Onslow Marine Support Base

Stage 2 Capital Dredging

Sediment Quality Assessment

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Executive Summary

Onslow Marine Support Base Pty Ltd (OMSB) is planning to modify and extend the harbour approach channel, turning circle and berth pockets as part of Stage 2 of the Onslow Marine Support Base Project (herein the OMSB Project). Capital dredging proposed includes a berth pocket to -8.0 m CD, and turning basin and channel to -6.0 m CD. The total volume of dredging is anticipated to be 930,000 m^3 and dredging will be undertaken using a medium-sized cutter suction dredge. Dredge material will be disposed of onshore between the area adjacent to Beadon Creek Rd and the airport for future development of the Light Industrial Area in Onslow.

The preliminary site investigation reviewed historical sediment investigations and sources of contaminants and identified that, with the exception of tributyltin (TBT), there are no known contaminants of potential concern within the capital dredge areas. Therefore, all areas were classified as being as *"probably clean"*. An area adjacent to the proposed community boating precinct and the southern boundary of the OMSB wharf was identified with elevated TBT during sampling undertaken in 2012 for Stage 1 capital dredging. The surface 1.5 m to 3.5 m depth of contaminated sediment material from the berth pocket has been removed during Stage 1 capital dredging and sampling previously identified the underlying natural geological materials are relatively clean. Historical sampling has also identified potential acid sulphide soils within creek sediments during investigations in 2009 and 2012. However, all testing predicted that the natural alkalinity of the sediments would neutralise the acidity generated from oxidising the material during onshore disposal.

A detailed site investigation was carried out between 15-18 March 2017. A total of 49 surface and subsurface samples were collected from 26 sediment sampling locations during the field survey. Sediment samples were collected through using a combination of vibracoring, sediment grab and a test pit was dug for sediments at one (1) intertidal site during low tide. Observations and a screening test for PASS was undertaken prior to sediments being homogenised and packed into laboratory containers. Collected sediment samples were sent to a NATA-accredited laboratory for testing of:

- Physical Sediment Characteristics: Particle size analysis (PSA), total organic carbon (TOC), moisture content;
- Inorganic Compounds: Metals and Metalloids (Al, Ag, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Sb, V and Zn);
- Organic Compounds: Total Petroleum Hydrocarbons (TPH), Benzene, Tolulene, Ethyl benzene and Xylene (BTEX), Poly Aromatic Hydrocarbons (PAH) and Tributyltin (TBT);
- Nutrients (TN, TKN, NH_4, NO_2+NO_3, TP, FRP); and
- Acid sulfate soils (SCr).

Sediments within the upper layers of the capital dredge areas are typically comprised of sandy/ shelly material which is low in moisture and TOC. These properties are typically considered beneficial for engineering grade fill and/or reclamation projects, indicating the bulk of the material is expected to be suitable for proposed future reuse plans to expand and develop the Light Industrial Area in Onslow for the Shire of Ashburton. However, the full volume of the dredge material has not been sampled and further sampling of the final material would be required to prior to reuse. Geochemical laboratory testing for total metals (Al, Ag, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Sb, V & Zn), organic compounds (TPH, BTEX, PAHs & TBT) and nutrients (TN, TKN, NH4, NO2+NO3, TP, FRP), and subsequent comparison against relevant screening levels for both onshore and ocean disposal, indicate dredging, loading (pumping) and onshore disposal of the sediments to be dredged is unlikely to result in adverse effects to marine living resources, terrestrial living resources and human health. Potential acid sulfate soils (PASS) were detected within the dredge footprint and DER (2015) recommend an acid sulfate soil management plan should be prepared. However, results show that the natural acid neutralising capacity of the sediments provide sufficient buffering for acid-generating processes, indicating the risk of acid sulfate soils is low and the material is not likely to require treatment strategies (i.e. lime dosing neutralisation of ASS) for disposal of the material to land.

1. Introduction

1.1. Project Description

Onslow Marine Support Base Pty Ltd (OMSB) is planning to modify and extend the harbour approach channel, turning circle and berth pocket as part of Stage 2 of the Onslow Marine Support Base Project (herein the OMSB Project). The proposed capital dredging will enable offshore supply vessels to access the newly-constructed OMSB land-backed wharf infrastructure within the Beadon Creek Maritime Facility.

Capital dredging proposed includes a turning basin and harbour approach channel to a declared depth of - 6.0 m CD and a berth pocket to -8.0mCD (**Figure 1**). The total volume of dredging is anticipated to be 930,000 cubic metres and it is expected that dredging will be undertaken using a medium-sized cutter suction dredge over a period of approximately eight (8) months. Current schedule has operations planned to commence in November 2017, subject to planning and approvals.

Dredge material is proposed to be disposed of onshore within surplus land owned freehold by the Shire of Ashburton (SoA) adjacent to the Onslow Airport (**Figure 1**). During dredging, the dredge spoil area will be dewatered to the intertidal flats between the disposal site and the western tributary of Beadon Creek. In accordance with the strategic objectives of the SoA to meet the region's demand for affordable serviced industrial land, the material is proposed for potential future reuse to develop and extend the Light Industrial Area in Onslow.

1.2. Objectives

A sediment quality assessment has been undertaken by O2 Marine and included:

- A preliminary site investigation to provide an initial indication of the contamination status of the material to be dredged and the nature and location of likely sources;
- Determination of an appropriate sampling design and methods for a detailed site investigation;
- completion of a detailed site investigation and analytical program of sediment characterisation in accordance with relevant guidelines applicable to the management and assessment of dredged sediments; and
- Assessment of the suitability of the dredged sediments for disposal at the proposed onshore locations.

1.3. Document Purpose

This document has been prepared by O2 Marine on behalf of OMSB Pty Ltd to demonstrate that the impacts of dredged material loading and disposal have been adequately assessed to support referral of Stage 2 of the OMSB Project to the Environmental Protection Authority under section 38 (Part IV) of the Environmental Protection Act (1986). This document has been prepared with consideration of relevant guidelines for this project which apply to the management and assessment of dredging programs in Western Australia, including but not limited to:

- The Department of Transport (DoT): Maintenance Dredging Environmental Management Framework (EMF) (BMT Oceanica 2016);
- The Department of Environment Regulation (DER): Assessment and Management of Contaminated Sites, Contaminated Sites Guidelines December 2014 (DER 2014);
- National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPM) 2011, Volume 2, Schedule B1, Guideline on Investigation Levels for Soil and Groundwater (NEPM 2011);
- National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPM) 2013, Volume 3, Schedule B2, Guideline on Site Characterisation (NEPM 2013);

- National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPM) 2013, Volume 8, Schedule B5c, Guideline on Ecological Investigation Levels for Arsenic, Chromium (III), Copper, DDT, Lead, Naphthalene, Nickel and Zinc (NEPM 2013a);
- The Department of Environment Regulation (DER): Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes, June 2015 (DER 2015);
- The National Assessment Guidelines for Dredging (NAGD), 2009 (NAGD 2009); and
- CSIRO Land and Water Science (CSIRO), Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines, 2013 (Simpson et al. 2013).

Figure 1 OMSB Stage 2 project area, including proposed capital dredging area and spoil disposal location

2. Preliminary Site Investigation

2.1. Site Identification, History and Use

Beadon Creek is located approximately 2 km East of the town of Onslow in the Pilbara, within the Shire of Ashburton. Onslow is located 1386 km north of Perth and 360 km south of Karratha. It is ideally located to service offshore locations including the Mackerel Islands, Barrow Island (Gorgon LNG Plant), Exmouth Gulf, and the Carnarvon Basin (oil and gas reserves), as well as inland mines including Rio Tinto's Mesa A site and Pannawonica (OCCI 2016).

The Beadon Creek Maritime Facility was developed in 1964 and is managed by the Department of Transport (DoT). The facility is located approximately 550 m South of the entrance to Beadon Creek and is used as a harbour for both recreational and commercial activities, although has recently transformed from a small facility supporting local and charter fishing activities to a larger facility supporting the myriad of industrial and commercial activities associated with the growing offshore oil and gas industry in the region. The Beadon Creek Maritime Facility covers an area of 15.29 ha and includes ~260 m of wharf face, mooring berths, cyclone moorings, public service wharf, dual public boat ramp, diesel fuelling facilities, public car park and fish cleaning facilities.

In 2014, the DoT developed a land use framework to upgrade the facilities in Beadon Creek to support the growing demand for industrial, commercial and recreational facilities (GHD 2014). The DoT gained relevant environmental approvals to undertake capital dredging of approximately 55,000 m^3 to form a new berth pocket and turning basin immediately West of the existing channel, with the material to be used to create an additional land-backed wharf area and preliminary development for a community boating precinct immediately north of the existing lots (BMT Oceanica 2014). The OMSB (Pty Ltd) leased Lot 13 from the DoT and commenced capital dredging and construction of the land-backed wharf in 2016 on behalf of the DoT as part of Stage 1 of the OMSB Project, with the intention of creating a maritime support base to service increasing onshore and offshore demands.

The broader Project area is largely undeveloped with the exception of a solar salt field with offshore loadout facilities to the West of Onslow, the Roller oilfield in shallow coastal waters to the West of Onslow and the Liquified Natural Gas (LNG) plants, Wheatstone and Macedon, with offshore jetty and materials offloading facility (MOF), at Ashburton North Strategic Industrial Area (ANSIA) approximately 12 km southwest of Onslow.

2.2. Environmental Setting

Dredging is proposed within Beadon Creek and in shallow (<6 m) nearshore areas for approximately 2 km to seaward of the mouth of Beadon Creek. The seafloor in this area is generally comprised of unconsolidated silt, sand and gravel. Previous benthic habitat surveys have determined there are no benthic communities comprised of macroalgae, seagrass, sponges, ascidians and hard and soft corals within Beadon Creek, although patches of these community types may be found on the substrate in adjacent nearshore coastal waters (Chevron 2010).

2.2.1. Geology, Geomorphology and Sediment Characteristics

The regional geology consists of Quaternary sedimentary, alluvial, shoreline and aeolian deposits. The hinterland of the Onslow Sector, referred to as the Onslow Plain, is low lying with vast areas of high tidal mud flats and supratidal salt flats. There is a series of rivers and tidal creeks along the coast which are subject to flash flooding and episodically discharge large volumes of freshwater and terrestrial sediments into the coastal zone. The river and creek systems support fringing mangrove habitats (Semeniuk 1993, Chevron 2010a).

The shore is predominantly beach/dune although limestone headlands and barrier islands also occur (e.g. Beadon Point). The coastline is highly dynamic and is characterised by an exposed sandy coast with ongoing constructional and erosional processes. The coastal intertidal habitats comprise sandy beaches and clayey estuarine sediments. Field investigations of these habitats indicate a low diversity of infauna species and an absence of rare or protected species. Sandy beaches with low diversity and productivity levels are representative of the Pilbara coastline (Chevron 2010a).

The coastal geology is described as Precambian and Phanerozoic rocks generally overlain with a veneer of predominantly limestone sediments (Chevron 2010b). Geomorphic elements include:

- The creek and bay lined mangroves backed by extensive tidal salt flats or by beaches and dunes that form a thick cover over limestone. The latter is often exposed to form limestone pavement or reefs in the intertidal or subtidal zones; and
- The gentle slope of the inner shelf to 20 m depth approximately 20 km offshore. The shelf is underlain by limestone that outcrops as local limestone reefs and platforms, islands and shoals, interspersed with a veneer of coarse and medium sands, gravels and shell/coral grit.

The area from Tubridgi Point, at the mouth of Exmouth Gulf, to Coolgra Point, North-East of Onslow, is identified as a single sediment cell extending over 70 km. The features of the sediment cell are the active delta of the Ashburton River, long sandy beaches and dunes and the island chains running parallel to the shore (Chevron 2010b). The net sediment movement within the cell is Easterly, although reversible from time to time due to onshore winds. As a result, sediment in the Eastern sector near Beadon Creek is of fluvial origin and is reworked in the littoral zone as chenier spits migrating Eastwards (Chevron 2010b).

Major sources of sediment in the Onslow catchment include:

- Erosion of saltflats and mudflats by fluvial runoff and tidal creeks after flooding and tidal inundation;
- Erosion of dunes and rocky shores by nearshore processes; and
- Production and reworking of material from the inner continental shelf.

Much of the nearshore region is covered by silt and sand sheets of varying thickness with high silica content overlying Pleistocene limestone. Sediments become increasingly coarse and increase in calcium carbonate content with distance offshore. Sediment resuspension is frequent immediately seaward of the intertidal zone due to wind-driven waves, and leads to considerable turbidity (Forde 1985).

2.3. Previous Dredging Programs in Beadon Creek

A summary of the previous dredging programs undertaken in Beadon Creek is provided in **Table 1**. The Beadon Creek Marine Facility was constructed in 1964 and included capital dredging at the entrance to the creek. Further dredging was carried out in 1968 in conjunction with the construction of a rock training wall on the western side of the creek. During this campaign, the creek was dredged to approximately -0.7 m chart datum (CD) (HGM 1998).

In 1999, the DoT carried out further capital and maintenance dredging works in Beadon Creek with the primary objective of improving safe passage and mooring of vessels during cyclone events (HGM 1999). This included dredging of the sand bar at the mouth of Beadon Creek, the entrance channel (to a minimum depth of -1.6 m CD) and the mooring basin (to a minimum depth of -2.6 m CD). A total of 40,900 m^3 of dredged material was removed during these works and deposited on the beach to the west of the rock training wall, and in the old quarry, south of Beadon Creek Road. Other works carried out at the same time included installation of new cyclone moorings and an upgrade of the existing timber wharf.

Maintenance dredging in Beadon Creek was carried out in November 2003, where the bell mouth and the mid-entrance channel were dredged to a minimum depth of -1.6 m CD (JFA 2004) and approximately 9,820 m^3 of material was dredged and disposed to the beach immediately west of the rock wall. Maintenance

dredging in Beadon Creek was also undertaken in 2012 and 2013, to maintain a navigable channel for access to the Maritime Facility. During these maintenance dredging campaigns, ~40,000 m^3 of material was dredged from the bell mouth, entrance channel and berth pockets during May to September 2012 and ~13,000 m^3 of material was dredged from the entrance channel and cyclone moorings during March to May 2013. The dredged material was disposed to the dune swales to the west of the channel entrance.

Stage 1 capital dredging of a berth pocket and turning basin on the less developed northern end of the Beadon Creek Maritime Facility was undertaken by OMSB Pty Ltd in 2016-2017 and completed immediately prior to undertaking the sediment survey, which is the subject of this report. The requirement for capital dredging was identified by the DoT as part of a planned framework to upgrade and improve the Beadon Creek Maritime Facilities to support the business and recreational needs of the community, particularly in relation to the significant increase in industrial and commercial activities occurring in Onslow since the development of Chevron Australia's Wheatstone LNG/domestic gas Project. OMSB Pty Ltd offered to undertake the planned and approved dredging works for the DoT. The design depth of the berth pocket is -2.6 m lowest astronomical tide (LAT) and the design depth of the turning basin is -1.6 m LAT. A total volume of ~55,000 m^3 was dredged and the material was used to create a land-backed wharf in the previously undeveloped northern end of the Maritime Facility.

Table 1 History of dredging at Beadon Creek

Date	Volume (m3)	Depth (m CD)	Disposal Site	Reference	Comments
1964-1968	Unknown	-0.7 m	Unknown	HGM (1998)	Capital dredging
1999	40,900	Bell mouth: -1.6 m Basin: -2.6 m	Dune swale to the west of the rock wall and quarry	HGM (1999)	Capital & Maintenance dredging
2003	9,820	Bell mouth: -1.6 m Channel: -1.6 m	Dune swale to the west of the rock wall	JFA (2004)	Maintenance dredging
2011	Unknown	Berth pocket adjacent to Channel	Onshore adjacent to berth pocket	Oceanica (2012c)	Unknown
2012	~40,000	Bell mouth: -1.6 m Channel: -1.5 m to -2.6 m	Dune swale to the west of the rock wall	BMT JFA (2013)	Maintenance dredging
2013	~13,000	Channel: -1.5 m to -2.6 m Cyclone moorings: -1.5 m	Dune swale to the west of the rock wall		Maintenance dredging
2013	~5,000	Berth pocket adjacent to channel: -1.6 m to -2.65 m	Dune swale to the west of the rock wall		Maintenance dredging
2016-2017	~55,000	Northern end Berth pocket: -2.5 m Turning basin: -1.6 m	Northern bank land-backed wharf	BMT Oceanica (2014)	Capital dredging

2.4. Previous Sediment Investigations

2.4.1. Beadon Creek Marine Sediments

Four (4) sediment contamination investigations have recently (2009 and 2016) been undertaken within Beadon Creek. A summary of previous contaminant sediment sampling programs is provided in **Table 2**. The 2009 sampling was undertaken in support of the 2012 and 2013 maintenance dredging (Oceanica JFA 2010). In 2011, samples were tested for acid sulfate soil (ASS) characteristics on material that had been excavated to create a small berth pocket adjacent to the maintenance dredge channel within the creek (Oceanica 2012). Sampling was undertaken at 15 randomly distributed sites from within the proposed berth pocket and turning circle capital dredging area and adjacent to the proposed community boating precinct immediately North of the existing lots and West of the existing channel within the Beadon Creek Maritime Facility in 2012 (BMT Oceanica 2014). A further 13 sediment samples were collected adjacent to the proposed community boating precinct and the Southern end of the berth pocket in 2016, prior to commencement of capital dredging activities (BMT Oceanica 2016a).

Previous sediment surveys in Beadon Creek have investigated the following:

- Particle size distribution (PSD) and settling velocity;
- Total organic carbon (TOC)/total carbonate;
- Nutrients (TKN, TP, NH_4, NO_2, NO_3, FRP);
- Metals (Al, Ag, As, Cd, Cr, Cu, Fe, Hg, Ni, Se and Zn);
- Potential acid sulfate soils (PASS)/Actual acid sulfate soils (AASS);
- Tributyltin (TBT);
- Total petroleum hydrocarbons (TPH);
- Polycyclic aromatic hydrocarbons (PAH); and
- Benzene, toluene, ethylbenzene and xylene (BTEX).

Sediment contaminant concentrations from Beadon Creek capital dredge area were compared to the NAGD (2009) Interim Sediment Quality Guidelines (ISQG) and Ecological Investigation Levels and Health Investigation Levels (EILs and HILs) from NEPM (2013). Contaminant concentrations for nutrients, metals, TPH, PAH and BTEX concentrations from these investigations were below the relevant guidelines (BMT Oceanica 2014).

PASS has been detected within creek sediments during investigations in 2009 and 2012, although all testing predicted that any potential acidity would be effectively neutralised by the natural alkalinity of the sediments (Oceanica JFA 2010, BMT Oceanica 2014). Further testing of disposed material in 2011 validated the conclusion that dredged creek bed material presented a low likelihood of developing acidity following onshore disposal (Oceanica 2012).

Sediment sampling in 2012 found elevated TBT concentrations exceeding NAGD (2009) ISQG-Low values at three (3) sites adjacent to the proposed community boating precinct at the Southern end of the berth pocket, in the surface 0.5 m of sediments at two (2) of the sites, and in the surface 1 m of sediment at the other site (BMT Oceanica 2014). Analysis of deeper core sediments (between 1 m and 2 m) indicated TBT concentrations were below the limit of reporting (LoR). Subsequent elutriate testing of sediments from these sites determined that concentrations from two (2) sites exceeded the ANZECC/ARMCANZ (2000) 90% species protection trigger value in surface sediments and in one sample at 1.5 m depth, that did not originally exceed the ISQG-Low.

Further intensive sampling of the area identified with the risk of high TBT concentrations in 2012, was undertaken in 2016 and involved collection of sediment samples from 11 additional sites and re-sampling of the two (2) elevated sites from the previous sampling event (BMT Oceanica 2016a). Four (4) of the additional sites within the identified area of risk exceeded the ISQG-Low values, with one (1) site showing exceedances

in both 0.5m and 1 m depth ranges. The samples taken in this 2016 survey of sites where previous (2012 survey) sampling had shown exceedances of the ISQG-Low all recorded levels below ISQG-Low values. The five (5) samples which showed elevated TBT levels were subjected to elutriate testing and two (2) samples exceeded the ANZECC/ARMCANZ (2000) 90% species protection level. The results of both 2012 and 2016 surveys showed no apparent spatial trend or pattern within the body of sediment where some elevated TBT levels were detected.

Between 1.5 m and 3.5 m depth of surface sediment material was removed from this area during the recent dredging program and buried within the wharf land-fill reclamation area to mitigate the potential impacts of TBT. There were no exceedances of relevant guidelines for TBT in water and biota during the Stage 1 capital dredging campaign (Pers comms Louise Synnot, 2017).

Sediment investigations of the dredged sediment material from previous maintenance dredging programs determined it was suitable for disposal to land.

Table 2 Summary of previous contaminant sediment sampling investigations

Year	Study	Monitoring Site	Comments
2009	Full Suite	Bell mouth, Basin	There were no exceedances of the relevant guidelines for nutrients, metals, or tributyltin (TBT). PASS detected, although neutralised by natural alkalinity of sediment
2011	Disposed material 2011	Berth Pocket	PASS testing indicated no low likelihood of acidity
2012	Full Suite, 15 sites Capital Dredging	Berth Pocket, Turning circle, Community boating precinct	There were no exceedances of the relevant guidelines for nutrients, metals, TPH, PAH and BTEX. Three sites exceeded ISQG-Low for TBT in the surface samples, one site also exceeded 0.5-1m sample. Elevated elutriate TBT concentrations exceed the Screening Levels in the surface 0.5 m at two sites and to 1.5 m at one site.
2016	13 TBT Samples, Capital dredging	Community boating precinct	Four sites exceeded ISQG-Low for TBT in the surface samples, one site also exceeded 0.5 -1m. Subsequent, elutriate TBT concentrations exceeded at two locations in surface 0.5 m and 1.0 m.

Geotechnical sediment investigations of Beadon Creek were carried out in 1968, 1975, 1986, 1999 and 2014. With the exception of 2014, the probes undertaken did not extend below -4 m CD and were reported to have encountered sand and shells at the surface of the creek bed, which were underlain by a hard sand/soft rock

or rock at a relatively shallow depth (CH2MHILL 2014). Eight (8) geotechnical boreholes to -13 m CD depth were collected along the line of the proposed wharf, three (3) boreholes were positioned within the proposed berth pocket to a depth of -4 m CD and one (1) borehole to -7.7 m CD collected on the Western edge of the creek adjacent to the small car park at the northern end of the gravel access road to investigate a proposed fishing platform site (CH2MHILL 2014). The engineering model identified the following engineering geological units:

- Marine/Estuarine Deposits: Typically, loose dark grey or yellow brown silty sand/ gravelly silty sand/ sandy gravel or soft to firm low plasticity silty clay. The depth of these materials varied significantly ranging from -2.9 m to -6.9 m CD and typically between 2 m and 6.5 m thick.
- Tantabiddi Member: A layer of cap rock comprised of yellow/brown low to high strength calcarenite/limestone found along the southern end of the wharf line from a depth ranging from -1 m to -1.6 m CD up to 2.4 m thick.
- Upper Onslow Red Beds: Described as medium dense to dense, orange brown silt sand/ sandy silt with gravel of authigenic nodules of siltstone/ sandstone (cemented silt/ sand) or very stiff orange brown high plasticity silty clay with authigenic nodules of siltstone/ sandstone. The top of the horizon varies between a depth of -1 m to -4 m CD and is typically between 3 m to 6 m thick.
- Lower Onslow Red Beds: Low to medium strength claystone, siltstone of sandstone with minor limestone interpreted as weak rock with low to medium strength. The top of the horizon varies between a depth of -6.2 m to -10 m CD and thickness extends below -13 m CD.

The results of the laboratory test data for each geological unit is presented in **Table 3**.

Table 3 Geotechnical test results for engineering geological units (CH2MHILL 2014)

Tests		Marine/Estuarine Deposits	Tantabiddi Member	Upper Onslow Red Beds	Lower Onslow Red Beds
Top of horizon		+1-0 m CD	-1-1.6 m CD	-1-4 m CD	-6.2-10 m CD
Thickness		2-6.5 m	0-2.4 m	3-6 m	Extends below 13 m CD
Moisture (%)		16.1-40.8%	N/A	14.5-24%	
TOC (%)		<5%	N/A		
PSD	Gravel	0-27%	N/A	0-39%	0-5%
	Sand	41-95%	N/A	9-74%	28-55%
	Fines	3-45%	N/A	14-71%	42-68%

2.4.2. Nearshore

Sediment quality has been assessed in the vicinity of the dredged area in three (3) previous investigations.

Background Quality of Pilbara Coast Sediments (DEC 2006)

In June 2005, marine sediments were assessed by the Department of Environment and Conservation (DEC) at four locations offshore from Beadon Creek to estimate the background concentrations for selected contaminants (DEC 2006). A primary assumption for this study was that no anthropogenic contamination had occurred in this area, with sediments analysed for TBT, PAHs, TPH, BTEX, organochlorine pesticides and polychlorinated biphenyls (PCBs), and total metals and metalloids (Al, As, Cd, Cr, Co, Cu, Fe, Pb, Hg, Ni, Se, Ag, V and Zn) (DEC 2006). The results of this study confirmed that there was no discernible anthropogenic enrichment of contaminants in sediments offshore of Beadon Creek. All concentrations of TBT, PAHs, TPH,

BTEX, OC pesticides and PCBs were reported as below the laboratory limit of reporting (LoR). The DEC (2006) also estimated natural background concentrations of trace metals in marine sediments, noting that natural background concentrations of arsenic were above the ANZECC/ARMCANZ (2000) Screening Level. All other mean trace metal concentrations in sediments offshore of Beadon Creek were below their relevant ANZECC/ARMCANZ (2000) Screening Levels (DEC 2006).

Wheatstone Pilot Investigation

In February 2009, URS collected surface sediment samples as a pilot investigation for the Wheatstone Project at 17 nearshore sites spanning from Ashburton North to Coolgra Point, to provide a broad understanding of sediment characteristics within and surrounding the Project area (Chevron 2010c). Sediments were analysed for a suite of total trace metals (Al, As, Ba, Be, Cd, Cr, Cu, Fe, Mn, Hg, Ni, Pb, Se, V, Zn), TPH, BTEX and TBT. The results of this study generally agreed with those of DEC (2006), with concentrations of TPH, BTEX, TBT and trace metals[1] being below the laboratory LoR or below the relevant NAGD (2009) ISQG-Low. The only exception was Arsenic, which was found to occur in naturally elevated background concentrations during the DEC (2006) survey, but not the URS (Chevron 2010c) survey. Samples from nine nearshore sampling locations from Ashburton North to Coolgra Point were predominantly comprised of sand fractions, ranging from 63% to 94% (mean 78%) (Chevron 2010c).

The URS pilot investigation established strong correlation trace element ratios exist between Aluminium, which is commonly used as a proxy element to represent variations in fine fractions of sediment, and trace metals in sampled whole sediments (Loring and Rantula 1992). Grain size was therefore determined to be the principle factor which controls the metal concentrations in tested sediments, with the exception of Arsenic which did not correlate with Aluminium (Chevron 2010c).

Wheatstone Dredging Program Sediment Quality Assessment

A total of 72 short core, 15 deep core and 64 grab sampling locations were identified for collection of sediments from the Wheatstone Project site, approximately 14 km West of Beadon Creek, and at proposed offshore disposal sites and surrounding areas (Chevron 2010c). Short cores were sampled using a manually driven piston coring device within the dredge footprint, although refusal was encountered at every sample location at a depth of less than 0.4 m, resulting in only one sample per short core location. A van veen grab sampler was used at 11 of the 72 short core sampling locations where a core sample was not obtained due to lack of penetration of the piston corer at these sampling locations (armoured shelly surface and loss of core). Deep cores were sampled to the full depth of dredging (13.5 m CD). Sediments 1 m below the seafloor were sampled for all Contaminants of Potential Concern (COPCs) except TBT and radionuclides (Chevron 2010c). Sediments deeper than 1 m were sampled as part of the geotechnical investigations. Grab samples were collected from the five (5) proposed offshore disposal sites, three (44 sampling locations) of which are located nearshore (Disposal Sites A, B, & C) (Chevron 2010c).

The samples were analysed for:

- Metals:
  - Short Cores: Al, Sb, As, Ba, Cd, Cr, Cu, Pb, Hg, Ni, Zn;
  - Deep Cores: Al, Sb, As, Ba, Cd, Cr, Cu, Pb, Hg, Ni, Zn, Be, Co, Fe, Mn, Mo, Se, Ag, Sn, V;
- TBT (excl Deep Cores & Grab);
- TOC (excl Deep Cores & Grab);
- Moisture Content;
- PSD (19 selected short cores and minimum 2 grab samples in each disposal site);

[1] Although the results of trace metals analysis from the DEC (2006) and URS (Chevron 2010c) surveys were generally consistent, it is noted that the DEC (2006) survey did not include analysis of Ba, Be, Mn, whilst the URS (Chevron 2010c) survey did not include analysis of Ag.

- Carbonate content ($CaCO_3$) (19 selected short cores and minimum 2 grab samples in each disposal site);
- Radionuclides (five randomly selected short core samples);
- Acid Sulfate Soils (ASS) Screening Test; and
- Chromium Suite Test (Scr).

Sediments within the dredge area were described as dark red to red brown clayey gravelly sands with abundant $CaCO_3$ shells and shell fragments, with varying mud (silt and clay fraction) contents of between 20%-40% and gravel contents ranging from <5% to 34% (Chevron 2010c). Surficial sediments of the proposed nearshore disposal sites A and B were comprised approximately 60% of sand fraction compared to approximately 52% in near surface sediments from the dredge area. Clay content typically varied between 13% and 16% in surficial sediments among all nearshore samples (Chevron 2010c). Hard armoured surfaces were sampled at numerous locations. TOC content was typically <0.2%. Sediment texture between the three (3) proposed nearshore disposal sites was similar with mud content ranging from 20% to 27% and surficial sediments comprising red brown ferruginous slightly gravelly muddy sands. Sediment colour was increasingly grey greenish colour and higher $CaCO_3$ content with distance from shore, reflecting the increasing marine influence to the sediment composition and decreasing lithogenic/terrigenous component (i.e. ferruginized clays and silts) (Chevron 2010c).

Concentrations of three of the COPCs (As, Cr and Ni) exceeded the NAGD screening levels for marine sediments. However, this only occurred at a limited number of sites and it was concluded these were naturally occurring concentrations (Chevron 2010c). Higher concentrations of these trace metals generally occurred within fine-grained material close to shore which decreased with distance from shore. The spatial distribution of COPCs in sediments is likely to be driven mainly by a strongly positive correlation between contaminants and fine-grained particles and/or TOC, which is known to increase the absorptive capacity of sediment (Matthai and Birch 2000), rather than proximity of sediments to anthropogenic sediment sources. Examination of this relationship found statistically significant correlations between Al and Cr, Cu, Ni and Zn (r=>0.72, n=136), which confirms the capacity of muds and clays to absorb metals (Chevron 2010c). Results of weak-acid extraction testing support these findings and determined that the extractable portion of As, Ni and Cr in near surface sediments is about 10% of the total extractable concentration and well below NAGD (2009) ISQG-low levels and is therefore unlikely to be bioavailable at concentrations sufficient to have adverse effects on aquatic biota (Chevron 2010c). Geochemical characterisation of two deep core samples to a depth of 13.5 m indicates that the subsurface geochemistry is similar and very homogenous throughout the horizons sampled, although Ni was present in higher levels within deeper core samples (Chevron 2010c).

An assessment of PASS and the carbonate buffering capacity of shallow and deep sediments was also undertaken. Analytical methods used to determine the presence of PASS included the acid sulfate soils (ASS) screening test (based on pH_F and pH_{FOX} values and a reaction rating) and the Chromium Suite Test (Scr). The risk of ASS material was determined to be low. This is indicated by the negligible acid generating capacity of the sediments, or where PASS was encountered, typically in the surficial sediment profile close to the coastline, laboratory testing indicates the sediments have sufficient available carbonate buffering capacity to negate any potential acidity for material that may be placed onshore (Chevron 2010d).

2.5. Identifying Contaminants of Potential Concern

The NAGD (2009) identifies the common metals and metalloids (e.g. Cu, Pb, Zn, Cr, Cd, Ni, Hg, As) are the most widespread pollutants in Australia, being present in most contaminated sediments, sometimes at high levels. Organotin compounds are also common contaminants in ports and harbours and are frequently present at high levels in berths and inner harbour areas. Petroleum hydrocarbons and polycyclic aromatic hydrocarbons (PAHs) are also common but are normally found at elevated levels only in restricted locations.

A review of the potential contaminant sources of the North-West Shelf (NWS) was undertaken in Chevron (2010c). Potential contaminants identified from marine based activities included organic and inorganic contaminants from the oil and gas industry, shipping activities, commercial and recreational fishing activities, aquaculture and tourism. Coastal issues such as domestic waste, e.g. sewage disposal, have been perceived as less significant in this region than elsewhere because of low population density. However, potential pollutants from diffuse sources in the region include metals and antifoulants from shipping, harbour works, shore-based plants and cross-shelf trunklines. A review of contaminant sources, impacts, pathways and effects on the NWS by Fandry et al. (2006) identified the following COPCs in the region, including:

- Metals: (Ba, Cd, Cr, Cu, Pb, Hg and Zn) associated with shipment of minerals and runoff from onshore mining activities;
- TBT: antifoulant on ships
- Nitrogen: Nutrients
- Produced Water from industrial processing;
- Hydrocarbons associated with oil spills and chronic releases such as bilge and tank residues from ships.

Due to the undeveloped nature of the catchment and sparse farming practices it was considered that sources for PAHs and Organochlorine (OC) pesticides would be unlikely to make a substantial contribution to contaminant loads in offshore sediments (Fandry et al. 2006).

Review of available literature from previous sediment investigations and review of potential indicates that with the exception of TBT, there are very few known COPC in the region.

3. Sampling and Analysis Methods

Field investigations were undertaken by two qualified marine scientists between 15-18 March 2017. The following tasks were completed during the sampling event:

- Sediment coring using a vibrocorer at 11 locations;
- Sediment grabs of surficial sediments at 14 locations; and
- Test pit at one (1) location.

A total of 49 surface and subsurface sediment samples were collected from 26 sampling locations during the field survey.

3.1. Field Sampling

3.1.1. Sampling Design

The date, time, water depth, coordinates and sample type of the 26 sediment sampling locations are presented in **Table 5** and shown in **Figure 2**. The sampling design reflects recommendations provided in NAGD (2009), DER (2014) and NEPM (2013). The proposed harbour approach channel for capital dredging was divided into three distinct areas based on the likelihood of potential changes in physical and chemical characteristics:

1. Berth pocket/turning circle;
2. Inner channel; and
3. Outer channel.

Sediment sampling locations were randomly distributed within each area selected for sampling. In accordance with NAGD (2009), the number of sample locations were focussed on the volume of the layer of recent sediments which *could* be contaminated, but does not include the volume of underlying natural geological materials which are, except for the surface 1 m of sediment, expected to be uncontaminated. The indicative gross volume of sediment expected to be dredged and the surface area for the berth pocket/turning circle, inner channel and outer channel are shown in **Table 5**.

Capital dredging of much of the berth pocket had only recently been completed prior to sampling (i.e. within days of the sampling event). Therefore, it has been assumed that sediment sampling was undertaken on the surface 1 m layer previously dredged (**Table 5**), and further capital dredging of the older underlying deposits *could not* be contaminated under the same principles.

Based on available data (see Section 2.0), all three dredge areas were classified as *"probably clean"*. The exception was elevated TBT concentrations detected during the 2012 and 2016 sampling surveys in surface sediments adjacent to the proposed community boating precinct. The identified body of sediment where elevated TBT levels have previously been detected only slightly encroaches into the proposed capital dredge area at the southern end of the proposed berth pocket. However, as described in Section 2.4.1, between 1.5 m and 3.5 m of surface sediment material has since been dredged from the southern end of the berth pocket and buried within the reclaimed wharf land-fill to mitigate the potential impacts of TBT. Intensive sampling of the risk of TBT prior to the recent capital dredging program indicated low TBT concentrations below 1.5 m depth which met ISQG-Low values. An overview of the sampling locations from the Berth Pocket/Turning Circle in 2012 (BMT Oceanica 2014), 2016 (BMT Oceanica 2016) and 2017 sampling locations are presented in **Figure 3**. There were no exceedances of relevant guidelines for TBT in water or biota monitored during the 2016/17 Beadon Creek capital dredging campaign (pers comms Louise Synnot 2017), so it is considered highly unlikely TBT contamination risks are present in dredging the underlying materials.

Table 4 Sediment sampling locations including coordinates, depth, date, time, method and field quality control

Sampling Location	Coordinates		Depth (m CD)	Date	Time	Method[2]	Field QC[3]
	Latitude	Longitude					
Berth Pocket/ Turning Circle							
BP1	21.645657	115.131424	-2.83	15/03/2017	10:20	G	
BP2	21.64643501	115.131393	-3.18	15/03/2017	9:23	G	
BP4	21.64602002	115.13175	-1.77	16/03/2017	7:02	C	
TC1	21.64458001	115.13111	-2.07	15/03/2017	16:36	C	S
TC2	21.64470004	115.132048	-0.12	15/03/2017	11:06	G	R
TC3	21.64517697	115.131982	-1.60	15/03/2017	10:25	G	
TC4	21.64446602	115.131489	-2.25	15/03/2017	13:41	G	
TC5	21.64533597	115.132283	1.71	17/03/2017	10:00	TP	
Inner Channel							
IC1	21.64314997	115.13165	-2.14	18/03/2017	15:30	C	R
IC2	21.64358499	115.131426	-2.52	15/03/2017	13:46	G	
IC3	21.64256299	115.131701	-1.94	16/03/2017	16:49	C	
IC4	21.64004498	115.132835	-0.72	16/03/2017	10:23	G	
IC5	21.64060699	115.132453	-1.08	18/03/2017	9:50	C	
IC6	21.63997801	115.132436	-1.95	16/03/2017	10:26	G	
IC7	21.64412001	115.13124	-2.09	16/03/2017	17:41	C	S
IC8	21.63935096	115.132814	-1.64	18/03/2017	9:25	C	
Outer Channel							
OC1	21.63464201	115.132844	-2.2	17/03/2017	12:00	C	
OC2	21.62456	115.12868	-4.8	18/03/2017	8:30	C	
OC3	21.63621001	115.13359	-1.2	17/03/2017	8:30	C	
OC4	21.63125496	115.131202	-4.0	17/03/2017	11:20	C	S
OC5	21.62736903	115.129169	-6.0	18/03/2017	14:20	G	
OC6	21.61724	115.12566	-6.5	17/03/2017	15:42	G	
OC7	21.62240996	115.127198	-6.0	18/03/2017	13:41	G	R
OC8	21.61386	115.1237	-8.0	17/03/2017	15:14	G	
OC9	21.61494998	115.12462	-7.5	17/03/2017	15:21	G	
OC10	21.61931997	115.12644	-6.5	17/03/2017	16:16	G	

[1] Depths for the berth pocket/turning circle are presented as Chart Datum due to the anchor barge not having a depth sounder. Depths for the outer channel were depths recorded during sampling

[2] Definitions: C= Core, G= Grab and TP= Test Pit

[3] Definitions: R= Field Replicates, S= Field Split Triplicates

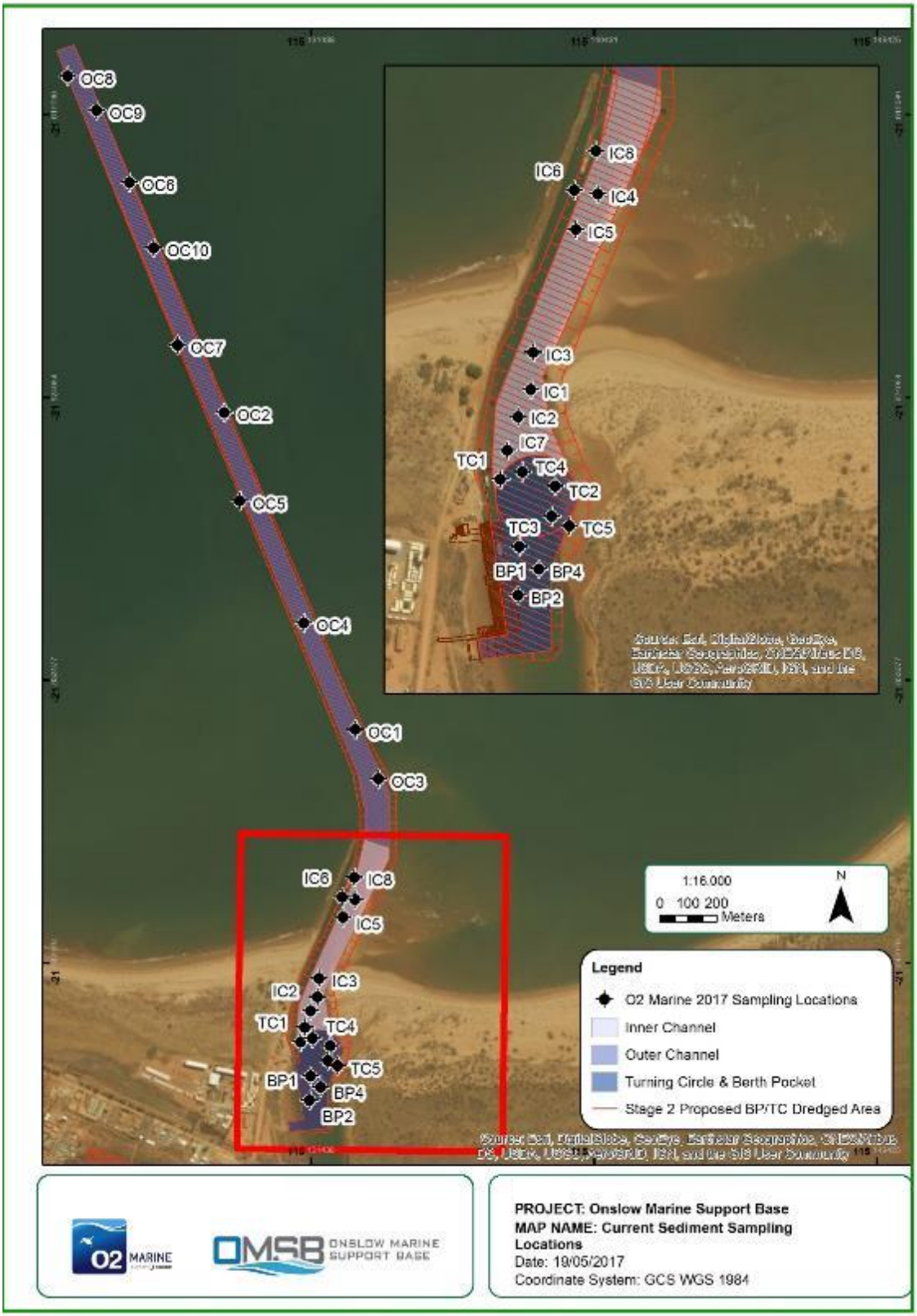


Figure 2 Sediment sampling locations divided into three (3) areas and the footprint of the capital dredging program completed days prior to the field investigations

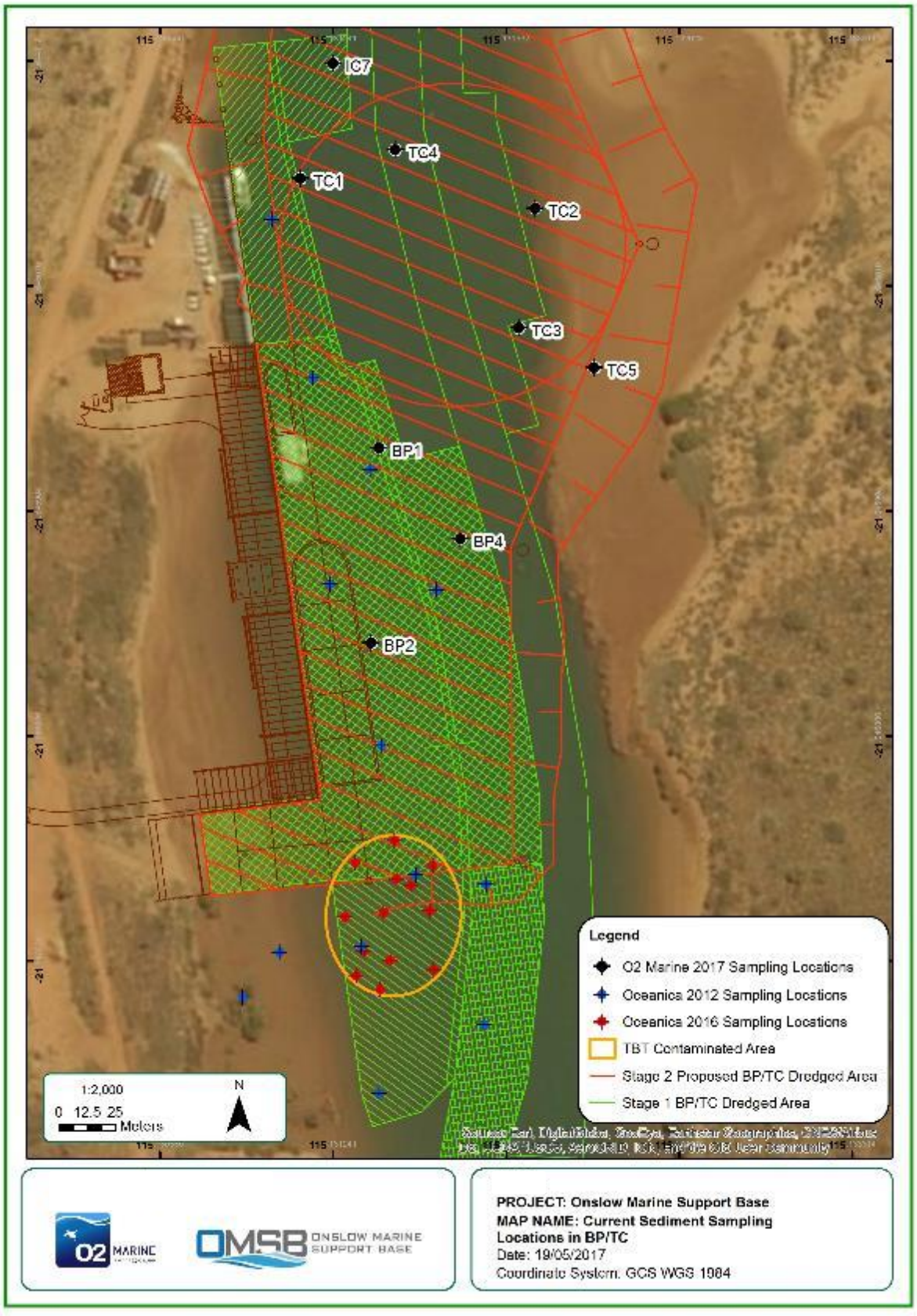


Figure 3 Current sediment sampling locations that have been collected within the Berth Pocket/ Turning Circle

Table 5 Dredge area volumes, surface areas and number of sample locations

Area	Dredge volume (m^3)	Surface Area (m^2)	Sample Locations[1]
Outer Channel	514,000	168,500	10
Inner Channel	244,000	73,300	8
Berth pocket/ turning circle	172,000	38,000	6[2]

[1] Assumes sediments are *"probably clean"*

[2] Six (6) sites sampled within the capital dredge area in 2012 and a further 13 sites sampled in the TBT contaminated area in 2016. dredging completed days prior to survey

Field Quality Control Samples

Field quality control samples included the following sampling design in accordance with NAGD (2009) and NEPM (2013):

- One trip blank filled with inert chromographic sand;
- Three field replicates (that is, three separate samples taken at the same location) to determine the variability of the physical and chemical characteristics; and
- Three field splits (that is, samples thoroughly mixed then split into three sub-samples with one of the three samples sent to a secondary laboratory) to assess laboratory variation.

Sediments were also collected for elutriate testing at a number of locations in the event samples exceeded ISQG-Low values.

3.1.2. Vibracoring

Vibracoring was undertaken at 11 locations; two (2) locations within the berth pocket/turning circle (BP4, TC1), five (5) locations within the inner channel (IC1, IC3, IC5, IC7, IC8) and four (4) locations within the outer channel (OC1, OC2, OC3, OC4). Vibracoring was selected as the appropriate sampling technique based on piston coring undertaken for Wheatstone Project encountering refusal at 72 sample locations at a depth of less than 0.4 m, resulting in only surficial sediments being collected. Vibracoring is the recommended technique for coarse or firm sediment in NAGD (2009).

A 76.2mm diameter stainless steel tube of 6 m length was fastened to a custom-made bracket which uses the flexible shaft of a small concrete vibrator to penetrate the tube into unconsolidated sediment (**Figure 4**). The tube was suspended from an A-frame/Hiab over the side of the vessel and vibrated into unconsolidated sediment. A plastic liner was used inside the tube to collect the sample and a one-way core catcher was custom made for the tube to prevent losing the sample on recovery. Three-point anchoring was required at all sampling locations.

The tube was recovered using the deck winch, the actual core depth was recorded and the core sample was removed from the tube. The core sample was initially vertically hung to settle sediments prior to being laid out on the deck and a photographic and observation record was taken before packing sediment into laboratory containers. Each sediment core was divided into 0.5 m depth intervals and samples were collected at each interval. The actual core depth recorded was typically deeper than the visual length of the core following removal due to a combination of the compaction of sediments during retrieval and the diameter of the plastic liner being larger (130 mm) than the tube (76.2 mm), creating additional space for sediments to fill at the base of the core once removed. However, due to the amount of sediment required for sampling tests, the core was typically split between into two horizons, as such it is possible that sediment from depths greater than the top 1m may have been sampled.

3.1.3. Sediment Grab

Surficial sediment samples were collected using a van Veen sediment grab (225 x 200 mm) at 15 locations; four (4) locations within the berth pocket/turning circle (BP1, BP2, TC3, TC4), three (3) locations within the inner channel (IC2, IC4, IC6) and six (6) locations within the outer channel (OC5, OC6, OC7, OC8, OC9, OC10).

The van Veen grab (225 mm x 200 mm) is constructed of two stainless steel buckets with zinc plated steel arms which collects a volume sample of 3 litres. The grab is lightweight (13 kg) which enabled deployment by hand using a pulley block hung over the side of the vessel (**Figure 4**). The impact of the grab on the bottom surface triggers a release mechanism to shut the buckets together and collect the sample. On return of the sample to the surface the water was carefully removed and the sediment was emptied into a plastic bucket and a photographic and observation record was taken before packing sediment into laboratory containers. Shell grit and coral rubble was encountered in surface sediments at many grab sites preventing the grab from closing properly and often resulting in more than one grab required at sampling locations. Samples were homogenised where the sediment from more than one grab was used to achieve the sample quantity required. The grab was decontaminated using appropriate decontamination solution (i.e. DECON) between each sampling location.

3.1.4. Test Pit

One test pit sample was collected from the intertidal area of the turning circle during low tide. The pit was excavated by hand with nitrile gloves. Surface sediment removed was packed into laboratory containers.

a) b)

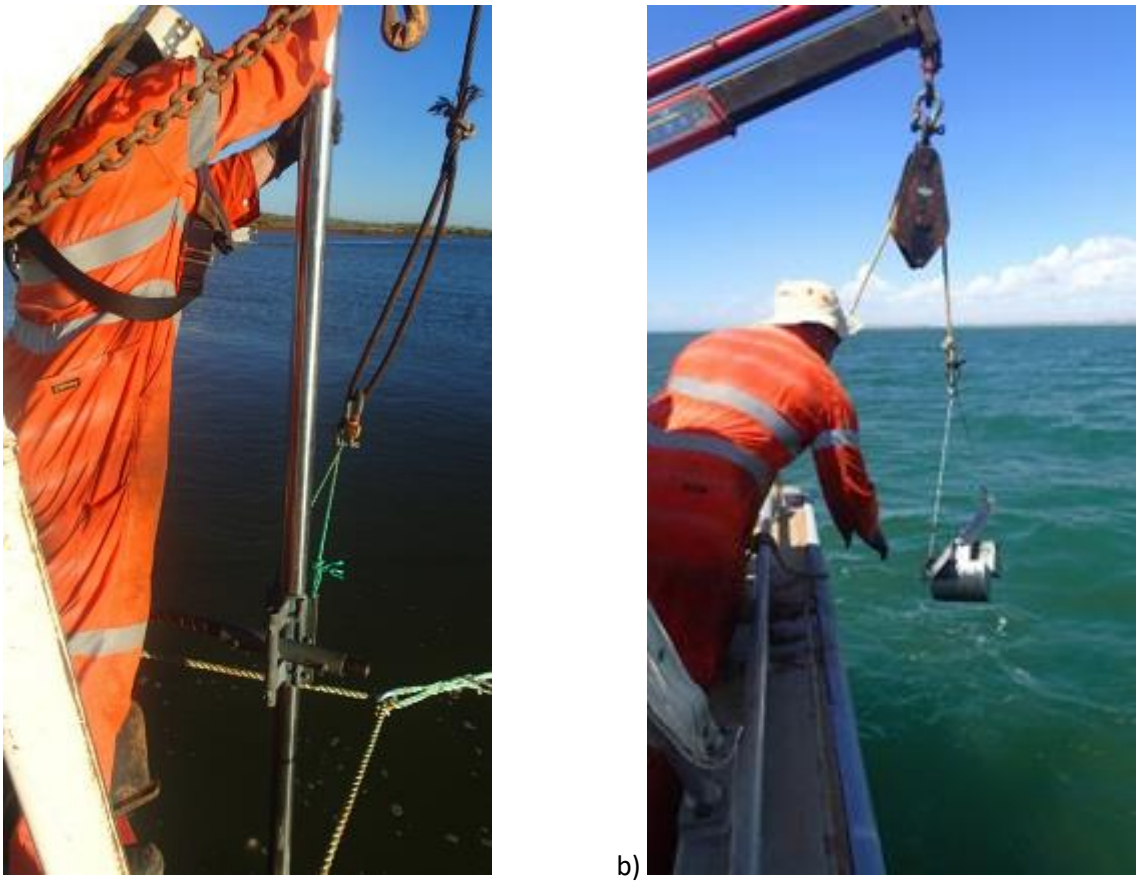


Figure 4 Field sampling images presenting a) vibracoring using a 6 m, 76.2mm diameter stainless steel tube housing the flexible shaft from a small concrete vibrator, and b) the deployment of the van veen grab using a pulley block hung over the side of the vessel

3.1.5. Acid Sulfate Soils Screening Test

The DER Guideline document for acid sulfate soils (DER 2015) describes how to identify PASS risk areas and the subsequent assessment methods, including sampling and reporting for dredge material that is planned to be disposed on land. Landgate's Shared Land Information Platform (SLIP) identified sediments within the proposed capital dredge area are classified as a high probability of PASS occurrence, although with very low confidence. Therefore, the actual and potential acidity of the capital dredge area sediments has been analysed.

