Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Detailed Site Investigation (Contamination)

Rehabilitation of Empire Bay Marina
16B Sorrento Road, Empire Bay

Prepared for
Department of Planning Industry & Environment
(Crown Lands)

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Executive Summary

Douglas Partners Pty Ltd (DP) has been engaged by the NSW Department of Planning Industry & Environment (Crown Lands) (DPIE) to complete this detailed site investigation (contamination) (DSI) for the rehabilitation of Empire Bay Marina site, located on the foreshore of Brisbane Water at 16B Sorrento Road, Empire Bay (the site).

It is understood that the recently vacated Empire Bay Marina site is to be rehabilitated, however, the final site use is yet to be determine by the DPIE. This DSI has been undertaken on the assumption that the site may potentially be returned to a public open space use consistent with the surrounding foreshore areas. On this basis, the objective of the DSI was to assess the suitability of the site for a potential public open space use and assess whether further investigation, remediation and/or management is required. It is understood that the report will be used to support a development application for the proposed rehabilitation of the site.

The site history information suggests that marina operations date back approximately 100 years. The most recent occupier has maintained tenancy and management of marina operations for approximately the last 40 years. During this time, marina operations appeared to include boat refuelling, servicing, repair, maintenance and storage. Records and anecdotal information suggest that the deterioration of marina facilities and inappropriate work practices had the potential to have resulted in contamination of the site. Records also identified the presence of underground petroleum storage system (UPSS) infrastructure likely to comprise two in-ground fuel storage tanks and connecting fuel/vent lines. Defouling (i.e. scraping and jet-washing) and recoating of boats with antifouling agents also presents a potential contamination source.

Based on the site history review and non-intrusive observations (i.e. walkover inspection, ground penetrating radar (GPR) survey and seabed under-water camera survey), intrusive contamination investigations were warranted to inform the conceptual site model (CSM) and assess the contamination status of the site. The intrusive investigations comprised a combined judgemental and systematic sampling strategy of soil, sediment and groundwater conditions, with assessment of soils at 14 locations, sediments at seven locations and groundwater at three locations.

It is considered that the site can be made suitable for a range of uses including a public open space use subject to implementation of the following recommendations:

- **Contaminated fill and near surface soils:** Site soils appear to be impacted as a result of past marina activities. More detailed investigations are recommended to further characterise / delineate the impacts identified including their potential to extend beyond the current site boundary and impact nearby surface water ecosystems and groundwater. Remediation and/or management actions are required based on the data collected. Following remediation / management of soils further consideration of the need for a quantitative human health or ecological risk assessment is required to evaluate any remnant contamination issues.
- **UPSS infrastructure:** Soils and groundwater in the locality of the existing/former UPSS infrastructure indicates that significant leakage from the UPSS is unlikely to have occurred. Notwithstanding, appropriate decommissioning and removal of the existing/former UPSS infrastructure is required together with any required soil and groundwater remediation.

- **Sediments:** Site sediments appear to be impacted as a result of past marina activities, however, nearby marine activities (i.e. other diffuse and point-sources) may also be impacting sediment contamination conditions. More detailed investigations would be required to further characterise / delineate the impacts identified including their potential to extend beyond the current site boundary. These more detailed investigations would aim to quantify actual risks (if any) to benthic organisms as a result of the contamination found to be present. Remediation and/or management actions are likely to be required based on the data collected.

If a use other than public open space is proposed (e.g. industrial/commercial or community purposes), then a review of the DSI and specifically the recommendations provided above is advised.

In addition to the recommendations provided above, investigations have also confirmed the presence of acid sulfate in soils and sediments at the site. On this basis, disturbance of site soils and sediments would need to be undertaken with reference to a site and development specific acid sulfate soil management plan (ASSMP).

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1. Introduction

Douglas Partners Pty Ltd (DP) has been engaged by the NSW Department of Planning Industry & Environment (Crown Lands) (DPIE) to complete this detailed site investigation (contamination) (DSI) for the rehabilitation of Empire Bay Marina site, located on the foreshore of Brisbane Water at 16B Sorrento Road, Empire Bay (the site). The site is shown on Drawing 1, Appendix A.

The objective of the DSI was to assess the suitability of the site for a range of potential uses, generally consistent with a generic public open space use; and assess whether further investigation, remediation and/or management is required. It is understood that the report will be used to support a development application for the proposed rehabilitation of the site.

This report must be read in conjunction with all appendices including the notes provided in Appendix B.

The following key guidelines were consulted in the preparation of this report:

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013); and
- NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020).

2. Proposed Development

It is understood that the recently vacated Empire Bay Marina site is to be rehabilitated, however, the final site use is yet to be determine by DPIE. This DSI has been undertaken on the assumption that the site may potentially be returned to a public open space use consistent with the surrounding foreshore areas.

3. Scope of Work

The scope of DSI work completed comprised:

- Collation and interpretation of readily available site data from the following sources:
  - Published public data, including topographical, geological and hydrogeological maps;
  - Registered groundwater bore licences;
  - Crown Lands supplied historical information;
  - NSW EPA Contaminated Land and Protection of Environment Operations databases;
  - Central Coast Council (CCC) property enquiry information;
  - Historical aerial photographs;
  - Historical and anecdotal information (where available) sourced from the previous tenant and local residents; and
  - SafeWork Hazardous Chemicals database;
- Site walkover to provide a visual assessment of potential contamination sources;
- Ground penetrating radar (GPR) survey of the suspected underground petroleum storage system (UPSS) area to identify the possible presence/absence of underground storage tanks (USTs) and remnant pipe infrastructure;
- Preliminary survey of the seabed in the locality of the shoreline and marina jetties using an underwater camera to visually record seabed conditions;
- Development of a preliminary Conceptual Site Model (CSM);
- Subsurface investigations comprising the assessment of soil, sediments and groundwater conditions at the site comprising:
  - Drilling of 14 onshore boreholes (i.e. Bores 1 to 6 and 14 to 21) to a maximum depth of 4.2 m to facilitate logging and sampling of subsurface materials;
  - Collection of overwater sediment samples at seven locations (i.e. Bore Logs / Locations 7 to 13) to facilitate logging and sampling of subsurface materials; and
  - Completion of three of the boreholes as groundwater monitoring wells (i.e. Wells 3, 4 and 6);
- Discrete soil and sediment samples collected at incremental depth intervals were screened for total photoionisable compounds (TOPIC);
- Discrete soil and sediment samples were screened for acid sulfate soil conditions, and then selected samples were submitted for Chromium Reducible Sulfur suite (S_{Cr}) testing to quantify the levels of acidity and sulfidity and confirm the need for management during site rehabilitation works;

- Analysis of soil and sediment samples to investigate identified potential contamination issues. Testing of these samples comprised:
  - Monocyclic aromatic hydrocarbons (benzene, toluene, ethylbenzene and xylene – BTEX);
  - Total recoverable hydrocarbons (TRH);
  - Polycyclic aromatic hydrocarbons (PAH);
  - Polychlorinated biphenyls (PCB);
  - Phenolics;
  - Organochlorine Pesticides (OCP);
  - Metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, Mn, Sb, Ba, Be, B, Co, Mo, Se, Sn);
  - Cyanide (CN);
  - Tributyltin (TBT); and
  - Asbestos (soil and material fragments).
- Monitoring of three groundwater monitoring wells (i.e. Wells 2, 4, and 6). The monitoring comprised:
  - Gauging groundwater levels (including light non-aqueous phase liquid (LNAPL);
  - Purging groundwater and measuring field parameters (pH, electrical conductivity (EC), dissolved oxygen (DO) and reduction oxidation potential (Redox)) prior to the collection of groundwater samples;
- Analysis of collected groundwater samples for the following principal contaminants of concern:
  - BTEX;
  - TRH;
  - PAH;
  - Phenols;
  - PCB; and
  - (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, Mn, Sb, Ba, Be, B, Co, Mo, Se, Sn);
  - CN; and
  - TBT.
- Revision of the Conceptual Site Model (CSM);
- Preparation of this report outlining the works undertaken and the findings of the DSI.

Specifics of the work completed are further detailed in the Sections 10 and 12 of the report.

4. Site Information

Site Address	16B Sorrento Road, Empire Bay
Legal Description	Part of Lot 7036 in DP 1058756, Part of Lot 486 in DP 727270 and Part of Brisbane Water (Cockle Channel)
Area	Total approximately 1,700 m^2. Onshore approximately 400 m^2. Overwater approximately 1,300 m^2.
Zoning	RE1 Public Recreation and W2 Recreational Waterways
Local Council Area	Central Coast Council
Existing Use (Prior to tenant vacating)	Empire Bay Marina. Storage and maintenance of boats. Including mechanical servicing, refuelling infrastructure, slipway facilities and general marine maintenance services/repairs (anti-fouling treatments).
Surrounding Uses	North-east – Brisbane Water (Cockle Channel) including unrelated boat moorings; South-east – Foreshore reserve (grassed reserve area); South-west – Foreshore reserve and then residential properties; North-west – Foreshore reserve and the access track between Sorrento Road and the Marina, then residential properties.
Site Coordinates	North corner: 347935mE 6292957mS East corner: 347964mE 6292927mS South corner: 347924mE 6292904mS West corner: 347917mE 6292916mS

Figure 1 is a plan of the local area and shows the site in relation to various local features.

Figure 1: Location of Site (image sourced from OpenStreetMap)

Figure 2, is an aerial view of the local area and shows the site in relation to the nearest street.

Figure 2 – Aerial view of site (sourced from metromap.com.au, dated 6 April 2020)

Drawing 1, which is included in Appendix A, shows the layout of the site on 6 April 2020.

5. Environmental Setting

5.1 Topography and Bathometry

Review of the local topographical mapping and project survey data indicates that surface levels in the on-shore areas of the site are generally relatively flat ranging between approximately 0.9 m and 1.1 m AHD. The near shore areas slope down to the north-east with sediment depths ranging up to 4 m below the water level towards the eastern boundary of the site (varying depending on tide levels) (i.e. measured to be approximately -3.4 m AHD).

5.2 Site Geology and Soil Landscape

Review of the local geology mapping indicates that the on-shore areas of the site are underlain by estuarine tidal-delta flat deposits described as fine to medium-grained lithic-carbonate-quartz sand (marine-deposited), silt, clay, shell material, polymictic gravel. The over-water areas of the site are mapped as being underlain by possibly a mix of estuarine tidal delta flat (subaqueous) and estuarine channel deposits (subaqueous). Both estuarine deposits are described as fine to medium-grained lithic-carbonate-quartz sand (marine-deposited), silt, clay, shell material and gravel.

Reference to the local soil landscape mapping indicates that the onshore areas of the site are underlain by Woy Woy beach landscape. The mapping indicates that site soils would generally comprise Holocene sediments of predominantly coarse to fine quartz sand with shell fragments and occasionally silt.

The subsurface conditions encountered during the DSI were generally consistent with the geological and soil landscape mapping.

5.3 Acid Sulfate Soils

The local acid sulfate risk mapping indicates that both the onshore and overwater areas are mapped as having a high probability of occurrence of acid sulfate soils. The mapping is considered to be consistent with the physical setting of the site.

On this basis, further consideration of the potential acid sulfate soil risks is warranted as part of the proposed decommission and rehabilitation of the site.

5.4 Surface Water and Groundwater

Surface water would generally be expected to runoff the sealed site surfaces and infiltrate into the unsealed surfaces in the locality of the site or drain into Brisbane Water. Brisbane Water is the closest water body to the site.

Figure 3 is a street map of the local area and shows the site in relation to the local registered groundwater bores.

Figure 3: Registered Groundwater Bores

(image sourced from OpenStreetMap with NSW Office of Water Registered Groundwater Bore location overlay)

A search of the publicly available registered groundwater bore database indicated that there are three registered groundwater bores within 500 m of the site as summarised in Table 1.

Table 1: Summary of Available Information from Nearby Registered Groundwater Bores

Bore ID Authorised Purpose Completion Year Status	Location Relative to Site	Final Depth (m)	Standing Water Level (m bgl)
GW201592 Domestic bore 2006, Current	130 m south-west	4	1.2
GW107255 Domestic bore 2006, Current	340 m north-west	2.5	-
GW202201 Domestic bore 2005, Current	481 m north-east (beyond Brisbane Water)	3.5	1.0

Given the site's topography and geology, it is considered likely that a permanent groundwater table is present at relatively shallow depth (i.e. less than 1 m depth) and it is anticipated that there may be a flow direction beneath the site toward Brisbane Water (i.e. north-east towards Cockle Channel). It should be noted that groundwater levels are potentially transient and can be affected by factors such as soil permeability, recent weather conditions and tidal conditions within Brisbane Water.

Given the proximity of the site to Brisbane Water and the local topography and geology, groundwater in the alluvial soils may comprise a mix of relatively fresh groundwater and potentially some highly saline conditions as a result of seawater intrusion. Accordingly, there would be no significant potential beneficial uses of the groundwater in the immediate locality of the site.

6. Site History

6.1 Crown Lands Historical Records

As part of an initial information package, Crown Lands provided a list of tenancy, development and incident records for the site. The tabulated records are provided in Appendix C. This information can assist in the identification of previous land uses and can, therefore, assist in establishing whether there were potentially contaminating activities occurring at the site. A brief summary of pertinent historical records is presented in Table 2.

Table 2: Summary of Historical Records

Date	Record Summary
11 December 1924	Permissive occupancy granted for boatshed.
1 May 1949	Permissive occupancy approved for commercial boatshed and ramp.
26 July 1963	Special lease agreement for boatshed, jetty, slip & landing places.
10 September 1971	Petroleum supplier agrees to install one underground fuel storage tank and bowser.
1 January 1978	Special lease and permissive occupancy - indicates that slipway and northern jetty have been moved and jetty extended.
12 April 2018	Underground Petroleum Storage System (UPSS) report by OPEC. Reports concluded both tanks and lines failed integrity testing.
23 July 2019	Crown Lands site inspection indicates underground fuel tank removed by operator.
2018 - 2020	Various compliance and safety issues recorded.
2020 to present	Site clean-up, make-safe works and secured.

6.2 Anecdotal Information

As part of the initial information package provided to DP, it was advised that the marina operations had fallen into disrepair and that appropriate work practices were not being maintained. The following anecdotal information was provided:

- Waste material, including batteries, may have been dumped in the waterway; and
- An in-ground fuel tank had been removed from the property without the required notification, approvals, and assessment.

6.3 Public Registers and Planning Records

EPA Notices available under Section 58 of the Contaminated Lands Management Act (CLM Act) Database searched 21 June 2021	There were no records of notices for the site or adjacent sites.
Sites notified to EPA under Section 60 of the CLM Act Database searched 21 June 2021	The site was listed as a notified contaminated site and management class is listed as under assessment.
Licences listed under Section 308 of the Protection of the Environment Operations Act 1997 (POEO Act) Database searched 21 June 2021	There were no records issued to the site or adjacent sites.
SafeWork NSW Searched Results 26 February 2021	Summary: – 1982, Single T5 (~5,000L) underground petrol tank licenced. – 1982, Location plan shows two underground tanks (one petrol and one diesel) on-site. Petrol bowser located on jetty. – 1986, Licence documents identify two underground tanks (one petrol and one diesel) on-site. – 1994, Licence documents identify two underground tanks (one leaded petrol and one diesel) on-site.
Council Records (for 16B Sorrento Road, Empire Bay) Searched Results 26 February 2021	Applications lodged: – 1984, Development Application - Marinas (>30 vessels). – 1987, Building Application - Fence. – 1988, Development Application – Acoustic Fence. – 1993, Development Application - Signs.

6.4 Historical Aerial Photographs

Historical aerial photographs were reviewed dating back to the earliest available record (1954) and approximately every 10 years thereafter to assess possible major changes to the site and surrounding areas during this period. Table 3 provides a summary of the observations made during the aerial photograph review.

Table 3: Aerial Photograph Review

Year	Site	Surrounding Land Use
1954	The site appears to comprise the boatshed building and a single jetty (relatively small). A large gum tree is visible in the photograph. Several boats appear to be moored along the shoreline. No other development activities are visible.	Nearby areas along the foreshore appear to be occupied by moored boats, possibly an enclosed swimming area (north-west), jetty (north-west) and a separate boatshed (south-east). Development along Sorrento Road appears to be typical of residential properties (noting the exception identified in Section 6.6).
1961	The site appears to comprise the boatshed building and a single jetty (extending further to the north than 1954). Other site features appear to be similar to the 1954 photograph.	No significant changes were observed, other than a general increase in the overall development in the local area.
1972	No significant changes were observed.	No significant changes were observed, other than a general increase in the overall development in the local area.
1980	The site appears to comprise the boatshed building and possibility an extension to the jetty structures (possibly two jetties visible).	Development in surrounding areas has continued, although the nearby boatshed (south) may have been removed.
1985	The site appears to have a layout similar to that observed during the site walkover, with the boathouse, two jetties and several boats located on the on-shore portion of the site.	No significant changes were observed, several boats appear to be moored along the shoreline and some boats moored nearby in Cockle Channel. The nearby suspected swimming enclosure is still visible.
1998	The photograph quality is poor. No significant changes were observed.	No significant changes were observed. The nearby swimming enclosure is no longer visible.
2006	The site appears to have a layout similar to that observed during the initial site walkover.	The number of near shoreline boat moorings has been reduced. The number of boats moored nearby in Cockle Channel has increased. Shoreline stabilisation works appear to have occurred (sandstone log retaining wall – field verified)
2019	The slipway appears to be in use and numerous boats stored on land and in the water around the site. It is noted that marina activities may extend beyond the current site boundary.	No significant changes were observed.

6.5 Interview with Former Tenant's Representative

As part of the initial site walkover (13 October 2020), a brief informal discussion was held with a representative of the former tenant. The following is a summary of the information provided:

- The family had operated the marina business for approximately 40 years;
- The marina operations had fallen into disrepair due to personal reasons;
- The operator was working towards cleaning up (i.e. removal of boats, equipment and debris) the site as part of the licence termination;
- Marina operations included mechanical and engineering services, shipwright services for repair, maintenance and refurbishment of vessels (including defouling and recoating of boats), and refuelling facilities;
- The marina operations had not used tributyltin antifouling paints on boats that were serviced, maintained or repaired at the site;
- No knowledge of inappropriate waste disposal of batteries and other items; and
- An in-ground fuel tank was removed from the property approximately two-years ago.

6.6 Previous Reports

As part of the initial information package, DP was supplied the following two reports:

- OPEC Systems (OPEC), UPSS Integrity Test Report*, Empire Bay Marina*, dated 12 April 2018 (OPEC, 2018); and
- IPRA Pty Ltd (IPRA), Building Condition Report, Empire Bay Marina, Ref DOC20/034626, dated 2 April 2020 (IPRA, 2020).

Review of DP archives also identified the following reports prepared for a neighbouring site:

- DP, Preliminary Contamination Assessment, Abandoned Refuelling Area, 12 Sorrento Road, Empire Bay, Ref.41212, dated November 2005 (DP, 2005); and
- DP, Report on Remediation and Validation, Abandoned Refuelling Area, 12 Sorrento Road, Empire Bay, Ref.41212B, dated January 2007 (DP, 2007).

An internet search identified the following document:

- Empire Bay Marina, Environmental Plan of Management, [no author, no date of issue].

The following subsections are summaries of the referenced reports.

6.6.1 OPEC (2018)

OPEC completed the equipment integrity tests on the UPSS in April 2018. The summary table concluded that the tanks and fuel lines associated with the storage and dispensing of unleaded petrol and diesel fuels had failed the integrity testing for a variety of reasons. It was concluded that the infrastructure was not suitable for further use without replacement and further compliance testing.

6.6.2 IPRA (2020)

The IPRA report concluded that the overall boatshed structure was in such a dilapidated state that a retain and repair option would not be economically viable. Testing of fibre cement sheeting from the internal areas of the boatshed building reported that samples collected did not contain asbestos. Samples of external paint reported elevated test results for lead in paint (Pb = 1.7% and 3.0% in paint). The external painted areas were assessed to be generally in poor condition (i.e. signs of peeling paint evident).

6.6.3 DP (2005)

DP completed a preliminary contamination assessment targeting an abandoned refuelling area at 12 Sorrento Road, Empire Bay in 2005. The site was estimated to be located approximately 50 m south-west of the Empire Bay Marina. The scope completed comprised the drilling of three boreholes and the installation of a single monitoring well. Low or non-detectable soil and groundwater contamination concentrations were encountered in the soil and groundwater, and the report concluded that the subject property had not been adversely affected by petroleum hydrocarbon contamination sourced from the abandoned refuelling area.

6.6.4 DP (2007)

DP completed a contamination validation assessment to verify that the remedial works undertaken with respect to an abandoned refuelling infrastructure located at 12 Sorrento Road, Empire Bay had been satisfactorily completed. Observations suggested that the UPSS infrastructure comprised a single tank connected to a single bowser (previously removed). Validation assessment included the sampling and testing of soils from the resultant excavation, excavated spoil and an additional groundwater sampling event. Based on the findings of the validation assessment and the assessment undertaken previously at the site (DP, 2005), DP considered that soils and groundwater conditions within the identified abandoned refuelling area had been appropriately validated for a residential land use.

On this basis, it is assessed that the nearby former UPSS, located at 12 Sorrento Road, would not pose a potential contamination source for the Empire Bay Marina site.

6.6.5 Environmental Plan of Management

An internet search identified that an Environmental Plan of Management (EPM) had been prepared for the marina operations. The following is a summary of pertinent information:

- Empire Bay Marina commenced operation in 1921 from the timber boatshed, and has been operated by the most recent tenant since 1983;
- Marina operations included:
  - Refuelling boats from two 5,000 L in-ground tanks (diesel and unleaded petrol);
  - Lifting equipment and slipway;
  - Defouling and recoating of antifouling;
  - Detailing and painting services;
  - Mechanical and engineering services;
  - Shipwright services for repair, maintenance and refurbishment of vessels.
- A summary of pertinent management practices included:
  - Oil or hydrocarbon thinners waste is stored in secured bonded store and disposed of by a licensed waste contractor;
  - Jet washing is generally carried out on the concrete wash-down bay area. All waste is drained firstly through a solids settlement pit before being removed from site; and
  - Soil waste is contained in bins with lids and checked/emptied regularly.

6.7 Site History Integrity Assessment

The information used to establish the history of the site was sourced from reputable and reliable reference documents, many of which were official records held by Government departments/agencies. The databases maintained by various Government agencies potentially can contain high quality information, but some of these do not contain any data at all.

In particular, aerial photographs provide high quality information that is generally independent of memory or documentation. They are only available at intervals of several years, so some gaps exist in the information from this source. The observed site features are open to different interpretations and can be affected by the time of day and/or year at which they were taken, as well as specific events, such as flooding. Care has been taken to consider different possible interpretations of aerial photographs and to consider them in conjunction with other lines of evidence.

6.8 Summary of Site History

The site history information suggests that marina operations date back approximately 100 years. The most recent occupier has maintained tenancy and management of marina operations for approximately the last 40 years. During this time, marina operations appeared to include boat refuelling, servicing, repair, maintenance and storage. Records and anecdotal information suggest that the deterioration of marina facilities and poor-work practices has the potential to have resulted in contamination of the site. Records also identified the presence of UPSS infrastructure likely to comprise two in-ground fuel storage tanks and connecting fuel/vent lines. Defouling (i.e. scraping and jet-washing) and recoating of boats with antifouling agents also presents a potential contamination source.

7. Site Walkover and Additional Survey Information

7.1 Initial Site Walkover (13 October 2020)

An initial site walkover was undertaken on 13 October 2020 by a Senior Environmental Engineer from DP. At the time of the walkover, site clean-up activities were in progress, and it was evident that marina operations had fallen into disrepair and that appropriate work practices were not being maintained. General site conditions identified during the initial site walkover are identified in Photos 1 to 4 (Appendix D).

Boats, materials/equipment and debris were still present at the site. Initial inspection identified that potentially two underground fuel storage tanks were present at the site and modifications (removal) to the concrete pavements indicated that an underground fuel tank may have been removed (supported by the operator's comments). Surface (oil) staining was observed in several areas but was concentrated in areas adjacent to the western wall of the boathouse, where an above ground oil storage tank was located. Inspection of near shore areas south of the boathouse identified anthropogenic inclusions (e.g. suspected asbestos-containing-material (ACM), metal, wood and glass) in the exposed surface soils.

7.2 Follow-up Site Walkover (11 March 2021)

A follow-up site walkover was undertaken on 11 March 2021 by a Senior Environmental Engineer from DP. At the time of the walkover, site clean-up activities had been completed, with all boats, materials/equipment and debris generally cleared from the site (one boat remained docked at the jetty). General site conditions identified during the follow-up walkover are identified in Photos 5 to 18 (Appendix D).

The follow-up inspection identified that potentially two underground fuel storage tanks were still present at the site (i.e. two tank dip points inspected). Surface (oil) staining was observed in several areas but was concentrated in areas adjacent to the western wall of the boathouse (two main areas identified).

Visual inspection indicated that an area of the concrete pavements had been sawcut and removed, which was consistent with the reported removal of an underground fuel tank and some of the connecting fuel/vent lines. Some of these areas had been covered with timber boards.

Inspection of the slipway area indicated that the ad-hoc drainage and wash-down collection/management system was likely to have been ineffective (i.e. a surface drain located below the high-tide line with no collection sump evident). The slipway concrete apron extended to the approximate low-tide water line.

Walkover identified paint covering some parts of the slipway concrete pavements. Site observations also identified that the near surface soils were likely to have been disturbed as a result of marina operations, with exposed surface soils observed to contain minor shells/barnacles and anthropogenic inclusions comprising concrete fragments, paint chips, timber, plastic, cloth and metal. The surface soil in the locality of the southern site boundary and the shoreline was observed to have additional inclusions of suspected asbestos-containing-material (ACM). Site observations suggested that these ACM fragments were likely to impact surface soils beyond the southern site boundary.

7.3 Ground Penetrating Radar Survey

A ground penetrating radar (GPR) survey of the suspected underground tank locations was completed as part of the service clearance for the proposed borehole locations. The results of the GPR survey appeared to confirm the presence of a single underground tank in the unsealed area immediately south-west of the existing concrete pavement (i.e. between Bores 4 and 6). The presence of a suspected second underground tank could not be confirmed beneath the concrete pavements. Subsequent coring of the concrete pavements identified the presence of two concrete pavements separated by a layer of fill and this is likely to have affected the performance of the GPR. It is noted that a GPR survey can be affected by interference from electrical currents and steel reinforcement.

7.4 Seabed Survey

A preliminary seabed survey was completed using an underwater camera. The raw footage was provided to DPIE as a separate information package. The footage appeared to confirm that the seabed in the locality of the marina was generally free of debris (including batteries). Materials identified at the seabed surface appeared to be limited to mainly fallen timber pylons, however, a fish trap, a plastic bucket and rope were also identified. Selected images of the camera footage are provided as Photos 19 to 26 (Appendix D).

8. Preliminary Conceptual Site Model

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM provides the framework for identifying how the site may have become contaminated and how potential receptors may be exposed to contamination either in the present or the future i.e. it enables an assessment of the potential source – pathway – receptor linkages (complete pathways).

Potential Contamination Sources and Contaminants of Concern

Table 4 summarises the potential sources of contamination and associated contaminants of concern that have been identified at the site.

Table 4: Potential Contamination Sources and Contaminants of Concern

Potential Contamination Source/Activity	Description of Potential Contaminating Activity	Primary Contaminants of Potential Concern (COPC)
Importation and/or placement of contaminated filling	Importation of substantial fill is unlikely based on the site history and walkover. Reworked site-won fill materials are suspected to be present at the site. Some fill materials may have been imported to reinstate the excavation following removal of fuel tank (circa 2018). Site observations also suggest historic ad-hoc shoreline stabilisation works are likely to have resulted in placement of contaminated fill materials (ACM identified).	Various - Common contaminants associated with filling are metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), TRH, BTEX, PAH, PCB, OCP and asbestos
Storage and use of dangerous goods	Spills/leaks of solvents, oils, fuels and other chemicals used/stored at site. Past usage and/or leakage/discharge of hazardous chemicals from the former infrastructure (i.e. UPSS, waste oil and solvents) represent a potential for contamination.	Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), TRH, BTEX, PAH, PCB and phenols.
Boat repair and maintenance activities	Site historical review identified that the marina performed boat repair and maintenance activities including mechanical repairs, defouling and recoating with antifouling paints/substances.	Various metals, TRH, BTEX, PAH, PCB, CN and organotin (TBT).
Dilapidated boatshed	The existing site buildings are identified to contain hazardous building materials (i.e. lead paint) in poor condition No asbestos identified by IPRA (2020).	Lead (in paint)
Nearby maritime related activities	Historical review has identified nearby areas were used to store boats (moored both adjacent to the shoreline and in Cockle Channel). Similar boat maintenance activities may have historically occurred along the foreshore area. Shoreline stabilisation works were also identified (excavation/filling behind retaining wall).	Various metals, TRH, BTEX, PAH, PCB, CN and organotin (TBT).

Notes:
As = arsenic, Cd = cadmium, Cr = chromium, Cu = copper, Pb = lead, Hg = mercury, Ni = nickel and Zn = zinc
TRH = total recoverable hydrocarbons, BTEX = benzene, toluene, ethylbenzene and xylene, VOC = volatile organic compounds, PAH = polycyclic aromatic hydrocarbons, PCB = polychlorinated biphenyls, OCP = organochlorine pesticides, TBT = tributyltin

For the purpose of developing a conceptual site model, the potential sources (S) of contamination are summarised as:

- S1 - Contaminated fill (imported fill and reworked site-sourced soils);
- S2 - Historical and contemporary site usage (leaks/spills of fuels, oils, and chemicals possibly used at the site and associated with the UPSS area, boat repair and maintenance activities and dilapidated boat shed); and
- S3 - Nearby maritime and foreshore stabilisation related activities.

Potential Receptors

The potential receptors of potential contamination sourced from the site are considered to be:

Human Health Receptors :-

- R1 - Future site users (recreational);
- R2 - Adjacent site users (residential and recreational); and
- R3 - Construction and maintenance workers;

Environmental Receptors :-

- R4 - Marine ecology (within Brisbane Water);
- R5 - Groundwater; and
- R6 - Terrestrial ecology.

Potential Contamination Migration Pathways

The pathways by which the potential sources of contamination could reach potential receptors are described below:

- P1 - Ingestion and dermal contact;
- P2 - Inhalation of dust and / or vapours;
- P3 - Surface run off;
- P4 - Leaching and vertical migration into groundwater;
- P5 - Lateral migration of groundwater providing base flow to water courses; and
- P6 - Direct contact with terrestrial/marine ecology / property.

Summary of Potentially Complete Exposure Pathways

A 'source–pathway–receptor' approach has been used to assess the potential risks of harm being caused to human or environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways (potential complete pathways). The possible pathways between the above sources (S1 to S3) and receptors (R1 to R6) are provided in below in Table 5.

Table 5: Summary of Potentially Complete Exposure Pathways

Source and COPC	Transport Pathway	Receptor	Risk Management Action
S1 - Contaminated fill. (Metals, TRH, BTEX, PAH, PCB, OCP and asbestos) S2 - Site usage. (Metals, TRH, BTEX, PAH, phenols, CN and TBT) S3 - Nearby maritime and foreshore stabilisation related activities. (Metals, TRH, BTEX, PAH, PCB, OCP phenols, CN and TBT and asbestos)	P1 – Ingestion and dermal contact	R1 – Site users R3 –Construction & maintenance workers R4 – Marine ecology R5 – Terrestrial ecology	An intrusive investigation is recommended to assess possible contamination including testing of the soils, sediments and groundwater. If site soil, sediment or groundwater is contaminated at unacceptable levels, mitigation / remediation measures will need to be implemented to manage the risk to the identified receptors.
	P2 – Inhalation of dust and / or vapours	R1 – Site users R2 – Adjacent site users R3 – Construction & maintenance workers	
	P3 – Surface run off P5 – Lateral migration of groundwater	R2 – Adjacent site users R4 – Marine ecology R5 – Terrestrial ecology	
	P4 - Leaching and vertical migration into groundwater	R4 – Marine ecology R5 – Groundwater	
	P6 – Direct contact with terrestrial/marine ecology / property	R4 – Marine ecology R5 – Groundwater	

9. Sampling and Analysis Quality Plan

9.1 Data Quality Objectives

The DSI was devised with reference to the seven-step data quality objective process which is provided in Appendix B Schedule B2, NEPC (2013). The DQO process is outlined in Appendix E.

9.2 Soil and Sediment Sampling Rationale

A combined judgemental and systematic sampling strategy to determine borehole locations was adopted. Locations were based on site history information and the CSM with the rationale provided below. Consideration was also given to NSW EPA C*ontaminated Sites , Sampling Design Guidelines* (NSW EPA, 1995) to determine borehole numbers and locations. Sampling locations were also adapted based on areas of access and were limited by the presence of in-ground obstructions.

Table A of NSW EPA (1995) recommends a minimum of five sampling points for a site of approximately 400 m^2 (onshore area) and a minimum of seven sampling points for a site of approximately 1,300 m^2 (overwater area) for site characterisation based on the detection of circular hot spots using a systemic grid sampling pattern. These minimum densities were met or exceeded, with a total of 21 test locations were positioned across accessible areas of the site.

Borehole / sediment sampling locations are shown on Drawing 1, in Appendix A.

Bores 1 and 2	General site coverage and in the vicinity of an informal slipway and boat maintenance areas (south side of boatshed).
Bores 3 and 15	In the vicinity of the waste oil storage areas. Visible surface staining observed (western side of boatshed).
Bores 4 and 6	General site coverage and in the vicinity of the UPSS infrastructure (i.e. tanks and fuel lines).
Bore 5	General site coverage and in the vicinity of the formal slipway and boat maintenance area (north side of boatshed).
Bores 7 to 13	Sediment sampling locations, general site coverage of overwater areas. Bore 7 targeted the boatshed historical hoist /internal mechanical servicing area. Bore 12 targeted the sediments in the formal slipway area.
Bore 14	Bore 14 targeted an informal slipway and soils/sediments impacted by suspected ACM fragments and was positioned below the approximate high-tide water line.
Bores 16 to 21	Exploratory boreholes completed to substantiate the location of the previously removed in-ground fuel storage tank.

Soil samples were generally collected from each borehole at depths of approximately 0.1 m, 0.5 m, 1.0 m and every 0.5 m thereafter, and changes in lithology or signs of contamination.

The general sampling methods are described in the field work methodology, included in Appendix F.

9.3 Groundwater Sampling Rationale

In order to assess the current groundwater contamination status at the site and evaluate whether historical, contemporary and off-site land uses have impacted on groundwater, sampling from three monitoring wells (i.e. Wells MW3, MW4 and MW6) was undertaken.

The locations were selected based on the following rationale:

- Wells MW3 and MW4 were positioned between the main potential groundwater contamination sources (i.e. UPSS and external service/maintenance areas) and the primary groundwater receptor (Brisbane Water). Well MW3 also targeted a suspected oil/chemical storage/spill area (oil staining identified at the ground surface). The results from Wells MW3 and MW4 will be used to evaluate whether the UPSS and storage/maintenance activities has impacted on groundwater quality and also provide data on the concentration of contaminants in groundwater exiting the site; and
- Well MW6 is positioned on the landward side (west and possibly hydraulically up-gradient) of the UPSS. The results from Well MW6 will be used to evaluate whether the UPSS has impacted on groundwater quality. The results at Well MW6 will also provide data on the concentration of contaminants in groundwater potentially entering the subject site.

The general sampling methods are described in the field work methodology, included in Appendix F.

10. Site Assessment Criteria

The site assessment criteria (SAC) applied in the current investigation are informed by the CSM (Section 8) which identified human and environmental receptors to potential contamination on the site. Analytical results are assessed (as a Tier 1 assessment) against the SAC comprising primarily the investigation and screening levels of Schedule B1 of NEPC (2013) and ANZG (2018).

The investigation and screening levels applied in the current investigation comprise levels adopted for a generic recreational land use scenario. The sediment SAC (sediment quality guideline values (SQGV)) are relevant to the over-water baseline sediment contamination investigation and have been adopted from ANZG (2018) and CSIRO (2016) Sediment Quality Assessment, A Practical Guide (2nd Ed) which draws from the SQGV in ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality and revisions to the guideline values as indicated by the footnotes to Table A.1 in CSIRO (2016) (reproduced, for reference in Appendix B).

The derivation of the SAC is included in Appendix G and the adopted SAC are listed on the summary analytical results tables in Appendix H.

11. Results

11.1 Field Work Results

The borehole logs for this assessment are included in Appendix I. The logs recorded the following general sub-surface profile:

Onshore Boreholes

Concrete Pavement:	In Bore 4 (MW4), two concrete pavements were encountered, comprising a surface pavement and then a second slab between 0.4 m and 0.55 m depth. The deeper slab may be part of a fuel tank anchoring system (i.e. concrete placed over the top of the tank to resist buoyance forces). Bore 4 was repositioned three times to avoid the second concrete slab and was finally positioned in a previously sawcut trench that was abandoned and not reinstated by the tenant. Bore 15 also refused on the deeper concrete slab at a depth of 0.25 m bgl.
Timber Sleeper:	In Bore 3 (MW3), timber sleepers provided a bridge between the concrete pavement areas and the suspended boathouse structure.
Fill:	Generally comprising brown and/or grey sand and silty sand in Bores 1 to 6 and 14 to 21, to depths of between 0.1 m and possibly 1.5 m bgl. Fill materials extending to depths beyond approximately 0.8 m bgl were likely to be associated with a reinstated in-ground tank excavation (i.e. Bores 19 to 21). Bore logs indicated that a suspected concrete obstruction was encountered in Bores 19 and 20 at a depth of 1.2 m and 0.9 m bgl, respectively. Trace quantities or singular anthropogenic inclusions comprising brick, concrete, rubber, timber, plastic, nylon rope, metal, glass and tile fragments were identified in the fill materials.
Sand (Alluvium):	Generally comprising brown and/or grey sand and silty sand to the termination depth of the bores (typically terminated between depths of 1.5 m and 4.2 m bgl).

Overwater Boreholes (Sediment Samples)

Brisbane Water:	The depth of water ranged between 0.3 m at Bore 12 to 3.6 m in Bore 10. The depth of water will vary based on prevailing tidal conditions.
Sand (Subaqueous Alluvium):	Generally comprising brown and/or grey sand and silty sand sediments with trace organics and shells.

Suspected petroleum hydrocarbon odours were noted at the following locations:

- Bore 1, suspected slight petroleum hydrocarbon odour was noted at 0.9 m bgl, with a PID results of <1 ppm;
- Bore 2, petroleum hydrocarbon odour was noted at 1.0 m bgl, with a PID results of <1 ppm;
- Bore 3, oil staining was observed in the fill at 0.4 m bgl, with a PID results of <1 ppm;

- Bore 4, petroleum hydrocarbon odour was noted below 0.8 m bgl, with a maximum PID result of 50 ppm; and
- Bore 15, oil staining and a slight petroleum hydrocarbon odour was noted in the fill at 0.25 m bgl, with a PID results of <1 ppm.

In additional to the trace quantities or singular inclusions of anthropogenic inclusions identified in the fill materials (as identified above), suspected ACM fragments were observed at the ground surface and also embedded in the near surface fill at Bore 14. The ACM fragments observed were assessed to be in a sound condition (non-friable condition). Furthermore, adjacent (south-east side) to Bore 4 an in-ground steel object was encountered (possible tank).

There were no other apparent records of visual or olfactory evidence (eg: staining, odours, free phase product) to suggest the presence of contamination within the soils or groundwater observed in the investigation. The PID screening results in all bores (other than Bore 4) recorded values of less than 1 ppm and this suggests the absence of gross volatile contamination at these locations.

Free groundwater was observed whilst drilling most of the on-shore bores at depths of ranging between 0.75 m and 0.85 m bgl. It should be noted that groundwater levels are affected by climatic conditions, soil permeability and potentially tidal conditions, and will therefore vary with time.

Groundwater levels were gauged on 24 March 2021 and 14 April 2021 using an electronic oil/water interface meter prior to prior to sampling. The measured water levels prior to sampling are shown in Table 6.

Table 6: Summary of Groundwater Level Measurements on 24 March 2021 and 14 April 2021

Well ID	Location of Monitoring Well	Ground Level * m (AHD)	SWL m (bgl)	SWL m (AHD)
MW3	down-gradient	1.02	0.59 / 0.57	0.43 / 0.45
MW4	down-gradient	1.09	0.70 / 0.64	0.39 / 0.45
MW6	up-gradient	1.21	0.61 / 0.76	0.60 / 0.45

Notes:
*Surveyed by dGPS
AHD – Australian Height Datum
SWL – standing water level
bgl – below ground level
^Down-gradient of UPSS

Based on the groundwater level measurements, the interpolated groundwater equipotential contours are relatively slight (or flat). The 24 March 2021 monitoring results indicate that groundwater is likely to be flowing to the north-east towards Brisbane Water, however, the 14 April 2021 indicates that groundwater in all wells have an equal piezometric surface (no inferred groundwater gradient). It should be noted that the 24 March 2021 monitoring event followed a significant rainfall event in the days preceding the monitoring, and the 14 April 2021 monitoring event was completed following a drier period when tide was observed to be relatively high.

Stabilised physical parameters were measured whilst sampling (where possible) and are summarised in Table 7.

Table 7: Summary of Field Parameters (Groundwater)

Well ID (date)	Temp. (°C)	DO (ppm)	EC (µS/cm)	pH	Redox (mV)
MW3 (24 March 21)	24.2	2.36	1826	6.2	138
MW4 (24 March 21)	24.2	3.21	1379	6.7	56
MW6 (24 March 21)	22.9	2.24	92.1	4.8	262
MW3 (14 April 21)	21.1	4.81	36,000	7.6	74
MW4 (14 April 21)	22.5	0.54	5,680	6.4	71
MW6 (14 April 21)	21.8	0.40	131	4.8	187

Notes:
DO – Dissolved Oxygen
EC – Electrical Conductivity

The dissolved oxygen levels indicated a mix of aerobic, anoxic and anaerobic conditions. The pH was generally slightly to moderately acidic. The electrical conductivity values are generally typical of fresh to slightly saline water. Redox potential (Eh) indicates generally oxidising conditions. The exception to the above statements would be the high salinity, neutral pH and relatively high dissolved oxygen measured in Well MW3 on 14 April 2021. These results are considered to be consistent with seawater intrusion or mixing. It should be noted that Well MW4 on 14 April 2021 also indicated a higher electrical conductivity result that may also indicate that some seawater intrusion or mixing was also occurring at this location (to a lesser extent than MW3).

No light non-aqueous phase liquid LNAPL (i.e. floating product or slick) was observed whilst sampling.

It was advised by the client that the suspected in-ground tanks were pumped-out by a liquid waste contractor prior to the commencement of intrusive investigation activities (circa early March 2021). The accessible tank dip points were gauged using an electronic oil/water interface meter on 14 April 2021. Measurements indicated that approximately 0.8 m and 0.46 m of water had accumulated in the tanks at the time of monitoring. This supports the conclusions in the OPEC (2018) report that the tanks had failed the integrity testing. No light non-aqueous phase liquid LNAPL (i.e. floating product or slick) was gauged by the interface meter.

11.2 Laboratory Analytical Results

The results of laboratory analysis are summarised in the following tables in Appendix H:

- Table H1: Summary of Results of Soil Contamination Analysis;
- Table H2: Summary of Results of Sediment Contamination Analysis;
- Table H3: Summary of Results of Groundwater Contamination Analysis; and
- Table H4: Summary of Results of Acid Sulfate Soil Analysis.

The laboratory certificates of analysis together with the chain of custody and sample receipt information are also provided in Appendix J.

12. Discussion

12.1 Soil Contamination

The following Table 8 provides a summary of the number of samples which exceeded the SAC. The remainder of analytes not listed in the Table 8 were all below the SAC.

Table 8: Summary of Soil Results that Exceeded the Site Assessment Criteria

Analyte	SAC	No. Primary Samples	No. Test Locations	No. Exceedances	No. Exceedances >2.5 x SAC
Copper	HIL-C	16	9	1	0
Copper	EIL	16	9	11	8
Lead	HIL-C	16	9	2	0
Nickel	EIL	16	9	2	0
Zinc	EIL	16	9	5	3
TRH >C_{10}-C_{16}	ESL	15	9	3	0
F3 (>C_{16}-C_{34})	ESL	15	9	6	5
F3 (>C_{16}-C_{34})	ML	15	9	2	2
F4 (>C_{34}-C_{40})	ESL	15	9	2	0
Asbestos	HSL	10	8	1 (ACM)	NA

In addition to the above exceedances, near surface soils also reported detectable concentrations of TBT. There are currently no NSW EPA endorsed health-based or ecological-based investigations levels for TBT in terrestrial soils, however, concentrations reported in near surface soils at Bore 1 (450 µg/kg), Bore 2 (960 µg/kg), Bore 3 (5,400 µg/kg) and Bore 5 (10,000 µg/kg) exceeded the sediment quality guideline values (SQGV – high) of 70 µg/kg. These detectable TBT concentrations in near surface soils are likely to be associated with boat repair and maintenance activities (specifically defouling and/or recoating of antifouling paints).

