2.5	<0.8
o-Xylene			<3.7	<4.1	<7.7	<2.5	<3.7	<1.2

ANALYTICAL RESULTS

Matrix: Canister
Method: TO-15.TPHCWG.07 Aromatic Fraction (w/v)
Sample units are expressed in mg/m³ Test Started: 28/09/2016

Analyte Name	Sampled Date / PQL	Leeder ID: 2016024444 Client ID: Shoreline L4294 22/09/2016	2016024445 Shoreline Field Dup L4550 22/09/2016	2016024446 Downwind L4547 22/09/2016	2016024447 GRAB sample L4606	2016024448 Shoreline L4294 Duplicate	2016024449 Method Blank
Aromatic EC5-7		<0.0031	<0.0034	<0.0064	<0.0021	<0.0031	<0.001
Aromatic EC>7-8		<0.0037	<0.0041	0.0077	0.0038	<0.0037	<0.0012
Aromatic EC>8-10		<0.12	<0.14	<0.26	<0.083	<0.12	<0.04
Aromatic EC>10-12		<0.12	<0.14	<0.26	<0.083	<0.12	<0.04

Matrix: Canister
Method: TO-15.TPHCWG.01 Aliphatic Fraction (w/v)
Sample units are expressed in mg/m³ Test Started: 28/09/2016

Analyte Name	Sampled Date / PQL	Leeder ID: 2016024444 Client ID: Shoreline L4294 22/09/2016	2016024445 Shoreline Field Dup L4550 22/09/2016	2016024446 Downwind L4547 22/09/2016	2016024447 GRAB sample L4606	2016024448 Shoreline L4294 Duplicate	2016024449 Method Blank
Aliphatic EC5-6		<0.12	<0.14	<0.26	<0.083	<0.12	<0.04
Aliphatic EC>6-8		<0.12	<0.14	<0.26	<0.083	<0.12	<0.04
Aliphatic EC>8-10		<0.12	<0.14	<0.26	<0.083	<0.12	<0.04
Aliphatic EC>10-12		<0.12	<0.14	<0.26	<0.083	<0.12	<0.04

ANALYTICAL RESULTS

Matrix: XAD Tube
Method: MA-72.ST.02 Polynuclear Aromatic Hydrocarbons (w/v)
Sample units are expressed in mg/m³ Test Started: 4/10/2016

	Leeder ID	2016024450
	Client ID	Downwind 5743704407
Analyte Name	**Sampled Date**	22/09/2016
	PQL	
Acenaphthene		<0.0007
Acenaphthylene		<0.0007
Anthracene		<0.0007
Benzo(a)anthracene		<0.0007
Benzo (a) pyrene		<0.0007
Benzo (b) fluoranthene		<0.0007
Benzo (ghi) perylene		<0.0007
Benzo (k) fluoranthene		<0.0007
Chrysene		<0.0007
Dibenz (ah) anthracene		<0.0007
7,12-Dimethylbenz(a)anthracene		<0.0007
Fluoranthene		<0.0007
Fluorene		<0.0007
Indeno (1,2,3-cd) pyrene		<0.0007
3-Methylcholanthrene		<0.0007
Naphthalene		<0.0007
Phenanthrene		<0.0007
Pyrene		<0.0007

ANALYTICAL RESULTS

Matrix: XAD Tube
Method: MA-72.ST.02 Polynuclear Aromatic Hydrocarbons (w/v)
Sample units are expressed in mg/m³ Test Started: 4/10/2016

Analyte Name	Sampled Date	PQL	Leeder ID: 2016024452 Client ID: Shoreline AA 5743704403 22/09/2016	Leeder ID: 2016024453 Client ID: Shroeline AA Field Dup 5743704409 22/09/2016
Acenaphthene			<0.003	<0.003
Acenaphthylene			<0.003	<0.003
Anthracene			<0.003	<0.003
Benzo(a)anthracene			<0.003	<0.003
Benzo (a) pyrene			<0.003	<0.003
Benzo (b) fluoranthene			<0.003	<0.003
Benzo (ghi) perylene			<0.003	<0.003
Benzo (k) fluoranthene			<0.003	<0.003
Chrysene			<0.003	<0.003
Dibenz (ah) anthracene			<0.003	<0.003
7,12-Dimethylbenz(a)anthracene			<0.003	<0.003
Fluoranthene			<0.003	<0.003
Fluorene			<0.003	<0.003
Indeno (1,2,3-cd) pyrene			<0.003	<0.003
3-Methylcholanthrene			<0.003	<0.003
Naphthalene			<0.003	<0.003
Phenanthrene			<0.003	<0.003
Pyrene			<0.003	<0.003