PASS screening tests (EA037) were undertaken in the field immediately following collection of sediment samples. The analytical methods selected for the analysis of PASS was undertaken in accordance with methodologies outlined in DER (2015).

PASS screening tests are a measure of pH_f and pH_{fox} (including assessment of reaction rating). The pH_F test measures the existing acidity and is therefore a useful indicator as to whether ASS are present. The pH_{FOX} test (or rapid oxidation) is used to indicate the presence of iron sulphides or PASS.

The test involves adding 30% hydrogen peroxide (H_2O_2) to a sample of sediment (to mimic the natural addition of air to the sediment). If sulphides are present, a reaction with the hydrogen peroxide will occur. The reaction can be influenced by the amount of sulphides in the sample and the presence of organic matter. A more vigorous reaction usually indicates a higher potential for acidity. The value of pH_{FOX} and its relationship to pH_F is also used to identify PASS. A lower final pH_{FOX} value and a greater difference between pH_{FOX} in comparison to pH_F, is indicative of the presence of PASS.

Detailed PASS screening test methodology is further described in Appendix A of DER (2015).

3.1.6. Laboratory Testing

The sediment samples were packed into suitable (laboratory supplied) jars and plastic bags and stored on ice during the field program and transferred to a freezer at the completion of each day. All samples were marked with a unique identifier with the date/time and sampler's name using a 'Wet Write' permanent marker. All samples were listed on an O2 Marine Chain of Custody (CoC) form and that form was included with the samples when transported to the NATA-accredited laboratory for analysis. Copies of the CoC are provided in **Appendix A**.

ALS Global Pty Ltd was selected for this project as the primary laboratory and Advanced Analytical Australia Pty Ltd was selected as the secondary laboratory.

The sediment samples were analysed for the following parameters:

- Sediment Properties: Particle size analysis (PSA), total organic carbon (TOC), moisture content;
- Inorganic Compounds: Total metals and metalloids (Al, Ag, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Sb, V and Zn);
- Organic Compounds: TPH, BTEX, PAH and TBT;
- Nutrients (TN, TKN, NH_4, NO_2+NO_3, TP, FRP); and
- Acid sulfate soils (SCr).

The analytical procedures used by the laboratory are described in **Appendix B**. ALS Global Pty Ltd has a comprehensive best practice QA/QC program designed to provide highly defensible analytical data in accordance with NEPM (1999), ANZECC/ARMCANZ (2000) and NAGD (DEHWA (2009) guidelines. ALS undertakes Laboratory Control Samples (LCS), Method Blanks (MB), Matrix Spikes (MS), Laboratory Duplicates (Dups) and Surrogates (where applicable), at frequencies at or above the NEPM guidelines – revised 2013.

Previous sediment sampling indicates a low likelihood of contamination of the proposed dredged sediments; therefore, the following risk-based screening approach was used to select samples and analytes for analysis:

- Sample surficial sediments from cores in the turning circle, inner channel and outer channel areas;
- Focus sampling on locations within the berthing pocket/turning circle that were not just dredged during the capital dredging completed in the days prior to sampling;
- Sample deeper cores for at least one site considered to have the highest risk of contamination within each area;
- Test contaminants with the highest risk (i.e. metals, TBT) at the majority of locations with less emphasis on contaminants which historical sampling indicates are lower risk (i.e. nutrients, hydrocarbons);
- Samples selected for chromium reducible sulfur suite testing are based on the results from soil field pH tests;
- Test all split field quality control samples, including samples sent to the secondary laboratory;
- Test one replicate field quality control sample for variability of sediment physical and chemical characteristics; and
- All the remaining samples were stored frozen for further analysis, if required.

A summary of the sediment samples that were analysed and preserved is provided in **Table 6**.

Table 6 Sediment samples and contaminants analysed (A) and preserved (P)

Sampling Location	Sediment Horizons	Analytes							QA/QC	
		Physical	Inorganic	TBT	Other Organics	Nutrients	SCr	Elutriate	Replicate	Splits
Berth Pocket/ Turning Circle										
BP1	S	P	P	P	P	P	A	-	-	-
BP2	S	P	P	P	P	P	P	-	-	-
BP4	0.7m	A	A	A	A	A	P	2P	-	-
TC1	0.75m	A	A	A	A	A	P	P	-	2A
	1.5m	A	A	A	A	A	A	P	-	2A
TC2	S	A	A	A	A	A	P	2P	1A/1P	-
TC3	S	P	P	P	P	P	A	-	-	-
TC4	S	A	A	A	P	P	P	-	-	-
TC5	S	A	A	P	P	P	A	-	-	-
Total Analyzed/Preserved		6/3	6/3	5/4	4/5	4/5	4/5	0/6	1/1	4/0
Inner Channel										
IC1	0.75m	A	A	A	A	A	P	-	1A/1P	-
	1.5m	P	P	P	P	P	A	-	-	-
IC2	S	A	A	P	A	A	P	P	-	-
IC3	0.75m	A	A	A	P	P	A	2P		

Sampling Location	Sediment Horizons	Analytes							QA/QC	
		Physical	Inorganic	TBT	Other Organics	Nutrients	SCr	Elutriate	Replicate	Splits
	1.5m	P	P	P	P	P	P	-	-	-
IC4	S	A	A	A	A	P	P	-	-	-
IC5	0.75m	A	A	A	A	A	P	-	-	-
	1.5m	P	P	P	P	P	A	-	-	-
	2.2m	P	P	P	P	P	A	-	-	-
IC6	S	A	A	A	P	P	P	-	-	-
IC7	0.6m	A	A	A	A	A	P	P	-	-
	1.2m	A	A	P	P	P	P	-	-	-
IC8	0.6m	A	A	P	P	A	A	P		
	1.2m	P	P	P	P	P	P	-	-	-
Total Analyzed/Preserved		9/5	9/5	6/8	5/9	5/9	5/9	0/5	1/1	0/0
Outer Channel										
OC1	0.75m	A	A	A	A	A	A	-	-	2A
	1.5m	P	P	P	P	P	P	-	-	-
OC2	0.5m	A	A	A	P	A	P	2P	-	-
	1.0m	A	A	P	P	P	P	-	-	-
OC3	0.5m	A	A	A	A	A	P	P		
	1.0m	A	A	P	P	P	P			
OC4	0.6m	A	A	A	A	A	A	P		
	1.2m	P	P	P	P	P	A	2P		
OC5	S	A	A	A	A	P	A			
OC6	S	A	A	A	P	P	A			
OC7	S	A	A	A	A	A	A		1A/1P	
OC8	S	A	A	A	P	P	P	P		
OC9	S	A	A	A	P	P	A			
OC10	S	A	A	A	A	A	P	P		
Total Analyzed/Preserved		12/2	12/2	10/4	6/8	6/8	7/7	0/8	1/1	2/0

3.2. Sediment Data Assessment

3.2.1. Comparison of Data to Screening Levels

The results for organic and inorganic compounds were compared to the ISQG-Low, which were developed as part of the ANZECC/ARMCANZ Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000).

Revised sediment quality guidelines were applied where appropriate as detailed in (Simpson et al. 2013). A screening level is exceeded if the upper 95% upper confidence limit of the mean (95% UCL) for a contaminant exceeds the ISQG-Low. The USEPA's ProUCL software is used to calculate and recommend the most appropriate 95% UCL test to apply based on the data size, data distribution and skewness. If the 95% UCL does not exceed the screening level, this means there is a 95% probability that the mean concentration of that contaminant within the material to be dredged will not exceed the screening level. If the 95 UCL of a contaminant exceeds the specified screening level, it is a Contaminant of Potential Concern (COPC) and evaluation should proceed through the decision-tree described in NAGD (2009).

The capital dredge material from the berth pocket/turning circle, inner channel and outer channel will be disposed to land, therefore characterisation of the material and assessment of its compatibility with the receiving environment and associated land uses on a site-specific basis is required in accordance with guidance provided in Schedule B2 of the NEPM. These guidelines consist of Ecological Health Investigation Levels (EILs) and Health Investigation Levels (HILs). Health Investigation Level D for industrial areas was applied, as this material would be disposed to a potential future Light Industrial Area.

Chevron (2010) and DEC (2006) both identified that PSD is a principle factor which determines the concentrations of metals in sediments. Investigations demonstrated strong correlations between Al concentrations and the proportion of mud fractions (clay and silt), as well as Al and the concentrations of metals tested, suggesting Al can be used to normalise the concentrations of other metals in areas with samples of variable PSD. Regression analysis was undertaken on Al concentrations and the proportion of mud fractions, as well as between the concentrations of Al and other metals to reveal which results may be influenced by the variability of the particle sizes between samples.

3.2.2. PASS Field Screening Test

The results of field screening tests are presented in a table to present the results of the three (3) combining factors considered in arriving at a 'positive field sulphide identification':

- A reaction with hydrogen peroxide as classified in **Table 7** – this reaction should be rated e.g. L = low reaction, M = medium reaction, H = high reaction, X = extreme reaction, V = volcanic reaction.
- The actual value of pH_{FOX} . If the pH_{FOX} <3, and a significant reaction occurred, then it strongly indicates PASS.
- A much lower pH_{FOX} than field pH_F . The lower the final pH_{FOX} value and the greater the difference between the pH_{FOX} compared to the pH_F, the more indicative of the presence of PASS.

A total of 16 samples from the 45 tested were selected for further laboratory analysis using the Chromium Reducible Sulfur Suite method. The selection of samples for further analysis were based on the following conservative results from the PASS Screening Test to indicate the sediment is likely to contain sulfides:

- 'High' or greater reaction rating;
- Actual value of pH_{FOX} <6; and
- Difference in pH_{FOX} and pH_F value of >2 units.

Table 7 Reaction observations to determine appropriate rating

Reaction Rating	Key	Observations
Low	L	Little to no reaction, languid bubble formation
Medium	M	Languid bubble formation two or more layers
High	H	Active bubble formation inside test tube, mild effervescence
Extreme	X	Foaming inside test tube, moderate effervescence, faint sulfuric odour
Volcanic	V	Vigorous foaming & overflow/ eruption, strong effervescence, strong sulfuric odour

3.2.3. Chromium Reducible Sulfur Suite

The chromium reducible sulfur suite method was used, this method involves a series of steps that yield an estimate of the actual and potential acidity, the acid neutralising capacity (ANC) and the total net acidity of a sediment sample. The soil pH, in potassium chloride suspension (pH_{KCl}), gives an estimate of the actual acidity of the sediment. The reduced inorganic sulfur content (S_{Cr}) provides an estimate of the potential sulfidic acidity of the sediment, which is assessed against an Action Criteria (DER 2015). Titratable Actual Acidity (TAA_{KCl}) and/or Net Acid Soluble Sulfur (S_{NAS}) are analysed if pH_{KCl} is <6.5. The ANC provides an estimate of the ability of the sediment to naturally neutralise any acid produced (e.g. due to the presence of carbonate material).

The total net acidity is calculated via Acid-Base Accounting (ABA), using the following equation (Ahern et al. 2004):

Net Acidity = Potential Sulfidic Acidity + Existing Acidity -ANC/FF

where:

- Potential Sulfidic Acidity is represented by S_{Cr} (converted from %S to mol H+/tonne by multiplying by 623.7).
- If there is no existing acidity, i.e. the sample has a pH_{KCl} greater than 6.5, the TAA_{KCl} is assumed to be zero and the Existing Acidity term is neglected. If the pH_{KCl} is less than 6.5, the TAA_{KCl} is measured and used for the Existing Acidity term in mol H+/tonne.
- ANC is represented by ANC_{BT} (converted from %CaCO3 to mol H+/tonne by multiplying by 199.8).
- FF is the fineness factor.

As the samples are finely ground in the laboratory, the ANC likely to be experienced in the field could be overestimated and therefore the net acid risk, underestimated. To allow for this, the measurements of ANC are divided by a fineness factor (FF) during ABA. A fineness factor of 1.5 was selected for this study to ensure a conservative calculation of the neutralising capacity for the fine shell and carbonate silts.

3.2.4. QA/QC Assessment

The precision of the sediment analyses was determined by quantifying the differences between the concentrations of analytes in the QA/QC samples, using the method outlined in the NAGD (NAGD 2009).

The relative percent difference (RPD) was calculated for analyte concentrations in the sample splits (both inter-laboratory and intra-laboratory splits) was calculated for analyte concentrations in the field replicates.

The RPD is calculated as follows

$$\text{RPD (\%)} = \frac{(difference\ between\ sample\ splits)\ X\ 100}{(average\ of\ sample\ splits)}$$

The RPD of sample splits should be less than ±35% for field splits and ±50% for field replicates, although the guidelines note that this may not always be the case where the sediments are very heterogeneous or greatly differing in grain size (NAGD 2009). If the RPD for a measured analyte fell outside of these limits, the value of the measured analyte was flagged as an estimate rather than a precise value (NAGD 2009).

4. Results

4.1. Sediment Properties

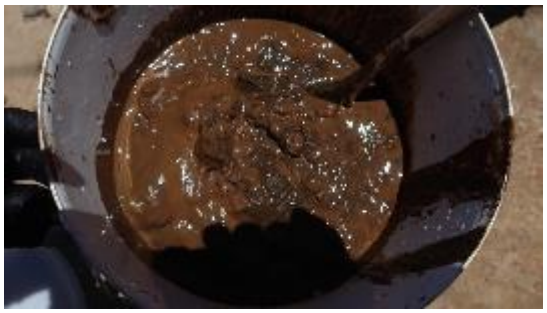
4.1.1. Field Observations

Berth Pocket/Turning Circle

A summary of the observed sediment characteristics of the samples from the berth pocket/turning circle is provided in **Table 8**. Sediment samples from the berth pocket/ turning circle were predominantly composed of brown fine sand. The core at location TC1 achieved a depth of -1.5 m before refusal although BP4 only sampled to -0.7 m. Shelly grit and coral rubble were found in sediment beneath the surface layer, although clay was observed in the deeper section of the core (-1.5 m) collected from TC1, which was recently dredged. A slight odour was detected in replicate samples collected from TC2.

Table 8 Description of the characteristics of sediment samples taken from the berth pocket/turning circle capital dredge area.

Location	Depth Core (m)	Depth Interval (m)	Sediment Description	Photograph
BP1	S	0-0.3	Dense brown/grey, fine sand, >10% fines	
BP2	S	0-0.3	Dense brown fine sand, 5-10% fines. Some leaves/twigs found in sample	
BP4	-0.7	0-0.7	Loose soft brown medium sand, <5% fines. Gravel beneath surficial sediment layer of shell/ coral grit	

Location	Depth Core (m)	Depth Interval (m)	Sediment Description	Photograph
TC1	-1.5	0-0.75	Dense fine/medium brown sand, 10% fines, Shell/ coral grit fragments	
		0.75-1.5	Dense brown silty sand, >10% fines, clay concentrations increase at depth	
TC2	S	0-0.3	Loose brown with some dark grey fine sand, 5-10% fines	
TC2 (REP1)	S	0-0.3	Loose brown with some dark grey fine sand, 5-10% fines, slight odour	
TC2 (REP2)	S	0-0.3	Loose brown with some dark grey fine sand, 5-10% fines, slight odour	
TC3	S	0-0.3	Loose brown with some dark grey silty sand, >10% fines	

Location	Depth Core (m)	Depth Interval (m)	Sediment Description	Photograph
TC4	S	0-0.3	Loose brown with some dark grey fine sand, 5-10% fines, slight odour	
TC5	S	0-0.1	Soft red/brown fine sand, <5% fines	

Inner Channel

A summary of the observed sediment characteristics from samples within the inner channel is provided in **Table 9**. Samples were composed of loose brown medium sand, although surficial sediments at sample location IC7 were composed of noticeably finer material (possible clay fractions). Cores sampled at IC1, IC3, and IC8 achieved a depth of approximately -1.2-1.5 m before refusal, and a deeper sediment core to -2.2 m was collected at IC5. The exception was site IC7 where the sample depth of -1.2 m was terminated due to mechanical failure of the concrete vibrator. Large shells, shelly grit and coral rubble were a common feature of surface and subsurface sediments, although deeper sediments (i.e. >1.5 m) comprised finer fractions and less gravel. A moderate odour was detected from surficial sediments at IC7, a slight odour from samples collected from IC1, IC6, IC7 deep and IC8.

Table 9 Description of the characteristics of sediment samples taken from the inner channel capital dredge area.

Location	Depth Core (m)	Core Interval (m)	Sediment Description	Photograph
IC1	-1.5	0-0.75	Loose red/brown medium sand/ gravel, <5% fines	
		0.75-1.5	Loose coarse dark brown sand/gravel, <5% fines, Shell/ coral grit and rubble common	

Location	Depth Core (m)	Core Interval (m)	Sediment Description	Photograph
IC1 (REP1)	-1.5	0-0.75	Loose brown medium sand/gravel, <5% fines, Shell/ coral grit and rubble common, slight odour	
IC1 (REP2)	-1.0	0-0.75	Loose brown medium sand/gravel, <5% fines, Shell/ coral grit and rubble common, slight odour	
IC2	S	0-0.3	Loose red/brown medium sand, <5% fines	
IC3	-1.5	0-0.75	Loose dark grey/ brown medium/coarse sand, <5% fines. Shell/ coral fragments	
		0.75-1.5	Loose dark grey/ brown coarse sand and gravel, <5% fines. Shell/ coral and rubble common	
IC4	S	0-0.3	Dense fine/medium brown sand, 10% fines, Shell/ coral grit fragments	

Location	Depth Core (m)	Core Interval (m)	Sediment Description	Photograph
IC5	-2.2	0-0.75	Loose dark brown coarse sand and gravel, <5% fines, Shell/ coral and rubble common	
		0.75-1.5	Soft dark brown/grey fine sand with some gravel, 5-10% fines, Shell/ coral grit & wood fragments	
		1.5-2.2	Dense red/brown silty sands, >10% fines, Small amounts of shell	
IC6	S	0-0.3	Loose brown with some dark grey fine sand, 5-10% fines, slight odour	
IC7	-1.2	0-0.6	Soft dark brown silty sand, >10% fines (possible clay), moderate odour, large fragments of shell and some shell grit present	
		0.6-1.2	Loose red/brown medium to coarse sand, <5% fines, slight odour, Shell/ coral grit fragments	
IC8	1.2	0-0.6	Loose light brown medium sand and gravel, 5-10% fines, large fragments of shell and shell grit common, very slight odour	
		0.6-1.2	Soft dark brown fine sand, 5-10% fines, some shell/coral grit, very slight odour	

Outer Channel

A summary of the observed sediment characteristics of samples from the outer channel is provided in **Table 10**. Sediment samples from nearshore sampling locations within the outer channel predominantly comprised of dense dark brown to greyish fine sand combined with large shell and coral rubble fractions. Sediment characteristics appeared relatively homogenous between surface and subsurface samples collected.

Cores collected from the outer channel ranged from a depth of -1.0 m to -1.5 m. Due to the 6 m length of the stainless steel tube, sample locations in depths below approximately 4 m CD proved difficult to sample. An

attempt to undertake vibracoring at low spring tide (+1.02 m) on 18 March 2017 at sample location OC7 was unable to recover a sufficient volume of sediment, due partly to the sample containing abundant shell and coral rubble (see OC7 image in **Table 10**) and oceanographic conditions (i.e. waves and currents). Therefore, grab sampling was undertaken at all deeper offshore sampling locations. Depth at these sites during grab sampling closer to high tide ranged from 6 m to 8 m. Loose red/brown fine sand and large shells, shelly grit and coral rubble were a very common feature of surface sediments from these samples.

Seagrass rhizomes and fibrous organic material were found in samples at sites OC4, OC7 and OC8. A slight odour was detected from surficial sediments at OC1 and OC6.

Table 10 Description of the characteristics of sediment samples taken from the outer channel capital dredge area.

Location	Depth Core (m)	Core Interval (m)	Sediment Description	Photograph
OC1	-1.5	0-0.75	Dense grey/dark brown silty sand, >10% fines, large shell fractions & shell/coral grit, very slight odour	
		0.75-1.5	Dense grey/dark brown fine sand, >10% fines, shell/coral grit, very slight odour	
OC2	-1.0	0-0.5	Dense dark brown fine sand/gravel, <5% fines, large shell & coral rubble fractions	
		0.5-1.0	Dense dark brown fine sand/gravel, <5% fines, large shell & coral rubble fractions	
OC3	-1.0	0-0.5	Dense grey/dark brown fine sand, <5% fines, some shell/coral grit	
		0.5-1.0	Dense dark grey/dark brown fine sand, <5% fines, some shell/coral grit	
OC4	-1.2	0-0.6	Dense grey/dark brown fine sand, <5% fines, large shell fragments at surface, shell/coral grit and seagrass rhizomes present	

Location	Depth Core (m)	Core Interval (m)	Sediment Description	Photograph
		0.6-1.2	Dense grey/dark brown fine sand, <5% fines, some shell/ coral grit	
OC5	S	0-0.3	Soft dark brown fine sand/shell, <5% fines, large shell fragments & shell grit common	
OC6	S	0-0.3	Loose dark brown fine sand/shell, <5% fines, large shell fragments & shell grit common, slight odour	
OC7	S	0-0.3	Loose red/ brown fine sand, 5-10% fines, large shell & coral rubble fragments & seagrass (*Halophila* spp.) rhizomes present	
OC7 (REP 1)	S	0-0.3		

Location	Depth Core (m)	Core Interval (m)	Sediment Description	Photograph
OC7 (REP 2)	S	0-0.3		
OC8	S	0-0.3	Soft red/brown fine sand, 5-10% fines, shell grit & fibrous organic material	
OC9	S	0-0.3	Loose red/brown fine sand/shell, <5% fines, large shell fragments & shell grit common	
OC10	S	0-0.3	Loose dark brown fine sand, 5-10% fines, large shell fragments & shell grit common	

4.1.2. Particle Size Distribution

Berth Pocket/Turning Circle

Sediment classifications based on the particle size distributions from each sample are shown in **Figure 5** and descriptive statistics provided in **Table 11**. Further details of the laboratory analysis results for particle size distribution are provided in **Appendix C**.

The PSD analysis of the sediment samples from the berth pocket/turning circle indicate sediments are mainly composed of sand size particles ($\bar{x}$ = 83.5%). The proportion of sand fractions within samples are

predominantly comprised of very fine to fine sand ($\bar{x}$ = 71%). The proportion of clay or silt sized particles typically range from 0% to 18%. Sampling locations BP4 and TC1 comprise a higher proportion of coarser sediment fractions. Deeper sediments sampled to -1.5 m at TC1 contains a higher proportion of muds (49% clay and silt).

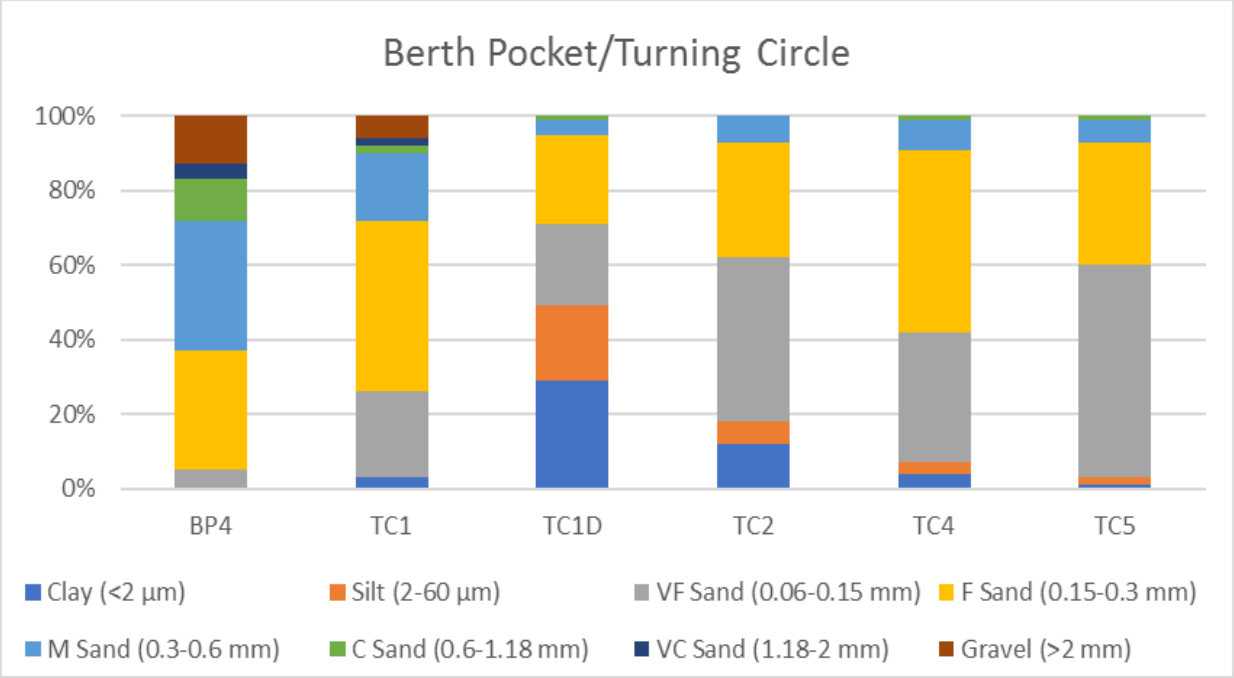


Figure 5 Sediment classification based on particle size for samples collected from the berth pocket/turning circle capital dredge area. Sand Definitions: VF= Very Fine, F= Fine, M= Medium, C= Coarse, VC= Very Coarse

Inner Channel

Sediment classifications based on the particle size distributions from each sample are shown in **Figure 6** and descriptive statistics provided in **Table 11**. Further details of the laboratory analysis results for particle size distribution are provided in **Appendix C**.

The PSD analysis of the samples from the inner channel indicate sediments are mainly composed of sand size particles ($\bar{x}$ = 85%). The proportion of sand fractions within samples are predominantly comprised of fine to medium sand ($\bar{x}$ = 65%). The proportion of muds (clay or silt sized particles) typically range from 1% to 3% except site IC7, which comprises 16% muds and also contains a significantly higher proportion of very fine sand (45%). Gravel sized particles typically range from 4% to 25% within samples except site IC4, for which particle sizes greater than medium sand are not recorded. Deeper sediments sampled to -1.2 m at IC7 are comparable to the sediment characteristics of surficial samples collected from other inner channel locations with 2% muds and 83% sand, predominantly in the fine to medium size range (63%) and 15% gravel.

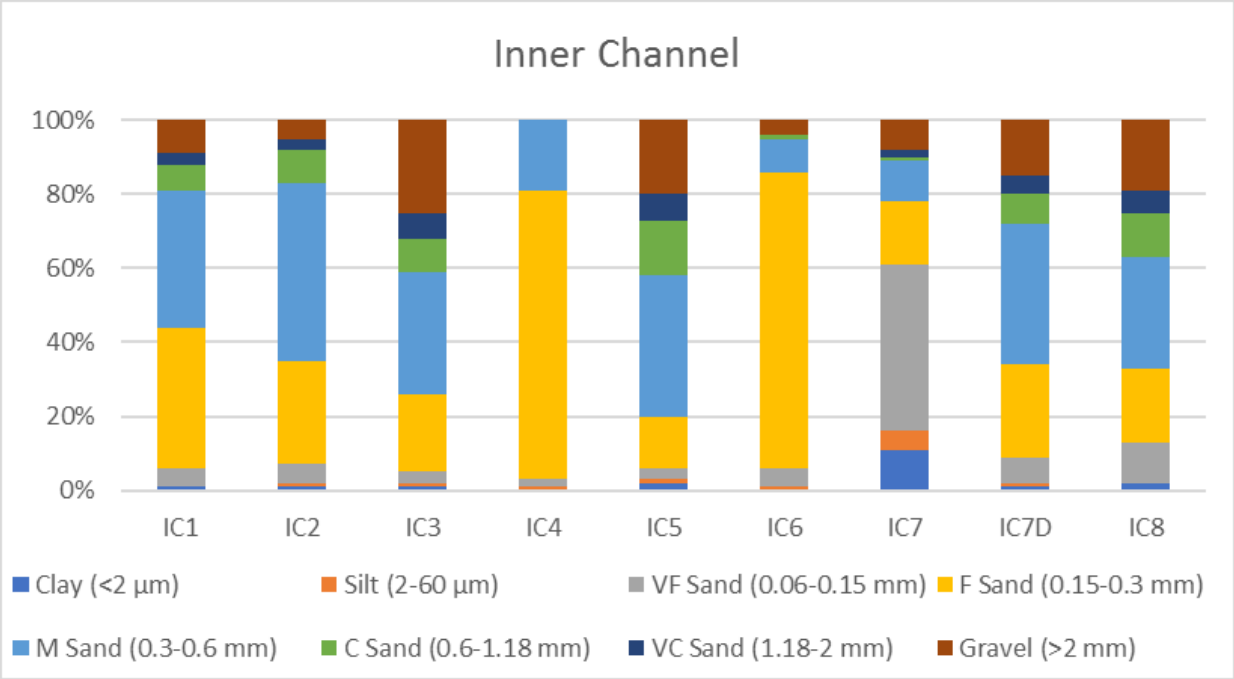


Figure 6 Sediment classification based on particle size for samples collected from the inner channel capital dredge area. Sand Definitions: VF= Very Fine, F= Fine, M= Medium, C= Coarse, VC= Very Coarse

Outer Channel

Sediment classifications based on the particle size distributions from each sample are shown in **Figure 7** and descriptive statistics provided in **Table 11**. Further details of the laboratory analysis results for particle size distribution are provided in **Appendix C**.

The PSD analysis of the samples collected from the outer channel indicate sediments are mainly composed of sand size particles ($\bar{x}$ = 79.9%). The proportion of sand fractions within samples are predominantly comprising of very fine to fine sand ($\bar{x}$ = 58%). The proportion of muds (clay or silt sized particles) typically range from 4% to 10% except samples OC3 and OC4, which comprise 0% and 18% muds, respectively. Gravel sized particles typically range from 9% to 25% within samples although nearshore sites OC1 and OC3 comprise less gravel (6% and 1%, respectively). Deeper sediments sampled to -1.0 m at OC2 and OC3 are relatively homogenous with the sediment characteristics of surficial samples collected from the same location.

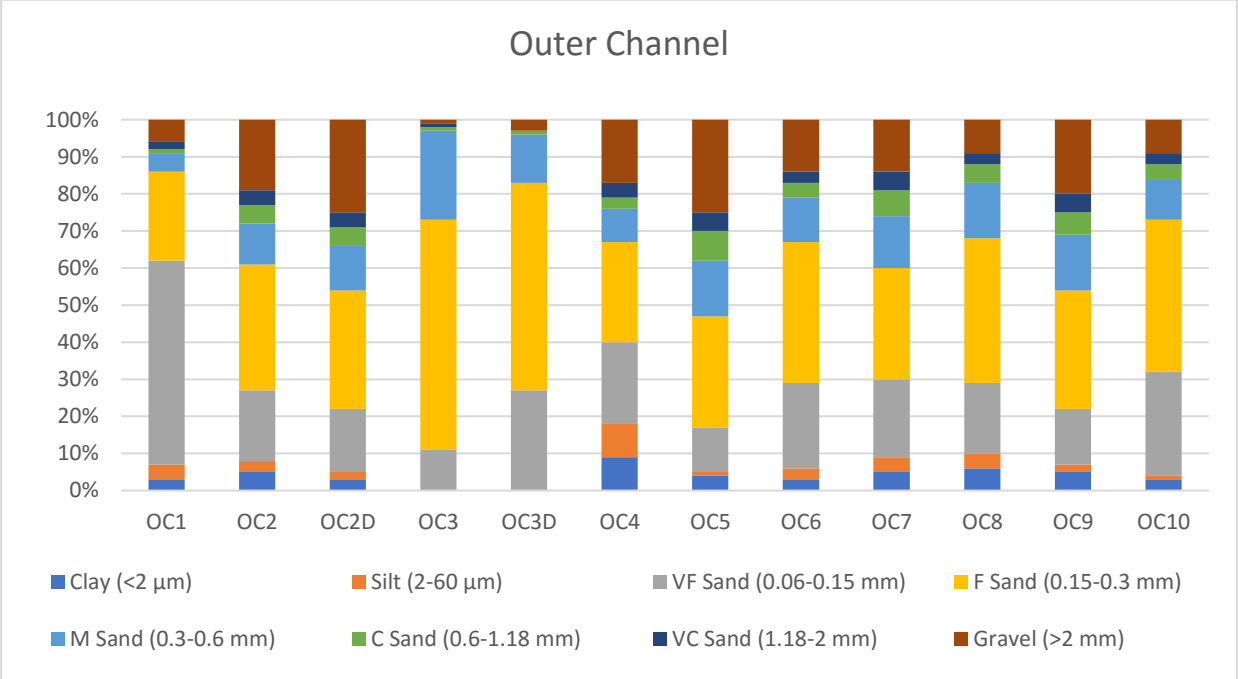


Figure 7 Sediment classification based on particle size for samples collected from the outer channel capital dredge area. Sand Definitions: VF= Very Fine, F= Fine, M= Medium, C= Coarse, VC= Very Coarse

Table 11 Descriptive statistics of sediment PSD from the berth pocket/turning circle, inner channel and outer channel

Area	Statistic	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
Berth Pocket/ Turning Circle	Min	0	0	51	0
	Max	29	20	97	13
	Mean	8.2	5.2	83.5	3.2
	SD	11.1	7.6	16.7	5.4
	n	6	6	6	6
Inner Channel	Min	0	0	73	0
	Max	11	5	99	25
	Mean	2.1	1.2	85	11.7
	SD	3.4	1.5	9.4	8.5
	n	9	9	9	9
Outer Channel	Min	0	0	65	1
	Max	9	9	99	25
	Mean	3.8	2.8	79.9	13.5
	SD	2.5	2.5	10.8	8.1
	n	12	12	12	12

4.1.3. Total Organic Carbon and Moisture Content

The TOC and moisture content of sediment samples from the berth pocket/turning circle, inner channel and outer channel capital dredge areas are presented in **Table 12** and raw laboratory results are provided in **Appendix C**.

Sediment samples from the berth pocket/turning circle are composed of relatively low percentages of TOC (0.04–0.34%) and moisture content (18%-26.9%), with slightly higher moisture in sediments from sample location TC2 (37.9%). The deeper sample to -1.5 m from TC1 contains lower TOC, but has a comparable moisture content to that recorded for the surface sample.

Table 12 Total organic carbon and moisture content for sediment samples from the berth pocket/turning circle, inner channel and outer channel capital dredging areas

Area	Location	Total Organic Carbon (%)	Moisture Content (%)
Berth Pocket/Turning Circle	BP4	0.04	19.3
	TC1	0.33	23.6
	TC1D	0.11	27.8
	TC2	0.22	37.9
	TC4	0.06	26.9
	TC5	0.07	18
Inner Channel	IC1	0.02	12
	IC2	<0.02	21
	IC3	<0.02	18.9
	IC4	0.03	23
	IC5	0.06	18.4
	IC6	<0.02	18.2
	IC7	0.14	31.2
	IC7D	<0.02	23.3
	IC8	0.12	17.9
Outer Channel	OC1	0.11	25
	OC2	0.05	15.3
	OC2D	0.06	16
	OC3	<0.02	22.2
	OC3D	<0.02	23.6
	OC4	0.66	25.2
	OC5	0.04	21.8
	OC6	0.1	25.6
	OC7	0.06	17.7
	OC8	0.08	29.5
	OC9	0.07	25.4
	OC10	0.04	26.8

Sediment samples from the inner channel show very low percentages of TOC (<0.02–0.14%). Seven (7) of nine (9) locations sampled record less than 0.06%, with surface samples from IC7 and IC8 the exceptions. Moisture content of the sediment samples (dried at 103°C) is also low typically ranging from 12% to 23.3%, except the surface sample at IC7 (31.2%). The TOC (<0.02%) and moisture content (23.3%) in the deeper sample to -1.2 m from IC7 is comparable to surficial samples from most inner channel locations.

The percent TOC in samples collected from the outer channel is low, typically ranging from <0.02% to 0.11% except for site OC4 (0.66%). The average moisture content in surficial sediments is 23%, ranging from 15.3% at OC2 to 29.5% at OC8. Deeper sediments to -1.0 m from OC2 and OC3 contains comparable TOC and moisture content to the surface samples collected from the same locations.

4.2. Total Metals and Metalloids

The total metal concentrations in sediment samples from the berth pocket/turning circle, inner channel and outer channel are presented in **Table 13**, raw laboratory results are presented in **Appendix C**.

The 95% UCL values for all metals within the berth pocket/turning circle, inner channel and outer channel areas are below the ISQG-Low and EIL screening levels with the exception of Arsenic in the outer channel. The 95% UCL for Arsenic exceeds the ISQG-Low (20 mg/kg) in the outer channel (29.5 mg/kg). However, the mean and median values for Arsenic in the outer channel are below the 80th percentile of natural background concentrations.

The arithmetic mean of total metal concentrations is below all HIL(s). The standard deviation of the sample data is less than 50% of the relevant HILs across all metals and no single value exceeds 250% of the relevant HILs.

The concentrations of some metals (i.e. Co, Cr, Cu, Fe, Ni, V, Zn) in a single sample (i.e. TC1D) were observed to be elevated either above the ISQG-Low and/or background concentrations. Arsenic exceeded the ISQG-Low in 10 of 12 individual samples within the outer channel, but all of these concentrations were close to the values recorded as natural background concentrations for offshore waters in this region (DEC 2006; Chevron 2010).

ISQG are not provided for Aluminium, Cobalt, Iron, Manganese and Vanadium. The median concentrations for these metals in all areas sampled are below background concentrations. However, Manganese exceeded the natural background concentrations in two (2) individual samples (OC5, OC7).

Results for the linear regression analysis of concentrations of Aluminium is shown in **Figure 8**. Linear regression shows a positive correlation between Aluminium and:

a) The proportion of mud (clay and silt) fractions (r^2=0.72);
b) Cobalt (r^2=0.63);
c) Chromium (r^2=0.9);
d) Copper (r^2=0.74):
e) Iron (r^2=0.75);
f) Nickel (r^2=0.87);
g) Vanadium (r^2=0.82) and
h) Zinc (r^2=0.87).

The concentrations of Aluminium do not correlate with the results for concentrations of Arsenic (r^2=0.16) or Manganese (r^2=0.18).

Table 13 Total metal concentrations (mg/kg) for the sediment samples in the Berth pocket/turning circle, inner channel and outer channel capital dredging areas. Red bold text identifies concentrations in excess of the ISQG-Low values (where provided). Blue shaded cells identify values above the natural background concentrations

Total Metals (mg/kg)	Al	Ag	As	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	V	Zn
LoR	50	0.1	1	0.1	0.5	1	1	50	0.01	10	1	1	0.5	2	1
ISQG-Low	-	1	20	1.5	-	80	65	-	0.15	-	21	50	2	-	200
DEC (2006)[1]	12,600	<0.2	34	<0.1	8.8	31.8	9.5	36,800	<0.01		11.8	5		49.6	20.2
Chevron (2010)[2]	10,800		29.7	<0.1	14.3	45.6	16.7	35,300	<0.01	618	20.1	9.1		63.2	32.4
EILs[3]			80	-		(III) 540	340		-		680	1,800			17,000
HILs (D)			3,000	800	4,000	(VI) 3,000	250,000		4,000	40,000	4,000	1,500			400,000
Berth Pocket/Turning Circle															
BP4	1370	<0.1	16	<0.1	3	10	1.6	9600	<0.01	388	3.1	1.3	<0.5	24	5.2
TC1	3440	<0.1	12.9	<0.1	5	19.7	5.5	14200	<0.01	272	8.6	2.6	<0.5	28.4	13.7
TC1D	7030	<0.1	15.4	<0.1	16.8	52.9	27.6	38100	<0.01	591	**26.5**	8.7	<0.5	70.3	43
TC2	6300	<0.1	20	<0.1	8.6	32.8	11.5	25600	<0.01	297	13.6	5.4	<0.5	53.8	23.7
TC4	3730	<0.1	14.1	<0.1	5.2	21.1	5.6	16000	<0.01	221	8.7	4.1	<0.5	33.4	14.2
TC5	2540	<0.1	18.6	<0.1	6.2	23	5.3	16700	<0.01	330	8.4	3.3	<0.5	36.1	15.5
95% UCL	5866	<0.1	18.4	<0.1	11.5	38.8	23.6	28484	<0.01	457.4	18.1	6.4	<0.5	55.5	30
Median	3585	<0.1	15.7	<0.1	5.7	22.1	5.6	16350	<0.01	313.5	8.7	3.7	<0.5	34.8	14.9
Mean	4068	<0.1	16.2	<0.1	7.5	26.6	9.5	20033	<0.01	349.8	11.5	4.2	<0.5	41	19.2
Std Deviation	2185	N/A	2.7	N/A	4.9	14.8	9.4	10273	N/A	130.7	8.1	2.6	N/A	17.6	13.1
Inner Channel															
IC1	1300	<0.1	14.4	<0.1	3.5	9	1.7	12000	<0.01	399	3.4	1.3	<0.5	23.3	5.7
IC2	1350	<0.1	13.6	<0.1	3	9	1.8	7780	<0.01	348	3.1	1.2	<0.5	18.5	5.5
IC3	1340	<0.1	15.3	<0.1	3.4	9.7	2	9060	<0.01	433	3.8	1.4	<0.5	22.2	5.6
IC4	1090	<0.1	10.5	<0.1	2.5	9.4	1.5	6460	<0.01	172	3.4	1	<0.5	15.5	5.2

Total Metals (mg/kg)	Al	Ag	As	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	V	Zn
LoR	50	0.1	1	0.1	0.5	1	1	50	0.01	10	1	1	0.5	2	1
ISQG-Low	-	1	20	1.5	-	80	65	-	0.15	-	21	50	2	-	200
DEC (2006)[1]	12,600	<0.2	34	<0.1	8.8	31.8	9.5	36,800	<0.01		11.8	5		49.6	20.2
Chevron (2010)[2]	10,800		29.7	<0.1	14.3	45.6	16.7	35,300	<0.01	618	20.1	9.1		63.2	32.4
EILs[3]			80	-		(III) 540	340		-		680	1,800			17,000
HILs (D)			3,000	800	4,000	(VI) 3,000	250,000		4,000	40,000	4,000	1,500			400,000
IC5	1300	<0.1	15.3	<0.1	3.1	8.8	1.8	8330	<0.01	439	3	1.2	<0.5	22.3	4.9
IC6	1190	<0.1	8.44	<0.1	2.7	10.5	1.7	6280	<0.01	160	3.4	1.1	<0.5	14.4	5.9
IC7	7650	<0.1	18	<0.1	11	38.8	16.1	28600	<0.01	379	17.7	6	<0.5	59	26.6
IC7D	1380	<0.1	14.6	<0.1	3.1	9.5	1.9	7680	<0.01	413	3.9	1.3	<0.5	19	5.8
IC8	1530	<0.1	14.7	<0.1	3.4	12.9	2.1	10800	<0.01	304	4.2	1.7	<0.5	25.3	6.1
95% UCL	5090	<0.1	15.6	<0.1	5.6	19.1	10.3	15261	<0.01	404.6	12	4.1	<0.5	32.7	18.1
Median	1340	<0.1	14.6	<0.1	3.1	9.5	1.8	8330	<0.01	379	3.4	1.3	<0.5	22.2	5.7
Mean	2014	<0.1	13.9	<0.1	4	13.1	3.4	10777	<0.01	338.6	5.1	1.8	<0.5	24.4	7.9
Std Deviation	2117	N/A	2.8	N/A	2.7	9.7	4.8	6942	N/A	106.5	4.7	1.6	N/A	13.5	7
Outer Channel															
OC1	3870	<0.1	**21.4**	<0.1	8	27.8	6.3	23200	<0.01	316	11.1	3.8	<0.50	47.1	16
OC2	3930	<0.1	**23.4**	<0.1	11.7	24	6.3	20800	<0.01	383	9.8	4	<0.50	44	14.1
OC2D	3220	<0.1	**29.2**	<0.1	9.6	22.9	3.9	22200	<0.01	435	7.8	3.7	<0.50	46.5	12.2
OC3	1340	<0.1	11	<0.1	3.1	11.2	2	8580	<0.01	196	4	1.4	<0.50	19	7.4
OC3D	1350	<0.1	9.68	<0.1	2.9	11.1	2.2	7460	<0.01	171	4	1.3	<0.50	17.9	6.9
OC4	5440	<0.1	**26**	<0.1	10.4	34.7	9.2	28800	<0.01	430	12.6	5.6	<0.50	59.7	19.9
OC5	3650	<0.1	**38.1**	<0.1	11.7	22.9	4.5	24900	<0.01	625	8.2	4.1	<0.50	52.1	14
OC6	3600	<0.1	**27.4**	<0.1	11.8	26.9	4.1	28300	<0.01	418	9	4.7	<0.50	50.2	14.9

Total Metals (mg/kg)	Al	Ag	As	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	V	Zn
LoR	50	0.1	1	0.1	0.5	1	1	50	0.01	10	1	1	0.5	2	1
ISQG-Low	-	1	20	1.5	-	80	65	-	0.15	-	21	50	2	-	200
DEC (2006)[1]	12,600	<0.2	34	<0.1	8.8	31.8	9.5	36,800	<0.01		11.8	5		49.6	20.2
Chevron (2010)[2]	10,800		29.7	<0.1	14.3	45.6	16.7	35,300	<0.01	618	20.1	9.1		63.2	32.4
EILs[3]			80	-		(III) 540	340		-		680	1,800			17,000
HILs (D)			3,000	800	4,000	(VI) 3,000	250,000		4,000	40,000	4,000	1,500			400,000
OC7	4610	<0.1	**33.4**	<0.1	12.3	29.8	6.4	29900	<0.01	634	10.4	5.4	<0.50	56.5	17.2
OC8	4330	<0.1	**27.4**	<0.1	13.4	30.5	5	32800	<0.01	435	10.1	5.4	<0.50	53.2	18.1
OC9	3760	<0.1	**26.6**	<0.1	12.8	25.5	4.3	27100	<0.01	439	9.1	4.9	<0.50	48.4	16
OC10	3290	<0.1	**29.2**	<0.1	11.3	28.2	3.5	29500	<0.01	401	7.8	4.8	<0.50	51.7	14.2
95% UCL	4148	<0.1	**29.5**	<0.1	14.4	28.3	5.9	27818	<0.01	478.8	10	4.8	<0.5	52.5	16.3
Median	3705	<0.1	27	<0.1	11.5	26.2	4.4	26000	<0.01	424	9.1	4.4	<0.5	49.3	14.6
Mean	3533	<0.1	25.2	<0.1	9.9	24.6	4.8	23628	<0.01	406.9	8.7	4.1	<0.5	45.5	14.2
Std Deviation	1187	N/A	8.2	N/A	3.5	7.1	2	8081	N/A	138.6	2.6	1.4	N/A	13.4	3.9

[1] Estimated natural background concentrations for Onslow from DEC (2006)

[2] 80th percentile of nine nearshore (i.e. 2km) sites from Ashburton North to Coolgra Point sampled in the pilot baseline investigation in Chevron (2010)

[3] Commercial/industrial = Ecological Investigation Level Calculation Spreadsheet (2010) using cation exchange capacity of 34.5 cmolc/kg dwt recorded from one site, mean pH of 9.75, mean TOC of 0.13% & mean clay content 4.2%. Background concentrations based on Chevron (2010). Aged metal concentrations are presented for EIL values.

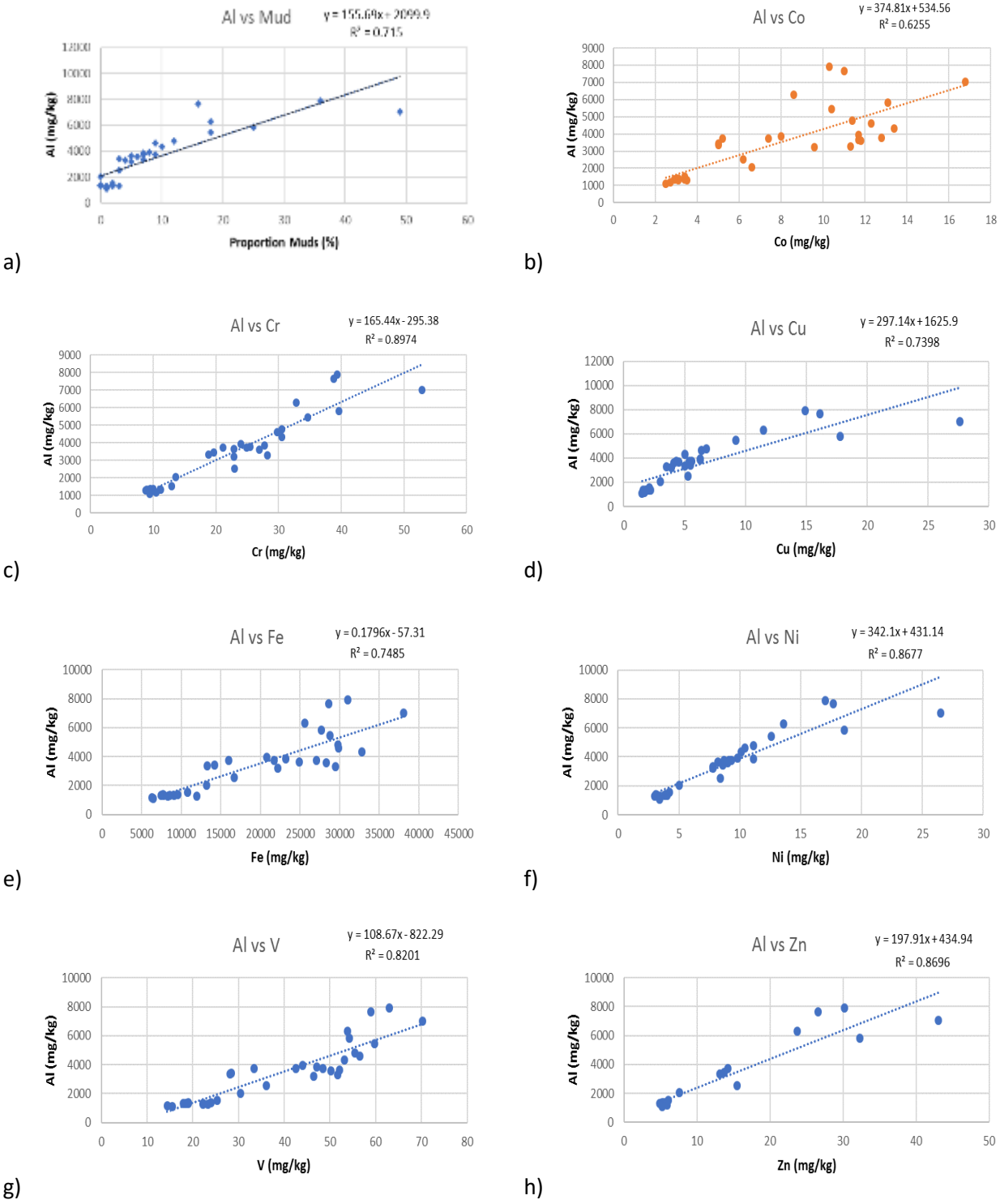


Figure 8 Linear regression showing strong positive correlation between concentrations of Aluminium and a) proportion of muds (clay and silts), b) Cobalt, c) Chromium, d) Copper, e) Iron, f) Nickel, g) Vanadium and h) Zinc

4.3. Organic Compounds

4.3.1. Total Petroleum Hydrocarbons

The TPH results for all the samples from the berth pocket/ turning circle, inner channel and outer channel capital dredge areas are shown in **Table 14** and are presented in full in **Appendix C**. TPH results are either below the laboratory LoR (<0.3/0.5 mg/kg), or are recorded at very low concentrations (i.e. <6 mg/kg). Detectable concentrations are only recorded within the C16-C34 carbon fractions. The 95% UCL is below the recommended Sediment Quality Guidelines (SQGs) from Simpson et al. (2013) and ESLs, all calculations are below and HSLs (D) (NEPM 2011).

4.3.2. Benzene, Toluene, Ethylbenzene, Xylene

The BTEX results for all samples from the berth pocket/ turning circle, inner channel and outer channel capital dredge areas are shown in **Table 14** and are presented in full in **Appendix C**. All concentrations in samples are below the LoR and therefore all relevant ESL and HSLs (D) are met.

4.3.3. Tributyltin

The TBT results for all samples from the berth pocket/ turning circle, inner channel and outer channel are shown in **Table 14** and are presented in full in **Appendix C**. Results from all monitoring locations are either at or below the LoR. Two (2) samples recorded TBT concentrations at the limit of reporting (BP4 and OC3). Concentrations at the limit of reporting (0.5 µg Sn/kg) normalised to 1% TOC create a value of 2.5 µg Sn/kg, which is below the NAGD (2009) ISQG-Low values.

4.3.4. Polycyclic Aromatic Hydrocarbons

The PAHs results for all parameters are below LoR in all samples tested and below the ISQG-Low concentrations from ANZECC/ARMCANZ (2000), ISQG-Low concentrations from NAGD (2009) and HILs (D) (NEPM 2011). The results are presented in full detail in **Appendix C**.

Table 14 Total Petroleum Hydrocarbons, BTEX and TBT concentrations in sediment samples from the berth pocket/turning circle, inner channel and outer channel capital dredge areas. Blue shaded areas presents results above the LoR.