The following discussion of the soil contamination results is provided:

- Several onshore soil samples reported a combination of metals (i.e. Cu, Pb, Ni and Zn), TRH and TBT concentrations that exceeded the SAC, or adopted comparative levels. These laboratory results combined with the results of the walkover and intrusive investigations suggest that soil impacts are likely to be associated with past marina activities (i.e. inappropriate work practices, boat maintenance, spills/leaks of fuels/oils, etc). The impacted soils generally appear to be limited to near surface soils / shallow fill materials, however, may extended to deeper depth in areas of historical disturbance (e.g. backfill materials placed around existing tanks or in reinstated tank excavations). The degree and extent of contamination concentrations encountered in the near surface soils are likely to pose an unacceptable risk to human health and terrestrial ecology for the potential uses including public open space.

- The ACM fragments identified at the ground surface and also embedded in the near surface soils at Bore 14 exceeded the SAC (HSL). Asbestos in the form of fibrous asbestos / asbestos fines (FA/AF) was not observed at any of the test locations or detected in any of the samples tested for asbestos. The results of the walkover and intrusive investigations suggest the ACM may have been used as part of historical ad-hoc foreshore bank stabilisation works, however, may also have also been incorporated into fill materials placed in this area. Walkover observations also suggest that similar fill materials may have been placed in areas beyond the current site boundary (towards the south-east). The presence of ACM fragments at the ground surface poses an unacceptable risk to human health for the potential public open space use.
- Low or non-detectable TRH, BTEX and PAH concentrations were reported in the soil samples targeting the UPSS infrastructure (i.e. Bores 4, 6 and 21, with a maximum TRH F3 concentration of 330 mg/kg at Bore 21 (0.9m depth)). This may indicate that the site has not been significantly impacted by widespread petroleum hydrocarbon contamination sourced from the abandoned refuelling area. These results would need to be assessed in association with the groundwater results and would not preclude the possibility of localised impacts in the vicinity of the UPSS infrastructure.

12.2 Sediment Contamination

Evaluation of sediment contamination should be undertaken as a staged process. Exceedance of the SQGV and SQGV-high does not necessarily mean the contaminants pose a risk to benthic organisms and according to CSIRO (2016) additional stages of investigation could be considered if concentrations exceed the SQGV-high to more accurately quantify risks. Additional stages of investigation are beyond the current scope of work as the objective of investigation was to provide a snapshot of the current concentrations of key contaminants in the sediments located at the site.

The following Table 9 provides a summary of the number of samples which exceeded the SQGVs. The remainder of analytes not listed in the Table 9 were all below the SQGVs.

Table 9: Summary of Sediment Results that Exceeded the Site Assessment Criteria

Analyte	SAC	No. Primary Samples	No. Test Locations	No. Exceedances	No. Exceedances SQGV-High
Copper	SQGV	7	7	4	2
Lead	SQGV	7	7	2	1
Mercury (inorganic)	SQGV	7	7	3	2
Zinc	SQGV	7	7	1	1
TBT	SQGV	7	7	5	3

Comparison of concentrations in samples to the adopted SQGV and SQGV-high have not been on the <2 mm fraction and this should be considered in the interpretation of results. Qualitative assessment indicates that a higher portion of <2 mm fraction sediments was observed in the nearshore samples, whereas samples collected further from the shoreline and boathouse typically comprised a lower component of silt and fine material. The TBT criterion in addition to other organic contaminants is generally normalised to 1% organic carbon (OC) within the limits of 0.2% to 10%. Sediment samples reported OC results ranging between 0.77% and 1.3%, with an average OC result of 1.07%. On this basis, normalisation of the TBT and other organic contaminants was not considered necessary.

The following discussion of the sediment contamination results is provided:

- Five of the seven sediment samples collected reported a combination of metals (i.e. Cu, Pb, Hg and/or Zn), TRH and TBT concentrations that exceeded the SQGV. Three of the samples also reported concentrations that exceeded the SQGV-high. The highest concentrations were reported in Bore 12 (i.e. sediment sample targeting the slipway area), with concentrations generally decreasing away from the operational areas of the marina (i.e. away from the slipway and boathouse). The lowest concentrations were reported in the Bores 10 and 11, that were positioned furthest away from the operational and nearshore areas.
- These laboratory results combined with the results of the onshore walkover and intrusive investigation results suggest the sediment impacts are likely to be as a result of the past marina activities (i.e. inappropriate work practices during boat maintenance/repairs). The magnitude and combination of contamination concentrations encountered in the sediments are likely to pose an unacceptable risk to marine ecology and would trigger the need for further investigations.

12.3 Groundwater

All results were below the SAC, with the exception of:

- Copper ranging between 11 µg/L and 200 µg/L at Wells MW3, MW4 and MW6 which exceeded the ANZG (2018) marine water guideline (MWG) for the protection of slightly to moderately disturbed marine water aquatic ecosystems of 1.3 µg/L. The copper concentrations exceeded the ANZG (2018) MWG during both the March and April monitoring events;
- Lead ranging between 6 µg/L and 43 µg/L at Wells MW3 and MW4 which exceeded the ANZG (2018) MWG for the protection of slightly to moderately disturbed marine water aquatic ecosystems of 4.3 µg/L. The lead concentrations exceeded the ANZG (2018) MWG at Wells MW3 and MW4 during both the March and April monitoring events;
- Mercury ranging between 0.14 µg/L and 0.16 µg/L at Wells MW3, MW4 and MW6, during the March monitoring event only, which exceeded the ANZG (2018) MWG for the protection of slightly to moderately disturbed marine water aquatic ecosystems of 0.1 µg/L. The mercury concentrations were below the SAC during the April monitoring event;
- Zinc ranging between 50 µg/L and 430 µg/L at Wells MW3, MW4 and MW6 which exceeded the ANZG (2018) MWG for the protection of slightly to moderately disturbed marine water aquatic ecosystems of 15 µg/L. The zinc concentrations exceeded the ANZG (2018) MWG during both the March and April 2021 monitoring events; and
- TBT of 0.56 µg/L at Well MW3 (April 2021) which exceeded the ANZG (2018) MWG for the protection of slightly to moderately disturbed marine water aquatic ecosystems of 0.006 µg/L.

The concentrations of metals in groundwater are likely to have been influenced by weather conditions prior to each sampling event and also the tidal conditions at the time of sampling (i.e. inference of seawater intrusion/mixing in MW3 and MW4 in April 2021).

Notwithstanding, based on our experience in the area, the concentration of some metals in groundwater may also in-part be attributed to the background concentrations that would be associated with the mineralogy of the soils in the local area and local urban runoff. Nevertheless, these groundwater concentrations are likely to pose an unacceptable risk to local marine ecology in Brisbane Water.

Low or non-detectable TRH, BTEX and PAH concentrations were reported in the groundwater samples and appear to be consistent with the soil contamination results from Bores 4, 6 and 21. These indicate that the site has not been significantly impacted by widespread petroleum hydrocarbon contamination sourced from the abandoned refuelling area but would not, however, preclude the possibility of localised impacts in the vicinity of the UPSS infrastructure.

12.4 Acid Sulfate Soils

Indicators of ASS from field screening comprise one, or preferably more of the following:

- Field pH / pH in distilled H_2O (pH_F) is less than or equal to 4 pH units. The pH_F (non-oxidised) is a measure of existing acidity;
- pH following addition of H_2O_2 (pH_{Fox}) is less than 3.5 pH units. The pH_{Fox} (oxidised pH) is a measure of potential acidity;
- A decrease of more than 1 pH unit from the pH_F to the pH_{Fox};
- Effervescence including bubbling, production of heat or release of sulfur odours during pH_{Fox} testing; and
- Change in colour from grey to brown tones during oxidation.

It should be noted the field screening is indicative only and can give false positive (and false negative) indications of the presence of ASS. False positives can be caused by organic matter, which often “froths” during oxidation.

The action criteria which define the requirement for management of acid sulfate soils can vary depending on the amount of soil disturbed and the textural classification of the soil. The criteria for the sandy soils were adopted as the applicable action criteria for the site, and are shown on Table H4, Appendix H.

Thirty-four samples (30 soil and four sediment samples) were screened for ASS using a calibrated pH meter to measure pH in water (H_2O) and hydrogen peroxide (H_2O_2). The initial screening indicated that all samples had one or more result exceeding the respective screening guideline values (i.e. $pH_F < 4$, $pH_{Fox} < 3.5$ or a difference of pH_F and $pH_{Fox} > 1$) indicating the presence of ASS. It was noted that the near surface soils reported the presence of froth which indicates the presence of organic matter and may suggest a false positive screening result. Based on the subsurface conditions encountered and the initial screening, four soil samples and two sediment samples from different depths ranges were selected for further S_{Cr} suite testing.

The laboratory results of the S_{Cr} testing with reference to Sullivan et al (2018) indicated the following:

- A sample from Bore 1 at 0.3 m depth (logged as pale grey sand with trace organics, above the groundwater table) reported non-detectable levels of sulfidity (i.e. S_{Cr}, S_{KCL} and S_{NAS}) and acidity (i.e. TAA); and
- Three samples from Bores 1 and 4 (below 1.0 m depth) and two sediment samples (Bores 8 and 9) reported detectable levels of sulfidity (i.e. S_{Cr}, S_{KCL} and S_{NAS}) and acidity (i.e. TAA) that exceeded the adopted action criteria.

The following Table 10 summarises the ASS management requirements for the different soil / sediment strata encountered, based on the laboratory testing.

Table 10: Summary of ASS Management Requirements

Material Description	Boreholes Encountered	ASS Management
FILL / Silty SAND / SAND: Brown and/or grey sand and silty sand with trace rootlets/organics/anthropogenic inclusions to depths of up to approximately 0.5 m.	Bores 1 to 6 and 15 to 21	Do not require management
ALLUVIAL / Silty SAND / SAND: Brown and/or grey sand and silty sand with trace rootlets to depths of up to approximately 0.5 m.	Bores 1 to 6 and 15 to 21	Do not require management
ALLUVIAL / Silty SAND / SAND: Brown and/or grey sand and silty sand below depths of approximately 0.5 m.	Bores 1 to 6 and 15 to 21	Management required Works to be carried out with reference to an ASSMP if soils are to be disturbed
SEDIMENTS / Silty SAND / SAND: Brown and/or grey sand and silty sand (all Brisbane Water sediments)	Bores 7 to 13	Management required Works to be carried out with reference to an ASSMP if soils are to be disturbed

Notes: ASSMP = Acid Sulfate Soil Management Plan
Foreshore transition areas (i.e. area between the high and low tide waterlines) would require specific assessment if these areas are proposed to be disturbed and no to be managed for ASS conditions.

12.5 Data Quality Assurance and Quality Control

The data quality assurance and quality control (QA/QC) results are included in Appendix L. Based on the results of the field QA and field and laboratory QC, and evaluation against the data quality indicators (DQI) it is concluded that the field and laboratory test data obtained are reliable and useable for this assessment.

13. Revised Conceptual Site Model

The data collected for this DSI has generally confirmed that certain potential contaminant sources outlined in the CSM outlined in Section 8 pose a potentially complete pathway to the identified receptor(s) whilst others do not. No other sources of contamination have been identified as a result of the testing results. This is summarised in Table 11.

Table 11: Updated Summary of Potentially Complete Exposure Pathways (Potential Land Use)

Source	Transport Pathway	Receptor	Remediation Action Required
S1 - Contaminated fill and near surface soils impacted from past marina activities. Bores 1,2 3, 4, 5, 6, 14, 15 and 21 impacted with Cu, Pb, Ni, Zn, TRH (C_{10}-C_{40}), ACM and/or TBT	P1 – Ingestion and dermal contact P2 – Inhalation of dust and / or vapours P3 – Surface run off P4 - Leaching and vertical migration into groundwater P5 – Lateral migration of groundwater P6 – Direct contact with terrestrial ecology / property	R1 – Site users R2 – Adjacent site users R3 –Construction & maintenance workers R4 – Marine ecology R5 – Terrestrial ecology	Data Gap - Further investigation would be required to further characterise / delineate the impacts identified including their potential to extend beyond the current site boundary and impact groundwater contamination conditions. Remediation and/or management actions are required based on the data collected. Following remediation / management of soils further consideration of the need for a quantitative human health or ecological risk assessment is required to evaluate any remnant contamination issues.
S2 - UPSS infrastructure	P2 – Inhalation of vapours P5 – Lateral migration of groundwater	R1 – Site users R3 –Construction & maintenance workers R4 – Marine ecology R5 – Terrestrial ecology	Testing of soil and groundwater in the locality to the existing/former UPSS infrastructure indicates that significant leakage from the UPSS is unlikely to have occurred. Notwithstanding, appropriate decommissioning and remediation of the existing/former UPSS infrastructure is required.
S3 – Sediments impacted from past marina activities. Bores 7, 8, 9, 12 and 13 impacted with Cu, Pb, Hg, Zn, TRH (C_{10}-C_{40}) and/or TBT	P6 – Direct contact with marine ecology	R4 – Marine ecology	Data Gap – More detailed investigations would be required to further characterise / delineate the impacts identified including their potential to extend beyond the current site boundary and potentially be in-part sourced from other diffuse and point-source inputs. Remediation and/or management actions are likely to be required based on data collected. Following remediation / management of soils further consideration of the need for a quantitative ecological risk assessment is required to evaluate any remnant contamination issues.

14. Conclusions and Recommendations

DP has undertaken this DSI for the rehabilitation of Empire Bay Marina site, located on the foreshore of Brisbane Water at 16B Sorrento Road, Empire Bay. It is understood that DPIE have not finalised future development plans at this stage, however, options being considered include the return of the site to public open space consistent with the surrounding foreshore areas. Remediation to a public open space standard may also allow other uses including industrial/commercial and some community purposes, however, these uses would require specific consideration prior to the commencement of the rehabilitation works.

A site historical review suggests that marina operations date back approximately 100 years, with the most recent occupier maintaining tenancy and management of marina operations for approximately the last 40 years. During this time, marina operations appeared to include boat refuelling, servicing, repair, maintenance and storage. Records and anecdotal information suggest that the deterioration of marina facilities and poor-work practices had the potential to result in contamination of the site. Records also identified that the presence of UPSS infrastructure that have not been appropriately decommissioned or remediated. Other nearby maritime related activities (i.e. storage/maintenance of boats and foreshore stabilisation works) also have the potential to have resulted in contamination of the site and nearby areas.

Based on the site history review and non-intrusive observations (i.e. walkover inspection, GPR survey and seabed under-water camera survey), intrusive contamination investigations were warranted to inform the CSM and assess the contamination status of the site. The intrusive investigations comprised a combined judgemental and systematic sampling strategy of soil, sediment and groundwater conditions, with assessment of soils at 14 locations, sediments at seven locations and groundwater at three locations.

The results of the DSI indicates that soil, sediment and groundwater contamination is present at the site and that further characterisation / delineation investigations are recommended to address the identified contamination data gaps. It is considered that the site can be made suitable for uses including public open space, subject to implementation of the following recommendations:

- **Contaminated fill and near surface soils:** Site soils appear to be impacted as a result of past marina activities. More detailed investigations are recommended to further characterise / delineate the impacts identified including their potential to extend beyond the current site boundary and impact nearby surface water ecosystems and groundwater. Remediation and/or management actions are required based on the data collected. Following remediation / management of soils further consideration of the need for a quantitative human health or ecological risk assessment is required to evaluate any remnant contamination issues.
- **UPSS infrastructure:** Soils and groundwater in the locality of the existing/former UPSS infrastructure indicates that significant leakage from the UPSS is unlikely to have occurred. Notwithstanding, appropriate decommissioning and removal of the existing/former UPSS infrastructure is required together with any required soil and groundwater remediation.

- **Sediments:** Site sediments appear to be impacted as a result of past marina activities, however, nearby marine activities (i.e. other diffuse and point-sources) may also be impacting sediment contamination conditions. More detailed investigations would be required to further characterise / delineate the impacts identified including their potential to extend beyond the current site boundary. These more detailed investigations would aim to quantify actual risks (if any) to benthic organisms as a result of the contamination found to be present. Remediation and/or management actions are likely to be required based on the data collected.

In addition to the recommendations provided above, investigations have also confirmed the presence of acid sulfate in soils and sediments at the site. On this basis, disturbance of site soils and sediments would need to be undertaken with reference to a site and development specific acid sulfate soil management plan (ASSMP).

It is also advised that the recommended remediation actions are likely to further impact on the stability of the dilapidated boatshed structure. In this regard, it is recommended that advice is sought from a structural engineer at the preliminary planning stage of rehabilitation works.

In summary, based on the results of the DSI it is considered that the site can be made suitable (from a site contamination perspective) for the potential public open space use subject to implementation of the recommendations above. If a use other than public open space is proposed (e.g. industrial/commercial or community purposes), then a review of the DSI and specifically the recommendations provided above is advised.

15. References

Ahern, C.R., Ahern, M.R. and Powell, B. (1998). *Guideline for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.* Indooroopilly, Queensland, Australia : Queensland Department of natural Resources, Resources Sciences Centre.

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DP. (2005). *Preliminary Contamination Assessment, Abandoned Refuelling Area, 12 Sorrento Road, Empire Bay.* DP Ref. 41212.

DP. (2007). *Report on Remediation and Validation, Abandoned Refuelling Area, 12 Sorrento Road, Empire Bay.* DP Ref. 41212B.

IPRA. (2020). *Building Condition Report, Empire Bay Marina.*

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM].* Australian Government Publishing Services Canberra: National Environment Protection Council.

NHMRC. (2008). *Guidelines for Managing Risks In Recreational Water.*

NSW EPA. (1995). *Contaminated Sites, Sampling Design Guidelines.* NSW Environment Protection Authority.

NSW EPA. (2015). *Guidelines on the Duty to Report Contamination under the Contaminated Land Act 1997.* NSW Environment Protection Authority.

NSW EPA. (2020). *Guidelines for Consultants Reporting on Contaminated Land.* Contaminated Land Guidelines: NSW Environment Protection Authority.

NSW EPA. (2020). *Underground Petroleum Storage Systems - Guidelines for implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019.* Doc Ref: EPA 2020P2700: NSW Environment Protection Authority.

OPEC. (2018). *UPSS Integrity Test Report, Empire Bay Marina.*

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Sullivan, L., Ward, N., Toppler, N., & Lancaster, G. (2018). *National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Sampling and Identification Methods Manual.* Canberra ACT CC BY 4.0: Department of Agriculture and Water Resources.

16. Limitations

Douglas Partners (DP) has prepared this report (or services) for this project at 16B Sorrento Road, Empire Bay with reference to DP's proposal CCT200357 dated 18 February 2021 and acceptance received from Mark Grace of the NSW Department of Planning, Industry and Environment (Crown Lands) dated March 2021. The work was carried out under DPIE Services Contract (Ref. Contamination Investigation – Empire Bay Marina). This report is provided for the exclusive use of DPIE (Crown Lands) for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Asbestos has been detected by observation and by laboratory analysis, on the surface of the site, and in fill materials at the test locations sampled and analysed. Building demolition materials, such as concrete, brick, metal, plastic and wood were identified in below-ground fill and these are considered as indicative of the possible presence of hazardous building materials (HBM), including asbestos.

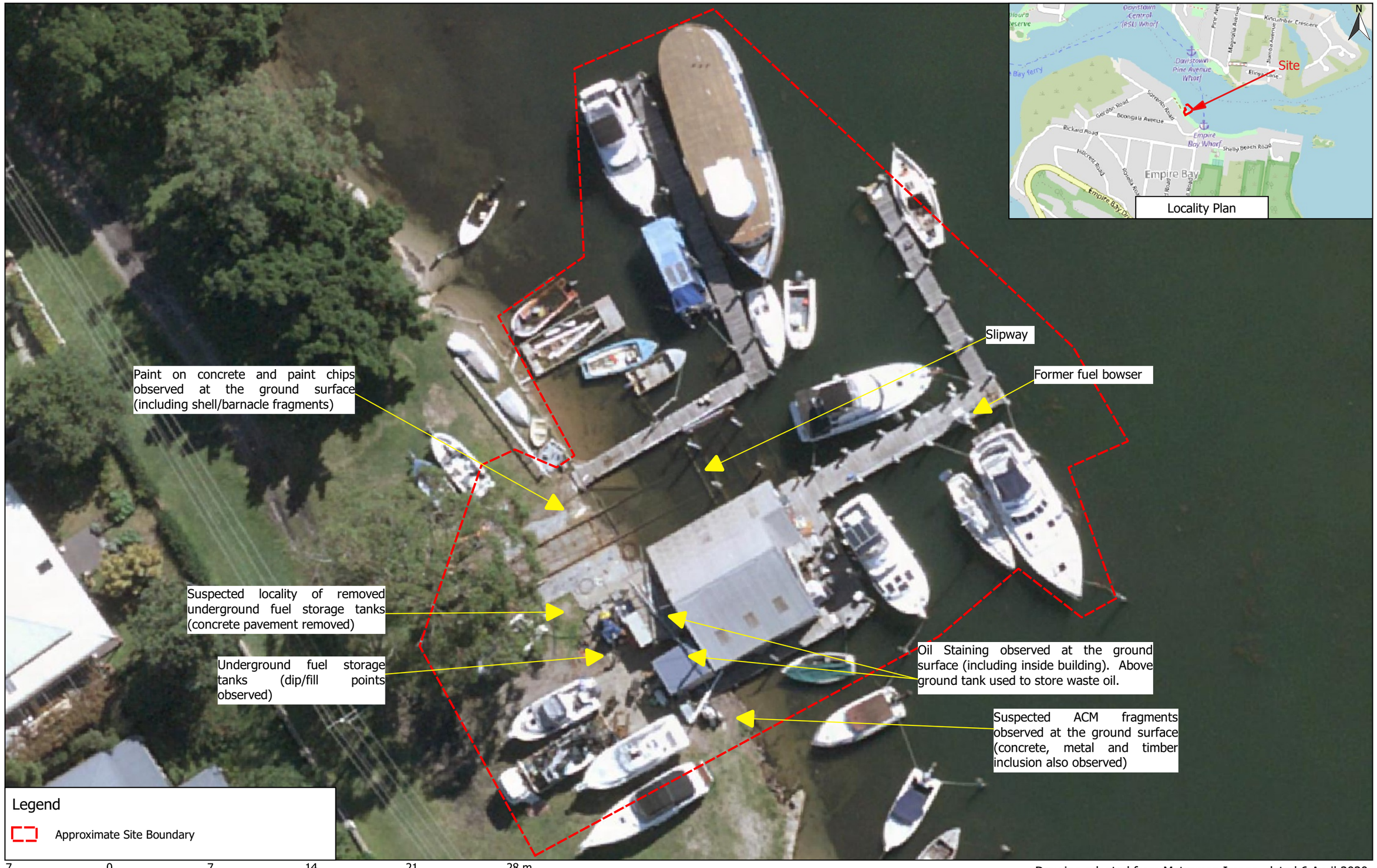
Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the site that have not been sampled and analysed. This is either due to undetected variations in ground conditions or to budget constraints (as discussed above), to vegetation preventing visual inspection and reasonable access. It is therefore considered possible that HBM, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the (geotechnical / environmental / groundwater) components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

Drawings 1 and 2



Drawing adapted from Metromap Image, dated 6 April 2020

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Department Planning, Industry & Environment		TITLE: **Summary of Walkover Findings**	PROJECT No:202478.00
OFFICE: Central Coast	DRAWN BY: BJK	**Detailed Site Investigation (Contamination)**	DRAWING No: 1
SCALE: 1:250 @ A3	DATE: 15.03.2021	**Former Empire Bay Marina - 16B Sorrento Road, Empire Bay**	REVISION: 0

Legend

- Approximate Site Boundary
- Borehole
- Borehole / Monitoring Well

7 0 7 14 21 28 m

Drawing adapted from Metromap Image, dated 6 April 2020

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Department Planning, Industry & Environment		
OFFICE: Central Coast	DRAWN BY: BJK	
SCALE: 1:250 @ A3	DATE: 15.03.2021	

TITLE: **Test Location Plan**
Detailed Site Investigation (Contamination)
Former Empire Bay Marina - 16B Sorrento Road, Empire Bay

N

PROJECT No:	202478.00
DRAWING No:	2
REVISION:	0

Appendix B

About This Report

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

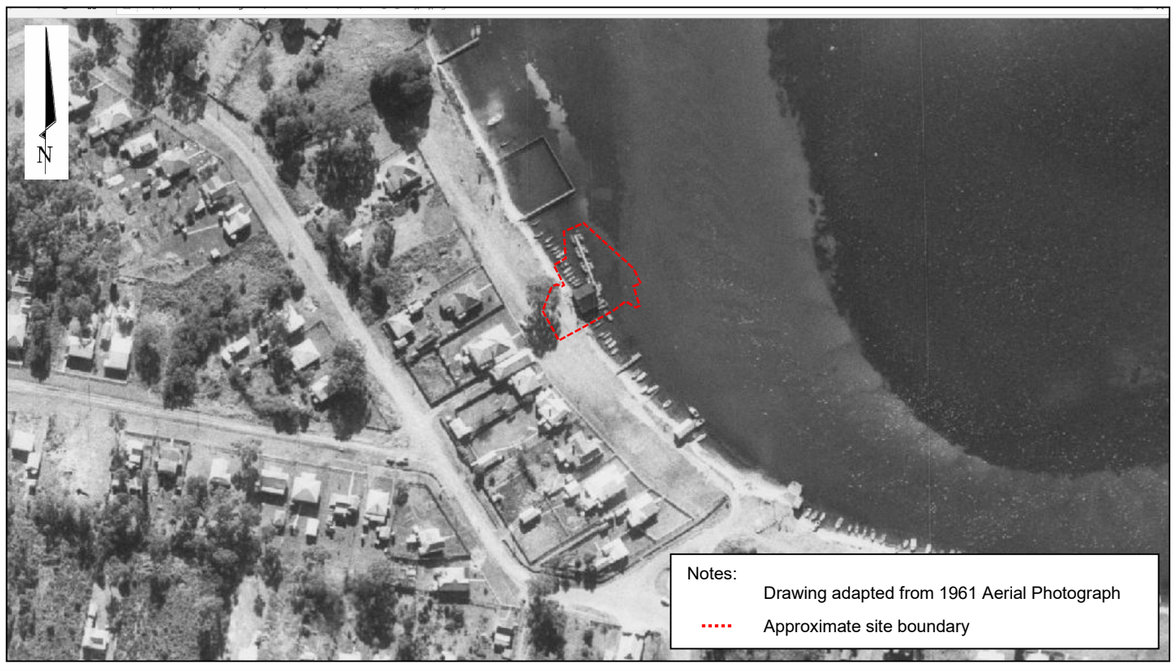
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

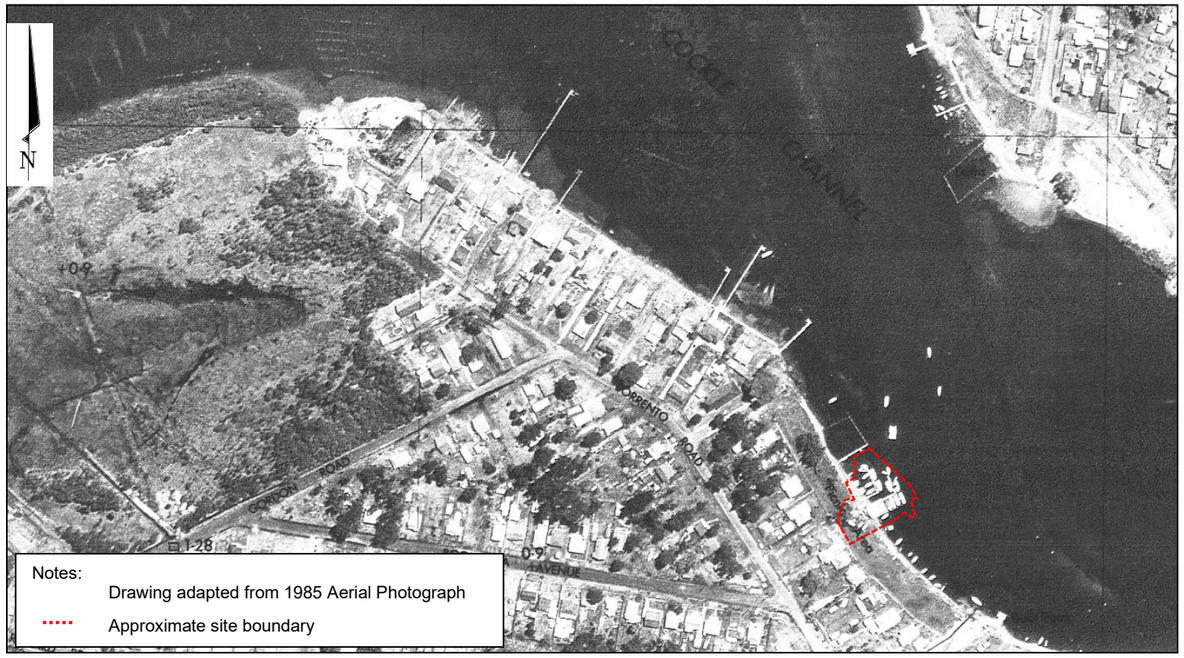
Appendix C

Background Information



Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	Department of Planning Industry & Environment (Crown Lands)		TITLE:	**Historical Aerial Photographs**	PROJECT No: 202478.00
OFFICE:	Central Coast	DRAWN BY: BJK		**Detailed Site Investigation (Contamination)**	DRAWING No: C1
SCALE:	NTS	DATE: June 2021		**Rehabilitation of Empire Bay Marina**	REVISION: A



Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	Department of Planning Industry & Environment (Crown Lands)		TITLE:	**Historical Aerial Photographs**	PROJECT No: 202478.00
OFFICE:	Central Coast	DRAWN BY: BJK		**Detailed Site Investigation (Contamination)**	DRAWING No: C2
SCALE:	NTS	DATE: June 2021		**Rehabilitation of Empire Bay Marina**	REVISION: A

DPIE (Crown Lands) Historical Records

Date	Action / Comment
30-Sep-24	Dept Lands receives Permissive Occupancy application for erection of boat shed from owner of adjacent lots
20-Oct-24	Erina Shire Council advise Dept Lands that they have no objection to Permissive Occupancy
11-Dec-24	Dept Lands issue Permissive Occupancy 4495 for boatshed below high water mark adjacent to Lot 18 Sorrento Estate
01-Nov-30	Dept Lands issue Permissive Occupancy 606 due to transfer
16-Jul-48	Dept Lands receive application for boatshed extension from tenant
01-May-49	Dept Lands issue Permissive Occupation 51-27 for commerical boatshed and ramp opposite lots 18 & 19 - use limited to "boat hiring"
30-Apr-54	Permissive Occupancy 51-27 terminated; replaced by PO 54-78
04-May-55	Plan showing land used by operator to access boatshed - being 12 & 13 Sorrento Rd (formerly Lots 18 & 19)
26-Jul-63	Gazettal of Special Lease 1964/81 (term from 26.07.1963 to 31.12.1990) for boatshed, jetty, slip & landing places (commercial) fronting lots 17-19 DP 4707
05-Sep-69	Transfer of Special Lease 1961/81
16-Nov-70	Transfer of Special Lease 1961/81
10-Sep-71	Agreement between operator and fuel supplier to install 1 x 1000 gal (4500l) tank plus bowser
08-Oct-71	Fuel supplier requests permission to install fuel bowser (and it is assumed underground tank)
11-Aug-72	Transfer of Special Lease 1961/81
07-Jan-77	Transfer of Special Lease 1961/81
01-Jan-78	Undated plan circa 1978 - provides dimension of structures for both special lease and permissive occupancy - indicates that slipway and northern jetty have been moved and jetty extended
01-Jan-81	Issue of Permissive Occupancy 1973-51 for commercial jetty and underground fuel tank
18-Mar-81	Transfer of Special Lease 1961/81
05-Jul-82	Transfer of Permissive Occupancy 1973-51
24-Jun-83	Transfer of Special Lease 1961/81
26-Aug-83	Transfer of Permissive Occupancy 1973-51
30-Sep-83	Transfer of Special Lease 1961/81
20-Feb-89	Creation of Lot 486/727270 - survey instruction is to define parcel 20.1m by 36.2m (being Special Lease 1961-81) and stated that it must "substantially include all structures"
21-Dec-90	Expiration of Special Lease 1961-81
18-May-93	Permissive Occupancy 1973-51 terminated; replaced by licence 194341
19-May-93	Licence 194341 granted for commercial jetty, boatshed, slip and landing place; authorises occupation until 30 Jan 1996
14-May-97	Licence 303679 granted for commercial marina, boatshed, slipway, hardstand, fuel storage, boat repairs, sales and service - no term
12-Apr-18	Underground petroleum storage system integrity test report
23-Jul-19	Crown Lands site inspection indicates underground fuel tank removed by operator
02-Apr-20	Crown Lands engaged consultants to undertake a building assessment
09-Apr-20	Crown Lands issue Order to Stop Unsafe Activity- cease use of the boatshed; based on interim findings of building assessment
06-May-20	Crown Lands building assessment and condition report finalised
19-Aug-20	Crown Lands issue Order to Stop Unsafe Activity - cease use of entire site due to safety concerns
08-Sep-20	Licence 303679 revoked by Crown Lands due to breaches of tenure conditions
09-Sep-20	Crown Lands take possession of site
03-Mar-21	Crown Lands complete initial make-safe works - removal of fuel, oil, visible asbestos from foreshore, etc.

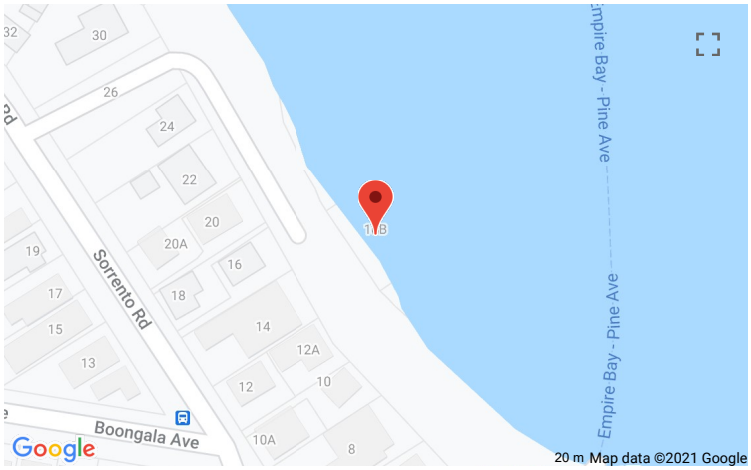
Search Options
- Find a Property
- Find an Application
- ePlanning Home

16 B Sorrento RD EMPIRE BAY NSW 2257

Details
16 B Sorrento RD EMPIRE BAY NSW 2257
Property Number: 4358

Titles
LOT: 486 DP: 727270
Lot / Deposited Plan
Land Area: 727.60

Map



Applications
003.1984.00005250.001
Development Application - MARINAS (> 30 VESSELS) (Lodged: 22/08/1984)
004.1987.00046130.001
Building Application - FENCE (Lodged: 17/12/1987)
003.1988.00010380.001
Development Application - Acoustic Fence (Lodged: 05/09/1988)
003.1993.00018100.001
Development Application - SIGNS (Lodged: 01/12/1993)

WaterNSW
Work Summary

GW201592

Licence: 20WA217884 **Licence Status:** CURRENT

Authorised Purpose(s): DOMESTIC
Intended Purpose(s): DOMESTIC

Work Type: Spear
Work Status: Supply Obtained
Construct.Method: Auger - Hollow
Owner Type: Private

Commenced Date:
Completion Date: 13/10/2006
Final Depth: 4.00 m
Drilled Depth: 4.00 m

Contractor Name: (None)
Driller: Warren Paul Greenway
Assistant Driller:

Property: NA 1 Boongala Ave EMPIRE BAY 2257 NSW
GWMA: -
GW Zone: -
Standing Water Level (m): 1.200
Salinity Description:
Yield (L/s): 0.500

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTHUMBERLAND	KINCU	2//11675
Licensed:	NORTHUMBERLAND	KINCUMBER	Whole Lot 2//11675

Region: 20 - Hunter
River Basin: 211 - MACQUARIE - TUGGERAH LAKES
Area/District:
CMA Map: 9131-2S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6292817.000
Easting: 347843.000
Latitude: 33°29'36.1"S
Longitude: 151°21'43.5"E

GS Map: -
MGA Zone: 56
Coordinate Source: GIS - Geogra

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	4.00	90			Auger - Hollow Flight
1	1	Casing	Pvc Class 9	0.00	3.00	90	86		Seated on Bottom
1	1	Opening	Screen - Gauze/Mesh	3.00	4.00	40		0	PVC Class 9, Glued, A: 0.60mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
1.20	4.00	2.80	Unknown	1.20		0.50			600.00

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	4.00	4.00	Sand, grey, roots & shell	Sand	

Remarks

13/10/2006: Form A Remarks:
Nat Carling, 26-Apr-2012; Coordinates based on location map provided with the Form-A.

***** End of GW201592 *****

ART C THE NEW SOUTH WALES GOVERNMENT
Putting people first by managing better

SCIENTIFIC SERVICES BRANCH
28 JAN 1994
DANGEROUS GOODS

WorkCover Authority

LICENCE TO KEEP DANGEROUS GOODS

(Dangerous Goods Act 1975)

Application for new licence, amendment or transfer

EXPIRY : 30/3/96

1. Name of applicant — ACN
EMPIRE BAY MARINA

2. Site to be licensed
No | Street
WATERFRONT RESERVE

Suburb/Town | Postcode
EMPIRE BAY | 2257

3. Previous licence number (if known) 35/019373

4. Nature of site MARINA 9144

5. Emergency contact on site:
Phone | Name
(043) 691800 | ANDRE VELLEMAN / TONY LEONARD

6. Site staffing: Hours per day 10 Days per week 7

7. Major supplier of dangerous goods MOBIL

8. If new site or significant modification
Plan stamped by: | Accredited consultant's name: | Date stamped

9. Number of dangerous goods depots at site 2

DATA
10 APR 1995
ENTERED

10. Trading name or occupier's name
EMPIRE BAY MARINA

11. Postal address of applicant | Suburb/Town | Postcode
PO Box 13 | Empire Bay | 2257

12. Contact for licence enquiries:
Phone | Fax | Name
(043) 691800 | (043) 692777 | ANDRE VELLEMAN

I certify that the details contained in this application (or the accompanying computer disk) are true and correct

13. Signature of applicant | Date 24.1.94

Please complete attached site sketch, depot listing and check sheet (if required) and return to WorkCover Authority in envelope provided.

11 APR 1995

Form DG1

P

35/99313

CHEMICAL STORAGE

Complete 1 section per depot

To change

If you have more depots than the space provided, photocopy sufficient sheets first.

Depot number	Type of depot	Class	Licensed maximum storage capacity
P1	UNDERGROUND TANK	3 ~~FCIT~~	5000 Litres

UN number	Shipping name	Pkg. Class	Pkg. Group	Pkg. EPG	Product or common name	Typical quantity	Unit eg. L, kg, m³
1203	PETROL	3	II		LEADED PETROL	2500	L

Depot number	Type of depot	Class	Licensed maximum storage capacity
D1	Exempt UNDERGROUND TANK	C1	5000 Litres

UN number	Shipping name	Pkg. Class	Pkg. Group	Pkg. EPG	Product or common name	Typical quantity	Unit eg. L, kg, m³
0001	DIESEL FUEL	C1			DIESEL	3000	L

Depot number	Type of depot	Class	Licensed maximum storage capacity

UN number	Shipping name	Pkg. Class	Pkg. Group	Pkg. EPG	Product or common name	Typical quantity	Unit eg. L, kg, m³

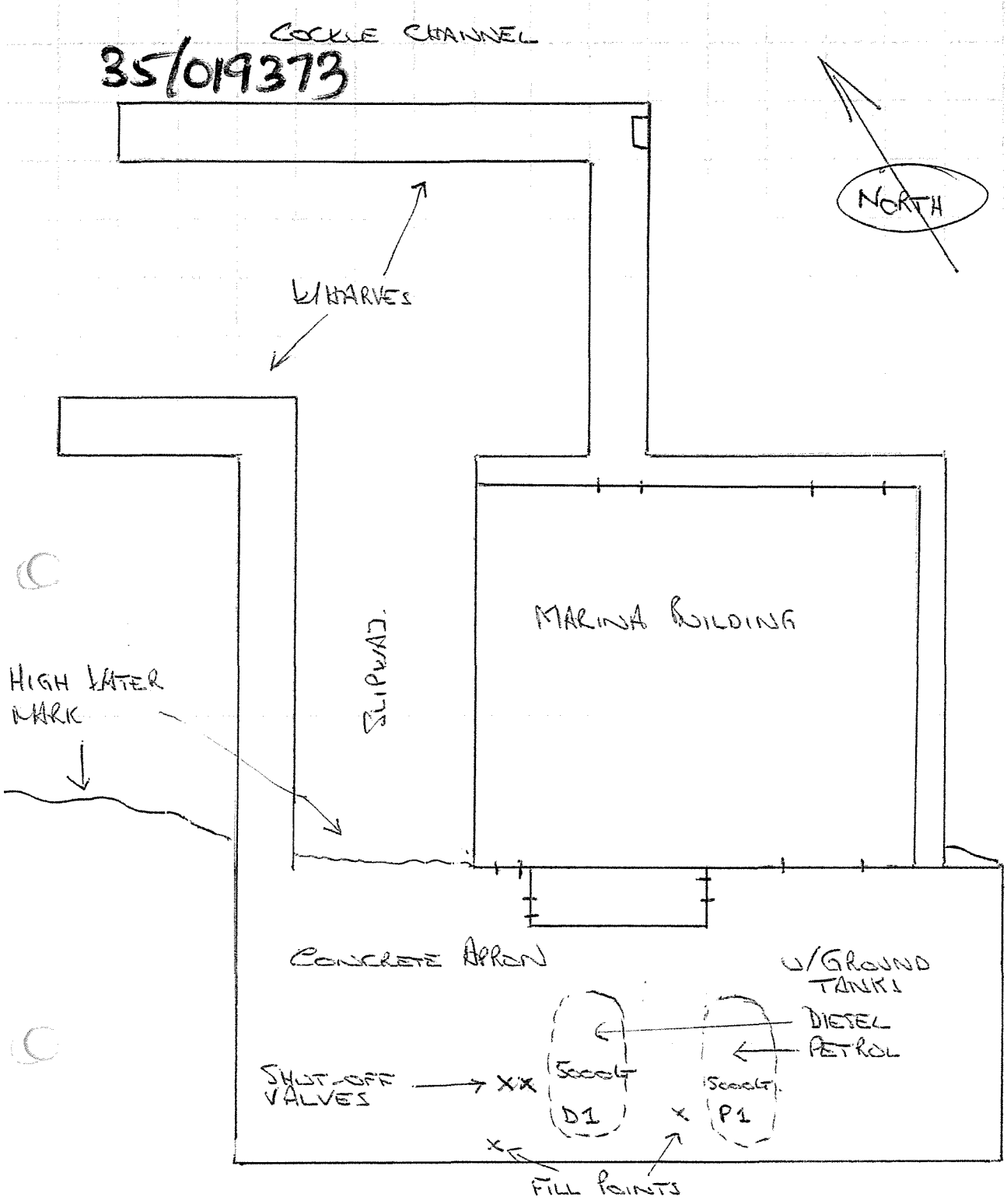
Depot number	Type of depot	Class	Licensed maximum storage capacity

UN number	Shipping name	Pkg. Class	Pkg. Group	Pkg. EPG	Product or common name	Typical quantity	Unit eg. L, kg, m³

Site Sketch

Please carefully read the instructions in Part B of the guide before sketching the site.

35/019373



GRASSED PUBLIC RESERVE

← VEHICLE ACCESS:-
1. COUNCIL GATE 100m approx
2. VACANT BLOCK 50m approx.

PART B

APPLICATION FOR ~~LICENCE (or AMENDMENT or~~ TRANSFER of LICENCE) FOR THE KEEPING OF DANGEROUS GOODS

DATA ENTERED 2 NOV 1983 OPERATOR THREE

Application is hereby made for— *a licence (or amendment of the licence) *the transfer of the licence for the keeping of dangerous goods in or on the premises described below.

(*delete whichever is not required)

FEE: ~~$10.00 per Depot for new licence.~~
$10.00 for ~~amendment or~~ transfer.

