Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Preliminary Remediation Action Plan

Cockle Bay Park Redevelopment
241-249 Wheat Road, Sydney

Prepared for
DPT Operator Pty Ltd

Project 202546.03
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Douglas Partners
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1. Introduction

1.1 General

Douglas Partners Pty Ltd (DP) has been engaged by DPT Operator Pty Ltd to complete this Preliminary Remediation Action Plan for the Cockle Bay Park redevelopment at 241-249 Wheat Road, Sydney (the site). The site is shown on Drawing 1, Appendix A.

This preliminary remediation action plan (RAP) describes the data gap investigations which are required to assess the contamination risks at the site and general procedures required to remediate the site if the data gap investigation identifies contamination.

The work was carried out in general accordance with Douglas Partners' (DP) proposal (202546.02.P.002) dated 8 April 2022.

It should be noted that this preliminary RAP does not form a specification for the proposed site remediation works, but rather represents a planning document which outlines the means by which site remediation could be achieved once the data gap investigation has been undertaken. This RAP must not be used to remediate the site unless, following the data gap investigation, DP determines that further revision of the RAP is not warranted.

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

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

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

1.2 Objective and Scope

The objective of this preliminary RAP is provide the general procedures for the anticipated remediation and management of potential contaminants at the site in an acceptable manner, with minimal environmental and health impacts and to a condition suitable for the proposed development. At this stage given the limited available data, which is a result of the limited site access which will not substantially be improved until after demolition works have commenced / been completed, a detailed RAP cannot be prepared.

Given the preliminary nature of this RAP the primary purpose is to outline the data gap investigations that are required and to provide unexpected finds protocols. Following the completion of the data gap investigations the preliminary RAP will require revision.

The strategy therefore aims to:

- Minimise impacts from the site works on the environment and on public health and safety during redevelopment works;
- Maximise the protection of workers who may be present at the site during these works; and
- Render the site suitable for the proposed land use.

In this regard, the objectives of the preliminary RAP are to:

- Establish an appropriate remediation strategy so as to render the site suitable, from a site contamination perspective, for the proposed development;
- Establish the remediation acceptance criteria to be adopted for the site and the validation requirements to confirm the successful implementation of the remediation strategy;
- Inform appropriate environmental safeguards required to complete the remediation works in an environmentally acceptable manner; and
- Inform appropriate work health and safety (WHS) procedures required to complete the remediation works in a manner that would not pose a threat to the health of site workers or users.

Acid sulfate soil (ASS) has been identified in fill and natural soils at the site. A separate acid sulfate soil management plant (ASSMP) will be required upon completion of the proposed data gap investigations outlined in this plan. The presence of ASS impacts the waste classification and on-site management of the affected materials.

Following the completion of the data gap investigations the following additional plans / reports are anticipated to be required:

- Revisions to this preliminary RAP;
- An acid sulfate soil management plan:
- A long-term environmental management plan to manage lead impacted soils below the concrete pavement in the vicinity of borehole CP1 (and any additional contaminants that are proposed to be capped / left in place);
- Preparation of a sediment management plan to provide procedures to limit the impacts of disturbing soils / sediments around the harbour foreshore; and
- A dewatering management plan.

1.3 Previous Reports

The following previous reports are relevant to the current investigation:

- Preliminary Site Investigation Report, DPT and DPPT Operator Pty Ltd c/- Enstruct, Group Pty Ltd *Proposed Development at Cockle Bay Park, Preliminary Site Investigation* dated 25 August 2017. Prepared by Coffey (Coffey 2017);
- *Cockle Bay Park Historical Archaeological Assessment*, report prepared for DPT and DPPT, August 2017. Prepared by GML Heritage (GML 2017);
- Appendix R, *Report on Geotechnical Investigation, Cockle Bay Park Redevelopment, 241-249 Wheat Road, Sydney*, Prepared for DPT Operator Pty Ltd Project 202546.00, December 2021, Rev1 (DP 2021a); and
- Appendix K *Report on Contamination Investigation, State Significant Development, Development Application (SSD DA), Cockle Bay Park Redevelopment, 241-249 Wheat Road, Sydney*, Prepared for DPT Operator Pty Ltd and DPPT Operator Pty Ltd Project 202546.00, October 2021 (DP 2021b).

1.4 Site Identification

Site Address	241-249 Wheat Road, Sydney
Legal Description	Lots 12 and 17, DP801770, Lots 60 and 65, DP1009964 and Part Lot 42, DP864696
Area	Approximately 21,000 m^2 as defined by the development outline on Drawing 1, Appendix A
Zoning	Darling Harbour Development Plan No 1
	Zone SP2 Infrastructure (Classified Road)
Local Council Area	City of Sydney Council
Current Use	Commercial and Open Space
Surrounding Uses	North - Pyrmont Bridge, a two storey bar and café and Sydney Aquarium. East - Western Distributor and commercial office towers. South - Western Distributor and site of former IMAX. West - A marina and Darling Harbour.

The main site features and the site boundary are shown on Figure 1.

Figure 1: Site Location

1.5 Proposed Development

The proposed scope of works includes the demolition of the existing Cockle Bay Wharf building and pedestrian bridge for the progression of a new proposed development. The existing Cockle Bay Wharf deck structure along the Harbour foreshore will be retained and used as a platform for the construction of the proposed podium structure. The proposed development includes several major components with proposed foundations as summarised below:

- Podium structure on Cockle Bay Wharf:
  - Low rise retail podium structure on Cockle Bay Wharf;
  - Reinforced concrete columns with an estimated column working load of 5 MN;
  - Superstructure proposed to be transferred at ground level onto a regular pile foundation grid.

- Tower structure:
  - 43 storey high rise commercial office tower located on the east side of the podium;
  - Reinforced concrete columns with an estimated column working load of 130 MN;
  - Columns proposed to be founded on pile groups of large diameter socketed in high strength rock with tower core to be founded on a piled 1.5 m deep raft; and
  - Raking piles proposed to be used to support lateral tower forces.
- Land bridge spanning across the existing Western Distributor:
  - Deck structure connecting the new podium structure on Cockle Bay Wharf with the existing Darling Park towers;
  - The deck structure will cover the area of Western Distributor between the new development and the Darling Park towers;
  - Reinforced concrete columns with an estimated column working load of 35 MN and ultimate horizontal impact load of 2.7 MN; and
  - Proposed to be founded on pile or pad foundations.

Temporary excavations are required adjacent to existing Harbour Street for the construction of core rafts, lift pits, large ground floor set-downs and loading docks.

It is understood that a bulk excavation to approximately 6 m depth will also be required towards the southern end of the proposed development to accommodate a large in-ground fire water tank.

The broad elements of the proposed development are presented in **Figure 2**.