Org	TPH (mg/kg)				BTEX (mg/kg)				TBT (µg Sn/kg)
	C6-C10	C10-C16	C16-C34	C34-C40	Benzene	Toluene	Ethylbenzene	Xylene	
LoR	3	3	3	5	0.2	0.2	0.2	0.5	0.5
ESLs[1]	215	170	1700		75	135	165	180	
HSLs[1]	260	NL	NL		3			230	
SQG[2]	280				-	-	-	-	9
Berth Pocket/Turning Circle									
BP4	<3	<3	<3	<5	<0.2	<0.2	<0.2	<0.5	0.5 (2.5)[2]
TC1	<3	<3	3	<5	<0.2	<0.2	<0.2	<0.5	<0.5
TC1-1	<3	<3	<3	<5	<0.2	<0.2	<0.2	<0.5	<0.5
TC2	<3	<3	4	<5	<0.2	<0.2	<0.2	<0.5	<0.5
TC4	---	---	---	---	---	---	---	---	<0.5
Inner Channel									
IC1	<3	<3	<3	<5	<0.2	<0.2	<0.2	<0.5	<0.5
IC2	<3	<3	<3	<5	<0.2	<0.2	<0.2	<0.5	---

Org	TPH (mg/kg)				BTEX (mg/kg)				TBT (µg Sn/kg)
	C6-C10	C10-C16	C16-C34	C34-C40	Benzene	Toluene	Ethylbenzene	Xylene	
LoR	3	3	3	5	0.2	0.2	0.2	0.5	0.5
ESLs[1]	215	170	1700		75	135	165	180	
HSLs[1]	260	NL	NL		3			230	
SQG[2]	280				-	-	-	-	9
IC3	---	---	---	---	---	---	---	---	<0.5
IC4	<3	<3	<3	<5	<0.2	<0.2	<0.2	<0.5	<0.5
IC5	<3	<3	<3	<5	<0.2	<0.2	<0.2	<0.5	<0.5
IC6	---	---	---	---	---	---	---	---	<0.5
IC7	<3	<3	5	<5	<0.2	<0.2	<0.2	<0.5	<0.5
Outer Channel									
OC1	<3	<3	5	<5	<0.2	<0.2	<0.2	<0.5	<0.5
OC2	---	---	---	---	---	---	---	---	<0.5
OC3	<3	<3	<3	<5	<0.2	<0.2	<0.2	<0.5	0.5 (2.5)[2]
OC4	<3	<3	<3	<5	<0.2	<0.2	<0.2	<0.5	<0.5
OC5	<3	<3	4	<5	<0.2	<0.2	<0.2	<0.5	<0.5
OC6	---	---	---	---	---	---	---	---	<0.5
OC7	<3	<3	5	<5	<0.2	<0.2	<0.2	<0.5	<0.5
OC8	---	---	---	---	---	---	---	---	<0.5
OC9	---	---	---	---	---	---	---	---	<0.5
OC10	<3	<3	5	<5	<0.2	<0.2	<0.2	<0.5	<0.5

[1] Management Limits and HSLs for Direct Contact not shown as all values below ESLs and HSLs.
[2] Revised SQG from Simpson et al. (2013)
[3] The concentration in brackets has been normalised to 1% TOC

4.4. Nutrients

The results for all samples tested from the berth pocket/ turning circle, inner channel and outer channel capital dredge areas are shown in **Table 15** and are presented in full in **Appendix C**. There are no relevant guidelines for total nutrients in sediments. Inorganic forms of nutrients in sediments (NO_2, NO_3, NH_4, FRP) from all samples tested are below the LoR, with the exception of FRP in one (1) sample at OC2 which recorded concentrations at the LoR. The level of total TKN/TN and TP reported is therefore likely to be entirely organically bound and representative of the low total organic concentrations in sediments which must be broken down into inorganic forms to be available for uptake by plants. Concentrations ranging from 30 to 360 mg/kg and 43 to 293 mg/kg, respectively, are similar to low concentrations of organic material reported in previous sampling within Beadon Creek (Oceanica 2010, BMT Oceanica 2014).

Table 15 Nutrient concentrations in sediment samples from the berth pocket/turning circle, inner channel and outer channel capital dredge areas.

Analyte	TOC	NH_4	NO_{-2}	NO_{-3}	NO_X	TKN	TN	TP	FRP
LoR	**(%)**	**20**	**0.1**	**0.1**	**0.1**	**20**	**20**	**2**	**0.1**
Berth Pocket/ Turning Circle									
BP4	0.04	<20	<0.1	<0.1	<0.1	40	40	98	<0.1
TC1	0.33	<20	<0.1	<0.1	<0.1	50	50	113	<0.1
TC2	0.22	<20	<0.1	<0.1	<0.1	120	120	126	<0.1
Inner Channel									
IC1	0.02	<20	<0.1	<0.1	<0.1	30	30	75	<0.1
IC2	<0.02	<20	<0.1	<0.1	<0.1	50	50	96	<0.1
IC5	0.06	<20	<0.1	<0.1	<0.1	150	150	162	<0.1
IC7	0.14	<20	<0.1	<0.1	<0.1	410	410	188	<0.1
IC8	0.12	<20	<0.1	<0.1	<0.1	100	100	126	<0.1
Outer Channel									
OC1	0.11	<20	<0.1	<0.1	<0.1	360	360	43	<0.1
OC2	0.05	<20	<0.1	<0.1	<0.1	140	140	276	**0.1**
OC3	<0.02	<20	<0.1	<0.1	<0.1	30	30	84	<0.1
OC4	0.66	<20	<0.1	<0.1	<0.1	180	180	195	<0.1
OC7	0.06	<20	<0.1	<0.1	<0.1	200	200	256	<0.1
OC10	0.04	<20	<0.1	<0.1	<0.1	160	160	293	<0.1

4.5. Acid Sulfate Soils

4.5.1. Field Screening Tests

The results from the field screening test undertaken on samples from the berth pocket/ turning circle, inner channel and outer channel are presented in **Table 16**. Values across all sites for pH_F range from 7.78 to 8.93 reflecting seawater influence (pH 8.2) and possibly dissolved carbonates typical of sediments in marine systems. Values for pH_{FOX} range from 3.81 to 7.94. One (1) sample from the inner channel (IC5D) and three (3) samples from the outer channel (OC1, OC4, OC4D) record pH_{FOX} values <6. The change in values between pH_F and pH_{FOX} ranges from 0.22 to 3.97. A change of >2 pH units is calculated in three (3) samples from the berth pocket/turning circle (BP1, TC2R2, TC3), four (4) samples from the inner channel (IC1D, IC3, IC5D, IC8) and three (3) samples from the outer channel (OC1, OC4, OC4D). Reaction ratings are ranked from 'Low' to 'Extreme' across all sites. One (1) sample from the berth pocket/turning circle (TC1D), one (1) sample from the inner channel (IC5DD) and five (5) samples from the outer channel (OC1, OC5, OC6, OC7, OC9) are ranked with a 'High' or 'Extreme' reaction. One sample collected from the intertidal area within the turning circle was not tested and consequently an evaluation for PASS at this location has not been conducted.

Based on the results and classification used to identify the presence of sulphides, a total of 17 samples from the capital dredge area were selected for further Chromium Reducible Sulfur Suite analysis in the laboratory; five (5) samples from within the berth pocket/turning circle, five (5) samples from inner channel and seven (7) samples from the outer channel.

Table 16 PASS field screening test results.

Location	pH_F	pH_{FOX}	ΔpH	Reaction[1]	Result[2]	Reason
Berth Pocket/ Turning Circle						
BP1	8.78	6.65	2.13	L	P	>2 ΔpH
BP2	8.26	6.56	1.7	L	U	
BP4	8.6	7.1	1.5	L	U	
TC1	8.57	6.91	1.66	L	U	
TC1D	8.53	7.01	1.52	H	P	H reaction
TC2	8.29	6.56	1.73	L	U	
TC2-R2	8.88	6.67	2.21	M	P	>2 ΔpH
TC2-R3	7.91	6.82	1.09	M	U	
TC3	8.77	6.7	2.07	L	P	>2 ΔpH
TC4	8.18	6.68	1.5	L	U	
TC5	N/A				P	Not tested
Inner Channel						
IC1	8.6	6.62	1.98	L	U	
IC1 R2	8.72	7.31	1.41	L	U	
IC1-R3	8.76	7.01	1.75	L	U	
IC1D	8.87	6.74	2.13	L	P	>2 ΔpH
IC2	8.87	7.87	1	L	U	
IC3	8.92	6.72	2.2	L	P	>2 ΔpH
IC3D	8.9	6.94	1.96	L	U	
IC4	8.32	7.36	0.96	L	U	
IC5	8.3	6.59	1.71	L	U	
IC5D	7.78	3.81	3.97	M	P	pH_{FOX} <6, >2 ΔpH
IC5DD	7.92	7.28	0.64	X	P	X reaction
IC6	8.22	7.32	0.9	L	U	
IC7	8.44	7.3	1.14	L	U	
IC7D	8.58	7.18	1.4	L	U	
IC8	8.73	6.37	2.36	L	P	>2 ΔpH,
IC8D	8.28	6.78	1.5	L	U	
Outer Channel						
OC1	7.93	5.3	2.63	H	P	pH_{FOX} <6 >2 ΔpH, H reaction
OC1D	8.2	6.61	1.59	L	U	
OC2	8.93	7.01	1.92	L	U	
OC2D	8.8	7.08	1.72	M	U	
OC3	8.84	7.11	1.73	L	U	

Location	pH_F	pH_{FOX}	ΔpH	Reaction[1]	Result[2]	Reason
OC3D	8.91	7.23	1.68	L	U	
OC4	8.5	5.32	3.18	M	P	pH_{FOX} <6, >2 ΔpH
OC4D	8.23	5.34	2.89	M	P	>2 ΔpH, pH_{FOX} <6
OC5	8.47	7.64	0.83	H	P	H reaction
OC6	8.5	7.65	0.85	H	P	H reaction
OC7	8.16	7.94	0.22	H	P	H reaction
OC7-R2	8.15	7.59	0.56	M	U	
OC7-R3	8.33	7.94	0.39	M	U	
OC8	8.19	7.41	0.78	M	U	
OC9	8.56	7.85	0.71	H	P	H reaction
OC10	8.43	7.73	0.7	M	U	

1 Reaction ratings: L= Low, M=Medium, H=High, X=Extreme, V=Volcanic
2 Result: P=PASS, U=PASS Unlikely

4.5.2. Chromium Reducible Sulfur Suite

The chromium reducible sulfur suite results from the berth pocket/turning circle, inner channel and outer channel capital dredge areas are presented in **Table 17**, results are presented in full in **Appendix C**. The pH_{KCl} in all the sediment samples is greater than 6.5 and therefore AASS are not present. Four (4) samples from the berth pocket/turning circle, three (3) samples from the inner channel and three (3) samples from the outer channel record sulfur values (%S (S_{Cr})) exceeding the Action Criteria.

To determine the net acidity of the PASS sediment samples, ABA was conducted and the findings presented in **Table 17**. The results indicate that the potential acidity of sediments are effectively buffered from the acid neutralising capacity (ANC), and therefore there would be a negative net acidity following disturbance of these sediments.

Table 17 Chromium reducible sulfur suite results for sediment samples tested from the berth pocket/turning circle, inner channel and outer channel capital dredge areas.

Location	pH_{KCL}	TAA (mol H+/t)	%S (S_{Cr})	Potential acidity (mol H+/t)	ANC_{BT} (%$CaCO_3$)[2]	ANC (mol H+/t)	FF	Net acidity (mol H+/t)[3]
Action criteria (%S)[1]			**0.03**	**18**				
Berth Pocket/ Turning Circle								
BP1	9.6	<2	**0.073**	**45**	9.06	1810	1.5	-1162
TC1D	9.4	<2	**0.162**	**101**	10.2	2030	1.5	-1252
TC2-R2	9.4	<2	**0.105**	**66**	13.5	2700	1.5	-1734
TC3	9.5	<2	**0.083**	**52**	11.8	2350	1.5	-1514
TC5	9.9	<2	<0.005	<10	---	---	---	---
Inner Channel								

IC1D	9.8	<2	0.005	<10	---	---	---	---
IC3	9.9	<2	0.005	<10	---	---	---	---
IC5D	9.1	<2	**0.489**	**305**	6.10	1220	1.5	-508
IC5DD	9.5	<2	**0.052**	**32**	22.1	4410	1.5	-2908
IC8	9.7	<2	**0.076**	**47**	40.3	8060	1.5	-5373
Outer Channel								
OC1	9.5	<2	**0.191**	**119**	23.5	4700	1.5	-3014
OC4	9.2	<2	**0.577**	**360**	31.5	6300	1.5	-3840
OC4D	9.1	<2	**0.567**	**353**	18.8	3750	1.5	-2147
OC5	9.8	<2	0.008	<10	---	---	---	---
OC6	9.8	<2	0.008	<10	---	---	---	---
OC7	9.8	<2	<0.005	<10	---	---	---	---
OC9	9.8	<2	0.005	<10	---	---	---	---

[1] Values in red exceed the Action Criteria for disturbance of >1000 tonnes of soils (DER 2015). These sediments are classified as PASS.
[2] ANC is the acid neutralising capacity of the sediments
[3] A positive number indicates excess acid. A negative number indicates excess neutralising capacity.

4.6. QA/QC Assessment

4.6.1. Laboratory QA/QC

The laboratory quality control report and the laboratory QA/QC compliance assessment report are provided in **Appendix B**. The findings of these results determined:

- No Method Blank outliers occur;
- No Duplicate outliers occur;
- No Laboratory Control outliers occur;
- Matrix Spike outliers exist;
- Surrogate recovery outliers exist;
- All samples were submitted and tested within analysis holding time compliance; and
- The number of QC samples was tested in accordance with or greater than guidance provided in NEPM (2012).

No results were qualified as unusable during the data review process due to undetermined matrix spike outliers, or to low surrogate recovery outliers.

Matrix spike recoveries were not determined for Aluminium and Iron in two (2) interlaboratory split samples (TC2, OC3D) due to the background level being greater than or equal to four times the spike level. NAGD (2009) recommends matrix spike data should not be reported if the naturally occurring levels in the sample are greater than twice the spiking level. Therefore, the matric spike recoveries for Aluminium and Iron can be omitted from reported results.

Surrogate recovery outliers for the PAH analytes Anthracene and 4-Terphenyl in two (2) (BP4, OC7) and three (3) (TC2, IC7, OC7) samples, respectively, were ≤3.1% lower than the ideal recovery rates. Given the minor variance below ideal recovery rates and that these analytes were not detectable above the LoR in any samples, it is considered unlikely that gross errors have occurred during the laboratory testing procedure which has significantly affected interpretation of the results.

4.6.2. Field QA/QC

The sediment vibracoring was selected as the appropriate methodology to collect sediment cores based on review of historical data indicating coarse or firm sediment present and sampling methods undertaken for the Wheatstone Project using a manually driven piston coring device encountering refusal at a depth of less than 0.4 m at 60 locations. The vibracoring method used was found to be limited in the depth due to surface wave action, although was successful in achieving cores to a depth of -2.2 m. Given the large size and abundance of shell grit and coral gravel encountered, which was often observed obstructing the core catcher on retrieval at a few locations, it is unlikely other sampling techniques would have provided the depth of cores recovered using the vibracorer.

Mechanical failure of the concrete vibrator hired in Onslow occurred during coring at some sites (i.e. IC7) where a deeper core may have been achieved. The vibracorer was replaced on the 17 March 2017. The sediment grab was also limited in sampling surface sediments with the shell grit and coral gravel often being caught between the buckets preventing complete closure and samples were lost on retrieval. Multiple grabs were required and samples homogenised to recover a suitable sample size at many locations in the outer channel.

Physical Sediment Characteristics

The RPD results for the physical sediment characteristics data for the field quality control samples are shown in **Table 18**, results are presented in full in **Appendix B**. The RPD of ±35% in field splits and ±50% in field replicates are not met between many split samples for mud (silt and clay), gravel sized fractions and TOC. This difference is likely associated with minor changes in small values calculating a large proportional change. Despite being outside the RPD, results were relatively consistent between the primary and secondary laboratory. The RPD for sand and moisture met the RPD across all samples. No results were qualified as unusable during the data review process due to RPDs not being met. Physical sediment characteristics are commonly used as estimates rather than precise values, so RPDs are not often required for these tested analytes.

Table 18 Relative percent difference (RPD) values for the physical sediment characteristics in the field quality control samples. Blue shaded cells identify values above the specified RPD.

Analytes	Clay (<2 µm)	Silt (2-60 µm)	Sand (0.06-2.00 mm)	Gravel (>2mm)	Cobbles (>6cm)	TOC (%)	Moisture (%)
Field Split Triplicates							
TC1	3	0	91	6	0	0.33	23.6
TC1-T2	3	4	85	8	0	0.08	21.7
TC1-T3	2	2	89	7	0	0.16	19.2
RPD (%)	37.5	100.0	6.8	28.6	0.0	131.6	20.5
TC1D	29	20	51	0	0	0.11	27.8
TC1D-T2	21	9	68	2	0	0.22	22.9
TC1D-T3	22	14	62	2	0	0.42	22.2
RPD (%)	33.3	76.7	28.2	150.0	0.0	124.0	23.1
OC1	3	4	87	6	0	0.11	25
OC1-T2	5	4	84	7	0	0.22	24.7
OC1-T3	4	6	80	10	0	0.33	21.7
RPD (%)	25.0	42.8	8.4	52.2	0.0	100.0	13.9

Analytes	Clay (<2 µm)	Silt (2-60 µm)	Sand (0.06-2.00 mm)	Gravel (>2mm)	Cobbles (>6cm)	TOC (%)	Moisture (%)
Field Replicates							
TC2	12	6	82	0	0	0.22	37.9
TC2-R2	13	12	75	0	0	0.03	39.7
RPD (%)	-8.00	66.7	8.9	0.0	0.0	152.0	4.6
IC1	1	0	90	9	0	0.02	12
IC1-R2	0	0	71	29	0	0.02	11
RPD (%)	200.0	0.0	23.6	105.3	0.0	0.0	8.7
OC7	5	4	77	14	0	0.06	17.7
OC7-R2	7	5	70	18	0	0.08	24.6
RPD (%)	33.3	22.2	9.5	25.0	0.0	28.6	32.6

Metals and Metalloids

The RPD results for metal concentrations from the field quality control samples are shown in **Table 19**, results are presented in full in **Appendix C**.

The RPD of ±35% is not met for Copper from split samples from TC1D (42%) in the berth pocket/ turning circle, and for Nickel also from TC1D (40.4%) as well as OC1 (43.6%) in the outer channel. NAGD (2009) recommends that results which fall outside these limits should be identified as estimates rather than precise values. However, the concentration of silt in sample TC1D (20%) is substantially greater than in split samples (TC1D-T2=9%, TC1D-T3=14%) and it is likely elevated concentrations of Copper and Nickel recorded in split samples at this location are due to differences in grain size. Similarly, Nickel concentrations recorded in OC1 split samples correlates with the proportion of sand size fractions. Closer inspection of the PSD results for split samples from OC1 indicates these differences are largely attributable to the very fine sand grainsizes (0.06-0.15 mm).

The RPD of ±50% is not met for Arsenic (57%), Cobalt (61%) and Copper (55%) from a replicate sample collected from IC1 in the inner channel. The proportion of gravel in sediments between IC1 (9%) and IC1-R2 (29%) is substantially different, indicating minor values higher than the ideal percent differences are likely due to heterogeneity in PSD of replicate samples.

No results were qualified as unusable during the data review process due to RPDs not being met. Results indicate higher than the ideal percent differences are likely due to heterogeneity of PSD in samples. A positive correlation for these metals and fine particle sizes has been demonstrated in **Figure 8**, with the exception of Arsenic. Elevated concentrations of Arsenic found within replicate samples at IC1 are well within the variability of results recorded during natural background concentrations and are likely to be based on natural origin.

Organic Compounds

Almost all results for organic compounds in field quality control samples are below the LoR, except for low values (<7 mg/kg) recorded in the C16-C34 carbon fractions for total petroleum hydrocarbons in samples collected from TC1 (split), TC2 and OC7 (replicates). These results were within the RPD of ±35% and ±50%, respectively. Therefore, the RPD results for organic concentrations are not presented, although results are presented in full in **Appendix B**.

Table 19 Relative percent difference (RPD) values for the total metal concentrations in the field quality control samples. Blue shaded cells identify values above the specified RPD.

Analytes	Al	Ag	As	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	V	Zn
Field Split Triplicates															
TC1	3440	<0.1	12.9	<0.1	5	19.7	5.5	14200	<0.01	272	8.6	2.6	<0.50	28.4	13.7
TC1-T2	3350	<0.1	12.6	<0.1	5	18.8	5	13300	<0.01	280	7.8	2.5	<0.50	28.1	13.1
TC1-T3	---	---	12.0	<0.1	---	19.0	5.1	---	<0.01	---	6.7	2.6	---	---	---
RPD (%)	2.7	0.0	7.2	0.0	0.0	3.7	7.7	6.6	0.0	2.9	24.7	0.0	0.0	1.1	4.5
TC1D	7030	<0.1	15.4	<0.1	16.8	52.9	27.6	38100	<0.01	591	26.5	8.7	<0.50	70.3	43
TC1D-T2	5820	<0.1	15.8	<0.1	13.1	39.6	17.8	27700	<0.01	535	18.6	6.7	<0.50	54.2	32.3
TC1D-T3	---	----	17.0	<0.1	----	44	23	---	<0.01	----	18	6.7	---	---	---
RPD (%)	18.8	0.0	10.0	0.0	24.8	29.2	43.0	31.6	0.0	10.0	40.4	27.2	0.0	25.9	28.4
OC1	3870	<0.1	21.4	<0.1	8.0	27.8	6.3	23200	<0.01	316	11.1	3.8	<0.50	47.1	16
OC1-T2	3740	<0.1	19.8	<0.1	7.4	24.9	5.4	21700	<0.01	326	9.3	3.5	<0.50	42.6	15
OC1-T3	---	---	20.0	<0.1	---	24.0	5.7	---	<0.01	---	7.1	3.4	---	---	---
RPD (%)	3.4	0.0	7.8	0.0	7.8	14.9	15.5	6.7	0.0	3.1	43.6	11.2	0.0	10.0	6.5
Field Replicates															
TC2	6300	<0.1	20	<0.1	8.6	32.8	11.5	25600	<0.01	297	13.6	5.4	<0.50	53.8	23.7
TC2-R2	7900	<0.1	23.2	<0.1	10.3	39.4	14.9	31000	<0.01	349	17	6.8	<0.50	63	30.2
RPD (%)	22.5	0.0	14.8	0.0	18.0	18.3	25.7	19.1	0.0	16.1	22.2	23.0	0.0	15.8	24.1
IC1	1300	<0.1	14.4	<0.1	3.5	9	1.7	12000	<0.01	399	3.4	1.3	<0.50	23.3	5.7
IC1-R2	2050	<0.1	25.9	<0.1	6.6	13.6	3	13200	<0.01	419	5	2.1	<0.50	30.5	7.6
RPD (%)	44.8	0.0	57.1	0.0	61.4	40.7	55.3	9.5	0.0	4.9	38.1	47.1	0.0	26.8	28.6
OC7	4610	<0.1	33.4	<0.1	12.3	29.8	6.4	29900	<0.01	634	10.4	5.4	<0.50	56.5	17.2
OC7-R2	4790	<0.1	29	<0.1	11.4	30.5	6.8	29800	<0.01	552	11.1	5.6	<0.50	55.5	17.7
RPD (%)	3.8	0.0	14.1	0.0	7.6	2.3	6.1	0.34	0.0	13.8	6.5	3.6	0.0	1.8	2.9

Nutrients

The RPD results for nutrients from the field quality control samples are shown in **Table 20**, results are presented in full in **Appendix B**. The RPD of ±35% in field splits is not met in two (2) samples for TKN/TN (TC1, OC1) and one (1) sample for TP (OC1). The RPD of ±50% in field replicates is not met in one (1) sample (TC2) for TKN/TN. All samples which did not meet RPDs also did not meet the relevant RPD for TOC. There does not appear to be an obvious trend between samples tested from the primary and secondary laboratory, indicating the variability observed is likely reflective of natural variability of test results rather than a laboratory processing error. In accordance with NAGD (2009), these results indicate nutrient concentrations should be identified as estimates rather than precise values.

Table 20 Relative percent difference (RPD) values for nutrients in the field quality control samples. Blue shaded cells identify values above the specified RPD.

Analyte	TKN/TN	TP
Field Splits		
TC1	50	113
TC1-T2	50	122
TC1-T3	100	140
RPD (%)	75.0	7.2
TC1D	200	216
TC1D-T2	190	212
TC1D-T3	235	250
RPD (%)	21.6	16.8
OC1	360	43
OC1-T2	200	167
OC1-T3	170	190
RPD (%)	78.1	110.3
Field Replicates		
TC2	120	126
TC2-R2	450	182
RPD (%)	115.8	36.4
IC1	30	75
IC1-R2	40	100
RPD (%)	28.6	28.6
OC7	200	256
OC7-R2	260	240
RPD (%)	26.1	6.5

Acid Sulfate Soils

The RPD results for PASS field screening tests from the field quality control samples are shown in **Table 21**, results are presented in full in **Appendix B**. The RPD of ±50% in field replicates are not met for the change in pH values in samples from TC2 in the turning circle and OC7 in the outer channel. This difference is likely associated with minor changes in small values calculating a large proportional change. However, results for

the change in pH have been used as estimates rather than precise values and a conservative approach of >2 units was adopted for interpretation of which samples should be investigated further using the chromium sulfer suite tests to characterise the risk of PASS.

Table 21 Relative percent difference (RPD) values for field screening test in the field quality control samples

Site	TC2	TC2-R2	TC2-R3	RPD	IC1	IC1-R2	IC1-R3	RPD	OC7	OC7-R2	OC7-R3	RPD
pH_F	8.29	8.88	7.91	11.60	8.6	8.72	8.76	1.84	8.16	8.15	8.33	2.19
pH_{FOX}	6.56	6.67	6.82	3.89	6.62	7.31	7.01	9.89	7.94	7.59	7.94	4.47
ΔpH	1.73	2.21	1.09	66.80	1.98	1.41	1.75	33.27	0.22	0.56	0.39	87.18

5. Discussion

5.1. Preliminary Site Investigation

The preliminary site investigation reviewed historical sediment investigations and potential sources of contaminants and identified that, with the exception of TBT, there are no known contaminants of potential concern within the berth pocket/turning circle, inner channel and outer channel areas. Therefore, all areas were classified as being as *"probably clean"*.

Capital dredging for the OMSB Project is undertaken in two (2) stages. In February 2014, BMT Oceanica referred a Capital Dredging Environmental Impact Assessment (DEIA) to the EPA under Part IV of the *Environmental Protection Act 1986* (EP Act) for Stage 1 capital dredging and construction of a land-backed wharf (BMT Oceanica 2014). The EPA provided advice of a decision to not assess the proposal in May 2014. Stage 1 capital dredging commenced in November 2016 and was completed days prior to implementing the field program for the detailed site investigation.

Sediment sampling undertaken in 2012 for Stage 1 collected sediment cores to 3 m from 15 locations within the berth pocket/turning circle and included an area immediately to the south for a proposed community boating precinct. Contaminants in sediments were found to not pose a risk to the local environment except for an area with elevated TBT at the southern boundary of the berth pocket. A more intensive assessment undertaken in 2016 defined the areas of TBT contamination within four (4) areas of the sampling cell to 1.5 m depth (Oceanica 2016). TBT concentrations in samples below 1.5 m depth met ISQG-Low values. It was hypothesised that the elevated TBT is related to a vessel grounding incident that had occurred at this location in 2009 or 2010 (BMT Oceanica 2014a). The management and monitoring program undertaken during Stage 1 capital dredging works included measures to manage the potential impacts of elevated TBT, including: containing known contaminated material in a settlement pond then moving to the reclamation area and capping using clean dredge material, diluting the dredge slurry to ensure dredge return water will meet the 90% species protection level, monitoring the water quality of the supernatant water and Beadon Creek waters, and sentinel oyster monitoring.

The identified TBT contaminated area only slightly encroaches into the proposed Stage 2 capital dredge footprint at the southern end of the proposed berth pocket and was found in surface sediments only within this area. Between 1.5 m and 3.5 m of surface sediment material has since been dredged and buried within the reclaimed wharf land-fill to mitigate the potential impacts of TBT. In addition, elevated TBT in supernatant water, Beadon Creek waters and in tissue of sentinel oysters was not detected during stage 1 dredging works. It is therefore considered sediment sampling undertaken for stage 1 supports the conclusion that the layer of potentially contaminated dredge material has been removed and the underlying natural geological materials are uncontaminated. Dredging of this material is therefore not likely to pose a risk to the local environment. These findings have been considered for development of a sampling design for the stage 2 field program.

5.2. Detailed Site Investigation

A detailed site investigation of sediments within the berth pocket/turning circle, inner channel and outer channel from the proposed Stage 2 capital dredge footprint was undertaken between the 15-18 March 2017. Sediment sampling was conducted under the guidance of the Oceanica (2016), DER (2014), NEPM (2013) and NAGD (2009). The vibracoring method was considered successful in collecting sediment cores down to a depth of -2.2 m in coarse firm sediment in which a manually driven piston corer used for the Wheatstone Project encountered refusal at a depth of less than -0.4 m at 60 locations. However, the coring method was limited in deep areas due to wave action and surface currents. The grab was used as a surrogate technique for sample collection. Sampling was limited by the abundant shell grit and coral gravel in surface sediments,

although sufficient sediment samples were obtained from all sites for testing at the laboratory. A summary of the results from the detailed site investigation is described below.

5.2.1. Sediment Properties

Surficial sediment samples from the berth pocket/turning circle, inner channel and outer channel are predominantly composed of brown fine sand with shelly grit. Sediments within the inner channel generally contain a less proportion of very fine sand and the outer channel samples are typically composed of higher gravel content consisting of shells and coral rubble. Analysis of PSD determined sand comprises an average of 83.5% in the berth pocket/turning circle, 85% in the inner channel and 79.9% in the outer channel. Sediments are typically low in moisture content and organic carbon characteristic of sediments with low fines content.

The samples from the berth pocket/turning circle are predominantly comprised of very fine to fine fractions (71%). Core samples tested at locations which have recently been dredged to 2.6 m CD (BP4, TC1) comprise a higher proportion of coarse sediment fractions in surface sediments (i.e. gravel 13% & 6%, respectively) which were absent from other samples in the berth pocket/turning circle. However, the coring process compared with surface grab samples may have contributed to collecting a higher proportion of coarse sediments at these locations. Higher clay content (21%-27% from split samples) in the deep sample (-1.5 m) at TC1D suggests clay contents may be present in higher quantities in the underlying geologic material. However, similar clay contents found in three (3) borehole samples between 2.5 m to 4.8 m depth from the geotechnical investigation undertaken in the Berth Pocket in July 2014 indicate higher clay contents may be an irregular feature of this sediment layer between the engineering geological units of the Marine/Estuarine Deposits and upper Onslow Red Beds. The core from BP4 encountered refusal at a relatively shallow depth (-0.7 m) on what is possibly low to high strength calcarenite/limestone cap rock consistent with the outcrops of the Tantabiddi Member of Bundera Calcarenite, which has not been found to extend below 2.5 m CD (CH2MHILL 2014). The low moisture and organic content with sandy sediments in samples from Beadon Creek suggest muddy fine sediment inputs are efficiently transported through the channel and are likely deposited at the entrance to the creek, along the bank or in the upper creek bed.

The samples from the inner channel are slightly coarser than sediment from the berth pocket/turning circle, comprising 65% fine to medium sand fractions and typically a lower proportion of muds and very fine sands (i.e. 12% compared to >30%), and higher proportion of gravels (i.e. 12% compared to 3%), including shelly grit, large shells and coral rubble. Samples collected with the grab (IC2, IC4, IC6) generally comprise less coarse sediment and deeper sediment samples (i.e. >1.5 m) comprise finer sand fractions and less gravel (shell grit and shells). However, higher concentrations of muds, fine sand, organic content and moisture are found within sediment samples collected from IC7, indicating this is a depositional area at the entrance to the creek. Refusal occurred at many sites at relatively shallow depths suggesting similar cap rock found in the berth pocket/turning circle on the Eastern bank of Beadon Creek. However, samples were observed to contain large shell grit obstructing the core catcher on retrieval, suggesting refusal may have been caused from a layer of loose large shell and coral rubble on occasions. The depth of -2.2 m at IC7 was terminated due to mechanical failure of the concrete vibrator and a deeper core is considered likely to be possible. Lower moisture, organic content and proportion of fine sand fractions than berth pocket/turning circle samples suggest tidal currents are stronger through the channel at the mouth of the creek, transporting mud (clays and silts) and slightly larger very fine sand fractions, depositing them outside the entrance to the creek, along the creek bank or in the upper creek bed. Although the observation describe loose medium sand, the anchor had difficulty grabbing within the inner channel suggesting the coarse sediment is relatively compact from the scouring of strong tidal currents.

Sediments within samples from the outer channel are typically dark brown or grey, comprising of very fine to fine sand ($\bar{x}$ = 58%) and typically higher gravel fractions ($\bar{x}$ = 13.5%) represented as shelly grit, large shells and coral rubble. Sampling of sediments at locations below 4 m CD depth using the vibracorer is limited and

consequently all outer channel samples at this depth or greater had to be collected using the grab. The depth of dredging in these areas and cores collected indicate homogenous sediment properties within surface sediment layers. Therefore, samples gathered are considered as being representative of the potentially contaminated sediment material to be dredged. Loose red/brown sand sediments are a common feature in samples collected with a grab from the outer part of the channel. The sediment is typically low in moisture and organic content except for location OC4 which records a TOC concentration of 0.66%, possibly representing *Halophila* spp. seagrass rhizomes found in this sample. Seagrass rhizomes are also found in samples OC7 and OC8, although TOC levels remained low possibly indicating organics are not homogenous throughout the sample.

5.2.2. Total Metals and Metalloids

The 95% UCL for concentrations for total metals (Ag, As, Cd, Cr, Cu, Hg, Ni, Sb, Zn) from samples within the berth pocket/turning circle, inner channel and outer channel are below the ISQG-Low and EIL screening levels except for Arsenic. The 95% UCL for Arsenic in the outer channel (29.5 mg/kg) exceeds the ISQG-Low (20 mg/kg). All relevant calculations for metal concentrations are below all HIL(s), and the medians for total metals (Al, Co, Fe, Mn, V) for which ISQG are not provided are below the 80th percentile of natural background concentrations for each area.

In accordance with NAGD (2009), if the 95% UCL of a contaminant exceeds the specified screening level, comparison to natural background concentrations is required. The mean and median values for Arsenic in the outer channel are below the 80th percentile of natural background concentrations. Sediments in Australia commonly have high natural levels of Arsenic (NAGD 2009). Elevated concentrations of Arsenic in Australian sediments have been shown to be of natural origin and related to sediment mineralogy and diagenetic processes (Davies 1979). No ISQG are provided for Aluminium, Cobalt, Iron, Manganese and Vanadium. The median concentrations for these metals in are below the 80th percentile of natural background concentrations. These results indicate dredging and onshore disposal dewatering of the sediment material is unlikely to result in loading of metal contaminants in the marine ecosystem.

Elevated concentrations of metals (Co, Cr, Cu, Fe, Ni, V, Zn) either above the ISQG-Low and/or background concentrations are recorded in sample TC1D. These elevated concentrations at TC1D are due to differences in grain size. The proportion of mud (clay and silt) contents in TC1D (49%) were substantially greater than other sites (0% to 18%) and split samples contained less silt content. Concentrations in split samples and at other sites were lower for almost all metals. The concentrations for total metals (Co, Cr, Cu, Fe, Ni, V & Zn) in sediment samples correlate strongly with the concentrations of Al, which is a proxy analyte to test for grainsize (Loring and Rantala 1992). These findings are consistent with previous sediment sampling which concluded grainsize is likely to be the principle factor which determines the concentrations of metals in sediments of the area (i.e. DEC 2010, Chevron 2010).

Elevated concentrations of metals in sediment were not recorded in any sample from the inner channel.

Arsenic exceeds the ISQG-Low in 10 of 12 samples within the outer channel although only one (1) of these samples exceeded the 80th percentile of natural background concentrations. Manganese exceeds the natural background concentrations in two (2) samples (OC5, OC7) and ISQG are not provided for this element. Isolated elevations above the 80th percentile is not unusual given these values are still likely to be within the statistical distribution of the range of baseline values.

5.2.3. Organic Compounds

Organic compounds including TPH, BTEX, PAHs and TBT are either below the laboratory LoR or are recorded at very low concentrations in samples tested from the berth pocket/turning circle, inner channel and outer channel. Therefore, the 95% UCL is below the ISQG-Low (NAGD 2009), ESLs, and all calculations are below HSLs (D) (NEPM 2011). This is consistent with historical sediment investigations in the area which have

previously recorded all concentrations of TPH, BTEX, and PAHs below the laboratory LoR and TBT was reported below the LoR in previous nearshore investigations (DEC 2010, Chevron 2010, Oceanica 2012). Low levels above the LoR recorded in this investigation for TPH is due to testing against a lower value LoR.

Detectable concentrations of TPH <6 mg/kg are only recorded within the C16-C34 carbon fractions from two (2) locations (TC1, TC2) in the berth pocket turning circle, one location (IC7) in the inner channel and three (3) locations in the outer channel. All samples tested for BTEX and PAHs record levels below the LoR. Traces of TBT, which was identified as a COPC in Stage 1 capital dredging, was recorded at the LoR concentration (0.5 µg Sn/kg normalised to 2.5 µg Sn/kg) in one (1) sampling location (BP4) within the berth pocket/turning circle and in one (1) sampling location (OC3) in the outer channel. All remaining samples tested were below the LoR. Results suggest dredging and onshore disposal dewatering of the sediment material is unlikely to result in loading of organic compounds in the marine ecosystem.

5.2.4. Nutrients

Inorganic forms of nutrients in sediments (NO_2, NO_3, NH_4, FRP) from all samples tested from the berth pocket/turning circle, inner channel and outer channel are below the LoR. The level of total TKN/TN and TP is therefore likely to be entirely organically bound and representative of low TOC in sediments which must be broken down into inorganic forms to be available for uptake by plants. Concentrations recorded during this investigation are similar to low concentrations of organic material reported in previous sampling within Beadon Creek (Oceanica 2010, 2014). These results indicate it is highly unlikely elevated nutrient loads will be released from sediments into the water column during dredging or into return waters during disposal.

5.2.5. Acid Sulfate Soils

All samples collected from the berth pocket/ turning circle, inner channel and outer channel were assessed for PASS using the field screening test to select high risk samples for further analysis using the chromium sulfer suite tests in the laboratory.

The pH values recorded during screening tests from all samples were within the expected values for marine waters (pH 8.2). Conservative classification of the screening test results were applied to selection of samples for further testing, which included:

- pH_{FOX} values <6,
- A change of >2 pH units between pH_F and pH_{FOX}; and
- Reaction ratings of 'High' or greater.

A total of 17 samples were selected for further chromium sulfer suite tests in the laboratory; five (5) samples from within the berth pocket/turning circle, five (5) samples from inner channel and seven (7) samples from the outer channel. Four (4) samples from the berth pocket/turning circle, three (3) samples from the inner channel and three (3) samples from the outer channel recorded sulfur values exceeding the action criterion of 0.03%S for managing acid sulfate soils. In accordance with recommendations from DER (2015), if the concentration meets or exceeds the 'action criteria', an acid sulfate soil management plan should be prepared for DER.

To determine the net acidity of the PASS sediment samples, quantitative laboratory analyses for PASS were undertaken to measure the net effect of acid-generating processes in the sediment, balanced against acid-neutralising (or basic) components that may be present. The results indicate that the potential acidity of these sediments are effectively buffered from the acid neutralising capacity (ANC), and therefore there would be a negative net acidity following disturbance of these sediments. These findings are similar to those found in previous investigations in Beadon Creek and the nearshore Onslow sediments (BMT Oceanica 2014, Chevron 2010c).

5.2.6. QA/QC Assessment

Review of the laboratory and field QA/QC outputs identified that no results collected during the detailed site investigation were qualified as being unusable during the data review process.

All laboratory QA/QC compliance assessments met necessary recommendations except matrix spike recoveries and surrogate recovery outliers. Matrix spike recoveries for Aluminium and Iron in two (2) interlaboratory split samples were not determined due to the background level being greater than or equal to four times the spike level. NAGD (2009) recommends that matrix spike data should not be reported if the naturally occurring levels in the sample are greater than twice the spiking level. Surrogate recovery outliers for two (2) PAH analytes were ≤3.1% lower than the ideal recovery rates. It was considered unlikely that gross errors have occurred during the laboratory testing procedure which has significantly affected interpretation of the results, particularly as all PAHs are below the LoR, which is consistent with previous investigations.

The RPD of 35% in field splits and ±50% in field replicates are not met in field control samples for many parameters. The sediment properties clay, silt, gravel and TOC were outside the RPD where low values are recorded and minor adjustments in small values result in a large proportional change. However, these sediment properties are commonly used as estimates rather than precise values for interpreting the sediment composition. The RPD was not met in control samples for Copper, Nickel, Cobalt and Arsenic. Results indicate higher than the ideal percent differences are likely due to heterogeneity of PSD in samples identified through regression analysis undertaken during the assessment for Copper, Nickel, Cobalt, whilst results for Arsenic was also considered to be based on natural differences between samples. The RPD was not met for TKN/TN in control field samples which likely reflects natural the variability of test results. Concentrations of TKN/TN were sufficiently low that the results can be interpreted as estimates rather than precise values. Despite being outside the RPD, all results were relatively consistent between the primary and secondary laboratory, indicating it is unlikely that gross errors have occurred during the laboratory testing procedure which has significantly affected interpretation of the results.

Assessment of the PASS field screening test for an RPD of ±50% in field replicates were not met for tested parameters although the classification for further testing is considered suitably conservative to allow for small variations in assessment of results between replicate samples to detect the risk of PASS.

5.3. Suitability of Material for Onshore Disposal

The material to be dredged is proposed to be disposed of at an onshore disposal site located at the back of the Light Industrial Area down to the airport adjacent to the East Arm of Beadon Creek. The material is proposed for future reuse to expand and develop the Light Industrial Area in Onslow as part of a strategic plan for the Shire of Ashburton. This assessment was undertaken to characterise the sediment within the proposed Stage 2 capital dredge area and undertake chemical and physical testing of the potentially contaminated materials to determine the suitability of this material for the proposed onshore disposal site. The assessment was undertaken in accordance with BMT Oceanica (2016), NEPM (2013) and NAGD (2009).

5.3.1. Suitability of Sediment Properties for Onshore Disposal

The Pilbara Ports Authority broadly categorises dredge material into five basic sediment property categories shown in **Table 22** to assist and guide proponents and contractors to manage dredge spoil resulting from capital works and maintenance programmes within Port limits (PPA 2012). Whilst the current project is not proposed to occur within port limits, this assessment of sediment properties was considered appropriate to onshore disposal for the OMSB project. Sediments to be dredged from each area are mainly composed of very fine to medium sands consistent with Category 2 in **Table 22**, which is considered broadly classified to be suitable for use as engineering grade fill and/or reclamation projects (PPA 2012). These results indicate sediment in the upper layers of the dredged material is suitable to be used for the future reuse proposal to expand and develop the Light Industrial Area in Onslow. However, it is acknowledged that the full volume of

the dredge material has not been sampled and further sampling of the final dewatered material would be required to prior to reuse.

Table 22 Dredge Material Categories from the Pilbara Ports Authority Dredging and Spoil Management Plan-Dampier (PPA 2012)

Category	Suitable for Recovery and Reuse?[1]	Material Description
1	No	Material unsuitable as engineering grade fill and/or reclamation projects such as high moisture content marine silts and ooze with varying proportions of silts, sand and clay. This may include material with an inherent structural strength (e.g. cut stiff to hard clays, ripped rock or rocklike material granular material with varying percentages of fines) but is discounted due to the propensity of the material to break down into colloidal material when handled causing excess turbidity and environmental concerns. This category may also include material with other properties which make it unsuitable for onshore disposal, such as high potential acid sulphate soils.
2	Yes	Fine to Medium (D_{50} 0.05 – 0.2mm) sands.
3	Yes	Coarse (D_{50} 0.2 – 2mm) sands.
4	Yes	Crushed rock and rock-like material.
5	Yes	Boulders and Blasted Rock.

[1] Material with nominal 90%+ coarser than 75 µm. This material is generally suitable for use onshore as a reclamation or engineered fill material.

5.3.2. Suitability of Sediment Contaminants for Onshore Disposal

Geochemical assessment of the material for identified COPCs from the review, including total metals and metalloids, organic compounds and nutrients, were compared to ISQG-Low, EILs, ESLs, HILs (D) and background concentrations for each area in order to inform appropriate marine ecological, terrestrial ecological and human health risk assessment. Testing of sediment from the berth pocket/turning circle, inner channel and outer channel capital dredge areas indicated total metals and metalloids (Al, Ag, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Sb, V & Zn), organic compounds (TPH, BTEX, PAH & TBT) and nutrients (TN, TKN, NH_4, NO_2+NO_3, TP, FRP) are below the ISQG-Low (NAGD 2009), EILs, ESLs, HILs (D) (NEPM 2011) and background concentrations. These results indicate further investigation of contaminants in sediments is not required and the material is composed of relatively clean sandy sediments. Dredging and onshore disposal of sediments to create the harbour approach channel is therefore unlikely to result in adverse effects to marine living resources, human health and terrestrial living resources, indicating the material is considered suitable for onshore disposal.

5.3.3. Suitability of Acid Sulfate Soils for Onshore Disposal

Acid sulfate soils are naturally occurring sediment that contain iron sulphides which upon disturbance by dredging and exposing it to oxygen through onshore disposal has the potential to cause significant environmental and economic impacts. Landgate's Shared Land Information Platform (SLIP) identified sediments within the proposed capital dredge area are classified as a high probability of PASS occurrence, although with very low confidence. Analysis of acid sulfate soils undertaken during the project determined samples from each area exceed the action criterion of 0.03%S for managing acid sulfate soils, indicating PASS sediments are present within the material to be dredged. In accordance with recommendations from DER (2015), an acid sulfate soil management plan should be prepared for submission to DER for the OMSB Project. However, quantitative laboratory analyses for PASS indicate the natural acid neutralising capacity of the sediment samples provide sufficient buffering for acid-generating processes, and treatment (i.e. lime dosing neutralisation of ASS) for excavated sediment is unlikely to be required. Therefore, the material is considered suitable for onshore disposal.

6. Conclusion

Sediments within the upper layers of the berth pocket/turning circle, inner channel and outer channel are typically comprised of sandy/ shelly material which is low in moisture and TOC. These properties are typically considered beneficial for engineering grade fill and/or reclamation projects, indicating the bulk of the material is expected to be suitable for the proposed future reuse plans to expand and develop the Light Industrial Area in Onslow for the Shire of Ashburton. However, it is acknowledged that the full volume of the dredge material has not been sampled and further sampling of the final dewatered material would be required to prior to reuse.

Geochemical laboratory testing of COPCs in sediments from the capital dredge areas was undertaken for total metals (Al, Ag, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Sb, V & Zn), organic compounds (TPH, BTEX, PAHs & TBT) and nutrients (TN, TKN, NH_4, NO_2+NO_3, TP, FRP). Laboratory results determined that all samples meet screening levels used for both onshore and ocean disposal, indicating dredging, loading (pumping) and onshore disposal proposed for the OMSB Project is unlikely to result in adverse effects to marine living resources, human health and terrestrial living resources. The guidelines for Acid Sulfate Soils (DER 2015) recommend an acid sulfate soil management plan should be prepared and submitted to DER for this project based on the presence of PASS within sediments to be dredged. However, based the natural acid neutralising capacity of sediments provide sufficient buffering for any acid-generating processes and the material is unlikely to need treatment strategies for onshore disposal (i.e. lime dosing neutralisation of ASS).

Results from the sediment quality assessment undertaken for the OMSB Project indicate that sandy clean uncontaminated sediments occur within the proposed capital dredge area which are considered suitable for onshore disposal.

7. References

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Appendix A Laboratory Chain of Custody Form

12pm 10/04/17

Sara Perkov Sara Perkov 10/04/17

From: Travis Hurley <travis.hurley@o2marine.com.au>
Sent: Saturday, 8 April 2017 1:42 AM
To: Sara Perkov; Lauren Ockwell
Cc: Samples Perth; ALS Enviro Perth
Subject: RE: Onslow Marine Support Base sediment sample testing
Attachments: SamplingRecord_COC_OMSB_revised.xlsx

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Sara/Lauren

Please can I request the following additional testing of the samples submitted and currently on hold.

1. Site TC1-1: TBT, Nutrients, Hydrocarbons
2. Site TC1-1-T2: TBT, Nutrients, Hydrocarbons, Metals, PSD/TOC
3. Site TC5: Metals, PSD/TOC, Chromium Reducible Sulphur

I have attached an updated CoC form with selected tests highlighted in Red. Please let me know if you would prefer a separate additional CoC form for these tests.

Please continue to hold additional samples in the event the regulatory authorities require further testing for approvals.

Regards

Travis Hurley
Principal Marine Ecologist

O2 MARINE

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W: www.o2marine.com.au

50 Cowcher Way (East), Medina, WA, 6167

Connect with us

Environmental Division
Perth
Work Order Reference
EP1703525

Telephone : +61-8-9209 7655

From: Travis Hurley
Sent: Wednesday, 22 March 2017 8:53 PM
To: 'Sara Perkov' <Sara.Perkov@ALSGlobal.com>
Cc: Samples Perth <Samples.Perth@ALSGlobal.com>; ALS Enviro Perth <ALSEnviro.Perth@ALSGlobal.com>
Subject: RE: Onslow Marine Support Base sediment sample testing

Hi Sara

Thanks for sending through these clarifications. Believe it or not, we did try to undertake a QA/QC process to confirm what samples were there. It was late at night when I was entering the changes required to reflect 'actual field samples collected' from the CoC form prefilled prior to fieldwork.

I have provided responses to these clarifications below in red.
Regards

Travis Hurley
Principal Marine Ecologist

O2 MARINE

M: +61 467 593 322
E: travis.hurley@o2group.com.au
W: www.o2marine.com.au

50 Cowcher Way (East), Medina, WA, 6167

Connect with us

From: Sara Perkov [mailto:Sara.Perkov@ALSGlobal.com]
Sent: Wednesday, 22 March 2017 7:07 PM
To: Travis Hurley <travis.hurley@o2marine.com.au>
Cc: Samples Perth <Samples.Perth@ALSGlobal.com>; ALS Enviro Perth <ALSEnviro.Perth@ALSGlobal.com>
Subject: Onslow Marine Support Base sediment sample testing

Good Evening Travis,

I am currently logging the sediment samples from the 'Onslow Marine Support Base' Project (ID17WAU-0008), and I have a few things to bring to your attention:

- We didn't receive a sample for *'OC8-0.5' Should be listed as OC8 in 250ml sample jar for elutriate testing to be placed on 'hold'*
- We received two additional samples not listed on the Chain of Custody; *'OC-05R'* and *'IC3R'* (250ml jar each) *Should be OC2-0.5R Meant to list 2J for both OC2-0.5 and IC3 which would include the R for each sample. The 250ml jars are for elutriate samples so will be placed on 'hold'.*

- The jars for sample *'IC8-0.5'* had large headspaces; therefore volatile analysis may be compromised. *Given volatile testing may be compromised on sample jar IC8-0.5, can we **not** undertake volatile organic analysis (BTEX, TRH, TPH, PAH) on IC8-0.5, and instead conduct volatile organic analysis on samples from IC4?* Additionally, there may not be enough sample to perform particle size analysis, but I have allocated as much sample as possible to this test. *Particle size analysis is considered very important for this program, can you please use any left over sample from chromium reducible sulphur test or if not enough please use the IC8 250ml elutriate sample to ensure you have enough required.*
- The jars for sample *'OC2-0.5'* had large headspaces; therefore volatile analysis may be compromised. *Given volatile testing may be compromised on sample jar OC2-0.5, can we **not** undertake volatile organic analysis (BTEX, TRH, TPH, PAH) on OC2-0.5, and instead conduct volatile organic analysis on samples from OC5?*
- Sample *'TC1-0.5'* on the Chain of Custody was labelled *'TC1-0.5-T1'*. Yes, correct. My notes from our QC check in the field indicate the Particle Size Distribution Sample (as a minimum) was labelled *'TC1-0.5-T1'*.
- Sample *'IC7'* was broken on arrival; however the bottom of the jar was broken off quite cleanly and I was able to salvage most of the sample. I'm glad that you were able to salvage the sample ☺
- I have placed all unused samples on hold. *Thankyou very much. Once we have the results we should be able to determine what further sampling will be required, what samples will need to be stored and what samples can be discarded.*

Your ALS workorder is EP1702676 please don't hesitate to contact me should you have any queries about this job.