ANALYTICAL RESULTS

Matrix: XAD Tube
Method: MA-72.ST.01 Polynuclear Aromatic Hydrocarbons
Sample units are expressed in µg total

Test Started: 4/10/2016

Analyte Name	PQL	Leeder ID: 2016024451 Client ID: Trip Blank 5743704400 Sampled Date: 22/09/2016	2016024454 Method Blank
Acenaphthene	0.1	nd	nd
Acenaphthylene	0.1	nd	nd
Anthracene	0.1	nd	nd
Benzo(a)anthracene	0.1	nd	nd
Benzo (a) pyrene	0.1	nd	nd
Benzo (b) fluoranthene	0.1	nd	nd
Benzo (ghi) perylene	0.1	nd	nd
Benzo (k) fluoranthene	0.1	nd	nd
Chrysene	0.1	nd	nd
Dibenz (ah) anthracene	0.1	nd	nd
7,12-Dimethylbenz(a)anthracene	0.1	nd	nd
Fluoranthene	0.1	nd	nd
Fluorene	0.1	nd	nd
Indeno (1,2,3-cd) pyrene	0.1	nd	nd
3-Methylcholanthrene	0.1	nd	nd
Naphthalene	0.1	nd	nd
Phenanthrene	0.1	nd	nd
Pyrene	0.1	nd	nd

ANALYTICAL RESULTS

Matrix: Radiello Tube
Method: MA-5.RAD.02 Volatile Organics in Air (w/v)
Sample units are expressed in µg/m³

Test Started: 4/10/2016

Analyte Name	Sampled Date	PQL	Leeder ID: 2016024455 Client ID: Shoreline AA 257UC 22/09/2016	Leeder ID: 2016024456 Client ID: Shroeline AA Field Dup 258UC 22/09/2016
Benzene			<3.8	<3.8
Bromochloromethane			<4.4	<4.4
Butanol			<4.2	<4.2
2-butoxyethanol			<5.5	<5.5
Butyl acetate			<5.1	<5.1
Carbon tetrachloride			<4.6	<4.6
Chlorobenzene			<4.5	<4.5
Cyclohexane			<5.7	<5.7
Cyclohexanone			<4.5	<4.5
n-decane			<7.2	<7.2
14-Dichlorobenzene			<6.0	<6.0
12-Dichloroethane			<4.0	<4.0
1,2-Dichloropropane			<4.7	<4.7
Ethyl acetate			<3.9	<3.9
Ethylbenzene			<4.5	<4.5
2-ethylhexanol			<7.2	<7.2
Ethyl-tert-butyl ether			<5.0	<5.0
n-Heptane			<5.3	<5.3
n-Hexane			<4.7	<4.7
Isobutanol			<4.0	<4.0
Isooctane			<5.6	<5.6
Isopropylbenzene			<5.3	<5.3
1-Methoxy-2-propanol			<5.6	<5.6
1-Methoxy-2-propyl acetate			<5.1	<5.1
Methyl methacrylate			<4.5	<4.5
Methylcyclohexane			<4.7	<4.7
Methylcyclopentane			<4.4	<4.4
Methylethylketone			<3.9	<3.9
Methylisobutylketone			<4.6	<4.6
2-Methylpentane			<4.4	<4.4
3-Methylpentane			<4.4	<4.4
Methyl-ter-butyl ether			<4.7	<4.7
Naphthalene			<12	<12
N-Nonane			<6.4	<6.4
N-Octane			<5.8	<5.8
n-Propylbenzene			<5.4	<5.4
Styrene			<5.0	<5.0
Tetrachloroethylene			<5.2	<5.2
Toluene			4.2	4.6
1,1,1-Trichloroethane			<5.0	<5.0

ANALYTICAL RESULTS

Matrix: Radiello Tube
Method: MA-5.RAD.02 Volatile Organics in Air (w/v)
Sample units are expressed in µg/m³