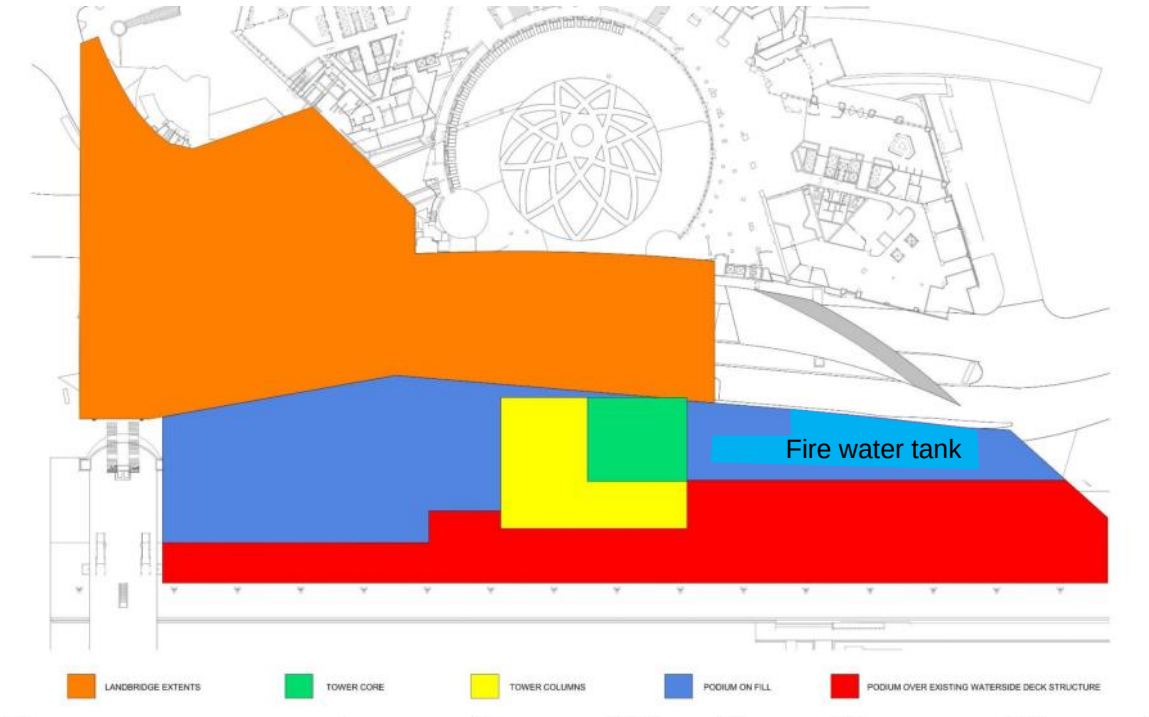


Figure 2: Proposed Development

2. Site Information

2.1 Site Description

Cockle Bay Park is located at 241-249 Wheat Road, Darling Harbour, currently occupied by the existing Cockle Bay Wharf precinct. The site comprises an irregular shaped area of about 21,000 m^2, the general layout of which is shown on Drawing 1 in Appendix A. The site is bound by Darling Harbour to the west, Pyrmont Bridge to the north and The W Hotel to the south. The northern end of the site extends out to the east, across the Western Distributor, to the existing Darling Park Towers. The areas north, south, and west of the existing building are typically paved public walkways. Loading docks and back-of-house facilities are located on the eastern side of the building.

The existing Cockle Bay Wharf building is generally used for retail purposes. The existing developments surrounding the site are a combination of retail and commercial office spaces.

An existing sheet pile sea wall is located beneath the site, running roughly north south, with the western portion of the site supported on a suspended deck which extends out over Darling Harbour, the surface of which is at about RL 2.2 m AHD. The approximate location of the existing sheet pile wall is shown on Drawings 4, 5 and 6.

The following features were noted during the PSI (Coffey 2017):

- Cockle Bay Wharf, which is part of the Darling Harbour Entertainment Precinct, is located on the site;
- The site consists of two buildings (referred to as the northern and southern building herein) which are occupied by cafes and restaurants on both the ground floor and the first floor. The two buildings are connected through an aboveground walkover in the middle. Two spiral staircases are also noted on either sides of the site;
- Both buildings appear to be concrete structures with tiles used in part of the buildings as decoration;
- The site surface is either paved with brick or concrete. A water feature is located in the open area between the two buildings;
- No major cracks were observed on the concrete floor within the site at the time of the site walkover. The general housekeeping practices appeared reasonable;
- Amenities facilities were located in the eastern portion of the buildings. Each building contains its own locking dock, air conditioning plant room, fire control room, electrical sub-station and switch room;
- The cleaner office was located within the air conditioning plant room in the northern building. Storage of general commercial cleaning products were noted during the site walkover;
- Recycling facilities were located with the loading docks. Potable gas cylinders were noted to be stored with the docking docks. No major cracking or staining was observed in the two loading docks at the time of site visit;
- There were two storage areas within the site: the first one located in the open area between the building which was used to store potable gas cylinders and restaurant furniture. The second storage area was located under the southern building where waste bins and potable gas cylinders were noted;

- The telecommunication room was located on the first floor of the northern building;
- Two chillers were located on the balcony level; and
- No underground storage tanks were identified at the site. No aboveground storage tanks, other than portable liquefied petroleum gas (LPG) cylinders, were noted during site visit. No fill points or vent pipes that may associated with underground storage tanks were noted during the site walkover.

The condition of the site has not changed substantially since 2017.

2.2 Geology, Topography, Hydrogeology and Regional Groundwater

2.2.1 Topography

The ground surface is relatively level to the east of the existing Cockle Bay Wharf precinct, with surface levels at or about reduced level (RL) 3 m relative to Australian Height Datum (AHD). The ground surface falls away into the harbour to the west of the existing precinct, with the bottom of the harbour at about RL -5 m AHD. The foreshore deck continues over the water to the west of the precinct, at about RL 2.2 m AHD.

2.2.2 Geology and Soil Landscape

The Sydney 1:100 000 Geological Series Sheet indicates the site spans across the boundary between Hawkesbury Sandstone (medium to coarse-grained sandstone with minor shale and laminate lenses) on the eastern side of the Western Distributor and Quaternary-aged alluvial and estuarine sediment (silty/peaty sand, silt, clay, common shell layers) on the western side of the Western Distributor. The area south of Darling Harbour is mapped as having man-made fill placed over the Quaternary-aged sediments, resulting from historical land reclamation works. A review of mapping suggests that no geological structures such as major fault zones or dykes cross the site.

The Sydney 1:100 000 Soils Landscape Sheet indicates the site spans across the boundary between 'Disturbed Terrain' on the western side of the Western Distributor and erosional sandy soils on the eastern side of the Western Distributor. 'Disturbed Terrain' is considered to have been extensively altered by anthropogenic influences, likely by placement of land fill material (soil, rock, building and waste materials). Based on the previous reports (refer to Section 6), it is understood that fill has been placed to raise surface elevations allowing the expansion of the foreshore as part of land reclamation works carried out mainly between the 1820s to 1890s, with minor infilling and straightening undertaken in the 1900s to 1910s.

The geotechnical investigation, DP (2021a) includes an interpreted subsurface profile based on the conditions encountered at borehole locations which was grouped into six geotechnical units. The location of the boreholes is presented on Drawing 1, Appendix A. The borehole logs are provided in Appendix B.

Six geotechnical cross sections (Section A-A', B-B', C-C', D-D', E-E' and F-F') showing the interpreted subsurface profile between the borehole locations are shown in Drawings 2 to 7 in Appendix A.

