# CONSULTING EARTH SCIENTISTS

**REMEDIATION ACTION PLAN:**
**COOKS COVE DEVELOPMENT ZONE**
PREPARED FOR COOK COVE INLET PTY LTD.
CES Document Reference: CES130608-BP-AS


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# REMEDIATION ACTION PLAN:
# COOKS COVE DEVELOPMENT ZONE
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## EXECUTIVE SUMMARY

This report has been prepared by Consulting Earth Scientists Pty Ltd (CES), on behalf of Cook Cove Inlet Pty Ltd (the Client), to support the public exhibition and assessment of the Cooks Cove Planning Proposal (PP-2022-1748), which was issued a Gateway Determination by the Department of Planning and Environment on 5 August 2022. The proposal seeks to amend Bayside Local Environmental Plan 2021 (BLEP 2021) to rezone and insert planning controls for certain land known as Cooks Cove within the BLEP 2021.

The Cooks Cove Planning Proposal aims to facilitate the long-planned transformation of 36.2ha of underutilised and strategically important land at Arncliffe, located to the north of the M5 Motorway and adjacent the western foreshore of the Cooks River. The project seeks a renewed focus on delivering a contemporary logistics and warehousing precinct within a well-connected location, surrounded by enhanced open space provisions. The site forms part of the broader Bayside West 2036 Precincts and generally comprises the footprint of the former Kogarah Golf Club, now in part occupied by a temporary M6 Stage 1 construction compound.

The Environmental Site Assessment (ESA) and subsequent Remediation Action Plan are required to satisfy State Environmental Planning Policy (Resilience and Hazards) 2021 former State Environmental Planning Policy No 55—Remediation of Land (SEPP 55).

The Cooks Cove Master Plan , as prepared by Hassell, represents an optimised and refined reference scheme, to guide best practice design and the preparation of detailed planning controls to achieve an attractive precinct with high amenity. Key features of the Cooks Cove Master Plan are:

- A net development zone of approximately 15ha with up to 343,250m$^2$ Gross Floor Area (GFA) comprising
  - 290,000m$^2$ of multi-level logistics and warehousing;
  - 20,000m$^2$ for hotel and visitor accommodation uses;
  - 22,350m$^2$ for commercial office uses;
  - 10,900m$^2$ of retail uses;
- Multi-level logistics with building heights generally up to 5 storeys (approx. 48m)
- A retail podium with commercial office and hotel above, up to a total of 12 storeys (approx. 51m)
- Built form of a scale and composition which caters for the generation of approximately 3,300 new jobs
- A surrounding open space precinct including:

- A highly activated waterfront including the Fig Tree Grove outdoor dining and urban park precinct
- A significant contribution to the extension of the regional Bay to Bay cycle link, 'Foreshore Walk', including active and passive recreational uses, together with environmental enhancements
- Master planned and Council-owned 'Pemulwuy Park' – with an agreed embellishment outcome of passive open space and environmental enhancements to be delivered in stages post construction of the M6 Stage 1 Motorway
- Complementary on and off-site infrastructure to be delivered by way of State and Local Voluntary Planning Agreements.

The Cooks Cove Development Zone (the site) is located to the north of the Southern and Western Suburbs Ocean Outfall Sewer (SWSOOS), and is generally bound by the Cooks River to the east and Marsh Street to the north and west. The site is approximately 36.2ha and is owned and managed by a number of landowners, both public and private. Surrounding development includes the Sydney Airport International Terminal precinct, Mercure Sydney Airport, an area of low density dwellings presently transitioning to medium-high density residential flat buildings, recreation and open space facilities and road and airport related infrastructure.

The 2008 environmental site assessments of the site (identified as Area A and Area B at the time) determined the area of the site referred to as, and currently occupied by, the WestConnex M8 and M6 Stage 1 Motorway Temporary Compound, as suitable for use as public open space. No knowledge of further contaminating sources had been introduced between 2008 and 2023 and as such the suitability of the site for the proposed use remained the same. It is understood by CES that Westconnex took possession of the site in 2016 and as such committed to returning the site to a suitable condition for use as public open space at the completion of their works. Therefore, CES has not included the current Westconnex temporary compound in this remediation action plan .

The temporary construction compound for the WestConnex M8 and M6 Stage 1 Motorway tunnelling works was originally established in June 2016. The temporary construction facility occupies approximately 7.5ha and is expected to remain until 2025. At this time the facility will reduce to 1.5ha to accommodate the permanent Arncliffe Motorway Operations Complex (MOC), located in the western corner of the site, adjacent Marsh Street. The complex will house ventilation and water treatment plant and maintenance equipment for both the M6 and M8 sub-grade motorways.

This report applies to the Cooks Cove Development Zone (the site) and addresses the requirement for a remedial action plan (RAP) specified by the Environmental Site Assessment (ESA).

The site covers approximately 36 ha and is currently occupied by the fairways and greens of the Kogarah Golf Club golf course. The site currently comprises the temporary WestConnex compound, a 7.5 ha block of land that is being used by WestConnex. This area is referred to as

the WestConnex Temporary Compound (WTC). This area was assessed in 2008 as being suitable for the ongoing use of the site as public open space. The condition of the WTC is not currently known, since it is being occupied and used by WestConnex. However, it is understood, through contractual arrangements, that WestConnex will return the site to Bayside Council in a condition that is suitable for its future use.

This report comprises a consolidation of the previous Area A and Area B RAPs (CES Document References: CES050706-BCC-22-F, Rev. 0 and CES050706-BCC-23-F Rev. 1, dated 28 and 29 July 2008, respectively) and addresses the minimum remediation and management requirements to be implemented as part of the redevelopment of the site. This RAP will be exhibited in conjunction with the public exhibition of the Cooks Cove Planning Proposal.

With the exception of BTEX impact in fill material surrounding bowsers and USTs located within the Kogarah Golf Club House car park and benzo(a)pyrene, copper and lead identified hotspots, the soil across the site does not contain contamination such that extensive remediation would be necessary to make the site suitable for the proposed mixed land use. However, it will be necessary prior to redevelopment of the site to remediate the impacted areas by decommissioning and removing the USTs and associated infrastructure; removing/managing benzo(a)pyrene, copper, and lead impacted soils and to ensure that fragments of Asbestos Containing Materials present in mainly surface fill in limited areas across the site are managed and disposed safely and in accordance with regulations.

In summary, remediation works will involve the excavation and off-site disposal of the four USTs, pipework, bowsers and vent pipework, excavation and off-site disposal of impacted soils immediately adjacent to the USTs and replacement with clean imported material; and the placement of a clean soil barrier for benzo(a)pyrene, copper and lead impacted soils. The excavated material must be appropriately stockpiled on-site, with any surplus material that needs to be removed from site to be classified in accordance with NSW EPA (2014) guidelines and transported to an appropriate landfill facility.

Where fragments of ACM are located at the surface, they will be collected by an AS1 licenced contractor and disposed to an appropriate landfill facility.

The management measures to be used for the site contamination will be recorded in a Site Management Plan (SMP).

It is concluded that if the RAP and a subsequent SMP are implemented the site will be suitable for the proposed use.

# REMEDIATION ACTION PLAN:
# COOKS COVE DEVELOPMENT SITE

PREPARED FOR COOK COVE INLET PTY LTD

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| | |
|---|---|
| ACM | Asbestos Containing Material |
| ASS | Acid Sulfate Soil |
| CCI | Cooks Cove Inlet Pty Ltd |
| BTEX | Benzene, Toluene, Ethylbenzene and Total Xylenes |
| CES | Consulting Earth Scientists Pty Ltd |
| CLM | Contaminated Land Management |
| COC | Chain of Custody |
| CT | Contaminant Threshold |
| CV | Coefficient of Variation |
| DQO | Data Quality Objectives |
| EIL | Ecologically-based Investigation Level |
| EPA | Environment Protection Authority |
| HIL | Health-based Investigation Level |
| mAHD | metres Australian Height Datum |
| mBGL | metres Below Ground Level |
| nd | not detectable |
| NSW | New South Wales |
| OCP | Organochlorine Pesticide |
| PAH | Polycyclic Aromatic Hydrocarbon |
| PAAH | Phenoxyacetic Acid Herbicides |
| PCB | Polychlorinated Biphenyl |
| PQL | Practical Quantitation Limit |
| QA/QC | Quality Assurance and Quality Control |
| RPD | Relative Percentage Difference |
| SAC | Site Assessment Criteria |
| SD | Standard Deviation |
| TPH | Total Petroleum Hydrocarbons |
| UCL | Upper Confidence Limit |
| USEPA | United States Environmental Protection Agency |
| VOC | Volatile Organic Compound |

# 1 INTRODUCTION

This report has been prepared by Consulting Earth Scientists Pty Ltd (CES), on behalf of Cook Cove Inlet Pty Ltd (the Client), to support the public exhibition and assessment of the Cooks Cove Planning Proposal (PP-2022-1748), which was issued a Gateway Determination by the Department of Planning and Environment on 5 August 2022. The proposal seeks to amend Bayside Local Environmental Plan 2021 (BLEP 2021) to rezone and insert planning controls for certain land known as Cooks Cove within the BLEP 2021.

The Cooks Cove Planning Proposal aims to facilitate the long-planned transformation of 36.2ha of underutilised and strategically important land at Arncliffe, located to the north of the M5 Motorway and adjacent the western foreshore of the Cooks River. The project seeks a renewed focus on delivering a contemporary logistics and warehousing precinct within a well-connected location, surrounded by enhanced open space provisions. The site forms part of the broader Bayside West 2036 Precincts and generally comprises the footprint of the former Kogarah Golf Club, now in part occupied by a temporary M6 Stage 1 construction compound.

The Environmental Site Assessment (ESA) and subsequent Remediation Action Plan are required to satisfy State Environmental Planning Policy (Resilience and Hazards) 2021 former State Environmental Planning Policy No 55—Remediation of Land (SEPP 55).

The Cooks Cove Master Plan , as prepared by Hassell, represents an optimised and refined reference scheme, to guide best practice design and the preparation of detailed planning controls to achieve an attractive precinct with high amenity. Key features of the Cooks Cove Master Plan are:

- A net development zone of approximately 15ha with up to 343,250m$^2$ Gross Floor Area (GFA) comprising
  - 290,000m$^2$ of multi-level logistics and warehousing;
  - 20,000m$^2$ for hotel and visitor accommodation uses;
  - 22,3500m$^2$ for commercial office uses;
  - 10,900m$^2$ of retail uses;
- Multi-level logistics with building heights generally up to 5 storeys (approx. 48m)
- A retail podium with commercial office and hotel above, up to a total of 12 storeys (approx. 51m)
- Built form of a scale and composition which caters for the generation of approximately 3,300 new jobs
- A surrounding open space precinct including:

- A highly activated waterfront including the Fig Tree Grove outdoor dining and urban park precinct
- A significant extension to the regional Bay to Bay cycle link, 'Foreshore Walk', including active and passive recreational uses, together with environmental enhancements
- Master planned and Council-owned 'Pemulwuy Park' – with an agreed embellishment outcome of passive open space and environmental enhancements to be delivered in stages post construction of the M6 Stage 1 Motorway
- Complementary on and off-site infrastructure to be delivered by way of State and Local Voluntary Planning Agreements.

Cooks Cove is located in the suburb of Arncliffe within the Bayside Council Local Government Area (LGA). The site is located to the west of the Cooks River, approximately 10 km south of the Sydney Central Business District (CBD). The site enjoys adjacency to key trade-related infrastructure being immediately west of Sydney Kingsford Smith International Airport and approximately 6 km west of Port Botany.

Cooks Cove is strategically located within close proximity to a number of railway stations including Banksia, Arncliffe, Wolli Creek and the International Airport Terminal, which vary in distance from the site between 700m and 1.1km. The M5 Motorway, providing regional connectivity to the Sydney Metropolitan area, runs in an east-west direction immediately to the south of the site. The M8 and M6 Motorways are, and will be, constructed in tunnels approximately 60 metres beneath the adjoining Bayside Council 'Trust' lands. The Sydney Gateway project, presently under construction to the immediate north of Cooks Cove and Sydney Airport, will substantially improve future accessibility to the St Peters interchange and the wider M4/M5 WestConnex network, via toll free connections, as well as the Domestic Airport and Port Botany.

The Cooks Cove Development Zone is located to the north of the Southern and Western Suburbs Ocean Outfall Sewer (SWSOOS), and is generally bound by the Cooks River to the east and Marsh Street to the north and west. The site is approximately 36.2ha and is owned and managed by a number of landowners, both public and private. Surrounding development includes the Sydney Airport International Terminal precinct, Mercure Sydney Airport, an area of low density dwellings presently transitioning to medium-high density residential flat buildings, recreation and open space facilities and road and airport related infrastructure. .

The 2008 environmental site assessments of the site (identified as Area A and Area B at the time) determined the area of the site referred to as, and currently occupied by, the WestConnex M8 and M6 Stage 1 Motorway Temporary Compound, as suitable for use as public open space. No knowledge of further contaminating sources had been introduced between 2008 and 2023 and as such the suitability of the site for the proposed use remained the same. It is understood by CES

that WestConnex took possession of the site in 2016 and as such committed to returning the site to a suitable condition for use as public open space at the completion of their works. Therefore, CES has not included the current WestConnex temporary compound in this environmental assessment.

The temporary construction compound for the WestConnex M8 and M6 Stage 1 Motorway tunnelling works was originally established in June 2016. The temporary construction facility occupies approximately 7.5ha and is expected to remain until 2025. At this time the facility will reduce to 1.5ha to accommodate the permanent Arncliffe Motorway Operations Complex (MOC), located in the western corner of the site, adjacent Marsh Street. The complex will house ventilation and water treatment plant and maintenance equipment for both the M6 and M8 sub-grade motorways.

This report applies to the Cooks Cove Development Zone (the site) only and addresses the requirement to satisfy State Environmental Planning Policy (Resilience and Hazards) 2021 former State Environmental Planning Policy No 55—Remediation of Land (SEPP 55).

This report refers to the Cooks Cove Development Zone, which is approximately 36.8ha and is owned and managed by a number of landowners, both public and private, including Kogarah Golf Club (KCG).

This Remediation Action Plan (RAP) refers to the consolidated former study areas of Area A and Area B (the site) (Figure 2). The site covers approximately 36.8 Ha and is currently occupied by Area A (northern portion) consisting the Clubhouse, maintenance sheds, car park, fairways and greens of the KGC and by Area B (southern portion) consisting fairways and greens of the KGC.

This consolidation has required the following changes:

- An amendment to the site boundaries was required since a portion of the site will be temporarily occupied (during the construction of the WestConnex project) by the WestConnex Temporary Compound (WTC) and will be permanently occupied by the Arncliffe Motorway Complex (MOC). These areas are defined in Figure 2. After completion of the WestConnex project, the WTC will be returned by the current occupants to its previous condition and handed back for incorporation into passive open space adjoining the Cooks Cove Development Zone. The MOC area will be retained permanently, and as such is no longer part of the site.
- The proposed development in 2008, comprised a Trade and Technology Zone. The current proposal comprises a new mixed use community incorporating a variety of uses including recreation, commercial, retail, hotel and multi-level logistics and warehousing land uses.

The RAP is based on the results of the CES (2008) Environmental Site Assessment: Area A, Proposed Trade and Technology Zone, Cooks Cove Development Site, Prepared for Cook Cove Pty Ltd (Ref: CES050706-BCC-17-F) and CES (2008) Environmental Site Assessment: Area B, Proposed Golf Course North, Cooks Cove Development Site, Prepared for Boyd Cook Cove (Ref: CES050706-BCC-18-D). These documents have been consolidated in CES *Environmental Site Assessment, Cooks Cove Development Zone* (CES document referenced: CES130608-BP-AR) and addresses the minimum remediation and management requirements to be implemented as part of the redevelopment of the site. This RAP is to be publicly exhibited with the Cooks Cove Planning Proposal.

This RAP has been prepared in general accordance with the requirements specified by the NSW Environment Protection Authority (NSW EPA) in the *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2011).

It is noted that the *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2011)have been superseded by NSW EPA 2020*, Contaminated Land Guidelines: Consultants Reporting on Contaminated Land.*

Based on a review of the new guidelines, overall, the RAP has been completed in general accordance with the updated guidelines and not impacted the assessment.

# 2 OBJECTIVES AND SCOPE OF WORKS

The principal objective of the RAP is to provide a strategy for the remediation of contamination identified on site to a standard suitable for the Cooks Cove Planning Proposal land-use concept including logistics warehousing, commercial retail and office, cafes and restaurants, tourist and visitor accommodation, , recreation, and community facilities. The RAP also seeks to ensure that works will have a minimal impact on the surrounding environment, with minimal human exposure to contaminants during the remediation works by adopting standard practices outlined in relevant legislation, guidelines and other publications.

The scope of works for the RAP is as follows:

- Identification of the contamination requiring remediation or management;
- Definition of remediation goals and Remediation Acceptance Criteria (RAC);
- Evaluation of remediation strategies and options;
- Provision of an outline of remediation methods for the site;
- Preparation of a conceptual WH&S plan to minimise the risk of exposure of remediation staff to contaminants; and
- Preparation of a conceptual environmental management plan to minimise the impact of remediation works on the surrounding environment.

Following the execution of the remediation works, a validation report will be prepared. The objective of the validation report will be to document that the site has been remediated to a standard commensurate with the proposed land use.

This RAP does not include the area within the WTC within the site. The temporary WestConnex facility occupies approximately 7.5ha. A separate RAP and validation report (if required) will be prepared for this area by WestConnex at the completion of the WestConnex occupancy of the site.

# 3 SITE INFORMATION

A summary of relevant site information is provided below.

### 3.1.1 Site Description

**Cooks Cove**

Cooks Cove is located in the suburb of Arncliffe within the Bayside Council Local Government Area (LGA). The site is located to the west of the Cooks River, approximately 10km south of the Sydney Central Business District (CBD). The site enjoys adjacency to key trade-related infrastructure being immediately west of Sydney Kingsford Smith International Airport and approx 6km west of Port Botany.

Cooks Cove is strategically located within close proximity to a number of railway stations including Banksia, Arncliffe, Wolli Creek and the International Airport Terminal, which vary in distance from the site between 700m and 1.1km. The M5 Motorway, providing regional connectivity to the Sydney Metropolitan area, runs in an east-west direction immediately to the south of the site. The M8 and M6 Motorways are, and will be, constructed in tunnels approximately 60 metres beneath the adjoining Bayside Council 'Trust' lands. The Sydney Gateway project, presently under construction to the immediate north of Cooks Cove and Sydney Airport, will substantially improve future accessibility to the St Peters interchange and the wider M4/M5 WestConnex network, via toll free connections, as well as the Domestic Airport and Port Botany.

The Cooks Cove Development Zone is located to the north of the Southern and Western Suburbs Ocean Outfall Sewer (SWSOOS), and is generally bound by the Cooks River to the east and Marsh Street to the north and west. The site is approximately 36.2ha and is owned and managed by a number of landowners, both public and private. Surrounding development includes the Sydney Airport International Terminal precinct, Mercure Sydney Airport, an area of low density dwellings presently transitioning to medium-high density residential flat buildings, recreation and open space facilities and road and airport related infrastructure.

**Kogarah Golf Club**

Kogarah Golf Club was established in 1928, with the Club occupying the land subject to the Planning Proposal boundary since 1955. At this time, the Cooks River was reconfigured to its current alignment to accommodate the expansion of Sydney Airport. The land presents a highly modified environment, with relatively flat topography, gently moulded fairways and greens, separated by strips of vegetation and man-made water bodies. The golf course clubhouse, car park and maintenance facilities are located in the northern corner of the site, adjacent the Cooks River. Access is provided via Levey Street. The members of Kogarah Golf Club will relocate from the site in May 2024 to new playing facilities.

**Arncliffe Motorway Operation Complex**

The temporary construction compound for the WestConnex M8 and M6 Stage 1 Motorway tunnelling works was originally established in June 2016. The temporary construction facility

occupies approximately 7.5ha and is expected to remain until 2025. At this time the facility will reduce to 1.5ha to accommodate the permanent Arncliffe Motorway Operations Complex, located in the western corner of the site, adjacent Marsh Street. The complex will house ventilation and water treatment plant and maintenance equipment for both the M6 and M8 sub-grade motorways.

**RTA Frog Ponds**

The site contains the existing RTA Frog Ponds, located in the south-west corner of the site, adjacent Marsh Street and SWSOOS. The two fenced areas contain ponds, constructed by the RTA as part of the M5 Motorway construction in 2002, as compensatory habitat for the Green and Golden Bell Frog.

**Easements and Affectations**

The Sydney Desalination Plant pipeline runs through the development zone, north-south adjacent the Cooks River. The pipe has a diameter of 1.8m and sits within an easement of 6-9m in width. From south to north the pipeline is constructed in a combination of trench and above ground with mounded cover and then transitions to micro-tunnel and typical depth of circa 11m. The Moomba to Sydney Pipeline, containing ethane gas, follows a similar general alignment north-south adjacent the Cooks River. The pipe has a nominal 225mm diameter, within an easement generally 5m wide and with the pipe located at a depth of 1.2m-2.3m..

### *3.2 Site Identification*

The site is referred to as the Cooks Cove Development Zone, Cooks Cove, NSW. The site was previously referred to as the Northern Precinct and Areas A and B but have been consolidated as one portion of land in this report.

The site covers an area of approximately 36 Ha of which 15ha is proposed to be developed.

This reports details the assessment of the site area covering approximately 29.5 ha of the site of which does not include the current Westconnex M8 and M6 Stage 1 Motorway temporary compound (WTC) or the parcel of land legally identified as Lot 31 DP1231486, It is understood by CES that the area occupied by the WTC has been disturbed by recent site works and is no longer indicative of the historic ground conditions. It is understood that WestConnex have committed to returning the site to a suitable condition for use as public open space at the completion of their works. Lot 31 has been subject to its own Environmental Site Assessment Report. The legal description of the site is Part of Lot 1 Deposited Plan (DP) 329283, Lot 1 DP 108492, Lot 14 DP 213314 and Lot 100 DP 1231954. It is located within the Local Government Area (LGA) of Bayside, Parish of St George, County of Cumberland.

A plan showing the site layout is presented in Figure 2.

### *3.3 Site Zoning and Land-use*

The site is currently zoned a combination of Open Space, Trade and Technology and Special Use land use under the State Environmental Planning Policy (Precincts—Eastern Harbour City) 2021. It is proposed to rezone the site for SP2 Infrastructure, RE1 Public Recreation and SP4 Enterprise uses.

### *3.4 Topography*

A review of the Botany Bay 1:25000 Topographic map (9130-3-S) indicated that the site elevation ranges from 0 to 10 m above Australian Height Datum (AHD). The northern site topography has been significantly modified through the placement of fill material over the original swamp and delta. An undulating surface has been landscaped to form the golf course including several small lakes as shown on Figure 2. The southern portion of the site generally drains in an easterly direction towards the Cooks River, although localised flow paths occur across the golf course, including an un-named intermittent stream draining the golf course shown on the 1:25000 Topographic Map. In addition, the central portion of the golf course drains internally towards a series of lakes.

### *3.5 Geology and Soils*

A review of the Sydney 1:100 000 Geological Series map indicates that the site is underlain by silty to peaty quartz sand, silt and clay. Ferruginous and humic cementation occurs in places with common shell layers also reported. These shell layers were also observed during field investigations. The material encountered is most likely of alluvial origin, deposited as sub-aerial and sub-aqueous components of the Cooks River delta. The deposit has been reworked significantly in the last century as part of river diversion and training works. These works would have involved significant dredging operations.

An outcrop of Hawkesbury Sandstone is also shown in the location of the existing Kogarah Golf Club House. A review of the Sydney 1: 100 000 Soil Landscape Sheet 9130 and field investigations indicated that the site is underlain by anthropogenic fill materials which are believed to have been dredged from the Cooks River and deposited on the site to form the KGC golf course.

Natural soil comprised sand and silty or clayey sand ranging in colour from pale to dark grey and brown with shells. Silty clay lenses, clayey sand and clay were encountered in places and were typically dark brown, dense and moist.

### *3.6 Hydrogeology*

#### 3.6.1 Regional Hydrogeology

The groundwater at this site lies within a shallow unconfined aquifer, with expected localised layers of low permeability (*e.g.* clay, peat and layers of localised iron-cemented sand) that may act

as local confining layers. Groundwater at the site flows in an easterly direction towards the Cooks River.

The Cooks River, Muddy Creek and the Spring Street Canal are tidal in the study area. Saline or brackish intrusion occurs around the periphery of the site as indicated by the decreasing electrical conductivity from east to west measured in groundwater wells installed along the southern boundary during the ESA. Diurnal fluctuations in groundwater levels in the peripheral areas are also expected to occur in response to tidal cycles.

### 3.6.2 Local Hydrogeology

CES (2001) undertook a search of the groundwater database at the DLWC (now DIPNR). A total of 69 registered groundwater wells were identified within a 2 km radius of the centre of the Cooks Cove Development site. Twenty-five wells are registered for "General Use" with a further 17 registered for "Domestic Use". Wells for general use were registered between 1950 and 1969, while wells for domestic use were registered between 1991 and 2000. It is proposed that general and domestic wells refer to use by private persons for non-potable use. The different classes are attributed to a change in well classification methods by the DLWC.

Three wells are registered for recreational or irrigation use. All of these wells are registered to local sporting facilities, including the Kogarah Golf Club (installed in 1966). Twenty one of the wells are registered for environmental monitoring or testing. Sixteen of the wells, number of which may be located within Area B, are registered in association with the M5 East Motorway. Inspection of DLWC work summaries reveals reported well yields of up to 3.0 L $s^{-1}$, with most yields of the order of 0.5 L $s^{-1}$. The salinity of wells installed is reported as "good". These data indicate that the study area is surrounded and underlain by relatively permeable strata. Low ("good") salinity of water extracted from the wells indicates that saline or brackish intrusion is likely to be limited to peripheral areas adjacent to the Cooks River and tidal reaches of tributaries thereof. This was confirmed in measurements collected during the ESA (CES, 2008).

## *3.7 Acid Sulfate Soils*

A review of the Botany Bay Acid Sulfate Soil Risk Map (2nd Ed, 1997) produced by the DLWC indicated that the site is located in an area of "… *high probability of occurrence of acid sulfate soil materials. The environment of deposition has been suitable for the formation of acid sulfate soil materials. Acid sulfate soils materials are widespread or sporadic and may be buried by alluvium or windblown sediments*".

Field observations show that Potential Acid Sulfate Soils are located between 1 and 3 m below the ground surface, that is, below the water table. Potential Occurring Acid Sulphate Soils (POCASS) were encountered during the drilling program of the Environmental Site Assessment (ESA) by

CES as some fill and soil exhibited the following characteristics (as defined in the ASSMAC 1998):

- A sulphurous smell;
- pH less than 3 (field tests);
- Groundwater table was encountered;
- Presence of shells; and
- Fill and soils were classified as estuarine silty sands or sands (mid to dark grey).