Test Started: 4/10/2016

Analyte Name	Sampled Date / PQL	Leeder ID: 2016024455 Client ID: Shoreline AA 257UC Sampled Date: 22/09/2016	Leeder ID: 2016024456 Client ID: Shroeline AA Field Dup 258UC Sampled Date: 22/09/2016
Trichloroethylene		<4.5	<4.5
Trichloromethane		<4.1	<4.1
124-Trimethylbenzene		<6.2	<6.2
N-Undecane		<13	<13
o-Xylene		<4.7	<4.7
m&p-Xylenes		<4.4	<4.4

ANALYTICAL RESULTS

Matrix: Radiello Tube
Method: MA-5.RAD.03 Volatile Organics in Air (w/tube)
Sample units are expressed in µg/tube

Test Started: 4/10/2016

Analyte Name	PQL	Leeder ID: 2016024457 Client ID: Trip Blank 256UC Sampled Date: 22/09/2016
Benzene	0.1	nd
Bromochloromethane	0.1	nd
Butanol	0.1	nd
2-butoxyethanol	0.1	nd
Butyl acetate	0.1	nd
Carbon tetrachloride	0.1	nd
Chlorobenzene	0.1	nd
Cyclohexane	0.1	nd
Cyclohexanone	0.1	nd
n-decane	0.1	nd
14-Dichlorobenzene	0.1	nd
12-Dichloroethane	0.1	nd
1,2-Dichloropropane	0.1	nd
Ethyl acetate	0.1	nd
Ethylbenzene	0.1	nd
2-ethylhexanol	0.1	nd
Ethyl-tert-butyl ether	0.1	nd
n-Heptane	0.1	nd
n-Hexane	0.1	nd
Isobutanol	0.1	nd
Isooctane	0.1	nd
Isopropylbenzene	0.1	nd
1-Methoxy-2-propanol	0.1	nd
1-Methoxy-2-propyl acetate	0.1	nd
Methyl methacrylate	0.1	nd
Methylcyclohexane	0.1	nd
Methylcyclopentane	0.1	nd
Methylethylketone	0.1	nd
Methylisobutylketone	0.1	nd
2-Methylpentane	0.1	nd
3-Methylpentane	0.1	nd
Methyl-ter-butyl ether	0.1	nd
Naphthalene	0.1	nd
N-Nonane	0.1	nd
N-Octane	0.1	nd
n-Propylbenzene	0.1	nd
Styrene	0.1	nd
Tetrachloroethylene	0.1	nd
Toluene	0.1	nd
1,1,1-Trichloroethane	0.1	nd

ANALYTICAL RESULTS

Matrix: Radiello Tube
Method: MA-5.RAD.03 Volatile Organics in Air (w/tube)
Sample units are expressed in µg/tube

Test Started: 4/10/2016

Analyte Name	PQL	Leeder ID: 2016024457 Client ID: Trip Blank 256UC Sampled Date: 22/09/2016
Trichloroethylene	0.1	nd
Trichloromethane	0.1	nd
124-Trimethylbenzene	0.1	nd
N-Undecane	0.1	nd
o-Xylene	0.1	nd
m&p-Xylenes	0.1	nd

ANALYTICAL RESULTS

Matrix: Radiello Tube
Method: MA-5.RAD.03 Volatile Organics in Air (w/tube)
Sample units are expressed in µg/tube

Test Started: 4/10/2016

Analyte Name	Leeder ID / Client ID / Sampled Date / PQL	2016024458 Method Blank
Benzene	0.1	nd
Bromochloromethane	0.1	nd
Butanol	0.1	nd
2-butoxyethanol	0.1	nd
Butyl acetate	0.1	nd
Carbon tetrachloride	0.1	nd
Chlorobenzene	0.1	nd
Cyclohexane	0.1	nd
Cyclohexanone	0.1	nd
n-decane	0.1	nd
14-Dichlorobenzene	0.1	nd
12-Dichloroethane	0.1	nd
1,2-Dichloropropane	0.1	nd
Ethyl acetate	0.1	nd
Ethylbenzene	0.1	nd
2-ethylhexanol	0.1	nd
Ethyl-tert-butyl ether	0.1	nd
n-Heptane	0.1	nd
n-Hexane	0.1	nd
Isobutanol	0.1	nd
Isooctane	0.1	nd
Isopropylbenzene	0.1	nd
1-Methoxy-2-propanol	0.1	nd
1-Methoxy-2-propyl acetate	0.1	nd
Methyl methacrylate	0.1	nd
Methylcyclohexane	0.1	nd
Methylcyclopentane	0.1	nd
Methylethylketone	0.1	nd
Methylisobutylketone	0.1	nd
2-Methylpentane	0.1	nd
3-Methylpentane	0.1	nd
Methyl-ter-butyl ether	0.1	nd
Naphthalene	0.1	nd
N-Nonane	0.1	nd
N-Octane	0.1	nd
n-Propylbenzene	0.1	nd
Styrene	0.1	nd
Tetrachloroethylene	0.1	nd
Toluene	0.1	nd
1,1,1-Trichloroethane	0.1	nd