It should be noted that the subsurface profile will likely vary away from and in between the borehole locations due to the high variability observed. The interpreted boundaries are accurate only at the test locations and are indicative only.

UNIT 1: FILL Comprises apparently moderately compacted road base beneath road pavements at the surface, underlain by sands, gravelly sands, silty sands, clayey sands, sandy gravels, and sandy clay uncontrolled fill with building rubble (bricks, concrete fragments, timber, metal) and sandstone gravel and cobbles. The fill generally appeared to be in a loose condition most likely a result of 'end-tipped' placement.

UNIT 2: ESTUARINE / MARINE SEDIMENTS Typically comprised of clays, silty clays and sandy clays interbedded with sands, silty sands and clayey sands. The clayey material is generally very soft to firm, tending towards a firm to stiff consistency with increasing sand content. The sandy material appears generally very loose to loose, apparently becoming medium dense to dense with reduced fines content.

UNIT 3: VL-L SANDSTONE Generally very low and low strength, highly to moderately weathered medium to coarse grained sandstone.

UNIT 4: L-M SANDSTONE Low and medium strength, slightly to highly weathered, slightly fractured to fractured medium to coarse grained sandstone, with occasional bands of highly weathered very low strength sandstone.

UNIT 5: M-H SANDSTONE Medium and high strength, slightly weathered and fresh, slightly fractured and unbroken, medium to coarse grained sandstone.

UNIT 6: L-M SILTSTONE: Dark grey, low to medium strength, slightly weathered to fresh siltstone band and interbedded siltstone and sandstone.

Uncontrolled fill material of varying thickness across the site is underlain by estuarine / marine sediment deposits. The thickness of the fill material retained by the existing sea wall appears to decrease towards the eastern end of the site. It is apparent that some fill material was tipped over the western side of the sea wall in some locations forming part of the Darling Harbour seabed. The thickness of the estuarine sediments appears to be greatest along the western edge of the site (beneath the foreshore deck), with thickness tapering away towards the eastern edge. Near SS1 and SS2, the site is underlain by probable ripped sandstone fill material underlain directly by sandstone bedrock.

The interpreted surface of the top of sandstone bedrock generally dips downwards towards the west towards Darling Harbour, with the shallowest depth to rock encountered along the eastern end of the site (SS1, RL 1.3 m) and the deepest depth to rock at the western edge of the site (W2, RL -18.2 m).

Along the western half of the site (the waterfront) the depth to the top of rock within the boreholes also generally falls towards the centre of the site along a north-south alignment, from RL -6.5 m and RL -11.0 m AHD at the northern (CW4) and the southern (CW5) end of the site respectively, to RL -17.5 m in the centre (CW1). This trend persists towards the east of the proposed tower core location towards CP2. However, it is noted that the changes in the rock head elevation are unlikely to be gradual, and sudden changes may occur over relatively short distances due to the presence of buried cliff lines.

2.2.3 Acid Sulfate Soils

Acid Sulfate Soils (ASS) Risk Mapping by the NSW Department of Planning Industry and Environment identifies the site to span across the boundary between a 'High Probability of Occurrence' along the eastern shoreline and Class 2 zone over the majority of the site. There is a high probability of encountering potential or actual ASS if the Darling Harbour bed is disturbed.

DP (2021b) included a preliminary acid sulfate soil investigation. Nine samples (two fill and seven from the alluvial soils) were subject to laboratory analysis for the chromium reducible suite. An action criteria of 0.03% S was adopted on the basis that that material included coarse material and greater than 1000 tonnes of material is expected to be disturbed.

The net acidity of all seven samples tested exceeded the action criteria of 0.03% S as below:

- CP2/1.9-2.0 (fill soil) - 0.09% S;
- CP2/2.9-3.0 (alluvial) - 0.05% S;
- CW1/13-13.45 (alluvial) - 0.12% S;
- CW2/9-9.15 (alluvial) - 2.1% S;
- CW5/5.5-9.5 (alluvial) - 1.4% S;
- W3/11.5-11.95 (alluvial) - 0.74% S;
- W3/14.5-14.95 (alluvial) - 0.04% S; and
- WD1/1.9-2.0 (fill) - .0.074% S.

Based on the results a preliminary liming rate was provided in the laboratory certificate ranged between 1 kg and 100 kg aglime per tonne.

Therefore, it was considered that both the fill material and the alluvial soils are potential acid sulfate soils (PASS) and require management and the preparation of an acid sulfate soil management plan (ASSMP). It was considered possible that some of the fill materials above the water table are potentially not PASS, however at this stage it should be assumed that all the fill is PASS.

It was recommended that, post demolition, additional high resolution investigations be undertaken within the proposed excavation zones (the commercial tower and proposed fire water tank) with a high density of laboratory tests (vertically and horizontally) to assess the lateral and vertical extent and nature of acid sulfate soils. Alternatively further testing can be undertaken ex situ as materials are excavated. Following the completion of the high resolution testing a ASSMP can be prepared.

2.2.4 Hydrogeology

Darling Harbour is located to the west of the site, which joins Sydney Harbour to the north. It is anticipated that the inferred groundwater flow is in a general to the west into Cockle Bay.

Based on information provided in Coffey (2017), there are no groundwater monitoring bores located within a 500 m radius of the site. A search of the publicly available registered groundwater bore database on 25 August 2021 also indicated that there are no groundwater monitoring bores within 500 m of the site.

Given the proximity of the site to Darling Harbour, it is expected that the groundwater table beneath the site is relatively shallow and is influenced by tidal movement.

The ground is generally level across the site. It is likely that drains and gutters in the buildings are connected to the stormwater system or directly into Darling Harbour. The entire site is covered with pavers and the building and as such there are no areas for infiltration of precipitation or stormwater runoff.

DP (2021b) included a preliminary groundwater investigation. Groundwater levels were gauged on 2 or 3 September 2021 prior to sampling using an electronic oil / water interface meter. The measured water levels prior to sampling are shown in **Table 1**.

Table 1: Summary of Groundwater Level Measurements on 9 October 2021

Well ID	Location of Monitoring Well	Ground Level * m (AHD)	SWL m (bgl)	SWL m (AHD)
CW2	Centre of site	2.9	2.97	-0.07
CW3	Centre of Site	3.1	2.81	0.29
CW5	Southern Side	2.8	2.98	-0.18
CW6	Northern Side	3.0	2.89	0.11
CP2	Eastern (up-gradient)	2.5	4.39	-1.89
SS2	North-eastern (up-gradient)	3.5	3.55	-0.55

Notes:
*Surveyed by dGPS
AHD - Australian Height Datum
SWL - standing water level
bgl - below ground level

It is noted that groundwater levels are transient and may fluctuate over time in response to climatic variations, tides, and anthropogenic influences. It is expected that the groundwater level at this site will be closely related to the tidal water level in Darling Harbour. The results of groundwater testing are discussed in Section 3.4.

2.3 Site History

Coffey (2017) was a preliminary contamination assessment comprising a site history investigation, a site walkover and report. Coffey (2017) provided the following summary of the site history.