Kind Regards,

Sara Perkov
Sample Receipt Officer
Environmental

LAB NEWS: ALS Perth Christmas Closures

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Chain of Custody (CoC) Record

Project:	Onslow Marine Support Base			Laboratory:	ALS										Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager. Email laboratory analysis results to O2M Project Manager.
				Address:	10 Hod Way Malaga										
Client:	OMSB Pty Ltd	Job No.:	17WAU-0008	Lab. Contact:	Lauren Ockwell										
				Containers				Analyses							
Lab Quote No.:	N/A	Turnaround Time:	Standard	Sample Matrix S-Soil / MS - Marine Sediment / W-Water / A-Air	Type B-Bottle / J-Jar / V-Vial / G-Glass / P-Plastic / B-Bag	No. of Samples	Total Volume (mL)	Organotins - TBT	Nutrients - TN, TKN, TP, NH4, NO2, NO3, FRP	BTEX, TRH, TNH, PAH	Trace Metals (As, Ag, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, Se, V, Zn)	Chromium Reducible Sulphur Suite	Particle Size Distribution, TOC		
O2M Project Manager	Travis Hurley 0467 593 322	Email Address:	travis.hurley@o2marine.com.												
O2M Sample ID	Laboratory Sample ID	Date	Time												Comments
BP1		15/03/2017	10:20	MS	2J, 2P	4	1100					X			Hold untested samples until further advice
BP2		15/03/2017	9:23	MS	2J, 2P	4	1100								Hold All Sample Testing until further advice
BP3		15/03/2017	9:28	MS	2J, 2P	4	1100								Hold All Sample Testing until further advice
BP4		16/03/2017	7:02	MS	2J, 2P	4	1100	X	X	X	X			X	Hold untested samples until further advice
TC2-R1		15/03/2017	11:06	MS	2J, 2P	4	1100	X	X	X	X	X		X	
TC2-R2		15/03/2017	11:06	MS	2J, 2P	4	1100								Hold All Sample Testing until further advice
TC1-0.5		15/03/2017	16:36	MS	2J, 1P	3	900	X	X	X	X			X	
TC1-1		15/03/2017	16:36	MS	2J, 2P	4	1100	X	X	X	X	X		X	
TC2		15/03/2017	11:06	MS	2J, 2P	4	1100	X	X	X	X			X	Hold untested samples until further advice
TC3		15/03/2017	10:25	MS	2J, 2P	4	1100					X			Hold untested samples until further advice
TC4		15/03/2017	13:41	MS	2J, 2P	4	1100	X			X			X	Hold untested samples until further advice
TC1-0.5-T2		15/03/2017	16:36	MS	2J, 2P	4	1100	X	X	X	X			X	Hold untested samples until further advice
TC1-T2-1		15/03/2017	16:36	MS	2J, 2P	4	1100	X	X	X	X			X	Hold untested samples until further advice
TC5		17/03/2017	10:00	MS	2J, 2P	4	1100				X	X		X	Hold untested samples until further advice
IC1		18/03/2017	15:30	MS	2J, 2P	4	1100	X	X	X	X			X	Hold untested samples until further advice
IC1-1.0		18/03/2017	15:30	MS	2J, 2P	4	1100					X			Hold untested samples until further advice
IC2		15/03/2017	13:45	MS	1J, 2P	3	950		X	X	X			X	Hold untested samples until further advice
IC3-0.5		16/03/2017	16:49	MS	2J, 2P	4	1100	X			X	X		X	Hold untested samples until further advice
IC3-1		16/03/2017	16:49	MS	2J, 2P	4	1100								Hold All Sample Testing until further advice
IC4		16/03/2017	10:23	MS	2J, 2P	4	1100	X		X	X			X	Hold untested samples until further advice
IC5-0.5		18/03/2017	9:50	MS	2J, 2P	4	1100	X	X	X	X			X	Hold untested samples until further advice
IC5-1		18/03/2017	9:50	MS	2J, 2P	4	1100					X			Hold untested samples until further advice
IC6		16/03/2017	10:26	MS	2J, 2P	4	1100	X			X			X	Hold untested samples until further advice
IC7-0.5		16/03/2017	17:41	MS	2J, 2P	4	1100	X	X	X	X			X	Hold untested samples until further advice
IC7-1		16/03/2017	17:41	MS	2J, 2P	4	1100				X			X	Hold untested samples until further advice
IC8-0.5		18/03/2017	9:25	MS	1J, 2P	3	950		X		X	X		X	
IC8-1		18/03/2017	9:25	MS	2J, 2P	4	1100								Hold All Sample Testing until further advice
IC1-R2		18/03/2017	15:45	MS	2J, 2P	4	1100	X	X	X	X			X	Hold All Sample Testing until further advice
IC1-R3		18/03/2017	16:00	MS	2J, 2P	4	1100								Hold All Sample Testing until further advice
IC5-1.5		18/03/2017	9:50	MS	1P	4	200					X			
OC1-0.5-T1		17/03/2017	12:00	MS	2J, 2P	4	1100	X	X	X	X	X		X	Hold untested samples until further advice
OC1-1		17/03/2017	12:00	MS	2J, 2P	5	1100								Hold All Sample Testing until further advice
OC2-0.5		18/03/2017	8:30	MS	2J, 2P	4	1100	X	X		X			X	Hold untested samples until further advice

Sampled By:		Date/Time:		Relinquished By:	
Received By Lab:		Date/Time:		Courier:	
Sample Cold (Yes/No):		Sample Container Sealed (Yes/No):			

Chain of Custody (CoC) Record

Project:	Onslow Marine Support Base			Laboratory:	ALS									Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager. Email laboratory analysis results to O2M Project Manager.
				Address:	10 Hod Way Malaga									
Client:	OMSB Pty Ltd	Job No.:	WA16-0013	Lab. Contact:	Lauren Ockwell									
				Containers				Analyses						
Lab Quote No.:	N/A	Turnaround Time:	Standard	Sample Matrix S-Soil / MS - Marine Sediment / W-Water / A-Air	Type B-Bottle / J-Jar / V-Vial / G-Glass / P-Plastic / Bag	No. of Samples	Total Volume (mL)	Organotins - TBT	Nutrients - TN, TON, TP, NH4, NO2, NO3, FRP	BTEX, TRH, TPH, PAH	Trace Metals (As, Ag, Al, Cd, Co, Cu, Fe, Hg, Mn, Ni, Pb, Sb, Se, V, Zn)	Chromium Reducible Sulphur Suite	Particle Size Distribution, TOC	
O2M Project Manager	Travis Hurley	Email Address:												
	0467 593 322	travis.hurley@o2marine.com.												
O2M Sample ID	Laboratory Sample ID	Date	Time											Comments
OC2-1		18/03/2017	8:30	MS	2J, 2P	4	1100				X		X	Hold untested samples until further advice
OC3-0.5		17/03/2017	8:35	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
OC3-1		17/03/2017	8:35	MS	2J, 2P	4	1100				X		X	Hold untested samples until further advice
OC4-0.5		17/03/2017	11:20	MS	2J, 2P	4	1100	X	X	X	X	X	X	
OC4-1		17/03/2017	11:20	MS	2J, 2P	4	1100					X		Hold untested samples until further advice
OC5		18/03/2017	14:20	MS	2J, 2P	4	1100	X		X	X	X	X	Hold untested samples until further advice
OC6		17/03/2017	15:42	MS	2J, 2P	4	1100	X			X	X	X	Hold untested samples until further advice
OC7		18/03/2017	15:30	MS	2J, 2P	4	1100	X	X	X	X	X	X	
OC8		17/03/2017	15:14	MS	2J, 2P	4	1100	X			X		X	Hold untested samples until further advice
OC9		17/03/2017	15:21	MS	2J, 2P	4	1100	X			X	X	X	Hold untested samples until further advice
OC10		17/03/2017	16:16	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
OC7-R2-0.5		18/03/2017	15:30	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
OC7-R3-0.5		18/03/2017	15:30	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
OC1-0.5-T2		17/03/2017	12:00	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
DS1		20/03/2017	10:00	S	2J, 1P	4	500							Hold All Sample Testing until further advice
DS2		20/03/2017	11:00	S	2J, 1P	4	500							Hold All Sample Testing until further advice
FIELDB				S	1J	1	250							
BP4		16/03/2017	7:02	MS	2J	1	500							Hold All Sample Testing until further advice
TC1-0.5		15/03/2017	16:36	MS	1J	1	250							Hold All Sample Testing until further advice
TC1-1		15/03/2017	16:36	MS	1J	1	250							Hold All Sample Testing until further advice
TC2		15/03/2017	11:06	MS	2J	1	500							Hold All Sample Testing until further advice
IC3		16/03/2017	16:49	MS	2J	1	250							Hold All Sample Testing until further advice
IC5-0.5		18/03/2017	9:50	MS	1J	1	250							Hold All Sample Testing until further advice
IC7		16/03/2017	17:41	MS	1J	1	250							Hold All Sample Testing until further advice
IC8		18/03/2017	9:25	MS	1J	1	250							Hold All Sample Testing until further advice
IC2		15/03/2017	13:45	MS	1J	1	250							Hold All Sample Testing until further advice
OC2-0.5		18/03/2017	8:30	MS	2J	1	250							Hold All Sample Testing until further advice
OC3		17/03/2017	8:35	MS	1J	1	250							Hold All Sample Testing until further advice
OC4-0.5		17/03/2017	11:20	MS	1J	1	250							Hold All Sample Testing until further advice
OC8		17/03/2017	15:14	MS	1J	1	250							Hold All Sample Testing until further advice
OC10		17/03/2017	16:16	MS	1J	1	250							Hold All Sample Testing until further advice
OC4-1.0		17/03/2017	11:20	MS	2J	2	500							Hold All Sample Testing until further advice
Sampled By:			Date/Time:				Relinquished By:							
Received By Lab:			Date/Time:				Courier:							
Sample Cold (Yes/No):		Sample Container Sealed (Yes/No):												

Chain of Custody (CoC) Record

Project:	Onslow Marine Support Base	Laboratory:	ALS
		Address:	10 Hod Way Malaga
Client:	OMSB Pty Ltd	Job No.:	WA16-0013
		Lab. Contact:	Lauren Ockwell
Lab Quote No.:	N/A	Turnaround Time:	Standard
O2M Project Manager	Travis Hurley 0467 598 322	Email Address:	travis.hurley@o2marine.com.

Please Note:
Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager.

Email laboratory analysis results to O2M Project Manager.

O2M Sample ID	Laboratory Sample ID	Date	Time	Containers: Sample Matrix S-Soil / MS - Marine Sediment / W-Water / A-Air	Containers: Type B-Bottle / J-Jar / V-Vial / G-Glass / P-Plastic / B-Bag	Containers: No. of Samples	Total Volume (mL)	Analyses: Elutriate Sample - TBA	Analyses	Analyses	Analyses	Analyses	Analyses	Comments

Sampled By:		Date/Time:	
Received By Lab:		Date/Time:	
Sample Cold (Yes/No):		Sample Container Sealed (Yes/No):	
Relinquished By:			
Courier:			

Chain of Custody (CoC) Record

O2 MARINE

Project:	Onslow Marine Support Base			Laboratory:	ALS
				Address:	10 Hod Way Malaga
Client:	OMSB Pty Ltd	Job No.:	17WAU-0008	Lab. Contact:	Lauren Ockwell
Lab Quote No.:	N/A	Turnaround Time:	Standard		
O2M Project Manager	Travis Hurley 0467 593 322	Email Address:	travis.hurley@o2marine.com		

Please Note:
Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager.

Email laboratory analysis results to O2M Project Manager.

O2M Sample ID	Laboratory Sample ID	Date	Time	Sample Matrix S-Soil / MS - Marine Sediment / W-Water / A-Air	Containers: Type B-Bottle / J-Jar / V-Vial / G-Glass / P-Plastic / B-Bag	Containers: No. of Samples	Containers: Total Volume (mL)	Analyses: Organotins - TBT	Analyses: Nutrients - TN, TKN, TP, NH4, NO2, NO3, FRP	Analyses: BTEX, TRH, TPH, PAH	Analyses: Trace Metals (Al, Ag, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, Se, V, Zn)	Analyses: Chromium Reducible Sulphur Suite	Analyses: Particle Size Distribution, TOC	Comments
BP1	1	15/03/2017	10:20	MS	2J, 2P	4	1100					X		Hold untested samples until further advice
BP2	2	15/03/2017	9:23	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
BP3	3	15/03/2017	9:28	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
BP4	4	16/03/2017	7:02	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
TC2-R1	5	15/03/2017	11:06	MS	2J, 2P	4	1100	X	X	X	X	X	X	
TC2-R2	6	15/03/2017	11:06	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
TC1-0.5	7	15/03/2017	16:36	MS	2J, 1P	3	900	X	X	X	X		X	
TC1-1	8	15/03/2017	16:36	MS	2J, 2P	4	1100				X	X	X	Hold untested samples until further advice
TC2	9	15/03/2017	11:06	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
TC3	10	15/03/2017	10:25	MS	2J, 2P	4	1100					X		Hold untested samples until further advice
TC4	11	15/03/2017	13:41	MS	2J, 2P	4	1100	X			X		X	Hold untested samples until further advice
TC1-0.5-T2	12	15/03/2017	16:36	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
TC1-T2-1	13	15/03/2017	16:36	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
TC5	14	17/03/2017	10:00	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
IC1	15	18/03/2017	15:30	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
IC1-1.0	16	18/03/2017	15:30	MS	2J, 2P	4	1100					X		Hold untested samples until further advice
IC2	17	15/03/2017	13:45	MS	1J, 2P	3	950		X	X	X		X	Hold untested samples until further advice
IC3-0.5	18	16/03/2017	16:49	MS	2J, 2P	4	1100	X			X	X	X	Hold untested samples until further advice
IC3-1	19	16/03/2017	16:49	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
IC4	20	16/03/2017	10:23	MS	2J, 2P	4	1100	X		X	X		X	Hold untested samples until further advice
IC5-0.5	21	18/03/2017	9:50	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
IC5-1	22	18/03/2017	9:50	MS	2J, 2P	4	1100					X		Hold untested samples until further advice
IC6	23	16/03/2017	10:26	MS	2J, 2P	4	1100	X			X		X	Hold untested samples until further advice
IC7-0.5	24	16/03/2017	17:41	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
IC7-1	25	16/03/2017	17:41	MS	2J, 2P	4	1100				X		X	Hold untested samples until further advice
IC8-0.5	26	18/03/2017	9:25	MS	1J, 2P	3	950		X		X	X	X	
IC8-1	27	18/03/2017	9:25	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
IC1-R2	28	18/03/2017	15:45	MS	2J, 2P	4	1100	X	X	X	X		X	Hold All Sample Testing until further advice
IC1-R3	29	18/03/2017	16:00	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
IC5-1.5	30	18/03/2017	9:50	MS	1P	4	200					X		
OC1-0.5-T1	31	17/03/2017	12:00	MS	2J, 2P	4	1100	X	X	X	X	X	X	Hold untested samples until further advice
OC1-1	32	17/03/2017	12:00	MS	2J, 2P	5	1100							Hold All Sample Testing until further advice
OC2-0.5	33	18/03/2017	8:30	MS	2J, 2P	4	1100	X	X		X		X	Hold untested samples until further advice

Sampled By:		Date/Time:		Relinquished By:	
Received By Lab:		Date/Time:		Courier:	
Sample Cold (Yes/No):		Sample Container Sealed (Yes/No):			

Environmental Division
Perth
Work Order Reference
EP1702676

Chain of Custody (CoC) Record

Project:	Onslow Marine Support Base			Laboratory:				ALS						Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager. Email laboratory analysis results to O2M Project Manager.
				Address:				10 Hod Way Malaga						
Client:	OMSB Pty Ltd	Job No.:	WA16-0013	Lab. Contact:				Lauren Ockwell						
				Containers				Analyses						
Lab Quote No.:	N/A	Turnaround Time:	Standard	Sample Matrix S-Soil / WS - Marine Sediment / W-Water / A-Air	Type B-Bottle / H-Jar / VA-Vial / G-Glass / P-Plastic / B-Bag	No. of Samples	Total Volume (mL)	Organotins - TBT	Nutrients - TN, TON, TP, FRP, NO3, NOX, FRP	BTEX, TPH, TPH, PAH	Trace Metals (Ag, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, Se, V, Zn)	Chromium Reducible Sulphur Suite	Particle Size Distribution, TOC	
O2M Project Manager	Travis Hurley 0467 593 322	Email Address:	travis.hurley@o2marine.com											
O2M Sample ID	Laboratory Sample ID	Date	Time											Comments
OCZ-1	34	18/03/2017	8:30	MS	2J, 2P	4	1100				X		X	Hold untested samples until further advice
OC3-0.5	35	17/03/2017	8:35	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
OC3-1	36	17/03/2017	8:35	MS	2J, 2P	4	1100				X		X	Hold untested samples until further advice
OC4-0.5	37	17/03/2017	11:20	MS	2J, 2P	4	1100	X	X	X	X	X	X	
OC4-1	38	17/03/2017	11:20	MS	2J, 2P	4	1100					X		Hold untested samples until further advice
OC5	39	18/03/2017	14:20	MS	2J, 2P	4	1100	X		X	X	X	X	Hold untested samples until further advice
OC6	40	17/03/2017	15:42	MS	2J, 2P	4	1100	X			X	X	X	Hold untested samples until further advice
OC7	41	18/03/2017	15:30	MS	2J, 2P	4	1100	X	X	X	X	X	X	
OC8	42	17/03/2017	15:14	MS	2J, 2P	4	1100	X			X		X	Hold untested samples until further advice
OC9	43	17/03/2017	15:21	MS	2J, 2P	4	1100	X			X	X	X	Hold untested samples until further advice
OC10	44	17/03/2017	16:16	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
OC7-R2-0.5	45	18/03/2017	15:30	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
OC7-R3-0.5	46	18/03/2017	15:30	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
OC1-0.5-T2	47	17/03/2017	12:00	MS	2J, 2P	4	1100	X	X	X	X		X	Hold untested samples until further advice
DS1	48	20/03/2017	10:00	S	2J, 1P	4	500							Hold All Sample Testing until further advice
DS2	49	20/03/2017	11:00	S	2J, 1P	4	500							Hold All Sample Testing until further advice
FIELDB	50			S	1J	1	250							
BP4	4	16/03/2017	7:01	MS	2J	1	500							Hold All Sample Testing until further advice
TC1-0.5	51	15/03/2017	16:36	MS	1J	1	250							Hold All Sample Testing until further advice
TC1-1	52	15/03/2017	16:36	MS	1J	1	250							Hold All Sample Testing until further advice
TC2	9	15/03/2017	11:06	MS	2J	1	500							Hold All Sample Testing until further advice
IC3	53	16/03/2017	16:49	MS	2J	1	250							Hold All Sample Testing until further advice
IC5-0.5	21	18/03/2017	9:50	MS	1J	1	250							Hold All Sample Testing until further advice
IC7	54	16/03/2017	17:41	MS	1J	1	250							Hold All Sample Testing until further advice
IC8	55	18/03/2017	9:25	MS	1J	1	250							Hold All Sample Testing until further advice
IC2	17	15/03/2017	13:45	MS	1J	1	250							Hold All Sample Testing until further advice
OC2-0.5	33	18/03/2017	8:30	MS	2J	1	250							Hold All Sample Testing until further advice
OC9	56	17/03/2017	8:35	MS	1J	1	250							Hold All Sample Testing until further advice
OC4-0.5	37	17/03/2017	11:20	MS	1J	1	250							Hold All Sample Testing until further advice
OC8	42	17/03/2017	15:14	MS	1J	1	250							Hold All Sample Testing until further advice
OC10	44	17/03/2017	16:16	MS	1J	1	250							Hold All Sample Testing until further advice
OC4-1.0	38	17/03/2017	11:20	MS	2J	2	500							Hold All Sample Testing until further advice

Sampled By:		Date/Time:		Relinquished By:	
Received By Lab:		Date/Time:		Courier:	
Sample Cold (Yes/No):		Sample Container Sealed (Yes/No):			

Jessica Walker 10:37 16/05/17

From: Marnie Thomsett
Sent: Tuesday, 16 May 2017 10:37 AM
To: Samples Perth
Subject: FW: Sediment Cation Exchange Capacity Tests

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: URGENT attention

Hi,

A re-batch as described below.

For Job: EP1702676 can we please test sample DC4-0.5 for:
Cation exchange capacity

Thanks

Kind Regards,

Marnie Thomsett
Client Services Officer
Malaga, Western Australia

T +61 8 9209 7655 D +61 8 9209 7632
F +61 8 9209 7600
Marnie.thomsett@alsglobal.com
10 Hod Way
Malaga WA 6090
AUSTRALIA

Environmental Division
Perth
Work Order Reference
EP1705039

Telephone : +61-8-9209 7655

We are keen for your feedback! Please click here for your 1 question survey

EnviroMail™ 111 - Analysis of VOCs by Thermal Desorption Analysis

EnviroMail™ 110 - Identifying Hidden PFAS Chemicals in Environmental Samples and Firefighting Foams

EnviroMail™ 109 - PFOS Trace Analysis to Meet Trace Guideline Requirements

EnviroMail™ 00 - Summary of all EnviroMails™ by Category

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www.alsglobal.com

From: Travis Hurley [mailto:travis.hurley@o2marine.com.au]
Sent: Monday, 15 May 2017 5:34 PM
To: Marnie Thomsett <marnie.thomsett@ALSGlobal.com>
Subject: RE: Sediment Cation Exchange Capacity Tests

Hi Marnie

The selected samples for each job are listed below:
TBH4A

Chain of Custody (CoC) Record

O2 MARINE

Project:	Onslow Marine Support Base		
Client:	OMSB Pty Ltd	Job No.:	17WAU-0008
Lab Quote No.:	N/A	Turnaround Time:	Standard
O2M Project Manager:	Travis Hurley 0467 593 322	Email Address:	travis.hurley@o2marine.com

Laboratory:	ALS
Address:	10 Hod Way Malaga
Lab. Contact:	Lauren Ockwell

Please Note:
Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager.

Email laboratory analysis results to O2M Project Manager.

O2M Sample ID	Laboratory Sample ID	Date	Time	Sample Matrix S-Soil / MS - Marine Sediment / W-Water / A-Air	Containers: Type S-Bottle / J-Jar / V-Vial / G-Glass / P-Plastic / B-Bag	Containers: No. of Samples	Containers: Total Volume (mL)	Analyses: Organotins - TBT	Analyses: Nutrients - TN, TKN, TP, NH4, NO2, NO3, FRP	Analyses: BTEX, TRH, TPH, PAH	Analyses: Trace Metals (Al, Ag, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, Se, V, Zn)	Analyses: Chromium Reducible Sulphur Suite	Analyses: Particle Size Distribution, TOC	Comments
BP1	1	15/03/2017	10:20	MS	2J, 2P	4	1100					x		Hold untested samples until further advice
BP2	2	15/03/2017	9:23	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
BP3	3	15/03/2017	9:28	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
BP4	4	16/03/2017	7:02	MS	2J, 2P	4	1100	x	x	x	x		x	Hold untested samples until further advice
TC2-R1	5	15/03/2017	11:06	MS	2J, 2P	4	1100	x	x	x	x	x	x	
TC2-R2	6	15/03/2017	11:06	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
TC1-0.5	7	15/03/2017	16:36	MS	2J, 1P	3	900	x	x	x	x		x	
TC1-1	8	15/03/2017	16:36	MS	2J, 2P	4	1100				x	x	x	Hold untested samples until further advice
TC2	9	15/03/2017	11:06	MS	2J, 2P	4	1100	x	x	x	x		x	Hold untested samples until further advice
TC3	10	15/03/2017	10:25	MS	2J, 2P	4	1100					x		Hold untested samples until further advice
TC4	11	15/03/2017	13:41	MS	2J, 2P	4	1100	x			x		x	Hold untested samples until further advice
TC1-0.5-T2	12	15/03/2017	16:36	MS	2J, 2P	4	1100	x	x	x	x		x	Hold untested samples until further advice
TC1-T2-1	13	15/03/2017	16:36	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
TC5	14	17/03/2017	10:00	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
IC1	15	18/03/2017	15:30	MS	2J, 2P	4	1100	x	x	x	x		x	Hold untested samples until further advice
IC1-1.0	16	18/03/2017	15:30	MS	2J, 2P	4	1100					x		Hold untested samples until further advice
IC2	17	15/03/2017	13:45	MS	1J, 2P	3	950		x	x	x		x	Hold untested samples until further advice
IC3-0.5	18	16/03/2017	16:49	MS	2J, 2P	4	1100	x			x	x	x	Hold untested samples until further advice
IC3-1	19	16/03/2017	16:49	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
IC4	20	16/03/2017	10:23	MS	2J, 2P	4	1100	x		x	x		x	Hold untested samples until further advice
IC5-0.5	21	18/03/2017	9:50	MS	2J, 2P	4	1100	x	x	x	x		x	Hold untested samples until further advice
IC5-1	22	18/03/2017	9:50	MS	2J, 2P	4	1100					x		Hold untested samples until further advice
IC6	23	16/03/2017	10:26	MS	2J, 2P	4	1100	x			x		x	Hold untested samples until further advice
IC7-0.5	24	16/03/2017	17:41	MS	2J, 2P	4	1100	x	x	x	x		x	Hold untested samples until further advice
IC7-1	25	16/03/2017	17:41	MS	2J, 2P	4	1100				x		x	Hold untested samples until further advice
IC8-0.5	26	18/03/2017	9:25	MS	1J, 2P	3	950		x		x	x	x	
IC8-1	27	18/03/2017	9:25	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
IC1-R2	28	18/03/2017	15:45	MS	2J, 2P	4	1100	x	x	x	x		x	Hold All Sample Testing until further advice
IC1-R3	29	18/03/2017	16:00	MS	2J, 2P	4	1100							Hold All Sample Testing until further advice
IC5-1.5	30	18/03/2017	9:50	MS	1P	4	200					x		
OC1-0.5-T1	31	17/03/2017	12:00	MS	2J, 2P	4	1100	x	x	x	x	x	x	Hold untested samples until further advice
OC1-1	32	17/03/2017	12:00	MS	2J, 1P	5	1100							Hold All Sample Testing until further advice
OC2-0.5	33	10/03/2017	8:30	MS	2J, 2P	4	1100	x	x		x		x	Hold untested samples until further advice

Sampled By:		Date/Time:		Relinquished By:	
Received By Lab:		Date/Time:		Courier:	
Sample Cold (Yes/No):		Sample Container Sealed (Yes/No):			

Environmental Division
Perth
Work Order Reference
EP1702676

Chain of Custody (CoC) Record

Project:	Onslow Marine Support Base			Laboratory:	ALS															Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager. Email laboratory analysis results to O2M Project Manager.	
				Address:	10 Hod Way Malaga																
Client:	OMSB Pty Ltd	Job No.:	WA16-0013	Lab. Contact:	Lauren Dickwell																
					Containers				Analyses												
Lab Quote No.:	N/A	Turnaround Time:	Standard		Sample Matrix (Soil / W - Marine Sediment / W-Water / A-Air)	Type (P-Bottle / J-Jar / V-Vial / G-Glass / P-Plastic / B-Bag)	No. of Samples	Total Volume (mL)	Organotins - TBT	Nutrients - TN, TKN, TP, NH4, NOx, NO3, FRP	BTEX, TRH, TPH, PAH	Trace Metals (Al, Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Sb, Se, V, Zn)	Chromium Reducible Sulphur Suite	Particle Size Distribution, TOC		
O2M Project Manager	Travis Hurley 0467 593 822	Email Address:	travis.hurley@o2marine.com.																		
O2M Sample ID	Laboratory Sample ID	Date	Time																	Comments	
OC2-1	34	18/03/2017	8:30		MS	2J, 2P	4	1100				X		X						Hold untested samples until further advice	
OC3-0.5	35	17/03/2017	8:35		MS	2J, 2P	4	1100	X	X	X	X		X						Hold untested samples until further advice	
OC3-1	36	17/03/2017	8:35		MS	2J, 2P	4	1100				X		X						Hold untested samples until further advice	
OC4-0.5	37	17/03/2017	11:20		MS	2J, 2P	4	1100	X	X	X	X	X	X							
OC4-1	38	17/03/2017	11:20		MS	2J, 2P	4	1100					X							Hold untested samples until further advice	
OC5	39	18/03/2017	14:20		MS	2J, 2P	4	1100	X		X	X	X	X						Hold untested samples until further advice	
OC6	40	17/03/2017	15:42		MS	2J, 2P	4	1100	X			X	X	X						Hold untested samples until further advice	
OC7	41	18/03/2017	15:30		MS	2J, 2P	4	1100	X	X	X	X	X	X							
OC8	42	17/03/2017	15:14		MS	2J, 2P	4	1100	X			X		X						Hold untested samples until further advice	
OC9	43	17/03/2017	15:21		MS	2J, 2P	4	1100	X			X	X	X						Hold untested samples until further advice	
OC10	44	17/03/2017	16:15		MS	2J, 2P	4	1100	X	X	X	X		X						Hold untested samples until further advice	
OC7-R2-0.5	45	18/03/2017	15:30		MS	2J, 2P	4	1100	X	X	X	X		X						Hold untested samples until further advice	
OC7-R3-0.5	46	18/03/2017	15:30		MS	2J, 2P	4	1100												Hold All Sample Testing until further advice	
OC1-0.5-T2	47	17/03/2017	12:00		MS	2J, 2P	4	1100	X	X	X	X		X						Hold untested samples until further advice	
DS1	48	20/03/2017	10:00		S	2J, 1P	4	500												Hold All Sample Testing until further advice	
DS2	49	20/03/2017	11:00		S	2J, 1P	4	500												Hold All Sample Testing until further advice	
FIELD8	50				S	1J	1	250													
BP4	4	16/03/2017	7:02		MS	2J	1	500												Hold All Sample Testing until further advice	
TC1-0.5	51	15/03/2017	16:36		MS	1J	1	250												Hold All Sample Testing until further advice	
TC1-1	52	15/03/2017	16:36		MS	1J	1	250												Hold All Sample Testing until further advice	
TC2	9	15/03/2017	11:06		MS	2J	1	500												Hold All Sample Testing until further advice	
IC8	53	16/03/2017	16:49		MS	2J	1	250												Hold All Sample Testing until further advice	
IC5-0.5	21	18/03/2017	9:50		MS	1J	1	250												Hold All Sample Testing until further advice	
IC7	54	16/03/2017	17:41		MS	1J	1	250												Hold All Sample Testing until further advice	
IC8	55	18/03/2017	9:25		MS	1J	1	250												Hold All Sample Testing until further advice	
IC2	17	15/03/2017	13:45		MS	1J	1	250												Hold All Sample Testing until further advice	
OC2-0.5	33	18/03/2017	8:30		MS	2J	1	250												Hold All Sample Testing until further advice	
OC3	36	17/03/2017	8:35		MS	1J	1	250												Hold All Sample Testing until further advice	
OC4-0.5	37	17/03/2017	11:20		MS	1J	1	250												Hold All Sample Testing until further advice	
OC8	42	17/03/2017	15:14		MS	1J	1	250												Hold All Sample Testing until further advice	
OC10	44	17/03/2017	16:16		MS	1J	1	250												Hold All Sample Testing until further advice	
OC4-1.0	38	17/03/2017	11:20		MS	2J	2	500												Hold All Sample Testing until further advice	
Sampled By:			Date/Time:																		
Received By Lab:			Date/Time:																		
Sample Cold (Yes/No):		Sample Container Sealed (Yes/No):																			
				Relinquished By:																	
				Courier:																	

A17/1096

Chain of Custody (CoC) Record

Project:	Onslow Marine Support Base	**Laboratory:**	Advanced Analytical
Client:	OMSB Pty Ltd	**Job No.:** 17WAU-0008	**Address:** 7 Forrest Avenue, East Perth WA 6004
Lab Quote No.:	TBA	**Turnaround Time:** Standard	**Lab. Contact:** Jane Struthers
O2M Project Manager	Travis Hurley 0467 593 322	**Email Address:** travis.hurley@o2group.com.au	

Please Note:
Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager.

Email laboratory analysis results to O2M Project Manager.

	O2M Sample ID	Laboratory Sample ID	Date	Time	Sample Matrix (Soil / WS, Marine Sediment / WW, Water / A, Air)	Containers: Type (B, Bottle / J, Jar / V, Vial / G, Glass / P, Plastic / B, Bag)	Containers: No. of Samples	Containers: Total Volume (mL)	Analyses: Digestion, TBT	Analyses: Nutrients TN, TKN, TP, NH4, NO2, NO3, DP	Analyses: BTEX, TRH, TPH, PAH	Analyses: Trace Metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg)	Analyses: Chromium Reducible Sulphur Suite	Analyses: Particle Size Distribution, TOC	Comments
1	TC1-0.5-T3		15/03/2017	16:36	MS	2GJ, 2PB	4	1000	X	X	X	X		X	
2	OC1-0.5-T3		17/03/2017	12:00	MS	2GJ, 2PB	4	1100	X	X	X	X		X	
3	TC1-T3-1		15/03/2017	16:36	MS	2GJ, 2PB	4	1000	X	X	X	X		X	

Sampled By:	(Andrew Bradbury)	**Date/Time:**	**Relinquished By:**
Received By Lab:	(David Strach)	**Date/Time:** 22/3 1450	**Courier:**
Sample Cold (Yes/No):	Y	**Sample Container Sealed (Yes/No):**	

Appendix B Laboratory QA/QC & Analytical Methods

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP1702676**	Page	: 1 of 14
Client	: **WA MARINE PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: TRAVIS HURLEY	Contact	: Lauren Ockwell
Address	: SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370 DUNSBOROUGH, PERTH WA, AUSTRALIA 6281	Address	: 10 Hod Way Malaga WA Australia 6090
Telephone	: ----	Telephone	: 08 9209 7606
Project	: 17WAU-0008 Onslow Marine Support Base	Date Samples Received	: 22-Mar-2017
Order number	: ----	Date Analysis Commenced	: 23-Mar-2017
C-O-C number	: ----	Issue Date	: 04-Apr-2017
Sampler	: ----		
Site	: ----		
Quote number	: EP/814/15		
No. of samples received	: 56		
No. of samples analysed	: 37		

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*
Amanda Conkie	Organic Chemist	Brisbane Organics, Stafford, QLD
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics, Malaga, WA
Daniel Fisher	Inorganics Analyst	Perth ASS, Malaga, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Malaga, WA
Huynh Huynh	Organic Chemist	Perth Organics, Malaga, WA
Indra Astuty	Instrument Chemist	Perth Inorganics, Malaga, WA
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Peter Keyte	Newcastle Manager	Newcastle - Inorganics, Mayfield West, NSW
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils, Stafford, QLD
Vanessa Nguyen	Organic Chemist	Perth Organics, Malaga, WA

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 (%)*
EA033-A: Actual Acidity (QC Lot: 806422)									
EP1702676-001	BP1	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.00	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.00	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	9.6	9.6	0.00	0% - 20%
EP1702676-037	OC4-0.5	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.00	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.00	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	9.2	9.2	0.00	0% - 20%
EA033-B: Potential Acidity (QC Lot: 806422)									
EP1702676-001	BP1	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.073	0.076	4.03	0% - 50%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	45	48	4.94	No Limit
EP1702676-037	OC4-0.5	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.577	0.559	3.17	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	360	348	3.26	0% - 20%
EA033-C: Acid Neutralising Capacity (QC Lot: 806422)									
EP1702676-001	BP1	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	9.06	9.06	0.00	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	2.90	2.90	0.00	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	1810	1810	0.00	0% - 20%
EP1702676-037	OC4-0.5	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	31.5	31.6	0.190	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	10.1	10.1	0.297	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	6300	6310	0.199	0% - 20%
EA033-E: Acid Base Accounting (QC Lot: 806422)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA033-E: Acid Base Accounting (QC Lot: 806422) - continued									
EP1702676-001	BP1	EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.00	No Limit
		EA033: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.07	0.08	13.3	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.00	No Limit
		EA033: Liming Rate excluding ANC	----	1	kg CaCO3/t	3	4	28.6	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.00	No Limit
		EA033: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	45	48	6.45	No Limit
EP1702676-037	OC4-0.5	EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.00	No Limit
		EA033: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.58	0.56	3.51	0% - 20%
		EA033: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.00	No Limit
		EA033: Liming Rate excluding ANC	----	1	kg CaCO3/t	27	26	3.77	0% - 20%
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.00	No Limit
		EA033: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	360	348	3.39	0% - 20%
EA055: Moisture Content (QC Lot: 807401)									
EP1702676-004	BP4	EA055-103: Moisture Content (dried @ 103°C)	----	1	%	19.3	18.4	4.75	0% - 50%
EP1702676-018	IC3-0.5	EA055-103: Moisture Content (dried @ 103°C)	----	1	%	18.9	16.8	11.8	0% - 50%
EA055: Moisture Content (QC Lot: 807402)									
EP1702676-035	OC3-0.5	EA055-103: Moisture Content (dried @ 103°C)	----	1	%	22.2	21.4	3.71	0% - 20%
EP1702676-045	OC7-R2-0.5	EA055-103: Moisture Content (dried @ 103°C)	----	1	%	24.6	24.5	0.594	0% - 20%
EG005-SD: Total Metals in Sediments by ICP-AES (QC Lot: 810872)									
EP1702676-004	BP4	EG005-SD: Aluminium	7429-90-5	50	mg/kg	1370	1350	1.36	0% - 20%
		EG005-SD: Iron	7439-89-6	50	mg/kg	9600	9740	1.48	0% - 20%
EP1702676-020	IC4	EG005-SD: Aluminium	7429-90-5	50	mg/kg	1090	1040	5.11	0% - 20%
		EG005-SD: Iron	7439-89-6	50	mg/kg	6460	6120	5.35	0% - 20%
EG005-SD: Total Metals in Sediments by ICP-AES (QC Lot: 810876)									
EP1702676-035	OC3-0.5	EG005-SD: Aluminium	7429-90-5	50	mg/kg	1340	1300	2.85	0% - 20%
		EG005-SD: Iron	7439-89-6	50	mg/kg	8580	8670	1.01	0% - 20%
EP1702676-047	OC1-0.2-T2	EG005-SD: Aluminium	7429-90-5	50	mg/kg	3740	3710	0.785	0% - 20%
		EG005-SD: Iron	7439-89-6	50	mg/kg	21700	24900	13.7	0% - 20%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 810873)									
EP1702676-004	BP4	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	1.0	1.2	19.3	0% - 50%
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	<0.50	0.00	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	3.0	3.1	0.00	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	16.0	16.2	0.718	0% - 50%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	10.0	9.6	3.78	0% - 50%
		EG020-SD: Copper	7440-50-8	1	mg/kg	1.6	1.6	0.00	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	1.3	1.3	0.00	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	3.1	3.0	0.00	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 (%)*
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 810873) - continued									
EP1702676-004	BP4	EG020-SD: Zinc	7440-66-6	1	mg/kg	5.2	5.4	3.95	No Limit
		EG020-SD: Manganese	7439-96-5	10	mg/kg	388	397	2.41	0% - 20%
		EG020-SD: Vanadium	7440-62-2	2	mg/kg	24.0	23.7	1.28	0% - 50%
EP1702676-020	IC4	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	0.6	0.5	0.00	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	<0.50	0.00	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	2.5	2.3	6.53	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	10.5	10.0	4.31	0% - 50%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	9.4	8.7	8.41	No Limit
		EG020-SD: Copper	7440-50-8	1	mg/kg	1.5	1.4	0.00	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	1.0	<1.0	0.00	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	3.4	3.1	8.91	No Limit
		EG020-SD: Zinc	7440-66-6	1	mg/kg	5.2	4.8	7.89	No Limit
		EG020-SD: Manganese	7439-96-5	10	mg/kg	172	163	5.38	0% - 50%
		EG020-SD: Vanadium	7440-62-2	2	mg/kg	15.5	14.4	7.24	No Limit
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 810877)									
EP1702676-035	OC3-0.5	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	0.7	0.8	0.00	No Limit
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	<0.50	0.00	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	3.1	3.0	3.28	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	11.0	11.3	2.34	0% - 50%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	11.2	11.5	2.39	0% - 50%
		EG020-SD: Copper	7440-50-8	1	mg/kg	2.0	1.8	8.76	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	1.4	1.4	0.00	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	4.0	3.8	4.78	No Limit
		EG020-SD: Zinc	7440-66-6	1	mg/kg	7.4	6.6	12.0	No Limit
		EG020-SD: Manganese	7439-96-5	10	mg/kg	196	194	1.41	0% - 50%
		EG020-SD: Vanadium	7440-62-2	2	mg/kg	19.0	19.1	0.00	No Limit
EP1702676-047	OC1-0.2-T2	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	1.3	1.2	11.2	0% - 50%
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	<0.50	0.00	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	7.4	7.8	6.56	0% - 50%
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	19.8	22.6	13.5	0% - 20%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	24.9	26.4	5.84	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	5.4	5.8	7.19	No Limit
		EG020-SD: Lead	7439-92-1	1	mg/kg	3.5	3.6	0.00	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	9.3	9.8	5.33	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 (%)*
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 810877) - continued									
EP1702676-047	OC1-0.2-T2	EG020-SD: Zinc	7440-66-6	1	mg/kg	15.0	14.6	2.63	0% - 50%
		EG020-SD: Manganese	7439-96-5	10	mg/kg	326	319	2.12	0% - 20%
		EG020-SD: Vanadium	7440-62-2	2	mg/kg	42.6	47.3	10.4	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 810874)									
EP1702676-004	BP4	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	No Limit
EP1702676-020	IC4	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 810875)									
EP1702676-035	OC3-0.5	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	No Limit
EP1702676-047	OC1-0.2-T2	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	No Limit
EK055: Ammonia as N (QC Lot: 807419)									
EP1702676-004	BP4	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.00	No Limit
EP1702676-026	1C8-0.5	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 807379)									
EP1702676-026	1C8-0.5	EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1702676-004	BP4	EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 807380)									
EP1702676-026	1C8-0.5	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1702676-004	BP4	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 808228)									
EP1702676-004	BP4	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	40	40	0.00	No Limit
EP1702676-028	IC1-R2	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	40	140	109	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 808227)									
EP1702676-004	BP4	EK067G: Total Phosphorus as P	----	2	mg/kg	98	86	12.8	0% - 20%
EP1702676-028	IC1-R2	EK067G: Total Phosphorus as P	----	2	mg/kg	100	97	3.12	0% - 20%
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 807381)									
EP1702676-028	IC1-R2	EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1702676-004	BP4	EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 814209)									
EM1703514-001	Anonymous	EP003: Total Organic Carbon	----	0.02	%	0.50	0.54	6.58	0% - 20%
EP1702676-012	TC1-0.5-T2	EP003: Total Organic Carbon	----	0.02	%	0.08	0.09	0.00	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 814210)									
EP1702676-031	OC1-0.5-T1	EP003: Total Organic Carbon	----	0.02	%	0.11	0.11	0.00	No Limit
EP1702676-043	OC9	EP003: Total Organic Carbon	----	0.02	%	0.07	0.07	0.00	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 818251)									
EP1702676-020	IC4	EP003: Total Organic Carbon	----	0.02	%	0.03	0.03	0.00	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 806596)									
EP1702676-004	BP4	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.00	0% - 3%
EP1702676-028	IC1-R2	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.00	0% - 3%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 806597)									
EP1702676-004	BP4	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	<5	0.00	No Limit
EP1702676-028	IC1-R2	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	4	41.5	No Limit
		EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	4	28.6	No Limit
		EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	<5	0.00	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 806596)									
EP1702676-004	BP4	EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	0.00	0% - 3%
EP1702676-028	IC1-R2	EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	0.00	0% - 3%
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 806597)									
EP1702676-004	BP4	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	<5	0.00	No Limit
EP1702676-028	IC1-R2	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	7	78.4	No Limit
		EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	7	80.0	No Limit
		EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	<5	0.00	No Limit
EP080-SD: BTEXN (QC Lot: 806596)									
EP1702676-004	BP4	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: Total Xylenes	1330-20-7	0.2	mg/kg	<0.5	<0.5	0.00	0% - .2%
		EP080-SD: Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
EP1702676-028	IC1-R2	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: Total Xylenes	1330-20-7	0.2	mg/kg	<0.5	<0.5	0.00	0% - .2%
		EP080-SD: Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
EP090: Organotin Compounds (QC Lot: 810646)									

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 (%)*
EP090: Organotin Compounds (QC Lot: 810646) - continued									
EP1702676-004	BP4	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	0.5	<0.5	0.00	No Limit
EP1702676-023	IC6	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.00	No Limit
EP090: Organotin Compounds (QC Lot: 810647)									
EP1702676-042	OC8	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.00	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 806598)									
EP1702676-004	BP4	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.00	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.00	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<5	0.00	No Limit
EP1702676-028	IC1-R2	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 806598) - continued									
EP1702676-028	IC1-R2	EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.00	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.00	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<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
EA033-A: Actual Acidity (QCLot: 806422)								
EA033: pH KCl (23A)	----	0.1	pH Unit	<0.1	----	----	----	----
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	73.0756 mole H+ / t	95.4	79	103
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 806422)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.1798 % S	95.0	77	117
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 806422)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	4.9 % CaCO3	104	85	115
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----
EA033-E: Acid Base Accounting (QCLot: 806422)								
EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA033: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
EG005-SD: Total Metals in Sediments by ICP-AES (QCLot: 810872)								
EG005-SD: Aluminium	7429-90-5	50	mg/kg	<50	----	----	----	----
EG005-SD: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG005-SD: Total Metals in Sediments by ICP-AES (QCLot: 810876)								
EG005-SD: Aluminium	7429-90-5	50	mg/kg	<50	----	----	----	----
EG005-SD: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 810873)								
EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	----	----	----	----
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	21.62091 mg/kg	100	74	130
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	4.6838 mg/kg	104	97	113
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	33.904 mg/kg	106	72	152
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	33.782 mg/kg	94.4	76	116
EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	<0.5	----	----	----	----
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	40.33169 mg/kg	90.5	74	124
EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	----	----	----	----
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	51.10088 mg/kg	102	81	135
EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Vanadium	7440-62-2	2	mg/kg	<2.0	----	----	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 810873) - continued								
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	61.70999 mg/kg	103	81	143
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 810877)								
EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	----	----	----	----
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	21.62091 mg/kg	99.3	74	130
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	4.6838 mg/kg	98.8	97	113
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	33.904 mg/kg	102	72	152
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	33.782 mg/kg	95.8	76	116
EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	<0.5	----	----	----	----
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	40.33169 mg/kg	88.8	74	124
EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	----	----	----	----
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	51.10088 mg/kg	102	81	135
EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Vanadium	7440-62-2	2	mg/kg	<2.0	----	----	----	----
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	61.70999 mg/kg	99.3	81	143
EG035T: Total Recoverable Mercury by FIMS (QCLot: 810874)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	2.154 mg/kg	104	80	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 810875)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	2.154 mg/kg	107	80	120
EK055: Ammonia as N (QCLot: 807419)								
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	10 mg/kg	87.0	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 807379)								
EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	2.5 mg/kg	104	89	121
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 807380)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	108	90	112
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 808228)								
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	1000 mg/kg	83.8	78	112
				<20	100 mg/kg	98.2	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 808227)								
EK067G: Total Phosphorus as P	----	2	mg/kg	<2	440 mg/kg	92.6	78	108
				<2	44 mg/kg	77.5	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 807381)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	<0.1	2.5 mg/kg	104	92	112
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 814209)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	109	70	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 814210)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	96.9	70	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 818251)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	103	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 806596)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	800 mg/kg	96.5	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 806597)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	138 mg/kg	102	70	130
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	290 mg/kg	100	70	130
EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	51 mg/kg	97.2	70	130
EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 806596)								
EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	925 mg/kg	99.7	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 806597)								
EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	202 mg/kg	102	70	130
EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	258 mg/kg	99.2	70	130
EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	18 mg/kg	92.8	70	130
EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD: BTEXN (QCLot: 806596)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	50 mg/kg	98.4	70	130
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	50 mg/kg	94.0	70	130
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	50 mg/kg	104	70	130
EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	100 mg/kg	105	70	130
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	50 mg/kg	98.9	70	130
EP080-SD: Total Xylenes	1330-20-7	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Sum of BTEX	----	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	50 mg/kg	95.9	70	130
EP090: Organotin Compounds (QCLot: 810646)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	111	52	139
EP090: Organotin Compounds (QCLot: 810647)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	91.8	52	139
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 806598)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	85.0	55	131
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	----	----	----	----
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	77.1	64	110
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	84.2	62	112
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	90.9	64	118
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	88.6	59	117
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	70.8	69	111
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	77.6	66	118

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 806598) - continued								
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	79.3	70	116
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	87.2	59	121
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	81.3	68	116
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	25 µg/kg	85.4	51	107
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	80.8	52	118
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	----	----	----	----
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	86.6	55	111
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	----	----	----	----
EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	88.2	62	106
EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	88.9	35	141
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	87.0	48	122
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	----	----	----	----
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
				Concentration	MS	Low	High
EG005-SD: Total Metals in Sediments by ICP-AES (QCLot: 810872)							
EP1702676-005	TC2-R1	EG005-SD: Aluminium	7429-90-5	50 mg/kg	# Not Determined	70	130
		EG005-SD: Iron	7439-89-6	50 mg/kg	# Not Determined	70	130
EG005-SD: Total Metals in Sediments by ICP-AES (QCLot: 810876)							
EP1702676-036	OC3-1	EG005-SD: Aluminium	7429-90-5	50 mg/kg	# Not Determined	70	130
		EG005-SD: Iron	7439-89-6	50 mg/kg	# Not Determined	70	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 810873)							
EP1702676-005	TC2-R1	EG020-SD: Arsenic	7440-38-2	50 mg/kg	92.1	70	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	99.4	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	77.9	70	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	84.1	70	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	83.7	70	130

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
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 810873) - continued							
EP1702676-005	TC2-R1	EG020-SD: Nickel	7440-02-0	50 mg/kg	94.8	70	130
		EG020-SD: Selenium	7782-49-2	50 mg/kg	77.0	70	130
		EG020-SD: Zinc	7440-66-6	250 mg/kg	92.4	70	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 810877)							
EP1702676-036	OC3-1	EG020-SD: Arsenic	7440-38-2	50 mg/kg	96.8	70	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	98.0	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	86.3	70	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	87.5	70	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	84.9	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	98.7	70	130
		EG020-SD: Selenium	7782-49-2	50 mg/kg	89.7	70	130
		EG020-SD: Zinc	7440-66-6	250 mg/kg	98.2	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 810874)							
EP1702676-005	TC2-R1	EG035T-LL: Mercury	7439-97-6	10 mg/kg	99.8	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 810875)							
EP1702676-036	OC3-1	EG035T-LL: Mercury	7439-97-6	10 mg/kg	103	70	130
EK055: Ammonia as N (QCLot: 807419)							
EP1702676-005	TC2-R1	EK055: Ammonia as N	7664-41-7	100 mg/kg	84.3	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 807379)							
EP1702676-005	TC2-R1	EK057G: Nitrite as N (Sol.)	14797-65-0	3 mg/kg	104	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 807380)							
EP1702676-005	TC2-R1	EK059G: Nitrite + Nitrate as N (Sol.)	----	3 mg/kg	96.3	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 808228)							
EP1702676-005	TC2-R1	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	83.1	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 808227)							
EP1702676-005	TC2-R1	EK067G: Total Phosphorus as P	----	100 mg/kg	80.8	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 807381)							
EP1702676-005	TC2-R1	EK071G: Reactive Phosphorus as P	14265-44-2	2.5 mg/kg	124	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 806596)							
EP1702676-005	TC2-R1	EP080-SD: C6 - C9 Fraction	----	600 mg/kg	87.6	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 806597)							
EP1702676-005	TC2-R1	EP071-SD: C10 - C14 Fraction	----	138 mg/kg	86.8	70	130
		EP071-SD: C15 - C28 Fraction	----	290 mg/kg	87.4	70	130
		EP071-SD: C29 - C36 Fraction	----	51 mg/kg	86.5	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 806596)							

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*
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 806596) - continued							
EP1702676-005	TC2-R1	EP080-SD: C6 - C10 Fraction	C6_C10	725 mg/kg	89.2	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 806597)							
EP1702676-005	TC2-R1	EP071-SD: >C10 - C16 Fraction	----	202 mg/kg	87.2	70	130
		EP071-SD: >C16 - C34 Fraction	----	258 mg/kg	87.1	70	130
		EP071-SD: >C34 - C40 Fraction	----	18 mg/kg	84.7	70	130
EP080-SD: BTEXN (QCLot: 806596)							
EP1702676-005	TC2-R1	EP080-SD: Benzene	71-43-2	50 mg/kg	88.2	70	130
		EP080-SD: Toluene	108-88-3	50 mg/kg	79.8	70	130
EP090: Organotin Compounds (QCLot: 810646)							
EP1702676-005	TC2-R1	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	107	20	130
EP090: Organotin Compounds (QCLot: 810647)							
EP1702676-043	OC9	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	98.7	20	130
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 806598)							
EP1702676-005	TC2-R1	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	118	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	118	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	115	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	125	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	119	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	122	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	127	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	123	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	112	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	96.4	70	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	25 µg/kg	113	70	130
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	97.4	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	105	70	130
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	25 µg/kg	125	70	130
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	25 µg/kg	113	70	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	114	70	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP1702676**	Page	: 1 of 20
Client	: **WA MARINE PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: TRAVIS HURLEY	Telephone	: 08 9209 7606
Project	: 17WAU-0008 Onslow Marine Support Base	Date Samples Received	: 22-Mar-2017
Site	: ----	Issue Date	: 04-Apr-2017
Sampler	: ----	No. of samples received	: 56
Order number	: ----	No. of samples analysed	: 37

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.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **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

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005-SD: Total Metals in Sediments by ICP-AES	EP1702676--005	TC2-R1	**Aluminium**	7429-90-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG005-SD: Total Metals in Sediments by ICP-AES	EP1702676--036	OC3-1	**Aluminium**	7429-90-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG005-SD: Total Metals in Sediments by ICP-AES	EP1702676--005	TC2-R1	**Iron**	7439-89-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG005-SD: Total Metals in Sediments by ICP-AES	EP1702676--036	OC3-1	**Iron**	7439-89-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Regular Sample Surrogates

Sub-Matrix: **SEDIMENT**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP132T: Base/Neutral Extractable Surrogates	EP1702676-004	BP4	**Anthracene-d10**	1719-06-8	68.2 %	70-130 %	**Recovery less than lower data quality objective**
EP132T: Base/Neutral Extractable Surrogates	EP1702676-041	OC7	**Anthracene-d10**	1719-06-8	69.9 %	70-130 %	**Recovery less than lower data quality objective**
EP132T: Base/Neutral Extractable Surrogates	EP1702676-009	TC2	**4-Terphenyl-d14**	1718-51-0	68.9 %	70-130 %	**Recovery less than lower data quality objective**
EP132T: Base/Neutral Extractable Surrogates	EP1702676-024	IC7-0.5	**4-Terphenyl-d14**	1718-51-0	66.9 %	70-130 %	**Recovery less than lower data quality objective**
EP132T: Base/Neutral Extractable Surrogates	EP1702676-041	OC7	**4-Terphenyl-d14**	1718-51-0	67.3 %	70-130 %	**Recovery less than lower data quality objective**

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

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
EA033-A: Actual Acidity							
80* dried soil (EA033) BP1, TC2-R1, TC1-1, TC3	**15-Mar-2017**	**23-Mar-2017**	15-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) IC3-0.5	**16-Mar-2017**	**23-Mar-2017**	16-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) OC1-0.5-T1, OC4-0.5, OC4-1, OC6, OC9	**17-Mar-2017**	**23-Mar-2017**	17-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) IC1-1.0, IC5-1, 1C8-0.5, IC5-1.5, OC5, OC7	**18-Mar-2017**	**23-Mar-2017**	18-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
EA033-B: Potential Acidity							
80* dried soil (EA033) BP1, TC2-R1, TC1-1, TC3	**15-Mar-2017**	**23-Mar-2017**	15-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) IC3-0.5	**16-Mar-2017**	**23-Mar-2017**	16-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) OC1-0.5-T1, OC4-0.5, OC4-1, OC6, OC9	**17-Mar-2017**	**23-Mar-2017**	17-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) IC1-1.0, IC5-1, 1C8-0.5, IC5-1.5, OC5, OC7	**18-Mar-2017**	**23-Mar-2017**	18-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
EA033-C: Acid Neutralising Capacity							
80* dried soil (EA033) BP1, TC2-R1, TC1-1, TC3	**15-Mar-2017**	**23-Mar-2017**	15-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) IC3-0.5	**16-Mar-2017**	**23-Mar-2017**	16-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) OC1-0.5-T1, OC4-0.5, OC4-1, OC6, OC9	**17-Mar-2017**	**23-Mar-2017**	17-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) IC1-1.0, IC5-1, 1C8-0.5, IC5-1.5, OC5, OC7	**18-Mar-2017**	**23-Mar-2017**	18-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓

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
EA033-D: Retained Acidity							
80* dried soil (EA033) BP1, TC2-R1, TC1-1, TC3	**15-Mar-2017**	**23-Mar-2017**	15-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) IC3-0.5	**16-Mar-2017**	**23-Mar-2017**	16-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) OC1-0.5-T1, OC4-0.5, OC4-1, OC6, OC9	**17-Mar-2017**	**23-Mar-2017**	17-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) IC1-1.0, IC5-1, 1C8-0.5, IC5-1.5, OC5, OC7	**18-Mar-2017**	**23-Mar-2017**	18-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
EA033-E: Acid Base Accounting							
80* dried soil (EA033) BP1, TC2-R1, TC1-1, TC3	**15-Mar-2017**	**23-Mar-2017**	15-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) IC3-0.5	**16-Mar-2017**	**23-Mar-2017**	16-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) OC1-0.5-T1, OC4-0.5, OC4-1, OC6, OC9	**17-Mar-2017**	**23-Mar-2017**	17-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓
80* dried soil (EA033) IC1-1.0, IC5-1, 1C8-0.5, IC5-1.5, OC5, OC7	**18-Mar-2017**	**23-Mar-2017**	18-Mar-2018	✓	**23-Mar-2017**	21-Jun-2017	✓

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)							
TC2-R1, TC1-0.5, TC1-1, TC2, TC4, TC1-0.5-T2, IC2	**15-Mar-2017**	**----**	----	----	**24-Mar-2017**	29-Mar-2017	✓
Soil Glass Jar - Unpreserved (EA055-103)							
BP4, IC3-0.5, IC4, IC6, IC7-0.5, IC7-1	**16-Mar-2017**	**----**	----	----	**24-Mar-2017**	30-Mar-2017	✓
Soil Glass Jar - Unpreserved (EA055-103)							
OC1-0.5-T1, OC3-0.5, OC3-1, OC4-0.5, OC6, OC8, OC9, OC10, OC1-0.2-T2	**17-Mar-2017**	**----**	----	----	**24-Mar-2017**	31-Mar-2017	✓
Soil Glass Jar - Unpreserved (EA055-103)							
IC1, IC5-0.5, 1C8-0.5, IC1-R2, OC2-0.5, OC2-1, OC5, OC7, OC7-R2-0.5	**18-Mar-2017**	**----**	----	----	**24-Mar-2017**	01-Apr-2017	✓

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
EA150: Particle Sizing							
Snap Lock Bag - frozen (EA150H)							
TC2-R1, TC1-0.5, TC1-1, TC2, TC4, TC1-0.5-T2, IC2	**15-Mar-2017**	**----**	----	----	**30-Mar-2017**	11-Sep-2017	✓
Snap Lock Bag - frozen (EA150H)							
BP4, IC3-0.5, IC4, IC6, IC7-0.5, IC7-1	**16-Mar-2017**	**----**	----	----	**30-Mar-2017**	12-Sep-2017	✓
Snap Lock Bag - frozen (EA150H)							
OC1-0.5-T1, OC3-0.5, OC3-1, OC4-0.5, OC6, OC8, OC9, OC10, OC1-0.2-T2	**17-Mar-2017**	**----**	----	----	**30-Mar-2017**	13-Sep-2017	✓
Snap Lock Bag - frozen (EA150H)							
IC1, IC5-0.5, 1C8-0.5, IC1-R2, OC2-0.5, OC2-1, OC5, OC7, OC7-R2-0.5	**18-Mar-2017**	**----**	----	----	**30-Mar-2017**	14-Sep-2017	✓

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
EA150: Soil Classification based on Particle Size							
Snap Lock Bag - frozen (EA150H) TC2-R1, TC1-0.5, TC1-1, TC2, TC4, TC1-0.5-T2, IC2	**15-Mar-2017**	**----**	----	----	**30-Mar-2017**	11-Sep-2017	✓
Snap Lock Bag - frozen (EA150H) BP4, IC3-0.5, IC4, IC6, IC7-0.5, IC7-1	**16-Mar-2017**	**----**	----	----	**30-Mar-2017**	12-Sep-2017	✓
Snap Lock Bag - frozen (EA150H) OC1-0.5-T1, OC3-0.5, OC3-1, OC4-0.5, OC6, OC8, OC9, OC10, OC1-0.2-T2	**17-Mar-2017**	**----**	----	----	**30-Mar-2017**	13-Sep-2017	✓
Snap Lock Bag - frozen (EA150H) IC1, IC5-0.5, 1C8-0.5, IC1-R2, OC2-0.5, OC2-1, OC5, OC7, OC7-R2-0.5	**18-Mar-2017**	**----**	----	----	**30-Mar-2017**	14-Sep-2017	✓

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
EG005-SD: Total Metals in Sediments by ICP-AES							
Soil Glass Jar - Unpreserved (EG005-SD)							
TC2-R1, TC1-0.5, TC1-1, TC2, TC4, TC1-0.5-T2, IC2	**15-Mar-2017**	**27-Mar-2017**	11-Sep-2017	✓	**29-Mar-2017**	11-Sep-2017	✓
Soil Glass Jar - Unpreserved (EG005-SD)							
BP4, IC3-0.5, IC4, IC6, IC7-0.5, IC7-1	**16-Mar-2017**	**27-Mar-2017**	12-Sep-2017	✓	**29-Mar-2017**	12-Sep-2017	✓
Soil Glass Jar - Unpreserved (EG005-SD)							
OC1-0.5-T1, OC3-0.5, OC3-1, OC4-0.5, OC6, OC8, OC9, OC10, OC1-0.2-T2	**17-Mar-2017**	**27-Mar-2017**	13-Sep-2017	✓	**29-Mar-2017**	13-Sep-2017	✓
Soil Glass Jar - Unpreserved (EG005-SD)							
IC1, IC5-0.5, 1C8-0.5, IC1-R2, OC2-0.5, OC2-1, OC5, OC7, OC7-R2-0.5	**18-Mar-2017**	**27-Mar-2017**	14-Sep-2017	✓	**29-Mar-2017**	14-Sep-2017	✓

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
EG020-SD: Total Metals in Sediments by ICPMS							
Soil Glass Jar - Unpreserved (EG020-SD)							
TC2-R1, TC1-0.5, TC1-1, TC2, TC4, TC1-0.5-T2, IC2	**15-Mar-2017**	**27-Mar-2017**	11-Sep-2017	✓	**29-Mar-2017**	11-Sep-2017	✓
Soil Glass Jar - Unpreserved (EG020-SD)							
BP4, IC3-0.5, IC4, IC6, IC7-0.5, IC7-1	**16-Mar-2017**	**27-Mar-2017**	12-Sep-2017	✓	**29-Mar-2017**	12-Sep-2017	✓
Soil Glass Jar - Unpreserved (EG020-SD)							
OC1-0.5-T1, OC3-0.5, OC3-1, OC4-0.5, OC6, OC8, OC9, OC10, OC1-0.2-T2	**17-Mar-2017**	**27-Mar-2017**	13-Sep-2017	✓	**29-Mar-2017**	13-Sep-2017	✓
Soil Glass Jar - Unpreserved (EG020-SD)							
IC1, IC5-0.5, 1C8-0.5, IC1-R2, OC2-0.5, OC2-1, OC5, OC7, OC7-R2-0.5	**18-Mar-2017**	**27-Mar-2017**	14-Sep-2017	✓	**29-Mar-2017**	14-Sep-2017	✓

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
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T-LL)							
TC2-R1, TC1-0.5, TC1-1, TC2, TC4, TC1-0.5-T2, IC2	**15-Mar-2017**	**27-Mar-2017**	12-Apr-2017	✓	**30-Mar-2017**	12-Apr-2017	✓
Soil Glass Jar - Unpreserved (EG035T-LL)							
BP4, IC3-0.5, IC4, IC6, IC7-0.5, IC7-1	**16-Mar-2017**	**27-Mar-2017**	13-Apr-2017	✓	**30-Mar-2017**	13-Apr-2017	✓
Soil Glass Jar - Unpreserved (EG035T-LL)							
OC1-0.5-T1, OC3-0.5, OC3-1, OC4-0.5, OC6, OC8, OC9, OC10, OC1-0.2-T2	**17-Mar-2017**	**27-Mar-2017**	14-Apr-2017	✓	**30-Mar-2017**	14-Apr-2017	✓
Soil Glass Jar - Unpreserved (EG035T-LL)							
IC1, IC5-0.5, 1C8-0.5, IC1-R2, OC2-0.5, OC2-1, OC5, OC7, OC7-R2-0.5	**18-Mar-2017**	**27-Mar-2017**	15-Apr-2017	✓	**30-Mar-2017**	15-Apr-2017	✓
EK055: Ammonia as N							
Soil Glass Jar - Unpreserved (EK055)							
TC2-R1, TC1-0.5, TC2, TC1-0.5-T2, IC2	**15-Mar-2017**	**----**	----	----	**24-Mar-2017**	11-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK055)							
BP4, IC7-0.5	**16-Mar-2017**	**----**	----	----	**24-Mar-2017**	12-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK055)							
OC1-0.5-T1, OC3-0.5, OC4-0.5, OC10, OC1-0.2-T2	**17-Mar-2017**	**----**	----	----	**24-Mar-2017**	13-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK055)							
IC1, IC5-0.5, 1C8-0.5, IC1-R2, OC2-0.5, OC7, OC7-R2-0.5	**18-Mar-2017**	**----**	----	----	**24-Mar-2017**	14-Sep-2017	✓

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
EK057G: Nitrite as N by Discrete Analyser							
Soil Glass Jar - Unpreserved (EK057G) TC2-R1, TC1-0.5, TC2, TC1-0.5-T2, IC2	**15-Mar-2017**	**28-Mar-2017**	11-Sep-2017	✓	**28-Mar-2017**	11-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK057G) BP4, IC7-0.5	**16-Mar-2017**	**28-Mar-2017**	12-Sep-2017	✓	**28-Mar-2017**	12-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK057G) OC1-0.5-T1, OC3-0.5, OC4-0.5, OC10, OC1-0.2-T2	**17-Mar-2017**	**28-Mar-2017**	13-Sep-2017	✓	**28-Mar-2017**	13-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK057G) IC1, IC5-0.5, 1C8-0.5, IC1-R2, OC2-0.5, OC7, OC7-R2-0.5	**18-Mar-2017**	**28-Mar-2017**	14-Sep-2017	✓	**28-Mar-2017**	14-Sep-2017	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Soil Glass Jar - Unpreserved (EK059G) TC2-R1, TC1-0.5, TC2, TC1-0.5-T2, IC2	**15-Mar-2017**	**28-Mar-2017**	11-Sep-2017	✓	**28-Mar-2017**	11-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK059G) BP4, IC7-0.5	**16-Mar-2017**	**28-Mar-2017**	12-Sep-2017	✓	**28-Mar-2017**	12-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK059G) OC1-0.5-T1, OC3-0.5, OC4-0.5, OC10, OC1-0.2-T2	**17-Mar-2017**	**28-Mar-2017**	13-Sep-2017	✓	**28-Mar-2017**	13-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK059G) IC1, IC5-0.5, 1C8-0.5, IC1-R2, OC2-0.5, OC7, OC7-R2-0.5	**18-Mar-2017**	**28-Mar-2017**	14-Sep-2017	✓	**28-Mar-2017**	14-Sep-2017	✓

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
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Soil Glass Jar - Unpreserved (EK061G) TC2-R1, TC1-0.5, TC2, TC1-0.5-T2, IC2	**15-Mar-2017**	**24-Mar-2017**	11-Sep-2017	✓	**29-Mar-2017**	11-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK061G) BP4, IC7-0.5	**16-Mar-2017**	**24-Mar-2017**	12-Sep-2017	✓	**29-Mar-2017**	12-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK061G) OC1-0.5-T1, OC3-0.5, OC4-0.5, OC10, OC1-0.2-T2	**17-Mar-2017**	**24-Mar-2017**	13-Sep-2017	✓	**29-Mar-2017**	13-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK061G) IC1, IC5-0.5, 1C8-0.5, IC1-R2, OC2-0.5, OC7, OC7-R2-0.5	**18-Mar-2017**	**24-Mar-2017**	14-Sep-2017	✓	**29-Mar-2017**	14-Sep-2017	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Soil Glass Jar - Unpreserved (EK067G) TC2-R1, TC1-0.5, TC2, TC1-0.5-T2, IC2	**15-Mar-2017**	**24-Mar-2017**	11-Sep-2017	✓	**29-Mar-2017**	11-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK067G) BP4, IC7-0.5	**16-Mar-2017**	**24-Mar-2017**	12-Sep-2017	✓	**29-Mar-2017**	12-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK067G) OC1-0.5-T1, OC3-0.5, OC4-0.5, OC10, OC1-0.2-T2	**17-Mar-2017**	**24-Mar-2017**	13-Sep-2017	✓	**29-Mar-2017**	13-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK067G) IC1, IC5-0.5, 1C8-0.5, IC1-R2, OC2-0.5, OC7, OC7-R2-0.5	**18-Mar-2017**	**24-Mar-2017**	14-Sep-2017	✓	**29-Mar-2017**	14-Sep-2017	✓

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
EK071G: Reactive Phosphorus as P by discrete analyser							
Soil Glass Jar - Unpreserved (EK071G) TC2-R1, TC1-0.5, TC2, TC1-0.5-T2, IC2	**15-Mar-2017**	**28-Mar-2017**	11-Sep-2017	✓	**28-Mar-2017**	11-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK071G) BP4, IC7-0.5	**16-Mar-2017**	**28-Mar-2017**	12-Sep-2017	✓	**28-Mar-2017**	12-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK071G) OC1-0.5-T1, OC3-0.5, OC4-0.5, OC10, OC1-0.2-T2	**17-Mar-2017**	**28-Mar-2017**	13-Sep-2017	✓	**28-Mar-2017**	13-Sep-2017	✓
Soil Glass Jar - Unpreserved (EK071G) IC1, IC5-0.5, 1C8-0.5, IC1-R2, OC2-0.5, OC7, OC7-R2-0.5	**18-Mar-2017**	**28-Mar-2017**	14-Sep-2017	✓	**28-Mar-2017**	14-Sep-2017	✓
EP003: Total Organic Carbon (TOC) in Soil							
Pulp Bag (EP003) IC4	**16-Mar-2017**	**31-Mar-2017**	13-Apr-2017	✓	**31-Mar-2017**	13-Apr-2017	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EP003) TC2-R1, TC1-0.5, TC1-1, TC2, TC4, TC1-0.5-T2, IC2	**15-Mar-2017**	**29-Mar-2017**	12-Apr-2017	✓	**29-Mar-2017**	12-Apr-2017	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EP003) BP4, IC3-0.5, IC6, IC7-0.5, IC7-1	**16-Mar-2017**	**29-Mar-2017**	13-Apr-2017	✓	**29-Mar-2017**	13-Apr-2017	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EP003) OC1-0.5-T1, OC3-0.5, OC3-1, OC4-0.5, OC6, OC8, OC9, OC10, OC1-0.2-T2	**17-Mar-2017**	**29-Mar-2017**	14-Apr-2017	✓	**29-Mar-2017**	14-Apr-2017	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EP003) IC1, IC5-0.5, IC1-R2, OC2-0.5, OC2-1, OC5, OC7, OC7-R2-0.5	**18-Mar-2017**	**29-Mar-2017**	15-Apr-2017	✓	**29-Mar-2017**	15-Apr-2017	✓
Soil Glass Jar - Unpreserved (EP003) 1C8-0.5	**18-Mar-2017**	**29-Mar-2017**	15-Apr-2017	✓	**29-Mar-2017**	15-Apr-2017	✓

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
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP071-SD) TC2-R1, TC1-0.5, TC2, TC1-0.5-T2, IC2	**15-Mar-2017**	**24-Mar-2017**	29-Mar-2017	✓	**27-Mar-2017**	03-May-2017	✓
Soil Glass Jar - Unpreserved (EP071-SD) BP4, IC4, IC7-0.5	**16-Mar-2017**	**24-Mar-2017**	30-Mar-2017	✓	**27-Mar-2017**	03-May-2017	✓
Soil Glass Jar - Unpreserved (EP071-SD) OC1-0.5-T1, OC3-0.5, OC4-0.5, OC10, OC1-0.2-T2	**17-Mar-2017**	**24-Mar-2017**	31-Mar-2017	✓	**27-Mar-2017**	03-May-2017	✓
Soil Glass Jar - Unpreserved (EP071-SD) IC1, IC5-0.5, IC1-R2, OC5, OC7, OC7-R2-0.5	**18-Mar-2017**	**24-Mar-2017**	01-Apr-2017	✓	**27-Mar-2017**	03-May-2017	✓
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP071-SD) TC2-R1, TC1-0.5, TC2, TC1-0.5-T2, IC2	**15-Mar-2017**	**24-Mar-2017**	29-Mar-2017	✓	**27-Mar-2017**	03-May-2017	✓
Soil Glass Jar - Unpreserved (EP071-SD) BP4, IC4, IC7-0.5	**16-Mar-2017**	**24-Mar-2017**	30-Mar-2017	✓	**27-Mar-2017**	03-May-2017	✓
Soil Glass Jar - Unpreserved (EP071-SD) OC1-0.5-T1, OC3-0.5, OC4-0.5, OC10, OC1-0.2-T2	**17-Mar-2017**	**24-Mar-2017**	31-Mar-2017	✓	**27-Mar-2017**	03-May-2017	✓
Soil Glass Jar - Unpreserved (EP071-SD) IC1, IC5-0.5, IC1-R2, OC5, OC7, OC7-R2-0.5	**18-Mar-2017**	**24-Mar-2017**	01-Apr-2017	✓	**27-Mar-2017**	03-May-2017	✓

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
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080-SD) TC2-R1, TC1-0.5, TC2, TC1-0.5-T2, IC2	**15-Mar-2017**	**24-Mar-2017**	29-Mar-2017	✓	**27-Mar-2017**	29-Mar-2017	✓
Soil Glass Jar - Unpreserved (EP080-SD) BP4, IC4, IC7-0.5	**16-Mar-2017**	**24-Mar-2017**	30-Mar-2017	✓	**27-Mar-2017**	30-Mar-2017	✓
Soil Glass Jar - Unpreserved (EP080-SD) OC1-0.5-T1, OC3-0.5, OC4-0.5, OC10, OC1-0.2-T2	**17-Mar-2017**	**24-Mar-2017**	31-Mar-2017	✓	**27-Mar-2017**	31-Mar-2017	✓
Soil Glass Jar - Unpreserved (EP080-SD) IC1, IC5-0.5, IC1-R2, OC5, OC7, OC7-R2-0.5	**18-Mar-2017**	**24-Mar-2017**	01-Apr-2017	✓	**27-Mar-2017**	01-Apr-2017	✓
EP080-SD: BTEXN							
Soil Glass Jar - Unpreserved (EP080-SD) TC2-R1, TC1-0.5, TC2, TC1-0.5-T2, IC2	**15-Mar-2017**	**24-Mar-2017**	29-Mar-2017	✓	**27-Mar-2017**	29-Mar-2017	✓
Soil Glass Jar - Unpreserved (EP080-SD) BP4, IC4, IC7-0.5	**16-Mar-2017**	**24-Mar-2017**	30-Mar-2017	✓	**27-Mar-2017**	30-Mar-2017	✓
Soil Glass Jar - Unpreserved (EP080-SD) OC1-0.5-T1, OC3-0.5, OC4-0.5, OC10, OC1-0.2-T2	**17-Mar-2017**	**24-Mar-2017**	31-Mar-2017	✓	**27-Mar-2017**	31-Mar-2017	✓
Soil Glass Jar - Unpreserved (EP080-SD) IC1, IC5-0.5, IC1-R2, OC5, OC7, OC7-R2-0.5	**18-Mar-2017**	**24-Mar-2017**	01-Apr-2017	✓	**27-Mar-2017**	01-Apr-2017	✓

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
EP090: Organotin Compounds							
Soil Glass Jar - Unpreserved (EP090) TC2-R1, TC1-0.5, TC2, TC4, TC1-0.5-T2	**15-Mar-2017**	**28-Mar-2017**	29-Mar-2017	✓	**03-Apr-2017**	07-May-2017	✓
Soil Glass Jar - Unpreserved (EP090) BP4, IC3-0.5, IC4, IC6, IC7-0.5	**16-Mar-2017**	**28-Mar-2017**	30-Mar-2017	✓	**03-Apr-2017**	07-May-2017	✓
Soil Glass Jar - Unpreserved (EP090) OC8, OC9, OC10, OC1-0.2-T2	**17-Mar-2017**	**27-Mar-2017**	31-Mar-2017	✓	**31-Mar-2017**	06-May-2017	✓
Soil Glass Jar - Unpreserved (EP090) OC1-0.5-T1, OC3-0.5, OC4-0.5, OC6	**17-Mar-2017**	**28-Mar-2017**	31-Mar-2017	✓	**03-Apr-2017**	07-May-2017	✓
Soil Glass Jar - Unpreserved (EP090) OC7-R2-0.5	**18-Mar-2017**	**27-Mar-2017**	01-Apr-2017	✓	**31-Mar-2017**	06-May-2017	✓
Soil Glass Jar - Unpreserved (EP090) IC1, IC5-0.5, IC1-R2, OC2-0.5, OC5, OC7	**18-Mar-2017**	**28-Mar-2017**	01-Apr-2017	✓	**03-Apr-2017**	07-May-2017	✓
EP132B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP132B-SD) TC2-R1, TC1-0.5, TC2, TC1-0.5-T2, IC2	**15-Mar-2017**	**24-Mar-2017**	29-Mar-2017	✓	**27-Mar-2017**	03-May-2017	✓
Soil Glass Jar - Unpreserved (EP132B-SD) BP4, IC4, IC7-0.5	**16-Mar-2017**	**24-Mar-2017**	30-Mar-2017	✓	**27-Mar-2017**	03-May-2017	✓
Soil Glass Jar - Unpreserved (EP132B-SD) OC1-0.5-T1, OC3-0.5, OC4-0.5, OC10, OC1-0.2-T2	**17-Mar-2017**	**24-Mar-2017**	31-Mar-2017	✓	**27-Mar-2017**	03-May-2017	✓
Soil Glass Jar - Unpreserved (EP132B-SD) IC1, IC5-0.5, IC1-R2, OC5, OC7, OC7-R2-0.5	**18-Mar-2017**	**24-Mar-2017**	01-Apr-2017	✓	**27-Mar-2017**	03-May-2017	✓

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)							
Buchi Ammonia	EK055	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055-103	4	31	**12.90**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	3	25	**12.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	4	31	**12.90**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	4	31	**12.90**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	4	31	**12.90**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	5	35	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Buchi Ammonia	EK055	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	3	35	**8.57**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Buchi Ammonia	EK055	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

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*	
Method Blanks (MB) - Continued							
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	3	35	**8.57**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Buchi Ammonia	EK055	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	19	**5.26**	**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
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Moisture Content	EA055-103	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Total Fe and Al in Sediments by ICPAES	EG005-SD	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3). LORs per NODG
Total Metals in Sediments by ICPMS	EG020-SD	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. Analyte list and LORs per NODG.
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Buchi Ammonia	EK055	SOIL	In house: Referenced to APHA 4500-NH3 B&G, H Samples are steam distilled (Buchi) prior to analysis and quantified using titration, FIA or Discrete Analyser.
Nitrite as N - Soluble by Discrete Analyser	EK057G	SOIL	In house: Referenced to APHA 4500-NO3- B. Nitrite in a water extract is determined by direct colourimetry by Discrete Analyser.
Nitrate as N - Soluble by Discrete Analyser	EK058G	SOIL	In house: Referenced to APHA 4500-NO3- F. Nitrate in the 1:5 soil:water extract is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results.
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	SOIL	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) in a water extract is determined by Chemical Reduction, and direct colourimetry by Discrete Analyser.
TKN as N By Discrete Analyser	EK061G	SOIL	In house: Referenced to APHA 4500-Norg-D Soil samples are digested using Kjeldahl digestion followed by determination by Discrete Analyser.
Total Nitrogen as N (TKN + NOx) By Discrete Analyser	EK062G	SOIL	In house: Referenced to APHA 4500 Norg/NO3- Total Nitrogen is determined as the sum of TKN and Oxidised Nitrrogen, each determined seperately as N.
Total Phosporus By Discrete Analyser	EK067G	SOIL	In house: Referenced to APHA 4500 P-B&F This procedure involves sulfuric acid digestion and quantification using Discrete Analyser.

Analytical Methods	Method	Matrix	Method Descriptions
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	SOIL	In house: Referenced to APHA 4500 P-F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) (
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.
TPH - Semivolatile Fraction	EP071-SD	SOIL	In house: Referenced to USEPA SW 846 - 8270D. Extracts are analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 504)
TRH Volatiles/BTEX in Sediments	EP080-SD	SOIL	In house: Referenced to USEPA SW 846 - 8260B Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve.
Organotin Analysis	EP090	SOIL	In house: Referenced to USEPA SW 846 - 8270D Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quanitified against an established calibration curve.
PAHs in Sediments by GCMS(SIM)	EP132B-SD	SOIL	In house: Referenced to USEPA 8270D GCMS Capillary column, SIM mode using large volume programmed temperature vaporisation injection.

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	SOIL	In house: Referenced to APHA 4500 Norg- D; APHA 4500 P - H. Macro Kjeldahl digestion.
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids for LVI (Non-concentrating)	ORG17D	SOIL	In house: 10g of sample, Na2SO4 and surrogate are extracted with 50mL 1:1 DCM/Acetone by end over end tumbling. An aliquot is concentrated by nitrogen blowdown to a reduced volume for analysis if required.
Organotin Sample Preparation	ORG35	SOIL	In house: 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP1703525**	Page	: 1 of 10
Client	: **WA MARINE PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: TRAVIS HURLEY	Contact	: Lauren Ockwell
Address	: SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370 DUNSBOROUGH, PERTH WA, AUSTRALIA 6281	Address	: 10 Hod Way Malaga WA Australia 6090
Telephone	: ----	Telephone	: 08 9209 7606
Project	: Ex EP1702676 17-WAU-0008 Onslow Marine Support Base	Date Samples Received	: 22-Mar-2017
Order number	: ----	Date Analysis Commenced	: 12-Apr-2017
C-O-C number	: ----	Issue Date	: 22-Apr-2017
Sampler	: ----		
Site	: ----		
Quote number	: EP/814/15		
No. of samples received	: 3		
No. of samples analysed	: 3		

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 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*
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics, Malaga, WA
Daniel Fisher	Inorganics Analyst	Perth ASS, Malaga, WA
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Efua Wilson	Metals Chemist	Perth Inorganics, Malaga, WA
Huynh Huynh	Organic Chemist	Perth Organics, Malaga, WA
Vanessa Nguyen	Organic Chemist	Perth Organics, Malaga, WA

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 (%)*
EA033-A: Actual Acidity (QC Lot: 839277)									
EP1703525-003	TC5	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.00	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.00	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	9.9	9.9	0.00	0% - 20%
EA033-B: Potential Acidity (QC Lot: 839277)									
EP1703525-003	TC5	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	0.00	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA033-C: Acid Neutralising Capacity (QC Lot: 839277)									
EP1703525-003	TC5	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	10.4	10.4	0.480	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	3.35	3.33	0.599	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	2090	2080	0.498	0% - 20%
EA033-E: Acid Base Accounting (QC Lot: 839277)									
EP1703525-003	TC5	EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.00	No Limit
		EA033: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	0.00	No Limit
		EA033: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.00	No Limit
		EA033: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	0.00	No Limit
		EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.00	No Limit
		EA033: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA055: Moisture Content (QC Lot: 846958)									
EP1703525-001	TC1-1	EA055-103: Moisture Content (dried @ 103°C)	----	1	%	25.6	22.4	13.3	0% - 20%
EG005-SD: Total Metals in Sediments by ICP-AES (QC Lot: 846097)									
EP1703525-002	TC1-T2-1	EG005-SD: Aluminium	7429-90-5	50	mg/kg	5820	5890	1.14	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 (%)*
EG005-SD: Total Metals in Sediments by ICP-AES (QC Lot: 846097) - continued									
EP1703525-002	TC1-T2-1	EG005-SD: Iron	7439-89-6	50	mg/kg	27700	27800	0.240	0% - 20%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 846098)									
EP1703525-002	TC1-T2-1	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	2.6	2.5	5.98	0% - 20%
		EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	<0.50	0.00	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	13.1	12.7	3.18	0% - 20%
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	15.8	18.6	16.1	0% - 50%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	39.6	38.0	4.15	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	17.8	16.8	5.79	0% - 50%
		EG020-SD: Lead	7439-92-1	1	mg/kg	6.7	6.6	0.00	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	18.6	18.1	2.76	0% - 50%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	32.3	30.5	5.76	0% - 20%
		EG020-SD: Manganese	7439-96-5	10	mg/kg	535	512	4.41	0% - 20%
		EG020-SD: Vanadium	7440-62-2	2	mg/kg	54.2	54.3	0.241	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 846099)									
EP1703525-002	TC1-T2-1	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	No Limit
EK055: Ammonia as N (QC Lot: 847181)									
EP1703488-014	Anonymous	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.00	No Limit
EP1703488-023	Anonymous	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 846993)									
EP1703525-001	TC1-1	EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 846992)									
EP1703525-001	TC1-1	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 836864)									
EP1703488-014	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	120	140	14.0	No Limit
EP1703488-024	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	420	490	15.2	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 836863)									
EP1703488-014	Anonymous	EK067G: Total Phosphorus as P	----	2	mg/kg	94	82	13.9	0% - 20%
EP1703488-024	Anonymous	EK067G: Total Phosphorus as P	----	2	mg/kg	141	128	9.48	0% - 20%
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 846994)									
EP1703525-001	TC1-1	EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	0.3	0.3	0.00	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 845037)									
EP1703488-026	Anonymous	EP003: Total Organic Carbon	----	0.02	%	0.07	0.06	28.0	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 836689)									
EP1703525-001	TC1-1	EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	<3	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 836689) - continued									
EP1703525-001	TC1-1	EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	<5	0.00	No Limit
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 843106)									
EP1703525-001	TC1-1	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.00	0% - 3%
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 836689)									
EP1703525-001	TC1-1	EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	<3	0.00	No Limit
		EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	4	41.7	No Limit
		EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	4	28.6	No Limit
		EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	<5	0.00	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 843106)									
EP1703525-001	TC1-1	EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	0.00	0% - 3%
EP080-SD: BTEXN (QC Lot: 843106)									
EP1703525-001	TC1-1	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: Total Xylenes	1330-20-7	0.2	mg/kg	<0.5	<0.5	0.00	0% - .2%
		EP080-SD: Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
		EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	0.00	0% - .2%
EP090: Organotin Compounds (QC Lot: 844512)									
EP1703444-003	Anonymous	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.00	No Limit
EP1703525-001	TC1-1	EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	0.00	No Limit
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 836690)									
EP1703525-001	TC1-1	EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	<4	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 836690) - continued									
EP1703525-001	TC1-1	EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	<4	0.00	No Limit
		EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	<5	0.00	No Limit
		EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	0.00	No Limit
		EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	<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
EA033-A: Actual Acidity (QCLot: 839277)								
EA033: pH KCl (23A)	----	0.1	pH Unit	<0.1	----	----	----	----
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	73.0756 mole H+ / t	90.6	79	103
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 839277)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.1798 % S	81.2	77	117
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 839277)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	4.9 % CaCO3	103	85	115
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----
EA033-E: Acid Base Accounting (QCLot: 839277)								
EA033: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA033: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA033: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
EG005-SD: Total Metals in Sediments by ICP-AES (QCLot: 846097)								
EG005-SD: Aluminium	7429-90-5	50	mg/kg	<50	----	----	----	----
EG005-SD: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 846098)								
EG020-SD: Antimony	7440-36-0	0.5	mg/kg	<0.50	----	----	----	----
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	21.62091 mg/kg	115	74	130
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	4.6838 mg/kg	109	97	113
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	33.904 mg/kg	103	72	152
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	33.782 mg/kg	102	76	116
EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	<0.5	----	----	----	----
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	40.33169 mg/kg	98.1	74	124
EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	----	----	----	----
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	51.10088 mg/kg	104	81	135
EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Silver	7440-22-4	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Vanadium	7440-62-2	2	mg/kg	<2.0	----	----	----	----
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	61.70999 mg/kg	111	81	143
EG035T: Total Recoverable Mercury by FIMS (QCLot: 846099)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	2.154 mg/kg	99.3	80	120

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EK055: Ammonia as N (QCLot: 847181)								
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	10 mg/kg	88.8	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 846993)								
EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	2.5 mg/kg	96.6	89	121
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 846992)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	107	90	112
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 836864)								
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	1000 mg/kg	84.5	78	112
				<20	100 mg/kg	85.9	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 836863)								
EK067G: Total Phosphorus as P	----	2	mg/kg	<2	440 mg/kg	88.4	78	108
				<2	44 mg/kg	90.7	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 846994)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	<0.1	2.5 mg/kg	105	92	112
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 845037)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	110	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 836689)								
EP071-SD: C10 - C14 Fraction	----	3	mg/kg	<3	138 mg/kg	103	70	130
EP071-SD: C15 - C28 Fraction	----	3	mg/kg	<3	290 mg/kg	106	70	130
EP071-SD: C29 - C36 Fraction	----	5	mg/kg	<5	51 mg/kg	113	70	130
EP071-SD: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 843106)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	800 mg/kg	73.4	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 836689)								
EP071-SD: >C10 - C16 Fraction	----	3	mg/kg	<3	202 mg/kg	105	70	130
EP071-SD: >C16 - C34 Fraction	----	3	mg/kg	<3	258 mg/kg	106	70	130
EP071-SD: >C34 - C40 Fraction	----	5	mg/kg	<5	18 mg/kg	96.0	70	130
EP071-SD: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 843106)								
EP080-SD: C6 - C10 Fraction	C6_C10	3	mg/kg	<3	925 mg/kg	77.0	70	130
EP080-SD: BTEXN (QCLot: 843106)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	50 mg/kg	106	70	130
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	50 mg/kg	103	70	130
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	50 mg/kg	110	70	130
EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	100 mg/kg	108	70	130
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	50 mg/kg	111	70	130
EP080-SD: Total Xylenes	1330-20-7	0.2	mg/kg	<0.2	----	----	----	----

Sub-Matrix: **SOIL**

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
EP080-SD: BTEXN (QCLot: 843106) - continued								
EP080-SD: Sum of BTEX	----	0.2	mg/kg	<0.2	----	----	----	----
EP080-SD: Naphthalene	91-20-3	0.2	mg/kg	<0.2	50 mg/kg	114	70	130
EP090: Organotin Compounds (QCLot: 844512)								
EP090: Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	1.25 µgSn/kg	103	52	139
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 836690)								
EP132B-SD: Naphthalene	91-20-3	5	µg/kg	<5	25 µg/kg	99.4	55	131
EP132B-SD: 2-Methylnaphthalene	91-57-6	5	µg/kg	<5	----	----	----	----
EP132B-SD: Acenaphthylene	208-96-8	4	µg/kg	<4	25 µg/kg	93.5	64	110
EP132B-SD: Acenaphthene	83-32-9	4	µg/kg	<4	25 µg/kg	101	62	112
EP132B-SD: Fluorene	86-73-7	4	µg/kg	<4	25 µg/kg	99.4	64	118
EP132B-SD: Phenanthrene	85-01-8	4	µg/kg	<4	25 µg/kg	103	59	117
EP132B-SD: Anthracene	120-12-7	4	µg/kg	<4	25 µg/kg	103	69	111
EP132B-SD: Fluoranthene	206-44-0	4	µg/kg	<4	25 µg/kg	100	66	118
EP132B-SD: Pyrene	129-00-0	4	µg/kg	<4	25 µg/kg	98.1	70	116
EP132B-SD: Benz(a)anthracene	56-55-3	4	µg/kg	<4	25 µg/kg	87.8	59	121
EP132B-SD: Chrysene	218-01-9	4	µg/kg	<4	25 µg/kg	116	68	116
EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	25 µg/kg	95.2	51	107
EP132B-SD: Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	25 µg/kg	90.0	52	118
EP132B-SD: Benzo(e)pyrene	192-97-2	4	µg/kg	<4	----	----	----	----
EP132B-SD: Benzo(a)pyrene	50-32-8	4	µg/kg	<4	25 µg/kg	91.0	55	111
EP132B-SD: Perylene	198-55-0	4	µg/kg	<4	----	----	----	----
EP132B-SD: Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	25 µg/kg	81.8	62	106
EP132B-SD: Dibenz(a.h)anthracene	53-70-3	4	µg/kg	<4	25 µg/kg	97.8	35	141
EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg	<4	25 µg/kg	104	48	122
EP132B-SD: Coronene	191-07-1	5	µg/kg	<5	----	----	----	----
EP132B-SD: Sum of PAHs	----	4	µg/kg	<4	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EG005-SD: Total Metals in Sediments by ICP-AES (QCLot: 846097)							
EP1703525-003	TC5	EG005-SD: Aluminium	7429-90-5	50 mg/kg	# Not Determined	70	130

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
EG005-SD: Total Metals in Sediments by ICP-AES (QCLot: 846097) - continued							
EP1703525-003	TC5	EG005-SD: Iron	7439-89-6	50 mg/kg	# Not Determined	70	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 846098)							
EP1703525-003	TC5	EG020-SD: Arsenic	7440-38-2	50 mg/kg	98.2	70	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	104	70	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	84.4	70	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	88.2	70	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	92.5	70	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	101	70	130
		EG020-SD: Selenium	7782-49-2	50 mg/kg	88.5	70	130
		EG020-SD: Zinc	7440-66-6	250 mg/kg	101	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 846099)							
EP1703525-003	TC5	EG035T-LL: Mercury	7439-97-6	10 mg/kg	98.0	70	130
EK055: Ammonia as N (QCLot: 847181)							
EP1703488-015	Anonymous	EK055: Ammonia as N	7664-41-7	100 mg/kg	90.3	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 846993)							
EP1703525-002	TC1-T2-1	EK057G: Nitrite as N (Sol.)	14797-65-0	3 mg/kg	100	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 846992)							
EP1703525-002	TC1-T2-1	EK059G: Nitrite + Nitrate as N (Sol.)	----	3 mg/kg	96.5	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 836864)							
EP1703488-015	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	# 56.3	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 836863)							
EP1703488-015	Anonymous	EK067G: Total Phosphorus as P	----	100 mg/kg	83.1	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 846994)							
EP1703525-002	TC1-T2-1	EK071G: Reactive Phosphorus as P	14265-44-2	2.5 mg/kg	110	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 836689)							
EP1703525-002	TC1-T2-1	EP071-SD: C10 - C14 Fraction	----	138 mg/kg	103	70	130
		EP071-SD: C15 - C28 Fraction	----	290 mg/kg	107	70	130
		EP071-SD: C29 - C36 Fraction	----	51 mg/kg	119	70	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 843106)							
EP1703525-002	TC1-T2-1	EP080-SD: C6 - C9 Fraction	----	600 mg/kg	73.7	70	130
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 836689)							
EP1703525-002	TC1-T2-1	EP071-SD: >C10 - C16 Fraction	----	202 mg/kg	106	70	130
		EP071-SD: >C16 - C34 Fraction	----	258 mg/kg	108	70	130
		EP071-SD: >C34 - C40 Fraction	----	18 mg/kg	103	70	130

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*
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 843106)							
EP1703525-002	TC1-T2-1	EP080-SD: C6 - C10 Fraction	C6_C10	725 mg/kg	75.8	70	130
EP080-SD: BTEXN (QCLot: 843106)							
EP1703525-002	TC1-T2-1	EP080-SD: Benzene	71-43-2	50 mg/kg	101	70	130
		EP080-SD: Toluene	108-88-3	50 mg/kg	102	70	130
EP090: Organotin Compounds (QCLot: 844512)							
EP1703444-004	Anonymous	EP090: Tributyltin	56573-85-4	1.25 µgSn/kg	70.6	20	130
EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 836690)							
EP1703525-002	TC1-T2-1	EP132B-SD: Naphthalene	91-20-3	25 µg/kg	79.4	70	130
		EP132B-SD: Acenaphthylene	208-96-8	25 µg/kg	76.7	70	130
		EP132B-SD: Acenaphthene	83-32-9	25 µg/kg	83.8	70	130
		EP132B-SD: Fluorene	86-73-7	25 µg/kg	86.1	70	130
		EP132B-SD: Phenanthrene	85-01-8	25 µg/kg	80.0	70	130
		EP132B-SD: Anthracene	120-12-7	25 µg/kg	83.9	70	130
		EP132B-SD: Fluoranthene	206-44-0	25 µg/kg	97.4	70	130
		EP132B-SD: Pyrene	129-00-0	25 µg/kg	95.6	70	130
		EP132B-SD: Benz(a)anthracene	56-55-3	25 µg/kg	88.8	70	130
		EP132B-SD: Chrysene	218-01-9	25 µg/kg	110	70	130
		EP132B-SD: Benzo(b+j)fluoranthene	205-99-2 205-82-3	25 µg/kg	85.4	70	130
		EP132B-SD: Benzo(k)fluoranthene	207-08-9	25 µg/kg	98.0	70	130
		EP132B-SD: Benzo(a)pyrene	50-32-8	25 µg/kg	78.4	70	130
		EP132B-SD: Benzo(g.h.i)perylene	191-24-2	25 µg/kg	93.4	70	130
		EP132B-SD: Dibenz(a.h)anthracene	53-70-3	25 µg/kg	87.2	70	130
		EP132B-SD: Indeno(1.2.3.cd)pyrene	193-39-5	25 µg/kg	88.9	70	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP1703525**	Page	: 1 of 10
Client	: **WA MARINE PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: TRAVIS HURLEY	Telephone	: 08 9209 7606
Project	: Ex EP1702676 17-WAU-0008 Onslow Marine Support Base	Date Samples Received	: 22-Mar-2017
Site	: ----	Issue Date	: 22-Apr-2017
Sampler	: ----	No. of samples received	: 3
Order number	: ----	No. of samples analysed	: 3

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.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005-SD: Total Metals in Sediments by ICP-AES	EP1703525--003	TC5	**Aluminium**	7429-90-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG005-SD: Total Metals in Sediments by ICP-AES	EP1703525--003	TC5	**Iron**	7439-89-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser	EP1703488--015	Anonymous	**Total Kjeldahl Nitrogen as N**	----	56.3 %	70-130%	**Recovery less than lower data quality objective**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA033-A: Actual Acidity						
Soil Glass Jar - Unpreserved						
TC5	19-Apr-2017	18-Mar-2017	**32**	----	----	----
EA033-B: Potential Acidity						
Soil Glass Jar - Unpreserved						
TC5	19-Apr-2017	18-Mar-2017	**32**	----	----	----
EA033-C: Acid Neutralising Capacity						
Soil Glass Jar - Unpreserved						
TC5	19-Apr-2017	18-Mar-2017	**32**	----	----	----
EA033-D: Retained Acidity						
Soil Glass Jar - Unpreserved						
TC5	19-Apr-2017	18-Mar-2017	**32**	----	----	----
EA033-E: Acid Base Accounting						
Soil Glass Jar - Unpreserved						
TC5	19-Apr-2017	18-Mar-2017	**32**	----	----	----
EA055: Moisture Content						
Soil Glass Jar - Unpreserved						
TC1-1, TC1-T2-1	----	----	----	20-Apr-2017	29-Mar-2017	**22**
Soil Glass Jar - Unpreserved						
TC5	----	----	----	20-Apr-2017	31-Mar-2017	**20**
EG035T: Total Recoverable Mercury by FIMS						
Soil Glass Jar - Unpreserved						
TC1-T2-1	20-Apr-2017	12-Apr-2017	**8**	20-Apr-2017	12-Apr-2017	**8**
Soil Glass Jar - Unpreserved						
TC5	20-Apr-2017	14-Apr-2017	**6**	20-Apr-2017	14-Apr-2017	**6**

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EP003: Total Organic Carbon (TOC) in Soil						
Soil Glass Jar - Unpreserved						
TC1-T2-1	19-Apr-2017	12-Apr-2017	**7**	19-Apr-2017	12-Apr-2017	**7**
Soil Glass Jar - Unpreserved						
TC5	19-Apr-2017	14-Apr-2017	**5**	19-Apr-2017	14-Apr-2017	**5**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions						
Soil Glass Jar - Unpreserved						
TC1-1, TC1-T2-1	13-Apr-2017	29-Mar-2017	**15**	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons						
Soil Glass Jar - Unpreserved						
TC1-1, TC1-T2-1	13-Apr-2017	29-Mar-2017	**15**	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons						
Soil Glass Jar - Unpreserved						
TC1-1, TC1-T2-1	13-Apr-2017	29-Mar-2017	**15**	18-Apr-2017	29-Mar-2017	**20**
EP080-SD: BTEXN						
Soil Glass Jar - Unpreserved						
TC1-1, TC1-T2-1	13-Apr-2017	29-Mar-2017	**15**	18-Apr-2017	29-Mar-2017	**20**
EP090: Organotin Compounds						
Soil Glass Jar - Unpreserved						
TC1-1, TC1-T2-1	19-Apr-2017	29-Mar-2017	**21**	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons						
Soil Glass Jar - Unpreserved						
TC1-1, TC1-T2-1	13-Apr-2017	29-Mar-2017	**15**	----	----	----

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: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EA033-A: Actual Acidity							
Soil Glass Jar - Unpreserved (EA033)							
TC5	**17-Mar-2017**	**19-Apr-2017**	18-Mar-2017	×	**19-Apr-2017**	18-Jul-2017	✓

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
EA033-B: Potential Acidity							
Soil Glass Jar - Unpreserved (EA033)							
TC5	**17-Mar-2017**	**19-Apr-2017**	18-Mar-2017	×	**19-Apr-2017**	18-Jul-2017	✓
EA033-C: Acid Neutralising Capacity							
Soil Glass Jar - Unpreserved (EA033)							
TC5	**17-Mar-2017**	**19-Apr-2017**	18-Mar-2017	×	**19-Apr-2017**	18-Jul-2017	✓
EA033-D: Retained Acidity							
Soil Glass Jar - Unpreserved (EA033)							
TC5	**17-Mar-2017**	**19-Apr-2017**	18-Mar-2017	×	**19-Apr-2017**	18-Jul-2017	✓
EA033-E: Acid Base Accounting							
Soil Glass Jar - Unpreserved (EA033)							
TC5	**17-Mar-2017**	**19-Apr-2017**	18-Mar-2017	×	**19-Apr-2017**	18-Jul-2017	✓
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055-103)							
TC1-1, TC1-T2-1	**15-Mar-2017**	**----**	----	----	**20-Apr-2017**	29-Mar-2017	×
Soil Glass Jar - Unpreserved (EA055-103)							
TC5	**17-Mar-2017**	**----**	----	----	**20-Apr-2017**	31-Mar-2017	×
EA150: Particle Sizing							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H)							
TC1-T2-1	**15-Mar-2017**	**----**	----	----	**19-Apr-2017**	11-Sep-2017	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H)							
TC5	**17-Mar-2017**	**----**	----	----	**19-Apr-2017**	13-Sep-2017	✓
EA150: Soil Classification based on Particle Size							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H)							
TC1-T2-1	**15-Mar-2017**	**----**	----	----	**19-Apr-2017**	11-Sep-2017	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H)							
TC5	**17-Mar-2017**	**----**	----	----	**19-Apr-2017**	13-Sep-2017	✓
EG005-SD: Total Metals in Sediments by ICP-AES							
Soil Glass Jar - Unpreserved (EG005-SD)							
TC1-T2-1	**15-Mar-2017**	**20-Apr-2017**	11-Sep-2017	✓	**20-Apr-2017**	11-Sep-2017	✓
Soil Glass Jar - Unpreserved (EG005-SD)							
TC5	**17-Mar-2017**	**20-Apr-2017**	13-Sep-2017	✓	**20-Apr-2017**	13-Sep-2017	✓
EG020-SD: Total Metals in Sediments by ICPMS							
Soil Glass Jar - Unpreserved (EG020-SD)							
TC1-T2-1	**15-Mar-2017**	**20-Apr-2017**	11-Sep-2017	✓	**20-Apr-2017**	11-Sep-2017	✓
Soil Glass Jar - Unpreserved (EG020-SD)							
TC5	**17-Mar-2017**	**20-Apr-2017**	13-Sep-2017	✓	**20-Apr-2017**	13-Sep-2017	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T-LL)							
TC1-T2-1	**15-Mar-2017**	**20-Apr-2017**	12-Apr-2017	×	**20-Apr-2017**	12-Apr-2017	×
Soil Glass Jar - Unpreserved (EG035T-LL)							
TC5	**17-Mar-2017**	**20-Apr-2017**	14-Apr-2017	×	**20-Apr-2017**	14-Apr-2017	×

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
EK055: Ammonia as N							
Soil Glass Jar - Unpreserved (EK055)							
TC1-1, TC1-T2-1	**15-Mar-2017**	**----**	----	----	**20-Apr-2017**	11-Sep-2017	✓
EK057G: Nitrite as N by Discrete Analyser							
Soil Glass Jar - Unpreserved (EK057G)							
TC1-1, TC1-T2-1	**15-Mar-2017**	**20-Apr-2017**	11-Sep-2017	✓	**20-Apr-2017**	11-Sep-2017	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Soil Glass Jar - Unpreserved (EK059G)							
TC1-1, TC1-T2-1	**15-Mar-2017**	**20-Apr-2017**	11-Sep-2017	✓	**20-Apr-2017**	11-Sep-2017	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Soil Glass Jar - Unpreserved (EK061G)							
TC1-1, TC1-T2-1	**15-Mar-2017**	**12-Apr-2017**	11-Sep-2017	✓	**19-Apr-2017**	11-Sep-2017	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Soil Glass Jar - Unpreserved (EK067G)							
TC1-1, TC1-T2-1	**15-Mar-2017**	**12-Apr-2017**	11-Sep-2017	✓	**19-Apr-2017**	11-Sep-2017	✓
EK071G: Reactive Phosphorus as P by discrete analyser							
Soil Glass Jar - Unpreserved (EK071G)							
TC1-1, TC1-T2-1	**15-Mar-2017**	**20-Apr-2017**	11-Sep-2017	✓	**20-Apr-2017**	11-Sep-2017	✓
EP003: Total Organic Carbon (TOC) in Soil							
Soil Glass Jar - Unpreserved (EP003)							
TC1-T2-1	**15-Mar-2017**	**19-Apr-2017**	12-Apr-2017	×	**19-Apr-2017**	12-Apr-2017	×
Soil Glass Jar - Unpreserved (EP003)							
TC5	**17-Mar-2017**	**19-Apr-2017**	14-Apr-2017	×	**19-Apr-2017**	14-Apr-2017	×
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP071-SD)							
TC1-1, TC1-T2-1	**15-Mar-2017**	**13-Apr-2017**	29-Mar-2017	×	**18-Apr-2017**	23-May-2017	✓
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080-SD)							
TC1-1	**15-Mar-2017**	**13-Apr-2017**	29-Mar-2017	×	**18-Apr-2017**	29-Mar-2017	×
Soil Glass Jar - Unpreserved (EP071-SD)							
TC1-1	**15-Mar-2017**	**13-Apr-2017**	29-Mar-2017	×	**18-Apr-2017**	23-May-2017	✓
Soil Glass Jar - Unpreserved (EP080-SD)							
TC1-T2-1	**15-Mar-2017**	**13-Apr-2017**	29-Mar-2017	×	**18-Apr-2017**	29-Mar-2017	×
Soil Glass Jar - Unpreserved (EP071-SD)							
TC1-T2-1	**15-Mar-2017**	**13-Apr-2017**	29-Mar-2017	×	**18-Apr-2017**	23-May-2017	✓
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080-SD)							
TC1-1, TC1-T2-1	**15-Mar-2017**	**13-Apr-2017**	29-Mar-2017	×	**18-Apr-2017**	29-Mar-2017	×
EP080-SD: BTEXN							
Soil Glass Jar - Unpreserved (EP080-SD)							
TC1-1, TC1-T2-1	**15-Mar-2017**	**13-Apr-2017**	29-Mar-2017	×	**18-Apr-2017**	29-Mar-2017	×

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
EP090: Organotin Compounds								
Soil Glass Jar - Unpreserved (EP090)								
TC1-1,	TC1-T2-1	**15-Mar-2017**	**19-Apr-2017**	29-Mar-2017	×	**20-Apr-2017**	29-May-2017	✓
EP132B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP132B-SD)								
TC1-1,	TC1-T2-1	**15-Mar-2017**	**13-Apr-2017**	29-Mar-2017	×	**19-Apr-2017**	23-May-2017	✓

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)							
Buchi Ammonia	EK055	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055-103	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Buchi Ammonia	EK055	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Buchi Ammonia	EK055	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

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*	
Method Blanks (MB) - Continued							
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Buchi Ammonia	EK055	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Organotin Analysis	EP090	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAHs in Sediments by GCMS(SIM)	EP132B-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fraction	EP071-SD	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	2	**50.00**	**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
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Moisture Content	EA055-103	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Total Fe and Al in Sediments by ICPAES	EG005-SD	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3). LORs per NODG
Total Metals in Sediments by ICPMS	EG020-SD	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. Analyte list and LORs per NODG.
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Buchi Ammonia	EK055	SOIL	In house: Referenced to APHA 4500-NH3 B&G, H Samples are steam distilled (Buchi) prior to analysis and quantified using titration, FIA or Discrete Analyser.
Nitrite as N - Soluble by Discrete Analyser	EK057G	SOIL	In house: Referenced to APHA 4500-NO3- B. Nitrite in a water extract is determined by direct colourimetry by Discrete Analyser.
Nitrate as N - Soluble by Discrete Analyser	EK058G	SOIL	In house: Referenced to APHA 4500-NO3- F. Nitrate in the 1:5 soil:water extract is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results.
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	SOIL	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) in a water extract is determined by Chemical Reduction, and direct colourimetry by Discrete Analyser.
TKN as N By Discrete Analyser	EK061G	SOIL	In house: Referenced to APHA 4500-Norg-D Soil samples are digested using Kjeldahl digestion followed by determination by Discrete Analyser.
Total Nitrogen as N (TKN + NOx) By Discrete Analyser	EK062G	SOIL	In house: Referenced to APHA 4500 Norg/NO3- Total Nitrogen is determined as the sum of TKN and Oxidised Nitrrogen, each determined seperately as N.
Total Phosporus By Discrete Analyser	EK067G	SOIL	In house: Referenced to APHA 4500 P-B&F This procedure involves sulfuric acid digestion and quantification using Discrete Analyser.

Analytical Methods	Method	Matrix	Method Descriptions
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	SOIL	In house: Referenced to APHA 4500 P-F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) (
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.
TPH - Semivolatile Fraction	EP071-SD	SOIL	In house: Referenced to USEPA SW 846 - 8270D. Extracts are analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 504)
TRH Volatiles/BTEX in Sediments	EP080-SD	SOIL	In house: Referenced to USEPA SW 846 - 8260B Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve.
Organotin Analysis	EP090	SOIL	In house: Referenced to USEPA SW 846 - 8270D Prepared sample extracts are analysed by GC/MS coupled with high volume injection, and quanitified against an established calibration curve.
PAHs in Sediments by GCMS(SIM)	EP132B-SD	SOIL	In house: Referenced to USEPA 8270D GCMS Capillary column, SIM mode using large volume programmed temperature vaporisation injection.