## *3.8 Site History*

### 3.8.1 Historical Aerial Photographs

Historical aerial photographs from the Department of Land and Water Conservation were examined. Aerial surveys have typically been conducted every 8-10 years with the earliest photographs being taken in 1930. The following photographs were examined for this report: 1930; 1951; 1961; 1970; 1978; 1986 and 1999. In addition, the 1943 aerial photograph acquired by the Department of Main Roads (DMR), now the Roads and Maritime Services (RMS), was also examined. The findings of air photo investigations are as presented below.

### 3.8.2 1930 (DLWC)

Cooks River is more torturous than at present day and does not adjoin the north-eastern section of the site as it does today. Muddy Creek and lower Cooks River are very thin and appear to be small tributaries off the main river only. The Cooks River outlet to Botany Bay is further north than presently located.

The study area has been subdivided. The northern half of the area presently occupied by Kogarah Golf Club, appears to be comprised of paddocks (possibly market gardens). The house in the north eastern part of the site presently utilised as the clubhouse has been built and may be surrounded by a few smaller buildings and a number of large trees. The southern half of the present day golf course and the area to the south has been subdivided and appears sandy with some scrubby vegetation.

The water main easement running across the Cooks River from the western to the eastern banks is present. Although property to the north west of the site adjoining the river appears to comprise sand it does seem to have been landscaped. River bank is in the present day location. Neighbouring areas to the west and north west are predominantly paddocks although some industrial buildings are present. Land south west of the site has been urbanised. East of the site across the lower Cooks River and Muddy Creek, the land is comprised of large subdivided blocks of dunes with some grass. White sand dunes occur on the north eastern side of the Cooks River.

### 3.8.3 1943 (DMR)

The 1943 aerial photograph indicates that the Cooks River is still fairly torturous in comparison to the aligned state of the present day. A golf course (the Bonnie Doon Golf Course) is present on the site, with what appears to be the present day club house in position. The site is generally covered in vegetation with greens, fairways and bunkers evident with some patches of sandy areas and some sealed sections around the clubhouse.

Market Gardens are present to the south of the site, residential property to the west, open space to the north and the Kingsford Smith International Airport to the east.

### 3.8.4 1951 (DLWC)

The shape of Cooks River has been altered extensively with the lower parts of the river now bounding the property. Muddy Creek has been considerably widened and canalised. Spring Street Canal has been constructed, as has the present day channel opening of the Cooks River into Botany Bay. Dredges and sand stockpiles in the photo indicate that these works were still in progress at the time.

The entire area of the present day Kogarah Golf Club appears to have reverted back to grass-and scrub-covered sand dunes, with the southern half being sandier.

There is a continued build-up of industry in the neighbouring area to the north-west and airport developments on the eastern side of the river are continuing.

### 3.8.5 1961 (DLWC)

The Cooks River has been reshaped and repositioned since the 1951 photograph. The north eastern side of the property now bounds the river. In addition Muddy Creek has been significantly narrowed.

The northern part of the site is now occupied by the golf course and is close to the present day layout. Numerous vehicles were noted around the golf club.

To the north of the site, land on the rivers edge has been landscaped and some small buildings erected. Additional factories and houses have been built on properties to the north west of the site and numerous trucks and smaller vehicles are visible around these buildings. Airport runways and aircraft hangars have been completed on the eastern bank of the Cooks River and are in operation with numerous planes visible in this area.

### 3.8.6 1970 (DLWC)

Additional alterations to the Cooks River have been performed since the 1961 photograph with the river essentially as in its present day form. Further industrial development has occurred to the north west of the site as well as superficial changes to other buildings in this area.

The construction of the airport overpass at the north eastern end of Marsh Street has commenced. Numerous construction site sheds are visible in on the north eastern corner of the Kogarah Golf Club. The golf course area is essentially the same as in the 1961 photograph although looking a little more grassy and with the addition of numerous small ponds.

### 3.8.7 1978 (DLWC)

The Kogarah Golf Club has been further landscaped with areas having been built up and additional ponds put in place. The western-most section of this area, previously occupied by market gardens is now included as part of the golf course.

To the north of the site demolition and construction of industrial buildings has occurred. The main span of the Marsh Street airport overpass has been constructed. Remaining neighbouring property appear essentially the same.

### 3.8.8 1986 (DLWC)

The site in general has not undergone many changes since the 1978 photograph.

To the north west of the site across Marsh Road, tennis courts have been built, as has the Airport Hilton in the place of the demolition area noted in the last photo. In addition, superficial changes have been made to other buildings in this area. A central section of the Marsh Street overpass to the airport has been constructed.

### 3.8.9 1999 (DLWC)

On the Kogarah Golf Course a large maintenance shed has been constructed on the northern most part of the property next to Marsh Street. In addition, a small building has been built in the middle of the golf course.

On neighbouring properties to the north small-scale construction and demolition works have been carried out. Houses on the corner of Marsh and West Botany Streets have been demolished. Directly north of the site across the river, some construction works or redevelopment activities are being carried out. The central section of the Marsh Street overpass to the airport has been completed.

### 3.8.10 1999- 2022 (Nearmap)

A review of the historical photographs produced on Nearmap (accessed 3 February2023) was undertaken. The review indicated no significant change to the site or its surrounds between the dates of 14 November 2009 and November 2022, with the exception of the construction of the Westconnex M8 and M6 Stage 1 Motorway Temporary Compound during August 2016 to date. The remaining data gap between the dates of 1999 and 2009 were unable to be addressed due to lack of photographic evidence, however the site did not appear to have significantly changed during this period when comparing the 1999 and 2009 aerial photographs.

### 3.8.11 Summary

A summary of the aerial photographs indicates that the site was part of the Cooks River delta and floodplain prior to its reclamation and development. The golf course has been required to move over time in concert with reclamation activities of former mangrove areas. Therefore, although the golf course has been present in the area since circa 1930, it has not always been in its existing location.

The following potentially contaminating activities have been carried out on the site:

- Introduction of contaminants in fill material. The most probable source of fill material is dredged spoil from the Cooks River and its delta; and
- Chemical inputs associated with the golf course such as fertilisers and pesticides.

In addition, the site is located to the immediate north of a number of former municipal landfill sites. It is understood that neither leachate nor gas management systems were constructed on these landfills. Consequently, the potential exists for either leachate or landfill gas to have migrated onto the site.

# 4 SITE CONDITION AND SURROUNDING ENVIRONMENT

## *4.1 CURRENT OWNER, OCCUPIER AND OPERATIONS*

The Site is currently on land owned by Kogarah Golf Club Limited, with a section along Marsh Street on the western boundary owned by The Municipality of the Council of Bayside, and a section along the southern boundary (Part Lot 20 DP1224233) owned by Sydney Water Corporation. The entirety of the site, excluding the temporary WestConnex compound, is currently occupied by Kogarah Golf Club for their golf course, with the section owned by Bayside Council under lease to the Kogarah Golf Club.

## *4.2 SITE DESCRIPTION*

The following description of the site is based upon a site inspection and information provided in previous reports.

Current access to the site is from Marsh Street via an underpass that crosses beneath the bridge that traverses the Cooks River. A car park, Club House and maintenance shed are located at the north eastern corner of the site. The remainder of the site consists of features typical of a golf course such as greens, fairways, sand bunkers and surface water bodies.

Vegetation on the site generally appeared to be healthy during fieldwork. No odours indicative of contamination or landfill gas were noted on the site (excluding during drilling and sampling within the Club House car park).

With the exception of the car park and access roads, the majority of the site is unsealed and used for a golf course. The areas encompassing the Club House and maintenance shed were sealed bitumen pavements with brick paths leading to the Club House from the course. All bituminous surfaces were in adequate conditions with no cracking or staining that was not associated with general everyday activities.

## *4.3 TANKS AND ASSOCIATED SERVICES*

Prior to commencement of the field programme it was understood that one Underground Storage Tank (UST) was present in the north eastern corner of the site. During field investigations, CES were informed of the presence of a further three USTs in the north eastern corner.

One UST and bowser containing unleaded fuel, one UST and bowser containing diesel fuel and associated pipes were located adjacent to the maintenance shed and used to fuel the various items of plant operated by the course curators. A further UST was located with the centre of the Club House car park but was not in use. However, it is not known if the tank has been decommissioned. A waste oil UST was located between the course maintenance shed and the KGC entry. This tank is currently in use. The location of the USTs is shown in Figure 3a.

### *4.4 SURROUNDING LAND-USE*

Without gaining access, the properties immediately surrounding the site are as follows.

- *North* – Marsh Street forms the northern boundary of the site. To the north of Marsh Street are the Mercure Hotel and St George Rowing Club;
- *South* – Remainder of the golf course, followed by the M5 East and SWSOOS easements form the southern boundary of the site;
- *East* – The Cooks River forms the eastern boundary of the site. To the east of the Cooks River is the International Terminal of Kingsford Smith Airport; and
- *West* – Marsh Street and a wetlands area also forms the western boundary of the site. Residential properties are located on the western side of Marsh Street.

### *4.5 NSW EPA CONTAMINATED LAND RECORD*

A search of the NSW EPA Contaminated Land Record was undertaken by CES for the Rockdale (Bayside) Council Local Government Area. It indicated that there are no notices relevant to the site on the Record.

### *4.6 INTEGRITY ASSESSMENT*

Historical and site information was sourced from reputable NSW Government departments with no known interest in the site. CES have relied on the accuracy of the documentation provided and our experience in historical document interpretation. Whilst there is a small margin for error in interpretation, CES consider the information presented in this assessment to be accurate.

# 5 SITE CHARACTERISATION

A characterisation of the site based on the results of the CES (2008) investigation and Environmental Site Assessment Cooks Development Zone (CES document reference: CES130608-BP-AR) is presented below. Tabulated investigation results are provided in Appendix 1.

It is noted that the updated plan uses the site boundary shown on the plans in Figure 2. The revised boundary excludes 7 boreholes (BBH416, BBH424, BH437, BBH444, BBH449, BBH454, BBH459). As these locations are outside of the site boundary, they have been removed from the updated assessment. In addition, one groundwater well (BMW403) and three gas wells (BLG401, BLG402, BLG403) are also outside the revised boundary, however, these were retained at the information from sampling of groundwater and gas is relevant to the revised subject site.

## *5.1 Soil*

With the exception of copper, nickel, zinc, lead, Benzo(a)pyrene TEQ and BTEX the SAC for soil were not exceeded in samples of natural soil and fill analysed. The elevated concentrations of copper and lead at sampling location AMW207 were potentially associated with isolated metal shaving uncovered within the fill material at a depth of 0.5-0.7 mBGL.

The assessment criteria for heavy metals (copper, nickel, zinc, and lead) were exceeded in eighteen fill samples across the site. Three zinc concentrations in the fill exceeded the adopted ecological-based SAC. These exceedances lie within proposed Block 3C – Logistics hub and were at a depth below the top 2 metres of soil. As the zinc concentrations did not exceed adopted health-based SAC and were identified below this depth remediation is not considered necessary. Two lead concentrations in the fill material exceeded the adopted heath-based SAC and these lie within proposed Block 3C – Logistics hub. These samples (located in BBH430 and BBH433 bores) were collected from fill material a depth of between 2.4 and 2.6 mBGL. Considering these are located at a depth of between 2.4 metres and 2.6 metres and will be capped during construction of proposed buildings (i.e. Block 3C), it is not considered likely to cause a risk to human health of the future receptors, and as such does not require remediation. However, a management strategy for lead contaminated soils will be included in the Remediation Action Plan (RAP). Eight Copper concentrations in the fill material exceeded the adopted ecological-based SAC and varied in depth ranging between 0.2 m BGL and 2.6 m BGL. As the copper concentrations did not exceed adopted health-based SAC, and the 95% UCL calculation for copper in the fill material of 33.73 mg/kg was less than the adopted EILs, it is not considered likely to cause a risk to human health of the future receptors and remediation is not considered necessary.

The assessment criteria for BTEX were exceeded in four fill samples in the immediate vicinity of the underground storage tanks located close to the maintenance sheds at the northern end of the site and lie within proposed Fig Tree Grove pavilion.

As a result of the elevated concentrations of BTEX, remediation and/or management measures are required to ensure protection of the environment and human health. The removal of the bowsers, USTs, associated pipework and impacted soil will be required under a Remediation Action Plan (RAP) as part of the redevelopment of the site.

Two Benzo(a)pyrene TEQ exceeded the adopted health-based SAC and lie within the proposed Flora Street intersection upgrade and extension in the east side of the site. These samples (located in BBH453 and BBH402) were collected from fill material a depth of between 0.2-0.3 mBGL in BBH453 and 0.5-0.6 mBGL in BBH402. As a result of the elevated concentrations of Benzo(a)pyrene TEQ, remediation and/or management measures are required to ensure protection of the environment and human health. The removal of the impacted soil will be required under a Remediation Action Plan (RAP) as part of the redevelopment of the site. Benzo(a)pyrene TEQ concentrations were not detected at depths greater than 0.3 mBGL in BBH453 and 0.6 mBGL in BBH402 and consequently the contamination is unlikely to extend underneath those depths.

Asbestos fibres were not found in near-surface fill during drilling works, however fragments of fibrous cement sheeting were found in surface fill in a limited number of locations across the site within fill on unsealed surface areas. Small scale remediation (localised) or management of the ACM fragments prior to the commencement of development construction will be required.

Potential Acid Sulfate Soils (PASS) are present in natural material below the water table. If these materials are not disturbed during the development process, they will not pose a risk to the local environment. However, it is expected that the planned development of the site may result in disturbance of the PASS, therefore, an acid sulfate soils management plan (ASSMP) will be required.

### *5.2 Groundwater*

Sixteen groundwater wells were installed along the boundary of the site and within the site to assess whether contamination resulting from the presence of landfills to the south was migrating onto the site, with one well being placed in the centre. Four groundwater wells were installed surrounding USTs located in KGC Club House car park. Of the suite of substances analysed in the groundwater samples, copper, lead, nickel, zinc and ammonia were detected at concentrations that exceeded the SAC established for groundwater, while TPH $C_6$-$C_{14}$ and ethylbenzene concentrations above the laboratory detection limit were detected around the USTs adjacent to the maintenance shed.

With respect to the concentrations of TPH and BTEX exceeding the laboratory reporting limit, as the concentrations of these substances was only detected within ABH202 and ABH2105, the potential for migration of contaminants appears to be limited. Given the limited extent of the contamination, off-site migration is not considered an issue and with the impending development, no immediate management of the area over and above current maintenance are recommended.

With respect to metal concentrations, given the nature of the fill materials identified, and that the concentrations identified are unlikely to occur naturally in the soil types in the area, it is considered likely that metals contamination in groundwater were possibly sourced from dredged sediments and pore water placed on the site during the realignment of Cooks River.

With respect to the low concentrations of ammonia detected in groundwater, it is considered likely that the potential source of ammonia is naturally occurring organic content in the dredged material placed on the site during the realignment of Cooks River and minor impact of fertilizers used during maintenance of the golf course.

Given the fact that the Cooks River is free flowing, is not a stagnant water body and that it is highly degraded due to industrial pollution and stormwater run-off, it is therefore not a sensitive receptor. Consequently, CES considers the elevated metal concentrations and ammonia to have low potential to adversely impact the receiving waters. CES considers the potential risk to human health and the environment to not be significant or warrant active remediation.

Results from the February 2017 sampling event showed no significant change when compared to the results of the 2008 sampling event. It is CES' opinion that the groundwater chemistry at the site has not significantly changed since the 2008 sampling event.

### *5.3 Landfill Gas*

Concentrations of methane, carbon dioxide and oxygen in the gas extracted from six subsurface gas monitoring wells installed along the southern perimeter of the site were not indicative of the presence of landfill gas, as such, there was no evidence that the former landfills to the south of the M5 East motorway are impacting on soil gas in the site.

The ground gas risk assessment, as outlined in NSW EPA (2012), was undertaken. The preliminary screening process did identify the potential source of landfill gas from the adjacent site, however, there was insufficient evidence to suggest risk to receptors and potential pathways of gas migration. Further assessment was not deemed necessary in consideration of the above findings.

It is noted that the NSW EPA (2012) guidelines have been superseded by NSW EPA (2020) *Contaminated Land Guidelines: Assessment and management of hazardous ground gases*. The risk assessment framework in the recent guidelines also recommends carrying out a preliminary screening based on the CSM and therefore the results of the risk assessment are still valid.

The elevated carbon dioxide concentrations with ALG204 can be attributed to the natural degradation of organic matter.

There is no obvious source to associate with the detection of toluene in ALG402. However, this location is off site and it is not deemed necessary investigate further.

### *5.4 Conclusions and recommendations*

With the exception of BTEX impact in fill material surrounding bowsers and USTs located within the Kogarah Golf Club House car park and benzo(a)pyrene, copper and lead identified hotspots, the soil across the site does not contain contamination such that extensive remediation would be necessary to make the site suitable for the proposed mixed land use. However, it will be necessary prior to redevelopment of the site to remediate the impacted areas by decommissioning and removing the USTs and associated infrastructure; removing/managing benzo(a)pyrene, copper, and lead impacted soils and to ensure that fragments of Asbestos Containing Materials present in mainly surface fill in limited areas across the site are managed and disposed safely and in accordance with regulations.

It is recommended that a Remediation Action Plan (RAP) be prepared to address hydrocarbon-impacted areas associated with refuelling infrastructure in the Kogarah Golf Clubhouse car park, the areas of the benzo(a)pyrene, copper and lead hotspots, and the presence of fragments of asbestos cement sheeting on the site.

# 6 REMEDIATION GOAL AND STRATEGY OPTIONS

## *6.1 Remediation Goal*

The remediation goal is to manage identified hotspots of, Benzo(a)Pyrene (BaP), Copper, Lead and Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) in soil and remove fragments of ACM at the surface in a manner that will have a minimal impact on the surrounding environment and minimal human exposure and result in the site being suitable for the redevelopment and change to a mixed use land-use, as defined by the Remediation Acceptance Criteria (RAC).

## *6.2 Remediation Options and Rationale for Selection*

On-site treatment is the preferred option for site remediation followed by off-site treatment. If treatment is not possible or viable, options to be considered include the removal of soil off-site, isolation using a properly designed barrier and retaining soil *in situ* with appropriate management measures.

Considering the type of contamination detected (i.e. BaP, Cu, Pb, BTEX and fragments of ACM), only a small number of proven and commonly used remediation technologies are recommended for the remediation of these contaminants:

- Excavation and off-site disposal;
- *In-situ* capping/containment; and
- Clean soil barrier.

A brief description of each technology and suitability is provided below.

### 6.2.1 Excavation and Off-Site Disposal

This option would require all of the accessible material impacted by BaP and BTEX contamination and ACM fragments to be excavated and disposed of to an appropriately licensed landfill or waste treatment facility. The excavation of the material would be guided by a suitably qualified environmental scientist/engineer using visual and olfactory indicators.

The advantage of this option is that it will remove all of the accessible impacted material from the site. The main risks are potentially high costs associated with landfill disposal and treatment depending on the waste classification of the material and a greater than expected volume of impacted material. Delineation of the lateral extent of the contamination could be undertaken prior to excavation works to minimise the volume.

### 6.2.2 In-situ capping/containment

*In-situ* capping involves maintaining the material on site underneath an impermeable capping so that human access and water infiltration is prevented. Containment involves the full containment

of the impacted fill material within an engineered cell. The construction of a containment cell involves the excavation of the contaminated material.

The main risk associated with these technologies are that the contamination is still present on site and as such, careful management, including preparation of site management plans and title notification, is required. There may also be some restrictions on site activities and the placement of structures. Excavation of the material exposes site workers to the contamination during remedial works.

### 6.2.3 Clean Soil Barrier

The hotspots of BTEX in soil have had a measurable impact on groundwater quality (CES, 2008), therefore the contamination encompassing the USTs could not be managed on site with the placement of a clean soil barrier.

### 6.2.4 Recommended Remediation Option

The recommended remediation options are determined by proposed end-use, as such, different remediation options have been recommended for each of the northern and southern portions of the site. The following paragraphs outline the recommended remediation options for the northern and southern portions of the site.

**Northern Portion**

As the site is proposed for mixed land-use and as the redevelopment is likely to expose the contaminated material through demolition and excavation, the most appropriate remediation for BTEX contaminated material encompassing the USTs is considered to be excavation and off-site disposal for the following reasons:

- Off-site disposal will remove the identified contamination from the site;
- No ongoing management of contamination and associated risk will be required on the site; and
- The greater Sydney area has suitably licensed landfill and waste treatment facilities to accept contaminated soil.

With respect to the fragments of ACM at the surface, all visible fragments at the surface must be collected by an appropriately licenced contractor and appropriately disposed to landfill. An occupational hygienist must inspect the area and provide a clearance certificate. An asbestos management plan must be prepared by an appropriately qualified and experienced consultant for the development works noting the procedures to be undertaken if additional ACM is encountered during the redevelopment.

**Southern Portion**

With respect to the two hotspots of BaP contamination, which were located in the east side of the site and within the proposed Flora Street intersection upgrade and extension, the placement of a clean soil barrier is considered to be the optimal remedial strategy. CES considers that a clean soil barrier with a minimum thickness of 0.5 m will be sufficient to prevent users of the site coming into contact with impacted surface soils.

Due to the depth of contamination at BBH430 and BBH433, it is possible that, subject to validation (i.e. analysis of two soil samples between 0 and 0.5 m for metals, TPH, PAH and asbestos), in-situ soil above these locations may be suitable for inclusion in a clean soil barrier layer. However, due to the shallow depth of contamination at BBH453 and BBH402, a clean soil barrier layer of minimum thickness 0.5 m is required to be applied. Subject to validation, some material for the clean soil barrier layer at BBH453 and BBH402 may be won elsewhere on site. The surface at BBH453 and BBH402 (and the other hotspot locations where in-situ soil is found to not be suitable for a clean soil barrier layer) should be prepared to a specification set by a Geotechnical Engineer prior to application of the clean soil barrier layer.

The clean soil barrier strategy will also require development of a long-term site management plan describing the impacted locations and procedures for future work in these areas (i.e. installation of services). Title notification (typically applied to the section 10.7certificate-previously known as Section 149 Certificates) will also be required. It should be noted that any site management plan will require approval by the site owners, who will be responsible for its implementation.

With respect to the fragments of ACM at the surface near BBH451 (approximate area of 5 m x 5 m), all visible fragments at the surface must be collected by an AS1 licenced contractor and appropriately disposed to landfill. An occupational hygienist must inspect the area and provide a clearance certificate. In addition, as the asbestos fragments were not associated with any particular site features (e.g. location of former structures), the occupational hygienist must inspect the surface of the entire site on a nominal grid of 25 m for randomly distributed asbestos fragments. This inspection should be undertaken before the AS1 licenced contractor demobilises from the site so that any additional fragments found during the inspection may be appropriately removed. The clearance certificate shall cover the nominated remediation area surrounding BBH451 and the entire site inspected on a 25 m grid.

An asbestos management plan must be prepared by an appropriately qualified and experienced consultant for the development works noting the procedures to be undertaken if additional ACM is encountered during golf course construction and earthworks.

### 6.2.5 UST Removal

The USTs are to be excavated as part of the redevelopment of the site, removal and appropriate off-site disposal of the USTs, bowsers and associated infrastructure should be undertaken in

accordance with the Australian Standard AS 4976-2008: *The Removal and Disposal of Underground Storage Tanks,* 2008. Notify the relevant local authority at least 30 days before the scheduled decommissioning work to identify if any planning requirements or approvals are needed. Note that USTs not used to store dangerous goods for a period of more than two years would need to be removed to comply with the UPSS Regulation . Following the removal of the USTs, bowsers, associated infrastructure and contaminated soil, validation of the excavations will need to be undertaken.

## *6.3 EXTENT OF REMEDIATION REQUIRED*

The approximate extent of remediation and/or management is as follows.

### 6.3.1 Remediation of Northern Portion

The "hot spot" concentrations were located as follows:

- ABH2105, located on the western side of the USTs and bowsers contained concentrations of TPH $C_6$-$C_9$ (200 mg $kg^{-1}$), $C_{10}$-$C_{36}$ (850 mg $kg^{-1}$), benzene (8.9 mg $kg^{-1}$) and Total Xylenes (56.4 mg $Kg^{-1}$), within sample 150508-333-KW at a depth of 1.4-1.5mBGL;
- ABH2107, located between the USTs and bowsers contained concentrations of TPH $C_6$-$C_9$ (1400 mg $kg^{-1}$), $C_{10}$-$C_{36}$ (2590 mg $kg^{-1}$), benzene (51 mg $kg^{-1}$), toluene (390 mg $kg^{-1}$) and Total Xylenes (630 mg $kg^{-1}$) within sample 150508-341-KW at a depth of 1.0-1.1mBGL. The deeper sample contained concentrations of TPH $C_6$-$C_9$ (1900 mg $kg^{-1}$), TPH $C_{10}$-$C_{36}$ (4890 mg $kg^{-1}$) and benzene (96 mg $kg^{-1}$), toluene (470 mg $kg^{-1}$) and Total Xylenes (470 mg $kg^{-1}$) within sample 150508-342-KW at a depth of 1.5-1.6mBGL; and
- ABH2108, located south of the USTs contained concentrations of TPH $C_6$-$C_9$ (860 mg $kg^{-1}$), $C_{10}$-$C_{36}$ (3170 mg $kg^{-1}$), benzene (28 mg $kg^{-1}$), Toluene (150 mg/$kg^{-1}$) and Total Xylenes (338 mg $kg^{-1}$) within sample 150508-345-KW at a depth of 1.1-1.2mBGL.

The approximate area of impact is assumed to be half the lateral distance between the impacted borehole and the surrounding non-impacted boreholes. Using this hypothesis, approximate area of impacted soil requiring remediation encompassing the USTs (including bowsers and associated infrastructure) adjacent to and underlying the maintenance shed is approximately 320 $m^2$. Hotspots were not present at a depth greater than 1.6mBGL, however remediation and the subsequent validation should extend to a minimum depth of the base of the UST pit. The current maintenance shed will need to be demolished in order to access the contaminated material underlying the shed.

The single UST in the centre of the Club House car park and the waste oil UST (identified in the vicinity of ABH2106) will need to be decommissioned, excavated and removed from site prior to redevelopment. During the excavation of the USTs, the subsequent pits will need to be validated.

The extent of the remediation and/or management required at the site is shown on Figure 3.

### 6.3.2 Remediation of Southern Portion

The "hot spot" concentrations were located as follows:

- BBH430, located in the eastern part of the site contained a concentration of lead of 2100 mg $kg^{-1}$ in a sample of fill (300408-107-KW) collected at a depth of 2.4-2.6 m. This sample was the deepest sample collected in this borehole, depth extent of lead contamination was not determined. Soils between 0 and 0.5 m at BBH430 should be analysed for metals, TPH, PAHs and asbestos to confirm the suitability of overlying soil to act as a clean soil barrier;

- BBH433, located in the eastern part of the site close to the northern boundary contained a concentration of lead of 4400 mg $kg^{-1}$ in a sample of fill (010508-159-KW) collected at a depth of 2.4-2.5 m. This sample was the deepest sample collected in this borehole, depth extent of lead contamination was not determined. Soils between 0 and 0.5 m at BBH433 should be analysed for metals, TPH, PAHs and asbestos to confirm the suitability of overlying soil to act as a clean soil barrier;

- AMW207, located in the eastern part of the site contained a concentration of copper 7500 mg/kg in a sample of fill (120508-219-KW) collected at a depth of 0.5-0.7. The deeper sample analysed (120508-220-KW) was below the SAC at 1.4-1.5 m. A clean soil barrier of minimum thickness 0.5 m is required at AMW207.