The earliest historical records indicate that the site was used as for heavy industrial uses and a working dock from the late 1880s to the 1960s, including shipyard, timber yard, warehouse, engineering workshop and garage. Heavy industrial activities ceased in the 1960s when most of the buildings were demolished. Between the 1960s to the early 1980s the site was still used as a shipping

dock but it appears that most of the heavy industries had moved out of the CBD area during this period. The western portion of the site was progressively reclaimed between the late 1880s to the 1980s. The finger wharves that were historical located on this part of the Darling Harbour foreshore were demolished by the early 1990s.

The foreshore layout was in its current form since 1991, with the Cockle Bay Wharf constructed between 1991 and 2000. No significant changes to the use of the site and surrounding area since 2000.

The surrounding area was predominately used for heavy industrial purposes to support the working dock until around the early 1980s. The area to the east of the site has been developed for office and retail uses since the 1980s. An automotive garage was identified in the northern portion of the site.

The site has been occupied by cafes and restaurants since the early 1990s. Based on information provided to Coffey and site observations, the amount of chemicals that are currently stored on-site are restricted to general cleaning products and cooking oils. The site surface is paved therefore top down impacts associated with spills are unlikely.

GML (2017) details the aboriginal and European heritage and archaeology of the site. The key findings of this report as it relates to this assessment include:

- Prior to European settlement the site formed part of the lands of the Cadigal clan of the Darug;
- The first European settlement was established in 1804 and by 1811 Market Wharf had been commissioned;
- The first industry was established in the Darling Harbour area in the 1820s;
- The Pyrmont Bridge was erected in 1857;
- The area continued to operate as working shipyard and dock from the late 1800s to 1960s. Industries included a timber yard, warehousing, shipping, engineering, vehicle and ship maintenance;
- The wharves underwent several periods of redevelopment and land reclamation; and
- The site was redeveloped for primarily office, restaurant and retail use in the 1980s and 1990s.

2.4 Summary of Previous Results

2.4.1 Soils

DP (2021b) included preliminary soil testing conjunction with the geotechnical investigation (DP 2021a). The proposed development includes a combination of public open space and commercial properties. Therefore, the results were compared to both the open space and commercial / industrial land use criteria.

BTEX (benzene, toluene, ethyl benzene and xylenes), organochlorine pesticides (OCP), organophosphate pesticides (OPP), polychlorinated biphenyls (PCB), volatile organic compounds (VOC), and phenols were below the laboratory limits of reporting in all samples tested.

No asbestos was observed or reported by the laboratory analysis. However, given the presence of building demolition materials in the fill, such as concrete and bricks, it is considered that the risk of asbestos being present is high and consideration for the risk of asbestos should be adopted during planning and proposed soil management.

The majority of heavy metals, polycyclic aromatic hydrocarbons (PAH) and total recoverable hydrocarbons (TRH) were below the adopted site acceptance criteria (SAC) for both open space and commercial / industrial land use with the exception of those listed in Table 2.

Table 2: Soil Exceedance

Analyte	SAC	Sample ID	Concentration (mg/kg)	Comments
Open Space				
Copper	EIL 240 mg/kg	W3/10.75-11.2 W5/8.8-9.23 CW4/2.5-2.95 CW6/3.8-4.25	310 410 440 320	With the exception of copper and lead ecological investigation level (EIL) exceedances at CW4, CW6, CP1 and WD1 all heavy metal and TRH exceedances were from boreholes drilled through the suspended decking of the wharf over the water. The proposed project may include new or reinforced foundations for the proposed podium structure that will sit over the water. With respect to the project area there is no direct exposure pathway to the alluvial soils below the suspended structure and therefore are not considered to warrant remediation in respect of the proposed development. Furthermore, remediation of the alluvial materials below the harbour is beyond the scope of the project and would be of little benefit in isolation to the rest of the harbour. The EIL exceedances at CW4 and CW6 are not considered significant due to the depth > 2m. With regards to HIL and EIL lead exceedances at CP1 these test locations are located below the proposed land bridge and were drilled primarily for geotechnical
Lead	HIL 600 mg/kg and EIL 1100 mg/kg	W4/10 W1/8-8.45 CP1/1-1.1 CP1/2-2.1 WD1/1.9-2.0	1200 1600 3900 2500 1500	
Lead	HIL only 600 mg/kg	W3/10.75-11.2 W5/8.8-9.23	810 880	
Zinc	EIL 820 mg/kg	W3/10.75-11.2 W4/10 W5/11.5-11.95	1100 1000 1400	
TRH C6-C10	ESL 120 mg/kg	W3/10.75-11.2 W5/8.8-9.23	180 200	
TRH C16-C34	ESL 300 mg/kg	W4/10 W3/10.75-11.2 W5/8.8-9.23	310 3000 4900	
TRH C16-C34	ESL 300 mg/kg Management Limit 2500 mg/kg	W3/10.75-11.2 W5/8.8-9.23 WD1/0.4-0.5	3000 4900 4000	

Analyte	SAC	Sample ID	Concentration (mg/kg)	Comments
				and waste classification purposes. Soil exceedances at the surface will not impact upon the proposed land bridge as there will be no direct exposure pathway from the surface soils to the land bridge. However, it would be recommended that the presence of elevated lead be noted in an environmental management plan. With regards to the lead exceedance at WD1, WD1 is part of the road reserve for the western distributor and therefore not considered a recreational open space. Therefore, the exceedance of the Open Space criteria is not considered significant. The ESL exceedance of TRH C16-C34 at WD1/0.4-0.5 is not considered significant as this test location is adjacent to the Western Distributor and exposure to ecological receptors would be limited.
Benzo (a) pyrene ESL 0.7 mg/kg		CW4/0.9-1.0 CW6/0.5-0.6 BD1/20210633* W4/10 CW5/2.0 W1/10-10.43 W1/8.0-8.45 W3/10.75-11.2 W5/8.8-9.23	0.75 1.6 1.9 0.96 2.3 0.71 0.95 6.4 26.0	Not considered significant, see below
Benzo (a) pyrene TeQ HIL 3 mg/kg		CW5/2.0 W3/10.75-11.2 W5/8.8-9.23	3.2 8.9 35	Material at CW5/2.0 will be excavated for the proposed fire tank. Moreover, the land use at CW5 would be considered commercial and therefore an exceedance of the open space criteria is not considered relevant