ANALYTICAL RESULTS

Matrix: Radiello Tube
Method: MA-5.RAD.03 Volatile Organics in Air (w/tube)
Sample units are expressed in µg/tube — Test Started: 4/10/2016

Analyte Name	Sampled Date / PQL	Leeder ID: 2016024458 Client ID: Method Blank
Trichloroethylene	0.1	nd
Trichloromethane	0.1	nd
124-Trimethylbenzene	0.1	nd
N-Undecane	0.1	nd
o-Xylene	0.1	nd
m&p-Xylenes	0.1	nd

Matrix: XAD Tube
Method: Surrogate Recovery
Sample units are expressed in % — Test Started: 4/10/2016

Analyte Name	Sampled Date / PQL	Leeder ID: 2016024450 Client ID: Downwind 5743704407 22/09/2016
p-Terphenyl-d14		98

Matrix: XAD Tube
Method: Surrogate Recovery
Sample units are expressed in % — Test Started: 4/10/2016

Analyte Name	Sampled Date / PQL	Leeder ID: 2016024451 Client ID: Trip Blank 5743704400 22/09/2016	2016024452 Shoreline AA 5743704403 22/09/2016	2016024453 Shroeline AA Field Dup 5743704409 22/09/2016	2016024454 Method Blank
p-Terphenyl-d14		100	106	96	94

QA/QC RESULTS

Matrix: XAD Tube
Method: MA-72.ST.01 Polynuclear Aromatic Hydrocarbons
Quality Control Results are expressed in Percent Recovery of expected result
Test Started: 4/10/2016

Analyte Name	Sampled Date / PQL	Leeder ID / Client ID	2016024461 Method Spike	2016024462 Method Spike Dup
Acenaphthene			83	89
Pyrene			80	87

Matrix: Radiello Tube
Method: MA-5.RAD.03 Volatile Organics in Air (w/tube)
Quality Control Results are expressed in Percent Recovery of expected result
Test Started: 4/10/2016

Analyte Name	Sampled Date / PQL	Leeder ID / Client ID	2016024463 Method Spike	2016024464 Method Spike Dup
Benzene			91	97
Chlorobenzene			82	87
14-Dichlorobenzene			94	91
Ethylbenzene			109	95
Toluene			92	94

Matrix: Radiello Tube
Method: MA-5.RAD.03 Volatile Organics in Air (w/tube)
Quality Control Results are expressed in Percent Recovery of expected result
Test Started: 4/10/2016

Analyte Name	Sampled Date / PQL	Leeder ID / Client ID	2016024463 Method Spike	2016024464 Method Spike Dup
o-Xylene			94	94
m&p-Xylenes			102	99

Matrix: XAD Tube
Method: Surrogate Recovery
Quality Control Results are expressed in Percent Recovery of expected result
Test Started: 4/10/2016

Analyte Name	Sampled Date / PQL	Leeder ID / Client ID	2016024461 Method Spike	2016024462 Method Spike Dup
p-Terphenyl-d14			97	97

QUALIFIERS / NOTES FOR REPORTED RESULTS

PQL	Practical Quantitation Limit
nd	Not Detected – The analyte was not detected above the reported PQL.
is	Insufficient Sample to perform this analysis.
T	Tentative identification based on computer library search of mass spectra.
NC	Not calculated and/or Results below PQL
NV	No Vacuum, Canister received above standard atmospheric pressure
nr	Not Requested for analysis.
R	Rejected Result – results for this analysis failed QC checks.
SQ	Semi-Quantitative result – quantitation based on a generic response factor for this class of analyte.
IM	Inappropriate method of analysis for this compound
U	Unable to provide Quality Control data – high levels of compounds in sample interfered with analysis of QC results.
UF	Unable to provide Quality Control data- Surrogates failed QC checks due to sample matrix effects
L	Analyte detected at a level above the linear response of calibration curve.
E	Estimated result. NATA accreditation does not cover estimated results.
C1	These compounds co-elute.
--	Parameter Not Determined
CT	Elevated concentration. Results reported from carbon tube analysis
**	Sample shows non-petroleum hydrocarbon profile

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APPENDIX ONE.