Name of Applicant in full (see over)	VELLEMAN, Andre Max and Kerry Robyn
Trading name or occupier's name (if any)	Empire Bay Marina
Postal address	37 Hillcrest Road, EMPIRE BAY, N.S.W. Postcode 2256
Address of the premises including street number (if any)	Waterfront Reserve, Empire Bay. Postcode 2256
Nature of premises (see over)	MARINA
Telephone number of applicant	STD Code 043 Number 695070

Particulars of type of depots and maximum quantities of dangerous goods to be kept at any one time. 7/11/83 03A

Depot number	Type of depot (see over)	Storage capacity	Dangerous goods — Product being stored	C & C Office use only DD 00 020 2
1	Underground Tank	5450	Petrol	2 0205
2	✓ ✓	5450	Diesel Exempt	~~2 020 5~~ 3
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Has site plan been approved? Yes ~~No~~ If yes, no plans required. ~~If no, please attach site plan.~~

Have premises previously been licensed? Yes ~~No~~ If yes, state name of previous occupier. Hadoleen Pty. Limited

Name of company supplying flammable liquid (if any) Ampol Ltd

Signature of applicant [signature] Date 26.10. 1983

For external explosives magazine(s), please fill in side 2.

FOR OFFICE USE ONLY

CERTIFICATE OF INSPECTION

I, Kenneth George MARTIN being an Inspector under the Dangerous Goods Act, 1975, do hereby certify that the premises described above do comply with the requirements of the Dangerous Goods Act, 1975, and the Dangerous Goods Regulation with regard to their situation and construction for the keeping of dangerous goods of the nature and in the quantity specified.

Signature of Inspector [signature] Date 3/11/86

Licence ISSUED

APPLICATION FOR LICENCE (or AMENDMENT or TRANSFER of LICENCE) FOR THE KEEPING OF DANGEROUS GOODS

$20.00 S

Application is hereby made for— *a licence (or amendment of the licence) *the transfer of the licence described below. (*delete whichever is not required) for the keeping of dangerous goods in or on the premises

FEE: $10.00 per Depot for new licence. $10.00 for amendment or transfer.

Name of Applicant in full (see over)	Sacmolt Pty. Ltd.
Trading name or occupier's name (if any)	Empire Bay Marina.
Postal address	Waterfront Reserve Empire Bay Postcode 2256
Address of the premises including street number (if any)	Waterfront Reserve Empire Bay Postcode 2256
Nature of premises (see over)	Boatshed.
Telephone number of applicant	STD Code 043 Number 69 1791

Particulars of type of depots and maximum quantities of dangerous goods to be kept at any one time.

Depot number	Type of depot (see over)	Storage capacity	Dangerous goods: Product being stored	C & C Office use only
		litres	DD	001 020 2
1	Underground tank	5450	Class 3.1. Petrol	2 020 5
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Has site plan been approved? ~~Yes~~ No — If yes, no plans required. If no, please attach site plan.

Have premises previously been licensed? ~~Yes~~ No — If yes, state name of previous occupier.

Name of company supplying flammable liquid (if any) Ampol

Signature of applicant X R Tredwell for SACMOLT PTY. LTD. EMPIRE BAY MARINA Date 18.2.82

For external explosives magazine(s), please fill in side 2.

FOR OFFICE USE ONLY

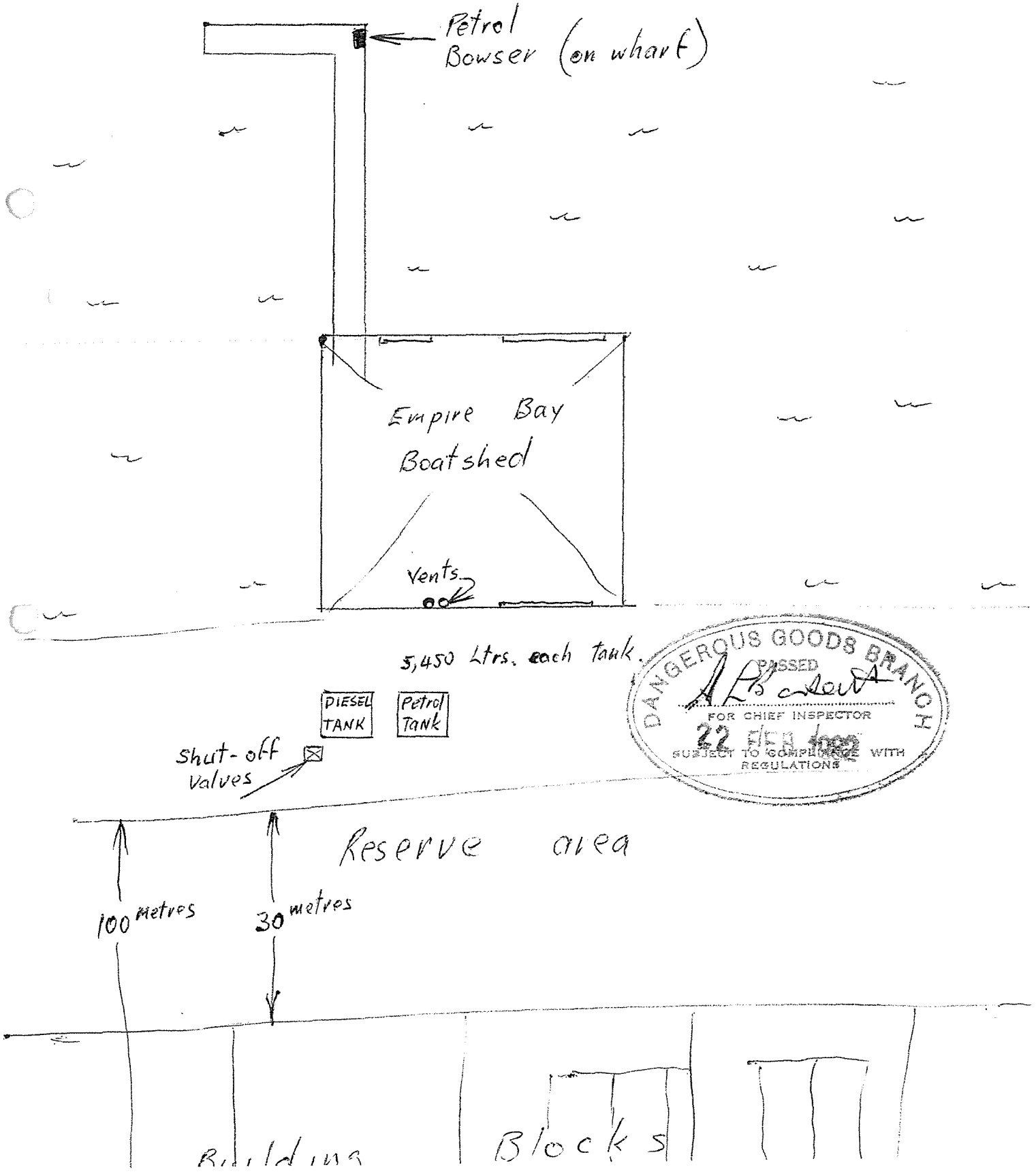
CERTIFICATE OF INSPECTION

I, Peter R. Williams being an Inspector under the Dangerous Goods Act, 1975, do hereby certify that the premises described above do comply with the requirements of the Dangerous Goods Act, 1975, and the Dangerous Goods Regulation with regard to their situation and construction for the keeping of dangerous goods of the nature and in the quantity specified.

Signature of Inspector P. R. Williams Date 23.6.82

35.019373.1

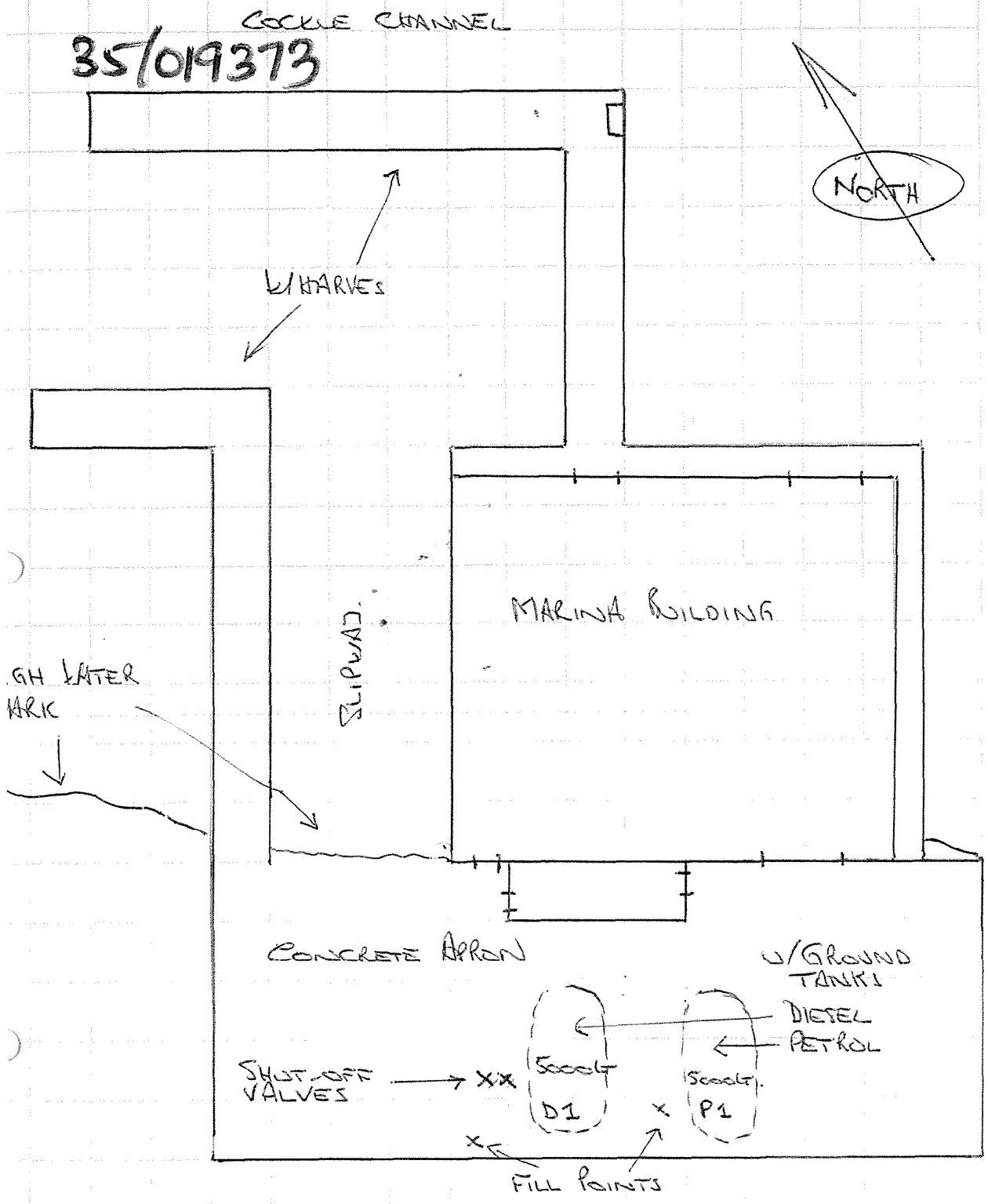
Sketch plan of location of tank + bowser at Empire Bay Marina. 18.2.82.



Site Sketch

Please carefully read the instructions in Part B of the guide before sketching the site.

35/019373



GRASSED PUBLIC RESERVE

VEHICLE ACCESS:-
1. COUNCIL GATE 100m approx
2. VACANT BLOCK 50m approx.

PART B

PA...

35/99313

CHEMICAL STORAGE

Complete 1 section per depot

To change

If you have more depots than the space provided, photocopy sufficient sheets first.

Depot number	Type of depot	Class	Licensed maximum storage capacity
P1	UNDERGROUND TANK	3 ~~PGII~~	5000 litres

UN number	Shipping name	Pkg. Class	Pkg. Group	Pkg. EPG	Product or common name	Typical quantity	Unit eg. L, kg, m³
1203	PETROL	3	II		LEADED PETROL	2500	L

Depot number	Type of depot	Class	Licensed maximum storage capacity
D1	Exempt UNDERGROUND TANK	C1	5000 litres

UN number	Shipping name	Pkg. Class	Pkg. Group	Pkg. EPG	Product or common name	Typical quantity	Unit eg. L, kg, m³
0001	DIESEL FUEL	C1			DIESEL	3000	L

Depot number	Type of depot	Class	Licensed maximum storage capacity

UN number	Shipping name	Pkg. Class	Pkg. Group	Pkg. EPG	Product or common name	Typical quantity	Unit eg. L, kg, m³

Depot number	Type of depot	Class	Licensed maximum storage capacity

UN number	Shipping name	Pkg. Class	Pkg. Group	Pkg. EPG	Product or common name	Typical quantity	Unit eg. L, kg, m³

Reference

WORKCOVER AUTHORITY

Chemical Safety Unit
Ph. (02) 370 5191 OR (02) 370 5192
Fax (02) 370 6105

Licensee

VELLEMAN A M & K R
EMPIRE BAY MARINA
BOX 13 P O
EMPIRE BAY 2256

26 FEB 1992

DANGEROUS GOODS BRANCH
13 MAR 1992

Dear Sir/Madam,

RE **APPLICATION FOR RENEWAL** OF LICENCE FOR THE KEEPING OF DANGEROUS GOODS

Our records indicate you hold licence number 35/019373 for keeping dangerous goods at WATERFRONT RESERVE
EMPIRE BAY 2256.

Details of depots at site.

Depot No.	Depot type	Goods stored in depot	Quantity kg/litres/no.
1	UNDERGROUND TANK	FLAMMABLE LIQUIDS	2 x 5 000

This licence is now due for renewal. **TO RENEW YOUR LICENCE.** Please carefully check the details shown in this letter and make any required corrections. Then, **SIGN and DATE** the declaration below and return this letter to the WorkCover Authority, Chemical Safety Unit. **Fees for these licences have been abolished. DO NOT SEND ANY MONIES.**

Declaration: I wish to renew this licence to 15/03/93. I certify that the licence details shown in this letter are correct.

....
(Signature) *(Date)*

If you do not wish to renew the licence. Please provide the Chemical Safety Unit with a signed statement giving the reason why it is not to be renewed. If you have sold/vacated the site please provide the name and address of the new owner/occupier so we may contact them.

Yours faithfully

Chief Inspector of Dangerous Goods.

APPLICATION FOR LICENCE (or AMENDMENT or TRANSFER of LICENCE) FOR THE KEEPING OF DANGEROUS GOODS

25 FEB 1982 VICTORIA REGISTRATOR ONE

$20.00 3

Application is hereby made for— *a licence (or amendment of the licence) *the transfer of the licence for the keeping of dangerous goods in or on the premises described below.

(*delete whichever is not required)

FEE: $10.00 per Depot for new licence.
$10.00 for amendment or transfer.

Name of Applicant in full (see over)	Sacmolt Pty. Ltd.
Trading name or occupier's name (if any)	Empire Bay Marina.
Postal address	Waterfront Reserve Empire Bay Postcode 2256
Address of the premises including street number (if any)	Waterfront Reserve Empire Bay 4674 17/03/82 M3A Postcode 2256
Nature of premises (see over)	Boatshed.
Telephone number of applicant	STD Code 043 Number 69 1791

Particulars of type of depots and maximum quantities of dangerous goods to be kept at any one time.

Depot number	Type of depot (see over)	Storage capacity	Dangerous goods: Product being stored	C & C Office use only
		Litres	DD	001 020 2
1	Underground Tank	5450	Class 3.1. Petrol	2 020 5
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Has site plan been approved? ~~Yes~~ No — If yes, no plans required. If no, please attach site plan.

Have premises previously been licensed? ~~Yes~~ No — If yes, state name of previous occupier.

Name of company supplying flammable liquid (if any) Ampol

Signature of applicant X SACMOLT PTY. LTD. EMPIRE BAY MARINA R Tredwell Date 18.2.82

For external explosives magazine(s), please fill in side 2.

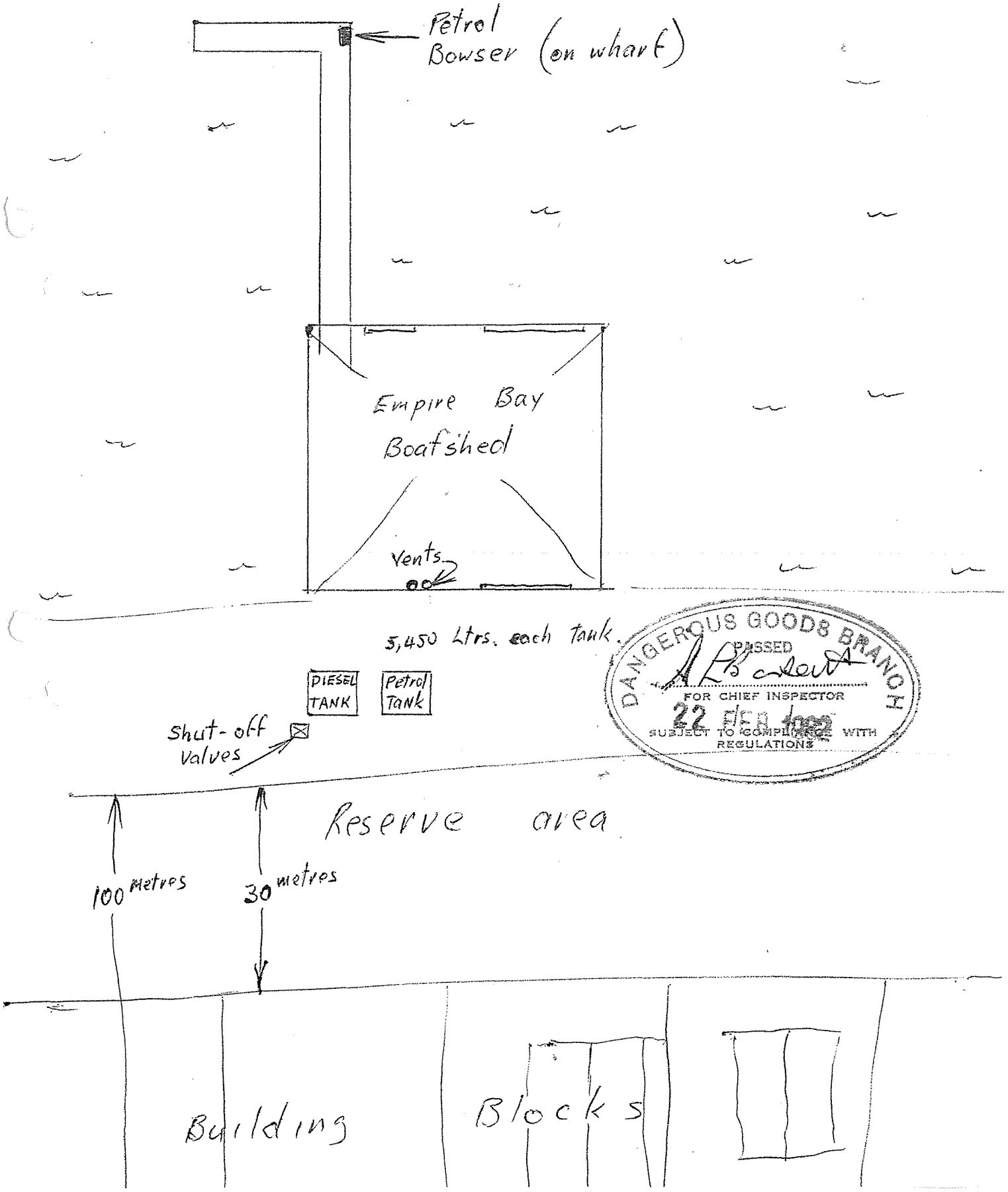
FOR OFFICE USE ONLY

CERTIFICATE OF INSPECTION

I, Peter R. Williams being an Inspector under the Dangerous Goods Act, 1975, do hereby certify that the premises described above do comply with the requirements of the Dangerous Goods Act, 1975, and the Dangerous Goods Regulation with regard to their situation and construction for the keeping of dangerous goods of the nature and in the quantity specified.

Signature of Inspector P. R. Williams Date 28.6.82

Sketch plan of location of tank + bowser at Empire Bay Marina. 18.2.82.



DANGEROUS GOODS BRANCH
PASSED
FOR CHIEF INSPECTOR
22 FEB 1982
SUBJECT TO COMPLIANCE WITH REGULATIONS

Form E

NEW SOUTH WALES—DANGEROUS GOODS ACT, 1975

LICENCE TO KEEP DANGEROUS GOODS

LICENCE NUMBER 35.019373.1

EXPIRY DATE

15th March 1983

Sacmolt Pty Ltd
Empire Bay Marina
Waterfront Reserve
EMPIRE BAY 2256

FEE PAYABLE, $20.00
Receipt no.4074 1/3/82

Subject to the payment of the prescribed fee the person and the premises specified are licensed for the keeping of dangerous goods in the class and quantity specified hereunder subject to the provisions of the Dangerous Goods Act, 1975, the Regulation thereunder and the conditions set out herein.

Trading Name: as above

Location of Premises: as above

Nature of Premises: boatshed

Particulars of Construction of Depots and Maximum Quantities of Dangerous Goods to be kept at any one time—

ST 425 D. WEST, GOVERNMENT PRINTER

Depot No.	Type of depot	Storage capacity	Product being kept	Class
1	Underground Tank	5450 l	Petrol	3.1

Dangerous Goods Branch,
Box 846, P.O.
DARLINGHURST 2010
(6th Floor, 1 Oxford Street)

H. N. BLACKMORE,
Chief Inspector of
Dangerous Goods

This licence is not transferable to any other premises. If any alteration is made to storage please return this licence together with full details. If transfer of licence is required FULL names of new occupier/s (including given names) must be furnished.

Renewals of this licence should be kept with this licence.

Form E

NEW SOUTH WALES—DANGEROUS GOODS ACT, 1975

LICENCE TO KEEP DANGEROUS GOODS

LICENCE NUMBER 35.019373.1

EXPIRY DATE

15th March 1983

Sacmolt Pty Ltd
Empire Bay Marina
Waterfront Reserve
EMPIRE BAY 2256

PAID
FEE PAYABLE, $20.00
Receipt no.4074 1/3/82

Subject to the payment of the prescribed fee the person and the premises specified are licensed for the keeping of dangerous goods in the class and quantity specified hereunder subject to the provisions of the Dangerous Goods Act, 1975, the Regulation thereunder and the conditions set out herein.

Trading Name: as above

Location of Premises: as above

Nature of Premises: boatshed

Particulars of Construction of Depots and Maximum Quantities of Dangerous Goods to be kept at any one time—

ST 425 D. WEST, GOVERNMENT PRINTER

Depot No.	Type of depot	Storage capacity	Product being kept	Class
1	Underground Tank	5450 l	Petrol	3.1

Dangerous Goods Branch,
Box 846, P.O.
DARLINGHURST 2010
(6th Floor, 1 Oxford Street)

H. N. BLACKMORE,
Chief Inspector of
Dangerous Goods

This licence is not transferable to any other premises. If any alteration is made to storage please return this licence together with full details. If transfer of licence is required FULL names of new occupier/s (including given names) must be furnished.

Renewals of this licence should be kept with this licence.

Appendix D

Photo Plates

Photo 1: Site Conditions (initial walkover), looking north-east

Photo 2: Site Conditions (initial walkover), looking south-east

Douglas Partners Geotechnics / Environment / Groundwater	**Photoplates**	PROJECT:	202478
	DSI (Contamination)	Plate	1
	Empire Bay Marina	REV:	A
	Client DPI&E	DATE:	07.06.21

Photo 3: Site Conditions (initial walkover), looking north-east

Photo 4: Site Conditions (initial walkover), looking north-east

Douglas Partners Geotechnics / Environment / Groundwater	**Photoplates**		PROJECT:	202478
	DSI (Contamination)		Plate	2
	Empire Bay Marina		REV:	A
	Client	DPI&E	DATE:	07.06.21

Photo 5: Site Conditions (following site clean-up), looking south-east

Photo 6: External former operational area, looking north-east

Douglas Partners Geotechnics / Environment / Groundwater	**Photoplates**	PROJECT:	202478
	DSI (Contamination)	Plate	3
	Empire Bay Marina	REV:	A
	Client DPI&E	DATE:	07.06.21

Photo 7: External former operational area, looking north-west

Photo 8: Oil staining and USTs, looking south-east

Douglas Partners Geotechnics / Environment / Groundwater	**Photoplates**	PROJECT:	202478
	DSI (Contamination)	Plate	4
	Empire Bay Marina	REV:	A
	Client DPI&E	DATE:	07.06.21

Photo 9: Surface oil staining, looking north-east

Photo 10: UST dip point, looking south-east

Douglas Partners Geotechnics | Environment | Groundwater	**Photoplates**	PROJECT:	202478
	DSI (Contamination)	Plate	5
	Empire Bay Marina	REV:	A
	Client DPI&E	DATE:	07.06.21

Photo 11: Internal workshop area (oil staining), looking north east

Photo 12: Slipway area, looking south-west

Douglas Partners Geotechnics / Environment / Groundwater	**Photoplates**		PROJECT:	202478
	DSI (Contamination)		Plate	6
	Empire Bay Marina		REV:	A
	Client	DPI&E	DATE:	07.06.21

Photo 13: Slipway area (paint debris), looking south-west

Photo 14: Slipway area, looking south-east

Douglas Partners Geotechnics / Environment / Groundwater	**Photoplates**	PROJECT:	202478
	DSI (Contamination)	Plate	7
	Empire Bay Marina	REV:	A
	Client DPI&E	DATE:	07.06.21

Photo 15: Southern side of the boathouse, facing south-west

Photo 16: ACM fragment observed (southern side of the boathouse)

Douglas Partners Geotechnics | Environment | Groundwater	**Photoplates**		PROJECT:	202478
	DSI (Contamination)		Plate	8
	Empire Bay Marina		REV:	A
	Client	DPI&E	DATE:	07.06.21

Photo 17: Suspected ACM fragment observed at the ground surface (south of the site boundary)

Photo 18: Close-up of photo 17

Douglas Partners Geotechnics / Environment / Groundwater	**Photoplates**	PROJECT:	202478
	DSI (Contamination)	Plate	9
	Empire Bay Marina	REV:	A
	Client DPI&E	DATE:	07.06.21

Photo 19: Seabed adjacent to southern jetty - fallen timber pylon visible

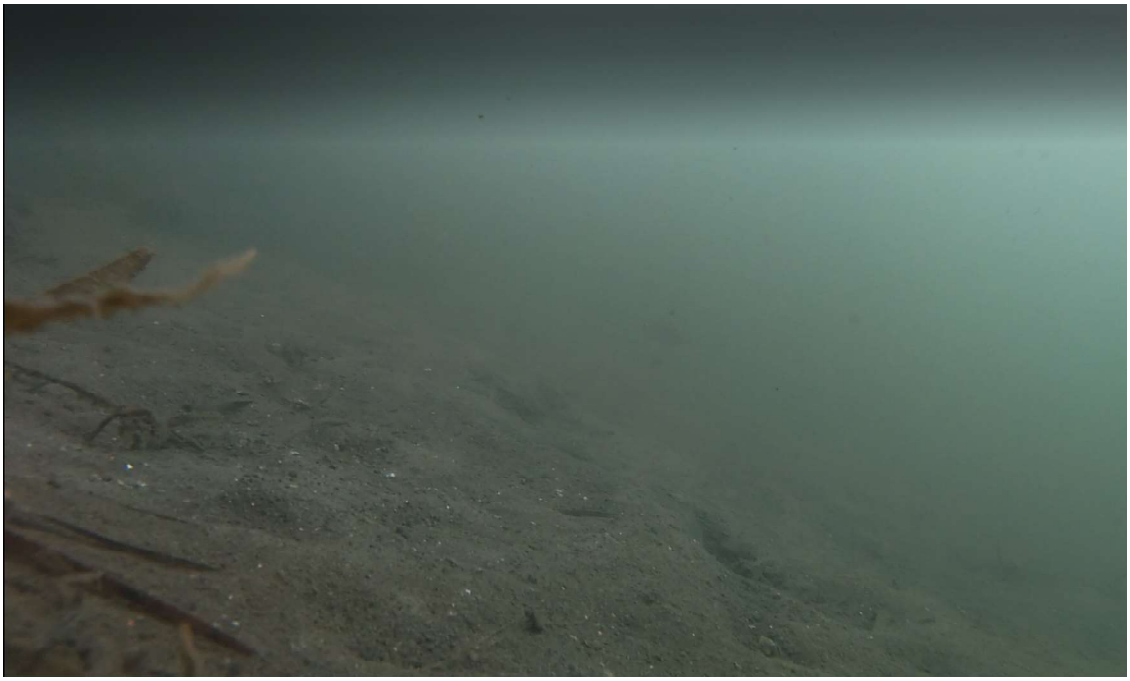


Photo 20: Seabed adjacent to eastern jetty

Douglas Partners Geotechnics | Environment | Groundwater	**Photoplates**		PROJECT:	202478
	DSI (Contamination)		Plate	10
	Empire Bay Marina		REV:	A
	Client	DPI&E	DATE:	07.06.21

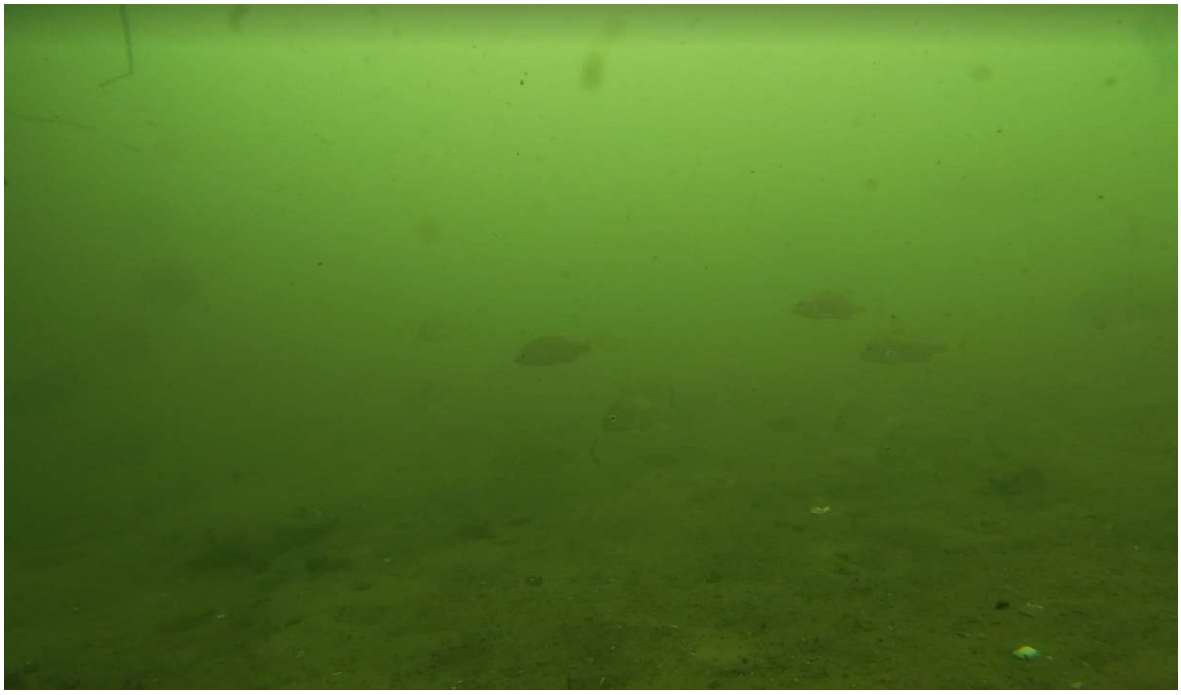


Photo 21: Seabed adjacent to northern jetty

Photo 22: Seabed adjacent to northern jetty

Douglas Partners Geotechnics / Environment / Groundwater	**Photoplates**	PROJECT:	202478
	DSI (Contamination)	Plate	11
	Empire Bay Marina	REV:	A
	Client DPI&E	DATE:	07.06.21

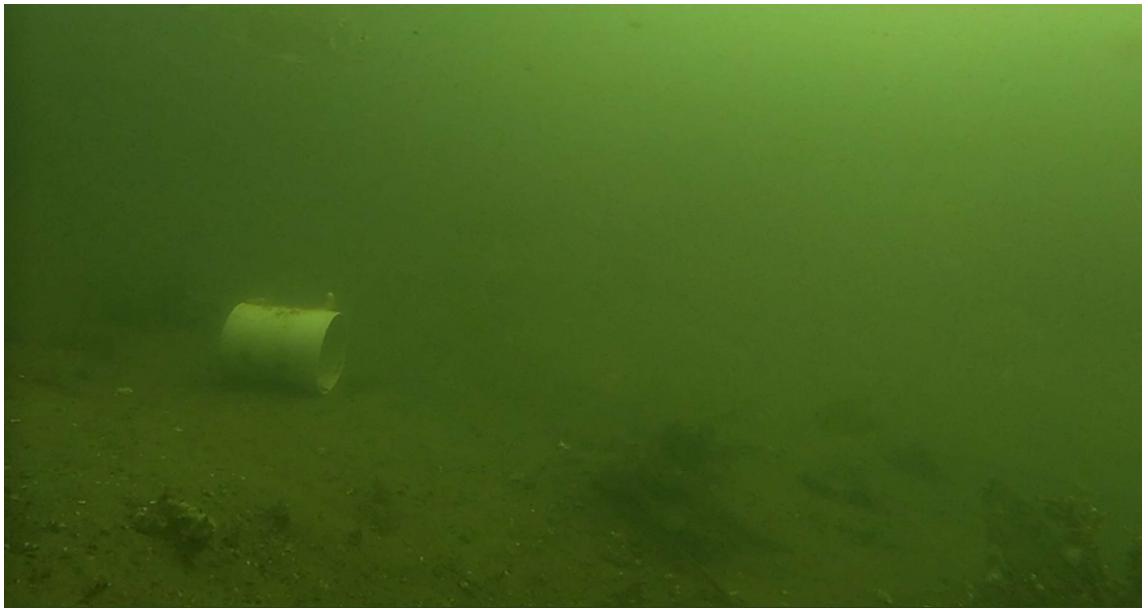


Photo 23: Seabed - Plastic bucket visible

Photo 24: Seabed near slipway and boathouse

Douglas Partners Geotechnics / Environment / Groundwater	**Photoplates**		PROJECT:	202478
	DSI (Contamination)		Plate	12
	Empire Bay Marina		REV:	A
	Client	DPI&E	DATE:	07.06.21

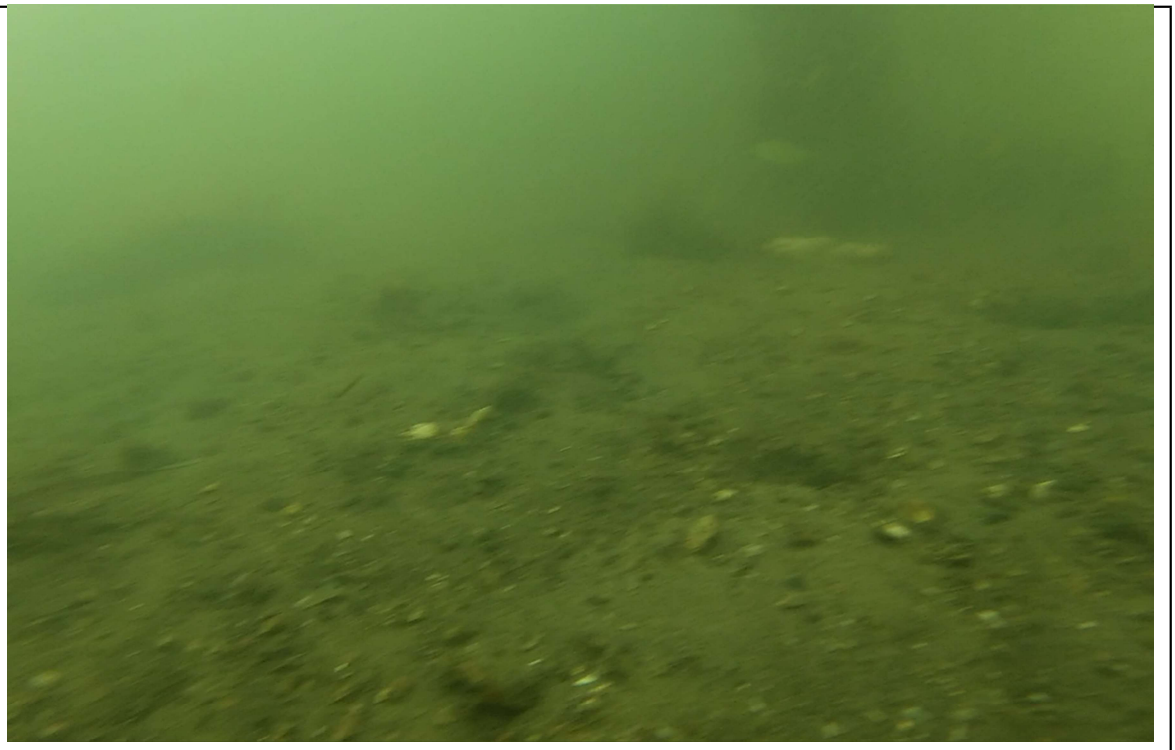


Photo 25: Seabed near slipway and boathouse

Photo 26: Seabed near slipway and boathouse

Douglas Partners Geotechnics / Environment / Groundwater	**Photoplates**	PROJECT:	202478
	DSI (Contamination)	Plate	13
	Empire Bay Marina	REV:	A
	Client DPI&E	DATE:	07.06.21

Appendix E

Data Quality Objectives

Appendix E
Data Quality Objectives - Detailed Site Investigation (Contamination)
Empire Bay Marina, Empire Bay

D1.0 Data Quality Objectives

The DSI has been devised broadly in accordance with the seven-step data quality objective (DQO) process which is provided in Appendix B, Schedule B2 of NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013).

Step	Summary
1: State the problem	The objective of the investigation was to confirm the contamination status of the site with respect to the potential land use (public open space use). The report was undertaken as the Empire Bay Marina is to be decommissioned and rehabilitated according *inter alia* to the requirements of The Department of Planning, Industry and Environment and NSW EPA endorsed guidance documents and taking into account DP's recent experience on other similar sites. A preliminary conceptual site model (CSM) and revised CSM has been prepared (Sections 8 and 13) for the potential end use. The project team consisted of experienced environmental engineers and scientists working in the roles of Project Reviewer, Project Manager, Field staff.
2: Identify the decisions / goal of the study	The site history has identified previous land uses which are potentially contaminating and are therefore included in the preliminary CSM (Section 8). The CSM identifies the associated contaminants of potential concern (COPC) and the likely impacted media. The site assessment criteria (SAC) for each of the COPC are detailed in Appendix G. The decision is to establish whether or not the results fall below the SAC. On this basis, an assessment of the site's suitability from a contamination perspective and whether (or not) further assessment and / or remediation will be required.
3: Identify the information inputs	Inputs to the investigation were the results of analysis of samples to measure the concentration of COPC identified in the preliminary CSM (Section 8) at the site using NATA accredited laboratories and methods, where possible. The SAC for each of the COPC are detailed in Appendix G and H. A photoionisation detector (PID) will be used on-site to screen soils for VOC. PID readings will be used to inform sample selection for laboratory analysis.
4: Define the study boundaries	The lateral boundaries of the investigation area are shown on Drawing 1, Appendix A. The vertical boundaries are restricted to the extent of contamination impact as determined from the site history assessment and site observations. The assessment is limited to the timeframe/period over which the field investigation was undertaken. Constraints to the assessment are identified and discussed in the conclusions and limitations of the report, Sections 14 and 16.

5: Develop the analytical approach (or decision rule)	The decision rule is to compare all analytical results with SAC (Sections 11 and 12, based on NEPC (2013)). Where guideline values are absent, other sources of guideline values accepted by NEPC (2013) shall be adopted where possible. Where a sample result exceeds the adopted criterion, a further site-specific assessment will be made to determine the risk posed by the presence of that contaminant. Initial comparisons utilised individual results then, if required/appropriate, summary statistics (including mean, standard deviation and 95% upper confidence limit (UCL) of the arithmetic mean (95% UCL) were used to assess potential risks posed by the site contamination. Quality control results were assessed according to their relative percent difference (RPD) values. For field duplicates, triplicates and laboratory results, RPDs should generally be below 30%; for field blanks and rinsates, results should be at or less than the limits of reporting (NEPC, 2013). The field and laboratory quality assurance assessment is included in Appendix L.
6: Specify the performance or acceptance criteria	Baseline condition: Contaminant levels at the site exceed human health and environmental SAC and pose a potentially unacceptable risk to receptors (null hypothesis). Alternative condition: Contaminant levels at the site comply with human health and environmental SAC and as such, does not pose a potentially unacceptable risk to receptors (alternative hypothesis). Unless conclusive information from the collected data is sufficient to reject the null hypothesis, it is assumed that the baseline condition is true. Uncertainty that may exist due to the above potential decision errors shall be mitigated as follows: As well as a primary screening exercise, the use of the 95% UCL as per NEPC (2013) may be applied, i.e: 95% is the defined confidence level associated with the UCL on the geometric mean for contaminant data. The resultant 95%UCL shall subsequently be screened against the corresponding SAC. The statistical assessment will only be able to be applied to certain datasets, such as those obtained via systematic sampling (not completed due to the majority targeted sampling strategy completed). Identification of areas for targeted sampling will be via professional judgement and errors will not be able to have a probability assigned to them.
7: Optimise the design for obtaining data	As the purpose of the sampling program is to assess for potential contamination across the site, the sampling program is reliant on professional judgement to identify and sample the potentially affected areas. Further details regarding the proposed sampling plan are presented in Section 9.

Appendix F

Field Work Methodology

Appendix F
Field Work Methodology
16B Sorrento Road, Empire Bay

F1.0 Guidelines

The following key guidelines were consulted for the field work methodology:

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013).
- CSIRO Sediment Quality Assessment, A Practical Guide (2nd Ed) (CSIRO, 2016).

F2.0 Soil and Sediment Sampling

Soil sampling is carried out in accordance with DP standard operating procedures. The general sampling and sample management procedures comprise:

- Collect soil samples directly from the sampling tube or hand auger at the nominated sample depths;
- Collect sediment samples directly from the hand auger at the nominated sample depths;
- Transfer samples in laboratory-prepared glass jars with Teflon lined lids by hand, capping immediately and minimising headspace within the sample jar;
- Transfer samples in laboratory-prepared container by hand, capping immediately and minimising headspace within the sample jar;
- Collect replicate samples in zip-lock bags for PID screening;
- Wear a new disposable nitrile glove for each sample point thereby minimising potential for cross-contamination;
- Collect 10% replicate samples for QC purposes;
- Label sample containers with individual and unique identification details, including project number, sample location and sample depth (where applicable);
- Place samples into a cooled, insulated and sealed container for transport to the laboratory; and
- Use chain of custody documentation.

F2.1 Field Testing

Field testing is carried out in accordance with DP standard operating procedures. The general sampling and sample management procedures comprise:

PID Field Test

- Calibrate the PID with isobutylene gas at 100 ppm and with fresh air prior to commencement of each successive day's field work;
- Allow the headspace in the PID zip-lock bag samples to equilibrate; and
- Screen using the PID.

F3.0 Groundwater Sampling

F3.1 Monitoring Well Installation

Monitoring wells are constructed using class 18 uPVC machine slotted screen and blank sections with screw threaded joints. The screened section of each well is backfilled with a washed sand filter pack to approximately 0.2 m above the screened interval. Each well is completed with a hydrated bentonite plug of at least 0.3 m thick and then finished with a stick-up (no monument).

F3.2 Monitoring Well Development

Groundwater monitoring wells are developed as soon as practicable following well installation. The purpose of well development is to remove sediments introduced to the well during drilling and to facilitate connection of the monitoring well to the aquifer. The wells are developed by bailing to remove a minimum of five well volumes.

F3.3 Groundwater Sampling

Groundwater sampling is carried out in accordance with DP standard operating procedures. Groundwater samples are collected using a positive displacement low flow bladder pump via the micro-purge (minimal drawdown) method. The method minimises aeration of the sample and disturbance to the water column thereby enhancing the quality of results for oxygen sensitive analytes.

The sampling method is described as follows:

- Measure the static water level using an electronic interface probe and record the thickness of any LNAPL (if encountered);
- Decontaminate the interface probe and cable between monitoring wells by rinsing in a diluted Liquinox solution and then rinsing in demineralised water;
- Fit the pump with a well-dedicated bladder and tubing. Lower the pump into the well then clamp at a level estimated to be mid-point of the screened interval and at least 1 m below the top of the water column;
- Set the pump at the lowest rate possible that could produce laminar flow to minimise drawdown of the water column;
- Measure physical parameters by continuously passing the purged water through a flow cell; and

- Following stabilisation of the field parameters, collect samples in laboratory-prepared bottles minimising headspace within the sample bottle and cap immediately.