Analyte	SAC	Sample ID	Concentration (mg/kg)	Comments
				W3 and W5 were collected from boreholes drilled through the wharf which is suspended over the water and the samples collected from the underlying harbour floor Exposure to contaminants below the suspended deck of the wharf are not considered significant with regards to the proposed development and remediation of the harbour floor is outside the scope of the project
Commercial / Industrial				
Copper	EIL 330 mg/kg	W5/8.8-9.23 CW4/2.5-2.95	410 440	With the exception of CW4 and CP1 all these samples were collected from boreholes drilled through the wharf which is suspended over the water and the samples collected from the underlying harbour floor. Given the depth from the surface (>2 m with the exception of CP1/1-1.1) or below the harbour exceedances of the EIL are not considered significant. Given the scope of the project and depth of the sample at W1 the risk to human health related to the lead HIL exceedance is considered insignificant to the proposed overland use. Remediation of the sediments and Cockle Bay is considered to be beyond the scope of the project. With regards to lead exceedances at CP1 this test location is located below a concrete slab and the proposed land bridge/western distributor
Lead	HIL 1500 mg/kg	W1/8-8.45	1600	
Lead	HIL 1500 mg/kg & EIL 1800 mg/kg	CP1/1-1.1 CP1/2-2.1	3900 2500	
Zinc	EIL 1200 mg/kg	W5/8.8-9.23	1400	
TRH C6-C10	ESL 170 mg/kg	W3/10.75-11.2 W5/8.8-9.23	180 200	
TRH C16-C34	ESL 1700 mg/kg	W3/10.75-11.2 W5/8.8-9.23	3000 4900	
TRH C16-C34	ESL 1700 mg/kg Management Limit 3500 mg/kg	W5/8.8-9.23 WD1/0.4-0.5	4900 4000	

Analyte	SAC	Sample ID	Concentration (mg/kg)	Comments
				and was drilled primarily for geotechnical and waste classification purposes. Soil exceedances at the surface will not impact upon the proposed land bridge as there will be no direct exposure pathway from the surface soils to the land bridge. However, it would be recommended that the presence of elevated lead be noted in an environmental management plan. The ESL exceedance of TRH C16-C34 at WD1/0.4-0.5 is not considered significant as this test location is adjacent to the Western Distributor and exposure to ecological receptors would be limited.
Benzo(a)pyrene	ESL 1.4 mg/kg	CW6/0.5-0.6 BD1/20210633* CW5/2.0 W3/10.75-11.2 W5/8.8-9.23	1.6 1.9 2.3 6.4 26.0	Not considered significant, see below

* replicate of above sample

In the investigation, nine samples had a concentration of B(a)P that exceeded the open space ESL of 0.7 mg/kg. It is noted that the B(a)P ESL is a low reliability value. Higher reliability screening levels have been published in CRC CARE *Risk-based Management and Remediation Guidance for Benzo(a)pyrene* (CRC CARE, 2017). The high reliability value of 33 mg/kg (or ranging from 21 mg/kg to 135 mg/kg) for fresh B(a)P suggests that the concentrations of B(a)P detected at the site are unlikely to pose an unacceptable risk to terrestrial ecology and therefore the exceedance(s) are not considered to be of concern. In regard to W5/8.8-9.23, which had a B(a)P concentration of 26 mg/kg the sample was collected from borehole through the deck of the wharf and was 8.8 m below the "surface level" of the decking and 2.05 m below the surface of the harbour floor. Therefore, the ESL are not considered applicable and as noted previously remediation of the harbour sediments is beyond the scope of the project.

Tributyl tin (TBT) was detected in boreholes drilled over the harbour (W1/8-8.45 - 3 µg/kg, W3/10.75-11.2 - 83 µg/kg and W5/11.5-11.95 - 85 µg/kg). It is likely that TBT is present sporadically within alluvial and fill materials along the shoreline. TBT was not detected in other locations in limited testing (eight samples collected from CW1, CW2, CW4, CW5, CP2, WD1 and WD3) and therefore it is considered likely that TBT impacts are limited to the near shore, however the extent of TBT impacts cannot be confirmed based on the limited analysis. Materials containing TBT must be handled in accordance with the Environmentally Hazardous Chemical Act 1985, Chemical Control Order in Relation to Organotin Waste. Further testing on materials during excavation or following demolition would be required to confirm if TBT is present.

The investigation concluded that remediation and preparation of a RAP in respect to soil contamination is not considered to warranted. However, it was recommended that as a minimum an unexpected finds protocol be prepared to appropriately manage potential risk associated with the excavation and disturbance of soils at the site, particularly those below the suspended wharf. It is also noted that given the limited access within the centre of the proposed podium section (on fill) increases the uncertainty. It was also recommended that an environmental management plan be prepared to address the elevated lead in the vicinity of CP1.

Furthermore, given the preliminary nature of the investigation and limited number of boreholes it was recommended that further investigations be undertaken, particularly in the footprint of the proposed commercial tower and fire tank.

The preliminary waste classification is summarised in Section 2.5

2.4.2 Groundwater Results

The results of VOC, BTEX, PAH, OPP, OCP, speciated phenols (including cresols) were all below the laboratory limits of reporting and SAC with the exception of:

- Chloroform in SS2 at a concentration of 2 µg/L. Within the SAC of 370 µg/L but above the limit of reporting; and
- Dieldrin (OCP) in SS2 at a concentration of 0.04 µg/L exceeding the 0.01 µg/L SAC (which is derived from the fresh water unknown reliability guideline.

It is noted that SS2 is located in the north-eastern corner of the site below the proposed land bridge and given its location on the upgradient site boundary may be derived from an up-gradient source. It is noted that chloroform and dieldrin were not detected in CW4 or CW6 suggesting the extent of such impacts are limited and do not extend to the proposed excavation zones and in that regard are unlikely to impact the dewatering of these features. Therefore, no action is required in regard to these detections.

TRH was detected in two locations CW5 and CW6 as follows:

- C_{10}-C_{16} (77 µg/L and 52 µg/L respectively);
- C_{16}-C_{34} (350 µg/L in CW6);
- F2 (77 µg/L and 52 µg/L respectively); and
- C_{15}-C_{28} (140 µg/L and 370 µg/L).

It was noted there are no SAC for the above TRH fractions and organic carbon was noted in soil and in the absence of volatile hydrocarbons or PAH in groundwater the above TRH detections are not considered likely to be related to petroleum hydrocarbons and therefore don't warrant remediation, however, may require consideration for dewatering and groundwater disposal.

Oil and grease was below the laboratory limits of reporting in all samples. Total suspended solids ranged from 0.41 mg/L to 44 mg/L.

The results of heavy metals testing were within the SAC with the exception of:

- Copper at 12 µg/L in SS2 which exceeded the 95% ANZG (2018) marine water guideline (MWG) 1.3 µg/L;
- Lead at 38 g/L in SS2 which exceeded the 95% ANZG (2018) marine water guideline (MWG) 4.4 µg/L;
- Nickel at 9 µg/L in CP2 (and 8 µg/L in its replicate BD1), 9 µg/L in CW3 and 33 µg/L in SS2 which exceeded the 99% ANZG (2018) marine water guideline (MWG) 7 µg/L. However, nickel is not considered a high risk bioaccumulation and therefore exceedance of the 99% MWG is not considered significant. Nickel was within the 95% MWG of 70 µg/L;
- Zinc at 13 µg/L and 15 µg/L at CW2 and 77 µg/L at SS2 which exceeded the 99% ANZG (2018) marine water guideline (MWG) 7 µg/L and the 95% MWG (15 µg/L) in SS2. Zinc is not considered a high risk for bioaccumulation and therefore exceedances of the 99% MWG are not considered significant; and
- Total iron at 38 mg/L at CP2, 5.6 mg/L at CW3, 3.5 mg/L at CW5, 5.8 mg/L at CW6 and 0.4 mg/L at SS2 exceeded the recreational water quality guideline (which has also been suggested in ANZG as an interim groundwater quality guideline in the absence of an alternative) of 0.3 mg/L. Iron is typically naturally present at similar concentrations in groundwaters of Hawkesbury Sandstone.