CHAIN OF CUSTODY DOCUMENT

SGS

TO-15 Canister Chain of Custody Record

Dispatch samples to: Unit 10/585 Blackburn Road, Notting Hill, Victoria 3168, Australia

Attn: Sample Reception - Contact Ph: +613 9574 3311
Email: au.samplereceipt.mitcham@sgs.com

CLIENT NAME: Synnot & Wilkinson
CLIENT ADDRESS: PO Box 20
STRATHDALE VIC 3666
ABN:
CONTACT: RWH/BJ.
SAMPLED BY: Russell Synnott.
PROJECT REF: Kendall Bay

CONTACT PHONE No: 03 5790 5288.
CONTACT FAX No:
RESULTS REQUIRED BY:
EMAIL ADDRESS: rsynnot@bcarrocks.com.au
LAB QUOTE NUMBER:
PURCHASE ORDER NUMBER:

PAGE 1 OF 1

Client Sample ID (Field Location)	Canister #	Back up Carbon Tube #	Soil Gas Train/ Mass Flow Controller #	Purge Volume	Leak Test Passed	PID	Vacuum	Carbon Tube Sample Volume	Date of Collection	Collection Time		Canister Pressure/Vacuum		Analysis Requested: TO-15	Analysis Requested: TPHC6-C9		
										Time on	Time Off	Inital	Final				
Shoreline	L4294		MFC32	–	✓	–	–	–	22/9/16	9:27am	14:32	-30 "Hg	-13	✓	✓		
Shoreline Dup.	L455D		MFC 2	–	✓	–	–	–	↓	↓	14:32	-30 "Hg	-19	✓	✓		

RELEASED BY: (Name) K Wilkinson (Signature) (Date / Time) 23/9/16 10am

RECEIVED BY: (Name) Benedict Robinson (Signature) (Date / Time) 26/9/16 10:30am

Notes:

SGS

TO-15 Canister Chain of Custody Record

Dispatch samples to: Unit 10/585 Blackburn Road, Notting Hill, Victoria 3168, Australia

Attn: Sample Reception - Contact Ph: +613 9574 3311
Email: au.samplereceipt.mitcham@sgs.com

CLIENT NAME: SYNNOT & WILKINSON
CLIENT ADDRESS: PO Box 20
STRATHBOGIE VIC 3666
ABN:
CONTACT:
SAMPLED BY: FH/BS.
PROJECT REF: KENDALL BAY.

CONTACT PHONE No: 03 5790 5288
CONTACT FAX No:
RESULTS REQUIRED BY:
EMAIL ADDRESS: rsynnot@bamrosken.com.au
LAB QUOTE NUMBER:
PURCHASE ORDER NUMBER:

Client Sample ID (Field Location)	Canister #	Back up Carbon Tube #	Soil Gas Train/ Mass Flow Controller #	Purge Volume	Leak Test Passed	PID	Vacuum	Carbon Tube Sample Volume	Date of Collection	Collection Time		Canister Pressure/Vacuum		Analysis Requested			
										Time on	Time Off	Inital	Final	TPHC6	TP-15	+ acetaldehyd	
Downwind	L4547		MFC 25	–	✓	N/A	–	–	22/9/16	10:30am	2:15pm	-30"Hg	-22"Hg	✓	✓		
Grab Sample	L4606		GRAB	–	–	–	–	–		11:25	———	-30"Hg	0"Hg	✓	✓	✓	

RELEASED BY: (Name) K. WILKINSON (Signature) (Date / Time) 23/9/16 10am

RECEIVED BY: (Name) Benedict Robinson (Signature) (Date / Time) 26/9/16 10:30am

Notes: L4606 - Grab sample from 2nd dredge Location.
E: 325465
N: 6253906

Dredge Spoil from Point 2 had PID of 4.0ppm directly over bucket of sample.

Downwind Sample from 10:20am - 11:55am then 1:20pm - 2:15pm.