Decontaminate the interface probe, pump and cable between monitoring wells by rinsing in a diluted Liquinox solution and then rinsing in demineralised water.

The general groundwater sample handling and management procedures comprise:

- Collect 10% replicate samples for QC purposes;
- Label sample containers with individual and unique identification details, including project number and sample location;
- Place the sample jars into a cooled, insulated and sealed container for transport to the laboratory; and
- Use chain of custody documentation.

Douglas Partners Pty Ltd

Appendix G

Site Assessment Criteria

Appendix G
Site Assessment Criteria
Empire Bay Marina, Empire Bay

G1.0 Introduction

G1.1 Guidelines

The following key guidelines were consulted for deriving the site assessment criteria (SAC):

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013).
- CRC CARE *Health screening levels for petroleum hydrocarbons in soil and groundwater* (CRC CARE, 2011).
- ANZG *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018).
- NHMRC *Guidelines for Managing Risks In Recreational Water* (NHMRC, 2008).
- ANZECC *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000).

G1.2 General

The SAC applied in the current investigation are informed by the CSM which identified human and environmental receptors to potential contamination at the site. Analytical results are assessed (as a Tier 1 assessment) against the SAC comprising primarily the investigation and screening levels of Schedule B1 of NEPC (2013).

The following inputs are relevant to the selection and/or derivation of the SAC:

- Land use recreational.
    - Corresponding to land use category ‘C‘, public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. It does not include undeveloped public open space (such as urban bushland and reserves) which should be subject to a site-specific assessment where appropriate.
- Soil type: sand.

G2.0 Soils

G2.1 Health Investigation and Screening Levels

The generic health investigation levels (HIL) and health screening levels (HSL) are considered to be appropriate for the assessment of human health risk via all relevant pathways of exposure associated with contamination at the site. The adopted soil HIL and HSL for the contaminants of concern are in Table 1 and Table 2.

Table 1: Health Investigation Levels (mg/kg)

Contaminant	HIL-C
Metals	
Arsenic	300
Beryllium	90
Boron	20 000
Cadmium	90
Chromium (VI)	300
Cobalt	300
Copper	17 000
Lead	600
Manganese	19 000
Mercury (inorganic)	80
Methyl mercury	13
Nickel	1200
Selenium	700
Zinc	30 000
Cyanide	
Cyanide (free)	240
PAH	
B(a)P TEQ	3
Total PAH	300
Phenols	
Phenol	40 000
Pentachlorophenol	120
OCP	
DDT+DDE+DDD	400

Contaminant	HIL-C
Aldrin and dieldrin	10
Chlordane	70
Endosulfan	340
Endrin	20
Heptachlor	10
HCB	10
Methoxychlor	400
OPP	
Chlorpyrifos	250
PCB	
PCB	1

Table 2: Health Screening Levels (mg/kg)

Contaminant	HSL-C	HSL-C	HSL-C	HSL-C
SAND	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4 m**	**4 m+**
Benzene	NL	NL	NL	NL
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	NL	NL	NL	NL
Naphthalene	NL	NL	NL	NL
TRH F1	NL	NL	NL	NL
TRH F2	NL	NL	NL	NL

Notes: TRH F1 is TRH C_6-C_{10} minus BTEX

TRH F2 is TRH >C_{10}-C_{16} minus naphthalene

The soil saturation concentration (Csat) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds Csat, a soil vapour source concentration for a petroleum mixture could not exceed a level that would results in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'

The HSL for direct contact derived from CRC CARE (2011) are in Table 3.

Table 3: Health Screening Levels for Direct Contact (mg/kg)

Contaminant	DC HSL-C
Benzene	120
Toluene	18 000
Ethylbenzene	5300
Xylenes	15 000
Naphthalene	1900
TRH F1	5100
TRH F2	3800
TRH F3	5300
TRH F4	7400

Notes: TRH F1 is TRH C_6-C_{10} minus BTEX
TRH F2 is TRH >C_{10}-C_{16} minus naphthalene

G2.2 Asbestos in Soil

The HSL for asbestos in soil are based on likely exposure levels for different scenarios published in NEPC (2013) for the following forms of asbestos:

- Bonded asbestos containing material (ACM); and
- Fibrous asbestos and asbestos fines (FA and AF).

The HSL are in Table 4.

Table 4: Health Screening Levels for Asbestos

Form of Asbestos	HSL-C
ACM	0.02%
FA and AF	0.001%
FA and AF and ACM	No visible asbestos for surface soil *

Notes: Surface soils defined as top 10 cm.
* Based on site observations at the sampling points and the analytical results of surface samples.

G2.3 Ecological Investigation Levels

Ecological investigation levels (EIL) and added contaminant limits (ACL), where appropriate, have been derived in NEPC (2013) for arsenic, copper, chromium (III), nickel, lead, zinc, DDT and naphthalene. The adopted EIL, derived using the interactive (excel) calculation spreadsheet on the NEPM toolbox website are shown in Table 6, with inputs into their derivation shown in Table 5.

Table 5: Inputs to the Derivation of the Ecological Investigation Levels

Variable	Input	Rationale
Age of contaminants	"Aged" (>2 years)	Marina has been operational for approximately 100 years, the contamination is considered as "aged" (>2 years)
pH	6	Lab pH results ranged 5.7 and 7.8. A pH of 6 has been adopted.
CEC	5 $cmol_c/kg$	CEC results ranged between 2 $cmol_c/kg$ and 28 $cmol_c/kg$. Local sandy soil typically have a relatively low CEC, and on this basis 5 $cmol_c/kg$ has been adopted.
Clay content	2%	Sandy soils with a low clay content
Traffic volumes	low	Foreshore Area (not adjacent to a main road)
State / Territory	NSW	

Table 6: Ecological Investigation Levels (mg/kg)

Contaminant	EIL-C
Metals	
Arsenic	100
Copper	110
Nickel	35
Chromium III	240
Lead	1100
Zinc	310
PAH	
Naphthalene	170
OCP	
DDT	180

G2.4 Ecological Screening Levels

Ecological screening levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. The adopted ESL are shown in Table 7.

Table 7: Ecological Screening Levels (mg/kg)

Contaminant	Soil Type	EIL-C
Benzene	Coarse	50
Toluene	Coarse	85
Ethylbenzene	Coarse	70
Xylenes	Coarse	105
TRH F1	Coarse/ Fine	180*
TRH >C10-C16	Coarse/ Fine	120*
TRH F3	Coarse	300
TRH F4	Coarse	2800
B(a)P	Coarse	0.7

Notes: ESL are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability
TRH F1 is TRH C_6-C_{10} minus BTEX
TRH F2 is TRH >C_{10}-C_{16} including naphthalene

G2.5 Management Limits

In addition to appropriate consideration and application of the HSL and ESL, there are additional considerations which reflect the nature and properties of petroleum hydrocarbons, including:

- Formation of observable light non-aqueous phase liquids (LNAPL);
- Fire and explosion hazards;
- Effects on buried infrastructure eg: penetration of, or damage to, in-ground services.

The adopted management limits are in Table 8.

Table 8: Management Limits (mg/kg)

Contaminant	Soil Type	ML- C
TRH F1	Coarse	700
TRH F2	Coarse	1000
TRH F3	Coarse	2500
TRH F4	Coarse	10 000

Notes: TRH F1 is TRH C_6-C_{10} including BTEX
TRH F2 is TRH >C_{10}-C_{16} including naphthalene

G3.0 Groundwater

G3.1 Introduction

The groundwater investigation levels (GIL) used for interpretation of the groundwater data (as a Tier 1 assessment) have been selected based on the potential risks posed from contamination sourced from the site to receptors at or down-gradient of the site, as identified by the conceptual site model (CSM). The receptors, exposure points and pathways are summarised in Table 9.

Table 9: Summary of Potential Receptors and Potential Risks

Receptor	Location	Exposure Point	Exposure Pathway
Surface water aquatic ecosystem	Down-gradient from site.	Receiving surface water body at the groundwater discharge point.	Exposure to contaminants.
Human recreation (eg: swimming)	Down-gradient from site.	Receiving surface water body at the groundwater discharge point.	Ingestion / dermal absorption of contaminants during recreational activities (eg: swimming).

The rationale for the selection of GIL is in Table 10.

Table 10: Groundwater Investigation Level Rationale

Receptor / Beneficial Use	GIL	Source	Comments / Rationale
Aquatic ecosystem	DGV	ANZG (2018)	Marine water 99% LOP for bioaccumulative contaminants 95% LOP for non-bioaccumulative contaminants
Recreational waters	GV	NHMRC (2008)	Based on the NHMRC (2018) values x10 to account for ingestion of water whilst undertaking recreational activities.

Notes: DGV default guideline value
% LOP percentage level of protection of species
HSL health screening level
GV guideline value

G3.2 Groundwater Investigation Levels for Aquatic Ecosystems

The DGV for the protection of aquatic ecosystems derived from ANZG (2018) are in Table 11.

Table 11: Groundwater Investigation Levels for Protection of Aquatic Ecosystems (µg/L)

Contaminant	Marine Water
Metals	
Arsenic	-
Beryllium	-
Boron	-
Cadmium	5.5
Chromium (IIII)	27.4
Cobalt	1
Copper	1.3
Lead	4.4
Manganese	-
Mercury (inorganic)	0.1
Nickel	70
Selenium	-
Zinc	15
Organics	
Benzene	700
Toluene	180
Ethylbenzene	5
o-Xylene	350
PAH	
B(a)P TEQ	0.1
Naphthalene	70
Total PAH	-
Phenols	
Phenol	400

Notes: Where the contaminant does not have a % LOP, the 'unknown' LOP has been adopted

G3.3 Health Screening Levels for Vapour Intrusion

The use of the HSLs requires consideration of a number of factors such as land use, soil type and depth of contamination. A specific limitation that affects the use of groundwater HSLs for this investigation is the shallow depth to groundwater (i.e. groundwater is less than 2 m depth). The HSLs adopted for this investigation were based on a generic groundwater depth of between 2 m and 4 m. It is acknowledged that this may not be appropriate for this site. Development of more appropriate HSLs could be undertaken using the CRC Care Risk / Health Based Criteria Model, however, based on the proposed public open space use, the absence of any buildings following site rehabilitation and given the non-detectable groundwater VOC concentrations, the soil vapour exposure pathway is considered to be incomplete and therefore further development of site specific HSLs was not warranted.

The HSL to evaluate potential vapour intrusion risks derived from NEPC (2013) are in Table 12.

Table 12: Groundwater Health Screening Levels for Vapour Intrusion (µg/L)

Contaminant	HSL-C	Solubility Limit
SAND	**2 m to <4 m**	**-**
Benzene	NL	59 000
Toluene	NL	61 000
Ethylbenzene	NL	3900
Xylenes	NL	21 000
Naphthalene	NL	170
TRH F1	NL	9000
TRH F2	NL	3000

Notes: TRH F1 is TRH C_6-C_{10} minus BTEX

TRH F2 is TRH >C_{10}-C_{16} minus naphthalene

The solubility limit is defined as the groundwater concentration at which the water cannot dissolve any more of an individual chemical based on a petroleum mixture. The soil vapour that is in equilibrium with the groundwater will be at its maximum. If the derived groundwater HSL exceeds the water solubility limit, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.

G3.4 Groundwater Investigation Levels for Recreational Water

The GV for recreational water derived from NHMRC (2008) are in Table 13.

Table 13: Groundwater Investigation Levels for Protection of Recreational Waters (µg/L)

Contaminant	Guideline Value
Metals	
Arsenic	100
Beryllium	-
Boron	4000
Cadmium	20
Chromium (VI)	-
Cobalt	-
Copper	20000
Lead	100
Manganese	500
Mercury (inorganic)	10
Nickel	200
Selenium	-
Zinc	-

G4.0 Sediments

The sediment SAC (sediment quality guideline values (SQGV)) are relevant to the baseline sediment contamination investigation and have been adopted from ANZG (2018) and CSIRO (2016) Sediment Quality Assessment, A Practical Guide (2nd Ed) which draws from the SQGV in ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality and revisions to the guideline values as indicated by the footnotes to Table A.1 in CSIRO (2016).

Australia and New Zealand adopted empirical SQGVs derived from a ranking of toxicity data and other effects data, from field studies using a large North American database. While both lower and upper guidelines were provided (termed 'SQGV' and 'SQGV-high', respectively), equivalent to the ERL ('effects range low') and ERM ('effects range median') introduced by Long et al. (1995), regulation was based on the lower guideline. By definition, there was a low probability of effects below the lower guideline value and a high probability above the upper guideline value. The lower value (the SQGV) is used as a screening value; if exceeded, it is a trigger for further investigation (CSIRO, 2016). Both the SQGV and SQGV-high have been included for reference purposes.

According to CSIRO (2016), all comparisons of guideline values with test sediment concentrations should initially be made using the total contaminant concentration in the <2 mm fraction. However, the guideline also notes that sieving of sediments causes major changes to sample integrity and possible losses of particular components (for example, volatile organics). Accordingly, for data quality purposes, and to allow consistency of results for future comparison with new data which may be obtained, DP elected not to sieve the sediment samples obtained.

The tributyltin (TBT) criterion in addition to other organic contaminants are generally normalised to 1% organic carbon (OC) within the limits of 0.2% to 10%. Thus, if a sediment has: (i) 2% OC, the '1% normalised' concentration would be the measured concentration divided by 2; (ii) 0.5% OC, then the 1% normalised value is the measured value divided by 0.5; (iii) 0.15% OC, then the 1% normalised value is the measured value divided by the lower limit of 0.2. Accordingly, selected soil samples were tested for OC in order to obtain an indication of the general adjustment range of the TBT and organic contaminants criteria. Sediment samples reported OC results ranging between 0.77% and 1.3%, with an average OC result of 1.07%. On this basis, normalisation of the TBT and other organic contaminants was not considered necessary.

The adopted sediment quality guideline values (SQGV and SQGV-high) are summarised in Table 14.

Table 14: Adopted Sediment Quality Guideline Values

Contaminant	Guideline value (SQGV)	SQGV-high
Metals[a]	(mg/kg dry weight)	(mg/kg dry weight)
Antimony	2.0	25
Cadmium	1.5	10
Chromium	80	370
Copper	65	270
Lead	50	220
Mercury	0.15	1.0
Nickel	21	52
Silver	1.0	4.0
Zinc	200	410
Metalloids	(mg/kg dry weight)	(mg/kg dry weight)
Arsenic	20	70
Organometallics	(µg Sn/kg dry weight, 1% OC)	(µg Sn/kg dry weight, 1% OC)
Tributyltin	9.0	70
Organics	(µg/kg dry weight, 1% OC)	(µg/kg dry weight, 1% OC)
Total PAHs (sum of PAHs)	10,000	50,000
Total DDT	1.2	5.0
p,p'-DDE	1.4	7.0
o,p'- + p,p'-DDD	3.5	9.0
Chlordane	4.5	9.0
Dieldrinf	2.8	7.0
Endrinf	2.7	60
Lindane	0.9	1.4
Total PCBs	34	280
Total petroleum hydrocarbons (TPHs)[g]	280 (mg/kg dry weight)	550 (mg/kg dry weight)

G5.0 References

ANZECC. (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Australia and New Zealand Environment and Conservation Council.

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NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM].* Australian Government Publishing Services Canberra: National Environment Protection Council.

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NHMRC, NRMMC. (2016). *Australian Drinking Water Guidelines 6 2011, Version 3.2.* Canberra: National Health and Medical Research Council, National Resource Management Ministerial Council.

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Appendix H

Summary Tables

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Table H1: Summary of Soil Laboratory Results – Metals, TRH, BTEX, PAH, Phenol, OCP, PCB, Asbestos, TBT, CN

			Metals																	
			Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	Manganese	Antimony	Barium	Beryllium	Boron	Cobalt	Molybdenum	Selenium (Total)	Tin (inorganic, SnIV)
		PQL	4	0.4	1	1	1	0.1	1	1	1	7	1	1	3	1	1	2	1
Sample ID	Depth	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1	0.05 m	12/03/2021	10	4.4	67	1800	270	0.5	40	880	140	<7	100	<1	6	5	7	<2	32
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
1	0.75 m	12/03/2021	<4	<0.4	3	2	3	<0.1	1	3	<1	<7	5	<1	<3	<1	1	<2	<1
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
2	0.05 m	12/03/2021	15	2	20	1400	980	5.3	9	900	120	<7	220	<1	<3	3	3	<2	61
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
2	1 m	12/03/2021	9	<0.4	3	2	6	<0.1	<1	15	<1	<7	2	<1	<3	<1	21	<2	<1
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
3	0.4 m	11/03/2021	51	1	130	1700	680	1.2	61	540	140	<7	97	<1	20	4	9	<4	110
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
3	0.7 m	11/03/2021	<4	<0.4	1	74	27	<0.1	<1	18	2	<7	2	<1	<3	<1	<1	<2	1
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
4	0.15 m	11/03/2021	6	<0.4	4	120	180	0.4	1	55	9	<7	94	<1	<3	<1	5	<2	4
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
4	1 m	11/03/2021	6	0.6	5	120	200	0.4	2	190	3	<7	34	<1	<3	<1	6	<2	2
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
5	0.05 m	12/03/2021	5	0.9	28	25000	120	0.5	24	8100	480	<7	79	<1	8	5	2	<8	38
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
5	0.3 m	12/03/2021	<4	<0.4	<1	40	3	<0.1	<1	34	<1	<7	3	<1	<3	<1	<1	<2	<1
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
6	0.05 m	12/03/2021	5	0.5	17	440	44	<0.1	11	180	130	<7	49	<1	<3	3	2	<2	6
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
6	0.5 m	12/03/2021	<4	<0.4	1	2	2	<0.1	<1	4	<1	<7	2	<1	<3	<1	<1	<2	<1
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
14	0.1 m	12/03/2021	<4	<0.4	3	120	120	<0.1	1	62	9	<7	13	<1	<3	<1	2	<2	3
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
14/FCA	0 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
14/FCB	0 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
15	0.1 m	12/03/2021	<4	1	14	440	130	0.2	6	290	38	10	30	<1	<3	<1	4	<2	12
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
21/0.05	0.05 m	13/04/2021	6	<0.4	14	280	23	<0.1	6	79	-	-	-	-	-	-	-	-	-
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -
21/0.9	0.9 m	13/04/2021	4	1	13	790	110	0.2	10	350	-	-	-	-	-	-	-	-	-
			300 100	90 -	300 240	17000 110	600 1100	80 -	1200 35	30000 310	19000 -	- -	- -	90 -	20000 -	300 -	- -	700 -	- -

Lab result	
HIL/HSL value	EIL/ESL value

HIL/HSL exceedance EIL/ESL exceedance HIL/HSL and EIL/ESL exceedance ML exceedance ML and HIL/HSL or EIL/ESL exceedance

Indicates that asbestos has been detected by the lab, refer to the lab report **Blue** = DC exceedance HSL 0-<1 Exceedance

Bold = Lab detections - = Not tested or No HIL/HSL/EIL/ESL (as applicable) or Not applicable NL = Non limiting AD = Asbestos detected NAD = No Asbestos detected

HIL = Health investigation level HSL = Health screening level (excluding DC) EIL = Ecological investigation level ESL = Ecological screening level ML = Management Limit DC = Direct Contact HSL

Notes:

a QA/QC replicate of sample listed directly below the primary sample

b Reported naphthalene laboratory result obtained from BTEXN suite

c Criteria applies to DDT only

Site Assessment Criteria (SAC):

Refer to the SAC section of report for information of SAC sources and rationale. Summary information as follows:

SAC based on generic land use thresholds for Recreational C including public open space

HIL C	Recreational / Open Space (NEPC, 2013)
HSL C	Recreational / Open Space (vapour intrusion) (NEPC, 2013)
DC HSL C	Direct contact HSL C Recreational /Open space (direct contact) (CRC CARE, 2011)
EIL/ESL UR/POS	Urban Residential and Public Open Space (NEPC, 2013)
ML R/P/POS	Residential, Parkland and Public Open Space (NEPC, 2013)

Table H1: Summary of Soil Laboratory Results – Metals, TRH, BTEX, PAH, Phenol, OCP, PCB, Asbestos, TBT, CN

			TRH						BTEX				PAH					Phenol
			TRH C6 - C10	TRH >C10-C16	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene [b]	Naphthalene [b]	Benzo(a)pyrene (BaP)	Benzo(a)pyrene TEQ	Total PAHs	Phenol
		PQL	25	50	25	50	100	100	0.2	0.5	1	1	1	1	0.05	0.5	0.05	5
Sample ID	Depth	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/l	mg/kg	mg/kg	mg/kg	mg/kg
1	0.05 m	12/03/2021	<25	320	<25	320	Blue	3800	<0.2	<0.5	<1	<1	<1	-	0.06	<0.5	0.6	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
1	0.75 m	12/03/2021	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	<0.05	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
2	0.05 m	12/03/2021	<25	75	<25	75	980	700	<0.2	<0.5	<1	<1	<1	-	0.2	<0.5	1.8	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
2	1 m	12/03/2021	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	<0.05	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
3	0.4 m	11/03/2021	<25	<50	<25	<50	780	480	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	0.1	<5
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
3	0.7 m	11/03/2021	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	<0.05	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
4	0.15 m	11/03/2021	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	<0.05	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
4	1 m	11/03/2021	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	0.1	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
5	0.05 m	12/03/2021	<25	220	<25	220	2100	800	<0.2	<0.5	<1	<1	<1	-	0.2	<0.5	3.2	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
5	0.3 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
6	0.05 m	12/03/2021	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	<0.05	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
6	0.5 m	12/03/2021	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	<0.05	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
14	0.1 m	12/03/2021	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	<0.05	<5
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
14/FCA	0 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
14/FCB	0 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
15	0.1 m	12/03/2021	<25	290	<25	290	Blue	4500	<0.2	<0.5	<1	<1	<1	-	<0.5	<5	<0.5	<5
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
21/0.05	0.05 m	13/04/2021	<25	<50	<25	<50	140	<100	<0.2	<0.5	<1	<1	<1	-	0.09	<0.5	0.74	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -
21/0.9	0.9 m	13/04/2021	<25	<50	<25	<50	330	<100	<0.2	<0.5	<1	<1	<1	-	0.07	<0.5	0.3	-
			- -	- 120	NL 180	NL -	- 300	- 2800	NL 50	NL 85	NL 70	NL 105	NL 170	NL 170	- 0.7	3 -	300 -	120 -

Lab result	
HIL/HSL value	EIL/ESL value

HIL/HSL exceedance EIL/ESL exceedance HIL/HSL and EIL/ESL exceedance ML exceedance ML and HIL/HSL or EIL/ESL exceedance

Indicates that asbestos has been detected by the lab, refer to the lab report **Blue** = DC exceedance HSL 0-<1 Exceedance

Bold = Lab detections - = Not tested or No HIL/HSL/EIL/ESL (as applicable) or Not applicable NL = Non limiting AD = Asbestos detected NAD = No Asbestos detected

HIL = Health investigation level HSL = Health screening level (excluding DC) EIL = Ecological investigation level ESL = Ecological screening level ML = Management Limit DC = Direct Contact HSL

Notes:

a QA/QC replicate of sample listed directly below the primary sample

b Reported naphthalene laboratory result obtained from BTEXN suite

c Criteria applies to DDT only

Site Assessment Criteria (SAC):

Refer to the SAC section of report for information of SAC sources and rationale. Summary information as follows:

SAC based on generic land use thresholds for Recreational C including public open space

HIL C	Recreational / Open Space (NEPC, 2013)
HSL C	Recreational / Open Space (vapour intrusion) (NEPC, 2013)
DC HSL C	Direct contact HSL C Recreational /Open space (direct contact) (CRC CARE, 2011)
EIL/ESL UR/POS	Urban Residential and Public Open Space (NEPC, 2013)
ML R/P/POS	Residential, Parkland and Public Open Space (NEPC, 2013)

Table H1: Summary of Soil Laboratory Results – Metals, TRH, BTEX, PAH, Phenol, OCP, PCB, Asbestos, TBT, CN

			OCP												PCB	Asbestos	Asbestos	Cyanide	Tributyltin	TOC
			DDD	DDT+DDE+DDD [c]	DDE	DDT	Aldrin & Dieldrin	Total Chlordane	Endrin	Total Endosulfan	Heptachlor	Hexachlorobenzene	Methoxychlor	Total PCB	Asbestos Summary	Asbestos (500 ml)	Cyanide (total)	Tributyltin	Total Organic Carbon
		PQL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		0.001	0.5	0.5	1000
Sample ID	Depth	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	-	-	mg/kg	µg/kg	mg/kg
1	0.05 m	12/03/2021	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	NAD	<0.5	450	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
1	0.75 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
2	0.05 m	12/03/2021	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	NAD	<0.5	960	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
2	1 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
3	0.4 m	11/03/2021	0.3	1	<0.1	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	-	NAD	-	5400	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
3	0.7 m	11/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
4	0.15 m	11/03/2021	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	NAD	-	<5.7	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
4	1 m	11/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
5	0.05 m	12/03/2021	0.3	1.8	0.7	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	<0.5	10000	67000
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
5	0.3 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.9	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
6	0.05 m	12/03/2021	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	NAD	<0.5	0.05	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
6	0.5 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
14	0.1 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD	-	22	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
14/FCA	0 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	NAD	-	-	-	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
14/FCB	0 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	AD (ACM)	-	-	-	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
15	0.1 m	12/03/2021	0.2	0.4	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	-	NAD	-	-	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
21/0.05	0.05 m	13/04/2021	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	NAD	-	20	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -
21/0.9	0.9 m	13/04/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			- -	400 180	- -	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	1 -			240 -	- -	- -

Lab result	
HIL/HSL value	EIL/ESL value

HIL/HSL exceedance EIL/ESL exceedance HIL/HSL and EIL/ESL exceedance ML exceedance ML and HIL/HSL or EIL/ESL exceedance

Indicates that asbestos has been detected by the lab, refer to the lab report **Blue** = DC exceedance HSL 0-<1 Exceedance

Bold = Lab detections - = Not tested or No HIL/HSL/EIL/ESL (as applicable) or Not applicable NL = Non limiting AD = Asbestos detected NAD = No Asbestos detected

HIL = Health investigation level HSL = Health screening level (excluding DC) EIL = Ecological investigation level ESL = Ecological screening level ML = Management Limit DC = Direct Contact HSL

Notes:

a QA/QC replicate of sample listed directly below the primary sample

b Reported naphthalene laboratory result obtained from BTEXN suite

c Criteria applies to DDT only

Site Assessment Criteria (SAC):

Refer to the SAC section of report for information of SAC so Refer to the SAC section of report for information of SAC sources and rationale. Summary information as follows:

SAC based on generic land use thresholds for Recreational C including public open space

HIL C	Recreational / Open Space (NEPC, 2013)
HSL C	Recreational / Open Space (vapour intrusion) (NEPC, 2013)
DC HSL C	Direct contact HSL C Recreational /Open space (direct contact) (CRC CARE, 2011)
EIL/ESL UR/POS	Urban Residential and Public Open Space (NEPC, 2013)
ML R/P/POS	Residential, Parkland and Public Open Space (NEPC, 2013)

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Table H2: Summary of Sediment Laboratory Results – Metals, TRH, BTEX, PAH, Phenol, CN, TBT, TOC

			Metals																	
			Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	Manganese	Antimony	Barium	Beryllium	Boron	Cobalt	Molybdenum	Selenium (Total)	Tin (inorganic, SnIV)
		PQL	4	0.4	1	1	1	0.1	1	1	1	7	1	1	3	1	1	2	1
Sample ID	Depth	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
7	0.65 m	12/03/2021	18	<0.4	5	270	56	<0.1	4	52	6	<7	5	<1	<3	1	16	<2	1
			20 70	1.5 10	80 370	65 270	50 220	0.15 1	21 52	200 410	- -	2 25	- -	- -	- -	- -	- -	- -	- -
8	2.1 m	12/03/2021	7	<0.4	11	320	22	0.2	5	94	36	<7	18	<1	20	1	2	<2	3
			20 70	1.5 10	80 370	65 270	50 220	0.15 1	21 52	200 410	- -	2 25	- -	- -	- -	- -	- -	- -	- -
9	2.1 m	12/03/2021	8	0.9	12	240	39	0.2	4	120	40	<7	33	<1	20	2	2	<2	9
			20 70	1.5 10	80 370	65 270	50 220	0.15 1	21 52	200 410	- -	2 25	- -	- -	- -	- -	- -	- -	- -
10	3.7 m	12/03/2021	<4	<0.4	3	8	4	<0.1	1	13	17	<7	3	<1	7	<1	<1	<2	<1
			20 70	1.5 10	80 370	65 270	50 220	0.15 1	21 52	200 410	- -	2 25	- -	- -	- -	- -	- -	- -	- -
11	2.7 m	12/03/2021	<4	<0.4	2	3	3	<0.1	<1	7	15	<7	2	<1	4	<1	<1	<2	<1
			20 70	1.5 10	80 370	65 270	50 220	0.15 1	21 52	200 410	- -	2 25	- -	- -	- -	- -	- -	- -	- -
12	0.4 m	12/03/2021	14	0.6	15	2600	1900	15	9	1800	30	<7	17	<1	10	3	5	<2	110
			20 70	1.5 10	80 370	65 270	50 220	0.15 1	21 52	200 410	- -	2 25	- -	- -	- -	- -	- -	- -	- -
13	2.5 m	12/03/2021	<4	<0.4	7	50	13	<0.1	2	32	20	<7	7	<1	10	<1	<1	<2	1
			20 70	1.5 10	80 370	65 270	50 220	0.15 1	21 52	200 410	- -	2 25	- -	- -	- -	- -	- -	- -	- -

Lab result	
SQGV	SQGV-high

SQGV-high exceedance SQGV exceedance

Notes:

a QA/QC replicate of sample listed directly below the primary sample

- = Not tested

Site Assessment Criteria (SAC):

Refer to the SAC section of report for information of SAC sources and rationale. Summary information as follows:

Sediment Assessment Criteria based on CSIRO (2016)

Table H2: Summary of Sediment Laboratory Results – Metals, TRH, BTEX, PAH, Phenol, CN, TBT, TOC

			TRH							BTEX				PAH				
			TRH C6 - C10	TRH >C10-C16	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Total +ve TRH (C10- C40)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene [b]	Naphthalene [b]	Benzo(a)pyrene (BaP)	Benzo(a)pyrene TEQ	Total PAHs
		PQL	25	50	25	50	100	100	50	0.2	0.5	1	1	1	1	0.05	0.5	0.05
Sample ID	Depth	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/l	mg/kg	mg/kg	mg/kg
7	0.65 m	12/03/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			- -	- -	- -	- -	- -	- -	280 550	- -	- -	- -	- -	- -	- -	- -	- -	10000 50000
8	2.1 m	12/03/2021	<25	<50	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	<0.05
			- -	- -	- -	- -	- -	- -	280 550	- -	- -	- -	- -	- -	- -	- -	- -	10000 50000
9	2.1 m	12/03/2021	<25	<50	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	<0.05
			- -	- -	- -	- -	- -	- -	280 550	- -	- -	- -	- -	- -	- -	- -	- -	10000 50000
10	3.7 m	12/03/2021	<25	<50	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	<0.05
			- -	- -	- -	- -	- -	- -	280 550	- -	- -	- -	- -	- -	- -	- -	- -	10000 50000
11	2.7 m	12/03/2021	<25	<50	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	<0.05
			- -	- -	- -	- -	- -	- -	280 550	- -	- -	- -	- -	- -	- -	- -	- -	10000 50000
12	0.4 m	12/03/2021	<25	<50	<25	<50	280	150	430	<0.2	<0.5	<1	<1	<1	-	0.2	<0.5	2.5
			- -	- -	- -	- -	- -	- -	280 550	- -	- -	- -	- -	- -	- -	- -	- -	10000 50000
13	2.5 m	12/03/2021	<25	<50	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	<1	-	<0.05	<0.5	<0.05
			- -	- -	- -	- -	- -	- -	280 550	- -	- -	- -	- -	- -	- -	- -	- -	10000 50000

Lab result	
SQGV	SQGV-high

SQGV-high exceedance SQGV exceedance

Notes:

a QA/QC replicate of sample listed directly below the primary sample

- = Not tested

Site Assessment Criteria (SAC):

Refer to the SAC section of report for information of SAC sources and rationale. Summary information as follows:

Sediment Assessment Criteria based on CSIRO (2016)

Table H2: Summary of Sediment Laboratory Results – Metals, TRH, BTEX, F

			Phenol	Cyanide	Tributyltin	TOC
			Total Phenolics	Total Cyanide	Tributyltin	Total Organic Carbon
		PQL	5	0.5	0.5	1000
Sample ID	Depth	Sample Date	mg/kg	mg/kg	µg/kg	mg/kg
7	0.65 m	12/03/2021	-	<0.5	16	7700
			- -	- -	9 70	- -
8	2.1 m	12/03/2021	<5	<0.5	160	11000
			- -	- -	9 70	- -
9	2.1 m	12/03/2021	<5	<0.5	110	13000
			- -	- -	9 70	- -
10	3.7 m	12/03/2021	<5	<0.5	<0.5	-
			- -	- -	9 70	- -
11	2.7 m	12/03/2021	<5	-	<0.5	-
			- -	- -	9 70	- -
12	0.4 m	12/03/2021	<5	<0.5	20000	11000
			- -	- -	9 70	- -
13	2.5 m	12/03/2021	<5	-	38	11000
			- -	- -	9 70	- -

Lab result	
SQGV	SQGV-high

SQGV-high exceedance SQGV exceedance

Notes:

a QA/QC replicate of sample listed directly below the primary sample

- = Not tested

Site Assessment Criteria (SAC):

Refer to the SAC section of report for information of SAC sources and rationale. Summary information as follows:

Sediment Assessment Criteria based on CSIRO (2016)

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Geotechnics / Environment / Groundwater

Table H3 : Summary of Groundwater Laboratory Results – Metals, TRH, BTEX, PAH, Phenols, CN, TBT

	Sample ID*			MW3	MW4	MW6	MW3	MW4	MW6	NHMRC (2008) Recreation	ANZG (2018) 95% LOP Marine	NEPC (2013) HSL 2-4m
	Sample Date			24/03/2021	24/03/2021	24/03/2021	14/04/2021	14/04/2021	14/04/2021			
		PQL	Units									
METALS	Arsenic-Dissolved	1	µg/l	19	4	7	3	4	11	100		
	Cadmium-Dissolved	0.1	µg/l	0.1	0.1	0.2	0.2	0.7	<0.1	20	5.5	
	Chromium-Dissolved	1	µg/l	3	3	1	<1	2	3		27.4	
	Copper-Dissolved	1	µg/l	200	150	58	18	40	11	20000	1.3	
	Lead-Dissolved	1	µg/l	43	35	3	6	20	4	100	4.4	
	Mercury-Dissolved	0.05	µg/l	0.14	0.16	0.14	<0.05	0.08	0.06	10	0.1	
	Nickel-Dissolved	1	µg/l	10	6	42	<1	5	2	200	70	
	Zinc-Dissolved	1	µg/l	71	120	100	50	430	81		15	
	Boron-Dissolved	20	µg/l	100	100	30	2800	520	100	4000		
	Barium-Dissolved	1	µg/l	4	26	6	18	190	17	700		
	Beryllium-Dissolved	0.5	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			
	Cobalt-Dissolved	1	µg/l	<1	<1	<1	<1	2	<1		1	
	Manganese-Dissolved	5	µg/l	8	14	<5	7	100	13	500		
	Molybdenum-Dissolved	1	µg/l	23	37	11	8	23	16	50		
	Antimony-Dissolved	1	µg/l	6	5	1	<1	3	<1	3		
	Selenium-Dissolved	1	µg/l	<1	<1	<1	<1	<1	<1			
	Tin-Dissolved	1	µg/l	<1	<1	<1	<1	3	<1			
TRH	F1 ((C6-C10)-BTEX)	10	µg/l	<10	<10	<10	-	-	-			NL
	F2 (>C10-C16 less Naphthalene)	50	µg/l	<50	<50	<50	-	-	-			NL
	F3 (>C16-C34)	100	µg/l	<100	<100	250	-	-	-			
	F4 (>C34-C40)	100	µg/l	<100	<100	<100	-	-	-			
BTEX	Benzene	1	µg/l	<1	<1	<1	-	-	-	10	700	NL
	Toluene	1	µg/l	<1	<1	<1	-	-	-	8000	180	NL
	Ethylbenzene	1	µg/l	<1	<1	<1	-	-	-	3000	5	
	o-Xylene	1	µg/l	<1	<1	<1	-	-	-		350	
	m+p-Xylene	2	µg/l	<2	<2	<2	-	-	-			
	Total Xylenes	1	µg/l	<1	<1	<1	-	-	-	6000		
	MTBE	1	µg/l	<1	<1	<1	-	-	-			NL
PAH	Acenaphthene	0.1	µg/l	<0.1	<0.1	<0.1	-	-	-			
	Acenaphthylene	0.1	µg/l	<0.1	<0.1	<0.1	-	-	-			
	Benzo(a)anthracene	0.1	µg/l	<0.1	<0.1	<0.1	-	-	-			
	Naphthalene	1	µg/l	<1	<1	<1	-	-	-		70	NL
	Benzo(a)pyrene (BaP)	0.1	µg/l	<0.1	<0.1	<0.1	-	-	-	0.1	0.1	
	Benzo(b,j+k)fluoranthene	0.2	µg/l	<0.2	<0.2	<0.2	-	-	-			
	Benzo(g,h,i)perylene	0.1	µg/l	<0.1	<0.1	<0.1	-	-	-			
	Chrysene	0.1	µg/l	<0.1	<0.1	<0.1	-	-	-			
	Dibenzo(a,h)anthracene	0.1	µg/l	<0.1	<0.1	<0.1	-	-	-			
	Fluoranthene	0.1	µg/l	<0.1	<0.1	<0.1	-	-	-		1	
	Fluorene	0.1	µg/l	<0.1	<0.1	<0.1	-	-	-			
	Indeno(1,2,3-c,d)pyrene	0.1	µg/l	<0.1	<0.1	<0.1	-	-	-			
	Phenanthrene	0.1	µg/l	<0.1	<0.1	<0.1	-	-	-		0.6	
	Pyrene	0.1	µg/l	<0.1	<0.1	<0.1	-	-	-			
Phenolics	Total Phenolics	0.05	µg/l	<0.05	<0.05	<0.05	-	-	-		400	
CN	Total Cyanide	4	µg/l	-	-	-	<4	<4	<4			
TBT	Tributyltin	0.002	µg/l	-	-	-	0.056	0.006	<0.002		0.006	

Notes:

*	QA/QC replicate of sample listed directly after the primary sample
PQL	Practical quantitation limit
-	No criterion / not defined / not tested / not applicable
	Shaded cell is exceedance of NHMRC (2008) Recreation Guideline value
	Shaded cell is exceedance of ANZG (2018) 95% LOP Marine guideline value

Where one or more guideline value is exceeded, the cell is shaded to the colour of the highest guideline value exceeded

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 95% level of protection of species for Marine aquatic ecosystems [NB: 99% level of protection adopted for bioaccumulative chemicals]

NHMRC (2008) Guidelines for Managing Risk in Recreational Water

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, orange text is 'unknown' level of protection

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 95% level of protection of species for Marine aquatic ecosystems [NB: 99% level of protection adopted for bioaccumulative chemicals]

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, orange text is 'unknown' level of protection

NHMRC (2008) Guidelines for Managing Risk in Recreational Water

Table H4 - Laboratory Summary Table (Acid Sulfate Soil Assessment)

	Screening Test (as reported by the laboratory)					S_{CR} Full Suite						
Sample ID (Bore/Depth)	Strata / Soil Texture	pH_F	pH_{FOX}	pH_F - pH_{FOX}	Strength of Reaction	pH_{KCL}	S_{KCL}	S_{CR}	S_{NAS}	Titratable Actual Acidity (TAA)	Acid Neutralising Capacity (ANC)	Sum of Existing and Potential Acidity
		pH units				pH units	% w/w S					% w/w S
1/0.3	Sand, pale grey / Coarse	5.8	3.3	2.5	1F	5.3	<0.005	<0.005	NT	<0.01	NT	<0.005
1/0.75	Sand, grey brown / Coarse	5.2	3.3	1.9	1	-	-	-	-	-	-	-
1/1.1	Sand, grey brown / Coarse	4.9	2.9	2.0	1	4.7	0.026	0.09	NT	0.01	NT	0.1
1/1.6	Sand, grey brown / Coarse	3.6	2.9	0.7	4	-	-	-	-	-	-	-
1/2.0	Sand, pale grey / Coarse	3.5	2.5	1.0	4	-	-	-	-	-	-	-
1/2.6	Sand, pale grey / Coarse	3.2	2.4	0.8	2	5	0.015	0.12	NT	<0.01	NT	0.13
2/0.3	Sand, pale grey / Coarse	4.6	2.9	1.7	1F	-	-	-	-	-	-	-
2/0.5	Sand, pale grey / Coarse	4.6	3.2	1.4	1	-	-	-	-	-	-	-
2/1.0	Sand, grey brown / Coarse	5.2	3.4	1.8	1	-	-	-	-	-	-	-
2/1.2	Sand, grey brown / Coarse	5.1	2.5	2.6	1	-	-	-	-	-	-	-
2/1.5	Sand, grey brown / Coarse	4.6	2.3	2.3	1	-	-	-	-	-	-	-
2/2.0	Sand, grey brown / Coarse	4.5	2.4	2.1	4	-	-	-	-	-	-	-
2/2.5	Sand, grey brown / Coarse	4.5	2.6	1.9	4	-	-	-	-	-	-	-
4/0.6	Silty Sand, dark brown / Coarse	6.4	5.4	1.0	1F	-	-	-	-	-	-	-
4/1.0	Silty Sand, dark brown / Coarse	6.3	2.5	3.8	1	6.7	0.019	0.28	NT	<0.01	0.08	0.28
4/1.5	Silty Sand, dark brown / Coarse	6.2	2.9	3.3	1	-	-	-	-	-	-	-
4/2.0	Sand, grey brown / Coarse	3.6	2.7	0.9	4	-	-	-	-	-	-	-
4/2.5	Sand, grey brown / Coarse	3.3	2.4	0.9	3	-	-	-	-	-	-	-
4/3.0	Sand, grey brown / Coarse	3.5	2.6	0.9	2	-	-	-	-	-	-	-
4/3.5	Sand, grey brown / Coarse	3.6	2.7	0.9	2	-	-	-	-	-	-	-
4/4.0	Sand, grey brown / Coarse	4.0	2.7	1.3	2	-	-	-	-	-	-	-
6/0.5	Sand, pale grey / Coarse	5.0	3.2	1.8	1F	-	-	-	-	-	-	-
6/0.8	Sand, grey brown / Coarse	4.4	2.9	1.5	1	-	-	-	-	-	-	-
6/1.0	Sand, grey brown / Coarse	4.7	3.2	1.5	1	-	-	-	-	-	-	-
6/1.5	Sand, grey brown / Coarse	4.4	2.8	1.6	1	-	-	-	-	-	-	-
6/2.0	Sand, grey brown / Coarse	3.7	2.5	1.2	2	-	-	-	-	-	-	-
6/2.5	Sand, orange brown (coffee rock)	4.7	2.4	2.3	2	-	-	-	-	-	-	-
6/3.0	Sand, grey brown / Coarse	3.9	3.0	0.9	4	-	-	-	-	-	-	-
6/3.5	Sand, pale grey / Coarse	3.7	3.1	0.6	2	-	-	-	-	-	-	-
6/4.1	Sand, pale grey / Coarse	3.5	2.6	0.9	4	-	-	-	-	-	-	-
8/2.1	Silty Sand, dark grey / Coarse	6.8	4.6	2.2	2	8.5	0.056	0.07	NT	<0.01	0.14	0.067
9/2.1	Silty Sand with clay, dark grey / Coarse	6.9	5.1	1.8	2	-	-	-	-	-	-	-
9/2.4	Silty Sand with clay, dark grey (some shells) / Medium	7.2	4.1	3.1	2	8.5	0.055	0.33	NT	<0.01	0.13	0.33
10/3.7	Sand, light brown grey / Coarse	7.3	5.7	1.6	2	-	-	-	-	-	-	-
Action Criteria (Sullivan et al 2018)												
Screening Levels		≤4	<3.5	>1	-	-	-	-	-	-	-	-
Action Criteria (<1000 t) (Coarse texture - sands to loamy sands)		-	-	-	-	-	-	-	-	-	-	0.03
Action Criteria (<1000 t) (Medium texture - sandy loams to light clays)		-	-	-	-	-	-	-	-	-	-	0.06
Action Criteria (<1000 t) (Fine texture - medium to heavy clays and silty clays)		-	-	-	-	-	-	-	-	-	-	0.1