- BBH453, located in the eastern boundary contained a concentration of BaP of 8.8 mg $kg^{-1}$ and BaP TEQ 29.47 mg/$kg^{-1}$ in a sample of fill (300408-92-KW) collected at a depth of 0.2-0.3 m. The deeper sample analysed for BaP and BaP TEQ (290408-93-KW) was below the SAC at 0.55-0.65 m. A clean soil barrier of minimum thickness 0.5 m is required at BBH453.

- BBH402, located in the eastern boundary contained a concentration of BaP of 2.7 mg $kg^{-1}$ and BaP TEQ 11.87 mg/$kg^{-1}$ in a sample fill (280408-06-KW) collected at a depth of 0.5-0.6. The deeper sample analysed for BaP and BaP TEQ was below the SAC at 0.8-0.9 m. A clean soil barrier of minimum thickness 0.5 m is required at BBH453.

The approximate area of impact is assumed to be half the lateral distance between the impacted boreholes and the surrounding non-impacted boreholes. The approximate lateral extent of the remediation and/or management required at the site is shown on Figure 3.

It is noted that additional soil sampling may be undertaken at the request of the site owner to delineate the soil impact and reduce the lateral extent of soil barrier that is to be applied. This RAP

does not provide for delineation sampling and if such work is to be undertaken at the site, a Sampling, Analysis and Quality Plan (SAQP) shall be prepared and provided to the Auditor for review and approval prior to investigations commencing.

### 6.3.3 Remediation of fragments of ACM

ACM fragments were located on the surface of un-grassed areas near ABH211, ABH267 and AMW207, and located at the surface around BBH451 in the central eastern part of the site across an area of exposed soil with dimensions of approximately 5 m by 5 m. ACM fragments were not detected in any boreholes. All visible fragments must be collected by an AS1 licenced contractor and disposed to landfill. An occupational hygienist must inspect the area and provide a clearance certificate. In addition, as the asbestos fragments identified in the Southern Portion of the site were not associated with any particular site features (e.g. location of former structures), the occupational hygienist must inspect the surface of the entire site on a nominal grid of 25 m for randomly distributed asbestos fragments. This inspection should be undertaken before the AS1 licenced contractor demobilises from the site so that any additional fragments found during the inspection may be appropriately removed. The clearance certificate shall cover the nominated remediation area surrounding BBH451 and the entire site inspected on a 25 m grid.

The extent of the remediation and/or management required at the site is shown on Figure 3.

## *6.4 REMEDIATION SEQUENCE*

The proposed sequence for the remediation work is as follows:

1. Submit RAP to council with development application and obtain consent;
2. Site establishment;
3. Removal of surface ACM and clearance;
4. Place clean soil barrier over impacted surface soils;
5. Demolition of maintenance shed to access contaminated fill;
6. Controlled excavation of contaminated material from encompassing the USTs and stockpiling onsite for waste classification;
7. Off-site disposal to licensed landfill or waste treatment facility;
8. Validation of excavations and imported material;
9. Targeted sampling of surface and near surface soil of the proposed small “pocket parks” and peripheral landscaped areas.
10. Importation of validated material for reinstatement of excavations (if required); and
11. Preparation of a validation report.

### *6.5 UST REMOVAL*

Removal and appropriate off-site disposal of the two USTs, bowsers and associated infrastructure (vent pipework) should be undertaken in accordance with:

- Work Health and Safety Regulation 2017;
- Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2014
- AS1940–2004: Storage and handling of flammable and combustible liquids (AS 2004)
- Australian Standard AS/NZS 60079.10.1: Explosive atmospheres – Classification of areas – Explosive gas atmospheres
- Australian Standard AS/NZS 60079.29.1: Explosive atmospheres – Gas detectors – Performance requirements of detectors for flammable gases
- AS4976–2008: Removal and disposal of underground petroleum storage tanks (AS 2008).

Following the removal of the USTs, bowsers, associated infrastructure (including vent pipework) and contaminated soil, validation of the excavations will need to be undertaken.

Local Council should be notified after the removal of the USTs with the production of a validation report.

### *6.6 CONTINGENCY PLAN*

Depending on the ground conditions encountered during the redevelopment, additional volumes of material other than those outlined in this RAP may require remediation in accordance with the methods outlined in this RAP or instructions from a suitably qualified environmental consultant. Remediation not outlined within this RAP will need to meet the objectives and the RAC outlined within this plan. Contingency items may include:

- Disposal of impacted groundwater or groundwater impacted by earthworks (eg. high sediment loading within excavation water); and

- Further assessment, management and/or remediation of suspected impacted materials not identified during the ESA.

### *6.7 REMEDIATION ACCEPTANCE CRITERIA*

To determine the success of the proposed remediation plan and to evaluate different clean up options, it is necessary to define appropriate RAC. In accordance with the requirements of the NEPM (2013) and considering the proposed mixed land-use, the RAC will be assessed against the recreational and commercial/industrial land-use guidelines will need to assess aesthetics (including soil odour and colour) and potential human health issues. In the case where impacted soil may

remain *in situ*, RAC apply only to material used to form the clean soil barrier layer. Any material imported to site for use as a clean soil barrier must be Virgin Excavated Natural Material (VENM).

### 6.7.1 Aesthetics

Aesthetics relates to the generation of odours from the soil and any discolouration of the soil as a result of contamination (NSW EPA, 1997). To address this issue, soil odour and discolouration will need to be continually assessed in the field while undertaking the remediation work and, if necessary, action taken to ensure adverse aesthetics are remediated.

### 6.7.2 Potential Ecological Impacts

Potential ecological impacts have to be assessed for soils to be retained on site, which are not underneath buildings or slabs. To address potential ecological impacts of soils, assessment of the analytical testing results against the NSW EPA (2013) Ecological Investigation Levels (EILs) and Ecological Screening Levels (ESLs) will be required to provide confidence that contaminant concentrations below those levels will not adversely impact specific flora proposed for the site.

A summary of the adopted ecologically-based RAC is provided in Table 1.

### 6.7.3 Human Health Based Investigation Levels

To address potential human health impacts at the site, CES has adopted a set of soil investigation levels appropriate for recreational and commercial/industrial land-use. That is, the RAC have been set at a level that provides confidence that contaminant concentrations below the RAC will not adversely affect human health.

The current Cooks Cove Planning Proposal comprises a mixed use concept including commercial, retail, hotel and multi-level logistics and warehousing land uses within the site. CES has adopted the following HSL and HIL criteria:

- NEPM (2013) Health-based Investigation Levels (HIL) recommended for exposure setting 'C' which includes recreational land use; and
- NEPM (2013) Health-based Investigation Levels (HIL) recommended for exposure setting 'D' which includes commercial/industrial land use.
- NEPM (2013) Health-based Screening Levels (HSL) recommended for exposure setting 'C' which includes recreational land use; and
- NEPM (2013) Health-based Screening Levels (HIL) recommended for exposure setting 'D' which includes commercial/industrial land use.

A summary of the RAC are provided in Table 1.

### 6.7.4 Asbestos

Asbestos in soil which are based on scenario-specific likely exposure levels for bonded ACM, Friable Asbestos and Asbestos Fines, are adopted from the Western Australia Department of Health guidelines and include Recreational C (e.g. public open space such as parks), and Commercial/Industrial D. For the proposed development, the asbestos HSL criteria applicable to Recreational (HSL C) and Commercial Industrial (HSL D) are considered appropriate. In addition to the HSL C and D criteria, the soil surface should be free of visible asbestos.

### 6.7.5 Assessment of Excavated Material for Off-Site Disposal

Any contaminated excavated material exported from the site must be classified in accordance with NSW EPA (2014) prior to disposal and transported to an appropriate facility. Under these guidelines, non-liquid waste may be classified in the following groups:

(i) General Solid Waste;
(i) Restricted Solid Waste; and
(ii) Hazardous Waste.

The guidelines contain a two stage classification for liquid and non-liquid waste.

The first stage involves the comparison of total or Specific Contaminant Concentrations (SCC) with Contaminant Threshold (CT) values (Table 2). The latter are equivalent to the limits for leachable concentrations (determined in stage 2) assuming that all the contaminants present in a sample are leachable. These threshold values are highly conservative and used largely in the early stages of waste-classification activities.

The second stage of waste characterisation involves the determination of leachable contaminant concentrations using the Toxicity Characteristics Leaching Procedure (TCLP). In this stage, both SCC and leachable concentrations are used to classify waste. The final waste classification is determined by consideration of both SCC and leachable concentrations. It should be noted that in the instance that either SCC or leachable concentration criteria for one contaminant are exceeded, then the higher waste category should be adopted.

The waste classification criteria for each waste category are far more stringent when classifying materials based solely on total concentrations. Values for leachable concentrations are usually necessary in order to obtain the necessary data required to classify the material to the most appropriate waste category.

The assessment criteria for non-liquid waste are summarised in Table 3.

### 6.7.6 Fill Used in Clean Soil Barrier and Backfill Material

#### *6.7.6.1 Imported material*

Material imported for use in the clean soil barrier layer must be classified as Virgin Excavated Natural Material (VENM) in accordance with NSW EPA (2014). According to the definition of Virgin Excavated Natural Material in the Protection of the Environment Operations Act (1997), for a material to be VENM it must:

- Be a natural material (e.g. clay, gravel, sand, soil and rock); and
- Not be mixed with any other waste; and
- Be excavated from areas that are not contaminated with manufactured chemicals as a result of industrial, commercial, mining or agricultural activities; and
- Not contain Sulfidic ores or soils; or
- Consist of excavated natural materials that meet criteria as may be approved by the NSW EPA.

As a consequence of these requirements, an understanding of the history of activities that have occurred on the Source Site is required as well as an inspection of the material in situ by an experienced environmental scientist/engineer.

#### *6.7.6.2 Material won on site*

Material won on site, including in-situ material (0-0.5 m depth) at BBH430 and BBH433 and any material won on site for application as a clean soil barrier of minimum thickness 0.5 m at BBH453 BBH402, AMW207 or other areas, must comply with the criteria outlined below for open space use.

*Aesthetics*

Aesthetics relates to the generation of odours from the site and/or any discolouration of the soil as a result of contamination. No material with adverse aesthetics may be used in the clean soil barrier layer. Aesthetic considerations include discolouration, odour and texture (e.g. presence of waste material, bricks, concrete, etc.).

*Potential Ecological Impacts*

Site observations indicated that the vegetation on the site was in generally good condition and that there were no areas of dead or stressed vegetation noted that may have indicated that contamination of the soil may have been causing a significant impact to the health of the vegetation. Consequently, the exceedances of the ecological-based SAC recorded in the ESA were considered not to present a significant risk to the existing flora. Further, given that the proposed use of Council land within the site is passive open space, it is expected that the proposed flora for the site will be

similar to the existing and therefore, there is unlikely to be a significant risk to flora proposed for the site. Ecologically-based RAC are not required for the assessment of soil for the clean soil barrier.

*Potential Human Health Impacts*

To address potential health impacts of material won on site for use in the clean soil barrier, results must be compared with the Health Based Soil Investigation Levels (HIL) appropriate for the proposed land use. That is, the HIL may be set at a level that provides confidence that contaminant concentrations below the HIL may not adversely affect human health.

The current Cooks Cove Planning Proposal comprises a mixed use concept including recreational, commercial, retail, hotel and multi-level logistics and warehousing land uses within the site. CES has adopted the following human health criteria:

- NEPM (2013) Health-based Investigation Levels (HIL) recommended for exposure setting 'C' which includes public open space land use.
- NEPM (2013) Health-based Investigation Levels (HIL) recommended for exposure setting 'D' which includes commercial/industrial land use.
- With respect to BTEX, the NEPM (2013) HSLs for exposure setting 'C and D' for public open space land use and commercial/industrial land use, respectively.

A summary of the RAC for soil is provided in Table 1.

*Asbestos*

Remediation criteria for asbestos in soil will be adopted from Table 7 of the NEPM (2013) Schedule B1- *Guideline on Investigation Levels for Soil and Groundwater*. The health screening levels used include the fixed Fibrous Asbestos (FA) and Asbestos Fines (AF) criteria of 0.001% w/w and the bonded ACM criteria for Recreational C and Commercial/ Industrial D, as dependant on the area of the proposed mixed development.

For this project, the RAC for material won on site for use in the clean soil barrier must contain no visible Asbestos Containing Materials (ACMs) and each sample collected must not contain any detectable respirable asbestos.

# 7 UST REMOVAL

The USTs are to be removed in accordance with NSW DECCW UPSS Technical Guidelines (2010) and AS4976-2008 as outlined below.

## *7.1 Tank Pumpouts*

Residual liquids (if any) will be removed from the tanks by a licensed liquid waste contractor. The procedure outlined below should be adopted (in general accordance with AS4976-2008):

(a) The principal, or supervisor, shall ensure that documented work instructions and all the relevant work permits including hot work permits are issued to the contractor prior to decommissioning works proceeding;
(b) Remove all possible product from the tank and pipework using the normal pumping system;
(c) Disconnect and isolate dispensers and other above-ground pumping equipment;
(d) Withdraw the residual product via the dip or other suitable fitting, using an air operated pump or other equipment suitable for a hazardous area and a suction hose, or spear, reaching the bottom of the tank. Transfer residual product to sealed drums or licensed tankers for safe off-site disposal;
(e) Prior to excavating, locate and isolate all electrical cables and product pipelines, in the vicinity;
(f) Seal off all ground level connections to the tank, but leave the vent intact, and excavate to expose all the tank top fittings.

## *7.2 Removal of USTs and Associated Infrastructure*

The staging of UST removal is presented below (in general accordance with AS4976-2008 and DECCW, 2010):

(a) Drain, blank (to prevent accidental leakage) and disconnect all redundant pipework, withdraw any tank mounted equipment, and plug all openings including the vent. One plug shall have a 3 mm hole to act as a pressure equalising vent;
(b) Complete the excavation to expose the total width and length of the tank, and remove concrete anchors if present. Care should be taken to prevent the excavator from striking the tank in any way.

**On no account should excavation equipment be used to punch holes into a tank.**

The work should be planned so that as soon as a tank is fully exposed, it is immediately removed from the excavation and placed on to the transport vehicle. It should then be taken to the approved disposal or storage site without delay;

(c) When lifting a tank, ensure that the lifting lugs on the tank are in good condition and that the crane or excavator has sufficient capacity to overcome the ground suction effects likely to be encountered. If the lifting lugs are deemed to be corroded, alternative lifting techniques (e.g. the use of slings) should be considered.

(d) An appropriately sized (to accommodate the tanks, lines, dunnage, blocks and tank clearance, as described below) HDPE liner should be positioned on the ground to minimise the potential for loss of product to the ground, with appropriate dunnage to keep the tank elevated above the ground (100 mm), blocks should be used to prevent the tanks from rolling and the tanks should be positioned so that access can be gained to all sides;

(e) As soon as the tank is clear of the excavation, scrape off all loose soil and inspect the shell of the tank for defects. Defects are to be noted and photographed. The operator and banksmen should remain clear of the tank at all times.

(f) Cold patch or plug any holes prior to loading the tank to transport vehicle;

(g) Immediately after removal from the ground, each tank shall be permanently marked with warning label:
"NOT GAS FREE
NO NAKED LIGHTS
TANK HAS CONTAINED LEADED PETROL/DIESEL
NOT SUITABLE FOR STORAGE OF FOOD OR LIQUIDS INTENDED FOR HUMAN OR ANIMAL CONSUMPTION."

Note:

- If tanks have been filled with concrete slurry this will need to be broken-out prior to lifting. Concrete may either be crushed and then taken off site or placed into the base of the excavation pit following validation of both the concrete and the base of the excavation;
- If the tanks have been filled with sand, this will need to be stockpiled in designated areas, tested, classified and managed in accordance with EPA NSW (1994) guidelines;
- Contaminated soil and backfill sands will be removed by controlled excavation. An environmental scientist using visual, olfactory and Photo Ionisation Detector (PID) or similar, will guide the excavation;
- Validation samples will then be collected from the resulting tank pit walls, base and pipework trenches;
- Upon the completion of excavation works in this area, the pits should be cordoned off with temporary fencing (Herras), to prevent unauthorised access to the area. Silt fences or bund walls or hay bales should be placed around the excavation area in order to prevent the inflow of runoff;
- Should contaminant concentrations in the validation samples exceed the RAC, further material will be removed from the walls and/or base to the stockpile prior to the collection of additional validation samples;

- Dewatering of the soil mass may be required during excavation works. Water removed from the excavation should be tested prior to disposal; and
- Stockpiles of excavated material should be placed so that they drain into the existing excavation, or in water-tight skips and the potential for cross-contamination is minimised.

### *7.3 Transport of USTs*

USTs will be transported in accordance with DECCW (2010) and AS4976-2008:

- Vehicles should be diesel powered and have exhaust systems generally in conformance with the requirements of AS2809-2008. The contractor should train drivers to recognise the hazards associated with the operation and appropriate emergency procedures;
- As far as possible, the trip to the disposal site should be uninterrupted. If it is necessary to park the vehicle for any period it should be isolated from other vehicles and kept under observation, with the warning notices clearly visible;
- Tanks will be transported to an appropriate facility for disposal, with adequate records kept of the tanks' disposal (disposal date and time and destination). The tanks will be destroyed by cutting with intrinsically safe cold shears prior to recycling;
- A certificate of tank destruction/disposal is required for each UST removed from the site; and
- Tanks that have been filled with an inert material (sand or concrete) may be disposed of at a licensed landfill or recycling yard following the removal of filling material. Documentation of the fate of such tanks should be provided, however destruction certificates are not required.

# 8 REMEDIATION SEQUENCE AND METHODS

## *8.1 LEAD, PAH, TPH AND BTEX HOTSPOTS*

### 8.1.1 Applications and Approvals to Undertake Remedial Works

It is considered that the remediation work will be classified as a Category 2 work in accordance with State Environmental Planning Policy (Resilience and Hazards) 2021. As such notification to Bayside Council will be required 30 days prior to the commencement of the remediation.

The following licences and approvals may also be required to undertake the remedial works:

- Possible Safework NSW friable asbestos permit to be obtained by the AS1 contractor;
- Sydney Airport Corporation Limited (SACL), drilling rig operation permit endorsed by the Airfield Operations Co-ordinator; and
- Controlled Activity Permit in Waterfront Land issued under the Water Management Act may be required.

### 8.1.2 Site Establishment

Prior to undertaking any excavation work associated with the remediation, the nominated site supervisor will ensure that the necessary environmental management and safety controls are in place. These will include but are not limited to:

- A hazard assessment, Project Safety Plan (PSP) and inductions;
- The remediation contractor will implement all necessary environmental controls (including but not limited to sedimentation and erosion controls) and safety measures (including but not limited to site signage, security fencing);
- The remediation contractor and site supervisor will locate areas suitable for the designated stockpile or bin placement areas;
- Ensure an adequate water supply is available to spray water on the excavated areas and waste material to minimise dust generation; and
- The remediation contractor will locate and arrange appropriately licensed trades people to temporarily disconnect or reroute all underground services which may be impacted by the remediation works.

Details of the environmental management and occupational health and safety controls specifically related to remediation are provided in Sections 12.

A minimum of two soil samples shall be collected from locations BBH430 and BBH433 (one surface sample and one shallow soil sample up to 0.5 m). The samples shall be analysed for metals, TPH, PAHs and asbestos to confirm the suitability of the sampled material for inclusion in a clean soil barrier layer. If soil at depths between 0 and 0.5 m is validated as being suitable (i.e. results meet the SAC), no additional soil is required to be applied to these three locations to form the clean soil barrier.

In the areas on which a clean soil barrier is to be applied (i.e. surrounding BBH453, BBH402, and AMW207 and at BBH430, BBH433 if in-situ near-surface soil is shown not to be suitable for inclusion in a clean soil barrier layer), the surface should be prepared to a specification set by a Geotechnical Engineer prior to application of the clean soil barrier.

### 8.1.3 Demolition of Structures to Access Contaminated Fill

The concrete slab and bitumen surface is to be demolished and removed from KGC to facilitate the proposed development. These activities will expose the impacted material identified encompassing the two USTs and bowsers adjacent to the maintenance shed.

### 8.1.4 Controlled Excavation and Stockpiling For Waste Classification

The TPH and BTEX impacted fill material requiring off-site disposal will be excavated in a controlled manner under the supervision of a CES environmental scientist or engineer. Excavation works will be undertaken by contractors with experience in contaminated site projects and continued until the contaminated material has visually been completely removed.

Contaminated material is to be excavated and placed directly into skip bins and/or stockpiled on sealed areas or plastic sheeting for waste classification prior to off-site disposal. Excavated contaminated material will be sampled and analysed at a rate of at least 4 samples for quantities up to 75 $m^3$ or 1 sample per 25 $m^3$ for quantities greater than 75 $m^3$. Classification of material to be removed from the site will be undertaken in accordance with the EPA NSW (1999) waste guidelines.

### 8.1.5 Off Site Disposal to a Licensed Landfill Facility

Following receipt of waste classification results, the skip bins or stockpiled material will be transferred to trucks for transport to appropriately licensed landfill facilities.

### 8.1.6 Validation

Following excavation and removal of the contaminated fill, a programme of soil validation will be implemented as described in Section 12 and Table 1. The validation programme will include excavations and if required, imported material used to re-instate the site.

### 8.1.7 Importation of Validated Material For Excavation Reinstatement (If Required)

If required, Virgin Excavated Natural Material (VENM) from off-site or on site soils will be used to backfill the excavations.

Any VENM to be used at the site will be validated in accordance with Section 10 and be accompanied by a certificate indicating that the material is contaminant free.

### 8.1.8 Validation Report

At the completion of the remediation works, a validation report will need to be prepared outlining the results of the remediation works undertaken and an assessment of the suitability of the site for the redevelopment and change of land use.

## *8.2 ACM HOTSPOTS*

### 8.2.1 Removal of Surface ACM And Clearance

The surface ACM is predominantly scattered around the surface at near ABH211, ABH267, AMW207 and BBH451. A method called 'emu picking' will be used to collect the fragments. Emu picking involves workers (AS1 contractor) walking along a grid across the impacted area and manually picking up the fragments and placing them into appropriately labelled bags.

Emu picking will be undertaken by contractors with experience in contaminated site projects and continued until the ACM has been completely removed. This method is believed to be adequate since the asbestos contamination is clearly identifiable (*eg* fragments of fibrous cement sheeting).

The AS1 licensed contractor will organise transport of the ACM fragments to a landfill licenced to accept asbestos waste. Landfill receipt dockets will be collected by each truck driver and copies provided to CES for inclusion in the validation report.

Following removal of all visible ACM, the AS1 licensed contractor will arrange for a visual inspection to be conducted by an occupational hygienist. The visual inspection is to be conducted on the area surrounding BBH451 (approximately 5 m by 5 m). In addition, as the asbestos fragments were not associated with any particular site features (i.e. location of former structures), the occupational hygienist must inspect the entire site on a nominal grid of 25 m for randomly distributed asbestos fragments. This inspection should be undertaken before the AS1 licenced contractor demobilises from the site so that any additional fragments found during the inspection may be appropriately removed. If all visible asbestos has been removed, the hygienist will provide a clearance certificate.

All ACM removal work will be undertaken in accordance with Safework NSW requirements.

### 8.2.2 Validation

Validation will consist of a clearance certificate following removal of surface ACM.

## *8.3 OPEN SPACE*

### 8.3.1 Application of Clean Soil Barrier

The clean soil barrier is to be placed in accordance with an earthworks specification prepared by a qualified Engineer. It is recommended that the placement be supervised by a qualified Geotechnical or Environmental Engineer with testing in accordance with relevant Australian Standards. An earthworks specification is to be prepared for the project by a qualified engineer incorporating the requirements of this RAP. The specification is to be prepared prior to the commencement of remediation works.

However, following stripping of grass and topsoil, the extent of are requiring barrier placement is to be determined in detailed inspections. The extent of the clean soil barrier is to be determined by the project Environmental Scientist/Engineer with reference to the Site Auditor. Additional soil sampling may be undertaken at the request of the site owner to delineate the soil impact and reduce the volume of soil barrier that is to be applied, if necessary.

Provided the in-situ soil 0-0.5 m depth at BBH430 and BBH433 is validated as suitable (i.e. meets the SAC), additional material will not be required to be applied for the clean soil barrier layer. A clean soil barrier of minimum thickness 0.5 m will be applied on the area surrounding BBH453, BBH402 and AMW207 and in a preliminary area extending to half the distance to the next clean borehole as shown in Figure 3. It is noted that Figure 3 shows only the inferred extent of impacted soil and the estimated extent of the clean soil barrier for all hotspots identified.

The clean soil barrier must comply with the following specifications:

- Imported material to be used in the barrier must be VENM or ENM;
- Material won on site must conform to the RAC defined in Section 6.7;
- Minimum thickness of 0.5 m measured from the existing base of cover layer to the base of serviceable components of irrigation systems. For clarity, it is noted that the barrier layer excludes any landscaping layers that do not meet the specification below. Suitable material for the clean soil barrier may be won on site provided that RAC in Section 6.7 are met;
- Placement in accordance with recommendations of Geotechnical Engineer;
- Barrier to be graded to encourage runoff and prevent ponding, to specifications by Hydrological Engineer; and
- The clean soil barrier at the site boundary will be graded to match the existing surface levels and facilitate storm water drainage. Therefore, there may be localised reductions in

barrier thickness along the boundary. Any localised areas of reduced barrier thickness will be noted and appropriate controls implemented in the Site Management Plan.

If any service trenches are constructed in impacted material, the following measures are required to be implemented:

- Trenches to be excavated to dimensions specified by the project engineer;
- Placement of clean soil barrier;
- Trenches to be lined with appropriate marker fabric (coloured non-woven geotextile);
- Backfill trenches with clean, validated material following placement of services; and
- Notation of trench location on site plans.

At the discretion of the project Engineer, services may also be installed in dedicated conduits. These conduits can be laid in or under the barrier layer without the requirement for marker fabric or filling sand on the proviso that the conduits are installed to allow access for repair, maintenance and upgrade of services without the need to excavate.

It is noted that 'before' and 'after' surveys (by a registered Surveyor) are required to demonstrate that the required thickness of clean soil barrier has been placed. The base and top of the barrier layer, service trenches (width, depth and location) and conduits must be surveyed by a registered surveyor. The survey reports will be included in the validation report and management plan for the site.

### 8.3.2 Validation

The collection of additional samples will be required if earthworks have caused the areas to be disturbed. If no disturbance has been caused, then the results from CES (2008) can be used, provided the number samples located in the proposed area conforms with the minimum requirements of the new *Contaminated Land Guidelines Sampling Design Part 1 – Application* (NSW EPA 2022) and *Contaminated Land Guidelines Sampling Design Part 2 – Interpretation* (NSW EPA 2022).