WHEN YOU NEED TO BE SURE

SGS

Site Log Sheet and Chain of Custody
Active Air Monitoring

Company: Sinnott & Wilkinson
Client Address: P Box 20 Strathbogie Vic 3666
Client Contact: Russell Sinnott.
Client Email: Sinnott@bigpond.com.au

Project /Site: Kendall Bay.
Purchase Order Number:
ABN:

Weather:

Sheet 3 / 5

Date	Location ID	Tube ID Number	Time	Flow (L/min)	Volume (L)	Analysis Required	Comments
22/9/16	Downwind	5743704407	140 m/h.	1997ml / 486ml		PAHs	
	TRIP BLANK	5743704400				PAHs	
	TIME ON: 10:30am	& then VC started @		Time on:	1.20pm		
	TIME OFF: 11:55am			Time off:	2.15pm		

Sampled by: KH / BS

Relinquished by: K. Hansen	Received by: Benedict Robinson		In esky? Yes/No
Signature:	Signature:		With ice brick? Yes/No
Date: 23/9/16 Time: 10am	Date: 26/9/16	Time: 10:30am	

WHEN YOU NEED TO BE SURE

SGS

Site Log Sheet and Chain of Custody
Active Air Monitoring

Company: Symonot & Williamson.
Client Address: PO Box 20 Strathdale Vic 3666
Client Contact: Russell Symonot.
Client Email: rsymonot@bigpond.com.au

Project /Site: Kendall Bay.
Purchase Order Number:
ABN:

Weather:

Sheet 4 of 5

Date	Location ID	Tube ID Number	Time	Flow (L/min)	Volume (L)	Analysis Required	Comments
22/9/16	Shoreline AA	5743204403	303 min	1.043/1.096		PAH	
↓	Shoreline AA Dup	5743204409	303 min	1.150/1.144		PAH	
	START TIME: 9:35am						
	STOP TIME: 14.42pm						

Sampled by: KH/BJ

Relinquished by: K. Vance
Signature:
Date: 22/9/16 Time: 10am

Received by: Benedict Robinson
Signature:
Date: 26/9/16 Time: 10:30am

In esky? Yes/No
With ice brick? Yes/No

WHEN YOU NEED TO BE SURE

SGS

Site Log Sheet and Chain of Custody
Passive Air Monitoring

Company: Symonst & Wilkinson
Client Address: Po Box 20 Strathbogie VIC 3666.
Client Contact: Russell Symonst
Client Email: rsymonst@bigpond.com.au

Project /Site: Kendall Bay
Purchase Order Number:
ABN:

Weather:

Sheet 5/5

Location ID	ID Number	Date On	Time On	Date Off	Time Off	Minutes	Average Temperature	Analysis Require
Shoreline AA	257 VC	22/9/16	9:15am	22/9/16	14:40			VOC
Shoreline AA Dup.	258 VC	↓	↓	↓	↓			↓
TRIP BLANK	256 VC	↓	—	↓	—			↓

Sampled by: KH/BJ

Relinquished by: K. Hanson
Signature:
Date: 23/9/16 Time: 10am

Received by: Benedict Robinson
Signature:
Date: 26/9/16 Time: 10:30am

Ektimo

Address (Head Office)
427 Canterbury Road
SURREY HILLS VIC 3127

Postal Address
Unit 13, 9 Ambitious Link
BIBRA LAKE WA 6163

Office Locations
VIC NSW WA QLD

Freecall: 1300 364 005
www.ektimo.com.au
ABN: 86 600 381 413

Report Number R003361a

Emission Testing Report
SGS Australia Pty Ltd, Mortlake

This document is confidential and is prepared for the exclusive use of SGS Australia Pty Ltd
and those granted permission by SGS Australia Pty Ltd.

Document Information

Client Name:	SGS Australia Pty Ltd
Report Number:	R003361a
Date of Issue:	5 December 2016
Attention:	Dane Egelton
Address:	Unit 16, 33 Maddox St Alexandria NSW 2015
Testing Laboratory:	Ektimo (EML) ABN 98 006 878 342

Report Status

Format	Document Number	Report Date	Prepared By	Reviewed By (1)	Reviewed By (2)
Preliminary Report	-	-	-	-	-
Draft Report	-	-	-	-	-
Final Report	R003361	29/9/2016	DBu	SCo	DHi
Amend Report	R003361a	5/12/2016	SCo	RCo	-

Template Version: 160909

Amendment Record

Document Number	Initiator	Report Date	Section	Reason
R003361a	SGS	5/12/2016	All	Report to contain Odour Characterisation only

Report Authorisation



Steven Cooper
Ektimo signatory

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1 EXECUTIVE SUMMARY

Ektimo was engaged by SGS Australia Pty Ltd to perform duplicate odour character sampling and subsequent analysis from a location downwind of Jemena operations at their Mortlake site.