Notes:

pH_F	non-oxidised pH (soil in distilled water) measures existing acidity
pH_{FOX}	oxidised pH (soil oxidised in hydrogen peroxide) measures potential acidity
pH_F - pH_{FOX}	change in pH - the greater the difference from pH_F to pHfox, the more likely of the soil being PASS
Strength of Reaction	chemical reaction may include colour change, effervescence (bubbling), gas evolution, heat and pungent/irritating odour (sulfur dioxide/hydrogen sulfide)
1	no or slight reaction
2	moderate reaction
3	vigorous reaction
4	high reaction
F	bubbling/frothy reaction indicative of organics
	exceeds screening criteria
	exceeds action criteria

Appendix I

Borehole Logs and

Notes

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: 1.04 AHD
COORDINATE **E:**347926.08 **N:** 6292904.85
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 1
PROJECT No: 202478.00
DATE: 12/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
0.75 m depth, 12/03/21	1	0.0	FILL/ Silty SAND; brown; poorly graded, trace rootlets, trace brick, trace concrete, trace rubber at ground surface		FILL		D		E		0.05	PID	<1
		0.1	(SW) SAND; pale grey; medium; well graded, trace organics				M		E		0.3	PID	<1
			0.75m: wet 0.8m: grey brown, trace silt 0.9m: possible slight hyrdocarbon odour						E		0.75	PID	<1
	0	1			ALV				E		1.0	PID	<1
												PID	<1
							W		E		1.6	PID	<1
	-1	2	2.0m: pale grey						E		2.0	PID	<1
									E		2.6	PID	<1
		2.7	Borehole discontinued at 2.70m depth Limit of investigation										
	-2	3									3		
	-3	4									4		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: TOYOTA 4WD
METHOD: 60mm diameter Dynamic Continuous Push Tube Sampling
REMARKS:

OPERATOR: MJH
CASING:

LOGGED: MJH

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: 1.03 AHD
COORDINATE **E:**347935.79 **N:** 6292906.22
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 2
PROJECT No: 202478.00
DATE: 12/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
0.85 m depth, 12/03/21	1	0.0	FILL/ Silty SAND; brown; poorly graded, trace rootlets, trace brick, trace concrete		FILL		D		E		0.05	PID	<1
		0.1	(SW) SAND; pale grey; medium; well graded, trace organics						E		0.3	PID	<1
							M		E		0.5	PID	<1
			0.9m: wet										
	0	1	1.0m: brown grey, hydrocarbon odour noted						E		1.0	PID	<1
									E		1.2	PID	<1
			1.4m: no hydrocarbon odour		ALV								
									E		1.5	PID	<1
							W						
	-1	2							E		2.0	PID	<1
		2.7	Borehole discontinued at 2.70m depth Limit of investigation						E		2.5	PID	<1
	-2	3									3		
	-3	4									4		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: TOYOTA 4WD
METHOD: 60mm diameter Dynamic Continuous Push Tube Sampling
REMARKS:

OPERATOR: MJH
CASING:

LOGGED: MJH

EXPORTED 09/06/21 11:38. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: 1.02 AHD
COORDINATE **E:**347933.35 **N:** 6292911.92
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 3
PROJECT No: 202478.00
DATE: 11/03/21
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	TESTING AND REMARKS: RESULTS AND REMARKS	BACKFILL / WELL PIPE
0.75 m depth, 11/03/21	1	0.0	Timber sleeper											Bentonite/concrete Cap; 50 mm Plain Cap
		0.08	Void											
		0.3	FILL/ SAND, trace silt; brown and grey; fine to medium; inclusions of timber, plastic (bottle and tape), wood organics (oil staining)		FILL		M to W		E		0.4	PID	<1	
	0	0.6	(SW) SAND; grey; fine to medium; , well graded						E		0.7	PID	<1	Gravel; 50 mm Slotted
			0.75m: wet											
		0.9												
		1			ALV		W		E		1.0	PID	<1	
									E		1.5	PID	<1	
		1.6	Borehole discontinued at 1.60m depth Collapsing conditions											
	-1	2									2			
	-2	3									3			
	-3	4									4			

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 100mm diameter Hand Auger
REMARKS: Surface staining observed (oil)

OPERATOR: BJK
CASING:

LOGGED: BJK

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BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: 1.09 AHD
COORDINATE **E:**347929.17 **N:** 6292915.88
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 4
PROJECT No: 202478.00
DATE: 11/03/21
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	TESTING AND REMARKS: RESULTS AND REMARKS	BACKFILL / WELL PIPE
0.8 m depth, 11/03/21	1	0.0	Concrete slab											
		0.1	FILL/ SAND, with silt; grey; fine; trace plastic, blue nylon rope		FILL		D to M		E		0.15	PID	3	Bentonite seal / Gravel / 50 mm PlainCap
		0.4	Concrete slab; <20mm (no steel reinforcement)											
		0.55	(SM) Silty SAND; dark brown; medium; trace organics						E		0.6	PID	4	
	0		0.8m: hydrocarbon odour		ALV		W		E		1.0	PID	50	50 mm Slotted
									E		1.5	PID	22	
		1.8	(SW) SAND; grey brown; medium to coarse 1.8-2.0m: no hyrdocarbon odour apparent						E		2.0	PID	2	
	-1								E		2.5	PID	2	
			2.8m: gre		ALV		W		E		3.0	PID	2	
	-2								E		3.5	PID	1	
		4.0	Borehole discontinued at 4.00m depth Limit of investigation						E		4.0	PID	1	
	-3													

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: TOYOTA 4WD
OPERATOR: MJH
LOGGED: MJH

METHOD: 60mm diameter Dynamic Continuous Push Tube Sampling
CASING:

REMARKS: Steel object (possible tank) on south-east side of borehole

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BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: .91 AHD
COORDINATE **E:**347924.32 **N:** 6292922.56
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 5
PROJECT No: 202478.00
DATE: 12/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
0.8 m depth, 12/03/21	0.0 / 0.1	FILL/ Silty SAND; brown; poorly graded, trace paint fragments, trace metal at ground surface		FILL		D		E		0.05	PID	<1
		(SW) SAND; pale grey; medium; well graded, trace organics						E		0.3	PID	<1
		0.6m: grey, with silt, wet						E		0.8	PID	<1
				ALV		W		E		1.2	PID	<1
											PID	<1
								E		2.0	PID	<1
		2.35m: pale brown										
	2.7							E		2.6	PID	<1
		Borehole discontinued at 2.70m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: TOYOTA 4WD
METHOD: 60mm diameter Dynamic Continuous Push Tube Sampling
REMARKS:

OPERATOR: MJH
CASING:

LOGGED: MJH

EXPORTED 09/06/21 11:38. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: 1.21 AHD
COORDINATE E:347922.2 **N:** 6292912.09
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 6
PROJECT No: 202478.00
DATE: 11/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE			TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL / WELL PIPE
0.8 m depth, 11/03/21	1.2	0.0	FILL/ Silty SAND; brown; poorly graded, trace rootlets, trace concrete, brick, plastic at ground surface		FILL		D		E		0.05	PID	<1	Concrete
	1	0.1	(SW) SAND; pale grey; medium; well graded, trace organics				M		E		0.5	PID	<1	Gravel
			0.8m: brown, with silt, wet						E		0.8	PID	<1	Stick Up a50 mm Plain
	0	1							E		1.0	PID	<1	50 mm Slotted
									E		1.5	PID	<1	
	-1	2			ALV				E		2.0	PID	<1	
			2.2-2.8m: orange brown (coffee rock)				D		E		2.5	PID	<1	
	-2	3							E		3.0	PID	<1	
			3.2m: pale grey						E		3.5	PID	<1	
	-3	4							E		4.1	PID	<1	
		4.2	Borehole discontinued at 4.20m depth Limit of investigation											

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: TOYOTA 4WD
METHOD: 60mm diameter Dynamic Continuous Push Tube Sampling
REMARKS:

OPERATOR: MJH
CASING:

LOGGED: MJH

EXPORTED 09/06/21 11:38. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: .8 AHD
COORDINATE **E:**347937.35 **N:** 6292916.28
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 7
PROJECT No: 202478.00
DATE: 12/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.0	Water - top of sediment 0.65m; (Sediment Sample)										
0.6 m depth, 12/03/21	0.65	(SM) SAND; grey; medium; trace organics, trace silt		ALV		W		E		0.65	PID	<1
	0.8	Borehole discontinued at 0.80m depth Limit of investigation						E		0.8	PID	<1

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 100mm diameter Hand Auger
REMARKS: Water 0.60m below floor level

OPERATOR: MJH
CASING:

LOGGED: MJH

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: .98 AHD
COORDINATE **E:**347946.59 **N:** 6292915.04
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 8
PROJECT No: 202478.00
DATE: 11/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.0	Water (Sediment Sample)										
	2.0	(SM) Silty SAND, trace gravel; dark grey; fine to medium; with shells, trace organics, (sediment)		EST		W		E	2.1	2.1	PID	<1
	2.4	Borehole discontinued at 2.40m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 100mm diameter Hand Auger
REMARKS: Water 0.60m below Jetty

OPERATOR: MJH
CASING:

LOGGED: MJH

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: .95 AHD
COORDINATE **E:**347940.72 **N:** 6292924.35
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 9
PROJECT No: 202478.00
DATE: 11/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.0	Water (Sediment Sample)										
	2.0	(SM) Silty SAND, with clay; dark grey; fine to medium; with trace shells, organics, (sediment) 2.3m: some shells		EST		W		E		2.1	PID	<1
	2.4	Borehole discontinued at 2.40m depth Limit of investigation						E		2.4	PID	<1

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 100mm diameter Hand Auger
REMARKS: Water 0.55m below Jetty

OPERATOR: MJH
CASING:

LOGGED: MJH

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: .95 AHD
COORDINATE **E:**347954.27 **N:** 6292928.59
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 10
PROJECT No: 202478.00
DATE: 11/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.0	Water (Sediment Sample)										
	3.6	(SW) SAND; light brown grey; fine to medium; with trace shell fragments, (sediment)		EST		W	(SED)	E		3.7	PID	<1
	3.8	Borehole discontinued at 3.80m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 100mm diameter Hand Auger
REMARKS: Water 0.75m below Jetty

OPERATOR: MJH
CASING:

LOGGED: MJH

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: .87 AHD
COORDINATE **E:**347946.42 **N:** 6292944.72
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 11
PROJECT No: 202478.00
DATE: 11/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.0	Water (Sediment Sample)										
	2.6	(SW) SAND; light brown grey; fine to medium; with trace shell fragments		EST		W	(SED)	E		2.7	PID	<1
	3.0	Borehole discontinued at 3.00m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 100mm diameter Hand Auger
REMARKS: Water 0.77m below Jetty

OPERATOR: MJH
CASING:

LOGGED: MJH

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: -.26 AHD
COORDINATE **E:**347932.65 **N:** 6292922.57
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 12
PROJECT No: 202478.00
DATE: 11/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.0	Water (Sediment Sample)										
	0.3	(SM) SAND, trace silt; dark grey; fine to medium; trace organics, (sediment)		EST		W	(SED)	E		0.4	PID	<1
	0.5	Borehole discontinued at 0.50m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 100mm diameter Hand Auger
REMARKS: Sediment sample at base of slipway

OPERATOR: MJH
CASING:

LOGGED: MJH

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: .99 AHD
COORDINATE E:347937.7 **N:** 6292936.44
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 13
PROJECT No: 202478.00
DATE: 11/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.0	Water (Sediment Sample)										
	2.5	(SM) Silty Clayey SAND; dark grey; fine to medium 2.7m: some small shells		EST		W	(SED)	E		2.5	PID	<1
	2.8	Borehole discontinued at 2.80m depth Limit of investigation					(SED)	E		2.8	PID	<1

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 100mm diameter Hand Auger
REMARKS: Water 0.50m below Jetty

OPERATOR: MJH
CASING:

LOGGED: MJH

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

Refer to explanatory notes for symbol and abbreviation definitions

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: .2 AHD
COORDINATE **E:**347937.25 **N:** 6292907.53
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 14
PROJECT No: 202478.00
DATE: 11/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
0.2 m depth, 11/03/21	0	0.0	FILL/ SAND; light brown; fine to medium; inclusions of suspected ACM, possible vinyl tile, glass, plastic.		FILL		W		E		0.1	PID	<1
		0.3	Sample of vinyl tile collected (14/FCA). Sample of corrugated fibre cement collected (14/FCB)										
			Borehole discontinued at 0.30m depth Collapsing conditions										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 100mm diameter Hand Auger
REMARKS: Borehole positioned below high tide level

OPERATOR: MJH
CASING:

LOGGED: MJH

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: 1.01 AHD
COORDINATE E:347931.1 **N:** 6292913.57
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 15
PROJECT No: 202478.00
DATE: 15/03/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
observed	0.0	FILL/ SAND; brown and grey; fine to medium; with organics (decomposing log), oil staining and slight odour		FILL		M to W		E		0.1	PID	<1
15/03/21, No free groundwater	0.25	Borehole discontinued at 0.25m depth Refusal on concrete slab										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 70mm diameter Hand Auger
REMARKS:

OPERATOR: MJH
CASING:

LOGGED: MJH

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: 1.11 AHD
COORDINATE **E:**347920.5 **N:** 6292915.55
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 16
PROJECT No: 202478.00
DATE: 13/04/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE			TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
13/04/21 ⊥	1 / 0.0	FILL/ Silty SAND, with grace; grey; fine to medium; with clay clumps, trace organics		FILL		M		E		0.05	PID	<1
	0.2	FILL/ Silty SAND; dark grey; fine to medium; with rootlets		FILL		M		E		0.3	PID	<1
	0.4	FILL/ (SP) SAND; pale grey; medium 0.5m: plastic fragment encountered		FILL		M to W		E		0.5	PID	<1
	0.8	(SM) Silty SAND; pale grey brown grading to dark grey; fine to medium		ALV		W		E		1.0	PID	<1
	0 / 1							E		1.5	PID	<1
	1.6	Borehole discontinued at 1.60m depth Limit of investigation										
	-1 / 2									2		
	-2 / 3									3		
	-3 / 4									4		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 75 diameter Hand Auger
REMARKS:

OPERATOR: MVB
CASING:

LOGGED: MVB

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: 1.07 AHD
COORDINATE **E:**347920 **N:** 6292918.53
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 17
PROJECT No: 202478.00
DATE: 13/04/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
13/04/21	1	0.0	FILL/ Silty SAND; grey; fine to medium		FILL				E		0.1	PID	<1
		0.2	FILL/ Silty SAND; dark grey; fine to medium		FILL								
		0.4	(SP) SAND; pale grey; medium; (possible fill)						E		0.5	PID	<1
	0	0.8	(SM) Silty SAND; dark grey grading to pale grey; fine to medium		ALV				E		1.0	PID	<1
		1											
	-1	1.5	Borehole discontinued at 1.50m depth Limit of investigation								2		
	-2	3									3		
	-3	4									4		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 75 diameter Hand Auger
REMARKS:

OPERATOR: MVB
CASING:

LOGGED: MVB

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: 1.08 AHD
COORDINATE **E:**347921.3 **N:** 6292913.98
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 18
PROJECT No: 202478.00
DATE: 13/04/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
13/04/21 ⊻	1 / 0.0	FILL/ Silty SAND; grey; fine to medium		FILL				E		0.1	PID	<1
	0.2	FILL/ Silty SAND; dark grey; fine to medium		FILL								
	0.4	(SP) SAND; pale grey; medium; (possible fill)						E		0.5	PID	<1
	0.8	(SM) Silty SAND; dark grey grading to pale grey; fine to medium		ALV				E		1.0	PID	<1
	0 / 1.5	Borehole discontinued at 1.50m depth Limit of investigation										
	-1 / 2									2		
	-2 / 3									3		
	-3 / 4									4		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 75 diameter Hand Auger
REMARKS:

OPERATOR: MVB
CASING:

LOGGED: MVB

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: 1.01 AHD
COORDINATE E:347924.8 **N:** 6292915.1
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 19
PROJECT No: 202478.00
DATE: 13/04/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
13/04/21 ⊥	0.0	FILL/ Silty SAND, with gravel; brown; fine to medium; with clay clumps, brick and tile fragments		FILL		M		E		0.1	PID	<1
	0.7	FILL/ Silty SAND; dark grey; fine to medium; with rootlets		FILL		W		E		0.8	PID	<1
	1.2	Borehole discontinued at 1.20m depth Refusal on obstruction (suspected concrete)										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 75 diameter Hand Auger
REMARKS: obstruction depths measured using a crowbar and tape measure

OPERATOR: MVB
CASING:

LOGGED: MVB

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: 1.03 AHD
COORDINATE **E:**347925.5 **N:** 6292915.56
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 20
PROJECT No: 202478.00
DATE: 13/04/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
13/04/21 ⊥	1 / 0.0	FILL/ Silty SAND, with gravel; brown; fine to medium; with clay clumps, brick and tile fragments		FILL				E		0.1	PID	<1
	0.4	FILL/ Silty SAND; dark grey; fine to medium; (possible fill)		FILL				E		0.5	PID	<1
	0.7	FILL/ (SP) SAND; grey and brown; medium; (possible fill)		FILL				E		1.0	PID	<1
	0 / 1											
	1.5	Borehole discontinued at 1.50m depth Limit of investigation										
	-1 / 2									2		
	-2 / 3									3		
	-3 / 4									4		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 75 diameter Hand Auger
REMARKS:

OPERATOR: MVB
CASING:

LOGGED: MVB

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

BOREHOLE LOG

CLIENT: Dept of Planning Industry & Enviro (Crown Lands)
PROJECT: Rehabiltiation of Empire Bay Marina
LOCATION: Empire Bay Marina, Empire Bay

SURFACE LEVEL: .98 AHD
COORDINATE **E:**347924.4 **N:** 6292914.93
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 21
PROJECT No: 202478.00
DATE: 13/04/21
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
13/04/21 ⊥	0.0	FILL/ Silty Gravelly SAND; gravel fraction fine to coarse; concrete and brick fragments		FILL				E		0.05	PID	<1
								E		0.5	PID	<1
	0.7	FILL/ Silty SAND; dark grey		FILL		W						
	0.9	Borehole discontinued at 0.90m depth Refusal on obstruction (suspected concrete)						E		0.9	PID	<1

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: 75 diameter Hand Auger
REMARKS: obstruction depths measured using a crowbar and tape measure

OPERATOR: MVB
CASING:

LOGGED: MVB

EXPORTED 09/06/21 11:39. TEMPLATE ID: DP_101.02.00_SOILLOG

Refer to explanatory notes for symbol and abbreviation definitions

Douglas Partners
Geotechnics / Environment / Groundwater

Sampling Methods

Douglas Partners

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 – 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 – 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)
- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)
- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with 'Mix of Soil and Cobbles/Boulders' with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;
- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.
  Soil tends to stick together.
  Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.
  Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- ‘Moist, dry of plastic limit’ or ‘w <PL’ (i.e. hard and friable or powdery).
- ‘Moist, near plastic limit’ or ‘w ≈ PL (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- ‘Moist, wet of plastic limit’ or ‘w >PL’ (i.e. soils usually weakened and free water forms on the hands when handling).
- ‘Wet’ or ‘w ≈LL’ (i.e. near the liquid limit).
- ‘Wet’ or ‘w >LL’ (i.e. wet of the liquid limit).

Rock Strength

Rock strength is defined by the Unconfined Compressive Strength and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $Is_{(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

Strength Term	Abbreviation	Unconfined Compressive Strength MPa	Point Load Index * $Is_{(50)}$ MPa
Very low	VL	0.6 - 2	0.03 - 0.1
Low	L	2 - 6	0.1 - 0.3
Medium	M	6 - 20	0.3 - 1.0
High	H	20 - 60	1 - 3
Very high	VH	60 - 200	3 - 10
Extremely high	EH	>200	>10

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Residual Soil	RS	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible
Highly weathered	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered	MW	The whole of the rock material is discoloured , usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	No signs of decomposition or staining.
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.

Rock Descriptions

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq \text{100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or stronger. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Symbols & Abbreviations

Douglas Partners

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

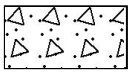
Symbols & Abbreviations

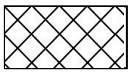
Graphic Symbols for Soil and Rock

General

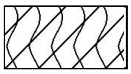

Asphalt

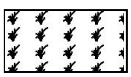

Road base

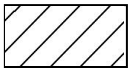

Concrete

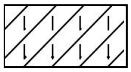

Filling

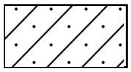
Soils


Topsoil

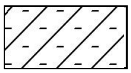

Peat

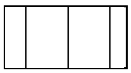

Clay

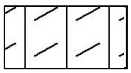

Silty clay

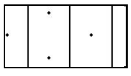

Sandy clay

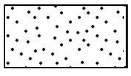

Gravelly clay

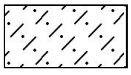

Shaly clay

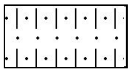

Silt


Clayey silt


Sandy silt

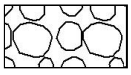

Sand

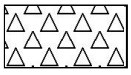

Clayey sand


Silty sand


Gravel

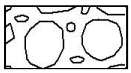

Sandy gravel


Cobbles, boulders

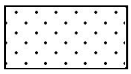

Talus

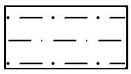
Sedimentary Rocks

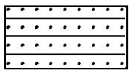

Boulder conglomerate

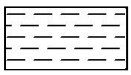

Conglomerate


Conglomeratic sandstone

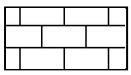

Sandstone


Siltstone

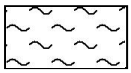

Laminite

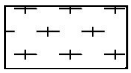

Mudstone, claystone, shale

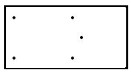

Coal


Limestone

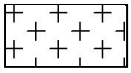
Metamorphic Rocks

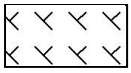

Slate, phyllite, schist

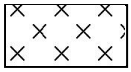

Gneiss

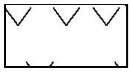

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Appendix J

Laboratory Certificates and

Calibration Certificates

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
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CERTIFICATE OF ANALYSIS 264461

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry
Address	Unit 5, 3 Teamster Close, Tuggerah, NSW, 2259

Sample Details

Your Reference	**202478.00, Empire Bay DSI**
Number of Samples	23 SOIL, 1 WATER, 2 MATERIAL
Date samples received	17/03/2021
Date completed instructions received	17/03/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	25/03/2021
Date of Issue	06/04/2021
Reissue Details	This report replaces R00 created on 25/03/2021 due to: revised report with additional metals results.

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Asbestos Approved By
Analysed by Asbestos Approved Identifier: Panika Wongchanda
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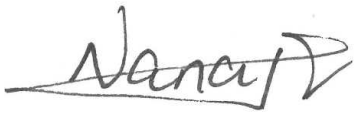

Nancy Zhang, Laboratory Manager

Asbestos ID - materials			
Our Reference		264461-25	264461-26
Your Reference	UNITS	14/FCA	14/FCB
Depth		-	-
Date Sampled		12/03/2021	12/03/2021
Type of sample		MATERIAL	MATERIAL
Date analysed	-	25/03/2021	25/03/2021
Mass / Dimension of Sample	-	70x60x5mm	100x40x6mm
Sample Description	-	Black bituminous material & sand	Beige fibre cement material
Asbestos ID in materials	-	No asbestos detected	Chrysotile asbestos detected Amosite asbestos detected Crocidolite asbestos detected
Trace Analysis	-	No asbestos detected	[NT]

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		264461-1	264461-2	264461-3	264461-4	264461-5
Your Reference	UNITS	1	1	2	2	3
Depth		0.05	0.75	0.05	1.0	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	18/03/2021	18/03/2021	19/03/2021	19/03/2021	19/03/2021
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	105	104	82	79	91

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		264461-6	264461-7	264461-8	264461-9	264461-11
Your Reference	UNITS	3	4	4	5	6
Depth		0.7	0.15	1.0	0.05	0.05
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	19/03/2021	19/03/2021	19/03/2021	19/03/2021	19/03/2021
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	78	88	88	86	93

vTRH(C6-C10)/BTEXN in Soil					
Our Reference		264461-12	264461-21	264461-22	264461-24
Your Reference	UNITS	6	15	QA2	TB1
Depth		0.5	0.1	0.4	-
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/03/2021	18/03/2021	18/03/2021	18/03/2021
Date analysed	-	19/03/2021	19/03/2021	19/03/2021	19/03/2021
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	87	77	82	81

svTRH (C10-C40) in Soil						
Our Reference		264461-1	264461-2	264461-3	264461-4	264461-5
Your Reference	UNITS	1	1	2	2	3
Depth		0.05	0.75	0.05	1.0	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	20/03/2021	20/03/2021	20/03/2021	20/03/2021	20/03/2021
TRH C_{10} - C_{14}	mg/kg	150	<50	69	<50	51
TRH C_{15} - C_{28}	mg/kg	10,000	<100	400	<100	330
TRH C_{29} - C_{36}	mg/kg	9,200	<100	820	<100	650
TRH >C_{10} -C_{16}	mg/kg	320	<50	75	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	320	<50	75	<50	<50
TRH >C_{16} -C_{34}	mg/kg	17,000	<100	980	<100	780
TRH >C_{34} -C_{40}	mg/kg	3,800	<100	700	<100	480
Total +ve TRH (>C10-C40)	mg/kg	22,000	<50	1,800	<50	1,300
Surrogate o-Terphenyl	%	#	77	98	77	84

svTRH (C10-C40) in Soil						
Our Reference		264461-6	264461-7	264461-8	264461-9	264461-11
Your Reference	UNITS	3	4	4	5	6
Depth		0.7	0.15	1.0	0.05	0.05
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	20/03/2021	20/03/2021	20/03/2021	20/03/2021	20/03/2021
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	260	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	1,400	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	1,100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	220	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	220	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	2,100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	800	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	3,200	<50
Surrogate o-Terphenyl	%	75	73	84	120	106

svTRH (C10-C40) in Soil				
Our Reference		264461-12	264461-21	264461-22
Your Reference	UNITS	6	15	QA2
Depth		0.5	0.1	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	20/03/2021	19/03/2021	19/03/2021
TRH C_{10} - C_{14}	mg/kg	<50	150	<50
TRH C_{15} - C_{28}	mg/kg	<100	8,200	330
TRH C_{29} - C_{36}	mg/kg	<100	9,000	490
TRH >C_{10} -C_{16}	mg/kg	<50	290	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	290	<50
TRH >C_{16} -C_{34}	mg/kg	<100	16,000	710
TRH >C_{34} -C_{40}	mg/kg	<100	4,500	290
Total +ve TRH (>C10-C40)	mg/kg	<50	20,000	1,000
Surrogate o-Terphenyl	%	84	#	108

PAHs in Soil						
Our Reference		264461-1	264461-2	264461-3	264461-4	264461-5
Your Reference	UNITS	1	1	2	2	3
Depth		0.05	0.75	0.05	1.0	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	19/03/2021	19/03/2021	19/03/2021	19/03/2021	19/03/2021
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.1	<0.1	0.3	<0.1	<0.1
Pyrene	mg/kg	0.3	<0.1	0.3	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	0.3	<0.2	<0.2
Benzo(a)pyrene	mg/kg	0.06	<0.05	0.2	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	0.1	<0.1	0.2	<0.1	0.1
Total +ve PAH's	mg/kg	0.60	<0.05	1.8	<0.05	0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	77	99	99	101	102

PAHs in Soil						
Our Reference		264461-6	264461-7	264461-8	264461-9	264461-11
Your Reference	UNITS	3	4	4	5	6
Depth		0.7	0.15	1.0	0.05	0.05
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	19/03/2021	19/03/2021	19/03/2021	19/03/2021	19/03/2021
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	0.5	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	0.6	<0.1
Pyrene	mg/kg	<0.1	<0.1	0.1	0.5	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	0.2	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	0.4	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	0.5	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	0.2	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	0.2	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	0.1	3.2	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	100	99	104	96	85

PAHs in Soil			
Our Reference		264461-12	264461-21
Your Reference	UNITS	6	15
Depth		0.5	0.1
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date extracted	-	17/03/2021	17/03/2021
Date analysed	-	19/03/2021	19/03/2021
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<1
Anthracene	mg/kg	<0.1	<1
Fluoranthene	mg/kg	<0.1	<1
Pyrene	mg/kg	<0.1	<1
Benzo(a)anthracene	mg/kg	<0.1	<1
Chrysene	mg/kg	<0.1	<1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<2
Benzo(a)pyrene	mg/kg	<0.05	<0.5
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<1
Benzo(g,h,i)perylene	mg/kg	<0.1	<1
Total +ve PAH's	mg/kg	<0.05	<0.5
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<5
Surrogate p-Terphenyl-d14	%	101	92

Organochlorine Pesticides in soil						
Our Reference		264461-1	264461-3	264461-5	264461-7	264461-9
Your Reference	UNITS	1	2	3	4	5
Depth		0.05	0.05	0.4	0.15	0.05
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	19/03/2021	19/03/2021	19/03/2021	19/03/2021	19/03/2021
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	0.7
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	0.3	<0.1	0.3
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	0.7	<0.1	0.8
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	1	<0.1	1.8
Surrogate TCMX	%	93	102	106	99	108

Organochlorine Pesticides in soil			
Our Reference		264461-11	264461-21
Your Reference	UNITS	6	15
Depth		0.05	0.1
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date extracted	-	17/03/2021	17/03/2021
Date analysed	-	19/03/2021	18/03/2021
alpha-BHC	mg/kg	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1
Dieldrin	mg/kg	<0.1	0.2
Endrin	mg/kg	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1
pp-DDD	mg/kg	<0.1	0.2
Endrin Aldehyde	mg/kg	<0.1	<0.1
pp-DDT	mg/kg	0.1	0.2
Endosulfan Sulphate	mg/kg	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	0.1	0.4
Surrogate TCMX	%	104	94

PCBs in Soil						
Our Reference		264461-1	264461-3	264461-5	264461-7	264461-9
Your Reference	UNITS	1	2	3	4	5
Depth		0.05	0.05	0.4	0.15	0.05
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	19/03/2021	19/03/2021	19/03/2021	19/03/2021	19/03/2021
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	0.4	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	0.4	<0.1	<0.1
Surrogate TCMX	%	93	102	106	99	108

PCBs in Soil			
Our Reference		264461-11	264461-21
Your Reference	UNITS	6	15
Depth		0.05	0.1
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date extracted	-	17/03/2021	17/03/2021
Date analysed	-	19/03/2021	19/03/2021
Aroclor 1016	mg/kg	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	0.1
Aroclor 1260	mg/kg	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	0.1
Surrogate TCMX	%	104	94

Acid Extractable metals in soil						
Our Reference		264461-1	264461-2	264461-3	264461-4	264461-5
Your Reference	UNITS	1	1	2	2	3
Depth		0.05	0.75	0.05	1.0	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	19/03/2021	19/03/2021	19/03/2021	19/03/2021	19/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Arsenic	mg/kg	10	<4	15	9	51
Cadmium	mg/kg	4.4	<0.4	2	<0.4	1
Chromium	mg/kg	67	3	20	3	130
Copper	mg/kg	1,800	2	1,400	2	1,700
Lead	mg/kg	270	3	980	6	680
Mercury	mg/kg	0.5	<0.1	5.3	<0.1	1.2
Nickel	mg/kg	40	1	9	<1	61
Zinc	mg/kg	880	3	900	15	540
Boron	mg/kg	6	<3	<3	<3	20
Barium	mg/kg	100	5	220	2	97
Beryllium	mg/kg	<1	<1	<1	<1	<1
Cobalt	mg/kg	5	<1	3	<1	4
Manganese	mg/kg	140	<1	120	<1	140
Molybdenum	mg/kg	7	1	3	21	9
Antimony	mg/kg	<7	<7	<7	<7	<7
Selenium	mg/kg	<2	<2	<2	<2	<4
Tin	mg/kg	32	<1	61	<1	110

Acid Extractable metals in soil						
Our Reference		264461-6	264461-7	264461-8	264461-9	264461-10
Your Reference	UNITS	3	4	4	5	5
Depth		0.7	0.15	1.0	0.05	0.3
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	19/03/2021	19/03/2021	19/03/2021	19/03/2021	19/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Arsenic	mg/kg	<4	6	6	5	<4
Cadmium	mg/kg	<0.4	<0.4	0.6	0.9	<0.4
Chromium	mg/kg	1	4	5	28	<1
Copper	mg/kg	74	120	120	25,000	40
Lead	mg/kg	27	180	200	120	3
Mercury	mg/kg	<0.1	0.4	0.4	0.5	<0.1
Nickel	mg/kg	<1	1	2	24	<1
Zinc	mg/kg	18	55	190	8,100	34
Boron	mg/kg	<3	<3	<3	8	<3
Barium	mg/kg	2	94	34	79	3
Beryllium	mg/kg	<1	<1	<1	<1	<1
Cobalt	mg/kg	<1	<1	<1	5	<1
Manganese	mg/kg	2	9	3	480	<1
Molybdenum	mg/kg	<1	5	6	2	<1
Antimony	mg/kg	<7	<7	<7	<7	<7
Selenium	mg/kg	<2	<2	<2	<8	<2
Tin	mg/kg	1	4	2	38	<1

Acid Extractable metals in soil						
Our Reference		264461-11	264461-12	264461-13	264461-14	264461-15
Your Reference	UNITS	6	6	7	8	9
Depth		0.05	0.5	0.65	2.1	2.1
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	19/03/2021	19/03/2021	19/03/2021	19/03/2021	19/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Arsenic	mg/kg	5	<4	18	7	8
Cadmium	mg/kg	0.5	<0.4	<0.4	<0.4	0.9
Chromium	mg/kg	17	1	5	11	12
Copper	mg/kg	440	2	270	320	240
Lead	mg/kg	44	2	56	22	39
Mercury	mg/kg	<0.1	<0.1	<0.1	0.2	0.2
Nickel	mg/kg	11	<1	4	5	4
Zinc	mg/kg	180	4	52	94	120
Boron	mg/kg	<3	<3	<3	20	20
Barium	mg/kg	49	2	5	18	33
Beryllium	mg/kg	<1	<1	<1	<1	<1
Cobalt	mg/kg	3	<1	1	1	2
Manganese	mg/kg	130	<1	6	36	40
Molybdenum	mg/kg	2	<1	16	2	2
Antimony	mg/kg	<7	<7	<7	<7	<7
Selenium	mg/kg	<2	<2	<2	<2	<2
Tin	mg/kg	6	<1	1	3	9

Acid Extractable metals in soil						
Our Reference		264461-16	264461-17	264461-18	264461-19	264461-20
Your Reference	UNITS	10	11	12	13	14
Depth		3.7	2.7	0.4	2.5	0.1
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	19/03/2021	19/03/2021	19/03/2021	19/03/2021	19/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Arsenic	mg/kg	<4	<4	14	<4	<4
Cadmium	mg/kg	<0.4	<0.4	0.6	<0.4	<0.4
Chromium	mg/kg	3	2	15	7	3
Copper	mg/kg	8	3	2,600	50	120
Lead	mg/kg	4	3	1,900	13	120
Mercury	mg/kg	<0.1	<0.1	15	<0.1	<0.1
Nickel	mg/kg	1	<1	9	2	1
Zinc	mg/kg	13	7	1,800	32	62
Boron	mg/kg	7	4	10	10	<3
Barium	mg/kg	3	2	17	7	13
Beryllium	mg/kg	<1	<1	<1	<1	<1
Cobalt	mg/kg	<1	<1	3	<1	<1
Manganese	mg/kg	17	15	30	20	9
Molybdenum	mg/kg	<1	<1	5	<1	2
Antimony	mg/kg	<7	<7	<7	<7	<7
Selenium	mg/kg	<2	<2	<2	<2	<2
Tin	mg/kg	<1	<1	110	1	3

Acid Extractable metals in soil						
Our Reference		264461-21	264461-22	264461-27	264461-28	264461-29
Your Reference	UNITS	15	QA2	1 - [TRIPLICATE]	6 - [TRIPLICATE]	15 - [TRIPLICATE]
Depth		0.1	0.4	0.05	0.05	0.1
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	19/03/2021	19/03/2021	19/03/2021	19/03/2021	19/03/2021
Date analysed	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Arsenic	mg/kg	<4	47	6	<4	<4
Cadmium	mg/kg	1	2	3	0.8	0.9
Chromium	mg/kg	14	140	67	17	11
Copper	mg/kg	440	1,300	1,500	490	380
Lead	mg/kg	130	740	210	43	190
Mercury	mg/kg	0.2	1.1	0.4	<0.1	0.3
Nickel	mg/kg	6	57	38	15	3
Zinc	mg/kg	290	720	790	210	150
Boron	mg/kg	<3	10	6	<3	<3
Barium	mg/kg	30	84	110	49	39
Beryllium	mg/kg	<1	<1	<1	<1	<1
Cobalt	mg/kg	<1	4	5	4	<1
Manganese	mg/kg	38	130	120	120	22
Molybdenum	mg/kg	4	8	7	1	4
Antimony	mg/kg	10	<7	<7	<7	10
Selenium	mg/kg	<2	<2	<2	<2	<2
Tin	mg/kg	12	72	30	6	11

Misc Soil - Inorg			
Our Reference		264461-5	264461-21
Your Reference	UNITS	3	15
Depth		0.4	0.1
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date prepared	-	17/03/2021	18/03/2021
Date analysed	-	17/03/2021	18/03/2021
Total Phenolics (as Phenol)	mg/kg	<5	<5

Moisture						
Our Reference		264461-1	264461-2	264461-3	264461-4	264461-5
Your Reference	UNITS	1	1	2	2	3
Depth		0.05	0.75	0.05	1.0	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	18/03/2021	18/03/2021	18/03/2021	18/03/2021	18/03/2021
Moisture	%	5.8	15	4.2	17	25

Moisture						
Our Reference		264461-6	264461-7	264461-8	264461-9	264461-10
Your Reference	UNITS	3	4	4	5	5
Depth		0.7	0.15	1.0	0.05	0.3
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	18/03/2021	18/03/2021	18/03/2021	18/03/2021	18/03/2021
Moisture	%	18	5.6	18	12	2.3

Moisture						
Our Reference		264461-11	264461-12	264461-13	264461-14	264461-15
Your Reference	UNITS	6	6	7	8	9
Depth		0.05	0.5	0.65	2.1	2.1
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	18/03/2021	18/03/2021	18/03/2021	18/03/2021	18/03/2021
Moisture	%	1.1	3.7	21	34	31

Moisture						
Our Reference		264461-16	264461-17	264461-18	264461-19	264461-20
Your Reference	UNITS	10	11	12	13	14
Depth		3.7	2.7	0.4	2.5	0.1
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	17/03/2021	17/03/2021	17/03/2021	17/03/2021	17/03/2021
Date analysed	-	18/03/2021	18/03/2021	18/03/2021	18/03/2021	18/03/2021
Moisture	%	20	18	25	25	15

Moisture			
Our Reference		264461-21	264461-22
Your Reference	UNITS	15	QA2
Depth		0.1	0.4
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date prepared	-	17/03/2021	17/03/2021
Date analysed	-	18/03/2021	18/03/2021
Moisture	%	11	26

Asbestos ID - soils NEPM						
Our Reference		264461-1	264461-3	264461-5	264461-7	264461-11
Your Reference	UNITS	1	2	3	4	6
Depth		0.05	0.05	0.4	0.15	0.05
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date analysed	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Sample mass tested	g	586.21	695.92	422.76	656.48	1,045.3
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected Synthetic mineral fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–	–	–	–
FA and AF Estimation*	g	–	–	–	–	–
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001	<0.001	<0.001	<0.001

Asbestos ID - soils NEPM			
Our Reference		264461-20	264461-21
Your Reference	UNITS	14	15
Depth		0.1	0.1
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date analysed	-	22/03/2021	22/03/2021
Sample mass tested	g	628.09	293.78
Sample Description	-	Brown coarse-grained soil & rocks	Black fine-grained soil
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected Synthetic mineral fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected
Total Asbestos#1	g/kg	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–
FA and AF Estimation*	g	–	–
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001

Misc Inorg - Soil			
Our Reference		264461-1	264461-2
Your Reference	UNITS	1	1
Depth		0.05	0.75
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date prepared	-	19/03/2021	19/03/2021
Date analysed	-	19/03/2021	19/03/2021
pH 1:5 soil:water	pH Units	7.8	5.7

CEC			
Our Reference		264461-1	264461-2
Your Reference	UNITS	1	1
Depth		0.05	0.75
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date prepared	-	22/03/2021	22/03/2021
Date analysed	-	22/03/2021	22/03/2021
Exchangeable Ca	meq/100g	25	1.3
Exchangeable K	meq/100g	0.1	<0.1
Exchangeable Mg	meq/100g	1.9	0.58
Exchangeable Na	meq/100g	0.21	<0.1
Cation Exchange Capacity	meq/100g	28	2.0

Tributyl Tin in Soil						
Our Reference		264461-1	264461-3	264461-9	264461-13	264461-18
Your Reference	UNITS	1	2	5	7	12
Depth		0.05	0.05	0.05	0.65	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	22/03/2021	22/03/2021	22/03/2021	22/03/2021	22/03/2021
Date analysed	-	25/03/2021	25/03/2021	25/03/2021	25/03/2021	25/03/2021
Tributyltin as Sn	µg Sn/kg	450	960	10,000	16	20,000
Surrogate Triphenyltin	%	100	110	110	110	100

vTRH(C6-C10)/BTEXN in Water		
Our Reference		264461-23
Your Reference	UNITS	RB1
Depth		-
Date Sampled		12/03/2021
Type of sample		WATER
Date extracted	-	19/03/2021
Date analysed	-	22/03/2021
TRH C_6 - C_9	µg/L	<10
TRH C_6 - C_{10}	µg/L	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	96
Surrogate toluene-d8	%	101
Surrogate 4-BFB	%	101

svTRH (C10-C40) in Water		
Our Reference		264461-23
Your Reference	UNITS	RB1
Depth		-
Date Sampled		12/03/2021
Type of sample		WATER
Date extracted	-	19/03/2021
Date analysed	-	23/03/2021
TRH C_{10} - C_{14}	µg/L	<50
TRH C_{15} - C_{28}	µg/L	170
TRH C_{29} - C_{36}	µg/L	<100
TRH >C_{10} - C_{16}	µg/L	170
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	170
TRH >C_{16} - C_{34}	µg/L	<100
TRH >C_{34} - C_{40}	µg/L	<100
Surrogate o-Terphenyl	%	95

Metals in Water - Dissolved		
Our Reference		264461-23
Your Reference	UNITS	RB1
Depth		-
Date Sampled		12/03/2021
Type of sample		WATER
Date digested	-	23/03/2021
Date analysed	-	23/03/2021
Arsenic - Dissolved	mg/L	<0.05
Cadmium - Dissolved	mg/L	<0.01
Chromium - Dissolved	mg/L	<0.01
Copper - Dissolved	mg/L	<0.01
Lead - Dissolved	mg/L	<0.03
Mercury - Dissolved	mg/L	<0.0005
Nickel - Dissolved	mg/L	<0.02
Zinc - Dissolved	mg/L	<0.02

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
Ext-054	Analysed by MPL Envirolab
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-020	Determination of various metals by ICP-AES.
Metals-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.