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	SOIL	In house: Referenced to APHA 4500 Norg- D; APHA 4500 P - H. Macro Kjeldahl digestion.
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids for LVI (Non-concentrating)	ORG17D	SOIL	In house: 10g of sample, Na2SO4 and surrogate are extracted with 50mL 1:1 DCM/Acetone by end over end tumbling. An aliquot is concentrated by nitrogen blowdown to a reduced volume for analysis if required.
Organotin Sample Preparation	ORG35	SOIL	In house: 20g sample is spiked with surrogate and leached in a methanol:acetic acid:UHP water mix and vacuum filtered. Reagents and solvents are added to the sample and the mixture tumbled. The butyltin compounds are simultaneously derivatised and extracted. The extract is further extracted with petroleum ether. The resultant extracts are combined and concentrated for analysis.

QUALITY CONTROL REPORT

Work Order	: **EP1705039**	Page	: 1 of 3
Client	: **WA MARINE PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: TRAVIS HURLEY	Contact	: Lauren Ockwell
Address	: SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370 DUNSBOROUGH, PERTH WA, AUSTRALIA 6281	Address	: 10 Hod Way Malaga WA Australia 6090
Telephone	: ----	Telephone	: 08 9209 7606
Project	: Ex EP1702676 17WAU-0008 Onslow Marine Support Base	Date Samples Received	: 22-Mar-2017
Order number	: ----	Date Analysis Commenced	: 24-May-2017
C-O-C number	: ----	Issue Date	: 25-May-2017
Sampler	: ----		
Site	: ----		
Quote number	: EP/814/15		
No. of samples received	: 1		
No. of samples analysed	: 1		

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*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

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

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

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

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 (%)*
ED008: Exchangeable Cations (QC Lot: 895521)									
EP1705039-001	OC4-0.5 EP1707626_037	ED008: Exchangeable Calcium	----	0.1	meq/100g	25.6	25.6	0.00	0% - 20%
		ED008: Exchangeable Magnesium	----	0.1	meq/100g	7.2	7.1	0.00	0% - 20%
		ED008: Exchangeable Potassium	----	0.1	meq/100g	0.7	0.7	0.00	No Limit
		ED008: Exchangeable Sodium	----	0.1	meq/100g	0.9	0.9	0.00	No Limit
EP1705103-008	Anonymous	ED008: Exchangeable Calcium	----	0.1	meq/100g	23.5	23.8	1.18	0% - 20%
		ED008: Exchangeable Magnesium	----	0.1	meq/100g	3.3	3.3	0.00	0% - 20%
		ED008: Exchangeable Potassium	----	0.1	meq/100g	<0.1	<0.1	0.00	No Limit
		ED008: Exchangeable Sodium	----	0.1	meq/100g	0.4	0.4	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
ED008: Exchangeable Cations (QCLot: 895521)								
ED008: Exchangeable Calcium	----	0.1	meq/100g	<0.1	10.925 meq/100g	105	91	109
ED008: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	5.9518 meq/100g	108	89	111
ED008: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.4769 meq/100g	103	79	116
ED008: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.8718 meq/100g	93.7	75	118
ED008: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	18.2255 meq/100g	106	88	110

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 to assist with Quality Review

Work Order	: **EP1705039**	Page	: 1 of 4
Client	: **WA MARINE PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: TRAVIS HURLEY	Telephone	: 08 9209 7606
Project	: Ex EP1702676 17WAU-0008 Onslow Marine Support Base	Date Samples Received	: 22-Mar-2017
Site	: ----	Issue Date	: 25-May-2017
Sampler	: ----	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

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

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
ED008: Exchangeable Cations						
Soil Glass Jar - Unpreserved						
OC4-0.5 - EP1707626_037	24-May-2017	14-Apr-2017	**40**	24-May-2017	14-Apr-2017	**40**

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
ED008: Exchangeable Cations							
Soil Glass Jar - Unpreserved (ED008)							
OC4-0.5 - EP1707626_037	**17-Mar-2017**	**24-May-2017**	14-Apr-2017	×	**24-May-2017**	14-Apr-2017	×

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)							
Exchangeable Cations with pre-treatment	ED008	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Exchangeable Cations with pre-treatment	ED008	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Exchangeable Cations with pre-treatment	ED008	1	13	**7.69**	**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
Exchangeable Cations with pre-treatment	ED008	SOIL	In house: Referenced to Rayment & Higginson (2011) Method 15A2. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)

Preparation Methods	Method	Matrix	Method Descriptions
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Higginson (1992) method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.

Appendix C Laboratory Results

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP1702676**	Page	: 1 of 42
Client	: **WA MARINE PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: TRAVIS HURLEY	Contact	: Lauren Ockwell
Address	: SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370 DUNSBOROUGH, PERTH WA, AUSTRALIA 6281	Address	: 10 Hod Way Malaga WA Australia 6090
Telephone	: ----	Telephone	: 08 9209 7606
Project	: 17WAU-0008 Onslow Marine Support Base	Date Samples Received	: 22-Mar-2017 10:55
Order number	: ----	Date Analysis Commenced	: 23-Mar-2017
C-O-C number	: ----	Issue Date	: 04-Apr-2017 07:20
Sampler	: ----		
Site	: ----		
Quote number	: EP/814/15		
No. of samples received	: 56		
No. of samples analysed	: 37		

Accreditation No. 825
Accredited for compliance with
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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*
Amanda Conkie	Organic Chemist	Brisbane Organics, Stafford, QLD
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics, Malaga, WA
Daniel Fisher	Inorganics Analyst	Perth ASS, Malaga, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Malaga, WA
Huynh Huynh	Organic Chemist	Perth Organics, Malaga, WA
Indra Astuty	Instrument Chemist	Perth Inorganics, Malaga, WA
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Peter Keyte	Newcastle Manager	Newcastle - Inorganics, Mayfield West, NSW
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils, Stafford, QLD
Vanessa Nguyen	Organic Chemist	Perth Organics, Malaga, WA

General Comments

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

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

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

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

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

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

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

- TOC and Organotins conducted by ALS Brisbane, NATA Site No. 818.
- PSD conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- EP132-SD: Poor surrogate recovery for some samples due to suspected matrix effects and interferences.
- EP132-SD: LOR has been raised for sample "IC5-0.5" for analyte "Dibenz(a,h)anthracene" due to suspected matrix effects and interferences.
- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.

Analytical Results

Sub-Matrix: **SEDIMENT** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	BP1	BP4	TC2-R1	TC1-0.5	TC1-1
				Client sampling date / time	15-Mar-2017 10:20	16-Mar-2017 07:02	15-Mar-2017 11:06	15-Mar-2017 16:36	15-Mar-2017 16:36
					EP1702676-001	EP1702676-004	EP1702676-005	EP1702676-007	EP1702676-008
					Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		**9.6**	----	**9.4**	----	**9.4**
Titratable Actual Acidity (23F)	----	2	mole H+ / t		<2	----	<2	----	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	----	<0.02	----	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		**0.073**	----	**0.105**	----	**0.162**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		**45**	----	**66**	----	**101**
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3		**9.06**	----	**13.5**	----	**10.2**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t		**1810**	----	**2700**	----	**2030**
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S		**2.90**	----	**4.32**	----	**3.25**
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	----	**1.5**	----	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		<0.02	----	<0.02	----	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		<10	----	<10	----	<10
Liming Rate	----	1	kg CaCO3/t		<1	----	<1	----	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		**0.07**	----	**0.11**	----	**0.16**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		**45**	----	**66**	----	**101**
Liming Rate excluding ANC	----	1	kg CaCO3/t		**3**	----	**5**	----	**8**
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%		----	**19.3**	**39.7**	**23.6**	**27.8**
EA150: Particle Sizing									
+75µm	----	1	%		----	**99**	**70**	**95**	**47**
+150µm	----	1	%		----	**95**	**23**	**74**	**29**
+300µm	----	1	%		----	**63**	**1**	**28**	**5**
+425µm	----	1	%		----	**35**	<1	**14**	**2**
+600µm	----	1	%		----	**28**	<1	**10**	**1**
+1180µm	----	1	%		----	**17**	<1	**8**	<1
+2.36mm	----	1	%		----	**11**	<1	**5**	<1
+4.75mm	----	1	%		----	**5**	<1	**3**	<1
+9.5mm	----	1	%		----	<1	<1	<1	<1
+19.0mm	----	1	%		----	<1	<1	<1	<1

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	BP1	BP4	TC2-R1	TC1-0.5	TC1-1
				Client sampling date / time	15-Mar-2017 10:20	16-Mar-2017 07:02	15-Mar-2017 11:06	15-Mar-2017 16:36	15-Mar-2017 16:36
Compound	CAS Number	LOR	Unit		EP1702676-001	EP1702676-004	EP1702676-005	EP1702676-007	EP1702676-008
					Result	Result	Result	Result	Result
EA150: Particle Sizing - Continued									
+37.5mm	----	1	%		----	<1	<1	<1	<1
+75.0mm	----	1	%		----	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	<1	13	3	29
Silt (2-60 µm)	----	1	%		----	<1	12	<1	20
Sand (0.06-2.00 mm)	----	1	%		----	87	75	91	51
Gravel (>2mm)	----	1	%		----	13	<1	6	<1
Cobbles (>6cm)	----	1	%		----	<1	<1	<1	<1
EG005-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		----	1370	7900	3440	7030
Iron	7439-89-6	50	mg/kg		----	9600	31000	14200	38100
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.5	mg/kg		----	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1	mg/kg		----	16.0	23.2	12.9	15.4
Cadmium	7440-43-9	0.1	mg/kg		----	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1	mg/kg		----	10.0	39.4	19.7	52.9
Copper	7440-50-8	1	mg/kg		----	1.6	14.9	5.5	27.6
Cobalt	7440-48-4	0.5	mg/kg		----	3.0	10.3	5.0	16.8
Lead	7439-92-1	1	mg/kg		----	1.3	6.8	2.6	8.7
Manganese	7439-96-5	10	mg/kg		----	388	349	272	591
Nickel	7440-02-0	1	mg/kg		----	3.1	17.0	8.6	26.5
Selenium	7782-49-2	0.1	mg/kg		----	1.0	1.8	1.0	2.2
Silver	7440-22-4	0.1	mg/kg		----	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2	mg/kg		----	24.0	63.0	28.4	70.3
Zinc	7440-66-6	1	mg/kg		----	5.2	30.2	13.7	43.0
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		----	<0.01	<0.01	<0.01	<0.01
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		----	<20	<20	<20	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg		----	<0.1	<0.1	<0.1	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg		----	<0.1	<0.1	<0.1	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	BP1	BP4	TC2-R1	TC1-0.5	TC1-1
				Client sampling date / time	15-Mar-2017 10:20	16-Mar-2017 07:02	15-Mar-2017 11:06	15-Mar-2017 16:36	15-Mar-2017 16:36
Compound	CAS Number	LOR	Unit		EP1702676-001	EP1702676-004	EP1702676-005	EP1702676-007	EP1702676-008
					Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser - Continued									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		----	<0.1	<0.1	<0.1	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		----	**40**	**450**	**50**	----
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		----	**40**	**450**	**50**	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		----	**98**	**182**	**113**	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		----	<0.1	<0.1	<0.1	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		----	**0.04**	**0.03**	**0.33**	**0.11**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		----	<3	<3	<3	----
>C16 - C34 Fraction	----	3	mg/kg		----	<3	**7**	**4**	----
>C34 - C40 Fraction	----	5	mg/kg		----	<5	<5	<5	----
>C10 - C40 Fraction (sum)	----	3	mg/kg		----	<3	**7**	**4**	----
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		----	<3	<3	<3	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		----	<3	<3	<3	----
C10 - C14 Fraction	----	3	mg/kg		----	<3	<3	<3	----
C15 - C28 Fraction	----	3	mg/kg		----	<3	**6**	**3**	----
C29 - C36 Fraction	----	5	mg/kg		----	<5	<5	<5	----
^ C10 - C36 Fraction (sum)	----	3	mg/kg		----	<3	**6**	**3**	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		----	<3	<3	<3	----
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
Toluene	108-88-3	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
Ethylbenzene	100-41-4	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
ortho-Xylene	95-47-6	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
^ Total Xylenes	1330-20-7	0.5	mg/kg		----	<0.5	<0.5	<0.5	----
^ Sum of BTEX	----	0.2	mg/kg		----	<0.2	<0.2	<0.2	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	BP1	BP4	TC2-R1	TC1-0.5	TC1-1
				Client sampling date / time	15-Mar-2017 10:20	16-Mar-2017 07:02	15-Mar-2017 11:06	15-Mar-2017 16:36	15-Mar-2017 16:36
Compound	CAS Number	LOR	Unit		EP1702676-001	EP1702676-004	EP1702676-005	EP1702676-007	EP1702676-008
					Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued									
Naphthalene	91-20-3	0.2	mg/kg		----	<0.2	<0.2	<0.2	----
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		----	**0.5**	<0.5	<0.5	----
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		----	<5	<5	<5	----
2-Methylnaphthalene	91-57-6	5	µg/kg		----	<5	<5	<5	----
Acenaphthylene	208-96-8	4	µg/kg		----	<4	<4	<4	----
Acenaphthene	83-32-9	4	µg/kg		----	<4	<4	<4	----
Fluorene	86-73-7	4	µg/kg		----	<4	<4	<4	----
Phenanthrene	85-01-8	4	µg/kg		----	<4	<4	<4	----
Anthracene	120-12-7	4	µg/kg		----	<4	<4	<4	----
Fluoranthene	206-44-0	4	µg/kg		----	<4	<4	<4	----
Pyrene	129-00-0	4	µg/kg		----	<4	<4	<4	----
Benz(a)anthracene	56-55-3	4	µg/kg		----	<4	<4	<4	----
Chrysene	218-01-9	4	µg/kg		----	<4	<4	<4	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		----	<4	<4	<4	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg		----	<4	<4	<4	----
Benzo(e)pyrene	192-97-2	4	µg/kg		----	<4	<4	<4	----
Benzo(a)pyrene	50-32-8	4	µg/kg		----	<4	<4	<4	----
Perylene	198-55-0	4	µg/kg		----	<4	<4	<4	----
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		----	<4	<4	<4	----
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		----	<4	<4	<4	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		----	<4	<4	<4	----
Coronene	191-07-1	5	µg/kg		----	<5	<5	<5	----
^ Sum of PAHs	----	4	µg/kg		----	<4	<4	<4	----
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		----	**81.9**	**77.7**	**91.1**	----
Toluene-D8	2037-26-5	0.2	%		----	**79.3**	**71.2**	**87.5**	----
4-Bromofluorobenzene	460-00-4	0.2	%		----	**79.6**	**77.4**	**87.6**	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		----	**117**	**105**	**89.3**	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		----	**79.6**	**98.2**	**91.1**	----
Anthracene-d10	1719-06-8	10	%		----	**68.2**	**91.6**	**98.5**	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	BP1	BP4	TC2-R1	TC1-0.5	TC1-1
				Client sampling date / time	15-Mar-2017 10:20	16-Mar-2017 07:02	15-Mar-2017 11:06	15-Mar-2017 16:36	15-Mar-2017 16:36
Compound	CAS Number	LOR	Unit		EP1702676-001	EP1702676-004	EP1702676-005	EP1702676-007	EP1702676-008
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	10	%		**----**	**76.2**	**77.6**	**106**	**----**

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Client sample ID	TC2	TC3	TC4	TC1-0.5-T2	IC1
			Client sampling date / time	15-Mar-2017 11:06	15-Mar-2017 10:25	15-Mar-2017 13:41	15-Mar-2017 16:36	18-Mar-2017 15:30
Compound	CAS Number	LOR	Unit	EP1702676-009	EP1702676-010	EP1702676-011	EP1702676-012	EP1702676-015
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	9.5	----	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	<2	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	<0.02	----	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	0.083	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	52	----	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	----	11.8	----	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	----	2350	----	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	----	3.77	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	1.5	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	----	<0.02	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	----	<10	----	----	----
Liming Rate	----	1	kg CaCO3/t	----	<1	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	0.08	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	52	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	4	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	37.9	----	26.9	21.7	12.0
EA150: Particle Sizing								
+75µm	----	1	%	79	----	91	92	98
+150µm	----	1	%	38	----	58	72	94
+300µm	----	1	%	7	----	9	27	56
+425µm	----	1	%	1	----	2	14	30
+600µm	----	1	%	<1	----	1	11	19
+1180µm	----	1	%	<1	----	<1	9	12
+2.36mm	----	1	%	<1	----	<1	7	7
+4.75mm	----	1	%	<1	----	<1	4	4
+9.5mm	----	1	%	<1	----	<1	<1	1
+19.0mm	----	1	%	<1	----	<1	<1	<1

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	TC2	TC3	TC4	TC1-0.5-T2	IC1
				Client sampling date / time	15-Mar-2017 11:06	15-Mar-2017 10:25	15-Mar-2017 13:41	15-Mar-2017 16:36	18-Mar-2017 15:30
Compound	CAS Number	LOR	Unit		EP1702676-009	EP1702676-010	EP1702676-011	EP1702676-012	EP1702676-015
					Result	Result	Result	Result	Result
EA150: Particle Sizing - Continued									
+37.5mm	----	1	%		<1	----	<1	<1	<1
+75.0mm	----	1	%		<1	----	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		12	----	4	3	1
Silt (2-60 µm)	----	1	%		6	----	3	4	<1
Sand (0.06-2.00 mm)	----	1	%		82	----	93	85	90
Gravel (>2mm)	----	1	%		<1	----	<1	8	9
Cobbles (>6cm)	----	1	%		<1	----	<1	<1	<1
EG005-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		6300	----	3730	3350	1300
Iron	7439-89-6	50	mg/kg		25600	----	16000	13300	12000
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.5	mg/kg		<0.50	----	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1	mg/kg		20.0	----	14.1	12.6	14.4
Cadmium	7440-43-9	0.1	mg/kg		<0.1	----	<0.1	<0.1	<0.1
Chromium	7440-47-3	1	mg/kg		32.8	----	21.1	18.8	9.0
Copper	7440-50-8	1	mg/kg		11.5	----	5.6	5.0	1.7
Cobalt	7440-48-4	0.5	mg/kg		8.6	----	5.2	5.0	3.5
Lead	7439-92-1	1	mg/kg		5.4	----	4.1	2.5	1.3
Manganese	7439-96-5	10	mg/kg		297	----	221	280	399
Nickel	7440-02-0	1	mg/kg		13.6	----	8.7	7.8	3.4
Selenium	7782-49-2	0.1	mg/kg		1.6	----	0.9	1.0	0.9
Silver	7440-22-4	0.1	mg/kg		<0.1	----	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2	mg/kg		53.8	----	33.4	28.1	23.3
Zinc	7440-66-6	1	mg/kg		23.7	----	14.2	13.1	5.7
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	----	<0.01	<0.01	<0.01
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		<20	----	----	<20	<20
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg		<0.1	----	----	<0.1	<0.1
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg		<0.1	----	----	<0.1	<0.1
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	TC2	TC3	TC4	TC1-0.5-T2	IC1
				Client sampling date / time	15-Mar-2017 11:06	15-Mar-2017 10:25	15-Mar-2017 13:41	15-Mar-2017 16:36	18-Mar-2017 15:30
Compound	CAS Number	LOR	Unit		EP1702676-009	EP1702676-010	EP1702676-011	EP1702676-012	EP1702676-015
					Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser - Continued									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		<0.1	----	----	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		**120**	----	----	**50**	**30**
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		**120**	----	----	**50**	**30**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		**126**	----	----	**122**	**75**
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		<0.1	----	----	<0.1	<0.1
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		**0.22**	----	**0.06**	**0.08**	**0.02**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		<3	----	----	<3	<3
>C16 - C34 Fraction	----	3	mg/kg		**5**	----	----	<3	<3
>C34 - C40 Fraction	----	5	mg/kg		<5	----	----	<5	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg		**5**	----	----	<3	<3
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	----	----	<3	<3
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	----	----	<3	<3
C10 - C14 Fraction	----	3	mg/kg		<3	----	----	<3	<3
C15 - C28 Fraction	----	3	mg/kg		**4**	----	----	<3	<3
C29 - C36 Fraction	----	5	mg/kg		<5	----	----	<5	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg		**4**	----	----	<3	<3
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	----	----	<3	<3
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	----	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg		<0.2	----	----	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	----	----	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.2	----	----	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	----	----	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg		<0.5	----	----	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	----	----	<0.2	<0.2

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	TC2	TC3	TC4	TC1-0.5-T2	IC1
				Client sampling date / time	15-Mar-2017 11:06	15-Mar-2017 10:25	15-Mar-2017 13:41	15-Mar-2017 16:36	18-Mar-2017 15:30
Compound	CAS Number	LOR	Unit		EP1702676-009	EP1702676-010	EP1702676-011	EP1702676-012	EP1702676-015
					Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued									
Naphthalene	91-20-3	0.2	mg/kg		<0.2	----	----	<0.2	<0.2
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	----	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	----	----	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	----	----	<5	<5
Acenaphthylene	208-96-8	4	µg/kg		<4	----	----	<4	<4
Acenaphthene	83-32-9	4	µg/kg		<4	----	----	<4	<4
Fluorene	86-73-7	4	µg/kg		<4	----	----	<4	<4
Phenanthrene	85-01-8	4	µg/kg		<4	----	----	<4	<4
Anthracene	120-12-7	4	µg/kg		<4	----	----	<4	<4
Fluoranthene	206-44-0	4	µg/kg		<4	----	----	<4	<4
Pyrene	129-00-0	4	µg/kg		<4	----	----	<4	<4
Benz(a)anthracene	56-55-3	4	µg/kg		<4	----	----	<4	<4
Chrysene	218-01-9	4	µg/kg		<4	----	----	<4	<4
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		<4	----	----	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg		<4	----	----	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg		<4	----	----	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg		<4	----	----	<4	<4
Perylene	198-55-0	4	µg/kg		<4	----	----	<4	<4
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		<4	----	----	<4	<4
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		<4	----	----	<4	<4
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		<4	----	----	<4	<4
Coronene	191-07-1	5	µg/kg		<5	----	----	<5	<5
^ Sum of PAHs	----	4	µg/kg		<4	----	----	<4	<4
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**85.3**	----	----	**87.4**	**85.8**
Toluene-D8	2037-26-5	0.2	%		**82.0**	----	----	**85.8**	**81.8**
4-Bromofluorobenzene	460-00-4	0.2	%		**84.4**	----	----	**88.1**	**82.8**
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		**94.2**	----	**96.1**	**95.2**	**105**
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		**79.3**	----	----	**96.8**	**77.5**
Anthracene-d10	1719-06-8	10	%		**76.1**	----	----	**89.5**	**75.9**

Analytical Results

Sub-Matrix: **SEDIMENT** (Matrix: **SOIL**)				Client sample ID	TC2	TC3	TC4	TC1-0.5-T2	IC1
				Client sampling date / time	15-Mar-2017 11:06	15-Mar-2017 10:25	15-Mar-2017 13:41	15-Mar-2017 16:36	18-Mar-2017 15:30
Compound	CAS Number	LOR	Unit		EP1702676-009	EP1702676-010	EP1702676-011	EP1702676-012	EP1702676-015
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	10	%		**68.9**	**----**	**----**	**109**	**80.6**

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Client sample ID	IC1-1.0	IC2	IC3-0.5	IC4	IC5-0.5
			Client sampling date / time	18-Mar-2017 15:30	15-Mar-2017 13:45	16-Mar-2017 16:49	16-Mar-2017 10:23	18-Mar-2017 09:50
Compound	CAS Number	LOR	Unit	EP1702676-016	EP1702676-017	EP1702676-018	EP1702676-020	EP1702676-021
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	9.8	----	9.9	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	----	<2	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	<0.02	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.005	----	0.005	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	<10	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	46.5	----	42.4	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	9300	----	8460	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	14.9	----	13.6	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	----	1.5	----	----
Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	<0.02	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	<10	----	----
Liming Rate	----	1	kg CaCO3/t	<1	----	<1	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	----	<0.02	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	----	<10	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	----	<1	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	----	21.0	18.9	23.0	18.4
EA150: Particle Sizing								
+75µm	----	1	%	----	98	98	99	96
+150µm	----	1	%	----	93	95	97	94
+300µm	----	1	%	----	65	74	19	80
+425µm	----	1	%	----	33	48	1	60
+600µm	----	1	%	----	17	41	<1	42
+1180µm	----	1	%	----	8	32	<1	27
+2.36mm	----	1	%	----	4	22	<1	17
+4.75mm	----	1	%	----	1	12	<1	10
+9.5mm	----	1	%	----	<1	2	<1	6
+19.0mm	----	1	%	----	<1	<1	<1	<1

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	IC1-1.0	IC2	IC3-0.5	IC4	IC5-0.5
				Client sampling date / time	18-Mar-2017 15:30	15-Mar-2017 13:45	16-Mar-2017 16:49	16-Mar-2017 10:23	18-Mar-2017 09:50
Compound	CAS Number	LOR	Unit		EP1702676-016	EP1702676-017	EP1702676-018	EP1702676-020	EP1702676-021
					Result	Result	Result	Result	Result
EA150: Particle Sizing - Continued									
+37.5mm	----	1	%		----	<1	<1	<1	<1
+75.0mm	----	1	%		----	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	1	1	<1	2
Silt (2-60 µm)	----	1	%		----	1	1	1	1
Sand (0.06-2.00 mm)	----	1	%		----	93	73	99	77
Gravel (>2mm)	----	1	%		----	5	25	<1	20
Cobbles (>6cm)	----	1	%		----	<1	<1	<1	<1
EG005-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		----	1350	1340	1090	1300
Iron	7439-89-6	50	mg/kg		----	7780	9060	6460	8330
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.5	mg/kg		----	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1	mg/kg		----	13.6	15.3	10.5	15.3
Cadmium	7440-43-9	0.1	mg/kg		----	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1	mg/kg		----	9.0	9.7	9.4	8.8
Copper	7440-50-8	1	mg/kg		----	1.8	2.0	1.5	1.8
Cobalt	7440-48-4	0.5	mg/kg		----	3.0	3.4	2.5	3.1
Lead	7439-92-1	1	mg/kg		----	1.2	1.4	1.0	1.2
Manganese	7439-96-5	10	mg/kg		----	348	433	172	439
Nickel	7440-02-0	1	mg/kg		----	3.1	3.8	3.4	3.0
Selenium	7782-49-2	0.1	mg/kg		----	1.0	1.1	0.6	1.0
Silver	7440-22-4	0.1	mg/kg		----	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2	mg/kg		----	18.5	22.2	15.5	22.3
Zinc	7440-66-6	1	mg/kg		----	5.5	5.6	5.2	4.9
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		----	<0.01	<0.01	<0.01	<0.01
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		----	<20	----	----	<20
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg		----	<0.1	----	----	<0.1
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg		----	<0.1	----	----	<0.1
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	IC1-1.0	IC2	IC3-0.5	IC4	IC5-0.5
				Client sampling date / time	18-Mar-2017 15:30	15-Mar-2017 13:45	16-Mar-2017 16:49	16-Mar-2017 10:23	18-Mar-2017 09:50
Compound	CAS Number	LOR	Unit		EP1702676-016	EP1702676-017	EP1702676-018	EP1702676-020	EP1702676-021
					Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser - Continued									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		----	<0.1	----	----	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		----	**50**	----	----	**150**
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		----	**50**	----	----	**150**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		----	**96**	----	----	**162**
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		----	<0.1	----	----	<0.1
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		----	<0.02	<0.02	**0.03**	**0.06**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		----	<3	----	<3	<3
>C16 - C34 Fraction	----	3	mg/kg		----	<3	----	<3	<3
>C34 - C40 Fraction	----	5	mg/kg		----	<5	----	<5	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg		----	<3	----	<3	<3
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		----	<3	----	<3	<3
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		----	<3	----	<3	<3
C10 - C14 Fraction	----	3	mg/kg		----	<3	----	<3	<3
C15 - C28 Fraction	----	3	mg/kg		----	<3	----	<3	<3
C29 - C36 Fraction	----	5	mg/kg		----	<5	----	<5	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg		----	<3	----	<3	<3
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		----	<3	----	<3	<3
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		----	<0.2	----	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg		----	<0.2	----	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		----	<0.2	----	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		----	<0.2	----	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg		----	<0.2	----	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg		----	<0.5	----	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		----	<0.2	----	<0.2	<0.2

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	IC1-1.0	IC2	IC3-0.5	IC4	IC5-0.5
				Client sampling date / time	18-Mar-2017 15:30	15-Mar-2017 13:45	16-Mar-2017 16:49	16-Mar-2017 10:23	18-Mar-2017 09:50
Compound	CAS Number	LOR	Unit		EP1702676-016	EP1702676-017	EP1702676-018	EP1702676-020	EP1702676-021
					Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued									
Naphthalene	91-20-3	0.2	mg/kg		----	<0.2	----	<0.2	<0.2
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		----	----	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		----	<5	----	<5	<5
2-Methylnaphthalene	91-57-6	5	µg/kg		----	<5	----	<5	<5
Acenaphthylene	208-96-8	4	µg/kg		----	<4	----	<4	<4
Acenaphthene	83-32-9	4	µg/kg		----	<4	----	<4	<4
Fluorene	86-73-7	4	µg/kg		----	<4	----	<4	<4
Phenanthrene	85-01-8	4	µg/kg		----	<4	----	<4	<4
Anthracene	120-12-7	4	µg/kg		----	<4	----	<4	<4
Fluoranthene	206-44-0	4	µg/kg		----	<4	----	<4	<4
Pyrene	129-00-0	4	µg/kg		----	<4	----	<4	<4
Benz(a)anthracene	56-55-3	4	µg/kg		----	<4	----	<4	<4
Chrysene	218-01-9	4	µg/kg		----	<4	----	<4	<4
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		----	<4	----	<4	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg		----	<4	----	<4	<4
Benzo(e)pyrene	192-97-2	4	µg/kg		----	<4	----	<4	<4
Benzo(a)pyrene	50-32-8	4	µg/kg		----	<4	----	<4	<4
Perylene	198-55-0	4	µg/kg		----	<4	----	<4	<4
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		----	<4	----	<4	<4
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		----	<4	----	<4	<6
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		----	<4	----	<4	<4
Coronene	191-07-1	5	µg/kg		----	<5	----	<5	<5
^ Sum of PAHs	----	4	µg/kg		----	<4	----	<4	<4
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		----	**76.0**	----	**78.9**	**81.8**
Toluene-D8	2037-26-5	0.2	%		----	**70.6**	----	**73.3**	**77.4**
4-Bromofluorobenzene	460-00-4	0.2	%		----	**75.8**	----	**75.2**	**79.7**
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		----	----	**96.1**	**115**	**84.9**
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		----	**90.0**	----	**75.4**	**94.5**
Anthracene-d10	1719-06-8	10	%		----	**80.8**	----	**73.6**	**81.4**

Analytical Results

Sub-Matrix: **SEDIMENT** (Matrix: **SOIL**)				Client sample ID	IC1-1.0	IC2	IC3-0.5	IC4	IC5-0.5
				Client sampling date / time	18-Mar-2017 15:30	15-Mar-2017 13:45	16-Mar-2017 16:49	16-Mar-2017 10:23	18-Mar-2017 09:50
Compound	CAS Number	LOR	Unit		EP1702676-016	EP1702676-017	EP1702676-018	EP1702676-020	EP1702676-021
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	10	%		**----**	**88.2**	**----**	**76.3**	**84.6**

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Client sample ID	IC5-1	IC6	IC7-0.5	IC7-1	1C8-0.5
			Client sampling date / time	18-Mar-2017 09:50	16-Mar-2017 10:26	16-Mar-2017 17:41	16-Mar-2017 17:41	18-Mar-2017 09:25
Compound	CAS Number	LOR	Unit	EP1702676-022	EP1702676-023	EP1702676-024	EP1702676-025	EP1702676-026
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	9.1	----	----	----	9.7
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	----	----	----	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.489	----	----	----	0.076
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	305	----	----	----	47
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	6.10	----	----	----	40.3
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	1220	----	----	----	8060
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	1.95	----	----	----	12.9
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	----	----	----	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	<10
Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.49	----	----	----	0.08
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	305	----	----	----	47
Liming Rate excluding ANC	----	1	kg CaCO3/t	23	----	----	----	4
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	----	18.2	31.2	23.3	17.9
EA150: Particle Sizing								
+75µm	----	1	%	----	99	79	98	97
+150µm	----	1	%	----	94	39	91	87
+300µm	----	1	%	----	14	22	66	67
+425µm	----	1	%	----	6	13	40	51
+600µm	----	1	%	----	5	11	28	37
+1180µm	----	1	%	----	4	10	20	25
+2.36mm	----	1	%	----	4	8	13	16
+4.75mm	----	1	%	----	3	5	8	6
+9.5mm	----	1	%	----	3	3	2	1
+19.0mm	----	1	%	----	2	<1	<1	<1

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	IC5-1	IC6	IC7-0.5	IC7-1	1C8-0.5
				Client sampling date / time	18-Mar-2017 09:50	16-Mar-2017 10:26	16-Mar-2017 17:41	16-Mar-2017 17:41	18-Mar-2017 09:25
Compound	CAS Number	LOR	Unit		EP1702676-022	EP1702676-023	EP1702676-024	EP1702676-025	EP1702676-026
					Result	Result	Result	Result	Result
EA150: Particle Sizing - Continued									
+37.5mm	----	1	%		----	<1	<1	<1	<1
+75.0mm	----	1	%		----	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	<1	11	1	2
Silt (2-60 µm)	----	1	%		----	1	5	1	<1
Sand (0.06-2.00 mm)	----	1	%		----	95	76	83	79
Gravel (>2mm)	----	1	%		----	4	8	15	19
Cobbles (>6cm)	----	1	%		----	<1	<1	<1	<1
EG005-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		----	1190	7650	1380	1530
Iron	7439-89-6	50	mg/kg		----	6280	28600	7680	10800
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.5	mg/kg		----	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1	mg/kg		----	8.44	18.0	14.6	14.7
Cadmium	7440-43-9	0.1	mg/kg		----	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1	mg/kg		----	10.5	38.8	9.5	12.9
Copper	7440-50-8	1	mg/kg		----	1.7	16.1	1.9	2.1
Cobalt	7440-48-4	0.5	mg/kg		----	2.7	11.0	3.1	3.4
Lead	7439-92-1	1	mg/kg		----	1.1	6.0	1.3	1.7
Manganese	7439-96-5	10	mg/kg		----	160	379	413	304
Nickel	7440-02-0	1	mg/kg		----	3.4	17.7	3.9	4.2
Selenium	7782-49-2	0.1	mg/kg		----	0.6	1.8	1.0	0.9
Silver	7440-22-4	0.1	mg/kg		----	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2	mg/kg		----	14.4	59.0	19.0	25.3
Zinc	7440-66-6	1	mg/kg		----	5.9	26.6	5.8	6.1
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		----	<0.01	<0.01	<0.01	<0.01
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		----	----	<20	----	<20
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg		----	----	<0.1	----	<0.1
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg		----	----	<0.1	----	<0.1
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	IC5-1	IC6	IC7-0.5	IC7-1	1C8-0.5
				Client sampling date / time	18-Mar-2017 09:50	16-Mar-2017 10:26	16-Mar-2017 17:41	16-Mar-2017 17:41	18-Mar-2017 09:25
Compound	CAS Number	LOR	Unit		EP1702676-022	EP1702676-023	EP1702676-024	EP1702676-025	EP1702676-026
					Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser - Continued									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		----	----	<0.1	----	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		----	----	**410**	----	**100**
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		----	----	**410**	----	**100**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		----	----	**188**	----	**126**
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		----	----	<0.1	----	<0.1
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		----	<0.02	**0.14**	<0.02	**0.12**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		----	----	<3	----	----
>C16 - C34 Fraction	----	3	mg/kg		----	----	**7**	----	----
>C34 - C40 Fraction	----	5	mg/kg		----	----	<5	----	----
>C10 - C40 Fraction (sum)	----	3	mg/kg		----	----	**7**	----	----
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		----	----	<3	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		----	----	<3	----	----
C10 - C14 Fraction	----	3	mg/kg		----	----	<3	----	----
C15 - C28 Fraction	----	3	mg/kg		----	----	**5**	----	----
C29 - C36 Fraction	----	5	mg/kg		----	----	<5	----	----
^ C10 - C36 Fraction (sum)	----	3	mg/kg		----	----	**5**	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		----	----	<3	----	----
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		----	----	<0.2	----	----
Toluene	108-88-3	0.2	mg/kg		----	----	<0.2	----	----
Ethylbenzene	100-41-4	0.2	mg/kg		----	----	<0.2	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		----	----	<0.2	----	----
ortho-Xylene	95-47-6	0.2	mg/kg		----	----	<0.2	----	----
^ Total Xylenes	1330-20-7	0.5	mg/kg		----	----	<0.5	----	----
^ Sum of BTEX	----	0.2	mg/kg		----	----	<0.2	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	IC5-1	IC6	IC7-0.5	IC7-1	1C8-0.5
				Client sampling date / time	18-Mar-2017 09:50	16-Mar-2017 10:26	16-Mar-2017 17:41	16-Mar-2017 17:41	18-Mar-2017 09:25
Compound	CAS Number	LOR	Unit		EP1702676-022	EP1702676-023	EP1702676-024	EP1702676-025	EP1702676-026
					Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued									
Naphthalene	91-20-3	0.2	mg/kg		----	----	<0.2	----	----
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		----	<0.5	<0.5	----	----
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		----	----	<5	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg		----	----	<5	----	----
Acenaphthylene	208-96-8	4	µg/kg		----	----	<4	----	----
Acenaphthene	83-32-9	4	µg/kg		----	----	<4	----	----
Fluorene	86-73-7	4	µg/kg		----	----	<4	----	----
Phenanthrene	85-01-8	4	µg/kg		----	----	<4	----	----
Anthracene	120-12-7	4	µg/kg		----	----	<4	----	----
Fluoranthene	206-44-0	4	µg/kg		----	----	<4	----	----
Pyrene	129-00-0	4	µg/kg		----	----	<4	----	----
Benz(a)anthracene	56-55-3	4	µg/kg		----	----	<4	----	----
Chrysene	218-01-9	4	µg/kg		----	----	<4	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		----	----	<4	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg		----	----	<4	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg		----	----	<4	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg		----	----	<4	----	----
Perylene	198-55-0	4	µg/kg		----	----	<4	----	----
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		----	----	<4	----	----
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		----	----	<4	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		----	----	<4	----	----
Coronene	191-07-1	5	µg/kg		----	----	<5	----	----
^ Sum of PAHs	----	4	µg/kg		----	----	<4	----	----
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		----	----	82.2	----	----
Toluene-D8	2037-26-5	0.2	%		----	----	78.9	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		----	----	81.4	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		----	85.0	103	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		----	----	79.8	----	----
Anthracene-d10	1719-06-8	10	%		----	----	76.3	----	----

Analytical Results

Sub-Matrix: **SEDIMENT** (Matrix: **SOIL**)				Client sample ID	IC5-1	IC6	IC7-0.5	IC7-1	1C8-0.5
				Client sampling date / time	18-Mar-2017 09:50	16-Mar-2017 10:26	16-Mar-2017 17:41	16-Mar-2017 17:41	18-Mar-2017 09:25
Compound	CAS Number	LOR	Unit		EP1702676-022	EP1702676-023	EP1702676-024	EP1702676-025	EP1702676-026
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	10	%		----	----	**66.9**	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Client sample ID	IC1-R2	IC5-1.5	OC1-0.5-T1	OC2-0.5	OC2-1
			Client sampling date / time	18-Mar-2017 15:45	18-Mar-2017 09:50	17-Mar-2017 12:00	18-Mar-2017 08:30	18-Mar-2017 08:30
Compound	CAS Number	LOR	Unit	EP1702676-028	EP1702676-030	EP1702676-031	EP1702676-033	EP1702676-034
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	9.5	9.5	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	<2	<2	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	<0.02	<0.02	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	0.052	0.191	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	32	119	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	----	22.1	23.5	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	----	4410	4700	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	----	7.07	7.53	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	1.5	1.5	----	----
Net Acidity (sulfur units)	----	0.02	% S	----	<0.02	<0.02	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	----	<10	<10	----	----
Liming Rate	----	1	kg CaCO3/t	----	<1	<1	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	0.05	0.19	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	32	119	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	2	9	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	11.0	----	25.0	15.3	16.0
EA150: Particle Sizing								
+75µm	----	1	%	99	----	91	90	93
+150µm	----	1	%	96	----	38	73	78
+300µm	----	1	%	74	----	14	39	46
+425µm	----	1	%	57	----	10	32	39
+600µm	----	1	%	47	----	9	28	34
+1180µm	----	1	%	36	----	8	23	29
+2.36mm	----	1	%	26	----	5	18	23
+4.75mm	----	1	%	17	----	<1	11	15
+9.5mm	----	1	%	7	----	<1	3	5
+19.0mm	----	1	%	<1	----	<1	<1	<1

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	IC1-R2	IC5-1.5	OC1-0.5-T1	OC2-0.5	OC2-1
				Client sampling date / time	18-Mar-2017 15:45	18-Mar-2017 09:50	17-Mar-2017 12:00	18-Mar-2017 08:30	18-Mar-2017 08:30
Compound	CAS Number	LOR	Unit		EP1702676-028	EP1702676-030	EP1702676-031	EP1702676-033	EP1702676-034
					Result	Result	Result	Result	Result
EA150: Particle Sizing - Continued									
+37.5mm	----	1	%		<1	----	<1	<1	<1
+75.0mm	----	1	%		<1	----	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		<1	----	3	5	3
Silt (2-60 µm)	----	1	%		<1	----	4	3	2
Sand (0.06-2.00 mm)	----	1	%		71	----	87	73	70
Gravel (>2mm)	----	1	%		29	----	6	19	25
Cobbles (>6cm)	----	1	%		<1	----	<1	<1	<1
EG005-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		2050	----	3870	3930	3220
Iron	7439-89-6	50	mg/kg		13200	----	23200	20800	22200
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.5	mg/kg		<0.50	----	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1	mg/kg		25.9	----	21.4	23.4	29.2
Cadmium	7440-43-9	0.1	mg/kg		<0.1	----	<0.1	<0.1	<0.1
Chromium	7440-47-3	1	mg/kg		13.6	----	27.8	24.0	22.9
Copper	7440-50-8	1	mg/kg		3.0	----	6.3	6.3	3.9
Cobalt	7440-48-4	0.5	mg/kg		6.6	----	8.0	11.7	9.6
Lead	7439-92-1	1	mg/kg		2.1	----	3.8	4.0	3.7
Manganese	7439-96-5	10	mg/kg		419	----	316	383	435
Nickel	7440-02-0	1	mg/kg		5.0	----	11.1	9.8	7.8
Selenium	7782-49-2	0.1	mg/kg		2.0	----	1.3	1.6	1.8
Silver	7440-22-4	0.1	mg/kg		<0.1	----	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2	mg/kg		30.5	----	47.1	44.0	46.5
Zinc	7440-66-6	1	mg/kg		7.6	----	16.0	14.1	12.2
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	----	<0.01	<0.01	<0.01
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		<20	----	<20	<20	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg		<0.1	----	<0.1	<0.1	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg		0.2	----	<0.1	<0.1	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	IC1-R2	IC5-1.5	OC1-0.5-T1	OC2-0.5	OC2-1
				Client sampling date / time	18-Mar-2017 15:45	18-Mar-2017 09:50	17-Mar-2017 12:00	18-Mar-2017 08:30	18-Mar-2017 08:30
Compound	CAS Number	LOR	Unit		EP1702676-028	EP1702676-030	EP1702676-031	EP1702676-033	EP1702676-034
					Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser - Continued									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		**0.2**	----	<0.1	<0.1	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		**40**	----	**360**	**140**	----
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		**40**	----	**360**	**140**	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		**100**	----	**43**	**276**	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		<0.1	----	<0.1	**0.1**	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		**0.02**	----	**0.11**	**0.05**	**0.06**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		<3	----	<3	----	----
>C16 - C34 Fraction	----	3	mg/kg		<3	----	<3	----	----
>C34 - C40 Fraction	----	5	mg/kg		<5	----	<5	----	----
>C10 - C40 Fraction (sum)	----	3	mg/kg		<3	----	<3	----	----
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	----	<3	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	----	<3	----	----
C10 - C14 Fraction	----	3	mg/kg		<3	----	<3	----	----
C15 - C28 Fraction	----	3	mg/kg		<3	----	<3	----	----
C29 - C36 Fraction	----	5	mg/kg		<5	----	<5	----	----
^ C10 - C36 Fraction (sum)	----	3	mg/kg		<3	----	<3	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	----	<3	----	----
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	<0.2	----	----
Toluene	108-88-3	0.2	mg/kg		<0.2	----	<0.2	----	----
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	----	<0.2	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.2	----	<0.2	----	----
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	----	<0.2	----	----
^ Total Xylenes	1330-20-7	0.5	mg/kg		<0.5	----	<0.5	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	----	<0.2	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	IC1-R2	IC5-1.5	OC1-0.5-T1	OC2-0.5	OC2-1
				Client sampling date / time	18-Mar-2017 15:45	18-Mar-2017 09:50	17-Mar-2017 12:00	18-Mar-2017 08:30	18-Mar-2017 08:30
Compound	CAS Number	LOR	Unit		EP1702676-028	EP1702676-030	EP1702676-031	EP1702676-033	EP1702676-034
					Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued									
Naphthalene	91-20-3	0.2	mg/kg		<0.2	----	<0.2	----	----
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	----	<0.5	<0.5	----
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	----	<5	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	----	<5	----	----
Acenaphthylene	208-96-8	4	µg/kg		<4	----	<4	----	----
Acenaphthene	83-32-9	4	µg/kg		<4	----	<4	----	----
Fluorene	86-73-7	4	µg/kg		<4	----	<4	----	----
Phenanthrene	85-01-8	4	µg/kg		<4	----	<4	----	----
Anthracene	120-12-7	4	µg/kg		<4	----	<4	----	----
Fluoranthene	206-44-0	4	µg/kg		<4	----	<4	----	----
Pyrene	129-00-0	4	µg/kg		<4	----	<4	----	----
Benz(a)anthracene	56-55-3	4	µg/kg		<4	----	<4	----	----
Chrysene	218-01-9	4	µg/kg		<4	----	<4	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		<4	----	<4	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg		<4	----	<4	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg		<4	----	<4	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg		<4	----	<4	----	----
Perylene	198-55-0	4	µg/kg		<4	----	<4	----	----
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		<4	----	<4	----	----
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		<4	----	<4	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		<4	----	<4	----	----
Coronene	191-07-1	5	µg/kg		<5	----	<5	----	----
^ Sum of PAHs	----	4	µg/kg		<4	----	<4	----	----
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**93.4**	----	**87.3**	----	----
Toluene-D8	2037-26-5	0.2	%		**89.3**	----	**81.1**	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		**94.7**	----	**85.3**	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		**84.2**	----	**92.5**	**100**	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		**86.6**	----	**95.3**	----	----
Anthracene-d10	1719-06-8	10	%		**77.8**	----	**83.6**	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	IC1-R2	IC5-1.5	OC1-0.5-T1	OC2-0.5	OC2-1
				Client sampling date / time	18-Mar-2017 15:45	18-Mar-2017 09:50	17-Mar-2017 12:00	18-Mar-2017 08:30	18-Mar-2017 08:30
Compound	CAS Number	LOR	Unit		EP1702676-028	EP1702676-030	EP1702676-031	EP1702676-033	EP1702676-034
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	10	%		**85.0**	**----**	**85.2**	**----**	**----**

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Client sample ID	OC3-0.5	OC3-1	OC4-0.5	OC4-1	OC5
			Client sampling date / time	17-Mar-2017 08:35	17-Mar-2017 08:35	17-Mar-2017 11:20	17-Mar-2017 11:20	18-Mar-2017 14:20
Compound	CAS Number	LOR	Unit	EP1702676-035	EP1702676-036	EP1702676-037	EP1702676-038	EP1702676-039
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	----	9.2	9.1	9.8
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	----	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	----	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	----	0.577	0.567	0.008
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	----	360	353	<10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	----	----	31.5	18.8	51.2
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	----	----	6300	3750	10200
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	----	----	10.1	6.01	16.4
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	----	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	----	----	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	----	----	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t	----	----	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	----	0.58	0.57	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	----	360	353	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	----	27	27	<1
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	22.2	23.6	25.2	----	21.8
EA150: Particle Sizing								
+75µm	----	1	%	99	99	81	----	94
+150µm	----	1	%	89	73	60	----	83
+300µm	----	1	%	27	17	33	----	53
+425µm	----	1	%	6	5	27	----	43
+600µm	----	1	%	3	4	24	----	38
+1180µm	----	1	%	2	3	21	----	30
+2.36mm	----	1	%	1	2	16	----	23
+4.75mm	----	1	%	<1	1	9	----	14
+9.5mm	----	1	%	<1	1	2	----	3
+19.0mm	----	1	%	<1	<1	<1	----	<1

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	OC3-0.5	OC3-1	OC4-0.5	OC4-1	OC5
				Client sampling date / time	17-Mar-2017 08:35	17-Mar-2017 08:35	17-Mar-2017 11:20	17-Mar-2017 11:20	18-Mar-2017 14:20
Compound	CAS Number	LOR	Unit		EP1702676-035	EP1702676-036	EP1702676-037	EP1702676-038	EP1702676-039
					Result	Result	Result	Result	Result
EA150: Particle Sizing - Continued									
+37.5mm	----	1	%		<1	<1	<1	----	<1
+75.0mm	----	1	%		<1	<1	<1	----	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		<1	<1	9	----	4
Silt (2-60 µm)	----	1	%		<1	<1	9	----	1
Sand (0.06-2.00 mm)	----	1	%		99	97	65	----	70
Gravel (>2mm)	----	1	%		1	3	17	----	25
Cobbles (>6cm)	----	1	%		<1	<1	<1	----	<1
EG005-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		1340	1350	5440	----	3650
Iron	7439-89-6	50	mg/kg		8580	7460	28800	----	24900
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.5	mg/kg		<0.50	<0.50	<0.50	----	<0.50
Arsenic	7440-38-2	1	mg/kg		11.0	9.68	26.0	----	38.1
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	----	<0.1
Chromium	7440-47-3	1	mg/kg		11.2	11.1	34.7	----	22.9
Copper	7440-50-8	1	mg/kg		2.0	2.2	9.2	----	4.5
Cobalt	7440-48-4	0.5	mg/kg		3.1	2.9	10.4	----	11.7
Lead	7439-92-1	1	mg/kg		1.4	1.3	5.6	----	4.1
Manganese	7439-96-5	10	mg/kg		196	171	430	----	625
Nickel	7440-02-0	1	mg/kg		4.0	4.0	12.6	----	8.2
Selenium	7782-49-2	0.1	mg/kg		0.7	0.6	1.7	----	2.1
Silver	7440-22-4	0.1	mg/kg		<0.1	<0.1	<0.1	----	<0.1
Vanadium	7440-62-2	2	mg/kg		19.0	17.9	59.7	----	52.1
Zinc	7440-66-6	1	mg/kg		7.4	6.9	19.9	----	14.0
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	<0.01	----	<0.01
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		<20	----	<20	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg		<0.1	----	<0.1	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg		<0.1	----	<0.1	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	OC3-0.5	OC3-1	OC4-0.5	OC4-1	OC5
				Client sampling date / time	17-Mar-2017 08:35	17-Mar-2017 08:35	17-Mar-2017 11:20	17-Mar-2017 11:20	18-Mar-2017 14:20
Compound	CAS Number	LOR	Unit		EP1702676-035	EP1702676-036	EP1702676-037	EP1702676-038	EP1702676-039
					Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser - Continued									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		<0.1	----	<0.1	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		**30**	----	**180**	----	----
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		**30**	----	**180**	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		**84**	----	**195**	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		<0.1	----	<0.1	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		<0.02	<0.02	**0.66**	----	**0.04**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		<3	----	<3	----	<3
>C16 - C34 Fraction	----	3	mg/kg		<3	----	<3	----	**5**
>C34 - C40 Fraction	----	5	mg/kg		<5	----	<5	----	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg		<3	----	<3	----	**5**
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	----	<3	----	<3
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	----	<3	----	<3
C10 - C14 Fraction	----	3	mg/kg		<3	----	<3	----	<3
C15 - C28 Fraction	----	3	mg/kg		<3	----	<3	----	**4**
C29 - C36 Fraction	----	5	mg/kg		<5	----	<5	----	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg		<3	----	<3	----	**4**
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	----	<3	----	<3
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	<0.2	----	<0.2
Toluene	108-88-3	0.2	mg/kg		<0.2	----	<0.2	----	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	----	<0.2	----	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.2	----	<0.2	----	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	----	<0.2	----	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg		<0.5	----	<0.5	----	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	----	<0.2	----	<0.2

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	OC3-0.5	OC3-1	OC4-0.5	OC4-1	OC5
				Client sampling date / time	17-Mar-2017 08:35	17-Mar-2017 08:35	17-Mar-2017 11:20	17-Mar-2017 11:20	18-Mar-2017 14:20
Compound	CAS Number	LOR	Unit		EP1702676-035	EP1702676-036	EP1702676-037	EP1702676-038	EP1702676-039
					Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued									
Naphthalene	91-20-3	0.2	mg/kg		<0.2	----	<0.2	----	<0.2
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		**0.5**	----	<0.5	----	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	----	<5	----	<5
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	----	<5	----	<5
Acenaphthylene	208-96-8	4	µg/kg		<4	----	<4	----	<4
Acenaphthene	83-32-9	4	µg/kg		<4	----	<4	----	<4
Fluorene	86-73-7	4	µg/kg		<4	----	<4	----	<4
Phenanthrene	85-01-8	4	µg/kg		<4	----	<4	----	<4
Anthracene	120-12-7	4	µg/kg		<4	----	<4	----	<4
Fluoranthene	206-44-0	4	µg/kg		<4	----	<4	----	<4
Pyrene	129-00-0	4	µg/kg		<4	----	<4	----	<4
Benz(a)anthracene	56-55-3	4	µg/kg		<4	----	<4	----	<4
Chrysene	218-01-9	4	µg/kg		<4	----	<4	----	<4
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		<4	----	<4	----	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg		<4	----	<4	----	<4
Benzo(e)pyrene	192-97-2	4	µg/kg		<4	----	<4	----	<4
Benzo(a)pyrene	50-32-8	4	µg/kg		<4	----	<4	----	<4
Perylene	198-55-0	4	µg/kg		<4	----	<4	----	<4
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		<4	----	<4	----	<4
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		<4	----	<4	----	<4
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		<4	----	<4	----	<4
Coronene	191-07-1	5	µg/kg		<5	----	<5	----	<5
^ Sum of PAHs	----	4	µg/kg		<4	----	<4	----	<4
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**76.1**	----	**86.4**	----	**81.2**
Toluene-D8	2037-26-5	0.2	%		**74.0**	----	**85.8**	----	**78.2**
4-Bromofluorobenzene	460-00-4	0.2	%		**76.5**	----	**87.7**	----	**78.2**
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		**96.3**	----	**90.5**	----	**91.2**
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		**86.7**	----	**90.4**	----	**88.4**
Anthracene-d10	1719-06-8	10	%		**76.2**	----	**84.6**	----	**85.4**