Validation will consist of:

- Validation of the thickness of the clean soil barrier by means of a 'before' and 'after' survey prepared by a registered surveyor;
- A clearance certificate following removal of surface ACM at BBH451. The clearance certificate should apply to the remediated area surrounding BBH451 (approximately 5 m x 5 m) and also the entire site following an inspection on a nominal grid of 25 m; and

- The analysis of imported material used in the clean soil barrier, including two samples collected from in-situ soil at 0-0.5 m in BBH430 and BBH433. This material may be imported VENM or won on site.

At the completion of the remediation works, a validation report will need to be prepared outlining the results of the remediation works undertaken and an assessment of the suitability of the site for the ongoing open space land-use.

# 9 CONTINGENCY PLAN

If remediation works fail, cannot be completed satisfactorily or is not accepted by land owners, a revised RAP will be prepared and submitted to the Auditor to address the concerns.

Depending on the ground conditions encountered during the redevelopment, additional volumes of material other than those outlined in this RAP may require remediation in accordance with the methods outlined in this RAP or instructions from a suitably qualified environmental consultant. Remediation not outlined within this RAP will need to meet the objectives and the RAC outlined within this plan.

## *9.1 ASBESTOS*

Asbestos waste or other Potential Asbestos Containing Materials (PACM) may be identified during the works. If fibrous cement fragments of PACM are identified, the following should be undertaken:

- An AS1 contractor will be engaged to obtain a job-specific friable asbestos work permit as required by SafeWork NSW and prepare a specific safe work method statement pertaining to the handling of asbestos waste;
- The AS1 contractor will be engaged to supervise the removal of ACM. Immediately upon disturbance, asbestos-containing material will be sprayed with water to minimise dust generation;
- Any asbestos or PACM identified will be disposed to landfill; and
- An occupational hygienist will be engaged to provide a clearance certificate for the ACM remediated area.

## *9.2 LANDFILL GAS*

It is possible that some landfill gas will be emitted during placement of the clean soil barrier. Odour should be used as the first indicator of the presence of landfill gas and explosive gas meters should also be used during the remedial works. In the event that landfill gas is detected during site works, personnel should be evacuated up wind from the area and monitoring should be undertaken until gases dissipate. The project environmental scientist should be contacted to undertake an inspection of the site.

If gases are still present at the conclusion of the work shift additional measures such as the application of temporary cover may be required.

### *9.3 SOIL VAPOUR*

VOC vapour may be emitted during excavations and the removal of the USTs. Odour should be used as the first indicator of the presence of VOC gases and explosive gas meters should also be used at all times during the works. In the event that VOC gases are detected at explosive levels during site works, personnel should be evacuated up wind from the area and monitoring should be undertaken until gases dissipate. The project environmental scientist should be contacted to undertake an inspection of the site.

If gases are still present at the conclusion of the work shift additional measures such as the application of temporary cover may be required.

### *9.4 DISCOVERY AND REMOVAL OF UNEXPECTED FINDS*

In the event that unexpected odorous material, discoloured material, putrescible waste, tanks, drums or other contamination are discovered during earthworks on the site, work will cease and a strategy will be developed in consultation with the project environmental scientist.

In the event that unexpected finds are encountered at the site, the Auditor should be informed.

# 10 SITE MANAGEMENT PLANS

## *10.1 INTERIM SITE MANAGEMENT PLAN*

The site is currently open and accessible to the public. No interim management requirements are recommended until the commencement of remediation works, at which time the contractor will be required to implement an Environmental Management Plan (EMP) including the provisions provided in Section 12.

As a precautionary measure, visible fragments of ACM (fibrous cement sheeting) should be removed and a clearance certificate obtained.

## *10.2 LONG-TERM SITE MANAGEMENT PLAN*

A Site Management Plan will be annexed to the validation report and Site Audit Statement (SAS). The SMP will address the following matters:

- Identification of the location of impacted soil and service trenches; and
- An asbestos management plan, including the location of surface ACM fragments.

It is noted that the SMP must be approved by the Auditor and landowner(s) (ie. party responsible for implementation of the plan) prior to the Auditor issuing the Site Audit Statement for the site. Consequently, the SMP shall be included in the Golf Course Plan of Management.

The SMP will also be required to contain sections addressing characterisation of the site, extent of remedial works undertaken, survey plans showing the location of service trenches and surface ACM fragments. In addition, the SMP should include a responsibility and reporting matrix, a schedule of review and mechanisms for the appropriate revision of the SMP in the event that conditions change (eg. changes in site conditions, legislation/regulation, guidelines, etc).

# 11 COMMUNITY RELATIONS PLAN

If required, a community relations plan will be prepared and followed. This requirement will determined by the community relations consultant for the project and in discussions with Council prior to the commencement of works.

# 12 SITE VALIDATION PLAN

Validation sampling will be undertaken during the remediation programme. Sampling will be conducted in accordance with relevant NSW EPA and NEPC guidelines to confirm whether the identified contamination has been adequately removed from excavations and whether any further remediation is required.

Validation will comprise:

- Validation of the thickness of the clean soil barrier by means of a 'before' and 'after' survey prepared by a registered surveyor;
- A clearance certificate following removal of surface ACM at BBH451. The clearance certificate should apply to the remediated area surrounding BBH451 (approximately 5 m x 5 m) and also the entire site following an inspection on a nominal grid of 25 m; and

The analysis of material used in the clean soil barrier, including two samples collected from in-situ soil from depths between 0-0.5 m in locations BBH430 and BBH433. Material used for the clean soil barrier may be imported VENM or appropriately validated material won on site.

A plan for validation sampling and analysis is presented below.

## *12.1 VALIDATION OF EARTHWORKS*

The validation schedule for the excavations where contaminated material is removed will be generally based on the *Contaminated Land Guidelines Sampling Design Part 1 – Application* (NSW EPA 2022) and *Contaminated Land Guidelines Sampling Design Part 2 – Interpretation* (NSW EPA 2022). The base of the excavations will be sampled at a minimum rate of one sample per 25 $m^2$. The wall of the excavation will be sampled at the vertical rate of one sample per metre and the horizontal rate of one sample per 10 metres. In addition, one additional sample will be collected from the floor and the wall for each 10 metres along extended excavations. Additional validation samples will also be collected from the excavation wall if significant differences in the sub-surface material are observed. Field QA/QC sampling will consist of one blind sample for every 10 environmental samples and one split (inter-laboratory) sample for every 20 environmental samples.

It is assumed all excavated contaminated material will be placed directly into skip bins or stockpiled on sealed surfaces or plastic sheeting. Therefore, areas underlying stockpiles will not require validation sampling.

Validation samples from remediation area encompassing the USTs will be analysed for TPH and BTEX. Once analytical results of validation samples have been assessed as meeting the adopted

RAC, excavations will be photographed. Once this is complete, the excavations may then be backfilled with validated fill.

The validation sampling and analysis programme for the contaminated fill is outlined in Table 3.

### 12.1.1 Imported Fill

If required, any fill used to re-instate excavations will need to be validated as VENM in accordance with the *Contaminated Land Guidelines Sampling Design Part 1 – Application* (NSW EPA 2022) and *Contaminated Land Guidelines Sampling Design Part 2 – Interpretation* (NSW EPA 2022). One sample will be collected for every 100 $m^3$ of imported fill or a minimum of 1 sample per fill source site.

The validation sampling and analysis programme for the imported material is outlined in Table 3.

### 12.1.2 Method of Sample Collection

Care will be taken to ensure that representative samples are obtained from the material and that the integrity is maintained, particularly when dealing with potentially semi-volatile compounds. Specific sampling procedures for each method of collection are provided below in following sections.

### 12.1.3 Sample Collection

Samples will be collected using either a decontaminated stainless steel trowel or by using or new latex or nitrile gloves for each sample and placing the soil directly into laboratory supplied jars.

### 12.1.4 Decontamination Procedures

The following decontamination procedures will be adopted for sampling equipment.

#### *12.1.4.1 Sampling Equipment*

Sampling equipment, such as trowels, will be washed between sampling events using Decon 90 (or similar laboratory grade detergent) initially followed by adequate rinsing with clean potable and de-ionised water. To check the adequacy of the decontamination protocol, rinsate samples will be collected for analysis.

### 12.1.5 Sample Containers

Soil sample jars will comprise glass with a Teflon lined lid and be supplied by either the primary or secondary laboratory. The jars will be completely filled with soil, labelled with the job number, date, unique sampling point identification and initials of CES staff.

Container, preservation requirements and holding times are outlined in Table 4.

### 12.1.6 Method of Sample Storage and Handling

The soil jars, once filled with sample, will immediately be placed in an esky / cool box in which ice has been added to keep the samples below a temperature of approximately 4ºC. At the end of each day the samples in the cool box will be transported to the CES Sydney office where more ice will be added until delivered to the laboratory (within holding times).

Container, preservation requirements and holding times are outlined in Table 4.

### 12.1.7 Sample Logging

A log of excavation works and soil samples collected will be completed during fieldwork by a qualified environmental engineer/scientist. The log records the following data:

- Sample number and depth
- Soil classification, colour, consistency or density, odour and moisture content
- Depth of excavation
- Excavator bucket refusal
- Method of excavation
- The depth of first encountered free water

### 12.1.8 QA/QC Documentation

While on site, the supervising engineer/scientist will be required to fill out a copy of CES 'sample register', which documents:

- Time of sample collection;
- Weather;
- Unique sample identification number; and
- Sample location and depth.

All samples will be classified in the field based on soil/fill characteristics and obvious signs of contamination such as discolouration or odour will be noted on a log.

All samples, including QC samples, will be transported to the primary and check laboratories under Chain-of Custody (COC) procedures and maintained in an ice-filled cooler. The following details will be recorded on the COC form:

- Site identification;
- The sampler;
- Nature of the sample;
- Collection time and date;

- Analyses to be performed;
- Sample preservation method;
- Departure time from site; and
- Dispatch courier(s).

### 12.1.9 Analytical methods

Analytical methods and Practical Quantitation Limits (PQLs) for soil samples are contained in Table 5.

## *12.2 FIELD SCREENING*

Field screening will be undertaken to screen potentially contaminated material being removed from the excavations and VENM used to reinstate the excavations for the presence of volatile compounds. Field screening will be conducted using a Flame Ionisation Detector (FID), Photo-Ionisation Detector (PID) or similar instrument capable of measuring Volatile Organic Compounds (VOCs) in air. The instrument will be operated using the controlled headspace method in accordance with the documented CES procedure by appropriately trained persons.

Full documentation will be provided relating to the daily calibration of the instrument, the samples analysed, gas screening results and site observations. If VOCs are detected in soil won from the site, further investigations will be required to determine the potential source as VOCs have not been previously detected at the site. These results will be compiled and presented in the validation report. The presence of VOCs in imported material will result in that batch of material being rejected.

## *12.3 QUALITY ASSURANCE AND QUALITY CONTROL PROGRAMME (QA/QC)*

The proposed field and laboratory QA/QC programme for this project is consistent with National Environmental Protection Council (2013) requirements. The programme consists of the following:

- Laboratory blind replicates at 1 in 20 samples or one per batch;
- Split samples (intra-lab duplicates) at 1 in 20 samples or one per batch;
- One trip spike per sample batch;
- One trip blank per sample batch; and
- Rinsate sample for non-dedicated sampling equipment, one per batch.

### 12.3.1 Field QA/QC Programme

Field QA/QC consists of CES Quality Work Procedures (QWPs) and the collection of field QC samples listed above.

***Environmental Samples***

Environmental samples collected for the validation programme are the representative samples of soil collected for analysis. Environmental samples are the original sample taken from a particular location and other samples are blind replicates or split samples of the original.

***Blind Replicate Samples***

Blind replicate samples are provided by the collection of two similar samples from the same location or successively from the same monitoring bore. These samples are preserved, stored, transported, prepared and analysed in an identical manner to environmental samples.

***Split Samples***

Split samples provide a check on the analytical proficiency of the laboratories. Split samples are collected from the same location or successively from the same monitoring bore. Split samples must be taken from the same location as the blind replicate, thus becoming a triplicate sample. However, split samples are not taken as often as blind replicates. Spilt samples (triplicates) are preserved, stored, transported, prepared and analysed in an identical manner to environmental samples.

***Trip Blanks***

Trip blanks consisting of laboratory-supplied sand blank containing acid-washed quartz sand will be supplied by the analytical laboratory. The role of trip blanks is to detect potential contamination during sample transport. These samples reside in transport vessels during sampling activities and are not opened in the field. Trip blanks are analysed at the laboratory as regular samples or only for volatile organic compounds, as deemed appropriate.

***Laboratory-prepared Trip Spikes***

Laboratory-prepared trip spikes consisting of sand spiked with known concentrations of BTEX should be included in QA/QC programmes where TPH and BTEX concentrations are being measured. Laboratory-prepared trip spikes should be included at a rate of one per sample batch. These samples are to be submitted for BTEX analysis with results compared with the known additions. The purpose of these samples is to monitor VOC losses during transit.

Care will be taken to ensure that only freshly-prepared spiked samples are used. Spikes more than 2 days old at the time of receipt from the laboratory should be discarded. All trip spikes received will be checked for leakage. Any spikes containing bubbles or any other defects will be discarded. Furthermore, only spikes delivered under laboratory COC will be accepted. COCs will be stored in the project file for reference.

***Rinsate (Equipment) Blanks***

Rinsate (equipment) blanks consist of pre-preserved bottles filled with laboratory-prepared water that is passed through decontaminated field equipment. Rinsate blanks will be prepared on site, exposed to the atmosphere and rinsed through decontaminated field equipment. These samples assess atmospheric background conditions at the site and the efficiency of decontamination procedures.

Rinsate samples are to consist of the required complement of sample bottles labelled with a unique CES sample identification number. Rinsate blanks are to be prepared by pouring blank laboratory-supplied rinsate water through or over the sampling equipment after the final cleaning rinse. Rinsate blanks are to be transported and analysed at the laboratory as regular samples. While the number of equipment blanks varies between projects, the following strategy is generally adopted:
- a rate of one rinsate blank for each field collection (>5 samples). Rinsate sampling will be subject to project requirements for smaller batches (<5 samples). Rinsate samples are not required if field equipment is dedicated for the specific sampling location.

### 12.3.2 Laboratory QA/QC Programme

The reliability of test results from the analytical laboratories will be monitored according to the QA/QC procedures used by the NATA accredited laboratory. The QA/QC programme employed by the NATA registered laboratories specifies sample tracking procedures, methods of extraction, analysis, PQLs and acceptance criteria for results. Laboratory QA/QC procedures adopted by the laboratories used in this investigation are summarised below.

***Laboratory Duplicate Samples***

Laboratory duplicates provide data on analytical precision for each batch of samples. Where required and in order to provide sufficient sample for analysis of laboratory duplicate, two batches of samples are collected at a site listed and marked ‘laboratory duplicate’ on the Chain of Custody form. This is done in order to ensure that sufficient sample is collected.

***Standards***

Calibration standards are prepared from individual certified materials, AR Grade or better reagents purchased as certified mixtures. Stock solutions are replaced every 6 months. Working standards are prepared at least every month from the stock solutions.

***Laboratory Control Samples***

Laboratory control samples consist of a clean matrix (de-ionised water or clean sand) spiked with a known concentration of the analyte being measured. These samples monitor method recovery in clean samples and can also be used to evaluate matrix interference by comparison with matrix spikes. Laboratory control samples may be certified reference materials.

***Surrogates***

For organic analyses, a surrogate is added to environmental samples at the extraction stage in order to verify method effectiveness. The surrogate is then analysed with the batch of samples. Percent recovery is calculated.

***Matrix Spike***

A matrix spikes consist of samples spiked with a known concentration of the analyte being measured, in order to identify properties of the matrix that may hinder method effectiveness. Samples are spiked with concentrations equivalent to 5 to 10 times the PQL. Percent recovery is calculated.

***Method Blanks***

Method blanks (de-ionised water or clear sand) were carried through all stages of sample preparation and analysis at a rate of approximately 10 %. Analyte concentrations in blanks should be less than the stated PQL. Reagent blanks are run if the method blank exceeds the PQL. The purpose of method blanks is to detect laboratory contamination.

## *12.4 DATA QUALITY OBJECTIVES (DQO) AND ACCEPTANCE CRITERIA*

The objective of the validation programme is to verify the quality of any soil brought onto the site, the quality and thickness of the clean soil barrier layer and validate the site surface as being free of asbestos fragments.

Sampling shall be conducted in accordance with relevant NSW DECC and NEPC guidelines to confirm whether the RAP objectives had been attained. Data Quality Objectives (DQOs) for the proposed validation sampling and analysis programme are presented below.

### 12.4.1 Data Quality Objectives

**Step 1 - State the Problem**

Two ESA's conducted by CES in 2008 of the site identified hotspots of soil contamination (PAH, TPH and BTEX) at eight locations and ACM fragments at the surface at five locations on the site. Remedial/management measures were required to make the site suitable for the proposed land-use. Detailed site information is provided in Sections 3, 4 and 5. It is proposed to dispose off-site the four hotspots encompassing the USTs, a clean soil barrier will be applied on the PAH hotspots identified in the southern portion of the site and a SMP will be implemented, while the ACM fragments will be remediated by disposal off site.

The relevant stakeholders and decisions makers for the site are as follows:

- The site owner;
- The project manager;

- The Environmental Consultant;
- The Remediation Contractor;
- The Site Auditor; and
- The Planning and Regulatory Authorities.

**Step 2 - Identify the Decision Statement**
The question that the validation programme will attempt to resolve is:

- Was the remediation and validation undertaken in accordance with the RAP?
- Is the site considered suitable for proposed land-use?

**Step 3 - Identify inputs to the decision**
The following informational inputs are required to resolve the decision question(s):

- Validation analytical data for soil samples collected from within the excavations undertaken to remove the USTs using appropriate methods and analysed for the contaminants of concern as outlined in Section 5;
- Validation analytical data for soil samples collected at the surface and shallow soil above BBH430 and BBH433 using appropriate methods and analysed for the contaminants of concern;
- Validation analytical data for soil samples collected from other material won on-site proposed to be used in the clean soil barrier layer at BBH453 (if imported VENM not used);
- Validation analytical data for soil samples collected from other material won on-site proposed to be used to reinstate excavations and in the clean soil barrier layer (if imported VENM not used);
- Field screening results from soil samples collected above;
- Comparisons of the analytical results with relevant RAC appropriate for the proposed land-use;
- A validation report confirming any imported fill is VENM and documentation that the material accepted onto the site is consistent with that inspected by the project environmental scientist/engineer at the source site;
- Documentation of the appropriate disposal of the ACM;
- A clearance certificate from an occupational hygienist following removal of ACM and clearance of the other areas of the site on a nominal grid of 25 m;
- 'Decision process' for assessment of the suitability of a site as outlined in NSW EPA (2017) "*Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd Edition)";* and
- An assessment of the implemented quality control/quality assurance programme.

**Step 4 - Define the Boundaries of the Study**

The site is referred to as the Cooks Cove Development Zone, Cooks Cove, NSW, comprising Area A and Area B. The legal description of the developable land is Part of 1 Deposited Plan (DP) 329283, Part of Lot 1 DP 108492, Part of Lot 14 DP 213314 and Part of Lot 100 DP 1231954.

The remediation and validation programme applies to soil at and encompassing the USTs located within the Club House car park (Figures 3 and 3a) and locations where ACM are present, in addition to soil at and surrounding former ESA (CES, 2008) locations BBH430, BBH433, AMW207, BBH453, BBH402 and surface soil surrounding BBH451 (**Figure 3**).

A registered surveyor shall be used to survey the depth and lateral extent of any clean soil barrier layer to a permanent benchmark. There are no anticipated practical constraints in the remediation areas that will interfere with the validation assessment.

**Step 5 - Develop a Decision Rule**

The purpose of this step is to define the parameters of interest, specify the action level and combine the outputs of the previous DQO steps into an "if…then…" decision rule that defines the conditions that would cause the decision maker to choose alternative actions.

The parameters of interest (or contaminants of concern) for validation of soil won on site to be used in a clean soil barrier layer are metals, TPH/BTEX, PAH and asbestos.

The parameters of interest for any waste classification of soil to be disposed off-site (if required) are metals, TPH/ BTEX, PAH, Organochlorine Pesticides (OCP), Organophosphorus Pesticides (OCP), Polychlorinated Biphenyls (PCBs) and asbestos.

The action levels which were to decide if the parameter represented an unacceptable risk for either the industrial, commercial, or open space land-use are tabulated in Table 1. The types of data quality required during the fieldwork and laboratory components of the investigation and the acceptable limits for this data are specified in Section 12.

Based on these data quality types and limits the following decision rules applied:

- For validation samples, if the absolute value of the measured concentration of a parameter or compound, are above the nominated RAC, then the material will not be suitable to remain on site for use in the clean soil barrier layer and a minimum of 0.5 m validated clean soil barrier will be applied;

- If contaminants of concern were detected in the trip blanks, then potential cross contamination may have occurred during sample transport. To assess whether this was the case, CES checked the trip blank results with the laboratory and compared the results with

other blanks provide by the same laboratory. It is possible that detections in trip blanks may reflect background concentrations in laboratory-supplied sand or analytical error. If it was concluded that cross contamination had occurred, CES assessed the severity of the cross contamination and subsequent impacts on the ability to resolve the decision question. Possible actions included the raising of working detection limits or the collection of replacement data;

- If chemicals of concern were detected in the rinsate blanks, then the decontamination process was potentially not adequate and cross contamination may have occurred. Before assuming that this was the case, CES checked the rinsate blank result with the laboratory and compared the result with other blanks which used a similar source of water. It is possible that detections in rinsate blanks may reflect background concentrations in laboratory-supplied water or analytical error. If it was concluded that decontamination procedures were inadequate CES assessed the severity of the cross contamination and subsequent impacts on the ability to resolve the decision question. Possible actions included the raising of working detection limits or the collection of replacement data;

- If RPDs for blind replicates or split samples were outside the acceptable limits, then there may have been errors in laboratory analysis process. When assessing duplicate pairs with elevated RPDs, CES checked the results with the laboratory(ies) and examine the nature of the sample being assessed, since heterogeneous samples can often provide high RPDs. If it was believed that irreversible errors had occurred during the laboratory process then additional investigation was deemed to be required to resolve the decision question; and

- If any of the laboratory data quality tests did not meet the acceptable limits, the laboratory was requested to retest samples or provide justification for the results.

**Step 6 - Specify Acceptable Limits on Decision Errors**

There are two types of errors:

a) Deciding that the site is acceptable for open space land-use when it actually is not. The consequence of this error may be unacceptable health risk for future users of the site.

b) Deciding that the site is unacceptable for commercial/industrial land-use when it is acceptable. The consequence of this error is that the client will pay for further investigation / remediation that are not necessary.

The more severe consequences are with decision error (a) since the risk of jeopardising human health outweighs the consequences of paying more for remediation.

**Step 7 - Optimising the Design for Obtaining Data**

The purpose of this step is to identify a resource-effective data collection design for generating data that are expected to satisfy the DQO's. The resource effective data collection design that was expected to satisfy the DQOs is described in detail below. To ensure the design satisfied the DQOs a comprehensive Quality Assurance and Quality Control Plan was implemented as described in Section 12.3.

### 12.4.2 Data Acceptance Criteria

Data Acceptance Criteria (DAC) for this project are presented in Table 7.

# 13 PRELIMINARY ENVIRONMENTAL MANAGEMENT PLAN

Remediation works shall be conducted in a manner that minimises environmental impacts and that meets statutory requirements. Site works should comply with the following legislation:

- NSW Contaminated Land Management Act (1997);
- NSW Protection of the Environment Operations Act (1997);
- NSW Environmentally Hazardous Chemicals Act (1985);
- NSW Waste Avoidance and Resource Recovery Act (2001);
- NSW Work Health and Safety Act (2011); and
- NSW Local Government Act (1993).

The contractor shall endeavour to:

1. Minimise fugitive dust emissions;
2. Minimise odour;
3. Minimise the volume of water containing suspended sediment leaving the site;
4. Prevent vehicles from tracking mud on local roads;
5. Ensure that noise and vibration levels conform to legislative requirements; and
6. Prepare their own EMP prior to mobilisation to site.

A preliminary environmental management plan is provided below. A formal management plan should be prepared prior to commencement and reviewed by an appropriately qualified Environmental Scientists or Engineer.

## *13.1 SITE SECURITY, RESTRICTED ACCESS AND SIGNAGE*

Access to the site will be restricted by means of a perimeter fence and locked gates outside operating hours. Any repairs required to the boundary fence will be undertaken prior to the commencement of remedial works.

Vehicular access to the site shall be through a single controlled entry and exit points. All loads shall be covered with a tarpaulin prior to leaving the site.

Warning signs will be posted to advise members of the public and employees not to enter sections of the site affected by remedial works. Contact information regarding site security including the details of the remediation contractor will be displayed on all access gates. Site security personnel will be advised of restricted access and contact procedures during remediation works.

During remediation works, the site will be designated as a construction area. Consequently, access will be restricted to authorised staff and contractors equipped with appropriate Personal Protective

Equipment (PPE). Site access will be controlled by the site supervisor. All visitors will report to the site supervisor prior to entering the site.

### *13.2 DRAINAGE, SEEPAGE AND STORMWATER MANAGEMENT*

Storm water will be diverted away from areas of exposed soil by a series of bunds or other appropriate storm water controls. Provisions for stockpiles below relate to material awaiting placement in the clean soil barrier. Management measures for the site will include:

- Storm water diversion bunds and appropriate erosion controls around any excavations (as required), areas of bare soil and stockpiles;
- Minimising surface disturbance and maximising the retention of existing surface cover during the works;
- Stockpiles to be located away from concentrated storm water flow paths including drainage lines, gutters or storm water pits and inlets;
- No stockpiles to be placed on footpaths or nature strips unless prior Council approval has been obtained;
- Construction of sediment controls downstream of diversion bunds, stockpile and traffic areas to minimise the off-site migration of sediment; and
- Vehicular access is to be stabilised to prevent tracking of mud onto roads and footpaths. Soil, earth and mud shall be removed from the roadway by sweeping, shovelling or a means other than washing on a daily basis or as required.

Storm water at site discharge points will be inspected on each day of discharge. Samples will also be collected during the works. Samples will be analysed for Total Suspended Solids (TSS) and Total Oil and Grease (TOG). Corrective action will be required if concentrations of these parameters exceed 50 and 10 mg $L^{-1}$ respectively.

Silt fences will be constructed around the site perimeter (as required). Hay bales will also be installed around storm water pits in accordance with Department of Housing (1998) requirements.

Visually contaminated seepage and ponded water will be removed by a licenced liquid waste contractor for disposal. Seepage without visible signs of contamination (eg. oily sheen) may be pumped onto stockpiles or bare areas for dust suppression or directly into the storm water system subject to Council approval. Discharges to the storm water system must be sampled and analysed for pH, concentrations of TSS, TOG and priority contaminants. Analytical results must comply with relevant EPA and current Guidelines for water quality prior to discharge. Council may impose additional discharge criteria for water released into the storm water system at the site.