Method ID	Methodology Summary
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS/GC-MSMS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	264461-5
Date extracted	-			17/03/2021	1	17/03/2021	17/03/2021		17/03/2021	17/03/2021
Date analysed	-			19/03/2021	1	18/03/2021	18/03/2021		19/03/2021	19/03/2021
TRH C_6 - C_9	mg/kg	25	Org-023	<25	1	<25	<25	0	104	93
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	1	<25	<25	0	104	93
Benzene	mg/kg	0.2	Org-023	<0.2	1	<0.2	<0.2	0	108	97
Toluene	mg/kg	0.5	Org-023	<0.5	1	<0.5	<0.5	0	101	90
Ethylbenzene	mg/kg	1	Org-023	<1	1	<1	<1	0	103	91
m+p-xylene	mg/kg	2	Org-023	<2	1	<2	<2	0	105	94
o-Xylene	mg/kg	1	Org-023	<1	1	<1	<1	0	107	97
naphthalene	mg/kg	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	89	1	105	98	7	94	80

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	264461-22
Date extracted	-			[NT]	11	17/03/2021	17/03/2021		[NT]	17/03/2021
Date analysed	-			[NT]	11	19/03/2021	19/03/2021		[NT]	19/03/2021
TRH C_6 - C_9	mg/kg	25	Org-023	[NT]	11	<25	<25	0	[NT]	92
TRH C_6 - C_{10}	mg/kg	25	Org-023	[NT]	11	<25	<25	0	[NT]	92
Benzene	mg/kg	0.2	Org-023	[NT]	11	<0.2	<0.2	0	[NT]	101
Toluene	mg/kg	0.5	Org-023	[NT]	11	<0.5	<0.5	0	[NT]	92
Ethylbenzene	mg/kg	1	Org-023	[NT]	11	<1	<1	0	[NT]	87
m+p-xylene	mg/kg	2	Org-023	[NT]	11	<2	<2	0	[NT]	89
o-Xylene	mg/kg	1	Org-023	[NT]	11	<1	<1	0	[NT]	93
naphthalene	mg/kg	1	Org-023	[NT]	11	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	[NT]	11	93	81	14	[NT]	83

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	21	18/03/2021	18/03/2021		[NT]	[NT]
Date analysed	-			[NT]	21	19/03/2021	19/03/2021		[NT]	[NT]
TRH C_6 - C_9	mg/kg	25	Org-023	[NT]	21	<25	<25	0	[NT]	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-023	[NT]	21	<25	<25	0	[NT]	[NT]
Benzene	mg/kg	0.2	Org-023	[NT]	21	<0.2	<0.2	0	[NT]	[NT]
Toluene	mg/kg	0.5	Org-023	[NT]	21	<0.5	<0.5	0	[NT]	[NT]
Ethylbenzene	mg/kg	1	Org-023	[NT]	21	<1	<1	0	[NT]	[NT]
m+p-xylene	mg/kg	2	Org-023	[NT]	21	<2	<2	0	[NT]	[NT]
o-Xylene	mg/kg	1	Org-023	[NT]	21	<1	<1	0	[NT]	[NT]
naphthalene	mg/kg	1	Org-023	[NT]	21	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	[NT]	21	77	90	16	[NT]	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	264461-5
Date extracted	-			17/03/2021	1	17/03/2021	17/03/2021		17/03/2021	17/03/2021
Date analysed	-			20/03/2021	1	20/03/2021	20/03/2021		20/03/2021	20/03/2021
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	1	150	200	29	131	104
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	1	10000	12000	18	98	120
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	1	9200	11000	18	96	#
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	1	320	400	22	131	104
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	1	17000	21000	21	98	120
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	1	3800	4500	17	96	#
Surrogate o-Terphenyl	%		Org-020	77	1	#	#		101	84

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	264461-22
Date extracted	-			[NT]	11	17/03/2021	17/03/2021		[NT]	17/03/2021
Date analysed	-			[NT]	11	20/03/2021	20/03/2021		[NT]	19/03/2021
TRH C_{10} - C_{14}	mg/kg	50	Org-020	[NT]	11	<50	<50	0	[NT]	#
TRH C_{15} - C_{28}	mg/kg	100	Org-020	[NT]	11	<100	<100	0	[NT]	#
TRH C_{29} - C_{36}	mg/kg	100	Org-020	[NT]	11	<100	<100	0	[NT]	#
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	[NT]	11	<50	<50	0	[NT]	#
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	[NT]	11	<100	<100	0	[NT]	#
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	[NT]	11	<100	<100	0	[NT]	#
Surrogate o-Terphenyl	%		Org-020	[NT]	11	106	98	8	[NT]	108

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	21	17/03/2021	17/03/2021		[NT]	[NT]
Date analysed	-			[NT]	21	19/03/2021	19/03/2021		[NT]	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-020	[NT]	21	150	170	12	[NT]	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-020	[NT]	21	8200	9400	14	[NT]	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-020	[NT]	21	9000	11000	20	[NT]	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	[NT]	21	290	340	16	[NT]	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	[NT]	21	16000	17000	6	[NT]	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	[NT]	21	4500	6000	29	[NT]	[NT]
Surrogate o-Terphenyl	%		Org-020	[NT]	21	#	#		[NT]	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	264461-5
Date extracted	-			17/03/2021	1	17/03/2021	17/03/2021		17/03/2021	17/03/2021
Date analysed	-			19/03/2021	1	19/03/2021	19/03/2021		19/03/2021	19/03/2021
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	103	109
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	111	108
Fluorene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	107	107
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	111	103
Anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	1	0.1	0.1	0	109	97
Pyrene	mg/kg	0.1	Org-022/025	<0.1	1	0.3	0.3	0	105	101
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	120	112
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	1	0.06	0.07	15	107	113
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	1	0.1	0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	102	1	77	79	3	101	100

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	11	17/03/2021	17/03/2021		[NT]	[NT]
Date analysed	-			[NT]	11	19/03/2021	19/03/2021		[NT]	[NT]
Naphthalene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Acenaphthylene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Phenanthrene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Anthracene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Pyrene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	[NT]	11	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	[NT]	11	<0.05	<0.05	0	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	[NT]	11	85	86	1	[NT]	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	21	17/03/2021	17/03/2021		[NT]	[NT]
Date analysed	-			[NT]	21	19/03/2021	19/03/2021		[NT]	[NT]
Naphthalene	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Acenaphthylene	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Phenanthrene	mg/kg	0.1	Org-022/025	[NT]	21	<1	<1	0	[NT]	[NT]
Anthracene	mg/kg	0.1	Org-022/025	[NT]	21	<1	<1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	[NT]	21	<1	<1	0	[NT]	[NT]
Pyrene	mg/kg	0.1	Org-022/025	[NT]	21	<1	<1	0	[NT]	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	[NT]	21	<1	<1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	[NT]	21	<1	<1	0	[NT]	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	[NT]	21	<2	<2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	[NT]	21	<0.5	<0.5	0	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	[NT]	21	<1	<1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	[NT]	21	<1	<1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	[NT]	21	<1	<1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	[NT]	21	92	90	2	[NT]	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	264461-5
Date extracted	-			17/03/2021	1	17/03/2021	17/03/2021		17/03/2021	17/03/2021
Date analysed	-			19/03/2021	1	19/03/2021	19/03/2021		19/03/2021	19/03/2021
alpha-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	103	100
HCB	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	104	97
gamma-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	93	99
delta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	97	99
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	97	103
gamma-Chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	103	103
Dieldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	101	103
Endrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	95	109
Endosulfan II	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	92	97
Endrin Aldehyde	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	93	126
Methoxychlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	106	1	93	91	2	106	102

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	11	17/03/2021	17/03/2021		[NT]	[NT]
Date analysed	-			[NT]	11	19/03/2021	19/03/2021		[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
HCB	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
gamma-BHC	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
delta-BHC	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
gamma-Chlordane	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Dieldrin	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Endrin	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Endosulfan II	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	[NT]	11	0.1	0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Methoxychlor	mg/kg	0.1	Org-022/025	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	[NT]	11	104	103	1	[NT]	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	21	17/03/2021	17/03/2021		[NT]	[NT]
Date analysed	-			[NT]	21	18/03/2021	18/03/2021		[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
HCB	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
gamma-BHC	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
delta-BHC	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
gamma-Chlordane	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Dieldrin	mg/kg	0.1	Org-022/025	[NT]	21	0.2	0.1	67	[NT]	[NT]
Endrin	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Endosulfan II	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	[NT]	21	0.2	0.2	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	[NT]	21	0.2	0.1	67	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Methoxychlor	mg/kg	0.1	Org-022/025	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	[NT]	21	94	93	1	[NT]	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	264461-5
Date extracted	-			17/03/2021	1	17/03/2021	17/03/2021		17/03/2021	17/03/2021
Date analysed	-			19/03/2021	1	19/03/2021	19/03/2021		19/03/2021	19/03/2021
Aroclor 1016	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	90	90
Aroclor 1260	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	106	1	93	91	2	106	102

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	11	17/03/2021	17/03/2021		[NT]	[NT]
Date analysed	-			[NT]	11	19/03/2021	19/03/2021		[NT]	[NT]
Aroclor 1016	mg/kg	0.1	Org-021	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1260	mg/kg	0.1	Org-021	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	[NT]	11	104	103	1	[NT]	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	21	17/03/2021	17/03/2021		[NT]	[NT]
Date analysed	-			[NT]	21	19/03/2021	19/03/2021		[NT]	[NT]
Aroclor 1016	mg/kg	0.1	Org-021	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	[NT]	21	0.1	0.2	67	[NT]	[NT]
Aroclor 1260	mg/kg	0.1	Org-021	[NT]	21	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	[NT]	21	94	93	1	[NT]	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	264461-5
Date prepared	-			19/03/2021	1	19/03/2021	19/03/2021		19/03/2021	19/03/2021
Date analysed	-			22/03/2021	1	22/03/2021	22/03/2021		22/03/2021	22/03/2021
Arsenic	mg/kg	4	Metals-020	<4	1	10	7	35	112	99
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	4.4	4	10	108	93
Chromium	mg/kg	1	Metals-020	<1	1	67	72	7	109	#
Copper	mg/kg	1	Metals-020	<1	1	1800	1700	6	110	##
Lead	mg/kg	1	Metals-020	<1	1	270	230	16	107	##
Mercury	mg/kg	0.1	Metals-021	<0.1	1	0.5	0.5	0	104	##
Nickel	mg/kg	1	Metals-020	<1	1	40	350	159	109	#
Zinc	mg/kg	1	Metals-020	<1	1	880	1300	39	116	##
Boron	mg/kg	3	Metals-020	<3	1	6	6	0	106	87
Barium	mg/kg	1	Metals-020	<1	1	100	83	19	113	89
Beryllium	mg/kg	1	Metals-020	<1	1	<1	<1	0	110	100
Cobalt	mg/kg	1	Metals-020	<1	1	5	6	18	108	99
Manganese	mg/kg	1	Metals-020	<1	1	140	150	7	110	73
Molybdenum	mg/kg	1	Metals-020	<1	1	7	7	0	103	[NT]
Antimony	mg/kg	7	Metals-020	<7	1	<7	<7	0	86	[NT]
Selenium	mg/kg	2	Metals-020	<2	1	<2	<2	0	106	101
Tin	mg/kg	1	Metals-020	<1	1	32	29	10	103	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-9	264461-22
Date prepared	-			[NT]	11	19/03/2021	19/03/2021		19/03/2021	19/03/2021
Date analysed	-			[NT]	11	22/03/2021	22/03/2021		22/03/2021	22/03/2021
Arsenic	mg/kg	4	Metals-020	[NT]	11	5	5	0	111	113
Cadmium	mg/kg	0.4	Metals-020	[NT]	11	0.5	1	67	107	92
Chromium	mg/kg	1	Metals-020	[NT]	11	17	16	6	107	#
Copper	mg/kg	1	Metals-020	[NT]	11	440	600	31	109	##
Lead	mg/kg	1	Metals-020	[NT]	11	44	100	78	105	##
Mercury	mg/kg	0.1	Metals-021	[NT]	11	<0.1	0.1	0	106	##
Nickel	mg/kg	1	Metals-020	[NT]	11	11	13	17	108	87
Zinc	mg/kg	1	Metals-020	[NT]	11	180	230	24	114	114
Boron	mg/kg	3	Metals-020	[NT]	11	<3	<3	0	104	91
Barium	mg/kg	1	Metals-020	[NT]	11	49	50	2	112	110
Beryllium	mg/kg	1	Metals-020	[NT]	11	<1	<1	0	108	97
Cobalt	mg/kg	1	Metals-020	[NT]	11	3	4	29	107	95
Manganese	mg/kg	1	Metals-020	[NT]	11	130	120	8	108	100
Molybdenum	mg/kg	1	Metals-020	[NT]	11	2	2	0	105	[NT]
Antimony	mg/kg	7	Metals-020	[NT]	11	<7	<7	0	90	[NT]
Selenium	mg/kg	2	Metals-020	[NT]	11	<2	<2	0	103	98
Tin	mg/kg	1	Metals-020	[NT]	11	6	8	29	104	[NT]

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	19/03/2021	19/03/2021		[NT]	[NT]
Date analysed	-			[NT]	21	22/03/2021	22/03/2021		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	21	<4	<4	0	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	21	1	0.8	22	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	21	14	13	7	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	21	440	250	55	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	21	130	110	17	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	21	0.2	0.2	0	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	21	6	4	40	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	21	290	160	58	[NT]	[NT]
Boron	mg/kg	3	Metals-020	[NT]	21	<3	<3	0	[NT]	[NT]
Barium	mg/kg	1	Metals-020	[NT]	21	30	24	22	[NT]	[NT]
Beryllium	mg/kg	1	Metals-020	[NT]	21	<1	<1	0	[NT]	[NT]
Cobalt	mg/kg	1	Metals-020	[NT]	21	<1	<1	0	[NT]	[NT]
Manganese	mg/kg	1	Metals-020	[NT]	21	38	29	27	[NT]	[NT]
Molybdenum	mg/kg	1	Metals-020	[NT]	21	4	5	22	[NT]	[NT]
Antimony	mg/kg	7	Metals-020	[NT]	21	10	9	11	[NT]	[NT]
Selenium	mg/kg	2	Metals-020	[NT]	21	<2	<2	0	[NT]	[NT]
Tin	mg/kg	1	Metals-020	[NT]	21	12	12	0	[NT]	[NT]

QUALITY CONTROL: Misc Soil - Inorg					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			17/03/2021	[NT]	[NT]	[NT]	[NT]	17/03/2021	[NT]
Date analysed	-			17/03/2021	[NT]	[NT]	[NT]	[NT]	17/03/2021	[NT]
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	[NT]	[NT]	[NT]	[NT]	102	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			19/03/2021	[NT]	[NT]	[NT]	[NT]	19/03/2021	[NT]
Date analysed	-			19/03/2021	[NT]	[NT]	[NT]	[NT]	19/03/2021	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]

QUALITY CONTROL: CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			22/03/2021	[NT]	[NT]	[NT]	[NT]	22/03/2021	[NT]
Date analysed	-			22/03/2021	[NT]	[NT]	[NT]	[NT]	22/03/2021	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	116	[NT]
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	124	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	118	[NT]
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	118	[NT]

QUALITY CONTROL: Tributyl Tin in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	264461-3
Date extracted	-			22/03/2021	1	22/03/2021	22/03/2021		22/03/2021	22/03/2021
Date analysed	-			25/03/2021	1	25/03/2021	25/03/2021		25/03/2021	25/03/2021
Tributyltin as Sn	µg Sn/kg	0.5	Ext-054	<0.5	1	450	410	9	90	#
Surrogate Triphenyltin	%		Ext-054	97	1	100	110	10	99	#

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W6	[NT]
Date extracted	-			19/03/2021	[NT]	[NT]	[NT]	[NT]	19/03/2021	[NT]
Date analysed	-			22/03/2021	[NT]	[NT]	[NT]	[NT]	22/03/2021	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	88	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	88	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	90	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	83	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	89	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	95	[NT]	[NT]	[NT]	[NT]	91	[NT]
Surrogate toluene-d8	%		Org-023	101	[NT]	[NT]	[NT]	[NT]	104	[NT]
Surrogate 4-BFB	%		Org-023	101	[NT]	[NT]	[NT]	[NT]	98	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	[NT]
Date extracted	-			19/03/2021	[NT]	[NT]	[NT]	[NT]	19/03/2021	[NT]
Date analysed	-			22/03/2021	[NT]	[NT]	[NT]	[NT]	22/03/2021	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	116	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	112	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	96	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	116	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	112	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	96	[NT]
Surrogate o-Terphenyl	%		Org-020	100	[NT]	[NT]	[NT]	[NT]	75	[NT]

QUALITY CONTROL: Metals in Water - Dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date digested	-			23/03/2021	[NT]	[NT]	[NT]	[NT]	23/03/2021	[NT]
Date analysed	-			23/03/2021	[NT]	[NT]	[NT]	[NT]	23/03/2021	[NT]
Arsenic - Dissolved	mg/L	0.05	Metals-020	<0.05	[NT]	[NT]	[NT]	[NT]	111	[NT]
Cadmium - Dissolved	mg/L	0.01	Metals-020	<0.01	[NT]	[NT]	[NT]	[NT]	110	[NT]
Chromium - Dissolved	mg/L	0.01	Metals-020	<0.01	[NT]	[NT]	[NT]	[NT]	108	[NT]
Copper - Dissolved	mg/L	0.01	Metals-020	<0.01	[NT]	[NT]	[NT]	[NT]	109	[NT]
Lead - Dissolved	mg/L	0.03	Metals-020	<0.03	[NT]	[NT]	[NT]	[NT]	103	[NT]
Mercury - Dissolved	mg/L	0.0005	Metals-021	<0.0005	[NT]	[NT]	[NT]	[NT]	106	[NT]
Nickel - Dissolved	mg/L	0.02	Metals-020	<0.02	[NT]	[NT]	[NT]	[NT]	114	[NT]
Zinc - Dissolved	mg/L	0.02	Metals-020	<0.02	[NT]	[NT]	[NT]	[NT]	117	[NT]

Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

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

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

PAHs in Soil - The PQL has been raised due to interferences from analytes (other than those being tested) in sample/s 264461-21,21d.

TRH_S_NEPM:# Percent recovery for the surrogate is not possible to report as the high concentration of analytes in sample 264461-1.21 has caused interference.
Percent recovery for the matrix spike is not possible to report as the high concentration of analytes in sample/s 264461-5,22 have caused interference.

Acid Extractable Metals in Soil:
- The laboratory RPD acceptance criteria has been exceeded for 264461-1 for Ni. Therefore a triplicate result has been issued as laboratory sample number 264461-27.
- The laboratory RPD acceptance criteria has been exceeded for 264461-11 for Pb. Therefore a triplicate result has been issued as laboratory sample number 264461-28.
- The laboratory RPD acceptance criteria has been exceeded for 264461-21 for Cu & Zn. Therefore a triplicate result has been issued as laboratory sample number 264461-29.
- # Percent recovery is not possible to report due to the inhomogeneous nature of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.
- ## Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.
- The PQL has been raised for Se for samples #5 and 9 due to interferences from analytes (other than those being tested) in the samples.

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

Note: All samples analysed as received. However, sample 264461-21 is below the minimum 500mL sample volume as per National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.

Tributyltin as Sn analysed by MPL Laboratories. Report No. 259034
#3ms - Organotin Compounds in Soil: # Percent recovery is not possible to report as the analytes in the sample/s have caused interference.
#9, 18 - Organotin Compounds in Soil: Tributyltin values detected exceeded the typical expected range in soil. The laboratory was unable to reach the dilution factor necessary to achieve a result within calibration range and therfore the uncertainty of the result will be increased.

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry

Sample Login Details

Your reference	202478.00, Empire Bay DSI
Envirolab Reference	264461
Date Sample Received	17/03/2021
Date Instructions Received	17/03/2021
Date Results Expected to be Reported	25/03/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	25 SOIL, 1 WATER
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	18
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticides in soil	PCBsin Soil	Acid Extractable metalsin soil	Misc Soil - Inorg	Asbestos ID - soils NEPM	Asbestos ID - soils	Misc Inorg - Soil	CEC	Tributyl Tin in Soil	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	Metals in Water - Dissolved
1-0.05	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓			
1-0.75	✓	✓	✓			✓				✓	✓				
2-0.05	✓	✓	✓	✓	✓	✓		✓				✓			
2-1.0	✓	✓	✓			✓									
3-0.4	✓	✓	✓	✓	✓	✓	✓	✓							
3-0.7	✓	✓	✓			✓									
4-0.15	✓	✓	✓	✓	✓	✓		✓							
4-1.0	✓	✓	✓			✓									
5-0.05	✓	✓	✓	✓	✓	✓						✓			
5-0.3						✓									
6-0.05	✓	✓	✓	✓	✓	✓		✓							
6-0.5	✓	✓	✓			✓									
7-0.65						✓						✓			
8-2.1						✓									
9-2.1						✓									
10-3.7						✓									
11-2.7						✓									
12-0.4						✓						✓			
13-2.5						✓									
14-0.1						✓		✓							
15-0.1	✓	✓	✓	✓	✓	✓	✓	✓							
QA2-0.4	✓	✓				✓									
RB1													✓	✓	✓
TB1	✓														
14/FCA									✓						
14/FCB									✓						

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

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Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	**Project Number** 202478.00	**To:**	Envirolab Services
Contact Person: Brent Kerry	**Project Name:** Empire Bay DSI	**Contact Person:**	Aileen Hie
Project Mgr: Brent Kerry	**PO No.:**	**Address:**	12 Ashley Street
	lab Quote No. : 2018-2019 List		Chatswood NSW 2068
Address: 5/3 Teanster Cl	**Date results required:** Standard TAT	**Phone:**	02 9910 6200
Tuggerah NSW 2259	*Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	**Fax:**	02 9910 6201
		Email:	ahie@envirolab.com.au
Phone: 4351 1422 **Mob:**	**Report format:** Esdat/PDF / Excel	**Laboratory Report No:**	
Email: brent.kerry@douglaspartners.com.au	**Comments:**	**Lab Comments:**	

Sample information						Tests Required											Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	COMBO #5	COMBO #7	COMBO #3	Asbestos (500ml)	Asbestos ID	CEC	pH	TBT	HM			Provide as much information about the sample as you can
1	1/0.05	0.05	12/03/2021	Jar/Bag	Soil	X			X		X	X	X				
2	1/0.75	0.75	12/03/2021	Jar	Soil			X			X	X					
3	2/0.05	0.05	12/03/2021	Jar/Bag	Soil	X			X				X				
4	2/1.0	1.0	12/03/2021	Jar	Soil			X									
5	3/0.4	0.4	11/03/2021	Jar/Bag	Soil		X		X								
6	3/0.7	0.7	11/03/2021	Jar	Soil			X									
7	4/0.15	0.15	11/03/2021	Jar/Bag	Soil	X			X								
8	4/1.0	1.0	11/03/2021	Jar	Soil			X									
9	5/0.05	0.05	12/03/2021	Jar/Bag	Soil	X							X				
10	5/0.3	0.3	12/03/2021	Jar	Soil									X			
11	6/0.05	0.05	11/03/2021	Jar/Bag	Soil	X			X								
12	6/0.5	0.5	11/03/2021	Jar	Soil			X									
13	7/0.65	0.65	12/03/2021	Jar	Soil								X	X			
14	8/2.1	2.1	12/03/2021	Jar	Soil									X			
15	9/2.1	2.1	12/03/2021	Jar	Soil									X			
16	10/3.7	3.7	12/03/2021	Jar	Soil									X			
17	11/2.7	2.7	12/03/2021	Jar	Soil									X			
18	12/0.4	0.4	12/03/2021	Jar	Soil								X	X			
19	13/2.5	2.5	12/03/2021	Jar	Soil									X			
~~DK~~	14/FCA	Surface	12/03/2021	Bag	Soil					X							
~~DK~~	14/FCB	Surface	12/03/2021	Bag	Soil					X							
20	14/0.1	0.1	12/03/2021	Jar/Bag	Soil				X					X			

ENVIROLAB GROUP

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 264461
Date Received: 17/3/21
Time Received: 10:30
Received By: KC
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by: Douglas Partners	**Sample Receipt**	*Lab use only:*	
Courier (by whom) TNT	**Received by (Company):** ELS Syd	**Samples Received:** Cool or Ambient (circle one)	
Condition of Sample at dispatch Cool or Ambient (circle) cool	**Print Name:** K. Clore	**Temperature Received at:** 18 (if applicable)	
Temperature (if Applicable):	**Date & Time:** 17/03/2021 10:30	**Transported by:** Hand delivered / courier	
Print Name: Brent Kerry	**Signature:**		
Date & Time: 16/3/21			
Signature:			

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	**Project Number** 202478.00	**To:**	Envirolab Services
Contact Person: Brent Kerry	**Project Name:** Empire Bay DSI	**Contact Person:**	Aileen Hie
Project Mgr: Brent Kerry	**PO No.:**	**Address:**	12 Ashley Street
	lab Quote No. : 2018-2019 List		Chatswood NSW 2068
Address: 5/3 Teanster Cl	**Date results required:** Standard TAT	**Phone:**	02 9910 6200
Tuggerah NSW 2259		**Fax:**	02 9910 6201
	Note: Inform lab in advance if urgent turnaround is required - surcharges apply	**Email:**	ahie@envirolab.com.au
Phone: 4351 1422 **Mob:**	**Report format:** Esdat/PDF / Excel	**Laboratory Report No:**	
Email: brent.kerry@douglaspartners.com.au	**Comments:**	**Lab Comments:**	

Sample information						Tests Required											Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	COMBO #5	COMBO #7	COMBO #3	Asbestos (500ml)	Asbestos ID	CEC	pH	TBT	Combo #1m	TRH B1e1		Provide as much information about the sample as you can
21	15/0.1	0.1	15/03/2021	Jar/Bag	Soil		X		X								
22	QA2	0.4	12/03/2021	Jar/Bag	Soil									X			
23	RB1	-	12/03/2021	bottles	Water									X			
24	TB1	-	12/03/2021	Jar	Soil									1BX1	X		

Relinquished by: Douglas Partners	**Sample Receipt**	***Lab use only:***
Courier (by whom) TNT	**Received by (Company):** EIS Syd	**Samples Received:** (Cool) or Ambient (circle one)
Condition of Sample at dispatch Cool or Ambient (circle) cool	**Print Name:** K-Chok	**Temperature Received at:** 18 (if applicable)
Temperature (if Applicable):	**Date & Time:** 17/03/2021 10:30	**Transported by:** Hand delivered / (Courier)
Print Name: Brent Kerry	**Signature:**	
Date & Time: 16/3/21		264461.
Signature:		

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customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 264461-B

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry
Address	Unit 5, 3 Teamster Close, Tuggerah, NSW, 2259

Sample Details

Your Reference	**202478.00, Empire Bay DSI**
Number of Samples	23 SOIL, 1 WATER, 2 MATERIAL
Date samples received	17/03/2021
Date completed instructions received	03/04/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	13/04/2021
Date of Issue	16/04/2021

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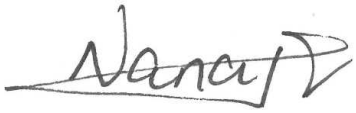
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Dragana Tomas, Senior Chemist
Giovanni Agosti, Group Technical Manager
Jeremy Faircloth, Operations Manager, Sydney
Manju Dewendrage, Chemist

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		264461-B-14	264461-B-15	264461-B-16	264461-B-17	264461-B-18
Your Reference	UNITS	8	9	10	11	12
Depth		2.1	2.1	3.7	2.7	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Date analysed	-	08/04/2021	08/04/2021	08/04/2021	08/04/2021	08/04/2021
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	101	101	93	72	100

vTRH(C6-C10)/BTEXN in Soil			
Our Reference		264461-B-19	264461-B-20
Your Reference	UNITS	13	14
Depth		2.5	0.1
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date extracted	-	07/04/2021	07/04/2021
Date analysed	-	08/04/2021	08/04/2021
TRH C_6 - C_9	mg/kg	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25
Benzene	mg/kg	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1
m+p-xylene	mg/kg	<2	<2
o-Xylene	mg/kg	<1	<1
naphthalene	mg/kg	<1	<1
Total +ve Xylenes	mg/kg	<3	<3
Surrogate aaa-Trifluorotoluene	%	78	96

svTRH (C10-C40) in Soil						
Our Reference		264461-B-14	264461-B-15	264461-B-16	264461-B-17	264461-B-18
Your Reference	UNITS	8	9	10	11	12
Depth		2.1	2.1	3.7	2.7	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Date analysed	-	08/04/2021	08/04/2021	08/04/2021	08/04/2021	08/04/2021
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	53
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	130
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	210
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	280
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	150
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	430
Surrogate o-Terphenyl	%	87	90	91	87	93

svTRH (C10-C40) in Soil			
Our Reference		264461-B-19	264461-B-20
Your Reference	UNITS	13	14
Depth		2.5	0.1
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date extracted	-	07/04/2021	07/04/2021
Date analysed	-	08/04/2021	08/04/2021
TRH C_{10} - C_{14}	mg/kg	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50
Surrogate o-Terphenyl	%	87	86

PAHs in Soil						
Our Reference		264461-B-14	264461-B-15	264461-B-16	264461-B-17	264461-B-18
Your Reference	UNITS	8	9	10	11	12
Depth		2.1	2.1	3.7	2.7	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Date analysed	-	07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.5
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.4
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.2
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.2
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	0.5
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	0.2
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.2
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.2
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05	2.5
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	110	111	113	112	103

PAHs in Soil			
Our Reference		264461-B-19	264461-B-20
Your Reference	UNITS	13	14
Depth		2.5	0.1
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date extracted	-	07/04/2021	07/04/2021
Date analysed	-	07/04/2021	07/04/2021
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	103	114

Misc Soil - Inorg						
Our Reference		264461-B-1	264461-B-3	264461-B-9	264461-B-11	264461-B-13
Your Reference	UNITS	1	2	5	6	7
Depth		0.05	0.05	0.05	0.05	0.65
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Date analysed	-	08/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Total Cyanide	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Misc Soil - Inorg						
Our Reference		264461-B-14	264461-B-15	264461-B-16	264461-B-17	264461-B-18
Your Reference	UNITS	8	9	10	11	12
Depth		2.1	2.1	3.7	2.7	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Date analysed	-	07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5
Total Cyanide	mg/kg	<0.5	<0.5	<0.5	[NA]	<0.5

Misc Soil - Inorg			
Our Reference		264461-B-19	264461-B-20
Your Reference	UNITS	13	14
Depth		2.5	0.1
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date prepared	-	07/04/2021	07/04/2021
Date analysed	-	07/04/2021	07/04/2021
Total Phenolics (as Phenol)	mg/kg	<5	<5

Moisture						
Our Reference		264461-B-1	264461-B-2	264461-B-3	264461-B-4	264461-B-5
Your Reference	UNITS	1	1	2	2	3
Depth		0.05	0.75	0.05	1.0	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Date analysed	-	08/04/2021	08/04/2021	08/04/2021	08/04/2021	08/04/2021
Moisture	%	0.5	13	2.4	14	21

Moisture						
Our Reference		264461-B-7	264461-B-9	264461-B-10	264461-B-11	264461-B-13
Your Reference	UNITS	4	5	5	6	7
Depth		0.15	0.05	0.3	0.05	0.65
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Date analysed	-	08/04/2021	08/04/2021	08/04/2021	08/04/2021	08/04/2021
Moisture	%	2.8	5.8	0.6	0.4	22

Moisture						
Our Reference		264461-B-14	264461-B-15	264461-B-16	264461-B-17	264461-B-18
Your Reference	UNITS	8	9	10	11	12
Depth		2.1	2.1	3.7	2.7	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Date analysed	-	08/04/2021	08/04/2021	08/04/2021	08/04/2021	08/04/2021
Moisture	%	26	27	15	14	20

Moisture			
Our Reference		264461-B-19	264461-B-20
Your Reference	UNITS	13	14
Depth		2.5	0.1
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date prepared	-	07/04/2021	07/04/2021
Date analysed	-	08/04/2021	08/04/2021
Moisture	%	25	8.9

Tributyl Tin in Soil						
Our Reference		264461-B-2	264461-B-4	264461-B-5	264461-B-7	264461-B-10
Your Reference	UNITS	1	2	3	4	5
Depth		0.75	1.0	0.4	0.15	0.3
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Date analysed	-	08/04/2021	08/04/2021	08/04/2021	08/04/2021	08/04/2021
Tributyltin as Sn	µg Sn/kg	<0.5	<0.5	5,400	<5.7	5.9
Surrogate Triphenyltin	%	93	91	110	99	93

Tributyl Tin in Soil						
Our Reference		264461-B-11	264461-B-14	264461-B-15	264461-B-16	264461-B-17
Your Reference	UNITS	6	8	9	10	11
Depth		0.05	2.1	2.1	3.7	2.7
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	07/04/2021	07/04/2021	07/04/2021	07/04/2021	07/04/2021
Date analysed	-	08/04/2021	08/04/2021	08/04/2021	08/04/2021	08/04/2021
Tributyltin as Sn	µg Sn/kg	230	160	110	<0.5	<0.5
Surrogate Triphenyltin	%	92	93	94	87	96

Tributyl Tin in Soil			
Our Reference		264461-B-19	264461-B-20
Your Reference	UNITS	13	14
Depth		2.5	0.1
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date extracted	-	07/04/2021	07/04/2021
Date analysed	-	08/04/2021	08/04/2021
Tributyltin as Sn	µg Sn/kg	38	22
Surrogate Triphenyltin	%	96	96

Method ID	Methodology Summary
Ext-054	Analysed by MPL Envirolab
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjusted as required prior to analysis. Cyanides amenable to Chlorination - samples are analysed untreated and treated with hyperchlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).

Method ID	Methodology Summary
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date extracted	-			07/04/2021	14	07/04/2021	07/04/2021		07/04/2021	[NT]
Date analysed	-			08/04/2021	14	08/04/2021	08/04/2021		08/04/2021	[NT]
TRH C_6 - C_9	mg/kg	25	Org-023	<25	14	<25	<25	0	93	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	14	<25	<25	0	93	[NT]
Benzene	mg/kg	0.2	Org-023	<0.2	14	<0.2	<0.2	0	107	[NT]
Toluene	mg/kg	0.5	Org-023	<0.5	14	<0.5	<0.5	0	102	[NT]
Ethylbenzene	mg/kg	1	Org-023	<1	14	<1	<1	0	96	[NT]
m+p-xylene	mg/kg	2	Org-023	<2	14	<2	<2	0	80	[NT]
o-Xylene	mg/kg	1	Org-023	<1	14	<1	<1	0	95	[NT]
naphthalene	mg/kg	1	Org-023	<1	14	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	110	14	101	103	2	106	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date extracted	-			07/04/2021	14	07/04/2021	07/04/2021		07/04/2021	[NT]
Date analysed	-			08/04/2021	14	08/04/2021	08/04/2021		08/04/2021	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	14	<50	<50	0	99	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	14	<100	<100	0	74	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	14	<100	<100	0	82	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	14	<50	<50	0	99	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	14	<100	<100	0	74	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	14	<100	<100	0	82	[NT]
Surrogate o-Terphenyl	%		Org-020	92	14	87	92	6	86	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date extracted	-			07/04/2021	14	07/04/2021	07/04/2021		07/04/2021	[NT]
Date analysed	-			07/04/2021	14	07/04/2021	07/04/2021		07/04/2021	[NT]
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	112	[NT]
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	97	[NT]
Fluorene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	95	[NT]
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	111	[NT]
Anthracene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	100	[NT]
Pyrene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	105	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	116	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	14	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	14	<0.05	<0.05	0	102	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	14	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	106	14	110	102	8	100	[NT]

QUALITY CONTROL: Misc Soil - Inorg						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	264461-B-1
Date prepared	-			07/04/2021	14	07/04/2021	07/04/2021		07/04/2021	07/04/2021
Date analysed	-			07/04/2021	14	07/04/2021	07/04/2021		07/04/2021	07/04/2021
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	14	<5	<5	0	101	[NT]
Total Cyanide	mg/kg	0.5	Inorg-014	<0.5	14	<0.5	<0.5	0	103	74

QUALITY CONTROL: Tributyl Tin in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			07/04/2021	[NT]	[NT]	[NT]	[NT]	07/04/2021	[NT]
Date analysed	-			08/04/2021	[NT]	[NT]	[NT]	[NT]	08/04/2021	[NT]
Tributyltin as Sn	µg Sn/kg	0.5	Ext-054	<0.5	[NT]	[NT]	[NT]	[NT]	79	[NT]
Surrogate Triphenyltin	%		Ext-054	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]

QUALITY CONTROL: Tributyl Tin in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date extracted	-			[NT]	[NT]	[NT]	[NT]	[NT]	07/04/2021	[NT]
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	08/04/2021	[NT]
Tributyltin as Sn	µg Sn/kg	0.5	Ext-054	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
Surrogate Triphenyltin	%		Ext-054	[NT]	[NT]	[NT]	[NT]	[NT]	99	[NT]

Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

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

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Samples received in good order: Holding time exceedance

TBT_S analysed by MPL report#259936

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry

Sample Login Details

Your reference	202478.00, Empire Bay DSI
Envirolab Reference	264461-B
Date Sample Received	17/03/2021
Date Instructions Received	03/04/2021
Date Results Expected to be Reported	13/04/2021

Sample Condition

Samples received in appropriate condition for analysis	Holding time exceedance
No. of Samples Provided	23 SOIL, 1 WATER, 2 MATERIAL
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	18
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Please contact the laboratory within 24 hours if you wish to cancel the aformentioned testing. Otherwise testing will proceed as per the COC and hence invoice accordingly.

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Misc Soil - Inorg	Tributyl Tin in Soil	On Hold
1-0.05				✓		
1-0.75					✓	
2-0.05				✓		
2-1.0					✓	
3-0.4					✓	
3-0.7						✓
4-0.15					✓	
4-1.0						✓
5-0.05				✓		
5-0.3					✓	
6-0.05				✓	✓	
6-0.5						✓
7-0.65				✓		
8-2.1	✓	✓	✓	✓	✓	
9-2.1	✓	✓	✓	✓	✓	
10-3.7	✓	✓	✓	✓	✓	
11-2.7	✓	✓	✓	✓	✓	
12-0.4	✓	✓	✓	✓		
13-2.5	✓	✓	✓	✓	✓	
14-0.1	✓	✓	✓	✓	✓	
15-0.1						✓
QA2-0.4						✓
RB1						✓
TB1						✓
14/FCA						✓
14/FCB						✓
1 - [TRIPLICATE]-0.05						✓
6 - [TRIPLICATE]-0.05						✓
15 - [TRIPLICATE]-0.1						✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

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Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	Project Number 202478.00	To: Envirolab Services
Contact Person: Brent Kerry	Project Name: Empire Bay DSI	Contact Person: Aileen Hie
Project Mgr: Brent Kerry	PO No.:	Address: 12 Ashley Street
	lab Quote No.: 2018-2019 List	Chatswood NSW 2068
Address: 5/3 Teanster Cl Tuggerah NSW 2259	Date results required: Standard TAT *Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	Phone: 02 9910 6200 Fax: 02 9910 6201 Email: ahie@envirolab.com.au
Phone: 4351 1422 Mob:	Report format: Esdat/PDF / Excel	Laboratory Report No:
Email: brent.kerry@douglaspartners.com.au	Comments:	Lab Comments:

Sample information						Tests Required											Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	COMBO #5	COMBO #7	COMBO #3	Asbestos (500ml)	Asbestos ID	CEC	CN	TBT	HM	TBT	TRH/BTEX/ PAH/phenols	Provide as much information about the sample as you can
1.	1/0.05	0.05	12/03/2021	Jar/Bag	Soil							X					
2.	1/0.75	0.75	12/03/2021	Jar	Soil										X		
3	2/0.05	0.05	12/03/2021	Jar/Bag	Soil							X					
4	2/1.0	1.0	12/03/2021	Jar	Soil										X		
5	3/0.4	0.4	11/03/2021	Jar/Bag	Soil										X		
6	3/0.7	0.7	11/03/2021	Jar	Soil												
7	4/0.15	0.15	11/03/2021	Jar/Bag	Soil										X		
8	4/1.0	1.0	11/03/2021	Jar	Soil												
9	5/0.05	0.05	12/03/2021	Jar/Bag	Soil							X					
10	5/0.3	0.3	12/03/2021	Jar	Soil										X		
11	6/0.05	0.05	11/03/2021	Jar/Bag	Soil							X			X		
12	6/0.5	0.5	11/03/2021	Jar	Soil												
13	7/0.65	0.65	12/03/2021	Jar	Soil							X					
14	8/2.1	2.1	12/03/2021	Jar	Soil							X			X	X	
15	9/2.1	2.1	12/03/2021	Jar	Soil							X			X	X	
16	10/3.7	3.7	12/03/2021	Jar	Soil							X			X	X	
17	11/2.7	2.7	12/03/2021	Jar	Soil										X	X	
18	12/0.4	0.4	12/03/2021	Jar	Soil							X				X	
19	13/2.5	2.5	12/03/2021	Jar	Soil										X	X	
25	14/FCA	Surface	12/03/2021	Bag	Soil												
26.	14/FCB	Surface	12/03/2021	Bag	Soil												
20.	14/0.1	0.1	12/03/2021	Jar/Bag	Soil										X	X	

Relinquished by: Douglas Partners	Sample Receipt Ref = 264461-B.	*Lab use only:*
Courier (by whom) TNT	Received by (Company): ELS Sydney	Samples Received: Cool or Ambient (circle one)
Condition of Sample at dispatch Cool or Ambient (circle) cool	Print Name: Minna Yau To.	Temperature Received at: (if applicable)
Temperature (if Applicable):	Date & Time: 03/04/2021 17:28	Transported by: Hand delivered / courier
Print Name: Brent Kerry	Signature: MT	
Date & Time:		
Signature:		

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CERTIFICATE OF ANALYSIS 264461-C

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry
Address	Unit 5, 3 Teamster Close, Tuggerah, NSW, 2259

Sample Details

Your Reference	**202478.00, Empire Bay DSI**
Number of Samples	23 SOIL, 1 WATER, 2 MATERIAL
Date samples received	17/03/2021
Date completed instructions received	19/04/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	26/04/2021
Date of Issue	23/04/2021

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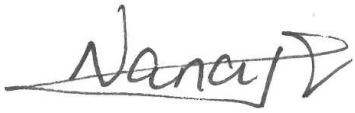
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		264461-C-9	264461-C-13	264461-C-14	264461-C-15	264461-C-18
Your Reference	UNITS	5	7	8	9	12
Depth		0.05	0.65	2.1	2.1	0.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	12/03/2021	12/03/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	21/04/2021	21/04/2021	21/04/2021	21/04/2021	21/04/2021
Date analysed	-	21/04/2021	21/04/2021	21/04/2021	21/04/2021	21/04/2021
Total Organic Carbon (Walkley Black)	mg/kg	67,000	7,700	11,000	13,000	11,000

Misc Inorg - Soil		
Our Reference		264461-C-19
Your Reference	UNITS	13
Depth		2.5
Date Sampled		12/03/2021
Type of sample		SOIL
Date prepared	-	21/04/2021
Date analysed	-	21/04/2021
Total Organic Carbon (Walkley Black)	mg/kg	11,000

Method ID	Methodology Summary
Inorg-036	Total Organic Carbon or Matter - A titrimetric method that measures the oxidisable organic content of soils.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			21/04/2021	13	21/04/2021	21/04/2021		21/04/2021	[NT]
Date analysed	-			21/04/2021	13	21/04/2021	21/04/2021		21/04/2021	[NT]
Total Organic Carbon (Walkley Black)	mg/kg	1000	Inorg-036	<1000	13	7700	7000	10	101	[NT]

Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

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

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

TOC - out of recommended holding time

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SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry

Sample Login Details

Your reference	202478.00, Empire Bay DSI
Envirolab Reference	264461-C
Date Sample Received	17/03/2021
Date Instructions Received	19/04/2021
Date Results Expected to be Reported	26/04/2021

Sample Condition

Samples received in appropriate condition for analysis	Holding time exceedance
No. of Samples Provided	23 SOIL, 1 WATER, 2 MATERIAL
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	18
Cooling Method	Ice
Sampling Date Provided	YES

Comments

TOC - out of recommended holding time

Please contact the laboratory within 24 hours if you wish to cancel the aformentioned testing. Otherwise testing will proceed as per the COC and hence invoice accordingly.