Analytical Results

Sub-Matrix: **SEDIMENT** (Matrix: **SOIL**)				Client sample ID	OC3-0.5	OC3-1	OC4-0.5	OC4-1	OC5
				Client sampling date / time	17-Mar-2017 08:35	17-Mar-2017 08:35	17-Mar-2017 11:20	17-Mar-2017 11:20	18-Mar-2017 14:20
Compound	CAS Number	LOR	Unit		EP1702676-035	EP1702676-036	EP1702676-037	EP1702676-038	EP1702676-039
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	10	%		**77.5**	**----**	**99.9**	**----**	**79.3**

Analytical Results

Sub-Matrix: **SEDIMENT** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	OC6	OC7	OC8	OC9	OC10
				Client sampling date / time	17-Mar-2017 15:42	18-Mar-2017 15:30	17-Mar-2017 15:14	17-Mar-2017 15:21	17-Mar-2017 16:16
					EP1702676-040	EP1702676-041	EP1702676-042	EP1702676-043	EP1702676-044
					Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		**9.8**	**9.8**	----	**9.8**	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t		<2	<2	----	<2	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	----	<0.02	----
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		**0.008**	<0.005	----	**0.005**	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		<10	<10	----	<10	----
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3		**37.1**	**44.4**	----	**45.5**	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t		**7420**	**8880**	----	**9090**	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S		**11.9**	**14.2**	----	**14.6**	----
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	----	**1.5**	----
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	----	<0.02	----
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	----	<10	----
Liming Rate	----	1	kg CaCO3/t		<1	<1	----	<1	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		<0.02	<0.02	----	<0.02	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		<10	<10	----	<10	----
Liming Rate excluding ANC	----	1	kg CaCO3/t		<1	<1	----	<1	----
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%		**25.6**	**17.7**	**29.5**	**25.4**	**26.8**
EA150: Particle Sizing									
+75µm	----	1	%		**93**	**90**	**88**	**92**	**95**
+150µm	----	1	%		**71**	**70**	**71**	**78**	**68**
+300µm	----	1	%		**33**	**40**	**32**	**46**	**27**
+425µm	----	1	%		**24**	**29**	**21**	**35**	**19**
+600µm	----	1	%		**21**	**26**	**17**	**31**	**16**
+1180µm	----	1	%		**17**	**19**	**12**	**25**	**12**
+2.36mm	----	1	%		**13**	**12**	**7**	**18**	**8**
+4.75mm	----	1	%		**9**	**4**	**4**	**9**	**2**
+9.5mm	----	1	%		**4**	**2**	<1	**2**	<1
+19.0mm	----	1	%		**4**	<1	<1	<1	<1

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	OC6	OC7	OC8	OC9	OC10
				Client sampling date / time	17-Mar-2017 15:42	18-Mar-2017 15:30	17-Mar-2017 15:14	17-Mar-2017 15:21	17-Mar-2017 16:16
Compound	CAS Number	LOR	Unit		EP1702676-040	EP1702676-041	EP1702676-042	EP1702676-043	EP1702676-044
					Result	Result	Result	Result	Result
EA150: Particle Sizing - Continued									
+37.5mm	----	1	%		<1	<1	<1	<1	<1
+75.0mm	----	1	%		<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		3	5	6	5	3
Silt (2-60 µm)	----	1	%		3	4	4	2	1
Sand (0.06-2.00 mm)	----	1	%		80	77	81	73	87
Gravel (>2mm)	----	1	%		14	14	9	20	9
Cobbles (>6cm)	----	1	%		<1	<1	<1	<1	<1
EG005-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		3600	4610	4330	3760	3290
Iron	7439-89-6	50	mg/kg		28300	29900	32800	27100	29500
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.5	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	7440-38-2	1	mg/kg		27.4	33.4	27.4	26.6	29.2
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1	mg/kg		26.9	29.8	30.5	25.5	28.2
Copper	7440-50-8	1	mg/kg		4.1	6.4	5.0	4.3	3.5
Cobalt	7440-48-4	0.5	mg/kg		11.8	12.3	13.4	12.8	11.3
Lead	7439-92-1	1	mg/kg		4.7	5.4	5.4	4.9	4.8
Manganese	7439-96-5	10	mg/kg		418	634	435	439	401
Nickel	7440-02-0	1	mg/kg		9.0	10.4	10.1	9.1	7.8
Selenium	7782-49-2	0.1	mg/kg		1.6	1.9	1.6	1.7	1.4
Silver	7440-22-4	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Vanadium	7440-62-2	2	mg/kg		50.2	56.5	53.2	48.4	51.7
Zinc	7440-66-6	1	mg/kg		14.9	17.2	18.1	16.0	14.2
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		----	<20	----	----	<20
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg		----	<0.1	----	----	<0.1
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg		----	<0.1	----	----	<0.1
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	OC6	OC7	OC8	OC9	OC10
				Client sampling date / time	17-Mar-2017 15:42	18-Mar-2017 15:30	17-Mar-2017 15:14	17-Mar-2017 15:21	17-Mar-2017 16:16
Compound	CAS Number	LOR	Unit		EP1702676-040	EP1702676-041	EP1702676-042	EP1702676-043	EP1702676-044
					Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser - Continued									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		----	<0.1	----	----	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		----	**200**	----	----	**160**
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		----	**200**	----	----	**160**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		----	**256**	----	----	**293**
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		----	<0.1	----	----	<0.1
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		**0.10**	**0.06**	**0.08**	**0.07**	**0.04**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		----	<3	----	----	<3
>C16 - C34 Fraction	----	3	mg/kg		----	**7**	----	----	**7**
>C34 - C40 Fraction	----	5	mg/kg		----	<5	----	----	<5
>C10 - C40 Fraction (sum)	----	3	mg/kg		----	**7**	----	----	**7**
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		----	<3	----	----	<3
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		----	<3	----	----	<3
C10 - C14 Fraction	----	3	mg/kg		----	<3	----	----	<3
C15 - C28 Fraction	----	3	mg/kg		----	**5**	----	----	**5**
C29 - C36 Fraction	----	5	mg/kg		----	<5	----	----	<5
^ C10 - C36 Fraction (sum)	----	3	mg/kg		----	**5**	----	----	**5**
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		----	<3	----	----	<3
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		----	<0.2	----	----	<0.2
Toluene	108-88-3	0.2	mg/kg		----	<0.2	----	----	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg		----	<0.2	----	----	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		----	<0.2	----	----	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg		----	<0.2	----	----	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg		----	<0.5	----	----	<0.5
^ Sum of BTEX	----	0.2	mg/kg		----	<0.2	----	----	<0.2

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	OC6	OC7	OC8	OC9	OC10
				Client sampling date / time	17-Mar-2017 15:42	18-Mar-2017 15:30	17-Mar-2017 15:14	17-Mar-2017 15:21	17-Mar-2017 16:16
Compound	CAS Number	LOR	Unit		EP1702676-040	EP1702676-041	EP1702676-042	EP1702676-043	EP1702676-044
					Result	Result	Result	Result	Result
EP080-SD: BTEXN - Continued									
Naphthalene	91-20-3	0.2	mg/kg		----	<0.2	----	----	<0.2
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	<0.5	<0.5	<0.5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		----	<5	----	----	<5
2-Methylnaphthalene	91-57-6	5	µg/kg		----	<5	----	----	<5
Acenaphthylene	208-96-8	4	µg/kg		----	<4	----	----	<4
Acenaphthene	83-32-9	4	µg/kg		----	<4	----	----	<4
Fluorene	86-73-7	4	µg/kg		----	<4	----	----	<4
Phenanthrene	85-01-8	4	µg/kg		----	<4	----	----	<4
Anthracene	120-12-7	4	µg/kg		----	<4	----	----	<4
Fluoranthene	206-44-0	4	µg/kg		----	<4	----	----	<4
Pyrene	129-00-0	4	µg/kg		----	<4	----	----	<4
Benz(a)anthracene	56-55-3	4	µg/kg		----	<4	----	----	<4
Chrysene	218-01-9	4	µg/kg		----	<4	----	----	<4
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		----	<4	----	----	<4
Benzo(k)fluoranthene	207-08-9	4	µg/kg		----	<4	----	----	<4
Benzo(e)pyrene	192-97-2	4	µg/kg		----	<4	----	----	<4
Benzo(a)pyrene	50-32-8	4	µg/kg		----	<4	----	----	<4
Perylene	198-55-0	4	µg/kg		----	<4	----	----	<4
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		----	<4	----	----	<4
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		----	<4	----	----	<4
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		----	<4	----	----	<4
Coronene	191-07-1	5	µg/kg		----	<5	----	----	<5
^ Sum of PAHs	----	4	µg/kg		----	<4	----	----	<4
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		----	**81.4**	----	----	**83.9**
Toluene-D8	2037-26-5	0.2	%		----	**78.0**	----	----	**77.1**
4-Bromofluorobenzene	460-00-4	0.2	%		----	**80.6**	----	----	**79.1**
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		**105**	**121**	**104**	**75.6**	**105**
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		----	**78.1**	----	----	**94.9**
Anthracene-d10	1719-06-8	10	%		----	**69.9**	----	----	**82.4**

Analytical Results

Sub-Matrix: **SEDIMENT** (Matrix: **SOIL**)				Client sample ID	OC6	OC7	OC8	OC9	OC10
				Client sampling date / time	17-Mar-2017 15:42	18-Mar-2017 15:30	17-Mar-2017 15:14	17-Mar-2017 15:21	17-Mar-2017 16:16
Compound	CAS Number	LOR	Unit		EP1702676-040	EP1702676-041	EP1702676-042	EP1702676-043	EP1702676-044
					Result	Result	Result	Result	Result
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	10	%		**----**	**67.3**	**----**	**----**	**82.4**

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Client sample ID	OC7-R2-0.5	OC1-0.2-T2	----	----	----
			Client sampling date / time	18-Mar-2017 15:30	17-Mar-2017 12:00	----	----	----
Compound	CAS Number	LOR	Unit	EP1702676-045	EP1702676-047	--------	--------	--------
				Result	Result	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	24.6	24.7	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	86	89	----	----	----
+150µm	----	1	%	66	51	----	----	----
+300µm	----	1	%	38	19	----	----	----
+425µm	----	1	%	29	13	----	----	----
+600µm	----	1	%	27	11	----	----	----
+1180µm	----	1	%	22	9	----	----	----
+2.36mm	----	1	%	16	7	----	----	----
+4.75mm	----	1	%	9	3	----	----	----
+9.5mm	----	1	%	<1	<1	----	----	----
+19.0mm	----	1	%	<1	<1	----	----	----
+37.5mm	----	1	%	<1	<1	----	----	----
+75.0mm	----	1	%	<1	<1	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	7	5	----	----	----
Silt (2-60 µm)	----	1	%	5	4	----	----	----
Sand (0.06-2.00 mm)	----	1	%	70	84	----	----	----
Gravel (>2mm)	----	1	%	18	7	----	----	----
Cobbles (>6cm)	----	1	%	<1	<1	----	----	----
EG005-SD: Total Metals in Sediments by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	4790	3740	----	----	----
Iron	7439-89-6	50	mg/kg	29800	21700	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS								
Antimony	7440-36-0	0.5	mg/kg	<0.50	<0.50	----	----	----
Arsenic	7440-38-2	1	mg/kg	29.0	19.8	----	----	----
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	----	----	----
Chromium	7440-47-3	1	mg/kg	30.5	24.9	----	----	----
Copper	7440-50-8	1	mg/kg	6.8	5.4	----	----	----
Cobalt	7440-48-4	0.5	mg/kg	11.4	7.4	----	----	----
Lead	7439-92-1	1	mg/kg	5.6	3.5	----	----	----
Manganese	7439-96-5	10	mg/kg	552	326	----	----	----
Nickel	7440-02-0	1	mg/kg	11.1	9.3	----	----	----
Selenium	7782-49-2	0.1	mg/kg	1.8	1.3	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	OC7-R2-0.5	OC1-0.2-T2	----	----	----
				Client sampling date / time	18-Mar-2017 15:30	17-Mar-2017 12:00	----	----	----
Compound	CAS Number	LOR	Unit		EP1702676-045	EP1702676-047	--------	--------	--------
					Result	Result	----	----	----
EG020-SD: Total Metals in Sediments by ICPMS - Continued									
Silver	7440-22-4	0.1	mg/kg		<0.1	<0.1	----	----	----
Vanadium	7440-62-2	2	mg/kg		**55.5**	**42.6**	----	----	----
Zinc	7440-66-6	1	mg/kg		**17.7**	**15.0**	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	----	----	----
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		<20	<20	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg		<0.1	<0.1	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg		<0.1	<0.1	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		<0.1	<0.1	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		**260**	**200**	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		**260**	**200**	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		**240**	**167**	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		<0.1	<0.1	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		**0.08**	**0.22**	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		<3	<3	----	----	----
>C16 - C34 Fraction	----	3	mg/kg		**9**	<3	----	----	----
>C34 - C40 Fraction	----	5	mg/kg		<5	<5	----	----	----
>C10 - C40 Fraction (sum)	----	3	mg/kg		**9**	<3	----	----	----
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	<3	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	<3	----	----	----
C10 - C14 Fraction	----	3	mg/kg		<3	<3	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Client sample ID	OC7-R2-0.5	OC1-0.2-T2	----	----	----
			Client sampling date / time	18-Mar-2017 15:30	17-Mar-2017 12:00	----	----	----
Compound	CAS Number	LOR	Unit	EP1702676-045	EP1702676-047	--------	--------	--------
				Result	Result	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons - Continued								
C15 - C28 Fraction	----	3	mg/kg	7	<3	----	----	----
C29 - C36 Fraction	----	5	mg/kg	<5	<5	----	----	----
^ C10 - C36 Fraction (sum)	----	3	mg/kg	7	<3	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	----	----	----
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	----	----	----
Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	----	----	----
Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	----	----	----
ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	----	----	----
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	----	----	----
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	----	----	----
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	----	----	----
EP090: Organotin Compounds								
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	<0.5	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	5	µg/kg	<5	<5	----	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg	<5	<5	----	----	----
Acenaphthylene	208-96-8	4	µg/kg	<4	<4	----	----	----
Acenaphthene	83-32-9	4	µg/kg	<4	<4	----	----	----
Fluorene	86-73-7	4	µg/kg	<4	<4	----	----	----
Phenanthrene	85-01-8	4	µg/kg	<4	<4	----	----	----
Anthracene	120-12-7	4	µg/kg	<4	<4	----	----	----
Fluoranthene	206-44-0	4	µg/kg	<4	<4	----	----	----
Pyrene	129-00-0	4	µg/kg	<4	<4	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg	<4	<4	----	----	----
Chrysene	218-01-9	4	µg/kg	<4	<4	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg	<4	<4	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg	<4	<4	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg	<4	<4	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg	<4	<4	----	----	----
Perylene	198-55-0	4	µg/kg	<4	<4	----	----	----
Benzo(g.h.i)perylene	191-24-2	4	µg/kg	<4	<4	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	OC7-R2-0.5	OC1-0.2-T2	----	----	----
				Client sampling date / time	18-Mar-2017 15:30	17-Mar-2017 12:00	----	----	----
Compound	CAS Number	LOR	Unit		EP1702676-045	EP1702676-047	--------	--------	--------
					Result	Result	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons - Continued									
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		<4	<4	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		<4	<4	----	----	----
Coronene	191-07-1	5	µg/kg		<5	<5	----	----	----
^ **Sum of PAHs**	----	4	µg/kg		<4	<4	----	----	----
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**82.3**	**89.5**	----	----	----
Toluene-D8	2037-26-5	0.2	%		**76.9**	**83.4**	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		**78.5**	**80.9**	----	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		**104**	**98.6**	----	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		**81.3**	**90.4**	----	----	----
Anthracene-d10	1719-06-8	10	%		**80.0**	**88.1**	----	----	----
4-Terphenyl-d14	1718-51-0	10	%		**77.0**	**93.8**	----	----	----

Surrogate Control Limits

Sub-Matrix: **SEDIMENT**

Compound	CAS Number	Recovery Limits (%) Low	High
EP080-SD: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	70	130
Toluene-D8	2037-26-5	70	130
4-Bromofluorobenzene	460-00-4	70	130
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	70	130
Anthracene-d10	1719-06-8	70	130
4-Terphenyl-d14	1718-51-0	70	130

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP1703525**	Page	: 1 of 8
Client	: **WA MARINE PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: TRAVIS HURLEY	Contact	: Lauren Ockwell
Address	: SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370 DUNSBOROUGH, PERTH WA, AUSTRALIA 6281	Address	: 10 Hod Way Malaga WA Australia 6090
Telephone	: ----	Telephone	: 08 9209 7606
Project	: Ex EP1702676 17-WAU-0008 Onslow Marine Support Base	Date Samples Received	: 22-Mar-2017 10:55
Order number	: ----	Date Analysis Commenced	: 12-Apr-2017
C-O-C number	: ----	Issue Date	: 22-Apr-2017 21:32
Sampler	: ----		
Site	: ----		
Quote number	: EP/814/15		
No. of samples received	: 3		
No. of samples analysed	: 3		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics, Malaga, WA
Daniel Fisher	Inorganics Analyst	Perth ASS, Malaga, WA
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Efua Wilson	Metals Chemist	Perth Inorganics, Malaga, WA
Huynh Huynh	Organic Chemist	Perth Organics, Malaga, WA
Vanessa Nguyen	Organic Chemist	Perth Organics, Malaga, WA

General Comments

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

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

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

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

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

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

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

- EA150H: Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1 2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently NATA endorsement does not apply to hydrometer results.
- EK061G (TKN): Poor spike recovery due to possible sample heterogeneity.
- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	TC1-1	TC1-T2-1	TC5	----	----
			Client sampling date / time	15-Mar-2017 00:00	15-Mar-2017 00:00	17-Mar-2017 00:00	----	----
Compound	CAS Number	LOR	Unit	EP1703525-001	EP1703525-002	EP1703525-003	--------	--------
				Result	Result	Result	----	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	----	9.9	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	----	<2	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	----	<0.02	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	----	<0.005	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	----	<10	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	----	----	10.4	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	----	----	2090	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	----	----	3.35	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	----	1.5	----	----
Net Acidity (sulfur units)	----	0.02	% S	----	----	<0.02	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	----	----	<10	----	----
Liming Rate	----	1	kg CaCO3/t	----	----	<1	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	----	<0.02	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	----	<10	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	----	<1	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	25.6	22.9	18.0	----	----
EA150: Particle Sizing								
+75µm	----	1	%	----	68	96	----	----
+150µm	----	1	%	----	46	40	----	----
+300µm	----	1	%	----	7	7	----	----
+425µm	----	1	%	----	3	1	----	----
+600µm	----	1	%	----	3	<1	----	----
+1180µm	----	1	%	----	2	<1	----	----
+2.36mm	----	1	%	----	2	<1	----	----
+4.75mm	----	1	%	----	<1	<1	----	----
+9.5mm	----	1	%	----	<1	<1	----	----
+19.0mm	----	1	%	----	<1	<1	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TC1-1	TC1-T2-1	TC5	----	----
				Client sampling date / time	15-Mar-2017 00:00	15-Mar-2017 00:00	17-Mar-2017 00:00	----	----
Compound	CAS Number	LOR	Unit		EP1703525-001	EP1703525-002	EP1703525-003	--------	--------
					Result	Result	Result	----	----
EA150: Particle Sizing - Continued									
+37.5mm	----	1	%		----	<1	<1	----	----
+75.0mm	----	1	%		----	<1	<1	----	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	**21**	**1**	----	----
Silt (2-60 µm)	----	1	%		----	**9**	**2**	----	----
Sand (0.06-2.00 mm)	----	1	%		----	**68**	**97**	----	----
Gravel (>2mm)	----	1	%		----	**2**	<1	----	----
Cobbles (>6cm)	----	1	%		----	<1	<1	----	----
EG005-SD: Total Metals in Sediments by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		----	**5820**	**2540**	----	----
Iron	7439-89-6	50	mg/kg		----	**27700**	**16700**	----	----
EG020-SD: Total Metals in Sediments by ICPMS									
Antimony	7440-36-0	0.5	mg/kg		----	<0.50	<0.50	----	----
Arsenic	7440-38-2	1	mg/kg		----	**15.8**	**18.6**	----	----
Cadmium	7440-43-9	0.1	mg/kg		----	<0.1	<0.1	----	----
Chromium	7440-47-3	1	mg/kg		----	**39.6**	**23.0**	----	----
Copper	7440-50-8	1	mg/kg		----	**17.8**	**5.3**	----	----
Cobalt	7440-48-4	0.5	mg/kg		----	**13.1**	**6.2**	----	----
Lead	7439-92-1	1	mg/kg		----	**6.7**	**3.3**	----	----
Manganese	7439-96-5	10	mg/kg		----	**535**	**330**	----	----
Nickel	7440-02-0	1	mg/kg		----	**18.6**	**8.4**	----	----
Selenium	7782-49-2	0.1	mg/kg		----	**2.6**	**1.5**	----	----
Silver	7440-22-4	0.1	mg/kg		----	<0.1	<0.1	----	----
Vanadium	7440-62-2	2	mg/kg		----	**54.2**	**36.1**	----	----
Zinc	7440-66-6	1	mg/kg		----	**32.3**	**15.5**	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		----	<0.01	<0.01	----	----
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		<20	<20	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg		<0.1	<0.1	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg		<0.1	<0.1	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TC1-1	TC1-T2-1	TC5	----	----
				Client sampling date / time	15-Mar-2017 00:00	15-Mar-2017 00:00	17-Mar-2017 00:00	----	----
Compound	CAS Number	LOR	Unit		EP1703525-001	EP1703525-002	EP1703525-003	--------	--------
					Result	Result	Result	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser - Continued									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		<0.1	<0.1	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		**200**	**190**	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)									
^ Total Nitrogen as N	----	20	mg/kg		**200**	**190**	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	2	mg/kg		**216**	**212**	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		**0.3**	**0.2**	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		**----**	**0.22**	**0.07**	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	3	mg/kg		<3	<3	----	----	----
>C16 - C34 Fraction	----	3	mg/kg		<3	<3	----	----	----
>C34 - C40 Fraction	----	5	mg/kg		<5	<5	----	----	----
>C10 - C40 Fraction (sum)	----	3	mg/kg		<3	<3	----	----	----
>C10 - C16 Fraction minus Naphthalene (F2)	----	3	mg/kg		<3	<3	----	----	----
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	3	mg/kg		<3	<3	----	----	----
C10 - C14 Fraction	----	3	mg/kg		<3	<3	----	----	----
C15 - C28 Fraction	----	3	mg/kg		<3	<3	----	----	----
C29 - C36 Fraction	----	5	mg/kg		<5	<5	----	----	----
^ C10 - C36 Fraction (sum)	----	3	mg/kg		<3	<3	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
C6 - C10 Fraction	C6_C10	3	mg/kg		<3	<3	----	----	----
EP080-SD: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	----	----	----
Toluene	108-88-3	0.2	mg/kg		<0.2	<0.2	----	----	----
Ethylbenzene	100-41-4	0.2	mg/kg		<0.2	<0.2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg		<0.2	<0.2	----	----	----
ortho-Xylene	95-47-6	0.2	mg/kg		<0.2	<0.2	----	----	----
^ Total Xylenes	1330-20-7	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TC1-1	TC1-T2-1	TC5	----	----
				Client sampling date / time	15-Mar-2017 00:00	15-Mar-2017 00:00	17-Mar-2017 00:00	----	----
Compound	CAS Number	LOR	Unit		EP1703525-001	EP1703525-002	EP1703525-003	--------	--------
					Result	Result	Result	----	----
EP080-SD: BTEXN - Continued									
Naphthalene	91-20-3	0.2	mg/kg		<0.2	<0.2	----	----	----
EP090: Organotin Compounds									
Tributyltin	56573-85-4	0.5	µgSn/kg		<0.5	<0.5	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	5	µg/kg		<5	<5	----	----	----
2-Methylnaphthalene	91-57-6	5	µg/kg		<5	<5	----	----	----
Acenaphthylene	208-96-8	4	µg/kg		<4	<4	----	----	----
Acenaphthene	83-32-9	4	µg/kg		<4	<4	----	----	----
Fluorene	86-73-7	4	µg/kg		<4	<4	----	----	----
Phenanthrene	85-01-8	4	µg/kg		<4	<4	----	----	----
Anthracene	120-12-7	4	µg/kg		<4	<4	----	----	----
Fluoranthene	206-44-0	4	µg/kg		<4	<4	----	----	----
Pyrene	129-00-0	4	µg/kg		<4	<4	----	----	----
Benz(a)anthracene	56-55-3	4	µg/kg		<4	<4	----	----	----
Chrysene	218-01-9	4	µg/kg		<4	<4	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	4	µg/kg		<4	<4	----	----	----
Benzo(k)fluoranthene	207-08-9	4	µg/kg		<4	<4	----	----	----
Benzo(e)pyrene	192-97-2	4	µg/kg		<4	<4	----	----	----
Benzo(a)pyrene	50-32-8	4	µg/kg		<4	<4	----	----	----
Perylene	198-55-0	4	µg/kg		<4	<4	----	----	----
Benzo(g.h.i)perylene	191-24-2	4	µg/kg		<4	<4	----	----	----
Dibenz(a.h)anthracene	53-70-3	4	µg/kg		<4	<4	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	4	µg/kg		<4	<4	----	----	----
Coronene	191-07-1	5	µg/kg		<5	<5	----	----	----
^ Sum of PAHs	----	4	µg/kg		<4	<4	----	----	----
EP080-SD: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		98.0	71.0	----	----	----
Toluene-D8	2037-26-5	0.2	%		72.6	97.9	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		97.4	92.3	----	----	----
EP090S: Organotin Surrogate									
Tripropyltin	----	0.5	%		90.7	104	----	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	10	%		110	101	----	----	----
Anthracene-d10	1719-06-8	10	%		104	96.1	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TC1-1	TC1-T2-1	TC5	----	----
				Client sampling date / time	15-Mar-2017 00:00	15-Mar-2017 00:00	17-Mar-2017 00:00	----	----
Compound	CAS Number	LOR	Unit		EP1703525-001	EP1703525-002	EP1703525-003	--------	--------
					Result	Result	Result	----	----
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	10	%		**103**	**88.2**	**----**	**----**	**----**

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP080-SD: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	70	130
Toluene-D8	2037-26-5	70	130
4-Bromofluorobenzene	460-00-4	70	130
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	70	130
Anthracene-d10	1719-06-8	70	130
4-Terphenyl-d14	1718-51-0	70	130

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP1705039**	Page	: 1 of 2
Client	: **WA MARINE PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: TRAVIS HURLEY	Contact	: Lauren Ockwell
Address	: SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370 DUNSBOROUGH, PERTH WA, AUSTRALIA 6281	Address	: 10 Hod Way Malaga WA Australia 6090
Telephone	: ----	Telephone	: 08 9209 7606
Project	: Ex EP1702676 17WAU-0008 Onslow Marine Support Base	Date Samples Received	: 22-Mar-2017 10:55
Order number	: ----	Date Analysis Commenced	: 24-May-2017
C-O-C number	: ----	Issue Date	: 25-May-2017 07:46
Sampler	: ----		
Site	: ----		
Quote number	: EP/814/15		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

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

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

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

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

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

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

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

- CEC conducted by ALS Brisbane, NATA Site No. 818.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	**OC4-0.5 EP1707626_037**	**----**	**----**	**----**	**----**
				Client sampling date / time	17-Mar-2017 11:20	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EP1705039-001**	**--------**	**--------**	**--------**	**--------**
					Result	----	----	----	----
ED008: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		**25.6**	**----**	**----**	**----**	**----**
Exchangeable Magnesium	----	0.1	meq/100g		**7.2**	**----**	**----**	**----**	**----**
Exchangeable Potassium	----	0.1	meq/100g		**0.7**	**----**	**----**	**----**	**----**
Exchangeable Sodium	----	0.1	meq/100g		**0.9**	**----**	**----**	**----**	**----**
Cation Exchange Capacity	----	0.1	meq/100g		**34.5**	**----**	**----**	**----**	**----**

Certificate of Analysis

ALS Laboratory Group Pty Ltd
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samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT: Travis Hurley

DATE REPORTED: 31-Mar-2017

COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

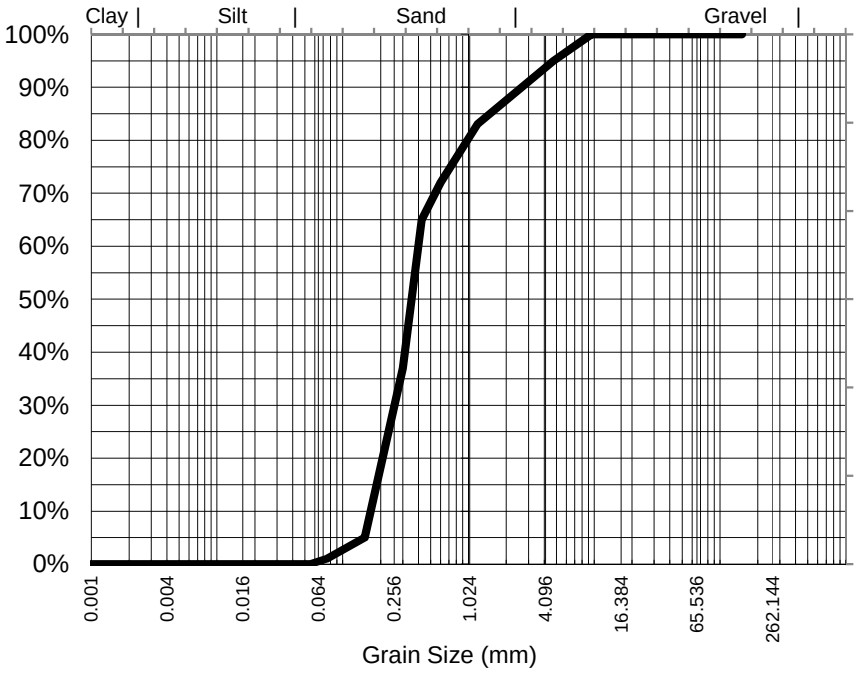
ADDRESS:

REPORT NO: EP1702676-004 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: BP4

Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	95%
2.36	89%
1.18	83%
0.600	72%
0.425	65%
0.300	37%
0.150	5%
0.075	1%
Particle Size (microns)	
75	1%
55	0%

Median Particle Size (mm)*	0.358

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, STONE, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

NATA Accreditation: 825 Site: Newcastle
This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

Peter Keyte
Manager Newcastle
Authorised Signatory

Certificate of Analysis

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ALS Environmental

Newcastle, NSW

CLIENT: Travis Hurley

DATE REPORTED: 31-Mar-2017

COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

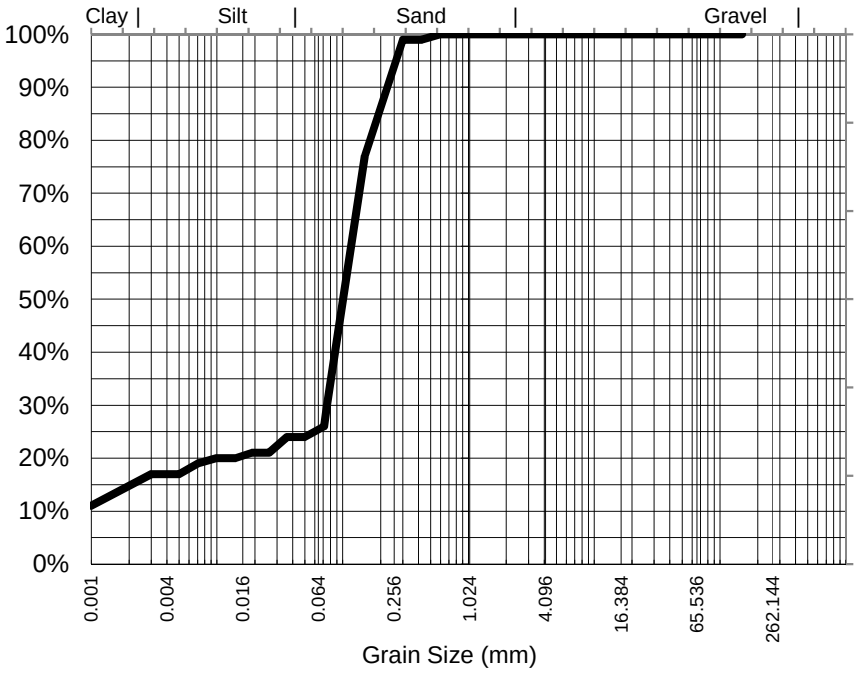
ADDRESS:

REPORT NO: EP1702676-005 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: TC2-R1

Particle Size Distribution



Particle Size (mm)	Percent Passing
0.600	100%
0.425	99%
0.300	99%
0.150	77%
0.075	30%
Particle Size (microns)	
71	26%
50	24%
36	24%
19	21%
10	20%
5	17%
1	11%

Median Particle Size (mm)*	0.107

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND, VEG, STONE

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

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Certificate of Analysis

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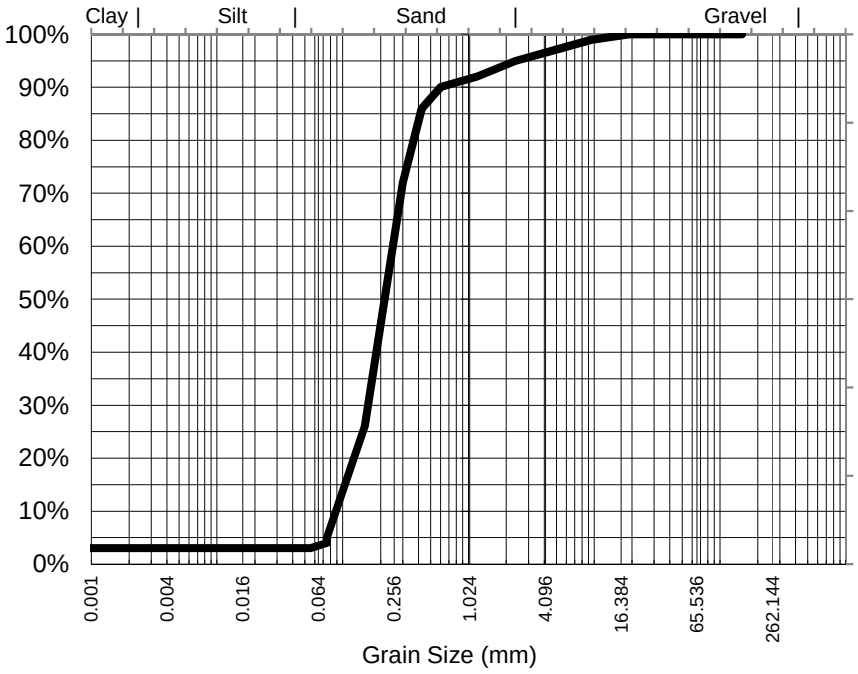
ALS Environmental

Newcastle, NSW

CLIENT:	Travis Hurley	**DATE REPORTED:**	31-Mar-2017
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:		**REPORT NO:**	EP1702676-007 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	TC1-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	99%
4.75	97%
2.36	95%
1.18	92%
0.600	90%
0.425	86%
0.300	72%
0.150	26%
0.075	5%
Particle Size (microns)	
75	4%
55	3%
39	3%
19	3%
10	3%
5	3%
1	3%

Median Particle Size (mm)*	0.228

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	SAND, STONE, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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Certificate of Analysis

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ALS Environmental

Newcastle, NSW

CLIENT: Travis Hurley

DATE REPORTED: 31-Mar-2017

COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

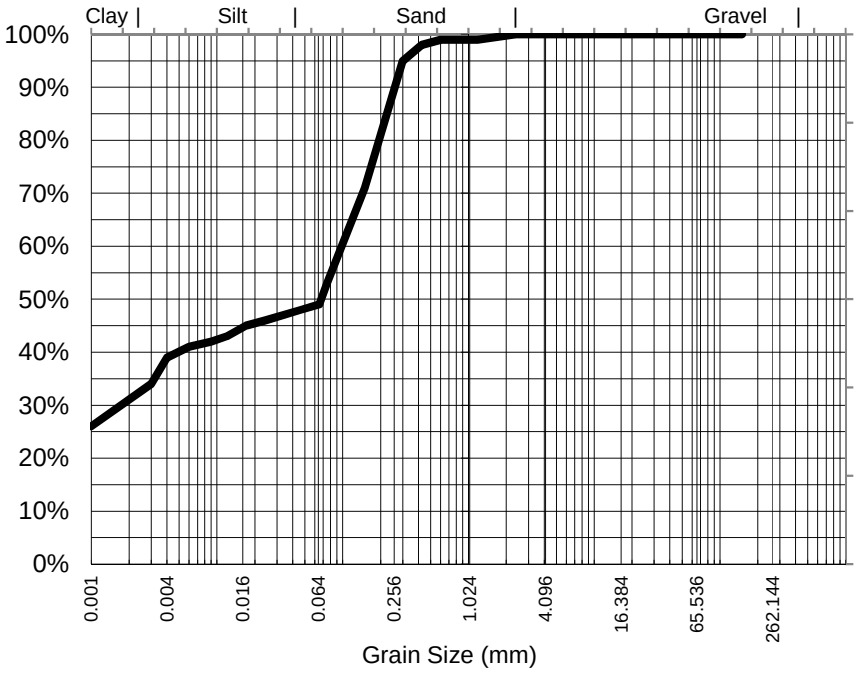
ADDRESS:

REPORT NO: EP1702676-008 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: TC1-1

Particle Size Distribution



Particle Size (mm)	Percent Passing
2.36	100%
1.18	99%
0.600	99%
0.425	98%
0.300	95%
0.150	71%
0.075	53%
Particle Size (microns)	
65	49%
46	48%
34	47%
17	45%
9	42%
4	39%
1	26%

Median Particle Size (mm)*	0.068

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

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Certificate of Analysis

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ALS Environmental

Newcastle, NSW

CLIENT: Travis Hurley

DATE REPORTED: 31-Mar-2017

COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

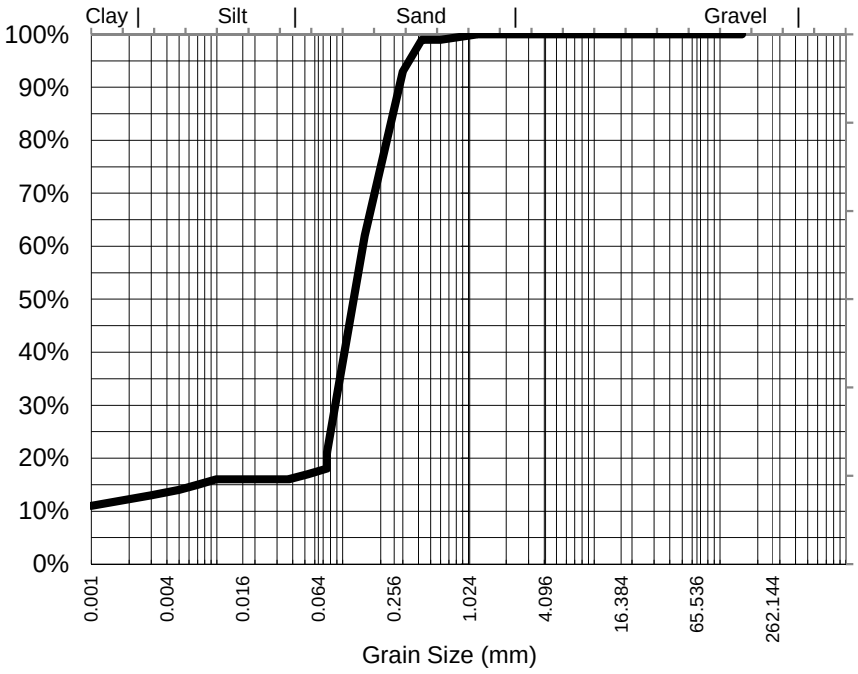
ADDRESS:

REPORT NO: EP1702676-009 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: TC2

Particle Size Distribution



Particle Size (mm)	Percent Passing
1.18	100%
0.600	99%
0.425	99%
0.300	93%
0.150	62%
0.075	21%
Particle Size (microns)	
75	18%
53	17%
37	16%
19	16%
10	16%
5	14%
1	11%

Median Particle Size (mm)*	0.128

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, FINES

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Peter Keyte
Manager Newcastle
Authorised Signatory

Certificate of Analysis

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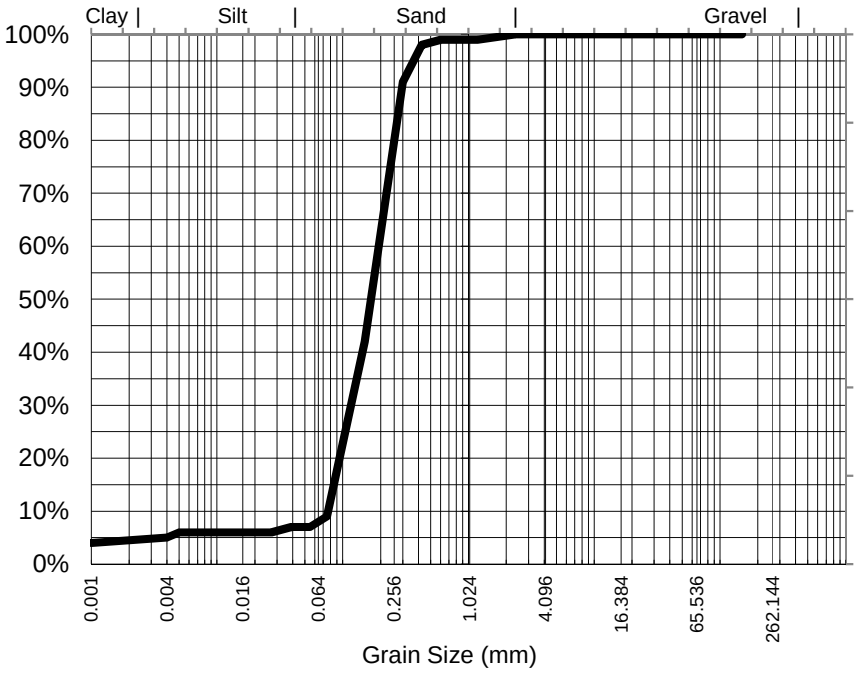
ALS Environmental

Newcastle, NSW

CLIENT:	Travis Hurley	**DATE REPORTED:**	31-Mar-2017
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:		**REPORT NO:**	EP1702676-011 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	TC4

Particle Size Distribution



Particle Size (mm)	Percent Passing
2.36	100%
1.18	99%
0.600	99%
0.425	98%
0.300	91%
0.150	42%
0.075	9%
Particle Size (microns)	
75	9%
55	7%
39	7%
19	6%
10	6%
5	6%
1	4%

Median Particle Size (mm)*	0.174

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	SAND, FINES, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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ALS Environmental

Newcastle, NSW

CLIENT: Travis Hurley

COMPANY: WA MARINE PTY LTD

ADDRESS:

PROJECT: 17Wau-0008 Onslow Marine

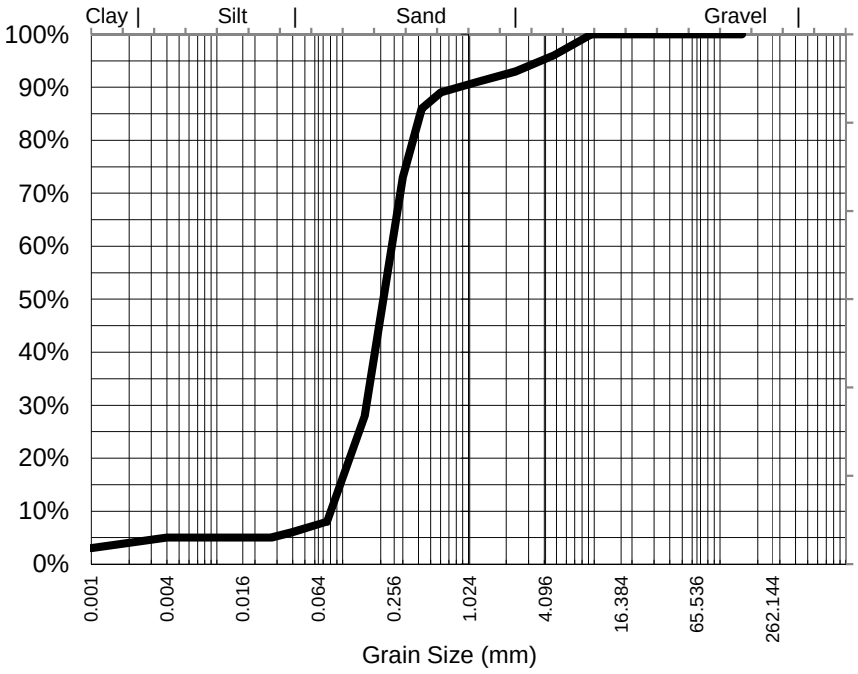
DATE REPORTED: 31-Mar-2017

DATE RECEIVED: 22-Mar-2017

REPORT NO: EP1702676-012 / PSD

SAMPLE ID: TC1-0.5-T2

Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	96%
2.36	93%
1.18	91%
0.600	89%
0.425	86%
0.300	73%
0.150	28%
0.075	8%
Particle Size (microns)	
74	8%
55	7%
39	6%
19	5%
10	5%
5	5%
1	3%

Median Particle Size (mm)*	0.223

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Loss on Pretreatment NA

Sample Description: SAND, STONE, SHELL

Test Method: AS1289.3.6.3 2003

Analysed: 28-Mar-17

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

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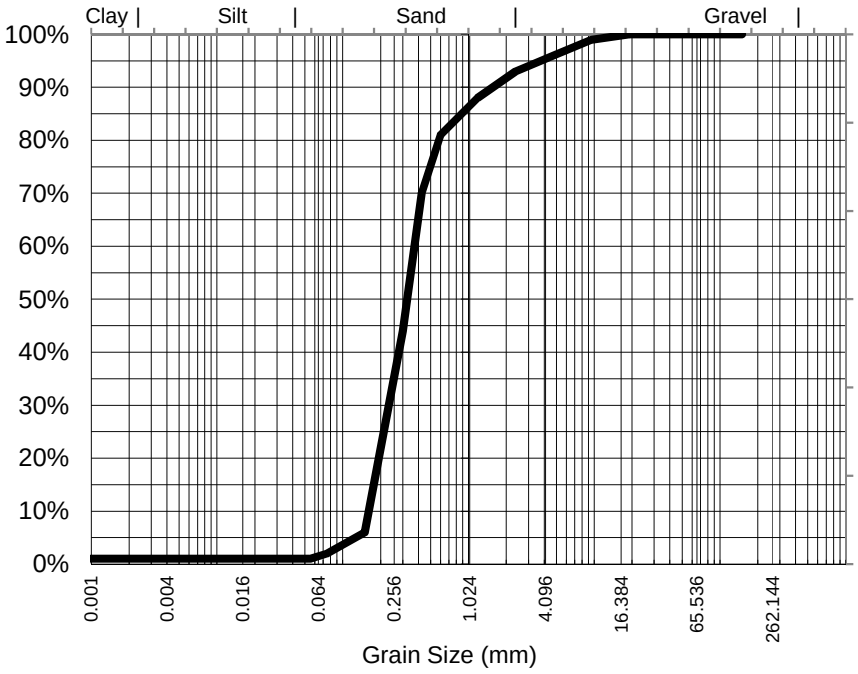
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:		**REPORT NO:**	EP1702676-015 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	IC1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	99%
4.75	96%
2.36	93%
1.18	88%
0.600	81%
0.425	70%
0.300	44%
0.150	6%
0.075	2%
Particle Size (microns)	
75	2%
55	1%
39	1%
19	1%
10	1%
5	1%
1	1%

Median Particle Size (mm)*	0.329

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	SAND, STONE, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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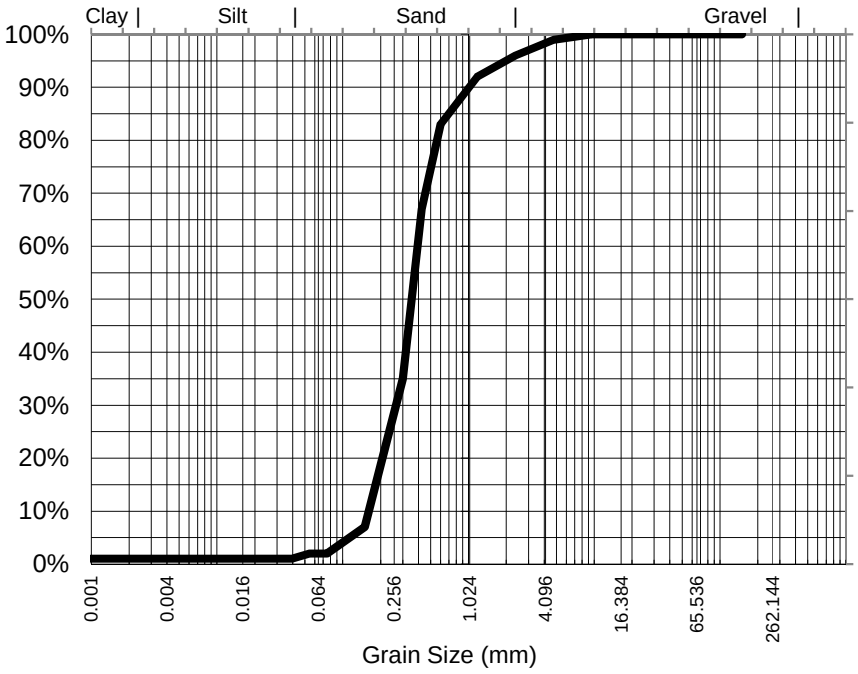
CLIENT:	Travis Hurley	**DATE REPORTED:**	31-Mar-2017
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:		**REPORT NO:**	EP1702676-017 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	IC2

Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	99%
2.36	96%
1.18	92%
0.600	83%
0.425	67%
0.300	35%
0.150	7%
0.075	2%
Particle Size (microns)	
75	2%
55	2%
39	1%
19	1%
10	1%
5	1%
1	1%

Median Particle Size (mm)*	0.359

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	SAND, STONE, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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CLIENT: Travis Hurley

DATE REPORTED: 31-Mar-2017

COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

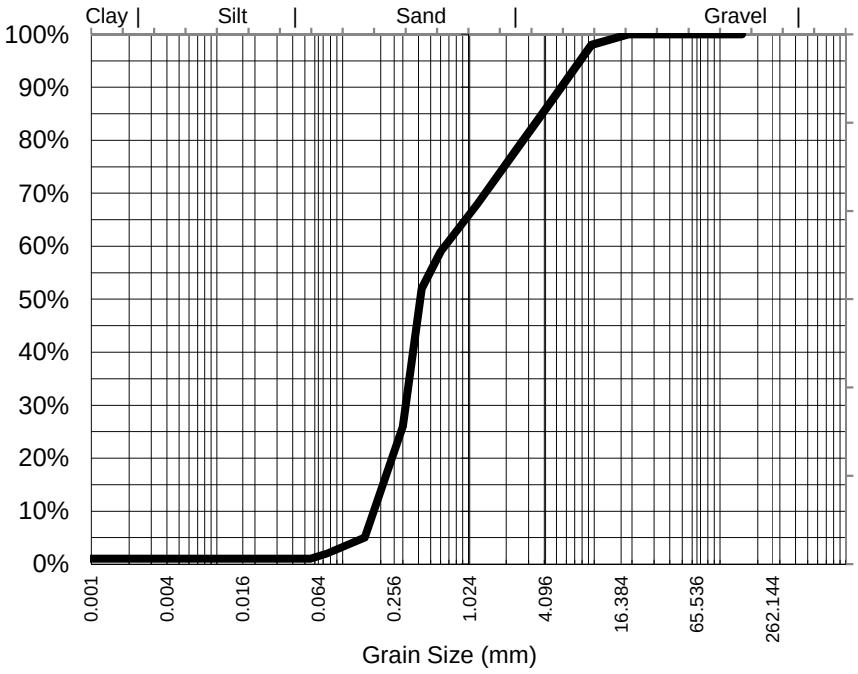
ADDRESS:

REPORT NO: EP1702676-018 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: IC3-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	98%
4.75	88%
2.36	78%
1.18	68%
0.600	59%
0.425	52%
0.300	26%
0.150	5%
0.075	2%
Particle Size (microns)	
75	2%
55	1%
39	1%
19	1%
10	1%
5	1%
1	1%

Median Particle Size (mm)*	0.415

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, STONE, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

NATA Accreditation: 825 Site: Newcastle
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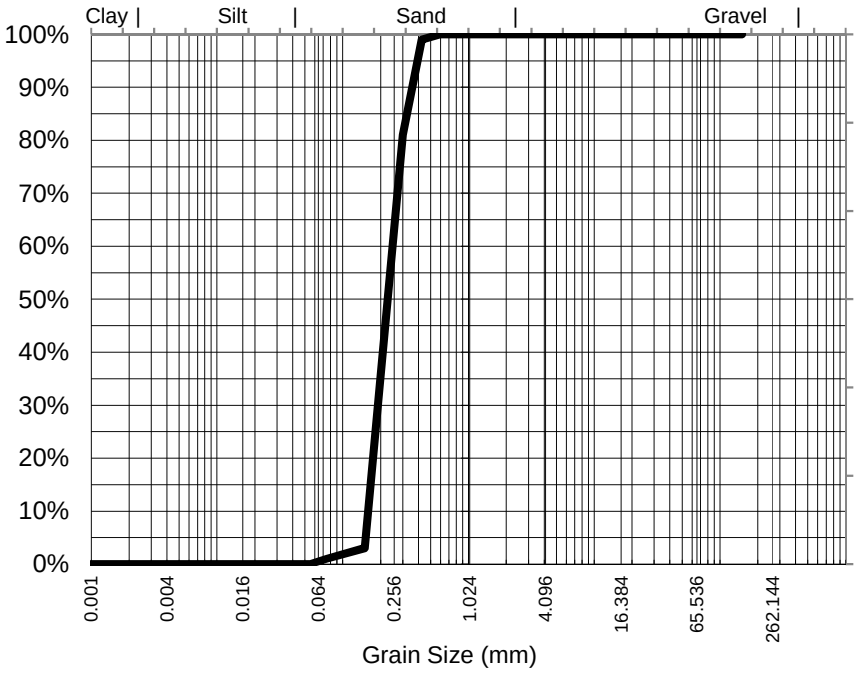
CLIENT:	Travis Hurley	**DATE REPORTED:**	31-Mar-2017
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:		**REPORT NO:**	EP1702676-020 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	IC4