It was considered that the concentrations of metals in groundwater are likely to be attributed to the background concentrations that would be associated uncontrolled fill within the harbour foreshore area and urban runoff. As stated above elevated iron levels are considered likely naturally occurring. Therefore, remediation of heavy metals in groundwater is not considered to be warranted, however will require consideration for dewatering and discharge purposes

Tributyl tin was below the limit of reporting in all samples indicating that groundwater is not impacted by TBT and indicating that the impacts of TBT in soil are likely limited to the near shore areas (as indicated in Section 11.1).

2.4.3 Gas Screening Results

Gas screening was performed using a photoionisation detector (PID) and GA5000 gas meter at the six groundwater monitoring wells CW2, CW3, CW5, CW6, SS2 and CP2.

No methane was detected during the gas screening. Therefore, it was considered that further assessment of bulk gases (landfill gases) is not warranted at this stage.

The PID results were less than 2 ppm at CW2 and CW3 were low which indicates a low risk of vapour intrusion into the proposed commercial building. Similarly, the PID at CW5 was less than 2 ppm indicating a low risk of vapour intrusion for the proposed fire tank. SS2 in the north-eastern corner of the site was also less than 2 ppm.

Slightly elevated PID readings were detected at CW6 (43.7 ppm) and CP2 (5.3 ppm). These results indicate a potential source of volatile contaminants such as petroleum hydrocarbons in these two locations. It is also noted that CP2 is located on the eastern site boundary and CW6 is located in the northern portion of the site adjacent to the Western Distributor and both were drilled primarily for the purpose of designing the proposed land bridge. The proposed development does not include any new building structures in these locations. As the land bridge will be suspended over the western distributor vapour intrusion risks to this element of the project are not considered to be relevant. If new buildings are proposed in the vicinity of these boreholes, then further vapour assessment may be warranted.

Therefore, at this stage, it was considered, that further detailed soil gas investigations are not warranted however was considered prudent to conduct a grab sample Suma Canister to be tested for VOC and TRH to attempt to better identify the unknown odour at CW6 and rule out the presence of VOC and TRH. If hydrocarbon impacted materials are encountered during recommended additional investigations, then targeted soil investigations may be warranted.

2.4.4 Preliminary Waste Classification

2.4.4.1 Fill Soils

All contaminant concentrations were within the criteria for General Solid Waste as defined in NSW EPA (2014) with exception of:

- Sample W1/8-8.45 which had a total lead concentration of 1600 mg/kg exceeding the SCC1 criterion for general solid waste;
- Sample W5 / 8.8-9.23 which was logged as natural clay and had a benzo(a)pyrene concentration of 26 mg/kg and total PAH concentration of 240 mg/kg which exceeds the SCC2 criterion for restricted solid waste; and
- Sample CP1/1-1.1 which had a total lead concentration of 3900 mg/kg and TCLP concentration of 11 mg/L exceeding SCC1 and TCLP1 criteria for general solid waste lead respectively and CP1/2-2.1 which had a total lead concentration of 2500 mg/kg exceeding the SCC1 criterion for general solid waste.

Table 3: Waste Classification Summary

Item	Description
Within the area subject to classification, **excluding materials below the waterline in the vicinity of W1 and W5 and fill material in the vicinity of CP1** as shown on Drawing 1, is classified as:	General Solid Waste (non-putrescible), PASS
Within the vicinity of W1 and CP1 as shown on Drawing 1, is classified as:	Restricted Solid Waste, PASS
Within the vicinity of W5, **excluding materials above the concrete wharf decking** as shown on Drawing 1, is classified as:	Hazardous Waste, PASS
Subject to appropriate management and neutralisation acid sulfate soils in accordance with an approved acid sulfate soil management plan.	

2.4.4.2 Natural Material

With respect to the natural soils the following was noted:

- Tributyl tin was detected in boreholes drilled over the harbour (W1/8-8.45 - 3 µg/kg, W3/10.75-11.2 p 83 µg/kg and W5/11.5-11.95 - 85 µg/kg).
- PAH were detected in the natural material in a number of locations. Sample W5 / 8.8-9.23 which was logged as natural clay and had a benzo(a)pyrene concentration of 26 mg/kg and total PAH concentration of 240 mg/kg.

Table 4: Waste Classification Summary

Item	Description
Within the area subject to classification, **excluding materials below the waterline in the vicinity of W5** as shown on Drawing 1, is classified as:	General Solid Waste (non-putrescible), PASS
Within the vicinity of W5, **excluding materials above the concrete wharf decking** as shown on Drawing 1, is classified as:	Hazardous Waste, PASS
Materials containing tributyl tin must be handled in accordance with the Environmentally Hazardous Chemical Act 1985, Chemical Control Order in Relation to Organotin Waste. Previous correspondence with the NSW EPA has indicated the chemical control order is intended for application for highly contaminated organotin waste scrapings from ships and similar and is not typically applied to low levels in contaminated soils. However further testing of the material upon excavation would be required and, specific advice obtained from the NSW EPA upon receipt of the results to determine if the order need apply.	
Subject to appropriate management and naturalisation acid sulfate soils in accordance with an approved acid sulfate soil management plan.	

It is possible that bedrock, if properly segregated from the overlying alluvial material and fill could be assessed separately ex situ to determine if the material can be classified as VENM.

It is possible that the alluvial soils could be classified as VENM, PASS. However further assessment, particularly to confirm that the alluvial soil was not impacted by TBT, heavy metals and PAH from the overlying fill would be required either via additional boreholes and / or via validation testing during excavation. Segregation of materials during bulk excavation for the tower and / or fire tank may be possible, although is unlikely where materials are excavated for foundations (piles).

This classification is preliminary in nature based on a limited dataset and is not intended for off-site disposal. Further *ex situ* classification will be required to confirm the classification during excavation of the material.

Any further waste classification assessment will be conducted in accordance with this preliminary RAP.