Monitoring was performed as follows:

Location	Test Date	Test Parameters
Northern A2	22 September 2016	Odour character x 2

The sampling methodologies chosen by Ektimo are those recommended by the NSW Office of Environment and Heritage (as specified in the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales, January 2007*).

Plant operating conditions have been noted in the report.

2 RESULTS

2.1 Northern A2

Date	22/09/2016	**Client**	SGS Australia Pty Ltd		
Report	R003361	**Stack ID**	Northern A2		
Licence No.	NA	**Location**	Mortlake	**State**	NSW
Ektimo Staff	Ryan Collins				
Process Conditions	Please refer to client records.				

Odour	Test 1		Test 2	
	Concentration		Concentration	
	ou		ou	
Results				
Hedonic tone	Neutral		Neutral	
Odour character	Salty		Salty	
Sampling date & Time	22/09/16	1036 - 1051	22/09/16	1036 - 1051
Analysis date & Time	22/09/16	1405	22/09/16	1425
Holding time	4 hours		4 hours	
Dilution factor	1		1	

3 PLANT OPERATING CONDITIONS

Unless otherwise stated, the plant operating conditions were normal at the time of testing.

4 TEST METHODS

Parameter	Sampling Method	Analysis Method	Method Detection Limit	Uncertainty	NATA Accredited	
					Sampling	Analysis
Odour Characterisation	NSW OM-7	NSW OM-7	NA	NA	×	×

5 QUALITY ASSURANCE/ QUALITY CONTROL INFORMATION

Ektimo (EML) and Ektimo (ETC) are accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo (EML) and Ektimo (ETC) are accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025. – General Requirements for the Competence of Testing and Calibration Laboratories. ISO/IEC 17025 requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Compliance Manager.

NATA is a member of APLAC (Asia Pacific Laboratory Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through the mutual recognition arrangements with both of these organisations, NATA accreditation is recognised world –wide.

A formal Quality Control program is in place at Ektimo to monitor analyses performed in the laboratory and sampling conducted in the field. The program is designed to check where appropriate; the sampling reproducibility, analytical method, accuracy, precision and the performance of the analyst. The Laboratory Manager is responsible for the administration and maintenance of this program.

6 DEFINITIONS

The following symbols and abbreviations may be used in this test report:

STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
VOC	Any chemical compound based on carbon with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the particular conditions of use. These compounds may contain oxygen, nitrogen and other elements, but specifically excluded are carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
TOC	The sum of all compounds of carbon which contain at least one carbon to carbon bond, plus methane and its derivatives.
OU	The number of odour units per unit of volume. The numerical value of the odour concentration is equal to the number of dilutions to arrive at the odour threshold (50% panel response).
$PM_{2.5}$	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PM_{10}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
BSP	British standard pipe
NT	Not tested or results not required
NA	Not applicable
D_{50}	'Cut size' of a cyclone defined as the particle diameter at which the cyclone achieves a 50% collection efficiency ie. half of the particles are retained by the cyclone and half are not and pass through it to the next stage. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
D	Duct diameter or equivalent duct diameter for rectangular ducts
<	Less than
>	Greater than
≥	Greater than or equal to
~	Approximately
CEM	Continuous Emission Monitoring
CEMS	Continuous Emission Monitoring System
DER	WA Department of Environment & Regulation
DECC	Department of Environment & Climate Change (NSW)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra Red
NATA	National Association of Testing Authorities
RATA	Relative Accuracy Test Audit
AS	Australian Standard
USEPA	United States Environmental Protection Agency
Vic EPA	Victorian Environment Protection Authority
ISC	Intersociety committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
APHA	American public health association, Standard Methods for the Examination of Water and Waste Water
CARB	Californian Air Resources Board
TM	Test Method
OM	Other approved method
CTM	Conditional test method
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
NIOSH	National Institute of Occupational Safety and Health
XRD	X-ray Diffractometry