### *13.3 CONTROL OF DUST AND ODOUR*

Works will be undertaken in a manner that minimises fugitive dust and odour emissions. The following measures shall be taken to control dust and odour:

- Careful handling of material in a manner that minimises dust emissions;
- Placement of screening material (eg. hessian) on perimeter fences adjacent to excavations;
- Spraying dusty parts of the site with water;
- Application of water during placement of material in the clean soil barrier;
- Keeping bare areas moist (where practical);
- Use of tarpaulins to cover loads (incoming and outgoing); and
- Restriction of height of stockpiles of material awaiting placement in the clean soil barrier to below the fence line where possible.

Where visual inspection indicates that dust levels may be unacceptable, work will cease until measures are taken to reduce emissions or until weather conditions improve. The site supervisor will be responsible for dust management.

Local Government requirements state that no odours shall be detected at the site boundary during remedial works by an authorised Council officer relying solely on the sense of smell.

The following procedures may be engaged in order to minimise odours:

- Covering of stockpiles of material awaiting placement in the capping system or clean soil barrier (where practical);
- Use of fine mist sprays and hydrocarbon mitigating agent on impacted areas and materials;
- Adequate maintenance of equipment and machinery to minimise exhaust emissions; and
- In odorous areas, excavate small quantities at the one time.

A programme of dust and noise monitoring should be implemented during the works. The programme will be documented and assessed for compliance against industry and Council standards.

### *13.4 NOISE CONTROL AND VIBRATION*

Noise and vibration will be restricted to reasonable levels. All plant and machinery will be fitted with mufflers to reduce noise. All machinery is to be operated in a manner that minimises noise emissions. Work shall comply with the EPA NSW Noise Manual for the control of construction site noise, such that:

- For a cumulative period of exposure to construction activity noise of up to 4 weeks, the LA10 (15 minute) noise level emitted by the works to specific residences should not exceed the LA90 background level by more than 20 dBA;
- For a cumulative construction noise exposure of between 4 and 26 weeks, the emitted LA10 noise level should not exceed the LA90 level by more than 5 dBA;
- For a cumulative construction noise exposure of greater than 26 weeks, the emitted LA10 noise level should not exceed the LA90 level by more than 5 dBA; and
- The use of any plant and machinery shall not cause vibrations to be felt or capable of being measured at any premises.

### *13.5 WORKING HOURS*

Working hours will be restricted to:

- 7:00 am to 6:00 pm between Monday and Friday; and
- 8:00 am to 1:00 pm on Saturday (or as specified by Council consent conditions).

Work will not be undertaken on Sundays or Public Holidays. The appointed environmental scientist will conduct regular inspections to ensure that operations are conducted in an acceptable manner.

### *13.6 TRAFFIC AND TRANSPORT*

No major traffic disruptions are expected as a result of site remediation works. All machinery will be transported to the site in accordance with regulatory requirements.

All haulage routes for trucks transporting soil, materials, equipment or machinery to and from the site are to be selected to meet the following requirements:

- Comply with all road traffic rules;
- Minimise noise, vibration and odour to adjacent properties; and
- Utilise State Roads and minimise the use of local roads.

The site supervisor shall ensure that all vehicles:

- Conduct deliveries of soil, materials, equipment of machinery during the hours of remediation work for the site;
- Securely cover all loads to prevent/minimise any dust or odour emissions during transport;
- Exit the site in a forward direction; and
- Do not track soil, mud or sediment onto the roads and footpaths.

### *13.7 UNDERGROUND SERVICES*

Service diagrams will be obtained by the civil contractor prior to commencement of remediation works. Where encountered, services will be adequately supported, re-routed or disconnected as required. All work is to be carried out by trades-people with appropriate qualifications.

Care must be taken when working around service conduits and other areas where landfill gas has the potential to accumulate.

### *13.8 SITE DIARY AND SUPERVISION*

The execution of the RAP will be supervised by an appropriately qualified environmental scientist in conjunction with any specialist contractor/s. This person shall be responsible for monitoring excavations, truck loading and recording the truck movements and load characteristics.
Load information shall be verified by comparison with tip dockets. The supervising scientists shall also maintain a site diary containing the following information:

- Date;
- Weather conditions;
- Details of unusual materials or odours encountered during earthworks;
- Field instrument calibration details;
- Location and results of field measurements;
- Details of accidents or incidents on the site;
- Details of any environmental issues and any related corrective and preventive action taken;
- Details of any visitors in relation to environmental or health issues;
- Details of any contractors engaged for the removal of material;
- Record of soil volumes imported or removed from the site, truck movements including destination/source, volumes of material exported/imported to the site;
- Daily site sketches showing the location of stockpiles, excavations and sediment controls; and
- Record of soil sampling locations.

### *13.9 VALIDATION AND ENVIRONMENTAL EFFECTS REPORTING*

Consistent with EPA requirements, a validation report will be prepared at the conclusion of remediation works. The validation report will be prepared in accordance with the requirements of *Contaminated Land Guidelines: Consultants Reporting on Contaminated Land* (NSW EPA, 2020) and will confirm that the site has been remediated in accordance with the RAP.

# 14 PRELIMINARY WORKKPLACE HEALTH AND SAFETY PLAN

The purpose of the WHS plan is to ensure that the RAP is conducted in a controlled and safe manner with due regard for potential hazards and safe work practices. The WHS plan will be implemented and enforced by the appointed site supervisor following a brief induction by CES. The following preliminary plan contains minimum WHS requirements at the site. Contractors must be required to produce their own project-specific Project Safety Plans prior to the commencement of any works at the site, which their employees are to operate, at all times whilst at the site.

## *14.1 PERSONNEL AND RESPONSIBILITY*

All personnel will be made aware of the person responsible for implementing health and safety procedures. All personnel should read and understand the WHS plan prior to commencing work and have signed a statement to verify this understanding. Contractors shall be responsible for ensuring that their employees are aware of and comply with both the Project Safety Plans developed for each task and with all relevant statutes and regulations.

## *14.2 IDENTIFICATION OF POTENTIAL HAZARDS*

### 14.2.1 Chemical Hazards

Chemicals or compounds that may be present at the site include, but are not limited to:

- Asbestos;
- Heavy Metals;
- PAHs
- TPH; and
- BTEX.

Potential risks to personnel associated with these compounds, if present at the site, include:

1. Ingestion of soil or liquids;
2. Dermal (skin) contact with contaminated soil or liquids;
3. Inhalation of dust, gas or aerosols containing contaminants; and
4. Combustion or explosion of VOC gases.

### 14.2.2 Physical Hazards

The following physical hazards may exist at the site:

- Heavy equipment (mobile and stationary);
- Light vehicles, associated traffic and vehicle hazards;
- Cranes, hoisting and lifting equipment;
- Excavations;

- Heat exposure;
- Buried Services;
- Uneven, slippery ground;
- Noise;
- Dust;
- Electrical equipment; and
- Snakes, spiders.

## *14.3 MEDICAL SURVEILLANCE*

It is expected that all personnel on the site have undergone specific training for working on contaminated sites. A site-specific medical surveillance scheme is not considered necessary for this project. Qualifications of personnel working on site will be verified by the contractor prior to the commencement of works.

## *14.4 SITE WORK PRACTICES*

### 14.4.1 Personal hygiene

No smoking, eating or drinking should be permitted on site in areas where the possibility of contamination exists. In particular, smoking should be prohibited in areas were VOC gases or other inflammable materials may have accumulated. In these areas, a designated clean location should be allocated for smoking and the consumption of food or drink. These areas should be equipped with hand washing facilities which must be used prior to engaging in these activities. Personnel should be made aware of the location of these facilities.

### 14.4.2 Decontamination

Contaminated equipment should not be removed from the work area. Removal of contaminated equipment should be undertaken with caution in order to avoid contaminating other parts of the site.

### 14.4.3 Restricted Access

Access to the site must be restricted by a perimeter fence. Signs should be erected to notify personnel of the presence of excavations on the site. Site visitors must report to the site office prior to entering the site.

### 14.4.4 Personal protection

Personnel will take measures to avoid into direct contact with contaminated material. Workers are to ensure that soil, surface water or groundwater are not ingested or swallowed and that direct contact with skin is avoided. Personnel should wear the following Personal Protective Equipment (PPE):

1. Steel-capped boots meeting AS2010 requirements;
2. Safety vest;
3. Hard hat meeting AS1801-1981 requirements when working within the site;
4. Hearing protection meeting AS1270-1988 requirements when working around machinery or plant and equipment if noise levels exceed exposure standards;
5. Safety glasses or goggles with side shields meeting AS1337-1992 requirements as necessary;
6. Disposable latex gloves for personnel involved in soil or groundwater sampling; and
7. Breathing apparatus shall be used as required.

In the unlikely event that personnel are required to work in areas with highly contaminated soil or other hazardous materials additional PPE. The contractor shall be responsible for ensuring that appropriate PPE is provided and used during site works.

An explosive gases meter must be used during all 'in-ground' works to detect the presence of landfill gas.

## *14.5 EMERGENCY RESPONSE PLAN*

### 14.5.1 Resources

The following emergency numbers can be called in the event that medical or other emergency services are required:

Hospital: St George Hospital
Gray Street,
Kogarah
(02) 9113 1111

Police: 000

Electrical: Energy Australia
(02) 131 388

Council: Bayside Council
444-446 Princes Highway,
Rockdale NSW 2216
(02) 9562 1777

Water: Sydney Water
(02) 132 090

Gas: Australian Gas Company (AGL)
111 Pacific Highway
North Sydney NSW 2060
(02) 131 909

### 14.5.2 Responsibilities

The site supervisor will be responsible for ensuring that site personnel are aware of emergency services available. A site safety officer must be available during remedial works.

### 14.5.3 Contact Names and Numbers

Contact names and numbers for the CES and the remediation contractor must be displayed on the site access gates during the works.

# 15 CONCLUSION

It is concluded that if the RAP and a subsequent SMP are implemented the site will be suitable for the proposed use.

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# Figures


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Title

**Figure 1. Site Location Plan**

| CES Project ID: | Date: |
|---|---|
| CES130608-BP | 17/02/2023 |
| Prepared By: T.Goodbody | Checked By: D. Lowe |


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Title

# Figure 2. Site Layout Plan and Sampling Locations

| CES Project ID: | Date: |
|---|---|
| CES130608-BP | 20/02/2023 |
| Prepared By: T. Goodbody | Checked By: D.Lowe |


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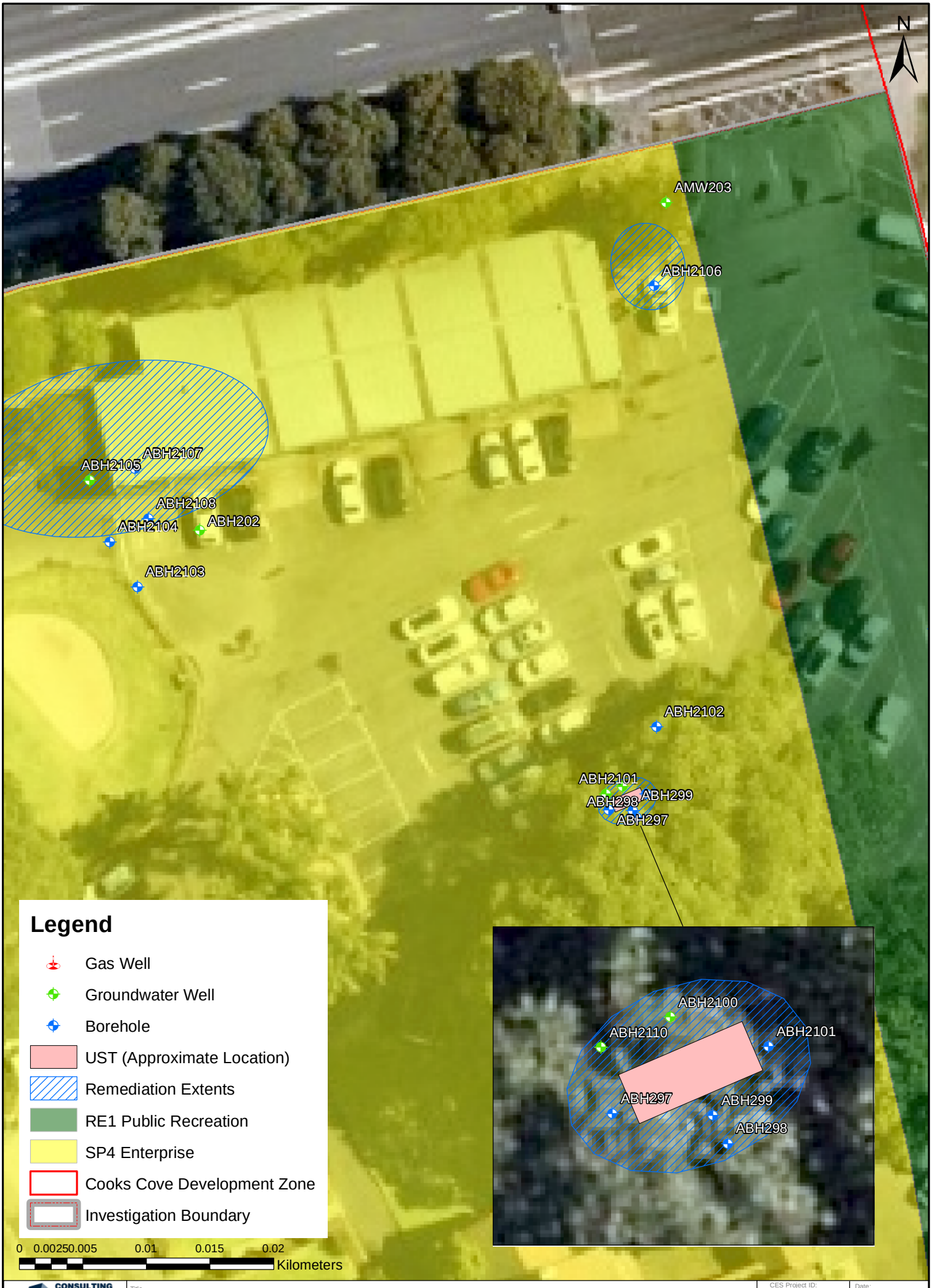
Title

# Figure 3. Approximate Remediation Extents

| CES Project ID: | Date: |
|---|---|
| CES130608-BP | 06/02/2023 |
| Prepared By: T. Goodbody | Checked By: D.Lowe |

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# Figure 3A. Site Layout Plan and Sampling Locations - UST Area

CES Project ID: CES130608-BP

Date: 20/02/2023

Prepared By: T. Goodbody

Checked By: D.Lowe


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# Figure 4. Proposed Development Plan

| CES Project ID: | Date: |
|---|---|
| CES130608-BP | 20/02/2023 |
| Prepared By: T. Goodbody | Checked By: D.Lowe |

# Tables

| **Table 1: Remediation Acceptance Criteria - Soils** (mg $kg^{-1}$) | | | | | |
|---|---|---|---|---|---|
| **Contaminant** | **HIL (C)** | **HIL (D)** | **HSL (C)** | **HSL (D)** | **Source** |
| Lead | 600 | 1500 | - | - | NEPC (2013) – Schedule (B1) |
| Benzo(a)pyrene TEQ | 3 | 40 | - | - | NEPC (2013) – Schedule (B1) |
| Total PAHs | 300 | 4000 | - | - | NEPC (2013) – Schedule (B1) |
| Benzene | - | - | - | 3 | NEPC (2013) – Schedule (B1) |
| Total Xylenes | - | - | - | 230 | NEPC (2013) – Schedule (B1) |
| Asbestos (Bonded ACM) (w/w %) | 0.02 | 0.05 | - | - | NEPC (2013) – Schedule (B1) |

| **Table 1: Remediation Acceptance Criteria - Soils** (mg $kg^{-1}$) | | | | | |
|---|---|---|---|---|---|
| **Contaminant** | **EIL (C)** | **EIL (D)** | **ESL (C)** | **ESL (D)** | **Source** |
| Lead | 1131 | 1831 | - | - | NEPC (2013) – Schedule (B1) |
| Benzo(a)pyrene | 0.7 | 0.7 | - | - | NEPC (2013) – Schedule (B1) |
| Benzo(a)pyrene TEQ | - | - | - | - | NEPC (2013) – Schedule (B1) |
| Total PAHs | - | - | - | - | NEPC (2013) – Schedule (B1) |
| Benzene | - | - | 50 | 75 | NEPC (2013) – Schedule (B1) |
| Total Xylenes | - | - | 45 | 95 | NEPC (2013) – Schedule (B1) |
| Asbestos (Bonded ACM) (w/w %) | - | - | - | - | NEPC (2013) – Schedule (B1) |

| Table 2: Summary of Criteria for Chemical Assessment to Determine Waste Classification | | |
|---|---|---|
| **Waste Classification** | **Criteria for classification by chemical assessment (any of the alternatives given)** | **Comments** |
| **General Solid Waste** | 1. **SCC test values** ≤ CT1 | TCLP test not required |
| | 2. **TCLP test values** ≤ TCLP1 and **SCC test values** ≤ SCC1. | |
| | 3. **TCLP test values** ≤ TCLP1 and **SCC test values** > SCC1 and immobilisation DEC approved. | Without DECC approval of immobilisation, classify as restricted or hazardous. |
| **Restricted Solid Waste** | 1. **SCC test values** ≤ CT2 | TCLP test not required |
| | 2. TCLP1 < **TCLP test values** ≤ TCLP2 and SCC1 **< SCC test values** ≤ SCC2. | |
| | 3. **TCLP test values** ≤ TCLP2 and **SCC test values** > SCC2 and immobilisation DEC approved. | Without DECC approval of immobilisation, classify as hazardous. |
| | 4. TCLP1 < **TCLP test values** ≤ TCLP2 and **SCC test values** > SCC2 and DECC approved for immobilisation. | |
| **Hazardous Waste** | 1. TCLP test values > TCLP2 | |
| | 2. **TCLP test values** ≤ TCLP2 and **SCC test values** > SCC2 and no DECC approval for immobilisation. | |
| Source: NSW EPA (2014) *Waste Classification Guidelines.* | | |

| Table 3: NSW EPA (2014) Assessment Criteria for Non-liquid Waste | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **General Solid Waste** | | | **Restricted Solid Waste** | | |
| | **CT1 mg $kg^{-1}$** | **TCLP1 mg $L^{-1}$** | **SCC1 mg $kg^{-1}$** | **CT2 mg $kg^{-1}$** | **TCLP2 mg $L^{-1}$** | **SCC2 mg $kg^{-1}$** |
| Arsenic | 100 | 5.0 | 500 | 400 | 20 | 2000 |
| Benzene | 10 | 0.5 | 18 | 40 | 2 | 72 |
| Benzo(a)pyrene | 0.8 | 0.04 | 10 | 3.2 | 0.16 | 23 |
| Cadmium | 20 | 1.0 | 100 | 80 | 4 | 400 |
| Ethylbenzene | 600 | 30 | 1080 | 2400 | 120 | 4320 |
| Lead | 100 | 5 | 1500 | 400 | 20 | 6000 |
| Mercury | 4 | 0.2 | 50 | 16 | 0.8 | 200 |
| Nickel | 40 | 2 | 1050 | 160 | 8 | 4200 |
| TPH $C_6$-$C_9$ | N/A [1] | N/A [1] | 650 | N/A [1] | N/A [1] | 2600 |
| TPH $C_{10}$-$C_{36}$ | N/A [1] | N/A [1] | 10000 | N/A [1] | N/A [1] | 40000 |
| Toluene | 288 | 14.4 | 518 | 1152 | 57.6 | 2073 |
| Total PAHs | N/A [1] | N/A [1] | 200 | N/A [1] | N/A [1] | 800 |
| PCBs | N/A [1] | N/A [1] | <50 | N/A [1] | N/A [1] | <50 |
| OCP | N/A [1] | N/A [1] | <50 | N/A [1] | N/A [1] | <50 |
| Xylenes (total) | 1000 | 50 | 1800 | 4000 | 200 | 7200 |
| Note 1: TPH, OCP, PAHs, PCBs and scheduled chemicals evaluated on the basis of total concentrations (SCC) only. No TCLP. | | | | | | |

| Table 4: Validation Sampling Programme | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Location** | **Number** | **Depth** | **Analytes** | | | | |
| | | | **Metals** | **TPH** | **PAHs** | **OCP, OPP, PCB, BTEX** | **Asbestos** |
| In-situ material at BBH430, BBH433 and BBH419 for clean soil barrier | Two samples (surface and shallow soil) | **0-0.1 m and 0.4-0.5 m** | ✔ | ✔ | ✔ | | ✔ |
| Material won on-site | 1 per 100 Tonne | **Representative of stockpiled material** | ✔ | ✔ | ✔ | | ✔ |
| Excavation and stockpiling for waste classification (if requried) | Four samples up to 75 $m^3$ or one sample per 25 $m^3$ for quantities greater then 75 $m^3$ | **Site dependent** | ✔ | ✔ | ✔ | ✔ | ✔ |
| Imported fill in clean soil barrier | VENM assessment report including site history, source site inspection and appropriate transportation dockets | - | **Classifyed as VENM** | | | | |

| Table 5: Analytical Parameters, PQLs and Methods - Soil | | | |
|---|---|---|---|
| **Parameter** | **Unit** | **Proposed PQL** | **Method based on** |
| **Metals in Soil** | | | |
| As [1] | mg $kg^{-1}$ | 5 | USEPA 200.7 |
| Cd [1] | mg $kg^{-1}$ | 0.5 | USEPA 200.7 |
| Cr [1] | mg $kg^{-1}$ | 5 | USEPA 200.7 |
| Cu [1] | mg $kg^{-1}$ | 5 | USEPA 200.7 |
| Hg [2] | mg $kg^{-1}$ | 0.05 | USEPA 7471A |
| Ni [1] | mg $kg^{-1}$ | 2 | USEPA 200.7 |
| Pb [1] | mg $kg^{-1}$ | 5 | USEPA 200.7 |
| Zn [1] | mg $kg^{-1}$ | 5 | USEPA 200.7 |
| Cr(VI) | mg $kg^{-1}$ | 1 | APHA 4300Cr-D |
| **Total Petroleum Hydrocarbons (TPH) in Soil** | | | |
| $C_6$-$C_9$ fraction | mg $kg^{-1}$ | 5 | USEPA 8015B |
| $C_{10}$-$C_{14}$ fraction | mg $kg^{-1}$ | 10 | USEPA 8015B |
| $C_{15}$-$C_{28}$ fraction | mg $kg^{-1}$ | 50 | USEPA 8015B |
| $C_{29}$-$C_{36}$ fraction | mg $kg^{-1}$ | 50 | USEPA 8015B |
| Total $C_6$-$C_{36}$ | mg $kg^{-1}$ | 5 | USEPA 8015B |
| **BTEX in Soil** | | | |
| Benzene | mg $kg^{-1}$ | 0.2 | USEPA 8021A |
| Toluene | mg $kg^{-1}$ | 1 | USEPA 8021A |
| Ethylbenzene | mg $kg^{-1}$ | 1 | USEPA 8021A |
| m&p-xylene | mg $kg^{-1}$ | 2 | USEPA 8021A |
| o-xylenes | mg $kg^{-1}$ | 1 | USEPA 8021A |
| **Organic Contaminants in Soil** | | | |
| PAHs | mg $kg^{-1}$ | 0.5 [3] | USEPA 8270 SIM |
| OC Pesticides | mg $kg^{-1}$ | 0.1 | USEPA 8081A |
| OP Pesticides | mg $kg^{-1}$ | 0.1 | USEPA 8081A |
| Total PCBs | mg $kg^{-1}$ | 1 | USEPA 8081A |
| **Miscellaneous Tests** | | | |
| Asbestos Identification | -- | -- | Polarised Light Microscopy |

Note 1: Acid soluble metals by ICP-AES.

Note 2: Total recoverable mercury.