2.5 DP (2021b) Conclusions and Recommendations

Based on the results of the investigation (DP 2021b) it was considered that the site can be made suitable for the proposed open space and commercial development subject to implementation of the recommendations below:

- Further detailed investigations should be undertaken within the proposed commercial tower and fire tank footprints following demolition of the overlying structures to confirm the contamination status of these materials;
- Further waste classification assessment. In particular the focus should be on areas where excavation is proposed (the commercial tower and fire water tank);
- Additional high resolution acid sulfate soil investigations was recommended to be undertaken within the proposed excavation zones following demolition of the overlying structures (the commercial tower and proposed fire water tank) with a high density (vertically and horizontally) of laboratory tests to assess the lateral and vertical extent and nature of acid sulfate soils. Alternatively further testing can be undertaken *ex situ* as materials are excavated;
- Outside of the proposed excavation zones, following the demolition of any structures at the site an asbestos clearance should be undertaken by a licenced asbestos assessor and further contamination assessment (soil and groundwater) be undertaken within those footprints which were inaccessible during the current preliminary investigation;
- A destructive hazardous building material (hazmat) assessment should be undertaken prior to demolition on all structures proposed for demolition;
- Preparation of a soil management plan including an unexpected finds protocol to provide procedures to limit the impacts of disturbing soils around the harbour foreshore and manage unexpected contaminant finds such as asbestos;
- Preparation of an environmental management plan to manage lead impacted soils below the concrete pavement in the vicinity of borehole CP1;
- An acid sulfate soil management plan should be prepared. The ASSMP should provide the proposed scope of the recommended high resolution acid sulfate soil assessment and the methodology to manage acid sulfate soils present at the site;

- Groundwater will be encountered during the excavation works for the proposed tower and fire tank. Therefore, a dewatering management plan should be prepared. Based on the results of the preliminary groundwater assessment the primary contaminants identified in groundwater were heavy metals and TSS. There are a number of treatment methods for heavy metals and TSS, most commonly the use of filtration and flocculant based systems. A supplementary round of groundwater testing should be conducted to confirm the presence (or otherwise) of TRH in some locations (and potential impact on dewatering management) and potential tidal influence variability in groundwater condition;
- It is recommended that if materials are disturbed and excavated from the vicinity of W1, W5 and / or CP1 that additional ex situ waste classification be undertaken to confirm the classification of this material which was provisionally classified as hazardous waste or restricted waste following excavation; and
- If building structures are proposed in the vicinity of CW6 or CP2 where elevated PID readings were detected during gas screening than further soil vapour assessment may be warranted. It would be considered prudent to collect a soil gas grab sample from CW6 for VOC and TRH analysis. If hydrocarbon contaminated soils and / or groundwater are encountered during further investigations or if elevated VOC or TRH are detected in the recommended grab sample from CW6 additional soil vapour assessment may be warranted.

Given the limited data available at this stage a detailed RAP cannot be prepared. It is the purpose of this preliminary RAP to provide the unexpected finds protocols and outline the recommended data gap assessment. Following the completion of the data gap investigations additional plans / reports to be required to satisfy the above recommendations as outlined in Section 12.

3. Conceptual Site Model

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

Potential Sources

The areas of environmental concern and contaminants of potential concern presented in **Table 5** are taken from Coffey (2017).

Table 5: Areas of Environmental Concern and Contaminants of Potential Concern

Potential Contaminating Activity / AEC	COPC	Likelihood of Impact	Comments
S1: Fill material of unknown origin used as part of site development and land reclamation process	PAH, TRH, heavy metals, and asbestos	Moderate to high	Fill material of unknown origin may have been used as part of site development and land reclamation process. Fill material could contain dredged materials, waste material generated from the site and nearby areas and ash from coal burning. Fill material is expected to be present up to several metres down above the underlying natural soils.
S2: Former shipyard operation	BTEX, PAH, TRH, heavy metals, PCB and asbestos	Low to moderate	Ship repairs were likely to be undertaken in the former shipyards operating along Darling Harbour. Fuels, engine oils and other lubricants were likely to be used and stored on-site at the time. Waste generated from shipyard operation may also be present on-site. The shipyard generally operated between the late 1800s to 1960s Coal was likely to be used as a fuel on-site until installation of town electricity supply. Ash resulting from burning of coal could be present within the fill material. Potential impacts are likely to be present a greater risk to the fill than underlying natural soil. Trialkyltins were not discovered as an antifouling agent until the 1950s, and became commonly used in antifouling paints in the 1960s and 1970s. Therefore, it is considered that organotin such as tributyl tin (TBT) may not have been used at the shipyard (although may be a contaminant of concern related to ship docking, see S5).
S3: Former timber yard operation	BTEX, PAH, TRH, heavy metals, OCP and creosols	Low to moderate	Chemicals associated with timber preservation activities may be present beneath the site. Waste products might have been disposed on-site which was considered to be an acceptable practice in the early 1900s. Coal was likely to be used as a fuel on-site until installation of town electricity supply. Ash is likely to be present within the fill material. Potential impacts are likely to be present a greater risk

Potential Contaminating Activity / AEC	COPC	Likelihood of Impact	Comments
			to the fill than underlying natural soil.
S4: Former automobile garage and engineer's workshop	BTEX, PAH, TRH, metals, VOC	Low to moderate	Chemicals associated with the use of lubricants and solvents may be present at the site. Waste oil and fuel might have been disposed on-site which was considered to be an acceptable practice in the early 1900s. Historical information reviewed as part of Coffey (2017) did not indicate the exact type of engineer's workshop and what was undertaken on-site, but it is anticipated that it would mostly likely involve metal works to support the site operations at the time. Coal was likely to be used as a fuel on-site until installation of town electricity supply. Ash is likely to be present within the fill material. Potential impacts are likely to be present a greater risk to the fill than underlying natural soil
S5: Former shipping dock	TBT	Low to moderate	Anti-fouling paint containing TBT might have come off vessels during docking. Potential impacts are likely to be present a greater risk to the fill than underlying natural soil.

Potential Receptors

The following potential human receptors have been identified:

- R1: Current users [commercial, recreational open space];
- R2: Construction and maintenance workers;
- R3: End users [commercial and recreational open space]; and
- R4: Adjacent site users [commercial and recreational open space].

The following potential environmental receptors have been identified:

- R5: Surface water [Cockle Bay, Saline];
- R6: Groundwater; and
- R7: Terrestrial ecosystems.

Potential Pathways

The following potential pathways have been identified:

- P1: Ingestion and dermal contact;
- P2: Inhalation of dust and / or vapours;
- P3: Surface water run-off;
- P4: Leaching of contaminants and vertical migration into groundwater;
- P5: Lateral migration of groundwater providing base flow to water bodies; and
- P6: Inhalation, ingestion and absorption.

Summary of Potentially Complete Exposure Pathways

A 'source - pathway - receptor' approach has been used to assess the potential risks of harm being caused to human or environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways (potential complete pathways). The possible pathways between the above sources (S1 to S5) and receptors (R1 to R7) are provided in below **Table 6**.

Table 6: Summary of Potentially Complete Exposure Pathways

Source and COPC	Transport Pathway	Receptor	Risk Management Action
S1: Fill material of unknown origin used as part of site development and land reclamation process PAH, TRH, heavy metals, and asbestos S2: Former shipyard operation BTEX, PAH, TRH, heavy metals, PCB and asbestos S3: Former timber yard Operation BTEX, PAH, TRH, heavy metals, OCP and creosols S4: Former automobile garage and engineer's workshop	P1: Ingestion and dermal contact P2: Inhalation of dust and/or vapours	R1: Current users [commercial, recreational open space]; R2: Construction and maintenance workers; R3: End users [commercial and recreational open space].	An intrusive investigation is recommended to assess possible contamination. Based on results of investigation a remediation action plan (RAP) and acid sulfate soil management plan (ASSMP) may be required. Further detailed investigations required within footprint of proposed excavations
	P2: Inhalation of dust and/or vapours	R4: Adjacent site users [commercial and recreational open space].	
	P3: Surface water run-off P5: Lateral migration of groundwater providing base flow to water bodies	R5: Surface water	
	P4: Leaching of contaminants and vertical migration into groundwater	R6: Groundwater	

Source and COPC	Transport Pathway	Receptor	Risk Management Action
BTEX, PAH, TRH, metals, VOC S5: Former shipping dock TBT	P6: Inhalation, ingestion and absorption	R7: Terrestrial ecosystems	

4. Remediation Extent and Options

The required extent of remediation (or management) of contamination at the site is not currently known, given the limitations in access for appropriate intrusive investigations. The extent of remediation (or management) will be determined through a data gap investigation as outlined in Section 4.3). The following discussion on remediation options is based on the anticipation of similar conditions to that encountered. A revised RAP will be developed on completion of the data gap investigation.