Particle Size Distribution



Particle Size (mm)	Percent Passing
0.600	100%
0.425	99%
0.300	81%
0.150	3%
0.075	1%
Particle Size (microns)	
75	1%
55	0%

Median Particle Size (mm)*	0.240

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	SAND, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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COMPANY: WA MARINE PTY LTD

ADDRESS:

PROJECT: 17Wau-0008 Onslow Marine

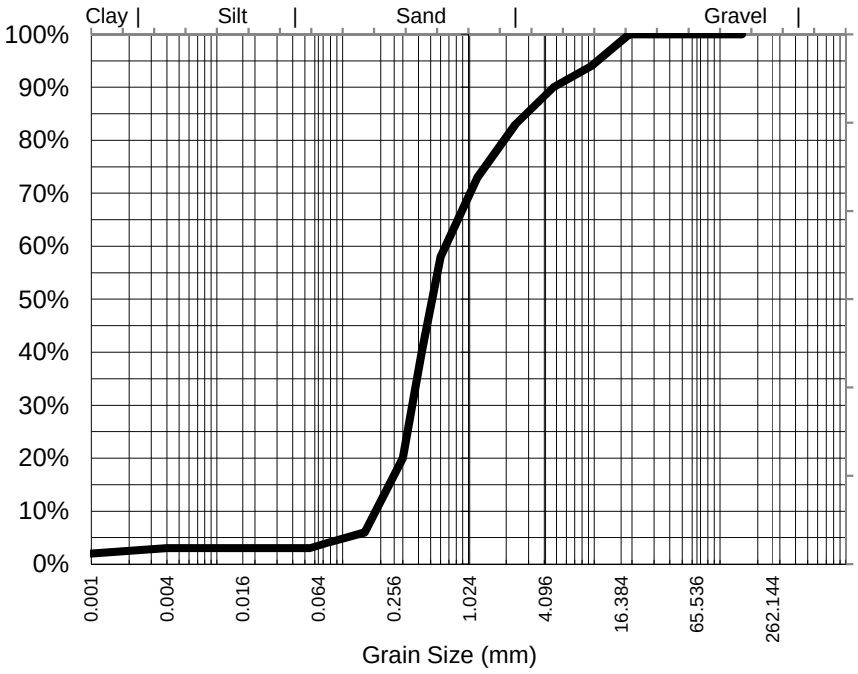
DATE REPORTED: 31-Mar-2017

DATE RECEIVED: 22-Mar-2017

REPORT NO: EP1702676-021 / PSD

SAMPLE ID: IC5-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	94%
4.75	90%
2.36	83%
1.18	73%
0.600	58%
0.425	40%
0.300	20%
0.150	6%
0.075	4%
Particle Size (microns)	
75	4%
55	3%
39	3%
19	3%
10	3%
5	3%
1	2%

Median Particle Size (mm)*	0.522

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Loss on Pretreatment NA

Sample Description: SAND, STONE, SHELL

Test Method: AS1289.3.6.3 2003

Analysed: 28-Mar-17

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

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CLIENT:	Travis Hurley	**DATE REPORTED:**	31-Mar-2017
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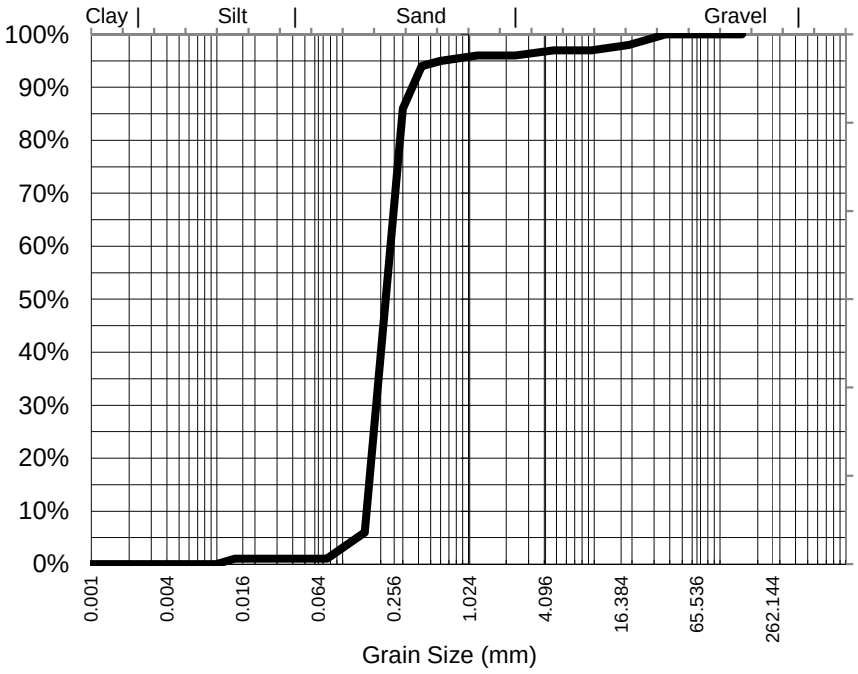
ADDRESS:		**REPORT NO:**	EP1702676-023 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	IC6

Particle Size Distribution



Particle Size (mm)	Percent Passing
37.5	100%
19.0	98%
9.50	97%
4.75	97%
2.36	96%
1.18	96%
0.600	95%
0.425	94%
0.300	86%
0.150	6%
0.075	1%
Particle Size (microns)	
75	1%
55	1%
39	1%
19	1%
10	0%

Median Particle Size (mm)*	0.233

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	SAND, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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CLIENT: Travis Hurley

DATE REPORTED: 31-Mar-2017

COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

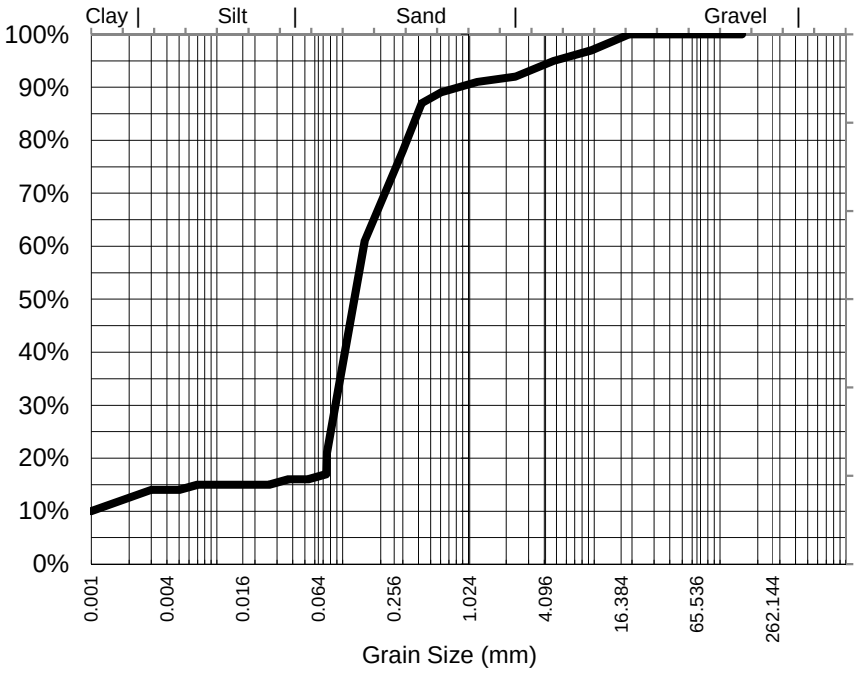
ADDRESS:

REPORT NO: EP1702676-024 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: IC7-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	97%
4.75	95%
2.36	92%
1.18	91%
0.600	89%
0.425	87%
0.300	78%
0.150	61%
0.075	21%
Particle Size (microns)	
74	17%
53	16%
37	16%
19	15%
10	15%
5	14%
1	10%

Median Particle Size (mm)*	0.129

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND, STONE, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

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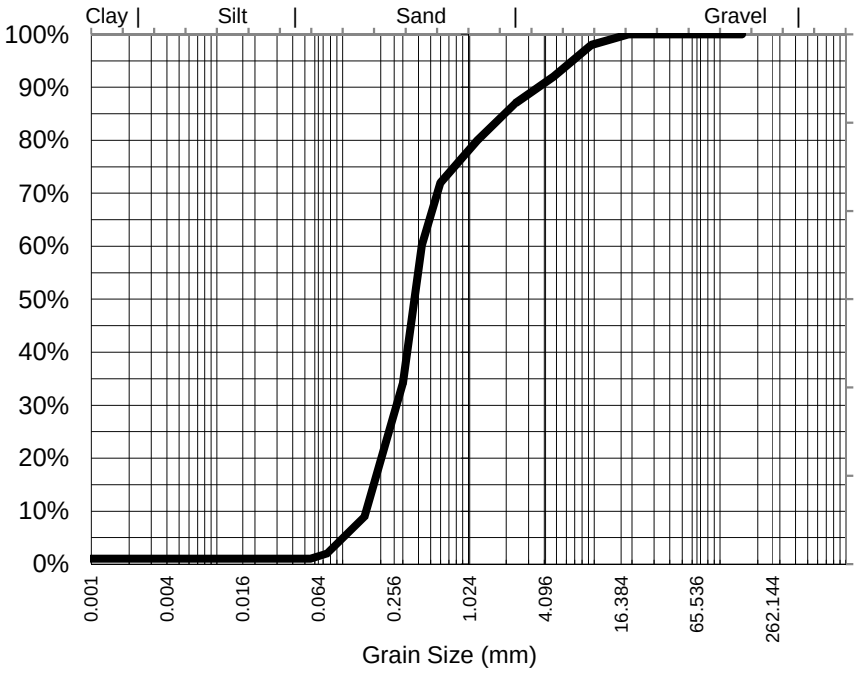
CLIENT:	Travis Hurley	**DATE REPORTED:**	31-Mar-2017
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:		**REPORT NO:**	EP1702676-025 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	IC7-1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	98%
4.75	92%
2.36	87%
1.18	80%
0.600	72%
0.425	60%
0.300	34%
0.150	9%
0.075	2%
Particle Size (microns)	
75	2%
55	1%
39	1%
19	1%
10	1%
5	1%
1	1%

Median Particle Size (mm)*	0.377

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	SAND, STONE, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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PROJECT: 17Wau-0008 Onslow Marine

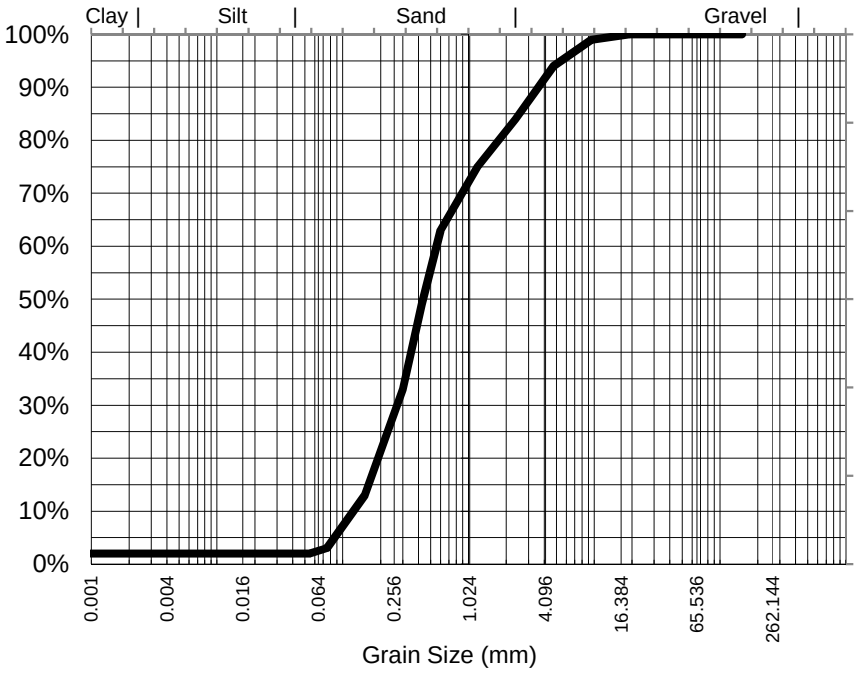
DATE REPORTED: 31-Mar-2017

DATE RECEIVED: 22-Mar-2017

REPORT NO: EP1702676-026 / PSD

SAMPLE ID: 1C8-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	99%
4.75	94%
2.36	84%
1.18	75%
0.600	63%
0.425	49%
0.300	33%
0.150	13%
0.075	3%
Particle Size (microns)	
75	3%
55	2%
39	2%
19	2%
10	2%
5	2%
1	2%

Median Particle Size (mm)*	0.438

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Loss on Pretreatment NA

Sample Description: SAND, STONE, SHELL

Test Method: AS1289.3.6.3 2003

Analysed: 28-Mar-17

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

NATA Accreditation: 825 Site: Newcastle
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CLIENT: Travis Hurley

DATE REPORTED: 31-Mar-2017

COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

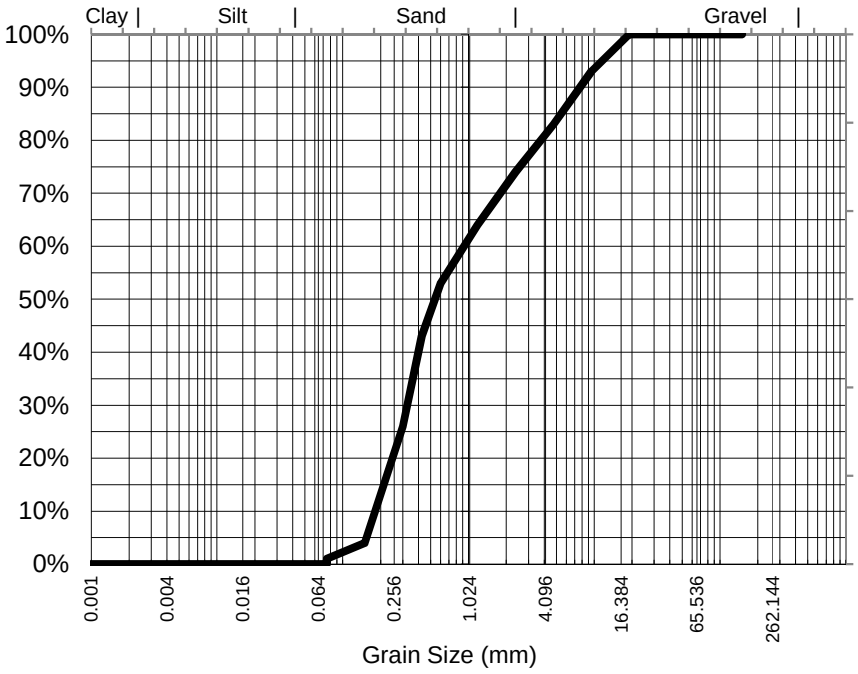
ADDRESS:

REPORT NO: EP1702676-028 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: IC1-R2

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	93%
4.75	83%
2.36	74%
1.18	64%
0.600	53%
0.425	43%
0.300	26%
0.150	4%
0.075	1%
Particle Size (microns)	

Median Particle Size (mm)*	0.548

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, STONE, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

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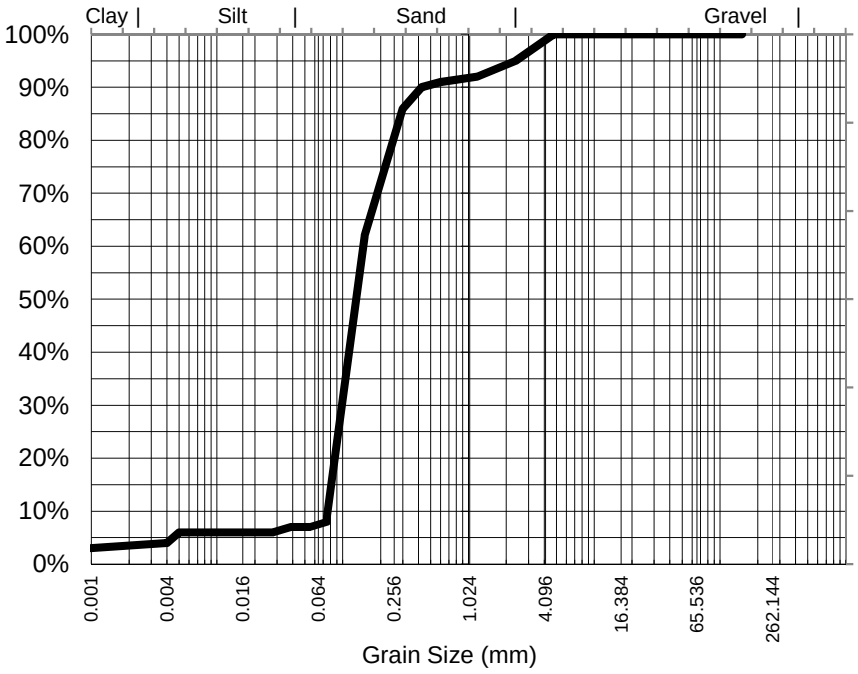
CLIENT:	Travis Hurley	**DATE REPORTED:**	31-Mar-2017
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:		**REPORT NO:**	EP1702676-031 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	OC1-0.5-T1

Particle Size Distribution



Particle Size (mm)	Percent Passing
4.75	100%
2.36	95%
1.18	92%
0.600	91%
0.425	90%
0.300	86%
0.150	62%
0.075	9%
Particle Size (microns)	
75	8%
55	7%
39	7%
19	6%
10	6%
5	6%
1	3%

Median Particle Size (mm)*	0.133

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	FINES, SAND, STONE, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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ALS Environmental

Newcastle, NSW

CLIENT: Travis Hurley

DATE REPORTED: 31-Mar-2017

COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

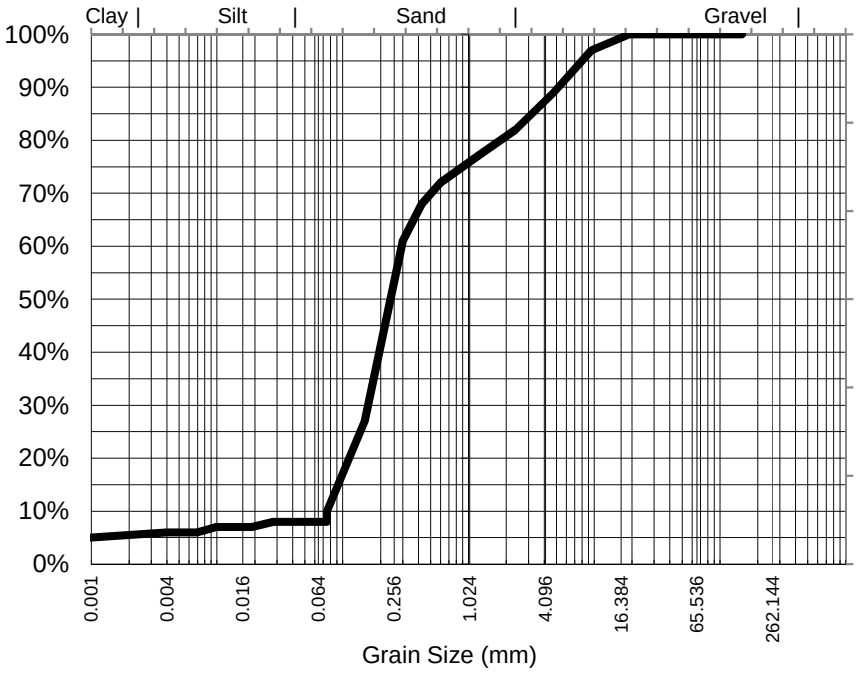
ADDRESS:

REPORT NO: EP1702676-033 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: OC2-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	97%
4.75	89%
2.36	82%
1.18	77%
0.600	72%
0.425	68%
0.300	61%
0.150	27%
0.075	10%
Particle Size (microns)	
75	8%
55	8%
39	8%
19	7%
10	7%
5	6%
1	5%

Median Particle Size (mm)*	0.251

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND, STONE, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

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CLIENT: Travis Hurley

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COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

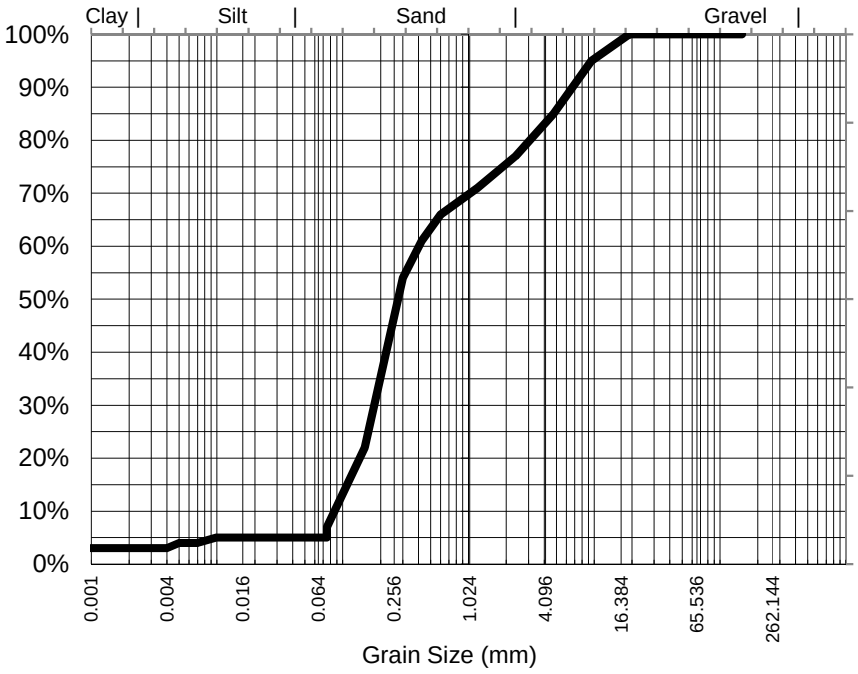
ADDRESS:

REPORT NO: EP1702676-034 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: OC2-1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	95%
4.75	85%
2.36	77%
1.18	71%
0.600	66%
0.425	61%
0.300	54%
0.150	22%
0.075	7%
Particle Size (microns)	
75	5%
55	5%
39	5%
19	5%
10	5%
5	4%
1	3%

Median Particle Size (mm)*	0.281

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND, STONE, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

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PROJECT: 17Wau-0008 Onslow Marine

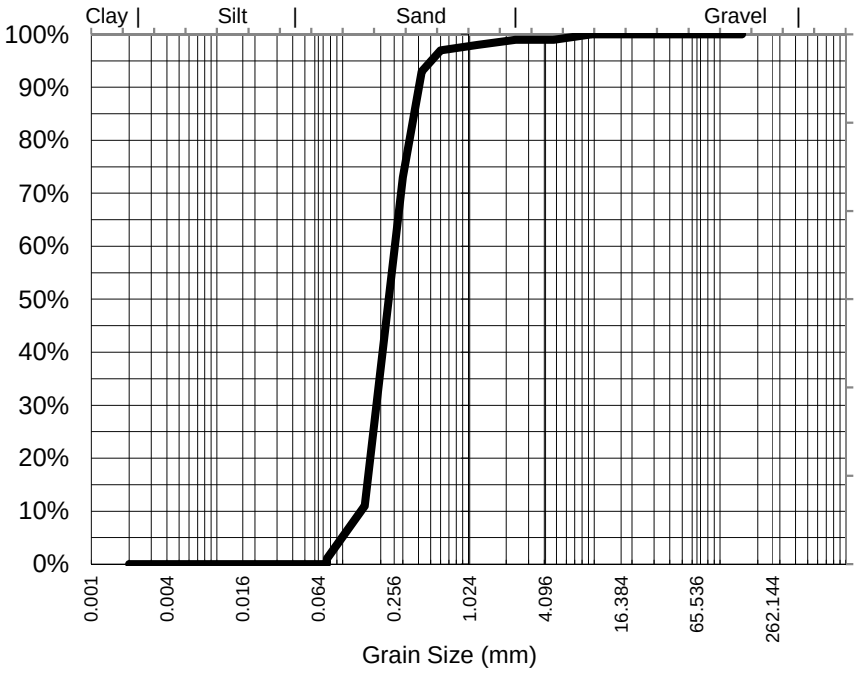
DATE REPORTED: 31-Mar-2017

DATE RECEIVED: 22-Mar-2017

REPORT NO: EP1702676-035 / PSD

SAMPLE ID: OC3-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	99%
2.36	99%
1.18	98%
0.600	97%
0.425	93%
0.300	73%
0.150	11%
0.075	1%
Particle Size (microns)	

Median Particle Size (mm)*	0.244

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Loss on Pretreatment NA

Sample Description: SAND, SHELL

Test Method: AS1289.3.6.3 2003

Analysed: 28-Mar-17

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

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CLIENT: Travis Hurley

DATE REPORTED: 31-Mar-2017

COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

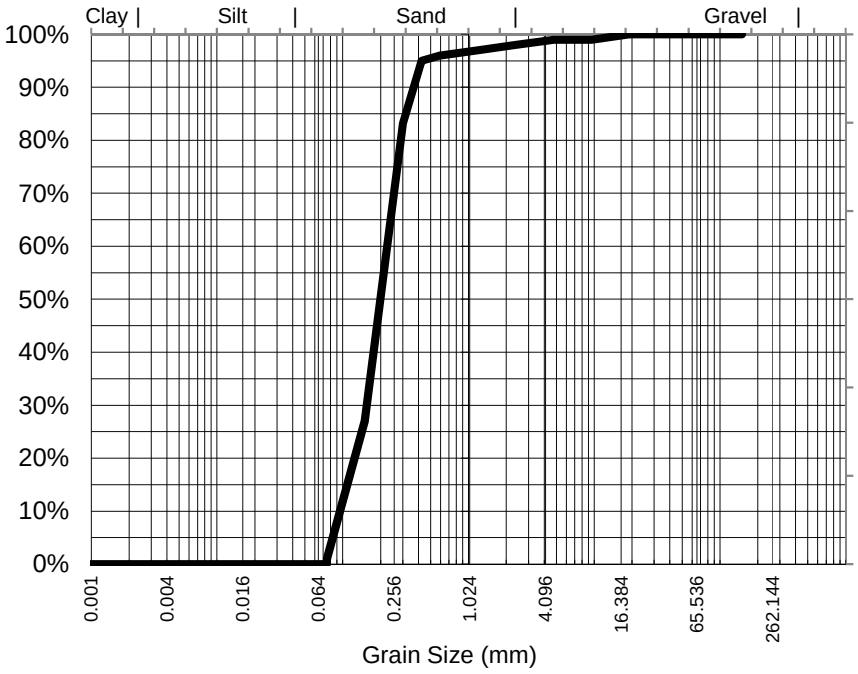
ADDRESS:

REPORT NO: EP1702676-036 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: OC3-1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	99%
4.75	99%
2.36	98%
1.18	97%
0.600	96%
0.425	95%
0.300	83%
0.150	27%
0.075	1%
Particle Size (microns)	

Median Particle Size (mm)*	0.212

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

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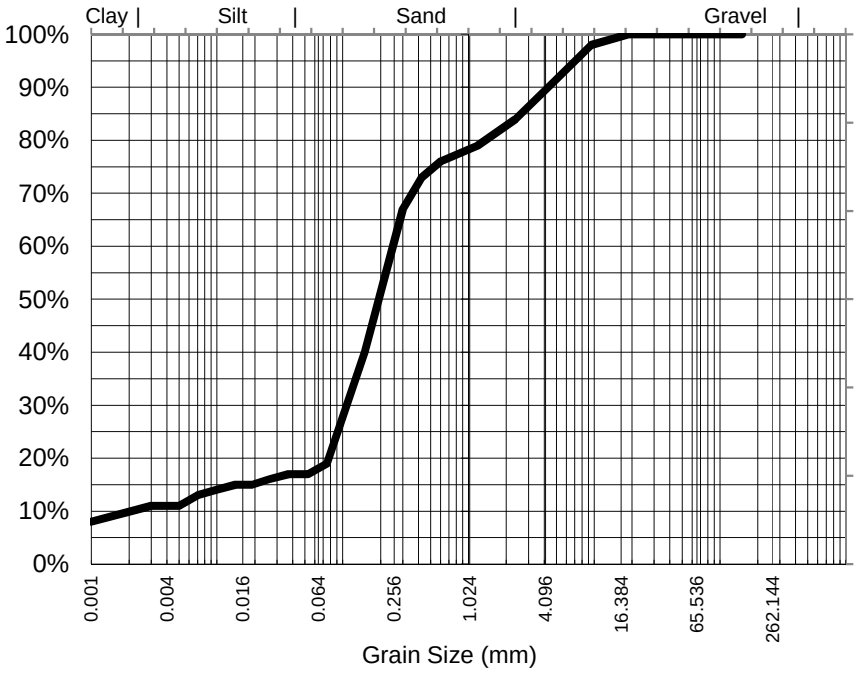
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:		**REPORT NO:**	EP1702676-037 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	OC4-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	98%
4.75	91%
2.36	84%
1.18	79%
0.600	76%
0.425	73%
0.300	67%
0.150	40%
0.075	19%
Particle Size (microns)	
75	19%
53	17%
37	17%
19	15%
10	14%
5	11%
1	8%

Median Particle Size (mm)*	0.206

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:		**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	FINES, SAND, STONE, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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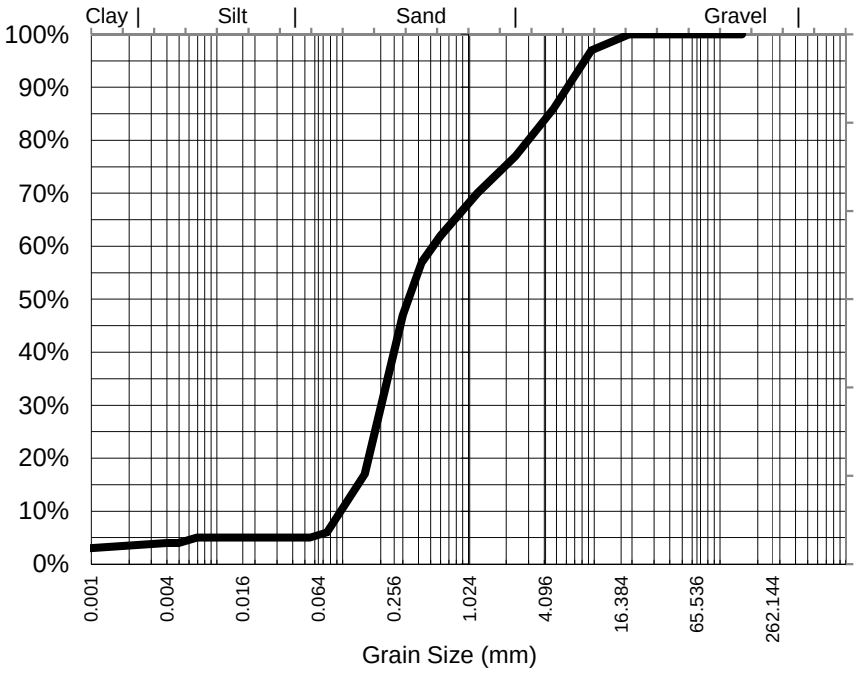
CLIENT:	Travis Hurley	**DATE REPORTED:**	31-Mar-2017
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:		**REPORT NO:**	EP1702676-039 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	OC5

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	97%
4.75	86%
2.36	77%
1.18	70%
0.600	62%
0.425	57%
0.300	47%
0.150	17%
0.075	6%
Particle Size (microns)	
75	6%
55	5%
39	5%
19	5%
10	5%
5	4%
1	3%

Median Particle Size (mm)*	0.338

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	FINES, SAND, STONE, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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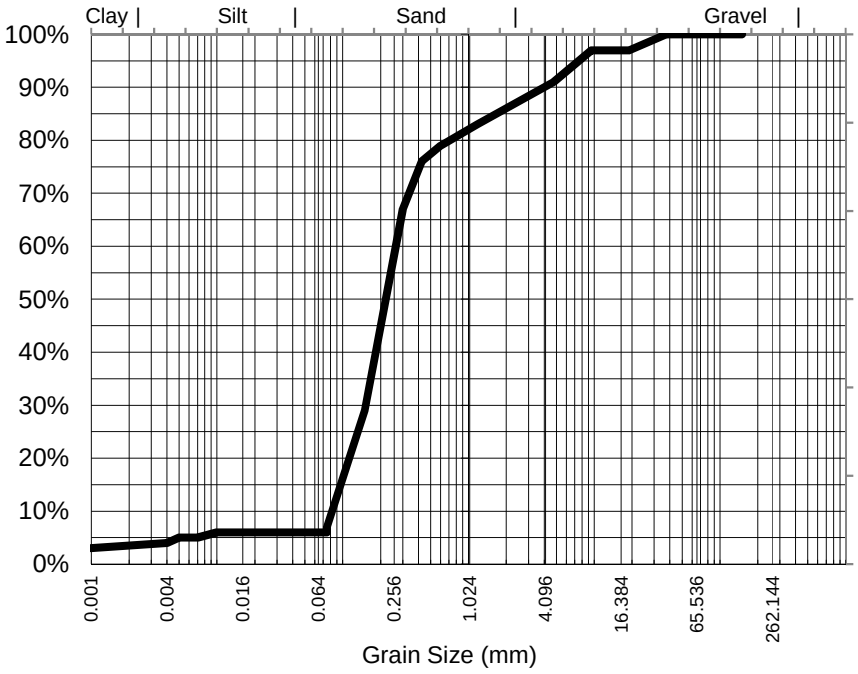
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:		**REPORT NO:**	EP1702676-040 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	OC6

Particle Size Distribution



Particle Size (mm)	Percent Passing
37.5	100%
19.0	97%
9.50	97%
4.75	91%
2.36	87%
1.18	83%
0.600	79%
0.425	76%
0.300	67%
0.150	29%
0.075	7%
Particle Size (microns)	
75	6%
55	6%
39	6%
19	6%
10	6%
5	5%
1	3%

Median Particle Size (mm)*	0.233

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	FINES, SAND, STONE, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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DATE REPORTED: 31-Mar-2017

COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

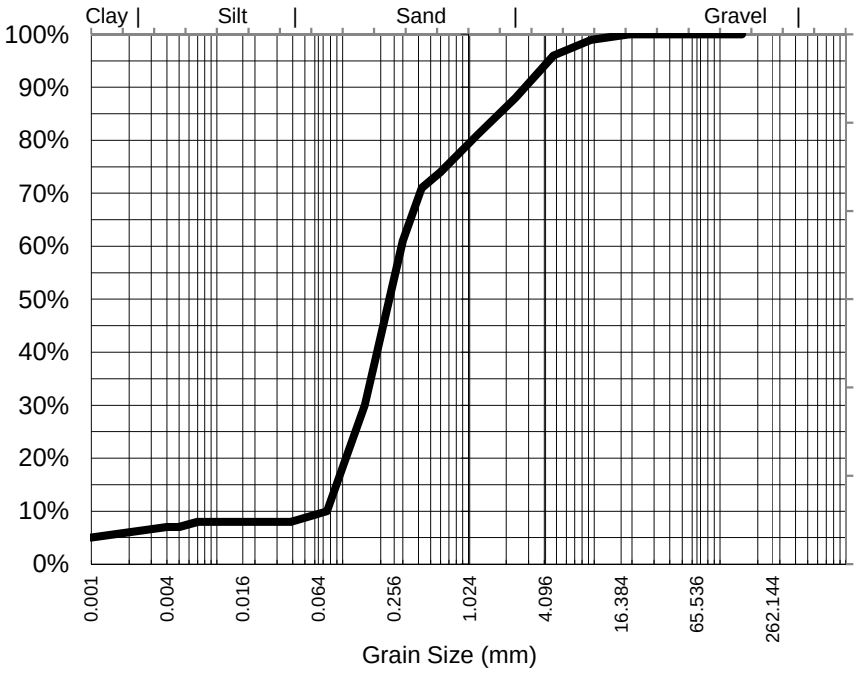
ADDRESS:

REPORT NO: EP1702676-041 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: OC7

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	99%
4.75	96%
2.36	88%
1.18	81%
0.600	74%
0.425	71%
0.300	61%
0.150	30%
0.075	10%
Particle Size (microns)	
75	10%
55	9%
39	8%
19	8%
10	8%
5	7%
1	5%

Median Particle Size (mm)*	0.247

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND, STONE, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

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CLIENT:	Travis Hurley	**DATE REPORTED:**	31-Mar-2017
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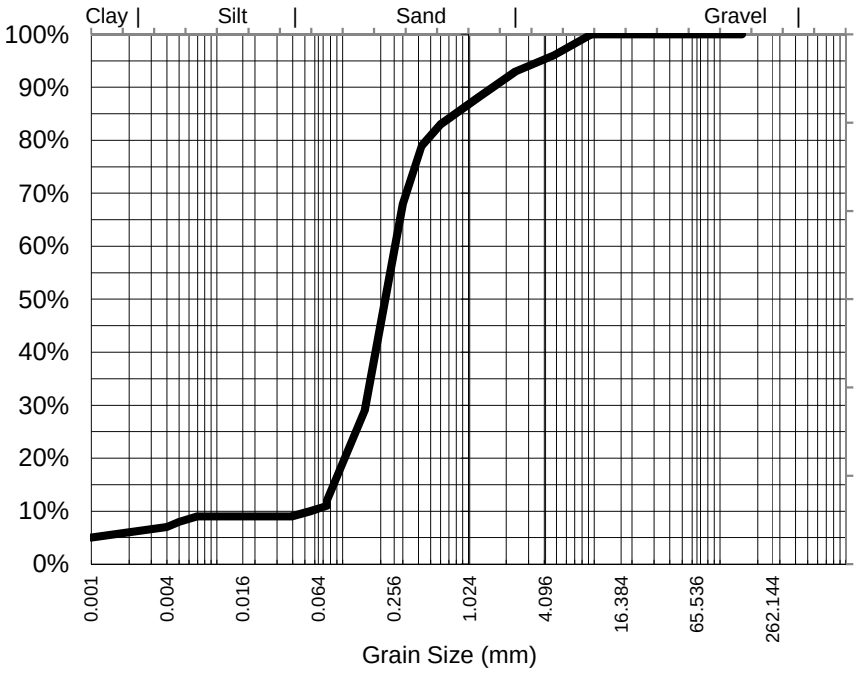
ADDRESS:		**REPORT NO:**	EP1702676-042 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	OC8

Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	96%
2.36	93%
1.18	88%
0.600	83%
0.425	79%
0.300	68%
0.150	29%
0.075	12%
Particle Size (microns)	
75	11%
55	10%
39	9%
19	9%
10	9%
5	8%
1	5%

Median Particle Size (mm)*	0.231

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:		**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	FINES, SAND, STONE, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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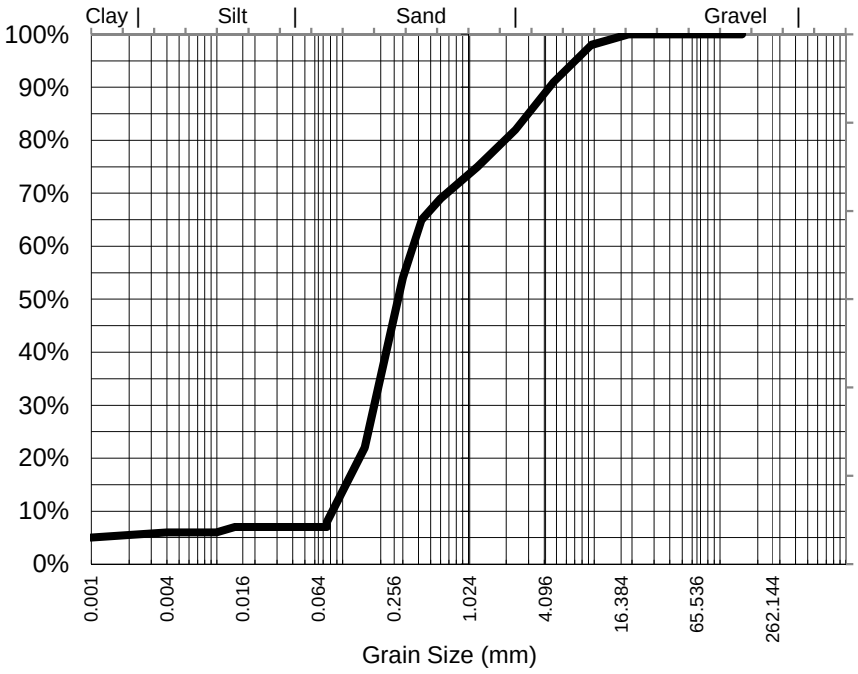
CLIENT:	Travis Hurley	**DATE REPORTED:**	31-Mar-2017
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:		**REPORT NO:**	EP1702676-043 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	OC9

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	98%
4.75	91%
2.36	82%
1.18	75%
0.600	69%
0.425	65%
0.300	54%
0.150	22%
0.075	8%
Particle Size (microns)	
75	7%
55	7%
39	7%
19	7%
10	6%
5	6%
1	5%

Median Particle Size (mm)*	0.281

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	FINES, SAND, STONE, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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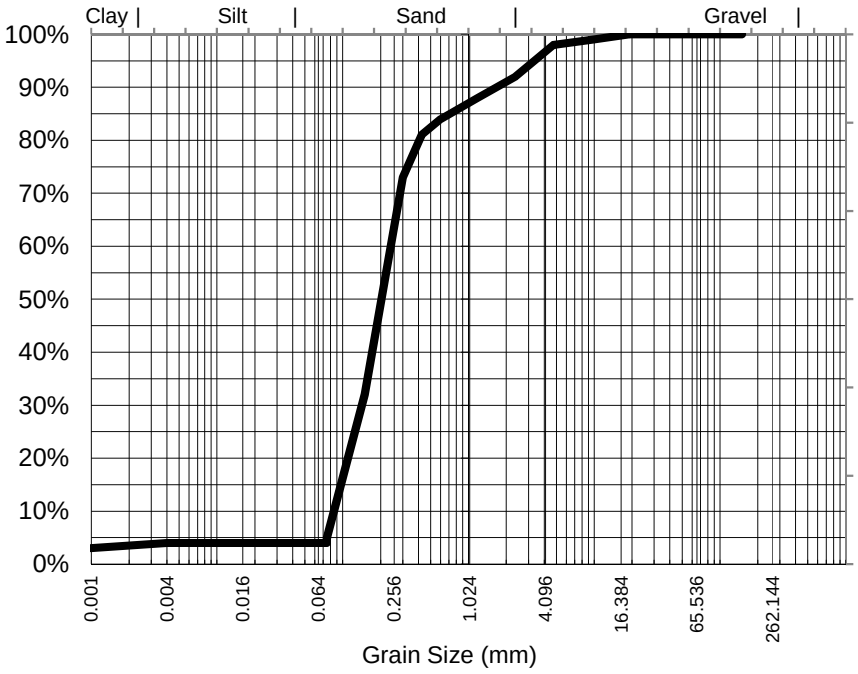
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:		**REPORT NO:**	EP1702676-044 / PSD
PROJECT:	17Wau-0008 Onslow Marine	**SAMPLE ID:**	OC10

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	99%
4.75	98%
2.36	92%
1.18	88%
0.600	84%
0.425	81%
0.300	73%
0.150	32%
0.075	5%
Particle Size (microns)	
75	4%
55	4%
39	4%
19	4%
10	4%
5	4%
1	3%

Median Particle Size (mm)*	0.216

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	28-Mar-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	SAND, STONE, SHELL	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

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DATE REPORTED: 31-Mar-2017

COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

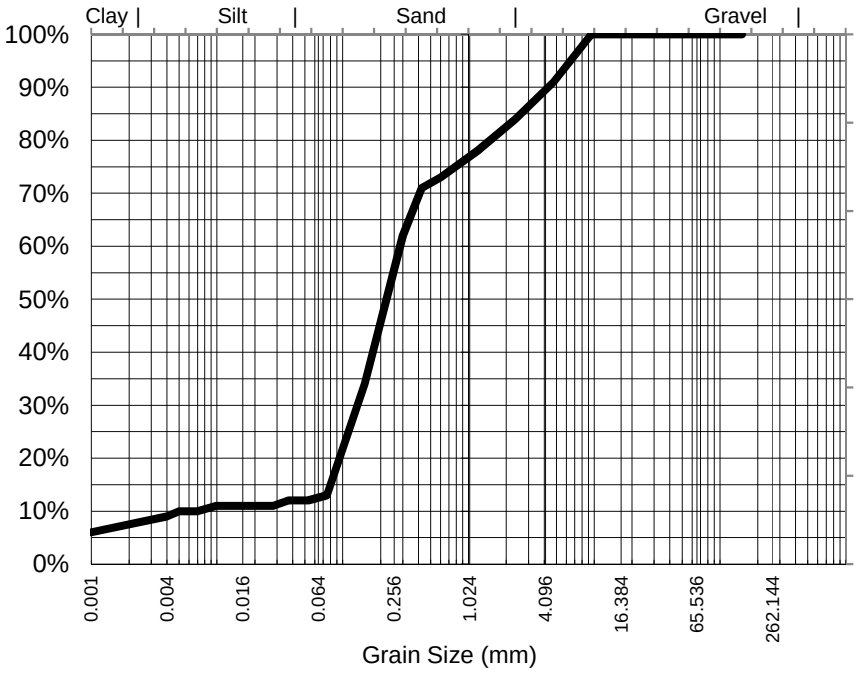
ADDRESS:

REPORT NO: EP1702676-045 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: OC7-R2-0.5

Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	91%
2.36	84%
1.18	78%
0.600	73%
0.425	71%
0.300	62%
0.150	34%
0.075	13%
Particle Size (microns)	
75	13%
53	12%
37	12%
19	11%
10	11%
5	10%
1	6%

Median Particle Size (mm)*	0.236

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND, STONE, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

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pH 02 4014 2500
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samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT: Travis Hurley

DATE REPORTED: 31-Mar-2017

COMPANY: WA MARINE PTY LTD

DATE RECEIVED: 22-Mar-2017

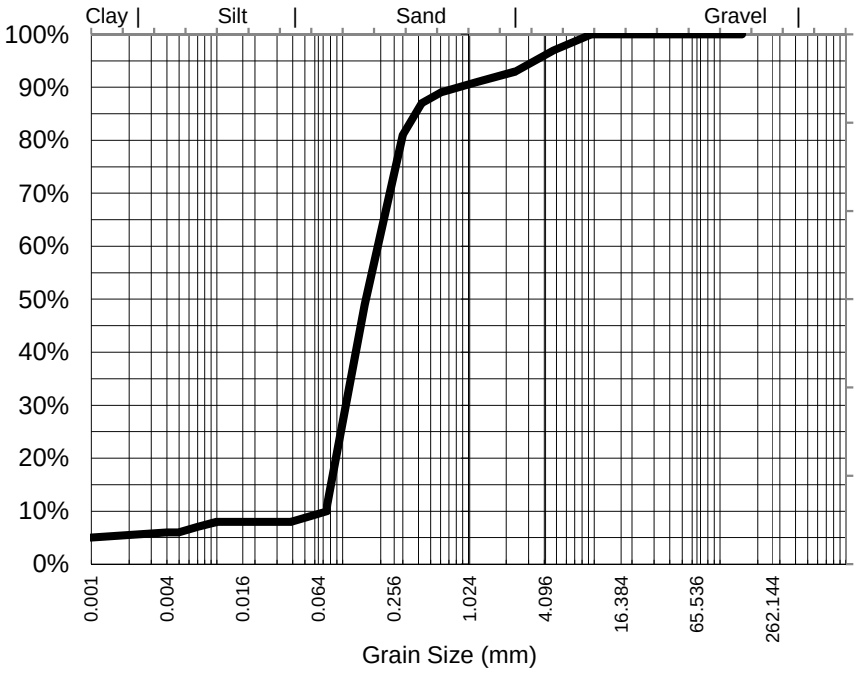
ADDRESS:

REPORT NO: EP1702676-047 / PSD

PROJECT: 17Wau-0008 Onslow Marine

SAMPLE ID: OC1-0.2-T2

Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	97%
2.36	93%
1.18	91%
0.600	89%
0.425	87%
0.300	81%
0.150	49%
0.075	11%
Particle Size (microns)	
75	10%
55	9%
39	8%
19	8%
10	8%
5	6%
1	5%

Median Particle Size (mm)*	0.155

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 28-Mar-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, SAND, STONE, SHELL

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Peter Keyte
Manager Newcastle
Authorised Signatory

Certificate of Analysis

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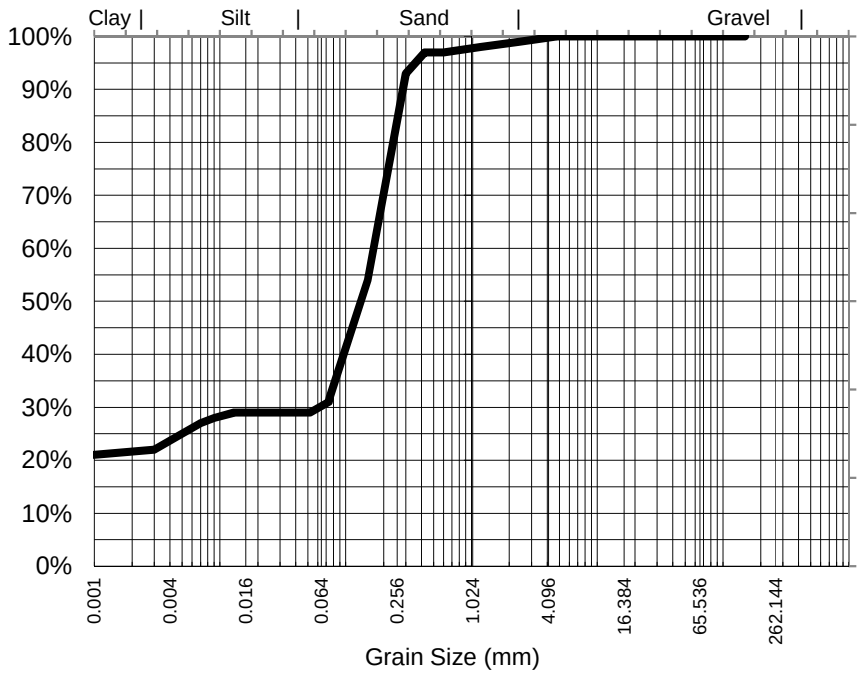
ALS Environmental

Newcastle, NSW

CLIENT:	Travis Hurley	**DATE REPORTED:**	20-Apr-2017
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:	SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370 DUNSBOROUGH, PERTH	**REPORT NO:**	EP1703525-002 / PSD
PROJECT:	Ex EP1702676 17-WAU-0008 Onslow Marine Support Base	**SAMPLE ID:**	TC1-T2-1

Particle Size Distribution



Particle Size (mm)	Percent Passing
4.75	100%
2.36	99%
1.18	98%
0.600	97%
0.425	97%
0.300	93%
0.150	54%
0.075	32%
Particle Size (microns)	
73	31%
52	29%
37	29%
18	29%
9	28%
5	25%
1	21%

Median Particle Size (mm)*	0.136

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 18-Apr-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, FINES

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) #N/A g/cm3

Dianne Blane
Laboratory Coordinator
Authorised Signatory

Certificate of Analysis

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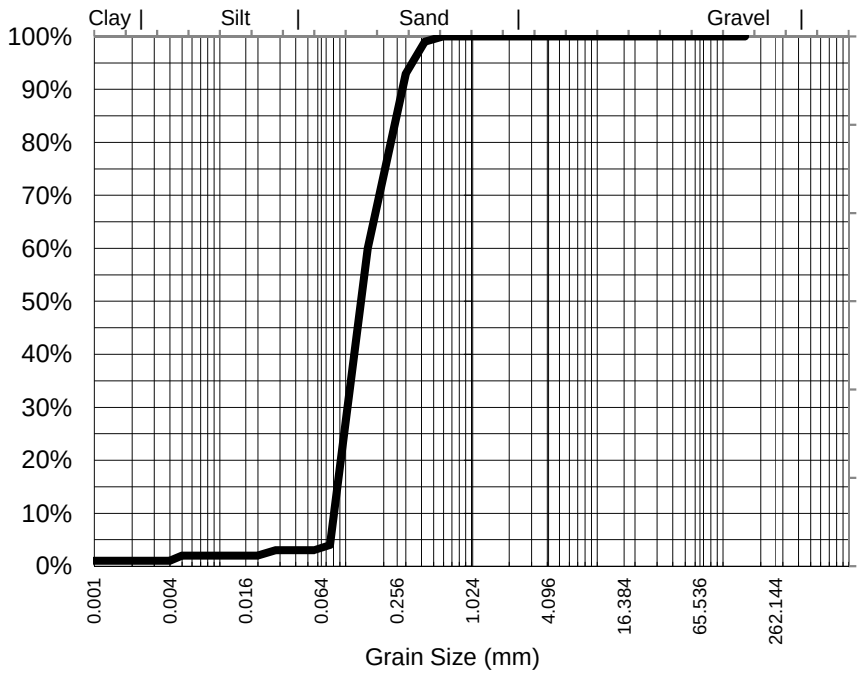
ALS Environmental

Newcastle, NSW

CLIENT:	Travis Hurley	**DATE REPORTED:**	20-Apr-2017
COMPANY:	WA MARINE PTY LTD	**DATE RECEIVED:**	22-Mar-2017
ADDRESS:	SUITE 5, 5/18 GRIFFON DRIVE PO BOX 1370 DUNSBOROUGH, PERTH	**REPORT NO:**	EP1703525-003 / PSD
PROJECT:	Ex EP1702676 17-WAU-0008 Onslow Marine Support Base	**SAMPLE ID:**	TC5

Particle Size Distribution



Particle Size (mm)	Percent Passing
0.600	100%
0.425	99%
0.300	93%
0.150	60%
0.075	4%
Particle Size (microns)	
75	4%
56	3%
40	3%
20	2%
10	2%
5	2%
1	1%

Median Particle Size (mm)*	0.137

Samples analysed as received.

** Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1—2006 was not requested by the client . Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	18-Apr-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:	SAND	**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) #N/A g/cm3

Dianne Blane
Laboratory Coordinator
Authorised Signatory