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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Sample ID	Misc Inorg - Soil	On Hold
1-0.05		✓
1-0.75		✓
2-0.05		✓
2-1.0		✓
3-0.4		✓
3-0.7		✓
4-0.15		✓
4-1.0		✓
5-0.05	✓	
5-0.3		✓
6-0.05		✓
6-0.5		✓
7-0.65	✓	
8-2.1	✓	
9-2.1	✓	
10-3.7		✓
11-2.7		✓
12-0.4	✓	
13-2.5	✓	
14-0.1		✓
15-0.1		✓
QA2-0.4		✓
RB1		✓
TB1		✓
14/FCA		✓
14/FCB		✓
1 - [TRIPLICATE]-0.05		✓
6 - [TRIPLICATE]-0.05		✓
15 - [TRIPLICATE]-0.1		✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

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Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Additional Testing on Batch 264461

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	Project Number: 202478.00	To:	Envirolab Services
Contact Person: Brent Kerry	Project Name: Empire Bay DSI	Contact Person:	Aileen Hie
Project Mgr: Brent Kerry	PO No.:	Address:	12 Ashley Street
	lab Quote No.: 2018-2019 List		Chatswood NSW 2068
Address: 5/3 Teanster Cl	Date results required: Standard TAT	Phone:	02 9910 6200
Tuggerah NSW 2259	*Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	Fax:	02 9910 6201
		Email:	ahie@envirolab.com.au
Phone: 4351 1422 Mob:	Report format: Esdat/PDF / Excel	Laboratory Report No:	
Email: brent.kerry@douglaspartners.com.au	Comments:	Lab Comments:	

Sample information						Tests Required										Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	COMBO #5	COMBO #7	COMBO #3	Asbestos (500ml)	Asbestos ID	CEC	pH	TBT	HM	TOC		Provide as much information about the sample as you can
14	8/2.1	2.1	11/03/2021	Jar	Soil/Sed										X		
18	12/0.4	0.4	11/03/2021	Jar	Soil/Sed										X		
9	5/0.05	0.05	12/03/2021	Jar	Soil/Sed										X		
13	7/0.65	0.7	12/03/2021	Jar	Soil/Sed										X		
15	9/2.1	2.1	11/03/2021	Jar	Soil/Sed										X		
19	13/2.5	2.5	11/03/2021	Jar	Soil/Sed										X		

Relinquished by: Douglas Partners	Sample Receipt: COC Received	*Lab use only:*	ROT: 264461-C
Courier (by whom): TNT	Received by (Company): EL Sydney	Samples Received: (Cool) or Ambient (circle one)	TAT: Standard
Condition of Sample at dispatch Cool or Ambient (circle): cool	Print Name: Ming Yan Zo.	Temperature Received at: 19.4 (if applicable)	Due: 26/04/2021
Temperature (if Applicable):	Date & Time: 19/04/2021 11:23	Transported by: Hand delivered / courier	
Print Name: Brent Kerry	Signature: MZ		
Date & Time: 19/4/21			
Signature:			

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CERTIFICATE OF ANALYSIS 266711

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry
Address	Unit 5, 3 Teamster Close, Tuggerah, NSW, 2259

Sample Details

Your Reference	**202478.00, Empire Bay DSI**
Number of Samples	2 SOIL
Date samples received	15/04/2021
Date completed instructions received	15/04/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	22/04/2021
Date of Issue	22/04/2021

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Asbestos Approved By
Analysed by Asbestos Approved Identifier: Ridwan Wijaya
Authorised by Asbestos Approved Signatory: Lucy Zhu

Results Approved By
Dragana Tomas, Senior Chemist
Giovanni Agosti, Group Technical Manager
Hannah Nguyen, Senior Chemist
Ken Nguyen, Senior Customer Service
Lucy Zhu, Asbestos Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil			
Our Reference		266711-1	266711-2
Your Reference	UNITS	21/0.05	21/0.9
Depth		0.05	0.9
Date Sampled		13/04/2021	13/04/2021
Type of sample		SOIL	SOIL
Date extracted	-	15/04/2021	15/04/2021
Date analysed	-	16/04/2021	16/04/2021
TRH C_6 - C_9	mg/kg	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25
Benzene	mg/kg	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1
m+p-xylene	mg/kg	<2	<2
o-Xylene	mg/kg	<1	<1
naphthalene	mg/kg	<1	<1
Total +ve Xylenes	mg/kg	<3	<3
Surrogate aaa-Trifluorotoluene	%	108	74

svTRH (C10-C40) in Soil			
Our Reference		266711-1	266711-2
Your Reference	UNITS	21/0.05	21/0.9
Depth		0.05	0.9
Date Sampled		13/04/2021	13/04/2021
Type of sample		SOIL	SOIL
Date extracted	-	15/04/2021	15/04/2021
Date analysed	-	16/04/2021	16/04/2021
TRH C_{10} - C_{14}	mg/kg	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	250
TRH C_{29} - C_{36}	mg/kg	<100	140
TRH >C_{10} -C_{16}	mg/kg	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50
TRH >C_{16} -C_{34}	mg/kg	140	330
TRH >C_{34} -C_{40}	mg/kg	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	140	330
Surrogate o-Terphenyl	%	90	103

PAHs in Soil			
Our Reference		266711-1	266711-2
Your Reference	UNITS	21/0.05	21/0.9
Depth		0.05	0.9
Date Sampled		13/04/2021	13/04/2021
Type of sample		SOIL	SOIL
Date extracted	-	15/04/2021	15/04/2021
Date analysed	-	15/04/2021	15/04/2021
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1
Fluoranthene	mg/kg	0.2	<0.1
Pyrene	mg/kg	0.2	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	0.3	0.2
Benzo(a)pyrene	mg/kg	0.09	0.07
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1
Total +ve PAH's	mg/kg	0.74	0.3
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	87	89

Organochlorine Pesticides in soil		
Our Reference		266711-1
Your Reference	UNITS	21/0.05
Depth		0.05
Date Sampled		13/04/2021
Type of sample		SOIL
Date extracted	-	15/04/2021
Date analysed	-	15/04/2021
alpha-BHC	mg/kg	<0.1
HCB	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
gamma-BHC	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Aldrin	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
gamma-Chlordane	mg/kg	<0.1
alpha-chlordane	mg/kg	<0.1
Endosulfan I	mg/kg	<0.1
pp-DDE	mg/kg	<0.1
Dieldrin	mg/kg	<0.1
Endrin	mg/kg	<0.1
Endosulfan II	mg/kg	<0.1
pp-DDD	mg/kg	<0.1
Endrin Aldehyde	mg/kg	<0.1
pp-DDT	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1
Surrogate TCMX	%	84

PCBs in Soil		
Our Reference		266711-1
Your Reference	UNITS	21/0.05
Depth		0.05
Date Sampled		13/04/2021
Type of sample		SOIL
Date extracted	-	15/04/2021
Date analysed	-	15/04/2021
Aroclor 1016	mg/kg	<0.1
Aroclor 1221	mg/kg	<0.1
Aroclor 1232	mg/kg	<0.1
Aroclor 1242	mg/kg	<0.1
Aroclor 1248	mg/kg	<0.1
Aroclor 1254	mg/kg	<0.1
Aroclor 1260	mg/kg	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1
Surrogate TCMX	%	84

Acid Extractable metals in soil			
Our Reference		266711-1	266711-2
Your Reference	UNITS	21/0.05	21/0.9
Depth		0.05	0.9
Date Sampled		13/04/2021	13/04/2021
Type of sample		SOIL	SOIL
Date prepared	-	16/04/2021	16/04/2021
Date analysed	-	16/04/2021	16/04/2021
Arsenic	mg/kg	6	4
Cadmium	mg/kg	<0.4	1
Chromium	mg/kg	14	13
Copper	mg/kg	280	790
Lead	mg/kg	23	110
Mercury	mg/kg	<0.1	0.2
Nickel	mg/kg	6	10
Zinc	mg/kg	79	350

Moisture			
Our Reference		266711-1	266711-2
Your Reference	UNITS	21/0.05	21/0.9
Depth		0.05	0.9
Date Sampled		13/04/2021	13/04/2021
Type of sample		SOIL	SOIL
Date prepared	-	15/04/2021	15/04/2021
Date analysed	-	16/04/2021	16/04/2021
Moisture	%	12	20

Asbestos ID - soils NEPM		
Our Reference		266711-1
Your Reference	UNITS	21/0.05
Depth		0.05
Date Sampled		13/04/2021
Type of sample		SOIL
Date analysed	-	21/04/2021
Sample mass tested	g	545.13
Sample Description	-	Grey fine-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected
ACM >7mm Estimation*	g	–
FA and AF Estimation*	g	–
FA and AF Estimation*#2	%(w/w)	<0.001

Tributyl Tin in Soil		
Our Reference		266711-1
Your Reference	UNITS	21/0.05
Depth		0.05
Date Sampled		13/04/2021
Type of sample		SOIL
Date extracted	-	20/04/2021
Date analysed	-	21/04/2021
Tributyltin as Sn	µg Sn/kg	20
Surrogate Triphenyltin	%	90

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
Ext-054	Analysed by MPL Envirolab
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.

Method ID	Methodology Summary
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS/GC-MSMS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	266711-1
Date extracted	-			15/04/2021	[NT]	[NT]	[NT]	[NT]	15/04/2021	15/04/2021
Date analysed	-			16/04/2021	[NT]	[NT]	[NT]	[NT]	16/04/2021	16/04/2021
TRH C_6 - C_9	mg/kg	25	Org-023	<25	[NT]	[NT]	[NT]	[NT]	104	107
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	[NT]	[NT]	[NT]	[NT]	104	107
Benzene	mg/kg	0.2	Org-023	<0.2	[NT]	[NT]	[NT]	[NT]	87	86
Toluene	mg/kg	0.5	Org-023	<0.5	[NT]	[NT]	[NT]	[NT]	87	87
Ethylbenzene	mg/kg	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	116	122
m+p-xylene	mg/kg	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	114	119
o-Xylene	mg/kg	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	118	123
naphthalene	mg/kg	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	101	[NT]	[NT]	[NT]	[NT]	99	103

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	266711-1
Date extracted	-			15/04/2021	[NT]	[NT]	[NT]	[NT]	15/04/2021	15/04/2021
Date analysed	-			15/04/2021	[NT]	[NT]	[NT]	[NT]	15/04/2021	16/04/2021
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	112	109
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	87	93
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	108	101
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	112	109
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	87	93
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	108	101
Surrogate o-Terphenyl	%		Org-020	100	[NT]	[NT]	[NT]	[NT]	118	90

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	266711-1
Date extracted	-			15/04/2021	[NT]	[NT]	[NT]	[NT]	15/04/2021	15/04/2021
Date analysed	-			15/04/2021	[NT]	[NT]	[NT]	[NT]	15/04/2021	15/04/2021
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	77	81
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	72	71
Fluorene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	77	81
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	89	116
Anthracene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	79	90
Pyrene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	77	90
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	71	80
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	93	84
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	100	[NT]	[NT]	[NT]	[NT]	95	100

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	266711-1
Date extracted	-			15/04/2021	[NT]	[NT]	[NT]	[NT]	15/04/2021	15/04/2021
Date analysed	-			15/04/2021	[NT]	[NT]	[NT]	[NT]	15/04/2021	15/04/2021
alpha-BHC	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	82	82
HCB	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	79	79
gamma-BHC	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	75	83
delta-BHC	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	86	90
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	82	90
gamma-Chlordane	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	84	94
Dieldrin	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	85	93
Endrin	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	91	105
Endosulfan II	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	86	98
Endrin Aldehyde	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	76	82
Methoxychlor	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	95	[NT]	[NT]	[NT]	[NT]	91	88

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	266711-1
Date extracted	-			15/04/2021	[NT]	[NT]	[NT]	[NT]	15/04/2021	15/04/2021
Date analysed	-			15/04/2021	[NT]	[NT]	[NT]	[NT]	15/04/2021	15/04/2021
Aroclor 1016	mg/kg	0.1	Org-021	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	<0.1	[NT]	[NT]	[NT]	[NT]	100	100
Aroclor 1260	mg/kg	0.1	Org-021	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-021	95	[NT]	[NT]	[NT]	[NT]	91	88

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	266711-1
Date prepared	-			16/04/2021	[NT]	[NT]	[NT]	[NT]	16/04/2021	16/04/2021
Date analysed	-			16/04/2021	[NT]	[NT]	[NT]	[NT]	16/04/2021	16/04/2021
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	92	82
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	[NT]	[NT]	100	99
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	99	87
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	96	#
Lead	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	98	95
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	[NT]	[NT]	90	96
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	95	86
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	98	85

QUALITY CONTROL: Tributyl Tin in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	266711-1
Date extracted	-			20/04/2021	1	20/04/2021	20/04/2021		20/04/2021	20/04/2021
Date analysed	-			21/04/2021	1	21/04/2021	21/04/2021		21/04/2021	21/04/2021
Tributyltin as Sn	µg Sn/kg	0.5	Ext-054	<0.5	1	20	36	57	96	#
Surrogate Triphenyltin	%		Ext-054	99	1	90	93	3	100	93

Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

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

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

8 metals in soil - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

Organotins analysed by MPL. Report no. 260482
#1, 1d - Organometallics in soil - Due to low Extracted Internal Standard recovery, results above adjusted PQLs will have a higher than normal measurement of uncertainty. The RPD for duplicate results is accepted due to the non homogenous nature of the sample/s.
#1MS - Organometallics in soil: # Percent recovery is not possible to report as positive analyte in the sample.

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	**Project Number** 202478.00	**To:**	Envirolab Services
Contact Person: Brent Kerry	**Project Name:** Empire Bay DSI	**Contact Person:**	Aileen Hie
Project Mgr: Brent Kerry	**PO No.:**	**Address:**	12 Ashley Street
	lab Quote No. : 2018-2019 List		Chatswood NSW 2068
Address: 5/3 Teanster Cl	**Date results required:** Standard TAT	**Phone:**	02 9910 6200
Tuggerah NSW 2259		**Fax:**	02 9910 6201
	Note: Inform lab in advance if urgent turnaround is required - surcharges apply	**Email:**	ahie@envirolab.com.au
Phone: 4351 1422 **Mob:**	**Report format:** Esdat/PDF / Excel	**Laboratory Report No:**	
Email: brent.kerry@douglaspartners.com.au	**Comments:**	**Lab Comments:**	

Sample information						Tests Required											Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	COMBO #5	COMBO #7	COMBO #3	Asbestos (500ml)	Asbestos ID	CEC	pH	TBT	HM			Provide as much information about the sample as you can
1	21/0.05	0.05	13/04/2021	Jar/Bag	Soil	X			X				X				
2	21/0.9	0.9	13/04/2021	Jar	Soil			X									

ENVIROLAB GROUP

Envirolab Service.
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 260711

Date Received: 15/4/21

Time Received: 10:25

Received By:

Temp: Cool/Ambient

Cooling: Ice/Icepack

Security: Intact/Broken/None

Relinquished by: Douglas Partners	**Sample Receipt**		***Lab use only:***
Courier (by whom) TNT	**Received by (Company):**	Envirolab	**Samples Received:** Cool or Ambient (circle one)
Condition of Sample at dispatch Cool or Ambient (circle) cool	**Print Name:**	Vanny Zhang	**Temperature Received at:** (if applicable)
Temperature (if Applicable):	**Date & Time:**	15/4/21 10:25	**Transported by:** Hand delivered / courier
Print Name: Brent Kerry	**Signature:**		
Date & Time: 14/4/21			
Signature:			

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry

Sample Login Details

Your reference	202478.00, Empire Bay DSI
Envirolab Reference	266711
Date Sample Received	15/04/2021
Date Instructions Received	15/04/2021
Date Results Expected to be Reported	22/04/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	2 SOIL
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	12
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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

Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticides in soil	PCBsin Soil	Acid Extractable metalsin soil	Asbestos ID - soils NEPM	Tributyl Tin in Soil
21/0.05-0.05	✓	✓	✓	✓	✓	✓	✓	✓
21/0.9-0.9	✓	✓	✓			✓		

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	**Project Number** 202478.00	**To:**	Envirolab Services
Contact Person: Brent Kerry	**Project Name:** Empire Bay DSI	**Contact Person:**	Aileen Hie
Project Mgr: Brent Kerry	**PO No.:**	**Address:**	12 Ashley Street
	lab Quote No. : 2018-2019 List		Chatswood NSW 2068
Address: 5/3 Teanster Cl	**Date results required:** Standard TAT	**Phone:**	02 9910 6200
Tuggerah NSW 2259	*Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	**Fax:**	02 9910 6201
		Email:	ahie@envirolab.com.au
Phone: 4351 1422 **Mob:**	**Report format:** Esdat/PDF / Excel	**Laboratory Report No:**	
Email: brent.kerry@douglaspartners.com.au	**Comments:**	**Lab Comments:**	

Sample information						Tests Required											Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	COMBO #5	COMBO #7	COMBO #3	Asbestos (500ml)	Asbestos ID	CEC	pH	TBT	HM			Provide as much information about the sample as you can
1	1/0.05	0.05	12/03/2021	Jar/Bag	Soil	X			X		X	X	X				
2	1/0.75	0.75	12/03/2021	Jar	Soil			X			X	X					
3	2/0.05	0.05	12/03/2021	Jar/Bag	Soil	X			X				X				
4	2/1.0	1.0	12/03/2021	Jar	Soil			X									
5	3/0.4	0.4	11/03/2021	Jar/Bag	Soil		X		X								
6	3/0.7	0.7	11/03/2021	Jar	Soil			X									
7	4/0.15	0.15	11/03/2021	Jar/Bag	Soil	X			X								
8	4/1.0	1.0	11/03/2021	Jar	Soil			X									
9	5/0.05	0.05	12/03/2021	Jar/Bag	Soil	X							X				
10	5/0.3	0.3	12/03/2021	Jar	Soil									X			
11	6/0.05	0.05	11/03/2021	Jar/Bag	Soil	X			X								
12	6/0.5	0.5	11/03/2021	Jar	Soil			X									
13	7/0.65	0.65	12/03/2021	Jar	Soil								X	X			
14	8/2.1	2.1	12/03/2021	Jar	Soil									X			
15	9/2.1	2.1	12/03/2021	Jar	Soil									X			
16	10/3.7	3.7	12/03/2021	Jar	Soil									X			
17	11/2.7	2.7	12/03/2021	Jar	Soil									X			
18	12/0.4	0.4	12/03/2021	Jar	Soil								X	X			
19	13/2.5	2.5	12/03/2021	Jar	Soil									X			
~~DK~~	14/FCA	Surface	12/03/2021	Bag	Soil					X							
~~DK~~	14/FCB	Surface	12/03/2021	Bag	Soil					X							
20	14/0.1	0.1	12/03/2021	Jar/Bag	Soil				X					X			

ENVIROLAB GROUP

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 264461
Date Received: 17/3/21
Time Received: 10:30
Received By: KC
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by: Douglas Partners	**Sample Receipt**	*Lab use only:*	
Courier (by whom) TNT	**Received by (Company):** ELS Syd	**Samples Received:** Cool or Ambient (circle one)	
Condition of Sample at dispatch Cool or Ambient (circle) cool	**Print Name:** K. Clore	**Temperature Received at:** 18 (if applicable)	
Temperature (if Applicable):	**Date & Time:** 17/03/2021 10:30	**Transported by:** Hand delivered / courier	
Print Name: Brent Kerry	**Signature:**		
Date & Time: 16/3/21			
Signature:			

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	**Project Number** 202478.00	**To:**	Envirolab Services
Contact Person: Brent Kerry	**Project Name:** Empire Bay DSI	**Contact Person:**	Aileen Hie
Project Mgr: Brent Kerry	**PO No.:**	**Address:**	12 Ashley Street
	lab Quote No. : 2018-2019 List		Chatswood NSW 2068
Address: 5/3 Teanster Cl	**Date results required:** Standard TAT	**Phone:**	02 9910 6200
Tuggerah NSW 2259		**Fax:**	02 9910 6201
	Note: Inform lab in advance if urgent turnaround is required - surcharges apply	**Email:**	ahie@envirolab.com.au
Phone: 4351 1422 **Mob:**	**Report format:** Esdat/PDF / Excel	**Laboratory Report No:**	
Email: brent.kerry@douglaspartners.com.au	**Comments:**	**Lab Comments:**	

Sample information						Tests Required											Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	COMBO #5	COMBO #7	COMBO #3	Asbestos (500ml)	Asbestos ID	CEC	pH	TBT	Combo #1m	TRH B1e1		Provide as much information about the sample as you can
21	15/0.1	0.1	15/03/2021	Jar/Bag	Soil		X		X								
22	QA2	0.4	12/03/2021	Jar/Bag	Soil									X			
23	RB1	-	12/03/2021	bottles	Water									X			
24	TB1	-	12/03/2021	Jar	Soil									1BX1	X		

Relinquished by: Douglas Partners	**Sample Receipt**	***Lab use only:***
Courier (by whom) TNT	**Received by (Company):** EIS Syd	**Samples Received:** (Cool) or Ambient (circle one)
Condition of Sample at dispatch Cool or Ambient (circle) cool	**Print Name:** K-Chok	**Temperature Received at:** 18 (if applicable)
Temperature (if Applicable):	**Date & Time:** 17/03/2021 10:30	**Transported by:** Hand delivered / (Courier)
Print Name: Brent Kerry	**Signature:**	
Date & Time: 16/3/21		264461.
Signature:		

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2109481**	Page	: 1 of 5
Client	: **DOUGLAS PARTNERS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: BRENT KERRY	Contact	: Sepan Mahamad
Address	: 5/3 Teanster Cl Tuggerah NSW 2259	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 202478.00 Empire Bay DSI	Date Samples Received	: 17-Mar-2021 15:00
Order number	: ----	Date Analysis Commenced	: 18-Mar-2021
C-O-C number	: ----	Issue Date	: 24-Mar-2021 15:56
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
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, unless the sampling was conducted by ALS. 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*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

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

- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	QA1	----	----	----	----
				Sampling date / time	11-Mar-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2109481-001	--------	--------	--------	--------
					Result	----	----	----	----
EA055: Moisture Content									
Moisture Content	----	1.0	%		**8.7**	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		**6**	----	----	----	----
Cadmium	7440-43-9	1	mg/kg		<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg		**6**	----	----	----	----
Copper	7440-50-8	5	mg/kg		**61**	----	----	----	----
Lead	7439-92-1	5	mg/kg		**94**	----	----	----	----
Nickel	7440-02-0	2	mg/kg		**3**	----	----	----	----
Zinc	7440-66-6	5	mg/kg		**116**	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		**0.2**	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	----	----	----	----
C10 - C14 Fraction	----	50	mg/kg		<50	----	----	----	----
C15 - C28 Fraction	----	100	mg/kg		<100	----	----	----	----
C29 - C36 Fraction	----	100	mg/kg		<100	----	----	----	----
^ **C10 - C36 Fraction (sum)**	----	50	mg/kg		<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	----	----	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg		<10	----	----	----	----
>C10 - C16 Fraction	----	50	mg/kg		<50	----	----	----	----
>C16 - C34 Fraction	----	100	mg/kg		<100	----	----	----	----
>C34 - C40 Fraction	----	100	mg/kg		<100	----	----	----	----
^ **>C10 - C40 Fraction (sum)**	----	50	mg/kg		<50	----	----	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	50	mg/kg		<50	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	----	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	----	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	----	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	----	----	----	----
^ **Sum of BTEX**	----	0.2	mg/kg		<0.2	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	QA1	----	----	----	----
				Sampling date / time	11-Mar-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2109481-001	--------	--------	--------	--------
					Result	----	----	----	----
EP080: BTEXN - Continued									
^ **Total Xylenes**	----	0.5	mg/kg		<0.5	----	----	----	----
Naphthalene	91-20-3	1	mg/kg		<1	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**74.3**	----	----	----	----
Toluene-D8	2037-26-5	0.2	%		**74.4**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		**80.8**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2109481**	Page	: 1 of 5
Client	: **DOUGLAS PARTNERS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: BRENT KERRY	Contact	: Sepan Mahamad
Address	: 5/3 Teanster Cl Tuggerah NSW 2259	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 202478.00 Empire Bay DSI	Date Samples Received	: 17-Mar-2021
Order number	: ----	Date Analysis Commenced	: 18-Mar-2021
C-O-C number	: ----	Issue Date	: 24-Mar-2021
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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, unless the sampling was conducted by ALS. 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*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3578574)									
ES2109481-001	QA1	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	6	6	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	3	3	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	6	6	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	61	62	2.47	0% - 50%
		EG005T: Lead	7439-92-1	5	mg/kg	94	99	5.26	0% - 50%
		EG005T: Zinc	7440-66-6	5	mg/kg	116	123	5.45	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3578576)									
ES2109529-001	Anonymous	EA055: Moisture Content	----	0.1	%	4.5	4.7	3.96	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3578575)									
ES2109481-001	QA1	EG035T: Mercury	7439-97-6	0.1	mg/kg	0.2	0.2	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3571750)									
ES2109481-001	QA1	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
EW2101214-007	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3573764)									
ES2109575-001	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3571750)									
ES2109481-001	QA1	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	11	0.00	No Limit
EW2101214-007	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3573764)									
ES2109575-001	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3573764) - continued									
ES2109575-001	Anonymous	EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
EP080: BTEXN (QC Lot: 3571750)									
ES2109481-001	QA1	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit
EW2101214-007	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3578574)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	121.1 mg/kg	107	88.0	113
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	0.74 mg/kg	105	70.0	130
EG005T: Chromium	7440-47-3	2	mg/kg	<2	20.2 mg/kg	105	68.0	132
EG005T: Copper	7440-50-8	5	mg/kg	<5	52.9 mg/kg	103	89.0	111
EG005T: Lead	7439-92-1	5	mg/kg	<5	62.1 mg/kg	95.3	82.0	119
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.4 mg/kg	101	80.0	120
EG005T: Zinc	7440-66-6	5	mg/kg	<5	162 mg/kg	79.4	66.0	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3578575)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.073 mg/kg	93.0	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3571750)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	86.0	68.4	128
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3573764)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	300 mg/kg	105	75.0	129
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	450 mg/kg	103	77.0	131
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	300 mg/kg	102	71.0	129
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3571750)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	87.6	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3573764)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	375 mg/kg	105	77.0	125
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	525 mg/kg	102	74.0	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	225 mg/kg	92.6	63.0	131
EP080: BTEXN (QCLot: 3571750)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	90.2	62.0	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	88.9	67.0	121
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	88.4	65.0	117
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	89.6	66.0	118
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	89.9	68.0	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	92.7	63.0	119

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3578574)							
ES2109481-001	QA1	EG005T: Arsenic	7440-38-2	50 mg/kg	99.4	70.0	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	97.8	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	97.4	68.0	132
		EG005T: Copper	7440-50-8	250 mg/kg	94.1	70.0	130
		EG005T: Lead	7439-92-1	250 mg/kg	96.0	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	96.1	70.0	130
		EG005T: Zinc	7440-66-6	250 mg/kg	91.9	66.0	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3578575)							
ES2109481-001	QA1	EG035T: Mercury	7439-97-6	5 mg/kg	89.2	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3571750)							
ES2109481-001	QA1	EP080: C6 - C9 Fraction	----	32.5 mg/kg	92.2	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3573764)							
ES2109575-001	Anonymous	EP071: C10 - C14 Fraction	----	523 mg/kg	100	73.0	137
		EP071: C15 - C28 Fraction	----	2319 mg/kg	115	53.0	131
		EP071: C29 - C36 Fraction	----	1714 mg/kg	114	52.0	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3571750)							
ES2109481-001	QA1	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	100	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3573764)							
ES2109575-001	Anonymous	EP071: >C10 - C16 Fraction	----	860 mg/kg	107	73.0	137
		EP071: >C16 - C34 Fraction	----	3223 mg/kg	101	53.0	131
		EP071: >C34 - C40 Fraction	----	1058 mg/kg	97.4	52.0	132
EP080: BTEXN (QCLot: 3571750)							
ES2109481-001	QA1	EP080: Benzene	71-43-2	2.5 mg/kg	75.9	70.0	130
		EP080: Toluene	108-88-3	2.5 mg/kg	83.2	70.0	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	85.7	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	85.8	70.0	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	87.0	70.0	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	88.2	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2109481**	Page	: 1 of 4
Client	: **DOUGLAS PARTNERS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: BRENT KERRY	Telephone	: +61 2 8784 8555
Project	: 202478.00 Empire Bay DSI	Date Samples Received	: 17-Mar-2021
Site	: ----	Issue Date	: 24-Mar-2021
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

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

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

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
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055)							
QA1	**11-Mar-2021**	**----**	----	----	**22-Mar-2021**	25-Mar-2021	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
QA1	**11-Mar-2021**	**22-Mar-2021**	07-Sep-2021	✓	**23-Mar-2021**	07-Sep-2021	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
QA1	**11-Mar-2021**	**22-Mar-2021**	08-Apr-2021	✓	**23-Mar-2021**	08-Apr-2021	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080)							
QA1	**11-Mar-2021**	**18-Mar-2021**	25-Mar-2021	✓	**22-Mar-2021**	25-Mar-2021	✓
Soil Glass Jar - Unpreserved (EP071)							
QA1	**11-Mar-2021**	**19-Mar-2021**	25-Mar-2021	✓	**22-Mar-2021**	28-Apr-2021	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080)							
QA1	**11-Mar-2021**	**18-Mar-2021**	25-Mar-2021	✓	**22-Mar-2021**	25-Mar-2021	✓
Soil Glass Jar - Unpreserved (EP071)							
QA1	**11-Mar-2021**	**19-Mar-2021**	25-Mar-2021	✓	**22-Mar-2021**	28-Apr-2021	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
QA1	**11-Mar-2021**	**18-Mar-2021**	25-Mar-2021	✓	**22-Mar-2021**	25-Mar-2021	✓

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)							
Moisture Content	EA055	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Total Mercury by FIMS	EG035T	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Total Mercury by FIMS	EG035T	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Mercury by FIMS	EG035T	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	16	**6.25**	**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
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	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 Schedule B(3)
Total Mercury by FIMS	EG035T	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 Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.

Preparation Methods	Method	Matrix	Method Descriptions
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 Schedule B(3).
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	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2109481**

Client	: **DOUGLAS PARTNERS PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: BRENT KERRY	Contact	: Sepan Mahamad
Address	: 5/3 Teanster Cl Tuggerah NSW 2259	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: brent.kerry@douglaspartners.com.au	E-mail	: Sepan.Mahamad@ALSGlobal.com
Telephone	: ----	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 202478.00 Empire Bay DSI	Page	: 1 of 2
Order number	: ----	Quote number	: EM2017DOUPAR0002 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 17-Mar-2021 15:00	Issue Date	: 18-Mar-2021
Client Requested Due Date	: 24-Mar-2021	Scheduled Reporting Date	: **24-Mar-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 3 - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EA055-103 Moisture Content	SOIL - S-05 TRH/BTEXN/8 Metals
ES2109481-001	11-Mar-2021 00:00	QA1	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE INVOICES

- A4 - AU Tax Invoice (INV)	Email	apinvoices@douglaspartners.com.au

BRENT KERRY

- *AU Certificate of Analysis - NATA (COA)	Email	brent.kerry@douglaspartners.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	brent.kerry@douglaspartners.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	brent.kerry@douglaspartners.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	brent.kerry@douglaspartners.com.au
- A4 - AU Tax Invoice (INV)	Email	brent.kerry@douglaspartners.com.au
- Chain of Custody (CoC) (COC)	Email	brent.kerry@douglaspartners.com.au
- EDI Format - ENMRG (ENMRG)	Email	brent.kerry@douglaspartners.com.au
- EDI Format - ESDAT (ESDAT)	Email	brent.kerry@douglaspartners.com.au
- EDI Format - XTab (XTAB)	Email	brent.kerry@douglaspartners.com.au

ELS ID: 264461.

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	**Project Number** 202478.00	**To:** ALS Sydney
Contact Person: Brent Kerry	**Project Name:** Empire Bay DSI	**Contact Person:** Sample Receipt
Project Mgr: Brent Kerry	**PO No.:**	**Address:**
	lab Quote No. : 2018-2019 List	
Address: 5/3 Teanster Cl Tuggerah NSW 2259	**Date results required:** Standard TAT *Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	**Phone:** **Fax:** **Email:**
Phone: 4351 1422 **Mob:**	**Report format:** Esdat/PDF / Excel	**Laboratory Report No:**
Email: brent.kerry@douglaspartners.com.au	**Comments:**	**Lab Comments:**

Sample information						Tests Required											Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	8 Metals	TRH/BTEX	COMBO #3	Asbestos (500ml)	Asbestos ID	CEC	pH	TBT				Provide as much information about the sample as you can
	QA1	1	11/03/2021	Jar	Soil	X	X										

Environmental Division
Sydney
Work Order Reference
ES2109481

Telephone : +61-2-8784 8555

Relinquished by: Douglas Partners	**Sample Receipt**	***Lab use only:***
Courier (by whom) TNT	**Received by (Company):** SOBH	**Samples Received: Cool or Ambient (circle one)**
Condition of Sample at dispatch Cool or Ambient (circle) cool	**Print Name:** SOBH	**Temperature Received at:** (if applicable)
Temperature (if Applicable):	**Date & Time:** 17/3/21 1500 3.6	**Transported by: Hand delivered / courier**
Print Name: Brent Kerry	**Signature:**	
Date & Time: 16/3/21		
Signature:		

Page 1 of 1

Relinquished by: ELS Syd K. Cook
17/03/2021 12:30

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

CERTIFICATE OF ANALYSIS 265209

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry
Address	Unit 5, 3 Teamster Close, Tuggerah, NSW, 2259

Sample Details

Your Reference	**202478.00, Empire Bay DSI**
Number of Samples	5 Water
Date samples received	26/03/2021
Date completed instructions received	26/03/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	06/04/2021
Date of Issue	06/04/2021
Reissue Details	This report replaces R00 created on 01/04/2021 due to: revised report with additional metals results. (client request)

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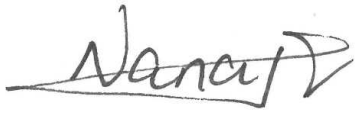
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Team Leader, Inorganics
Dragana Tomas, Senior Chemist
Jaimie Loa-Kum-Cheung, Metals Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water						
Our Reference		265209-1	265209-2	265209-3	265209-4	265209-5
Your Reference	UNITS	MW3	MW4	MW6	QAW1	RBW1
Date Sampled		24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	29/03/2021	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Date analysed	-	30/03/2021	30/03/2021	30/03/2021	30/03/2021	30/03/2021
TRH C_6 - C_9	µg/L	<10	<10	<10	<10	<10
TRH C_6 - C_{10}	µg/L	<10	<10	<10	<10	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10	<10	<10	<10
Benzene	µg/L	<1	<1	<1	<1	<1
Toluene	µg/L	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2	<2	<2
o-xylene	µg/L	<1	<1	<1	<1	<1
MTBE	µg/L	<1	<1	<1	<1	<1
Naphthalene	µg/L	<1	<1	<1	<1	<1
Surrogate Dibromofluoromethane	%	109	107	112	112	112
Surrogate toluene-d8	%	100	100	100	102	101
Surrogate 4-BFB	%	85	89	86	83	87

svTRH (C10-C40) in Water						
Our Reference		265209-1	265209-2	265209-3	265209-4	265209-5
Your Reference	UNITS	MW3	MW4	MW6	QAW1	RBW1
Date Sampled		24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	29/03/2021	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Date analysed	-	30/03/2021	30/03/2021	30/03/2021	30/03/2021	30/03/2021
TRH C_{10} - C_{14}	µg/L	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	µg/L	<100	150	<100	200	<100
TRH C_{29} - C_{36}	µg/L	<100	<100	<100	<100	<100
TRH >C_{10} - C_{16}	µg/L	<50	<50	<50	<50	58
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	<50	<50	<50	58
TRH >C_{16} - C_{34}	µg/L	<100	190	<100	250	<100
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	79	84	82	96	85

PAHs in Water - Low Level					
Our Reference		265209-1	265209-2	265209-3	265209-4
Your Reference	UNITS	MW3	MW4	MW6	QAW1
Date Sampled		24/03/2021	24/03/2021	24/03/2021	24/03/2021
Type of sample		Water	Water	Water	Water
Date extracted	-	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Date analysed	-	30/03/2021	30/03/2021	30/03/2021	30/03/2021
Naphthalene	µg/L	<0.2	<0.2	<0.2	<0.2
Acenaphthylene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	<0.1	<0.1	<0.1
Surrogate p-Terphenyl-d14	%	72	78	71	76

Total Phenolics in Water					
Our Reference		265209-1	265209-2	265209-3	265209-4
Your Reference	UNITS	MW3	MW4	MW6	QAW1
Date Sampled		24/03/2021	24/03/2021	24/03/2021	24/03/2021
Type of sample		Water	Water	Water	Water
Date extracted	-	30/03/2021	30/03/2021	30/03/2021	30/03/2021
Date analysed	-	30/03/2021	30/03/2021	30/03/2021	30/03/2021
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05	<0.05

HM in water - dissolved						
Our Reference		265209-1	265209-2	265209-3	265209-4	265209-5
Your Reference	UNITS	MW3	MW4	MW6	QAW1	RBW1
Date Sampled		24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	29/03/2021	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Date analysed	-	29/03/2021	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Arsenic-Dissolved	µg/L	19	4	7	4	<1
Cadmium-Dissolved	µg/L	0.1	0.1	0.2	0.1	<0.1
Chromium-Dissolved	µg/L	3	3	1	3	<1
Copper-Dissolved	µg/L	200	150	58	150	<1
Lead-Dissolved	µg/L	43	35	3	39	<1
Mercury-Dissolved	µg/L	0.14	0.16	0.14	0.17	<0.05
Nickel-Dissolved	µg/L	10	6	42	6	<1
Zinc-Dissolved	µg/L	71	120	100	120	<1
Boron-Dissolved	µg/L	100	100	30	200	<20
Barium-Dissolved	µg/L	4	26	6	27	<1
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt-Dissolved	µg/L	<1	<1	<1	<1	<1
Manganese-Dissolved	µg/L	8	14	<5	14	<5
Molybdenum-Dissolved	µg/L	23	37	11	38	<1
Antimony-Dissolved	µg/L	6	5	1	5	<1
Selenium-Dissolved	µg/L	<1	<1	<1	<1	<1
Tin-Dissolved	µg/L	<1	<1	<1	<1	<1

Method ID	Methodology Summary
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	[NT]
Date extracted	-			29/03/2021	1	29/03/2021	29/03/2021		29/03/2021	[NT]
Date analysed	-			30/03/2021	1	30/03/2021	30/03/2021		30/03/2021	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	1	<10	<10	0	99	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	1	<10	<10	0	99	[NT]
Benzene	µg/L	1	Org-023	<1	1	<1	<1	0	92	[NT]
Toluene	µg/L	1	Org-023	<1	1	<1	<1	0	101	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	1	<1	<1	0	101	[NT]
m+p-xylene	µg/L	2	Org-023	<2	1	<2	<2	0	101	[NT]
o-xylene	µg/L	1	Org-023	<1	1	<1	<1	0	104	[NT]
MTBE	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Naphthalene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	106	1	109	102	7	99	[NT]
Surrogate toluene-d8	%		Org-023	98	1	100	99	1	99	[NT]
Surrogate 4-BFB	%		Org-023	83	1	85	104	20	105	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	[NT]
Date extracted	-			29/03/2021	[NT]	[NT]	[NT]	[NT]	29/03/2021	[NT]
Date analysed	-			30/03/2021	[NT]	[NT]	[NT]	[NT]	30/03/2021	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	117	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	118	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	96	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	117	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	118	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	96	[NT]
Surrogate o-Terphenyl	%		Org-020	87	[NT]	[NT]	[NT]	[NT]	81	[NT]

QUALITY CONTROL: PAHs in Water - Low Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	[NT]
Date extracted	-			29/03/2021	[NT]	[NT]	[NT]	[NT]	29/03/2021	[NT]
Date analysed	-			30/03/2021	[NT]	[NT]	[NT]	[NT]	30/03/2021	[NT]
Naphthalene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	76	[NT]
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	70	[NT]
Fluorene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	77	[NT]
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	80	[NT]
Anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	71	[NT]
Pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	73	[NT]
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	70	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	75	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	83	[NT]	[NT]	[NT]	[NT]	81	[NT]

QUALITY CONTROL: Total Phenolics in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	[NT]
Date extracted	-			30/03/2021	[NT]	[NT]	[NT]	[NT]	30/03/2021	[NT]
Date analysed	-			30/03/2021	[NT]	[NT]	[NT]	[NT]	30/03/2021	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	[NT]	[NT]	[NT]	[NT]	100	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date prepared	-			29/03/2021	1	29/03/2021	29/03/2021		29/03/2021	[NT]
Date analysed	-			29/03/2021	1	29/03/2021	29/03/2021		29/03/2021	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	19	19	0	102	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	0.1	0.1	0	103	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	3	3	0	102	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	1	200	200	0	101	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	1	43	38	12	92	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	0.14	0.14	0	104	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	10	10	0	102	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	71	73	3	104	[NT]
Boron-Dissolved	µg/L	20	Metals-022	<20	1	100	100	0	93	[NT]
Barium-Dissolved	µg/L	1	Metals-022	<1	1	4	3	29	95	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	1	<0.5	<0.5	0	88	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	105	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	8	8	0	98	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	1	23	24	4	106	[NT]
Antimony-Dissolved	µg/L	1	Metals-022	<1	1	6	6	0	92	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	103	[NT]
Tin-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	105	[NT]

Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

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

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

SCC0226

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	**Project Number** 202478.00	**To:**	Envirolab Services
Contact Person: Brent Kerry	**Project Name:** Empire Bay DSI	**Contact Person:**	Aileen Hie
Project Mgr: Brent Kerry	**PO No.:**	**Address:**	12 Ashley Street
	lab Quote No. : 2018-2019 List		Chatswood NSW 2068
Address: 5/3 Teanster Cl	**Date results required:** Standard TAT	**Phone:**	02 9910 6200
Tuggerah NSW 2259	*Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	**Fax:**	02 9910 6201
		Email:	ahie@envirolab.com.au
Phone: 4351 1422 **Mob:**	**Report format:** Esdat/PDF / Excel	**Laboratory Report No:**	
Email: brent.kerry@douglaspartners.com.au	**Comments:**	**Lab Comments:**	

Sample information						Tests Required											Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	COMBO #4L	COMBO #1M	COMBO #3	MTBE								Provide as much information about the sample as you can
1	MW3		24/03/2021	Bottles	GW	X			X								Groundwater Samples were field filtered
2	MW4		24/03/2021	Bottles	GW	X			X								
3	MW6		24/03/2021	Bottles	GW	X			X								
4	QAW1		24/03/2021	Bottles	GW	X			X								
5	RBW1		24/03/2021	Bottles	GW		X										

ENVIROLAB

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 205209

Date Received: 26/3/2021
Time Received: 1040
Received By: TB
Temp: Cool/Ambient
Cooling: Ice/icepack
Security: Intact/Broken/None

Relinquished by: Douglas Partners	**Sample Receipt**	***Lab use only:***	
Courier (by whom) TNT	**Received by (Company):** EL	**Samples Received:** Cool or Ambient (circle one)	
Condition of Sample at dispatch Cool or Ambient (circle) cool	**Print Name:** Pilay	**Temperature Received at:** 4.2 (if applicable)	
Temperature (if Applicable):	**Date & Time:** 26/3/2021 1040	**Transported by:** Hand delivered / courier	
Print Name: Brent Kerry	**Signature:**		
Date & Time: 25/3/21			
Signature:			

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry

Sample Login Details

Your reference	202478.00, Empire Bay DSI
Envirolab Reference	265209
Date Sample Received	26/03/2021
Date Instructions Received	26/03/2021
Date Results Expected to be Reported	06/04/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	5 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	14.2
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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

Sample ID	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHs in Water - Low Level	Total Phenolicsin Water	HM in water - dissolved
MW3	✓	✓	✓	✓	✓
MW4	✓	✓	✓	✓	✓
MW6	✓	✓	✓	✓	✓
QAW1	✓	✓	✓	✓	✓
RBW1	✓	✓			✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 266713

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry
Address	Unit 5, 3 Teamster Close, Tuggerah, NSW, 2259

Sample Details

Your Reference	**202478.00, Empire Bay DSI**
Number of Samples	3 Water
Date samples received	15/04/2021
Date completed instructions received	15/04/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	22/04/2021
Date of Issue	22/04/2021

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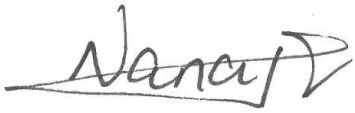
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Team Leader, Inorganics
Giovanni Agosti, Group Technical Manager
Jeremy Faircloth, Operations Manager, Sydney

Authorised By



Nancy Zhang, Laboratory Manager

Tributyl Tin in Water				
Our Reference		266713-1	266713-2	266713-3
Your Reference	UNITS	MW3	MW4	MW6
Date Sampled		14/04/2021	14/04/2021	14/04/2021
Type of sample		Water	Water	Water
Date extracted	-	20/04/2021	20/04/2021	20/04/2021
Date analysed	-	21/04/2021	21/04/2021	21/04/2021
Tributyltin as Sn	µg/L	0.056	0.006	<0.002
Surrogate Triphenyltin	%	97	98	99

Miscellaneous Inorganics				
Our Reference		266713-1	266713-2	266713-3
Your Reference	UNITS	MW3	MW4	MW6
Date Sampled		14/04/2021	14/04/2021	14/04/2021
Type of sample		Water	Water	Water
Date prepared	-	16/04/2021	16/04/2021	16/04/2021
Date analysed	-	16/04/2021	16/04/2021	16/04/2021
Total Cyanide	mg/L	<0.004	<0.004	<0.004

All metals in water-dissolved				
Our Reference	UNITS	266713-1	266713-2	266713-3
Your Reference		MW3	MW4	MW6
Date Sampled		14/04/2021	14/04/2021	14/04/2021
Type of sample		Water	Water	Water
Date prepared	-	16/04/2021	16/04/2021	16/04/2021
Date analysed	-	16/04/2021	16/04/2021	16/04/2021
Arsenic-Dissolved	µg/L	3	4	11
Boron-Dissolved	µg/L	2,800	520	100
Barium-Dissolved	µg/L	18	190	17
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5
Cadmium-Dissolved	µg/L	0.2	0.7	<0.1
Cobalt-Dissolved	µg/L	<1	2	<1
Chromium-Dissolved	µg/L	<1	2	3
Copper-Dissolved	µg/L	18	40	11
Mercury-Dissolved	µg/L	<0.05	0.08	0.06
Manganese-Dissolved	µg/L	7	100	13
Molybdenum-Dissolved	µg/L	8	23	16
Nickel-Dissolved	µg/L	<1	5	2
Lead-Dissolved	µg/L	6	20	4
Antimony-Dissolved	µg/L	<1	3	<1
Selenium-Dissolved	µg/L	<1	<1	<1
Tin-Dissolved	µg/L	<1	3	<1
Zinc-Dissolved	µg/L	50	430	81

Method ID	Methodology Summary
Ext-054	Analysed by MPL Envirolab
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjusted as required prior to analysis. Cyanides amenable to Chlorination - samples are analysed untreated and treated with hyperchlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Tributyl Tin in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			20/04/2021	[NT]	[NT]	[NT]	[NT]	20/04/2021	[NT]
Date analysed	-			21/04/2021	[NT]	[NT]	[NT]	[NT]	21/04/2021	[NT]
Tributyltin as Sn	µg/L	0.002	Ext-054	<0.002	[NT]	[NT]	[NT]	[NT]	116	[NT]
Surrogate Triphenyltin	%		Ext-054	100	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	266713-2
Date prepared	-			16/04/2021	1	16/04/2021	16/04/2021		16/04/2021	16/04/2021
Date analysed	-			16/04/2021	1	16/04/2021	16/04/2021		16/04/2021	16/04/2021
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	88	71

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			16/04/2021	[NT]	[NT]	[NT]	[NT]	16/04/2021	[NT]
Date analysed	-			16/04/2021	[NT]	[NT]	[NT]	[NT]	16/04/2021	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Boron-Dissolved	µg/L	20	Metals-022	<20	[NT]	[NT]	[NT]	[NT]	106	[NT]
Barium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	94	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	88	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	103	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Antimony-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	87	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Tin-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
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Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
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Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

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

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

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Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

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

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

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Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Organotins analysed by MPL. Report no. 260482
#4 - Organometallics in water: PQL has been raised due to decreased internal standard efficiency. This may be due to sample matrix interferences.