Note 3: PQL of 0.5 mg $kg^{-1}$ for PAHs in soil except total PAH, benzo(b) and (k)fluoranthene (1 mg $kg^{-1}$).

| Table 6: Containers, Preservation Requirements and Holding Times - Soil | | | | |
|---|---|---|---|---|
| **Parameter** | **Container** | **Preservation** | **Maximum holding time** | **Colour code** |
| Acid digestible metals and metalloids (As,Cd,Cu,Cr,Ni,Pb,Zn) | Glass with Teflon lid | Nil | 6 months | Orange |
| Mercury | Glass with Teflon lid | Nil | 28 days | Orange |
| TPH/BTEX | Glass with Teflon lid | 4°C, zero headspace | 7 days | Orange |
| PAHs | Glass with Teflon lid | 4°C | 14 days [1] | Orange |
| OCPs, OPPs and total PCBs | Glass with Teflon lid | 4oC | 14 days [1] | Orange |
| Asbestos | Polyethylene bag or equivalent | Nil | N/A | Orange |
| Note 1: Extraction within 14 days. Analysis within 40 days. | | | | |

| Table 7: QA/QC Data Acceptance Criteria | | |
|---|---|---|
| **QA/QC Sample Type** | **Method of Assessment** | **Acceptable Range** |
| ***Field QA/QC*** | | |
| Blind Replicates and Split Samples | The assessment of split replicate is undertaken by calculating the Relative Percent Difference (RPD) of the replicate concentration compared with the original sample concentration. The RPD is defined as:<br>$RPD = 100 \times \frac{\lvert X_1 - X_2 \rvert}{\text{Average}}$<br>Where: $X_1$ and $X_2$ are the concentration of the original and replicate samples. | The acceptable range depends upon the levels detected:<br>▪ 0 – 100% RPD (When the average concentration is < 5 times the PQL)<br>▪ 0 – 75% RPD (When the average concentration is 5 to 10 times the PQL)<br>• 0 – 50% RPD (When the average concentration is > 10 times the PQL) |
| Blanks (Rinsate and Trip blanks) | Each blank is analysed as per the original samples. | Analytical Result < PQL |
| ***Laboratory QA/QC (as below or appropriate laboratory-defined criteria)*** | | |
| Laboratory Duplicates | Assessment as per Split Replicates. | The acceptable range depends upon the levels detected:<br>▪ 0 – 100% RPD (When the average concentration is < 4 times the PQL)<br>▪ 0 – 50% RPD (When the average concentration is 4 to 10 times the PQL)<br>▪ 0 – 30% RPD (When the average concentration is > 10 times the PQL) |
| Surrogates<br>Matrix Spikes<br>Laboratory Control Samples | Assessment is undertaken by determining the % Recovery of the known spike or addition to the sample.<br>$\% \text{ Recovery} = 100 \times \frac{C - A}{B}$<br>Where: A = Concentration of analyte determined in the original sample; B = Added Concentration; C = Calculated concentration after adding B. | Surrogates:<br>70% – 130%<br>Matrix Spikes:<br>70% - 130% (Organics)<br>80% - 120% (Inorganics)<br>LCS:<br>70% - 130% (Organics)<br>90% - 110% (Inorganics)<br>If the result is outside the above ranges, the appropriate laboratory-defined criteria shall be used) |
| Method Blanks | Each blank is analysed as per the original samples. | Analytical Result < PQL |

***Note:*** *1 PQL = Laboratory Practical Quantitation Limit or the minimum detection limit for a particular analyte.*
*Reference: APHA 18th Edition. Australian Standard AS4482.1-1997 Guide to Sampling and investigation of potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds*

# Appendix 1

## Summary of Analytical Results and Borehole Logs

| | | | |
|---|---|---|---|
| **Project ID:** | CES050706-BCC | **Easting:** | 329867.686 |
| **Project:** | ESA | **Northing:** | 6243591.190 |
| **Client:** | Boyd Cooks Cove | **Elevation:** | 2.97 |
| **Location:** | Cooks Cove - Area A | **Environmental Log:** | **ABH201** |

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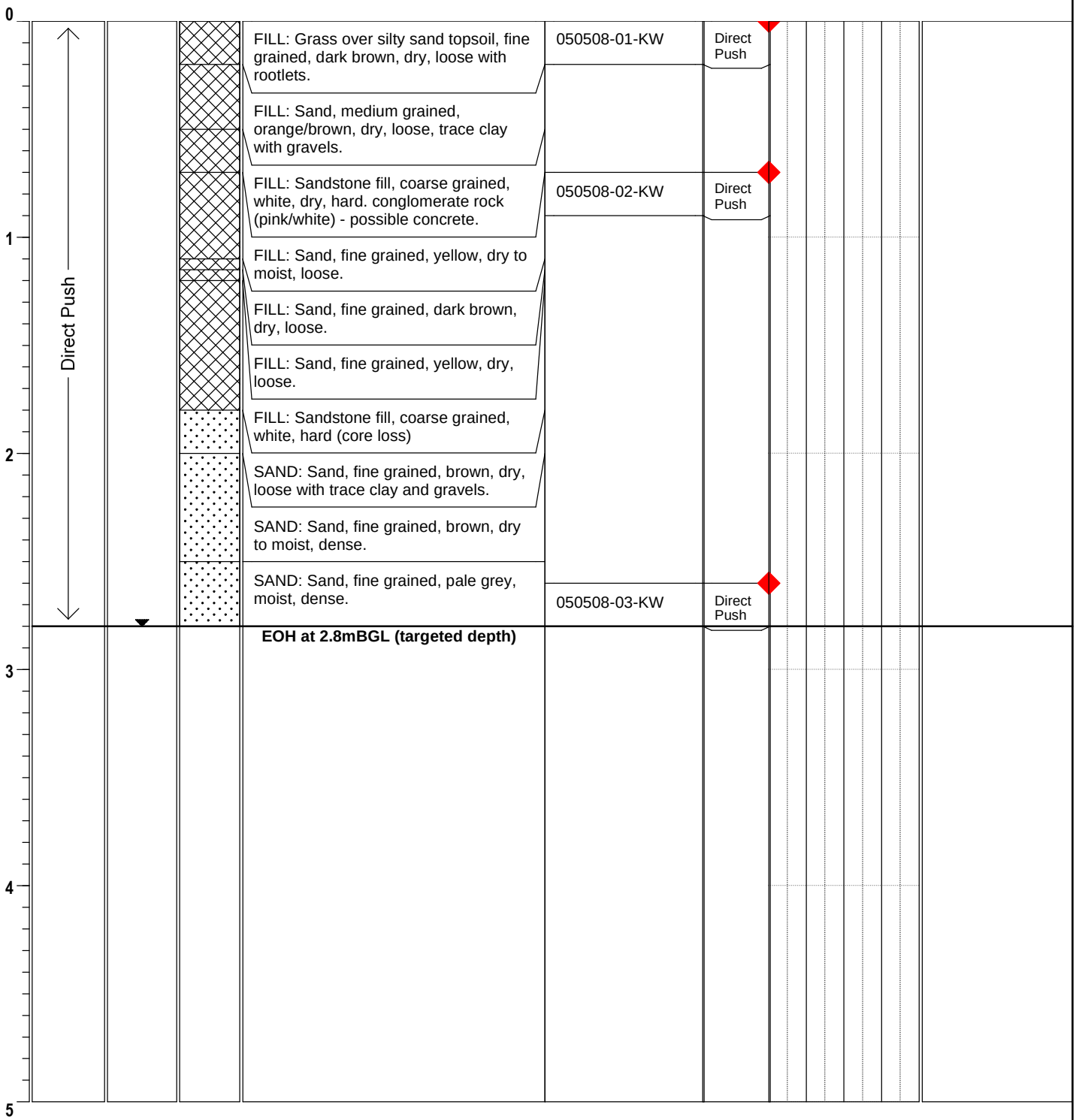


| | | | |
|---|---|---|---|
| **Drill Company:** | Macquarie Drilling | **Date Commenced:** | 05/05/2008 |
| **Drill Model:** | Mac200 | **Date Completed:** | 05/05/2008 |
| **Hole Diameter (mm):** | 50 | **Logged/checked by:** | K.Weir/L.Jenkins |

**Project ID:** CES050706-BCC **Easting:** 329924.428

**Project:** ESA **Northing:** 6243586.055

**Client:** Boyd Cooks Cove **Elevation:** 1.74

**Location:** Cooks Cove - Area A

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**Environmental Log: ABH202**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Auger Hollow Flight | ▼ | | ASPHALT: Bitumen | 090508-191-KW | Hand Auger | | |
| | | | | FILL: Sand, fine grained, brown, dry, loose, gravels and rootlets, odourless. Moist at 0.4 m. | 090508-192-KW | Hand Auger | | |
| 1 | | | | FILL: Silty sand, fine grained, brown/grey, moist, soft, trace clay, sandstone, gravels, roots. | 090508-193-KW | Hand Auger | | |
| | | | | SAND: Sand, fine to medium grained, grey/brown, wet at 1.3 m. Hydrocarbon odour at 1.3 m. Strong hydrocarbon odour at 2.0 m. | 090508-200-KW | Push Tube | | |
| 2 | | | | | 090508-202-KW | Push Tube | | |
| | | | | SAND: Silty sand, fine grained, grey, wet, soft, trace clay, slight H2S odour. | | | | |
| | | | | SAND: Sand, fine grained, grey, wet, dense, silty. | 090508-203-KW | Push Tube | | |
| 3 | | | | SAND: Sand, fine to medium grained, grey, saturated, very slight hydrocarbon odour. | | | | |
| | | | | SAND: Sand, medium grained, brow, wet, loose. | 150508-601-KW | Solid Flight Auger | | |
| 4 | | | | **EOH at 4.0mBGL (targeted depth)** | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 09/05/2008

**Drill Model:** Mac200 **Date Completed:** 15/05/2008

**Hole Diameter (mm):** 150 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329763.306

**Project:** ESA **Northing:** 6243541.165

**Client:** Boyd Cooks Cove **Elevation:** 1.23

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH203**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | TOPSOIL: Grass over silty sand topsoil, fine grained, dark brown, moist, dense, rootlets. | 070508-59-KW | Push Tube | | |
| | | | | FILL: Silty sand, fine to medium grained, grey/brown, moist, dense, gravels, minor crushed sandstone. | | | | |
| | | | | SAND: Sand, fine to medium grained, pale grey, moist, dense. | 070508-60-KW | Push Tube | | |
| 1 | | | | SAND: Sand, fine to medium grained, daker grey, wet from 1.2 m, moderately dense, H2S odour, roots, saturated from 1.5 m to 2.2 m. | | | | |
| 2 | | | | | ABH203(1.9-2.0) | Push Tube | | |
| | | | | SAND: Sand, fine to medium grained, pale grey, wet, dense, slight H2S odour. | | | | |
| | | | | | 070508-61-KW | Push Tube | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 07/05/2008

**Drill Model:** Mac200 **Date Completed:** 07/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329799.291

**Project:** ESA **Northing:** 6243532.840

**Client:** Boyd Cooks Cove **Elevation:** 1.06

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH204**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | TOPSOIL: Grass over silty sand topsoil, fine grained, dark brown, moist, rootlets. | 070508-57-KW | Push Tube | | |
| | | | | FILL: Silty sand, fine grained, dark brown/grey, moist, dense, ironstone gravel at 0.2 m, rootlets throughout. | 070508-56-KW | Push Tube | | |
| | | | | | 070508-55-KW | Push Tube | | |
| 1 | | | | SAND: Sand, fine to medium grained, pale grey, moist to wet from 1.2 m, dense, minor silty lenses, H2S odour. | | | | |
| | | | | SILTY SAND: Silty sand, fine to medium grained, dark grey, moist to wet, dense. | 070508-58-KW | Push Tube | | |
| 2 | | | | SAND: Sand, fine to medium grained, pale grey, saturated from 1.5 to 1.8 m, then moist to wet, H2S odour. | | | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 07/05/2008

**Drill Model:** Mac200 **Date Completed:** 07/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329831.695

**Project:** ESA **Northing:** 6243544.297

**Client:** Boyd Cooks Cove **Elevation:** 1.19

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH205**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | TOPSOIL: Grass over silty sand topsoil, fine grained, dark brown, moist, rootlets. | 060508-49-KW | Push Tube | | |
| | | | | FILL: Sand, fine grained, dark brown/grey, moist, firm, silty. | 060508-50-KW | Push Tube | | |
| 1 | | | | FILL: Silty sand, fine to medium grained, dark brown/black, moist, dense. | | | | |
| | | | | FILL: Sand, fine to medium grained, pale grey, moist, moderately dense, silty lenses, H2S odour. | | | | |
| | | | | FILL: Sand, fine to medium grained, pale brown, wet at 1.5 m, silty lenses, H2S odour. | | | | |
| 2 | | | | SAND: Sand, fine to meidum grained, pale grey, wet, dense, silty lenses, H2S odour. | 060508-51-KW | Push Tube | | |
| 3 | | | | **End of borehole.** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329880.449

**Project:** ESA **Northing:** 6243542.211

**Client:** Boyd Cooks Cove **Elevation:** 2.68

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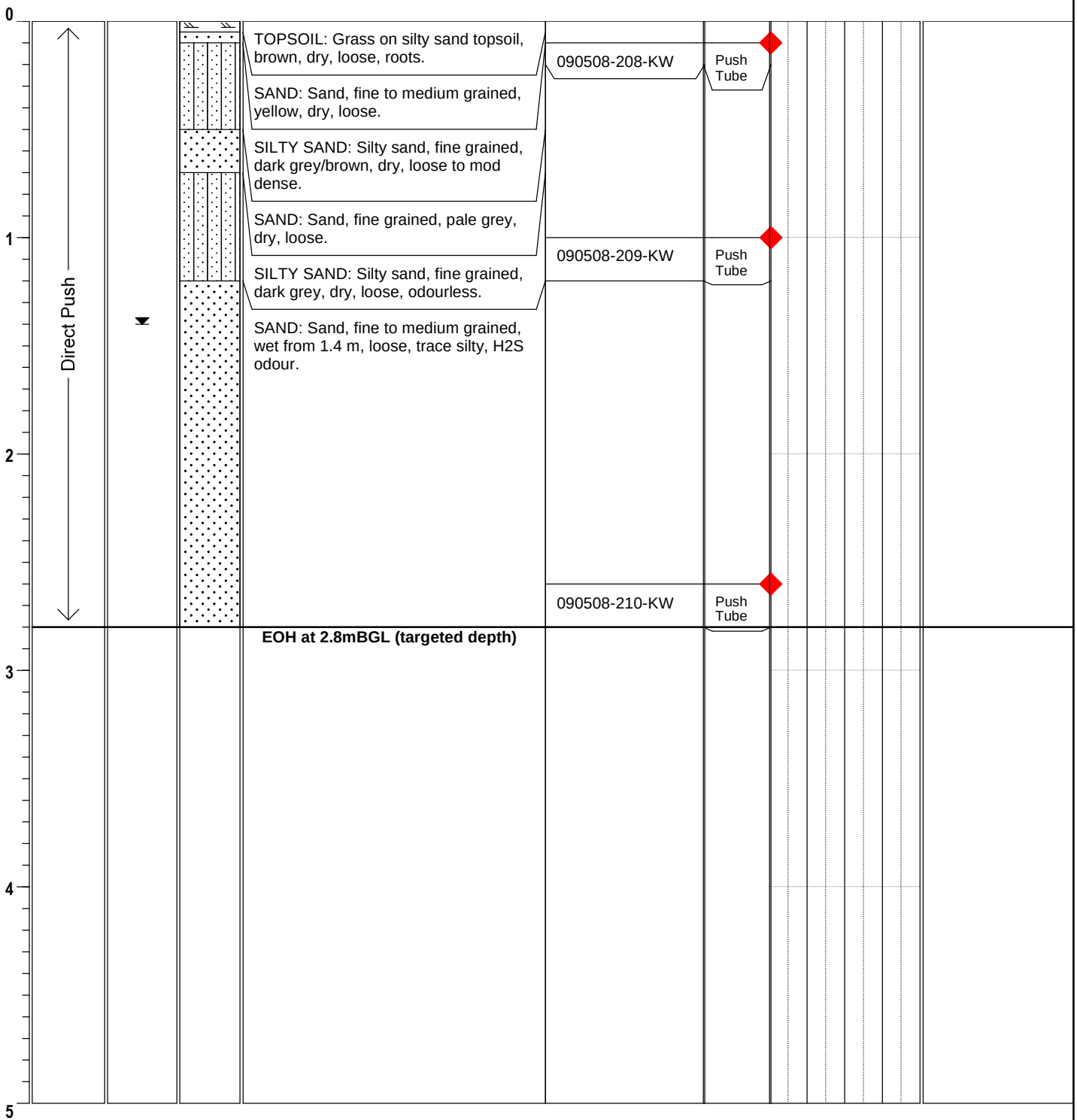
**Location:** Cooks Cove - Area A **Environmental Log:** **ABH206**




**Drill Company:** Macquarie Drilling **Date Commenced:** 09/05/2008

**Drill Model:** Mac200 **Date Completed:** 09/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329925.011

**Project:** ESA **Northing:** 6243539.904

**Client:** Boyd Cooks Cove **Elevation:** 3.72

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH207**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | ASPHALT: Bitumen | | | | |
| | | | | FILL: Roadbase and gravel with crushed sandstone, dry, odourless. | 090508-207-KW | Push Tube | | |
| | | | | SANDSTONE: Sandstone, white/orange, dry, hard. EOH at 0.4mBGL (Refusal on sandstone bedrock) | | | | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 09/05/2008

**Drill Model:** Mac200 **Date Completed:** 09/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

| | | | |
|---|---|---|---|
| **Project ID:** | CES050706-BCC | **Easting:** | 329676.926 |
| **Project:** | ESA | **Northing:** | 6243500.164 |
| **Client:** | Boyd Cooks Cove | **Elevation:** | 2.12 |
| **Location:** | Cooks Cove - Area A | **Environmental Log:** | **ABH208** |

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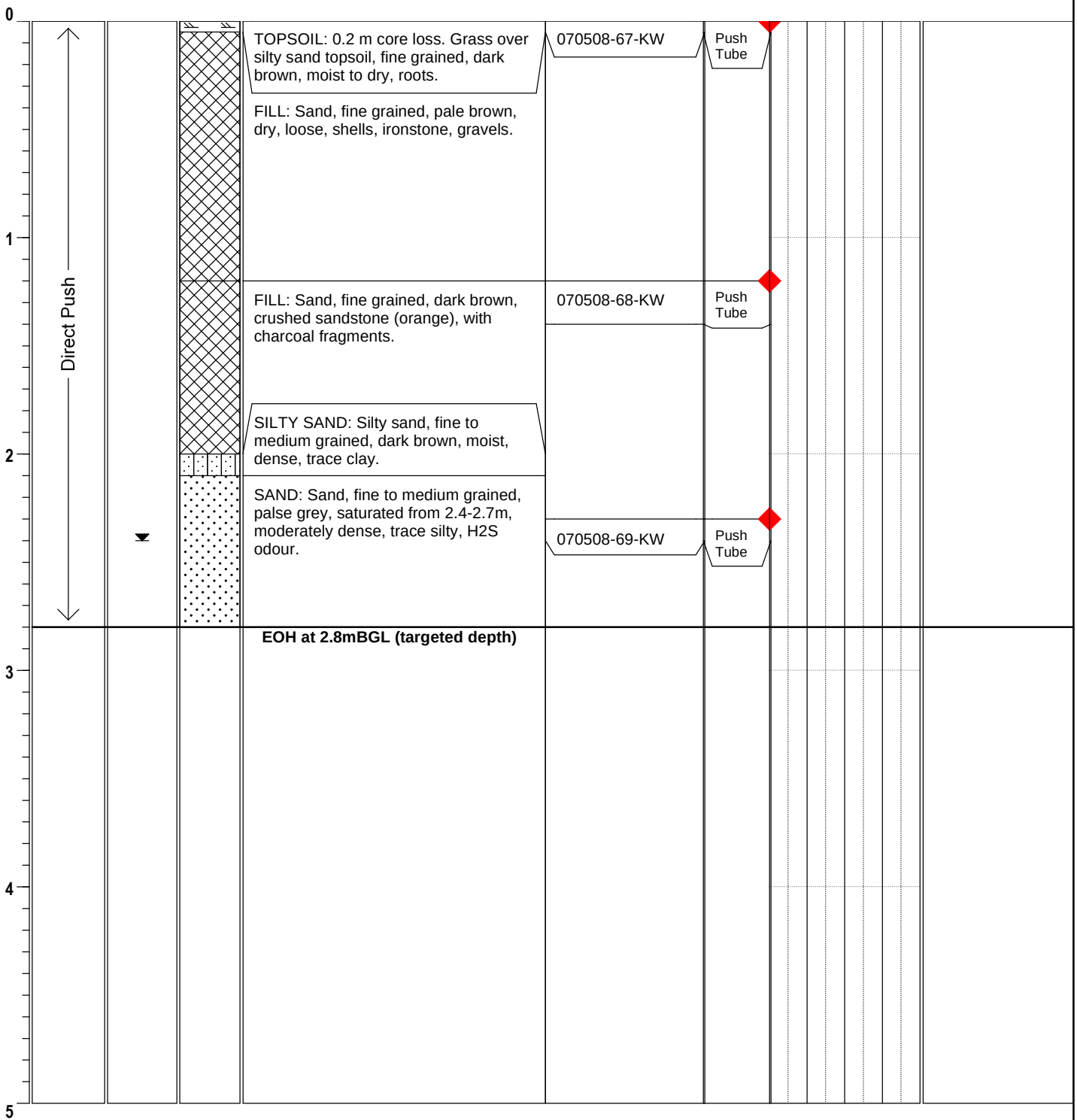


| | | | |
|---|---|---|---|
| **Drill Company:** | Macquarie Drilling | **Date Commenced:** | 07/05/2008 |
| **Drill Model:** | Mac200 | **Date Completed:** | 07/05/2008 |
| **Hole Diameter (mm):** | 50 | **Logged/checked by:** | K.Weir/L.Jenkins |

**Project ID:** CES050706-BCC **Easting:** 329738.333

**Project:** ESA **Northing:** 6243496.302

**Client:** Boyd Cooks Cove **Elevation:** 1.13

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH209**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | TOPSOIL: 0.5 m core loss. Grass over silty sand, fine grained, dark brown, moist, roots. | 070508-62-KW | Push Tube | | |
| | | | | FILL: Sand, fine to medium grained, yellow, dry to moist, loose, bark and gravel. | 070508-63-KW | Push Tube | | |
| 1 | | | | SILTY SAND: Silty sand, fine to medium grained, dark brown, moist, moderately dense, trace clay, increasing clay with depth. | | | | |
| | | | | SILTY SAND: Sand, fine grained, pale grey/brown, saturated from 1.5-2.2 m, soft, silt lenses, H2S odour. | 070508-64-KW | Push Tube | | |
| 2 | | | | SAND: Sand, fine to medium grained, pale grey, wet, dense, trace silty lenses H2S odour. | ABH209(1.7-1.9) | Push Tube | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 07/05/2008

**Drill Model:** Mac200 **Date Completed:** 07/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329798.581

**Project:** ESA **Northing:** 6243492.370

**Client:** Boyd Cooks Cove **Elevation:** 0.86

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH210**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | TOPSOIL: 0.3 m core loss. Grass over silty clay topsoil, fine grained, dark brown, moist, soft, rootlets. | 060508-46-KW | Push Tube | | |
| | | | | FILL: Black coke and ash with white slag and silty sand, fine grained, dark brown, moist, glass, VOC (WD40) odour. | 060508-47-KW | Push Tube | | |
| 1 | | | | SILTY SAND: Silty sand, fine to medium grained, dark grey, moist, dense. | | | | |
| | | | | SILTY SAND: Silty sand, medium to coarse grained, pale brown, moist, dense, trace clay, slight VOC and H2S odour. | 060508-48-KW | Push Tube | | |
| 2 | | | | SAND: Sand, medium grained, pale grey, moist and wet at 1.2 m, dense, silt lenses, H2S odour. | | | | |
| | | | | SILTY SAND: Silty sand, medium grained, dark grey, wet (saturated from 1.4-2.8 m), H2S odour. | | | | |
| | | | | SAND: Sand, medium grained, grey, wet, moderately dense, silty lenses. | ABH210(2.6-2.8) | Push Tube | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329832.382

**Project:** ESA **Northing:** 6243498.085

**Client:** Boyd Cooks Cove **Elevation:** 1.18

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH211**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand, trace clay, dark brown, fine grained, moist, dense with rootlets | 120508-214-KW | Push Tube | | |
| | | | | FILL: Sand, brown, trace clay, fine to medium grained, dense, moist, silt lenses and rootlets | | | | |
| 1 | | | | FILL: Sand, pale grey, medium grained, moist to wet, H2S odour, dense, silt lenses throughout, saturated at 1.4m to 2.0m | 120508-216-KW | Push Tube | | |
| | | | | | 120508-215-KW | Push Tube | | |
| 2 | | | | SAND: Sand, pale grey, course grained, dense and wet | 120508-217-KW | Push Tube | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 12/05/2008

**Drill Model:** Mac200 **Date Completed:** 12/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

| | | | |
|---|---|---|---|
| **Project ID:** | CES050706-BCC | **Easting:** | 329878.222 |
| **Project:** | ESA | **Northing:** | 6243497.379 |
| **Client:** | Boyd Cooks Cove | **Elevation:** | 5.73 |
| **Location:** | Cooks Cove - Area A | **Environmental Log:** | **ABH212** |

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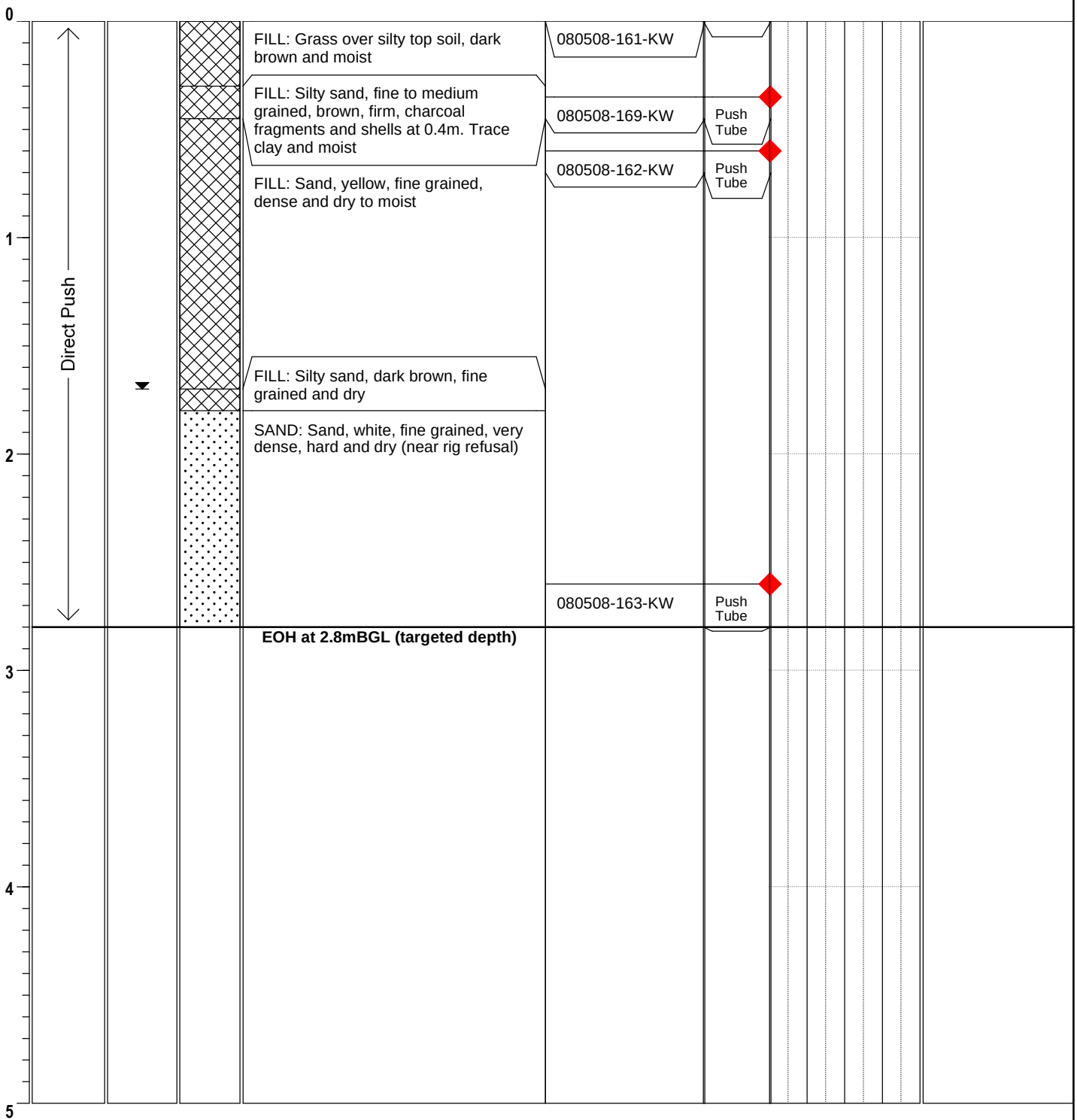


| | | | |
|---|---|---|---|
| **Drill Company:** | Macquarie Drilling | **Date Commenced:** | 08/05/2008 |
| **Drill Model:** | Mac200 | **Date Completed:** | 08/05/2008 |
| **Hole Diameter (mm):** | 50 | **Logged/checked by:** | K.Weir/L.Jenkins |

**Project ID:** CES050706-BCC **Easting:** 329919.200

**Project:** ESA **Northing:** 6243488.726

**Client:** Boyd Cooks Cove **Elevation:** 5.00

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH213**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand topsoil, dark brown, loose, dry to moist with rootlets | 120508-211-KW | Push Tube | | |
| | | | | FILL: Sand, pale brown, fine grained, loose, dry to moist | 120508-212-KW | Push Tube | | |
| 1 | | | | FILL: Sand, yellow, medium grained, dry, black charcoal at 0.5m | | | | |
| | | | | SANDSTONE: Sandstone, orange course grained and dry. Refusal at 1.3m BGL on sandstone bedrock | 120508-213-KW | Push Tube | | |
| | | | | **End of borehole.** | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 12/05/2008

**Drill Model:** Mac200 **Date Completed:** 12/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329655.819

**Project:** ESA **Northing:** 6243449.734

**Client:** Boyd Cooks Cove **Elevation:** 0.97

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH214**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, moist with rootlets | 070508-70-KW | Push Tube | | |
| | | | | FILL: Silty sand, dark brown, fine grained, dense and moist | 070508-71-KW | Push Tube | | |
| 1 | | | | FILL: Sand, yellow/pale grey, fine to medium grained, dense, moist and H2S odour. Silt lenses from 0.8m. Wet from 0.6m. Saturated from 1.5-2.0m | | | | |
| 2 | | | | SAND: Sand, pale grey, fine to medium grained, dense, moist to wet | | | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 07/05/2008

**Drill Model:** Mac200 **Date Completed:** 07/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329724.248

**Project:** ESA **Northing:** 6243447.953

**Client:** Boyd Cooks Cove **Elevation:** 1.04

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH215**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty clay topsoil, dark brown, firm to soft, moist with rootlets | 060508-36-KW | Push Tube | | |
| | | | | FILL: Silty sand, dark grey, fine to medium grained, moist and dense | | | | |
| | | | | FILL: Sand, yellow/pale grey, fine to medium grained, dense, moist with rootlets. Silt lenses and H2S odour throughout | 060508-38-KW | Push Tube | | |
| 1 | | | | | 060508-37-KW | Push Tube | | |
| | | | | SILTY SAND: Silty sand, fine to medium grained with trace clay, brown/grey, soft and H2S odour. Saturated form 1.45m to 2.0m | | | | |
| 2 | | | | SAND: Sand, pale grey, fine to medium grained, moderately dense, moist to wet with H2S odour | 060508-39-KW | Push Tube | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329754.370

**Project:** ESA **Northing:** 6243446.681

**Client:** Boyd Cooks Cove **Elevation:** 0.97

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH216**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty clay topsoil, brown/orange, moist, dense with rootlets | 060508-40-KW | Push Tube | | |
| | | | | FILL: Silty sand, fine to medium grained, pale brown, moist and slightly loose | 060508-41-KW | Push Tube | | |
| 1 | | | | FILL: Silty clayey sand, dark brown, fine to medium grained, dense, moist and odourless | | | | |
| | | | | FILL: Silty sand, fine to medium grained, pale brown/yellow, moist, dense with H2S odour | | | | |
| | | | | FILL: Sand with minor silt, pale grey, moist, loose and moist with H2S odour, becoming darker grey/brown. Sturated from 1.4-2.1m | | | | |
| 2 | | | | SAND: Sand, pale grey, wet, fine to medium grained, dense with H2S odour | 060508-42-KW | Push Tube | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329814.547

**Project:** ESA **Northing:** 6243438.850

**Client:** Boyd Cooks Cove **Elevation:** 0.93

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH217**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand, topsoil, fine to medium grained, dark brown, moist and loose | 060508-43-KW | Push Tube | | |
| | | | | FILL: Silty sand, fine to medium grained, moist, pale brown/grey, dense with H2S odour. Grading to sand with trace silts with depth | 060508-44-KW | Push Tube | | |
| 1 | | | | FILL: Silty sand with trace clay, light brown, fine to medium grained, moist and dense with H2S odour | | | | |
| | | | | FILL: Increase in clay content, becoming wet at 1.3m | 050608-45-KW | Push Tube | | |
| | | | | SILTY SAND: Silty sand, dark brown/grey, fine to medium grained, saturated, loose wit H2S odour | | | | |
| 2 | | | | SAND: Sand with trace silt, grey, fine to medium grained, moist, dense with H2S odour. | | | | |
| | | | | **EOH at 2.3mBGL (refusal on dense sands)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329845.698

**Project:** ESA **Northing:** 6243452.655

**Client:** Boyd Cooks Cove **Elevation:** 1.39

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH218**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand topsoil, dark brown, moist with rootlets | 060508-06-KW | Push Tube | | |
| | | | | FILL: Sand, brown, moist, fine grained and dense | | | | |
| | | | | SAND: Sand, light brown, fine grained, moist and dense. Refusal at 0.5mBGL on Sandstone | 060508-07-KW | Push Tube | | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329884.676

**Project:** ESA **Northing:** 6243447.707

**Client:** Boyd Cooks Cove **Elevation:** 2.50

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH219**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand topsoil, dark brown, loose, moist, with rootlets | 060508-08-KW | Push Tube | | |
| | | | | FILL: Sand, brown, fine grained, loose, dry to moist. Sandstone at 0.4-0.5m | | | | |
| | | | | SAND: Sand, dark grey, fine to medium grained and moist. Refusal on sandstone at 1.0mBGL | 060508-09-KW | Push Tube | | |
| 1 | | | | **EOH at 1.0mBGL (refusal on sandstone bedrock)** | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329924.044

**Project:** ESA **Northing:** 6243450.645

**Client:** Boyd Cooks Cove **Elevation:** 2.25

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH220**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand topsoil, dark brown, fine grained, moist with rootlets | 060508-04-KW | Push Tube | | |
| | | | | FILL: Ash fill, black/grey, crisp and dry to moist | 060508-05-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine grained, moist and dense | | | | |
| 1 | | | | FILL: Clayey sand with trace silt, dark grey, moist and dense | | | | |
| | | | | FILL: Sand, trace clay, light brown, dense and moist. Refusal on sandstone bedrock at 0.6mBGL | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329994.603

**Project:** ESA **Northing:** 6243450.997

**Client:** Boyd Cooks Cove **Elevation:** 1.31

**Location:** Cooks Cove - Area A

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**Environmental Log: ABH221**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass on silty sand topsoil, dark brown, fine brown, roots, dry to moist | 080508-158-KW | Push Tube | | |
| | | | | FILL: concrete rubble | | | | |
| | | | | FILL: Sand, fine grained, brown, loose and dry. Shells at 0.8m | | | | |
| | | | | FILL: Sandstone, course grained, yellow and dry | 080508-159-KW | Push Tube | | |
| 1 | | | | FILL: Sand, brown, fine to medium grained, dense, shells, moist to wet with silt lenses | | | | |
| | | | | FILL: Silty clay sand, brown, soft, wet to saturated at 1.5-1.8m | 080508-160-KW | Push Tube | | |
| | | | | SAND: Sand, grey soft, fine grained, wet with numerous shells | | | | |
| 2 | | | | | | | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329565.810

**Project:** ESA **Northing:** 6243401.446

**Client:** Boyd Cooks Cove **Elevation:** 0.94

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH222**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Silty topsoil, brown, moist with roots | 070508-76-KW | Push Tube | | |
| | | | | FILL: Silty sand, dark brown/black, fine grained, moist and soft | 070508-77-KW | Push Tube | | |
| 1 | | | | UNKNOWN: Coreloss | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, moist to wet, soft and loose with H2S odour. Silt lenses from 2.0. Saturated from 1.7-2.5m. | 070508-78-KW | Push Tube | | |
| 2 | | | | | | | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329606.336

**Project:** ESA **Northing:** 6243406.270

**Client:** Boyd Cooks Cove **Elevation:** 2.09

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH223**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over sandy topsoil, brown, dry with gravels and rootlets | 070508-72-KW | Push Tube | | |
| | | | | FILL: Sand, fine grained, brown, dry and loose with gravels and ash at 0.5-0.6m. Shells and sandstone gravels, dense and moist at depth | 070508-73-KW | Push Tube | | |
| 1 | | | | FILL: Silty sand, brown/grey, fine grained, dense, moist, with gravels and possible ash | | | | |
| | | | | FILL: Silty sand, dark grey/black, fine grained, dense, moist, silt lenses at 1.9-2.1m | 070508-74-KW | Push Tube | | |
| 2 | | | | SAND: Sand, pale grey, fine to medium grained, dense, moist to wet with roots | | | | |
| | | | | SILTY SAND: Silty sand, dark grey, fine to medium grained, moist to wet at 2.8m. Saturated at 3.7-4.1m | | | | |
| 3 | | | | | | | | |
| | | | | | 070508-75-KW | Push Tube | | |
| 4 | | | | **EOH at 4.1mBGL (targeted depth)** | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

| | | | |
|---|---|---|---|
| **Project ID:** | CES050706-BCC | **Easting:** | 329657.034 |
| **Project:** | ESA | **Northing:** | 6243404.105 |
| **Client:** | Boyd Cooks Cove | **Elevation:** | 1.16 |
| **Location:** | Cooks Cove - Area A | **Environmental Log:** | **ABH224** |

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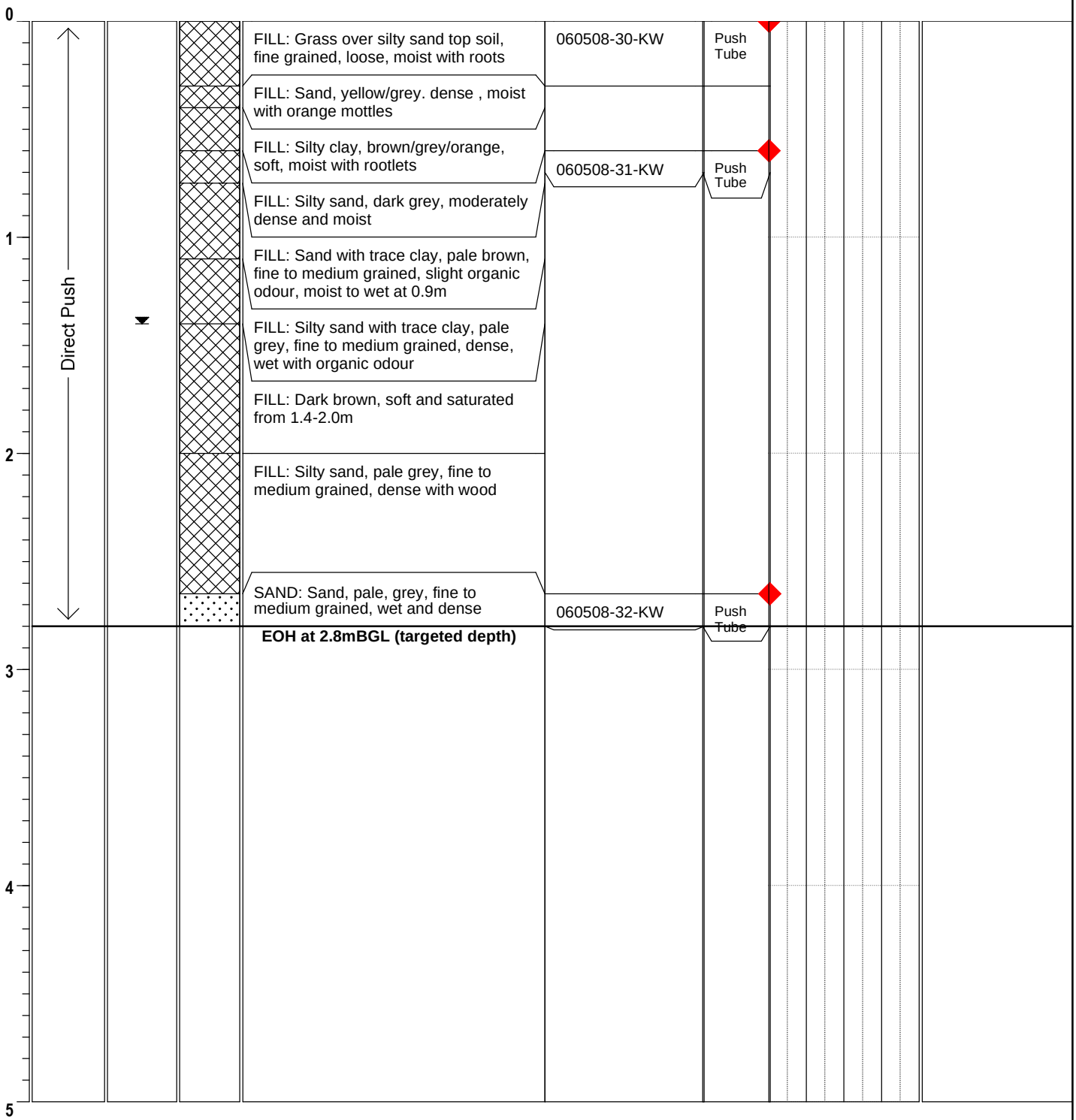


| | | | |
|---|---|---|---|
| **Drill Company:** | Macquarie Drilling | **Date Commenced:** | 06/05/2008 |
| **Drill Model:** | Mac200 | **Date Completed:** | 06/05/2008 |
| **Hole Diameter (mm):** | 50 | **Logged/checked by:** | K.Weir/L.Jenkins |

**Project ID:** CES050706-BCC **Easting:** 329694.665

**Project:** ESA **Northing:** 6243404.713

**Client:** Boyd Cooks Cove **Elevation:** 1.32

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH225**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, fine to medium grained, dark brown, moist with rootlets | 060508-33-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, loose, moist, odourless and shells | 060508-34-KW | Push Tube | | |
| 1 | | | | FILL: Silty clay, brown/orange, dense, moist with rootlets | | | | |
| | | | | FILL: Silty sand, dark grey, fine to medium grained, moist and odourless with silt lenses. Saturated at 1.5m | | | | |
| | | | | FILL: Silty sand, brown, fine to medium grained wit trace clays, loose and soft with slight H2S odour. Saturated from 1.5-2.0m | 060508-35-KW | Push Tube | | |
| 2 | | | | FILL: Silty clay sand, dark grey/brown, fine to medium grained, wet, slightly loose with slight H2S odour | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, moist, dense and odourless | | | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

| | | | |
|---|---|---|---|
| **Project ID:** | CES050706-BCC | **Easting:** | 329755.651 |
| **Project:** | ESA | **Northing:** | 6243402.717 |
| **Client:** | Boyd Cooks Cove | **Elevation:** | 1.32 |
| **Location:** | Cooks Cove - Area A | **Environmental Log:** | **ABH226** |

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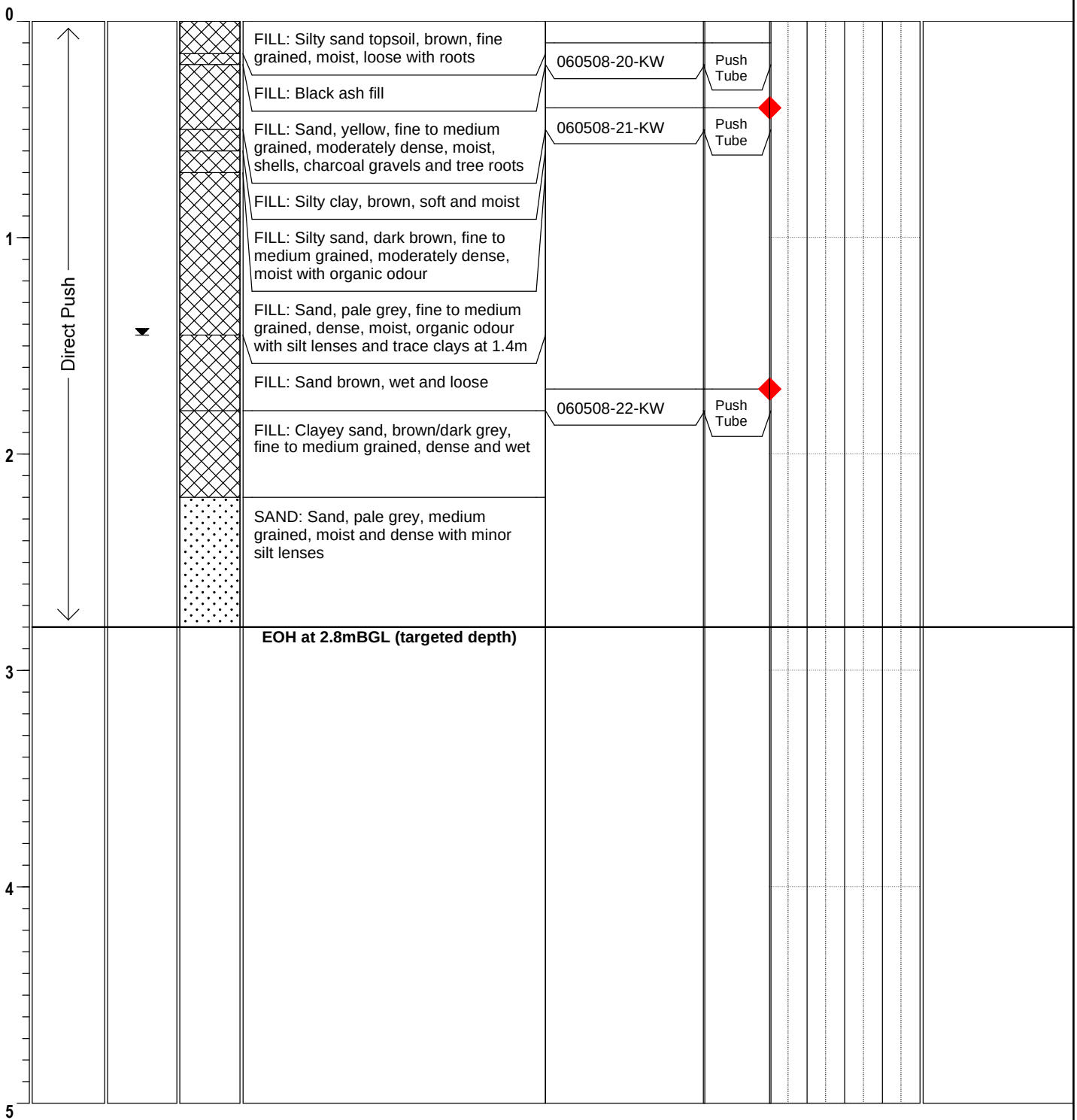


| | | | |
|---|---|---|---|
| **Drill Company:** | Macquarie Drilling | **Date Commenced:** | 06/05/2008 |
| **Drill Model:** | Mac200 | **Date Completed:** | 06/05/2008 |
| **Hole Diameter (mm):** | 50 | **Logged/checked by:** | K.Weir/L.Jenkins |

**Project ID:** CES050706-BCC **Easting:** 329798.506

**Project:** ESA **Northing:** 6243404.901

**Client:** Boyd Cooks Cove **Elevation:** 1.03

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH227**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, brown, moist and loose | 060508-19-KW | Push Tube | | |
| | | | | FILL: Silty clay, brown/grey, soft and moist with minor gravels | | | | |
| | | | | FILL: Silty sand, dark brown/grey, fine to medium grained moderately dense and moist | 060508-18-KW | Push Tube | | |
| 1 | | | | FILL: Sand, pale grey, medium grained, moderately dense with trace silt lenses | 060508-17-KW | Push Tube | | |
| | | | | FILL: Clayey silt sand, dark grey with organic odour | | | | |
| | | | | FILL: Silty sand, brown/grey, moist and moderately dense | | | | |
| | | | | FILL: Grading to silty clayey sand | | | | |
| 2 | | | | SAND: Sand, pale grey, fien to medium grained, wet with slight organic odour | | | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329849.080

**Project:** ESA **Northing:** 6243400.702

**Client:** Boyd Cooks Cove **Elevation:** 1.10

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH228**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty clay topsoil, dark brown and moist with charcoal at 0.3m | 060508-10-KW | Push Tube | | |
| | | | | FILL: Sand, yellow/pale grey, fine to medium grained with shells and moist | 060508-11-KW | Push Tube | | |
| | | | | FILL: Clayey silt, brown/grey, soft, moist with minor gravels | | | | |
| 1 | | | | FILL: Sand, dark grey, fine to medium grained with trace clay, moist with rootlets | | | | |
| | | | | FILL: Sand, pale grey, fine grained with silt lenses, moist and wet at 1.5m | | | | |
| | | | | FILL: silty sand, dark grey, wet, loose with organic odour | | | | |
| 2 | | | | SAND: Sand, pale grey, fine to medium grained, dense and moist | 060508-12-KW | Push Tube | | |
| | | | | **EOH at 2.6mBGL (refusal on sandstone bedrock)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329888.140

**Project:** ESA **Northing:** 6243401.205

**Client:** Boyd Cooks Cove **Elevation:** 0.76

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH229**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty clay topsoil, dark brown, moist with rootlets. Ash at 0.1m and tree roots at 0.3m | 060508-13-KW | Push Tube | | |
| | | | | FILL: Sand, pale grey, fine to medium grained, shells, moist and dense | | | | |
| | | | | FILL: Silty sand, dark brown, firm, moist with trace clay | 060508-16-KW | Push Tube | | |
| 1 | | | | SAND: Sand, pale grey, fine grained, dense, moist with H2S odour. Silt clay contant from 1.2m. Wet from 1.5m. Refusal on sandstone at 1.6mBGL | 060508-15-KW | Push Tube | | |
| | | | | | 060508-14-KW | Push Tube | | |
| | | | | **EOH at 1.6mBGL (refusal on sandstone bedrock)** | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

| | | | |
|---|---|---|---|
| **Project ID:** | CES050706-BCC | **Easting:** | 329918.449 |
| **Project:** | ESA | **Northing:** | 6243403.763 |
| **Client:** | Boyd Cooks Cove | **Elevation:** | 1.23 |
| **Location:** | Cooks Cove - Area A | **Environmental Log:** | **ABH230** |

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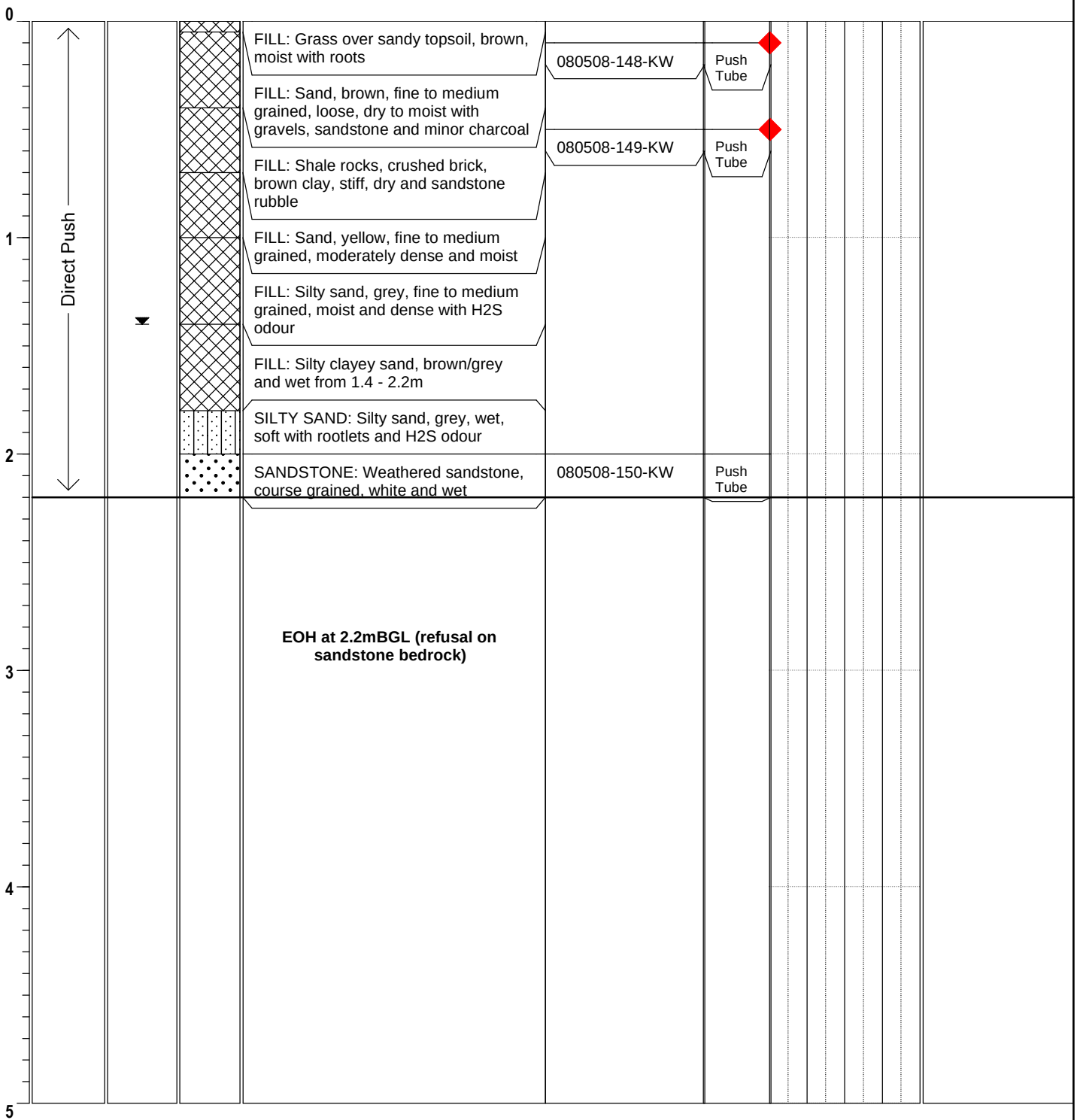


| | | | |
|---|---|---|---|
| **Drill Company:** | Macquarie Drilling | **Date Commenced:** | 08/05/2008 |
| **Drill Model:** | Mac200 | **Date Completed:** | 08/05/2008 |
| **Hole Diameter (mm):** | 50 | **Logged/checked by:** | K.Weir/L.Jenkins |

**Project ID:** CES050706-BCC **Easting:** 329973.047

**Project:** ESA **Northing:** 6243405.760

**Client:** Boyd Cooks Cove **Elevation:** 0.97

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH231**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand topsoil, fine grained, loose, moist with roots | 080508-151-KW | Push Tube | | |
| | | | | FILL: Sand, pale grey/brown, fine grained, loose and dry | | | | |
| | | | | FILL: Crushed sandtsone, white, dry | | | | |
| | | | | FILL: Silty sand with trace clay, fine grained, brown, moderately dense and moist | 080508-153-KW | Push Tube | | |
| 1 | | | | FILL: Sand, yellow, fine to medium grained, moderately dense and moist | 080508-152-KW | Push Tube | | |
| | | | | FILL: Silty sand, grey, fine grained, dense and moist with concrete gravels | 080508-154-KW | Push Tube | | |
| | | | | FILL: Sand, pale grey, fine to medium grained, dense, silty lenses with H2S odour | | | | |
| 2 | | | | FILL: Silty clayey sand, brown, soft and wet, Saturated from 1.5-2.1m | | | | |
| | | | | SILTY SAND: Silty sand, dark grey, fine to medium grained, dense and moist to wet | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, dense and wet to moist | | | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329835.915