Revised COC 15/04/2021 12:25

266713.

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	Project Number 202478.00	To:	Envirolab Services
Contact Person: Brent Kerry	Project Name: Empire Bay DSI	Contact Person:	Aileen Hie
Project Mgr: Brent Kerry	PO No.:	Address:	12 Ashley Street
	lab Quote No. : 2018-2019 List		Chatswood NSW 2068
Address: 5/3 Teanster Cl	Date results required: Standard TAT	Phone:	02 9910 6200
Tuggerah NSW 2259		Fax:	02 9910 6201
	Note: Inform lab in advance if urgent turnaround is required - surcharges apply	Email:	ahie@envirolab.com.au
Phone: 4351 1422 Mob:	Report format: Esdat/PDF / Excel	Laboratory Report No:	
Email: brent.kerry@douglaspartners.com.au	Comments:	Lab Comments:	

Sample information						Tests Required										Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	COMBO #4L	COMBO #1M	COMBO #3	MTBE	TBT	Total CN	17 Metals				Provide as much information about the sample as you can
1	MW3		14/04/2021	Bottles	GW					X	X	X				Groundwater Samples were field filtered (metals bottle only)
2	MW4		14/04/2021	Bottles	GW					X	X	X				
3	MW6		14/04/2021	Bottles	GW					X	X	X				

Relinquished by: Douglas Partners	Sample Receipt	*Lab use only:*
Courier (by whom) TNT	Received by (Company): ES8 Sydney	Samples Received: (Cool) or Ambient (circle one)
Condition of Sample at dispatch Cool or Ambient (circle) cool	Print Name:	Temperature Received at: 12.0 °(if applicable)
Temperature (if Applicable):	Date & Time: 15/04/2021 10:25	Transported by: Hand delivered / courier
Print Name: Brent Kerry	Signature:	
Date & Time: 14/4/21		
Signature:		

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	**Project Number** 202478.00	**To:**	Envirolab Services
Contact Person: Brent Kerry	**Project Name:** Empire Bay DSI	**Contact Person:**	Aileen Hie
Project Mgr: Brent Kerry	**PO No.:**	**Address:**	12 Ashley Street
	lab Quote No. : 2018-2019 List		Chatswood NSW 2068
Address: 5/3 Teanster Cl	**Date results required:** Standard TAT	**Phone:**	02 9910 6200
Tuggerah NSW 2259	*Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	**Fax:**	02 9910 6201
		Email:	ahie@envirolab.com.au
Phone: 4351 1422 **Mob:**	**Report format:** Esdat/PDF / Excel	**Laboratory Report No:**	
Email: brent.kerry@douglaspartners.com.au	**Comments:**	**Lab Comments:**	

Sample information						Tests Required											Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	COMBO #4L	COMBO #1M	COMBO #3	MTBE	TBT	CN						Provide as much information about the sample as you can
1	MW3		14/04/2021	Bottles	GW					X	X						Groundwater Samples were field filtered
2	MW4		14/04/2021	Bottles	GW					X	X						
3	MW6		14/04/2021	Bottles	GW					X	X						

metals bottle only

ENVIROLAB GROUP
Envirolab Service:
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 206713
Date Received: 15/4/21
Time Received: 10:25
Received By:
Temp: Cool/Ambient
Cooling: Ice/Icepack)
Security: Intact/Broken/None

Relinquished by: Douglas Partners	**Sample Receipt**	***Lab use only:***
Courier (by whom) TNT	**Received by (Company):** Envirolab	**Samples Received: Cool or Ambient (circle one)**
Condition of Sample at dispatch Cool or Ambient (circle) cool	**Print Name:** Nancy Zhang	**Temperature Received at:** (if applicable)
Temperature (if Applicable):	**Date & Time:** 15/4/21 10:25	**Transported by: Hand delivered / courier**
Print Name: Brent Kerry	**Signature:**	
Date & Time: 14/4/21		
Signature:		

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry

Sample Login Details

Your reference	202478.00, Empire Bay DSI
Envirolab Reference	266713
Date Sample Received	15/04/2021
Date Instructions Received	15/04/2021
Date Results Expected to be Reported	22/04/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	3 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	12
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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

Sample ID	Tributyl Tin in Water	Total Cyanide	All metals in water-dissolved
MW3	✓	✓	✓
MW4	✓	✓	✓
MW6	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

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customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 264687

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry
Address	Unit 5, 3 Teamster Close, Tuggerah, NSW, 2259

Sample Details

Your Reference	**202478.00, Empire Bay DSI**
Number of Samples	4 Soil
Date samples received	19/03/2021
Date completed instructions received	19/03/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	26/03/2021
Date of Issue	26/03/2021

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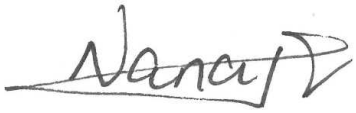
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Chromium Suite					
Our Reference		264687-1	264687-2	264687-3	264687-4
Your Reference	UNITS	1/0.3	1/1.1	1/2.6	9/2.4
Depth		0.1	1.1	2.6	2.4
Date Sampled		12/03/2021	12/03/2021	12/03/2021	11/03/2021
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021
Date analysed	-	23/03/2021	23/03/2021	23/03/2021	23/03/2021
pH $_{kcl}$	pH units	5.3	4.7	5.0	8.5
s-TAA pH 6.5	%w/w S	<0.01	0.01	<0.01	<0.01
TAA pH 6.5	moles H^+ /t	<5	6	<5	<5
Chromium Reducible Sulfur	%w/w	<0.005	0.09	0.12	0.33
a-Chromium Reducible Sulfur	moles H^+ /t	<3	57	77	210
S_{HCl}	%w/w S	NT	NT	NT	NT
S_{KCl}	%w/w S	<0.005	0.026	0.015	0.055
S_{NAS}	%w/w S	NT	NT	NT	NT
ANC_{BT}	% $CaCO_3$	NT	NT	NT	0.40
s-ANC_{BT}	%w/w S	NT	NT	NT	0.13
s-Net Acidity	%w/w S	<0.005	0.10	0.13	0.25
a-Net Acidity	moles H^+ /t	<5	64	79	150
Liming rate	kg $CaCO_3$ /t	<0.75	5	6	12
a-Net Acidity without ANCE	moles H^+ /t	<5	64	79	210
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75	4.8	5.9	16
s-Net Acidity without ANCE	%w/w S	<0.005	0.10	0.13	0.33

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

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			23/03/2021	1	23/03/2021	23/03/2021		23/03/2021	[NT]
Date analysed	-			23/03/2021	1	23/03/2021	23/03/2021		23/03/2021	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	1	5.3	5.2	2	96	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	1	<0.01	<0.01	0	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	<5	1	<5	<5	0	94	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	<3	1	<3	<3	0	108	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	1	NT	NT		[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	1	NT	NT		[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	1	NT	NT		[NT]	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	1	NT	NT		[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	<5	1	<5	<5	0	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	<0.75	<0.75	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	<5	1	<5	<5	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	<0.75	<0.75	0	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]

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CHAIN OF CUSTODY

Douglas Partners
Geotechnics | Environment | Groundwater

Client: Douglas Partners	**Project Number** 202478.00	**To:**	Envirolab Services
Contact Person: Brent Kerry	**Project Name:** Empire Bay DSI	**Contact Person:**	Aileen Hie
Project Mgr: Brent Kerry	**PO No.:**	**Address:**	12 Ashley Street
	lab Quote No. : 2018-2019 List		Chatswood NSW 2068
Address: 5/3 Teanster Cl	**Date results required:** Standard TAT	**Phone:**	02 9910 6200
Tuggerah NSW 2259	*Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	**Fax:**	02 9910 6201
		Email:	ahie@envirolab.com.au
Phone: 4351 1422 **Mob:**	**Report format:** Esdat/PDF / Excel	**Laboratory Report No:**	
Email: brent.kerry@douglaspartners.com.au	**Comments:**	**Lab Comments:**	

Sample information						Tests Required											Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	COMBO #5	COMBO #7	COMBO #3	Asbestos (500ml)	Asbestos ID	CEC	pH	TBT	HM	SCr Suite		Provide as much information about the sample as you can
1	1/0.3	0.3	12/03/2021	Jar/Bag	Soil										X		
2	1/1.1	1.1	12/03/2021	Jar/Bag	Soil										X		
3	1/2.6	2.6	12/03/2021	Jar/Bag	Soil										X		
—	4/1.0	1.0	11/03/2021	Jar/Bag	Soil										X		
—	8/2.1	2.1	11/03/2021	Jar/Bag	Soil										X		
4	9/2.4	2.4	11/03/2021	Jar/Bag	Soil										X		

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 264687
Date Received: 19/3/21
Time Received: 1020
Received By: JD
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by: Douglas Partners	**Sample Receipt**	***Lab use only:***	IP
Courier (by whom) TNT	**Received by (Company):** EGS SYD	**Samples Received** Cool or Ambient (circle one)	
Condition of Sample at dispatch Cool or Ambient (circle) cool	**Print Name:** Jason Day	**Temperature Received at:** 19°C (if applicable)	
Temperature (if Applicable):	**Date & Time:** 19/3/21 1020	**Transported by:** Hand delivered / courier	
Print Name: Brent Kerry	**Signature:** JAY		
Date & Time: 18/3/21			
Signature:			

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry

Sample Login Details

Your reference	202478.00, Empire Bay DSI
Envirolab Reference	264687
Date Sample Received	19/03/2021
Date Instructions Received	19/03/2021
Date Results Expected to be Reported	26/03/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	4 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	19
Cooling Method	Ice Pack + Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
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Sample ID	Chromium Suite
1/0.3-0.1	✓
1/1.1-1.1	✓
1/2.6-2.6	✓
9/2.4-2.4	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

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CERTIFICATE OF ANALYSIS 264461-A

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry
Address	Unit 5, 3 Teamster Close, Tuggerah, NSW, 2259

Sample Details

Your Reference	**202478.00, Empire Bay DSI**
Number of Samples	25 SOIL, 1 WATER
Date samples received	17/03/2021
Date completed instructions received	19/03/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

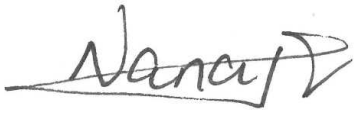
Date results requested by	26/03/2021
Date of Issue	26/03/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Chromium Suite			
Our Reference		264461-A-8	264461-A-14
Your Reference	UNITS	4	8
Depth		1.0	2.1
Date Sampled		12/03/2021	12/03/2021
Type of sample		SOIL	SOIL
Date prepared	-	23/03/2021	23/03/2021
Date analysed	-	23/03/2021	23/03/2021
pH $_{kcl}$	pH units	6.7	8.5
s-TAA pH 6.5	%w/w S	<0.01	<0.01
TAA pH 6.5	moles H^+ /t	<5	<5
Chromium Reducible Sulfur	%w/w	0.28	0.07
a-Chromium Reducible Sulfur	moles H^+ /t	170	42
S_{HCl}	%w/w S	NT	NT
S_{KCl}	%w/w S	0.019	0.056
S_{NAS}	%w/w S	NT	NT
ANC_{BT}	% $CaCO_3$	0.25	0.45
s-ANC_{BT}	%w/w S	0.08	0.14
s-Net Acidity	%w/w S	0.22	<0.005
a-Net Acidity	moles H^+ /t	140	<5
Liming rate	kg $CaCO_3$ /t	10	<0.75
a-Net Acidity without ANCE	moles H^+ /t	170	42
Liming rate without ANCE	kg $CaCO_3$ /t	13	3.1
s-Net Acidity without ANCE	%w/w S	0.28	0.067

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

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			23/03/2021	[NT]	[NT]	[NT]	[NT]	23/03/2021	[NT]
Date analysed	-			23/03/2021	[NT]	[NT]	[NT]	[NT]	23/03/2021	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	[NT]	[NT]	[NT]	[NT]	96	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	<5	[NT]	[NT]	[NT]	[NT]	94	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	<3	[NT]	[NT]	[NT]	[NT]	108	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

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

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	**Project Number** 202478.00	**To:**	Envirolab Services
Contact Person: Brent Kerry	**Project Name:** Empire Bay DSI	**Contact Person:**	Aileen Hie
Project Mgr: Brent Kerry	**PO No.:**	**Address:**	12 Ashley Street
	lab Quote No. : 2018-2019 List		Chatswood NSW 2068
Address: 5/3 Teanster Cl	**Date results required:** Standard ~~TAT~~	**Phone:**	02 9910 6200
Tuggerah NSW 2259	*Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	**Fax:**	02 9910 6201
		Email:	ahie@envirolab.com.au
Phone: 4351 1422 **Mob:**	**Report format:** Esdat/PDF / Excel	**Laboratory Report No:**	
Email: brent.kerry@douglaspartners.com.au	**Comments:**	**Lab Comments:**	

Sample information						Tests Required											Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	COMBO #5	COMBO #7	COMBO #3	Asbestos (500ml)	Asbestos ID	CEC	pH	TBT	HM	SCr Suite		Provide as much information about the sample as you can
1	1/0.3	0.3	12/03/2021	Jar/Bag	Soil										X		
2	1/1.1	1.1	12/03/2021	Jar/Bag	Soil										X		
3	1/2.6	2.6	12/03/2021	Jar/Bag	Soil										X		
~~8~~	4/1.0	1.0	11/03/2021	Jar/Bag	Soil										X		
~~14~~	8/2.1	2.1	11/03/2021	Jar/Bag	Soil										X		
4	9/2.4	2.4	11/03/2021	Jar/Bag	Soil										X		

Ref: 264461-A.
Due: 26/03/21.

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 264687
Date Received: 19/3/21
Time Received: 1020
Received By: SD
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by: Douglas Partners	**Sample Receipt**		***Lab use only:*** IP
Courier (by whom) TNT	**Received by (Company):**	ELS Stp	**Samples Received** Cool or Ambient (circle one)
Condition of Sample at dispatch Cool or Ambient (circle) cool	**Print Name:**	Jason Day	**Temperature Received at:** 19°C (if applicable)
Temperature (if Applicable):	**Date & Time:**	19/3/21 1020	**Transported by:** Hand delivered / courier
Print Name: Brent Kerry	**Signature:**	JAM	
Date & Time: 18/3/21			
Signature:			

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry

Sample Login Details

Your reference	202478.00, Empire Bay DSI
Envirolab Reference	264461-A
Date Sample Received	17/03/2021
Date Instructions Received	19/03/2021
Date Results Expected to be Reported	26/03/2021

Sample Condition

Samples received in appropriate condition for analysis	Holding time exceedance
No. of Samples Provided	25 SOIL, 1 WATER
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	18
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Please contact the laboratory within 24 hours if you wish to cancel the aformentioned testing. Otherwise testing will proceed as per the COC and hence invoice accordingly.

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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

Sample ID	Chromium Suite	On Hold
1-0.05		✓
1-0.75		✓
2-0.05		✓
2-1.0		✓
3-0.4		✓
3-0.7		✓
4-0.15		✓
4-1.0	✓	
5-0.05		✓
5-0.3		✓
6-0.05		✓
6-0.5		✓
7-0.65		✓
8-2.1	✓	
9-2.1		✓
10-3.7		✓
11-2.7		✓
12-0.4		✓
13-2.5		✓
14-0.1		✓
15-0.1		✓
QA2-0.4		✓
RB1		✓
TB1		✓
14/FCA		✓
14/FCB		✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

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Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

airmet
Work with Confidence

Calibration Certificate

AirMet Scientific P/L
Level 3, 18-26 Dickson Avenue
Artarmon
NSW 2064, Australia
Tel: 02 8425 8300
Fax: 02 8425 8399

This document certifies that the instrument detailed has been calibrated to the parameters

Certificate Print Date: 8-Mar-2021
Calibration Date: 08-Mar-2021
Next Calibration Due: 8-Mar-2022

Call ID / Order No: 248693
Job No / Pack No: S2486930001

Customer: Douglas Partners Pty Ltd-ID 207143 Serial No: T-108916
Description: PhoCheck Tiger Li-ion Battery Battery Charger & M

Calibration Summary

Frequency: 365 Days Temp: 22°C As Found: In Tolerance Result: Pass
Humidity: 45% Certificate: S2486930001

Desc	As Found Actual	As Found Result	As Left (Cal Status) Actual	As Left (Cal Status) Result
PID ISOBUTYLENE 100ppm	97.5	Pass	101.2	Pass
PID ISOBUTYLENE 1000ppm	991.4	Pass	1007.9	Pass

Standard Used

Equip ID	Description	Valid Until	Cert
SY321	ISOBUTYLENE 1000PPM, AIR BALANCE	12-05-2023	BU70910-111419
SY360	ISOBUTYLENE 100PPM. AIR BALANCE	06-11-2025	400294662
SY356	Zero Grade Air 20.9%VOL O2, N2 Balance	26-09-2025	400293734

This instrument is not intrinsically safe

Completed By: Jason Cheng Signed:

AES
sensing safety

Calibration & Service Report
Water Quality Meter

Company: Active Environmental Solutions Hire
Address: Unit 16, 191 Parramatta Road
AUBURN NSW 2144
Phone: 02 9716 5966 | Fax: 02 9716 5988
Email: hire@aesoultions.com.au

Manufacturer: QED
Instrument/Model: QMP10

Client Company: AECOM
Client Name:

Serial #: 3461
Cable Length:

Client Email:
Client Phone:

Equipment Check

MP Kit QMP15

Customer: AECOM
Contact: Milenko
Order:

Manufacturer: QED
Instrument: QMP10
Serial #: 3461
Pump S/N #: 144469

Item	Test	Pass	Comments
QMP10	Condition	✓	
	Operation Check	✓	
	Blue Coiled Hose	✓	
Pump	Decontaminated	✓	
	Condition	✓	
	Bladder Fitted	✓	
	Fittings	✓	New
Compressor	Operations Check	✓	
	Fittings	✓	
	Red Compressor Hose	✓	
Instruction manuals	Included	✓	

Comments

Compressor
S/N: 230289

This is to certify that the above instrument has been checked and is in good working order.

Checked By: Milenko Sisic

Check Date: 05/01/2021 Due for Check: 05/07/2021

Douglas Partners
Geotechnics | Environment | Groundwater

Calibration and Service Record
Water Quality Meter

Douglas Partners Pty Ltd
Unit 5, 3 Teamster Close
Tuggerah NSW 2259
Phone (02) 4351 1422

Manufacturer : TPS

Instrument/Model: 90-FLT

Item	Test	Pass	Fail	Comments
Battery	Condition	x		
Connections	Condition	x		
Cable	Condition	x		
Display	Condition	x		
Unit/Monitor Housing	Condition	x		
pH	Condition of Probe	x		
ORP	Condition of Probe	x		
Conductivity	Condition of Probe	x		
Dissolved Oxygen	Condition of Probe	x		
Turbidity	Condition of Probe	x		

pH

Standards	Calibration Point	Before	After	Units
pH - 4.00	4.00	3.96	4.00	pH
pH - 7.00	7.00	7.01	7.00	pH

ORP (Redox)

Standards	Calibration Point	Before	After	Units
ORP (Redox)	Zobell A &B	*Ext Calibration*	*ExtCalibraion*	mV

Conductivity

Standards	Calibration Point	Before	After	Units
2760 µS/cm at 25°C	2760.00	2765	2760.00	µS/cm

Dissolved Oxygen

Standards	Calibration Point	Before	After	Units
NaSO3 in Distilled Water	0.00	0.5	0.00	%
100% Air Saturation (100%)	100.00	8.3	8.50	%

Turbidty

Standards	Calibration Point	Before	After	Units
Distilled Water	3.00	3.1	0.00	NTU
Turbidty Standard	90.00	85.6	90.00	NTU

Calibrated By: MJH

Calibration Date: 01/03/21 **Calibration Due:** 01/04/21

AES
sensing safety

Calibration & Service Report
Water Quality Meter

Company:	Active Environmental Solutions Hire	Manufacturer:	Solinst	Serial #:	253025
Address:	Unit 16, 191 Parramatta Road AUBURN NSW 2144	Instrument/Model:	122 Interface Probe 60m	Tape Length:	60m
Phone:	02 9716 5966 | Fax: 02 9716 5988	Client Company:		Client Email:	
Email:	hire@aesoultions.com.au	Client Name:		Client Phone:	

Equipment Check

Oil/Water Interface Meter - Solinst 122 Interface Meter

Customer:		**Manufacturer:**	Solinst Interface Meter
Contact:	Milenko	**Instrument:**	Model 122
Order:		**Serial #:**	253025
		Tape length:	60m

Item	Test	Pass	Comments
Battery	Voltage (2 x 9v battery)	✓	Voltage above 7.9v
	Fuses	✓	
	Capacity	✓	
Probe	Decontaminated	✓	
	Condition	✓	
	Operation	✓	
Connectors	Condition	✓	
Tape Check	Condition	✓	
	Decontaminated	✓	
Instrument Test	At surface level	✓	Tap water and Petrol
Speaker	Operation	✓	

Comments Old unit.

This is to certify that the above instrument has been checked and is in good working order.

Checked By: Milenko Sisic

Check Date: 05/01/2021 Due for Check: 05/07/2021

Calibration & Service Report
Water Quality Meter

Company:	Active Environmental Solutions Hire	Manufacturer:	YSI	Serial #:	18H111016
Address:	Unit 16, 191 Parramatta Road AUBURN NSW 2144	Instrument/Model:	ProDSS Handheld Water Quality Meter	Cable Length:	1 M
Phone:	02 9716 5966 | Fax: 02 9716 5988	Client Company:		Client Email:	
Email:	hire@aesoultions.com.au	Client Name:		Client Phone:	

Item	Test	Pass	Comments
Battery	Charged	✓	
	Battery Saver	✓	Automatically turns off after 15 minutes if not used
Connections	Condition	✓	Good, clean
Cable	Condition	✓	Clean, no tears
Display	Operation	✓	
Firmware	Version	✓	1.1.8
Keypad	Operational	✓	
Display	Screen	✓	
Unit	Condition, seals and O-rings	✓	
Monitor housing	Condition	✓	
pH			
Condition		✓	Good, clean
pH millivolts for pH7 calibration range 0 mV ± 50 mV		✓	
pH 4 mV range + 165 to + 180 from 7 buffer mV value		✓	
pH slope		✓	
Response time < 90 seconds		✓	
Calibrated and conforms to manufacturer's specifications		✓	
ORP			
Condition		✓	Good, clean
Response time < 90 seconds		✓	
within ± 80mv of reference Zobell Reading		✓	
Calibrated and conforms to manufacturer's specifications		✓	Variance range ± 20mV
Conductivity			
Condition		✓	Good, clean
Calibrated and conforms to manufacturer's specifications		✓	°C
Turbidity			
Calibrated and conforms to manufacturer's specifications		✓	
Condition		✓	
Dissolved Oxygen			
Condition		✓	Good, clean
Calibrated and conforms to manufacturer's specifications		✓	

Parameter	Standards	Reference	Calibration Point	Before	After	Units
Temperature	Center 370 Thermometer	Room Temp.	21.9	N/A	21.9	°C
pH	pH 4.00	349389	4.01	4.18	4.01	pH
pH	pH 10.00	344906	10.00	10.2	10.00	pH
pH	pH 7.00	349958	7.00	7.12	7.00	pH
Conductivity	2760 µs/cm at 25°C	354236	2760	2748	2760	µs/cm
ORP (Ref. check only)	Zobell A & B	340526 & 340529	235.3	232.9	235.3	mV
Zero Dissolved Oxygen	NaSO3 in distilled water	283762; V070819	0.0	0.4	0.0	%
100% Dissolved Oxygen	100% Air Saturation	Fresh Air	100.9	98.7	100.9	%
Zero Turbidity	0 FNU	W-54320-V070819	0.00	-0.13	0.00	FNU
Turbidity	124.00 FNU	20H20290164	124.00	123.61	124.00	FNU

Calibrated By: Milenko Sisic

Calibration Date: 31/03/2021 Calibration Due: 30/09/2021

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Calibration and Service Record
Water Quality Meter

Douglas Partners Pty Ltd
Unit 5, 3 Teamster Close
Tuggerah NSW 2259
Phone (02) 4351 1422

Manufacturer : TPS

Instrument/Model: 90-FLT

Item	Test	Pass	Fail	Comments
Battery	Condition	x		
Connections	Condition	x		
Cable	Condition	x		
Display	Condition	x		
Unit/Monitor Housing	Condition	x		
pH	Condition of Probe	x		
ORP	Condition of Probe	x		
Conductivity	Condition of Probe	x		
Dissolved Oxygen	Condition of Probe	x		
Turbidity	Condition of Probe	x		

pH

Standards	Calibration Point	Before	After	Units
pH - 4.00	4.00	4.01	4.00	pH
pH - 7.00	7.00	7	7.00	pH

ORP (Redox)

Standards	Calibration Point	Before	After	Units
ORP (Redox)	Zobell A &B	*Ext Calibration*	*ExtCalibraion*	mV

Conductivity

Standards	Calibration Point	Before	After	Units
2760 µS/cm at 25°C	2760.00	2810	2760.00	µS/cm

Dissolved Oxygen

Standards	Calibration Point	Before	After	Units
NaSO3 in Distilled Water	0.00	0.02	0.00	%
100% Air Saturation (100%)	100.00	7.9	8.50	%

Turbidty

Standards	Calibration Point	Before	After	Units
Distilled Water	3.00	4	0.00	NTU
Turbidty Standard	90.00	82	90.00	NTU

Calibrated By: MJH

Calibration Date: 06/04/21 **Calibration Due:** 06/05/21

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GROUNDWATER SAMPLING FORM

Project: Rehabilitation of Empire Bay Marina	**Project No:** 202478.00
Client: Department of Planning Industry & Environment (Crown Lands)	
Location: Empire Bay Marina, Empire Bay	
Sampling Method: Low-flow - Micro purge QAW1	

Bore No.	MW6	MW3	MW4		
Purging Date	24/3/21	24/3/21	24/3/21		
Bore Casing Diameter (mm)	50	50	50		
SWL (m below top of casing)	1.314	0.42	0.58		
Height of Casing (m above GL*)	0.70	-0.165	-0.12		
SWL (m below GL*)	0.614	0.59	0.70		
Total Bore Depth (m below GL*)	1.8	1.665	1.8		
Well Volume (L) **[which for 50mm casing is 2L approx. per metre depth]	2.4L	2.2L	2.2L		
Purged Volume (L) (≈ well vol x 3)	~6L	~6L	~6L		
Sampling Date	24/3/21	24/3/21	24/3/21		
Sampling Time	3:00 pm	4:00 pm	5:00 pm		
Temperature (°C)	22.9	24.2	24.2		
pH (record to one decimal place)	4.76	6.19	6.74		
EC (µS/cm)	92.1	1826	1379		
Dissolved Oxygen (% Sat)	~	-	-		
Dissolved Oxygen (mg/L)	2.24	2.36	3.21		
Turbidity (NTU)	332	745	434		
Redox (mV)	262	138	56		
TDS (mg/L)					
Odour	None	None	None		
Colour	brown	brown	brown		
Recharge Rate	good	good	good		
Observations	PID<1	PID<1	PID<1		

Notes: No LNAPL observed/gauged. No sheen/odour. Stabilized field params recorded

Supervisor: BJK **Date:** 24/3/21

Water quality meter calibration details (please tick calibration liquids used):

Meter ID							
Buffer (pH 4)	☐	Use-by Date		Conductivity Standard (2.76 mS/cm)	☐	Use-by Date	
Buffer (pH 6.88)	☐	Use-by Date		Total Dissolved Solids Standard (2 parts per thousand)	☐	Use-by Date	
Buffer (pH 9)	☐	Use-by Date		Rapid Cal Solution	☐	Use-by Date	

*GL – denotes ground level **Well Volume = πr^2 x depth of water, where r is internal casing radius

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GROUNDWATER SAMPLING FORM

Project: Rehabilitation of Empire Bay Marina	**Project No:** 202478.00
Client: Department of Planning Industry & Environment (Crown Lands)	
Location: Empire Bay Marina, Empire Bay	
Sampling Method: Low Flow	

Bore No.	MW6	MW2	MW3	UST1	UST2
Purging Date	14/4/21	14/4/21	14/4/21		
Bore Casing Diameter (mm)	50	50	50		
SWL (m below top of casing)	1.46	0.49	0.40	1.06	1.54
Height of Casing (m above GL*)	0.70	-0.15	-0.17	~~1.83~~	~~1.90~~
SWL (m below GL*)	0.76	0.64	0.57		
Total Bore Depth (m below GL*)	~1.8	~1.8	~1.5	1.83	1.90
Well Volume (L) **[which for 50mm casing is 2L approx. per metre depth]	2	2	~2		
Purged Volume (L) (≈ well vol x 3)	4L	4L	4L		
Sampling Date	14/4/21	14/4/21	14/4/21		
Sampling Time	1:00 pm	2:00 pm	3:00 pm		
Temperature (°C)	22.7/21.8	24.7/22.5	21.6/21.1		
pH (record to one decimal place)	4.9/4.8	6.34/6.43	7.5/7.6		
EC (µS/cm)	139/131	5.52 ms/568	36 ms/		
Dissolved Oxygen (% Sat)	-	-	-		
Dissolved Oxygen (mg/L)	0.13/0.40	0.45/0.54	4.41/4.81		
Turbidity (NTU)	148	437/471	10/128		
Redox (mV)	192/187	94/71	68/74		
TDS (mg/L)	-	-	-		
Odour	None	None	None		
Colour	Brown	Brown	Brown		
Recharge Rate	Good	Good	Good		
Observations	-	-	-		

Notes: UST1 - 1.06m DTW - 1.86m base of UST
UST2 - 1.54m DTW - 1.90m base of UST

Supervisor: BJK **Date:** 14/4/21

Water quality meter calibration details (please tick calibration liquids used):

Meter ID							
Buffer (pH 4)	☐	Use-by Date		Conductivity Standard (2.76 mS/cm)	☐	Use-by Date	
Buffer (pH 6.88)	☐	Use-by Date		Total Dissolved Solids Standard (2 parts per thousand)	☐	Use-by Date	
Buffer (pH 9)	☐	Use-by Date		Rapid Cal Solution	☐	Use-by Date	

*GL – denotes ground level **Well Volume = πr^2 x depth of water, where r is internal casing radius

+ Dip USTs
- 500ml Amber
- NaOH

Appendix L

Quality Assurance / Quality Control

Appendix L
Quality Assurance and Quality Control
Empire Bay Marina, Empire Bay

L1.0 Field and Laboratory Data Quality Assurance and Quality Control

The field and laboratory data quality assurance and quality control (QA/QC) procedures and results are summarised in the following Table . Reference should be made to the field work methodology and the laboratory results / certificates of analysis for further details. The relative percentage difference (RPD) results, along with the other field QC samples are included in at the end of this appendix.

Table L1: Field and Laboratory Quality Control

Item	Evaluation / Acceptance Criteria	Compliance
Analytical laboratories used	NATA accreditation	C
Holding times	Various based on type of analysis	PC
Intra-laboratory replicates	5% of primary samples; <30% RPD	C
Inter-laboratory replicates	5% of primary samples; <30% RPD	C
Trip Blanks	1 per sampling event; <PQL	C
Rinsates	1 per sampling event; <PQL	C
Laboratory / Reagent Blanks	1 per batch; <PQL	C
Matrix Spikes	1 per lab batch; 70-130% recovery (inorganics); 60-140% recovery (organics)	PC
Surrogate Spikes	All organics analysis; 70-130% recovery (inorganics); 60-140% recovery (organics)	PC
Control Samples	1 per lab batch; 70-130% recovery (inorganics); 60-140% recovery (organics)	PC
Standard Operating Procedures (SOP)	Adopting SOP for all aspects of the sampling field work	PC

Notes:
C = compliance; PC = partial compliance; NC = non-compliance

Reference to the laboratory certificates of analysis the following comments have been provided by the laboratories (sic):

Certificate of Analysis 264461

- PAHs in Soil - The PQL has been raised due to interferences from analytes (other than those being tested) in sample/s 264461-21,21d.
- TRH_S_NEPM:# Percent recovery for the surrogate is not possible to report as the high concentration of analytes in sample 264461-1.21 has caused interference.
- # Percent recovery for the matrix spike is not possible to report as the high concentration of analytes in sample/s 264461-5,22 have caused interference.

Acid Extractable Metals in Soil:

- The laboratory RPD acceptance criteria has been exceeded for 264461-1 for Ni. Therefore a triplicate result has been issued as laboratory sample number 264461-27.
- The laboratory RPD acceptance criteria has been exceeded for 264461-11 for Pb. Therefore a triplicate result has been issued as laboratory sample number 264461-28.
- The laboratory RPD acceptance criteria has been exceeded for 264461-21 for Cu & Zn. Therefore a triplicate result has been issued as laboratory sample number 264461-29.
- # Percent recovery is not possible to report due to the inhomogeneous nature of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.
- ## Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Asbestos-ID in soil:

- This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.
- Note: All samples analysed as received. However, sample 264461-21 is below the minimum 500mL sample volume as per National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.

Tributyltin as Sn analysed by MPL Laboratories. Report No. 259034

- #3ms - Organotin Compounds in Soil: # Percent recovery is not possible to report as the analytes in the sample/s have caused interference.
- #9, 18 - Organotin Compounds in Soil: Tributyltin values detected exceeded the typical expected range in soil. The laboratory was unable to reach the dilution factor necessary to achieve a result within calibration range and therefore the uncertainty of the result will be increased.

Certificate of Analysis 264461-B

- Samples received in good order: Holding time exceedance.
- TBT_S analysed by MPL report#259936.

Certificate of Analysis 264461-C

- TOC - out of recommended holding time.

Certificate of Analysis 264711

- 8 metals in soil - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However, an acceptable recovery was obtained for the LCS.

Asbestos-ID in soil:

- This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

Organotins analysed by MPL. Report no. 260482

- #1, 1d - Organometallics in soil - Due to low Extracted Internal Standard recovery, results above adjusted PQLs will have a higher than normal measurement of uncertainty. The RPD for duplicate results is accepted due to the non homogenous nature of the sample/s.
- #1MS - Organometallics in soil: # Percent recovery is not possible to report as positive analyte in the sample.

Certificate of Analysis 266713

Organotins analysed by MPL. Report no. 260482

- #4 - Organometallics in water: PQL has been raised due to decreased internal standard efficiency. This may be due to sample matrix interferences.

The RPD results were all within the acceptable range, with the exception of those indicated in Table L2. The exceedances are not, however, considered to be of concern given that:

- The typically low actual differences in the concentrations of the replicate pairs where some RPD exceedances occurred, particularly for groundwater;
- The number of replicate pairs being collected from fill soils which by its nature is heterogeneous;
- Replicates, rather than homogenised duplicates, were used to minimise risk of volatile loss, hence greater variability can be expected;
- Most of the recorded concentrations being relatively close to the PQLand
- All other QA/QC parameters met the DQIs.

In summary, the QC data is determined to be of sufficient quality to be considered acceptable for the assessment.

L2.0 Data Quality Indicators

The reliability of field procedures and analytical results was assessed against the following data quality indicators (DQIs) as outlined in NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013):

- Completeness: a measure of the amount of usable data from a data collection activity;
- Comparability: the confidence (qualitative) that data may be considered to be equivalent for each sampling and analytical event;
- Representativeness: the confidence (qualitative) of data representativeness of media present on-site;
- Precision: a measure of variability or reproducibility of data; and
- Accuracy: a measure of closeness of the data to the 'true' value.

Table L1: Data Quality Indicators

Data Quality Indicator	Method(s) of Achievement
Completeness	Systematic and selected target locations sampled.
	Preparation of borehole logs, sample location plan and chain of custody records.
	Preparation of field groundwater sampling sheets.
	Laboratory sample receipt information received confirming receipt of samples intact and appropriateness of the chain of custody.
	Samples analysed for contaminants of potential concern (COPC) identified in the Conceptual Site Model (CSM).
	Completion of chain of custody (COC) documentation.
	NATA accredited laboratory results certificates provided by the laboratory.
	Satisfactory frequency and results for field and laboratory quality control (QC) samples as discussed in Section 1.
Comparability	Using appropriate techniques for sample recovery, storage and transportation, which were the same for the duration of the project.
	Experienced samplers used.
	Use of NATA registered laboratories, with test methods the same or similar between laboratories.
	Satisfactory results for field and laboratory QC samples.
Representativeness	Target media sampled.
	Sample numbers recovered and analysed are considered to be representative of the target media and complying with DQOs.
	Samples were extracted and analysed within holding times.
	Samples were analysed in accordance with the COC.
Precision	Field staff followed standard operating procedures.
	Acceptable RPD between original samples and replicates.
	Satisfactory results for all other field and laboratory QC samples.
Accuracy	Field staff followed standard operating procedures.
	Satisfactory results for all field and laboratory QC samples.

Based on the above, it is considered that the DQIs have been generally complied with.

L3.0 Conclusion

Based on the results of the field QA and field and laboratory QC, and evaluation against the DQIs it is concluded that the field and laboratory test data obtained are reliable and useable for this assessment.

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Table L3: Field Rinsate Blank Results – Soils & Groundwater

		Metals								TRH						BTEX				PAH		Phenol
		Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	TRH C6 - C10	TRH >C10-C16	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	Total Xylene	Naphthalene [b]	Total PAHs	Phenol
Sample ID	Sample Date	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/kg	mg/L
RB1	12/03/2021	-	-	-	-	-	-	-	-	ND	170	ND	170	ND	ND	ND	ND	ND	ND	ND	ND	ND
RB1W	24/03/2021	ND	ND	ND	ND	ND	ND	ND	ND	ND	58	ND	58	ND	ND	ND	ND	ND	ND	ND	ND	ND

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Table L4: Trip Blank Results - Soils (mg/kg)

Sample ID	Sample Date	Benzene	Benzene	Toluene	Toluene	Ethylbenzene	Ethylbenzene	o-Xylene	o-Xylene	m+p-Xylene	m+p-Xylene
TB1	12/03/2021	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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Table L5: Relative Percentage Difference Results – Intra-laboratory Replicates

			Metals																	TRH												BTEX							
			Arsenic	Arsenic	Cadmium	Cadmium	Total Chromium	Total Chromium	Copper	Copper	Lead	Lead	Mercury (inorganic)	Mercury (inorganic)	Nickel	Nickel	Zinc	Zinc	Manganese	TRH C6 - C10	TRH C6 - C10	TRH >C10-C16	TRH >C10-C16	F1 ((C6-C10)-BTEX)	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F3 (>C16-C34)	F4 (>C34-C40)	F4 (>C34-C40)	Benzene	Benzene	Toluene	Toluene	Ethylbenzene	Ethylbenzene	Total Xylenes
Sample ID	Depth	Sample Date	mg/kg	mg/l	mg/kg	mg/l	mg/kg	mg/l	mg/kg	mg/l	mg/kg	mg/l	mg/kg	mg/l	mg/kg	mg/l	mg/kg	mg/l	mg/kg	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg	µg/l	mg/kg
Soil Intra-Laboratory Replicates																																							
QA2	0.4 m	12/03/2021	47	NT	2	NT	140	NT	1300	NT	740	NT	1.1	NT	57	NT	720	NT	130	<25	NT	<50	NT	<25	NT	<50	NT	710	NT	290	NT	<0.2	NT	<0.5	NT	<1	NT	<1	
3	0.4 m	12/03/2021	51	NT	1	NT	130	NT	1700	NT	680	NT	1.2	NT	61	NT	540	NT	140	<25	NT	<50	NT	<25	NT	<50	NT	780	NT	480	NT	<0.2	NT	<0.5	NT	<1	NT	<1	
		Difference	4	-	1	-	10	-	400	-	60	-	0.1	-	4	-	180	-	10	0	-	0	-	0	-	0	-	70	-	190	-	0	-	0	-	0	-	0	
		RPD	8%	-	**67%**	-	7%	-	27%	-	8%	-	9%	-	7%	-	29%	-	7%	0%	-	0%	-	0%	-	0%	-	9%	-	**49%**	-	0%	-	0%	-	0%	-	0%	
Soil Inter-Laboratory Replicates																																							
QA1	0 m	11/03/2021	6	NT	<1	NT	6	NT	61	NT	94	NT	0.2	NT	3	NT	116	NT	NT	<10	NT	<50	NT	<10	NT	<50	NT	<100	NT	<100	NT	<0.2	NT	<0.5	NT	<0.5	NT	<0.5	
4	1 m	11/03/2021	6	NT	0.6	NT	5	NT	120	NT	200	NT	0.4	NT	2	NT	190	NT	3	<25	NT	<50	NT	<25	NT	<50	NT	<100	NT	<100	NT	<0.2	NT	<0.5	NT	<1	NT	<1	
		Difference	0	-	0.4	-	1	-	59	-	106	-	0.2	-	1	-	74	-	-	15	-	0	-	15	-	0	-	0	-	0	-	0	-	0	-	0.5	-	0.5	
		RPD	0%	-	**50%**	-	18%	-	**68%**	-	**72%**	-	**67%**	-	**40%**	-	**48%**	-	-	**86%**	-	0%	-	**86%**	-	0%	-	0%	-	0%	-	0%	-	0%	-	**67%**	-	**67%**	
Groundwater Intra-Laboratory Replicates																																							
MW4	-	12/03/2021	NT	4	NT	0.1	NT	3	NT	150	NT	35	NT	0.16	NT	6	NT	120	NT	NT	<10	NT	<10	NT	<10	NT	<50	NT	190	NT	<100	NT	<1	NT	<1	NT	<1	NT	
QAW1	-	12/03/2021	NT	4	NT	0.1	NT	3	NT	150	NT	39	NT	0.17	NT	6	NT	120	NT	NT	<10	NT	<10	NT	<10	NT	<50	NT	250	NT	<100	NT	<1	NT	<1	NT	<1	NT	
		Difference	-	0	-	0	-	0	-	0	-	-	-	-	-	0	-	0	-	-	0	-	0	-	0	-	0	-	-	-	0	-	0	-	0	-	0	-	
		RPD	-	0%	-	0%	-	0%	-	0%	-	11%	-	6%	-	0%	-	0%	-	-	0%	-	0%	-	0%	-	0%	-	27%	-	0%	-	0%	-	0%	-	0%	-	

PAH					Phenol	OCP											PCB	Asbestos	Asbestos	Additional metals								
Naphthalene [b]	Naphthalene [b]	Benzo(a)pyrene (BaP)	Benzo(a)pyrene TEQ	Total PAHs	Phenol	DDD	DDT+DDE+DDD [c]	DDE	DDT	Aldrin & Dieldrin	Total Chlordane	Endrin	Total Endosulfan	Heptachlor	Hexachlorobenzene	Methoxychlor	Total PCB	Trace Analysis	Asbestos (500 ml)	Antimony	Barium	Beryllium	Boron	Cobalt	Cyanide (total)	Molybdenum	Selenium (Total)	Tin (inorganic, Sn/+)
mg/kg	µg/l	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	-	-	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<1	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	-	-	<7	84	<1	10	4	NT	8	<2	72
<1	NT	<0.05	<0.5	0.1	<5	0.3	1	<0.1	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	-	-	<7	97	<1	20	4	NT	9	<4	110
0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	13	0	10	0	-	1	2	38
0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0%	14%	0%	**67%**	0%	-	12%	**67%**	**42%**

<1	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	-	-	NT	NT	NT	NT	NT	NT	NT	NT
<1	NT	<0.05	<0.5	0.1	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	-	-	<7	34	<1	<3	<1	NT	6	<2	2
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