**Project:** ESA **Northing:** 6243574.015

**Client:** Boyd Cooks Cove **Elevation:** 1.30

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH232**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty clay top soil, dark brown, soft and moist | 060508-52-KW | Push Tube | | |
| | | | | FILL: Crushed sandstone, white/orange, course grained, dry to moist | 060508-53-KW | Push Tube | | |
| | | | | FILL: Silty clayey sand, dark brown, moist with rootlets | | | | |
| 1 | | | | FILL: Silty sand, dark brown, fine grained, moist and odourless | | | | |
| | | | | FILL: Sand, pale grey, fine to medium grained, dense, moist with silt lenses. Wet at 1.4m | | | | |
| 2 | | | | | 060508-54-KW | Push Tube | | |
| | | | | SAND: Sand with silt layers, grey, fine to medium grained, dense with H2S odour. Saturated from, 2.2-2.6m | | | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329498.372

**Project:** ESA **Northing:** 6243360.060

**Client:** Boyd Cooks Cove **Elevation:** 1.27

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH233**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, moist, dense with roots | 070508-93-KW | Push Tube | | |
| | | | | FILL: Sand, brown, fine to medium grained, loose, moist with gravels | 070508-95-KW | Push Tube | | |
| | | | | FILL: Sandstone rubble, white/orange, hard. Clay with sand, brown, fine grained and moist | 070508-94-KW | Push Tube | | |
| 1 | | | | FILL: Silty sand, black, fine grained, dinse and moist | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, moderately dense, moist, H2S odour. Wet from 1.4m. Saturated at 2.2-2.6m | | | | |
| 2 | | | | SILTY SAND: Silty clay sand, grey, wet with H2S odour | 070508-96-KW | Push Tube | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 07/05/2008

**Drill Model:** Mac200 **Date Completed:** 07/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329568.152

**Project:** ESA **Northing:** 6243360.562

**Client:** Boyd Cooks Cove **Elevation:** 0.85

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH234**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, moist with roots | | | | |
| | | | | FILL: Sand, pale grey, fine to medium grained, moderately dense and moist | 070508-82-KW | Push Tube | | |
| | | | | FILL: Silty sand, dark brown, fine grained, very dense and moist | 070508-81-KW | Push Tube | | |
| 1 | | | | FILL: Sand with trace clay, pale brown, dense and moist with roots | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, dense, moist with H2S odour. Saturated at 1.5-2.4m | | | | |
| 2 | | | | SILTY SAND: Silty sand, dark grey, fine to medium grained, soft to dense and moist to wet | 070508-83-KW | Push Tube | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 07/05/2008

**Drill Model:** Mac200 **Date Completed:** 07/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329611.110

**Project:** ESA **Northing:** 6243354.212

**Client:** Boyd Cooks Cove **Elevation:** 1.14

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH235**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, fine grained, loose, moist with roots | 070508-79-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine grained, loose and moist | 070508-80-KW | Push Tube | | |
| | | | | FILL: Silty clay, brown/grey, soft and moist | | | | |
| 1 | | | | FILL: Sand, yellow, fine to medium grained, dense and moist | | | | |
| | | | | FILL: Silty clay, dark brown, soft and moist | | | | |
| | | | | FILL: Sand, yellow, fine to medium grained, dense and moist | | | | |
| | | | | FILL: Silty clay, dark brown, soft and moist | | | | |
| 2 | | | | FILL: Sand, pale grey/orange, fien to medium grained, dense and moist | | | | |
| | | | | FILL: Silty clay, dark brown, soft and moist | | | | |
| | | | | FILL: Silty sand, dark grey, fine to medium grained, dense and moist | | | | |
| | | | | SAND: Sand, pale grey, silt lenses, moist to wet and H2S odour. Saturated from 1.4-2.3m | | | | |
| 3 | | | | SAND: Sand, pale grey, medium grained, dense, moist to wet with silt lenses at 2.6m. EOH at 2.8mBGL (targeted depth) | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 07/05/2008

**Drill Model:** Mac200 **Date Completed:** 07/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329665.268

**Project:** ESA **Northing:** 6243343.476

**Client:** Boyd Cooks Cove **Elevation:** 1.25

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH236**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand topsoil, dark brown, fine grained, loose, moist with roots | 080508-102-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, loose, moist, trace silts and shells | | | | |
| | | | | FILL: Silty clay, dark brown, soft and moist | 080508-103-KW | Push Tube | | |
| 1 | | | | FILL: Sand, pale grey with orange mottles, fine to medium grained, trace silt lenses, shells and moist | | | | |
| | | | | FILL: Silty sand, dark grey, fine grained, dense and moist with rootlets | 080508-104-KW | Push Tube | | |
| | | | | FILL: Sand, pale brown/grey, fine to medium grained, silt lenses and moist to wet | | | | |
| 2 | | | | SILTY SAND: Silty clayey sand, brown/grey, fine to medium grained, wet, soft with H2S odour. Saturated from 1.4-2.5m | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, dense and moist | | | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329703.000

**Project:** ESA **Northing:** 6243361.425

**Client:** Boyd Cooks Cove **Elevation:** 1.40

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH237**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand topsoil, dark brown, fine grained, loose, moist with roots | 060508-27-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, silty clay lenses at 1.0-1.2m, moderately dense, moist and shells | | | | |
| 1 | | | | FILL: Silty clay lense, grey, moist and dense | 060508-28-KW | Push Tube | | |
| | | | | FILL: Silty sand, dark brown, fine to medium grained, moist with rootlets | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, dense, moist with shells. Saturated at 1.7m | | | | |
| 2 | | | | SILTY SAND: Silty clay sand, dark grey, fine to medium grained, moderately dense, wet and H2S odour | 060508-29-KW | Push Tube | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329743.172

**Project:** ESA **Northing:** 6243375.462

**Client:** Boyd Cooks Cove **Elevation:** 1.22

**Location:** Cooks Cove - Area A

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**Environmental Log: ABH238**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand topsoil, dark brown, fine grained, loose, moist with roots | 060508-24-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, loose, moist with shells at 0.7m | 060508-23-KW | Push Tube | | |
| | | | | FILL: Silty clay, grey/brown, moist and oderately dense | | | | |
| 1 | | | | FILL: Sand, pale grey, fine to medium grained, dense and moist | 060508-25-KW | Push Tube | | |
| | | | | FILL: Silty clay, grey/brown, fine to medium grained and moderately dense | | | | |
| | | | | FILL: Silty sand, dark brown, fine to medium grained, dense and moist | 060508-26-KW | Push Tube | | |
| 2 | | | | FILL: Sand, yellow, fine to medium grained, dense, moist with organic odour | | | | |
| | | | | SILTY SAND: Silty sand with trace clays, brown/grey, moist, dense, organic odour and shells. Saturated from 1.5m | | | | |
| | | | | SILTY SAND: Silty clay sand, dark grey, fine to medium grained with increase in density | | | | |
| 3 | | | | SAND: Sand, pale grey, moist and dense. EOH at 2.8mBGL (targeted depth) | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 06/05/2008

**Drill Model:** Mac200 **Date Completed:** 06/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329791.277

**Project:** ESA **Northing:** 6243361.707

**Client:** Boyd Cooks Cove **Elevation:** 1.04

**Location:** Cooks Cove - Area A

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**Environmental Log: ABH239**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand topsoil, dark brown, fine grained, loose, moist with roots | 080508-121-KW | Push Tube | | |
| | | | | FILL: Crushed sandstone, orange, course grained and white | 080508-122-KW | Push Tube | | |
| | | | | FILL: Sand, pale, brown, fine grained, loose and moist with white shells | | | | |
| 1 | | | | FILL: Silty clay, dark brown, firm and moist | | | | |
| | | | | FILL: Sand, grey, fine to medium grained, silty clay lenses throughout and moist | | | | |
| | | | | SILTY SAND: Silty clay sand, fine to medium grained, brown/grey with H2S odour. Saturated from 1.4 to 1.7m | | | | |
| 2 | | | | SAND: Sand, pale grey, fine to medium grained, wet and very dense | | | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329850.039

**Project:** ESA **Northing:** 6243371.561

**Client:** Boyd Cooks Cove **Elevation:** 1.04

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH240**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, fine grained, loose, moist with roots | 080508-125-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, loose, moist with shells | 080508-124-KW | Push Tube | | |
| | | | | | 080508-123-KW | Push Tube | | |
| | | | | FILL: Silty sand, brown, soft and moist | | | | |
| 1 | | | | FILL: Silty sand, dark grey, firm and moist with trace silty clay lenses | 080508-126-KW | Push Tube | | |
| | | | | FILL: Sand, pale grey, fine to medium grained, dense, moist with slight organic odour | | | | |
| | | | | FILL: Silty clay sand, brown/grey, soft and wet. Saturated from 1.4-1.6m and wet from 1.6-2.0m | | | | |
| 2 | | | | SAND: Sand, pale grey, fine to medium grained, dense and most to wet | | | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329885.967

**Project:** ESA **Northing:** 6243340.325

**Client:** Boyd Cooks Cove **Elevation:** 0.79

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH241**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty clay topsoil, dark brown, loose, moist with rootlets | 080508-127-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, loose, moist with shells and orange mottles | | | | |
| | | | | FILL: Silty clay, orange/brown/grey, soft to firm and moist | 080508-128-KW | Push Tube | | |
| 1 | | | | FILL: Silty sand, dark grey/orange/brown, dense and moist | | | | |
| | | | | FILL: Silty clayey sand, dark brown, soft and moist. Saturated from 1.4-1.9m. Clay contant and stiffness increased with depth | 080508-129-KW | Push Tube | | |
| 2 | | | | SILTY SAND: Silty sand with trace clay, dark grey, fine grained and moist to wet | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, dense and moist | | | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329921.058

**Project:** ESA **Northing:** 6243367.814

**Client:** Boyd Cooks Cove **Elevation:** 0.68

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH242**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, dense with roots | 080508-144-KW | Push Tube | | |
| | | | | FILL: Sand, pale grey, fine grained, dense, moist with orange mottles, rootlets and shells | 080508-146-KW | Push Tube | | |
| | | | | FILL: Crushed brick, orange and dry | 080508-145-KW | Push Tube | | |
| 1 | | | | FILL: Silty sand, brown, fine grained, dense and moist | | | | |
| | | | | SAND: Sand, pale grey, interspersed with thin silty clay layers, moist, firm with H2S odour. Saturated at 1.5-2.0m | | | | |
| 2 | | | | SAND: Sand, pale grey, fine to medium grained, dense and wet | 080508-147-KW | Push Tube | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329975.701

**Project:** ESA **Northing:** 6243350.352

**Client:** Boyd Cooks Cove **Elevation:** 0.82

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH243**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, fine grained, loose, moist with roots | 080508-141-KW | Push Tube | | |
| | | | | FILL: Silty sand, dark brown, fine grained, dense and moist with black charcoal at 0.2m | 080508-142-KW | Push Tube | | |
| 1 | | | | FILL: Silty sand, dark grey, fine grained, moderately dense, moist with course grained, yellow crushed sandstone | | | | |
| | | | | FILL: Sand, pale grey with orange mottles, fine grained, moist to wet and dense | | | | |
| | | | | FILL: Silty sand, dark brown, firm and moist | 080508-143-KW | Push Tube | | |
| 2 | | | | FILL: Silty sand, dark brown, silty clay lenses throughout, dense and moist | | | | |
| | | | | SILTY SAND: Silty clay sand, dark grey, soft and wet | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, dense and moist | | | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329477.016

**Project:** ESA **Northing:** 6243318.888

**Client:** Boyd Cooks Cove **Elevation:** 1.37

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH244**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, fine grained, loose, moist with roots | 070508-90-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, loose, dry to moist | 070508-91-KW | Push Tube | | |
| | | | | FILL: Ash fill, black/grey with sand | | | | |
| 1 | | | | FILL: Silty sand with trace clays, dark grey, soft and moist | | | | |
| | | | | FILL: Ash fill, white gravels, minor sand, moist to wet | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained with silt lenses, moderately dense, moist to wet with H2S odour. Saturated from 1.5-2.7m | 070508-92-KW | Push Tube | | |
| 2 | | | | SAND: Sand, darker grey with minor silt, wet with H2S odour | | | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329519.186

**Project:** ESA **Northing:** 6243321.583

**Client:** Boyd Cooks Cove **Elevation:** 1.19

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH245**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, moist, gravels with roots | | | | |
| | | | | FILL: Sand, dark brown, fine grained, loose with ash | 070508-87-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine grained, loose and moist | 070508-88-KW | Push Tube | | |
| | | | | FILL: Sand, dark brown, fine grained, ash waste and loose | | | | |
| 1 | | | | FILL: Silty sand, dark brown, fine grained, dense and moist | 070508-89-KW | Push Tube | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, loose to moderately dense and moist. Saturated from 1.5-2.8m with H2S odour | | | | |
| 2 | | | | | | | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 07/05/2008

**Drill Model:** Mac200 **Date Completed:** 07/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329557.512

**Project:** ESA **Northing:** 6243322.832

**Client:** Boyd Cooks Cove **Elevation:** 0.94

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH246**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, moist with roots | 070508-84-KW | Push Tube | | |
| | | | | FILL: Sand, pale grey, fine to medium grained, loose, dry and moist | | | | |
| | | | | FILL: Silty sand and trace clay, dark brown, moist and loose | | | | |
| 1 | | | | FILL: Sand, yellow, fine to medium grained, firm and moist | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, firm, moist, with silt lenses and H2S odour. Staurated at 1.4-2.8m | 070508-86-KW | Push Tube | | |
| 2 | | | | | 070508-85-KW | Push Tube | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 07/05/2008

**Drill Model:** Mac200 **Date Completed:** 07/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329615.280

**Project:** ESA **Northing:** 6243323.531

**Client:** Boyd Cooks Cove **Elevation:** 1.60

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH247**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand topsoil, dark brown, roots and dry | 070508-99-KW | Push Tube | | |
| | | | | FILL: Silty sand, dark brown, fine to medium grained, dense, black charcoal and gravels | 070508-98-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, dense with some gravels | | | | |
| 1 | | | | FILL: Sand, pale grey, fine to medium grained, dense, moist with silt lenses and shells | 070508-100-KW | Push Tube | | |
| | | | | SILTY SAND: Silty sand, dark grey/brown, dense, moist with H2S odour. Saturated from 1.5-2.2m | | | | |
| 2 | | | | SAND: Sand, pale grey, fine to medium grained, dense, moist with H2S odour | 070508-101-KW | Push Tube | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 07/05/2008

**Drill Model:** Mac200 **Date Completed:** 07/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329653.717

**Project:** ESA **Northing:** 6243309.430

**Client:** Boyd Cooks Cove **Elevation:** 1.26

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH248**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, trace clay and moist | 080508-105-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, loose, dry to moist with silt lenses and shells | | | | |
| 1 | | | | FILL: Silty clayey sand, fine grained, soft and moist | 080508-107-KW | Push Tube | | |
| | | | | FILL: Silty sand, dark grey, fine to medium grained, trace clay with H2S odour | 080508-106-KW | Push Tube | | |
| | | | | FILL: Sand, pale grey, fine to medium grained, moderately dense and moist | | | | |
| 2 | | | | SILTY SAND: Silty clayey, sand, dark grey, saturated, from 1.7-2.0m. Wet from 2.0-2.3m with H2S odour | | | | |
| | | | | SAND: Sand, pale grey, fine to medium, moderately, moist to wet with H2S odour | 080508-108-KW | Push Tube | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329700.709

**Project:** ESA **Northing:** 6243313.382

**Client:** Boyd Cooks Cove **Elevation:** 1.25

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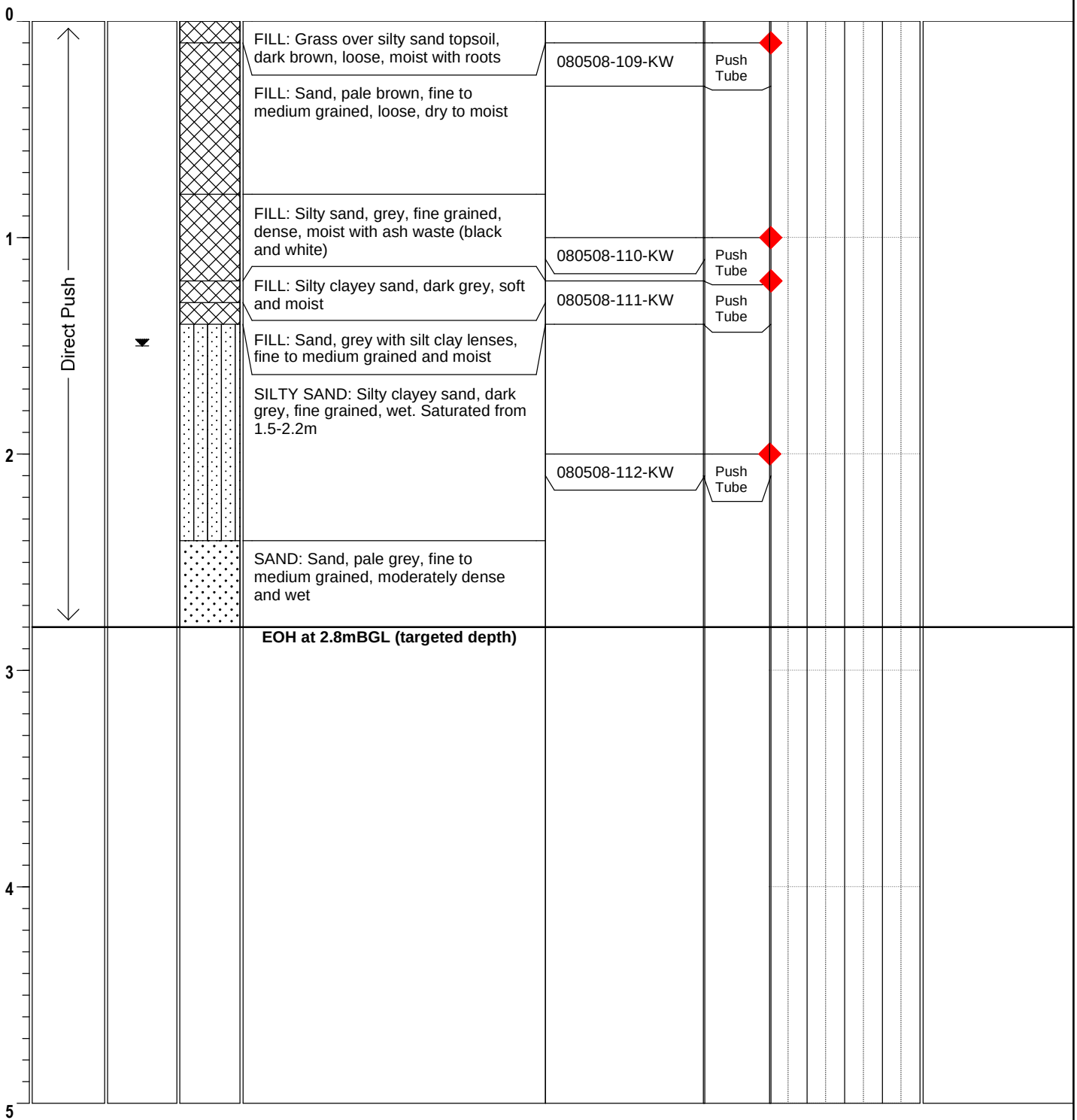
**Location:** Cooks Cove - Area A **Environmental Log:** **ABH249**




**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329744.618

**Project:** ESA **Northing:** 6243326.767

**Client:** Boyd Cooks Cove **Elevation:** 1.28

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH250**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand, dark brown, fine grained, loose and moist with roots | 080508-113-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, loose, dry to moist, shells, black gravels with trace silty clay lenses | | | | |
| 1 | | | | FILL: Ash waste layer, balck/white, wet from 0.9-1.1m | 080508-114-KW | Push Tube | | |
| | | | | FILL: Sailty sand, grey, fine grained, silty clay lenses and moist to wet | | | | |
| | | | | SILTY SAND: Silty clayey sand, fine grained, soft and wet. Saturated from 1.4-2.0m | 080508-115-KW | Push Tube | | |
| 2 | | | | SAND: Sand, pale grey, fien to medium grained, moserately dense, wet with silt lenses | | | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329785.264

**Project:** ESA **Northing:** 6243325.035

**Client:** Boyd Cooks Cove **Elevation:** 1.28

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH251**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand topsiul, dark brown, fine grained, loose and moist with roots | 080508-116-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, loose, moist with shells and orange mottles | | | | |
| 1 | | | | FILL: Silty sand with trace clay, brown, firm and moist with roots | 080508-117-KW | Push Tube | | |
| | | | | FILL: Silty clay, brown, soft and moist | | | | |
| | | | | SILTY SAND: Silty sand with trace clay, saturated at 1.4-2.4m | | | | |
| 2 | | | | SAND: Sand, pale grey, fine to medium grained, dense and wet with trace silt | | | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329839.757

**Project:** ESA **Northing:** 6243324.867

**Client:** Boyd Cooks Cove **Elevation:** 0.93

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH252**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, fine to medium grained, moist with rootlets | 080508-130-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, loose, shells and moist | | | | |
| | | | | FILL: Silty clay, dark brown, soft and moist | 080508-131-KW | Push Tube | | |
| 1 | | | | FILL: Sand, yellow, fine to medium grained, dense and moist with shells | | | | |
| | | | | FILL: Silty clay, dark brown, firm and moist | 080508-132-KW | Push Tube | | |
| | | | | FILL: Silty sand, dark grey, fine to medium grained, dense and moist | | | | |
| 2 | | | | FILL: Silty clayey sand, brown/grey, fine grained, soft and wet from 1.4-2.1m | | | | |
| | | | | SILTY CLAY: Sand, pale grey, fine to medium grained, dense, moist to wet | | | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329882.049

**Project:** ESA **Northing:** 6243319.073

**Client:** Boyd Cooks Cove **Elevation:** 0.83

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH253**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, loose, moist with roots | 080508-133-KW | Push Tube | | |
| | | | | FILL: Sand, fine to medium grained, loose, moist with silt lenses | | | | |
| | | | | FILL: Silty clay, dark brown, soft and moist | 080508-134-KW | Push Tube | | |
| 1 | | | | FILL: Sand, yellow, fine to medium grained, loose and moist | | | | |
| | | | | FILL: Silty clay, dark brown, firm and moist | | | | |
| | | | | FILL: Sand, yellow, fine to medium grained, loose and moist with shells | | | | |
| | | | | FILL: Silty clay, dark brown, soft and very moist | | | | |
| | | | | FILL: Silty sand, dark grey/brown, fine grained and moist | | | | |
| 2 | | | | SILTY SAND: Silty clayey sand, brown, fine grained, soft, moist to wet. Saturated from 1.5-2.4m | 080508-135-KW | Push Tube | | |
| | | | | SAND: Shells with pale grey sand | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, dense and moist | | | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329933.287

**Project:** ESA **Northing:** 6243310.216

**Client:** Boyd Cooks Cove **Elevation:** 0.82

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH254**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty clay topsoil, trace sand, dark brown, firm, moist with roots and shells | 080508-136-KW | Push Tube | | |
| | | | | FILL: Sand, yellow, fine to medium grained, loose to moderately dense, moist with shells | | | | |
| | | | | FILL: Silty sand, dark grey, fine grained, dense and moist | 080508-137-KW | Push Tube | | |
| 1 | | | | FILL: Silty sand, dark grey, soft and wet to 0.6m | | | | |
| | | | | FILL: Silty sand, dark grey/brown mottled silty clay lenses, soft and moist to wet | | | | |
| | | | | FILL: Sand yellow, fine to medium grained, dense, shells and moist | | | | |
| 2 | | | | SILTY SAND: Silty clayey sand, grey, soft and wet. Saturated from 1.5-2.0m then wet | | | | |
| | | | | SILTY SAND: Ilty sand with trace clay, grey, rootlets, dense and moist | 080508-138-KW | Push Tube | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329978.015

**Project:** ESA **Northing:** 6243308.488

**Client:** Boyd Cooks Cove **Elevation:** 0.77

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH255**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand topsoil, dark brown, dense, moist with roots | 080508-139-KW | Push Tube | | |
| | | | | FILL: Sand, yellow/pale brown, fine grained, danse with large shells | | | | |
| | | | | FILL: Silty clay, dark brown, firm and moist | | | | |
| | | | | FILL: Sand, pale grey, fine to medium grained, loose to moderately dense, moist with silt lenses | | | | |
| 1 | | | | FILL: Silty clay, brown, soft and wet | 080508-140-KW | Push Tube | | |
| | | | | FILL: Silty sand, silty clay lenses throughout, dark grey, dense and moist to wet | | | | |
| | | | | SAND: Sand, pale grey, fine to medium grained, moist and dense | | | | |
| 2 | | | | SILTY SAND: Silty clayey sand, dark grey, soft and wet. Saturated from 1.5-2.1m | | | | |
| | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 08/05/2008

**Drill Model:** Mac200 **Date Completed:** 08/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329467.368

**Project:** ESA **Northing:** 6243267.568

**Client:** Boyd Cooks Cove **Elevation:** 1.04

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**Location:** Cooks Cove - Area A **Environmental Log:** **ABH256**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | | | FILL: Grass over silty sand, brown, moist with roots | 120508-264-KW | Push Tube | | |
| | | | | FILL: Sand, pale brown, fine to medium grained, loose, moist with roots | | | | |
| | | | | FILL: Silty sand, dark brown, fine grained, dense and moist | | | | |
| 1 | | | | SAND: Sand, pale grey, fine to medium grained, moderately dane, silt lenses, Wet from 1.5-2.6m with slight H2S odour at 2.0m | 120508-265-KW | Push Tube | | |
| 2 | | | | | 120508-266-KW | Push Tube | | |
| | | | | SILTY SAND: Silty sand, brown, fine grained, dense and moist | | | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 12/05/2008

**Drill Model:** Mac200 **Date Completed:** 12/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins

**Project ID:** CES050706-BCC **Easting:** 329513.168

**Project:** ESA **Northing:** 6243272.842

**Client:** Boyd Cooks Cove **Elevation:** 1.65

**Location:** Cooks Cove - Area A

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**Environmental Log:** **ABH257**

| DRILLING INFO. | | | LITHOLOGY | | SAMPLING INFORMATION | | | WELL DETAIL |
|---|---|---|---|---|---|---|---|---|
| Depth | Method | Water | Symbol | Description | Sample ID | Type | FID/PID (ppm) 0 250 500 750 | |
| 0 | Direct Push | ▼ | | FILL: Grass over silty sand topsoil, dark brown, fine grained, loose, moist with roots | 120508-254-KW | Push Tube | | |
| | | | | FILL: Silty sand with trace clay, dark brown, medium grained, dense, moist with roots and gravels at 0.4-0.5m | 120508-255-KW | Push Tube | | |
| 1 | | | | SAND: Sand, pale grey, medium grained, dense, moist to wet with silt lenses. Saturated from 1.4-2.2m | | | | |
| 2 | | | | | 120508-256-KW | Push Tube | | |
| 3 | | | | **EOH at 2.8mBGL (targeted depth)** | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Drill Company:** Macquarie Drilling **Date Commenced:** 12/05/2008

**Drill Model:** Mac200 **Date Completed:** 12/05/2008

**Hole Diameter (mm):** 50 **Logged/checked by:** K.Weir/L.Jenkins