A number of remedial options were reviewed. The suitability of the remedial options was examined in accordance with a number of relevant documents, including, *inter alia*, the following:

- NSW Environment Protection Authority, Contaminated Land Management, Guidelines for the NSW Site Auditor Scheme (3rd edition);
- ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality;
- ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality;
- NEPC (2013) National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013);
- NHMRC (2018) Australian Drinking Water Guidelines 6 2011 (v3.5 updated August 2018);
- NHMRC (2008) Guidelines for Managing Risk in Recreational Water;
- NEPC (2013) National Environment Protection (Assessment of Site Contamination) Measure (as amended 2013); and
- Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019 (UPSS Regulation).

Soil (and groundwater if required) remediation would commence following demolition of the existing structures and the data gap assessment. Prior to demolition of buildings hazardous building materials must be removed and validated. Following the completion of the demolition works a site clearance must be undertaken by an Occupational Hygienist. A hazardous building materials assessment (Hazmat) and demolition management plan must be prepared to facilitate this process.

4.1 Remediation Options

Possible remedial options to achieve the remedial objectives (refer Section 1) are identified as follows:

- No action;
- On-site treatment of contaminated material;
- Removal of contaminated material to landfill;
- Capping / on-site containment of contaminated materials; and
- Groundwater remediation (if required).

The following is a summary of the review of remediation options.

4.1.1 No Action

The “No Action” option involves no remedial response to the contamination identified on the subject site.

If the data gap investigation does not identify contamination that warrants remediation, then no action may be considered appropriate with the adoption of the unexpected finds protocols.

4.1.2 On-site Treatment of Contaminated Material

On-site treatment of the contaminated material would typically involve the excavation, stockpiling, treatment and replacement of the treated contaminated material. On-site treatment is considered unlikely to be suitable due to the nearby sensitive receptors, and the proposed basement excavation which is not likely to accommodate the replacement of treated soils.

4.1.3 Removal of Contaminated Material to Landfill

Off-site disposal of contaminated material is considered a suitable option for managing human health and environmental impacts from the contaminated materials, particularly in view of the extent of bulk excavation required for the construction of basement levels, resulting in net surplus soils.

This option would adequately address the remediation objectives via the (likely) removal of the contaminants from the subject site. The strategy, if adopted would likely entail removal of contaminated material within the proposed bulk excavation footprints (i.e., tower and fire tank) and potentially excavation outside these areas if capping or alternative measures are not deemed suitable (if contamination is identified).

The removal of the contaminated material would involve the stockpiling, waste classification and transport of contaminated material to an EPA licensed landfill.

4.1.4 Capping

Based on the proposed development capping may be considered appropriate outside of the proposed bulk excavation areas (the commercial tower and proposed fire water tank).

The necessity for capping, location and nature of such capping systems will be determined based on the outcome of the data gap assessment. If capping systems are required, this must be detailed in a revised RAP.

4.1.5 Groundwater Remediation

Based on the findings of the data gap assessment it may be necessary to undertake some form of groundwater remediation. If groundwater remediation is required (beyond source removal during the bulk excavation works), this preliminary RAP must be revised to detail the nature and extent of groundwater remediation works required.

4.1.6 Selected Remediation Options

Based on the anticipated potential contamination at the site and the nature of the proposed development which includes basement excavations and landscape elements, it is considered that the proposed remediation options with respect to soil contamination will comprise:

- Hazardous building materials assessment, demolition and clearance inspections;
- Data gap investigations as outlined in Section 4.3;
- If no contamination warranting remediation is identified application of the unexpected finds protocols on an as needed basis;
- Excavation, waste classification and removal of soils from the tower / fire tank excavations, and any additional contamination outside the excavation footprints, if deemed unsuitable to be retained within the site;
- Potential capping of contaminated materials outside of the proposed bulk excavation areas; and
- Validation of the remedial excavations to confirm the completeness of the remediation.

The appropriate soil remediation methodology will need to be confirmed upon completion of the data gap assessment. Furthermore, all excavation works will need to be undertaken in accordance with an acid sulfate soil management plan (ASSMP).

The necessity and / or nature of potential groundwater remediation will be determined based on the results of the data gap assessment.

4.2 Hazmat, Demolition and Clearance

Prior to the commencement of demolition works a hazardous building materials (hazmat) assessment must be undertaken to identify the type, condition, and location of hazardous building materials in the structures to be demolished (such as asbestos).

Following the completion of the hazmat a demolition plan must be prepared to detail the process to safely remove hazardous materials in a manner to prevent risk to human and environmental health. Following the removal of the hazardous materials a clearance inspection and report must be completed by an Occupational Hygienist before general demolition works commence.

Following the completion of the demolition works a surface clearance inspection and certificate must be prepared by an Occupational Hygienist to confirm that no hazardous building materials from the demolition works remain at the surface before the data gap assessment can commence.

4.3 Data Gap Assessment

It is proposed that the data gap assessment will be undertaken post demolition and clearance at which point the potential risk associated with asbestos in building demolition waste can most effectively be assessed.

4.3.1 Proposed Scope of Data Gap Investigation

The proposed scope of the data gap assessment for each area of the site is outlined in Table 7.

Table 7: Proposed Data Gap Assessment

Item	Area (approx. m^2)	Previous Boreholes	Proposed No of Data Gap Boreholes and Purpose	Proposed No of Boreholes Converted to Additional Wells
Tower	1600	CW1, CW2P, CW3P	5 Site assessment, acid sulfate soil assessment and waste classification	2
Fire Tank	700	CW5P	4 Site assessment, acid sulfate soil assessment and waste classification	2
Podium on Fill	3500	CW4, CW6P, CW7	10 Site assessment, acid sulfate soil assessment and waste classification	0
Podium on Water	4500	W1-W5, CW1	6* Acid sulfate soil assessment and waste classification	0
Land Bridge	10,000-11,000	CP1-CP2P WD1-WF2 SS1-SS2P	# Acid sulfate soil assessment and waste classification	0

Note:
P groundwater well installed.
* The proposed number of location of boreholes through the podium on fill will be decided following the design and location of foundations which disturb / interact with the seafloor.
# The number and location of boreholes for the land bridge will be determined based on the number and location of foundations / piles for the land bridge. The purpose of boreholes for the land bridge shall be to complete waste classification and acid sulfate soil assessment on the material to be excavated / disturbed and therefore is subject to the foundation design. Alternatively, soils excavated for the proposed land bridge foundations can be assessed *ex situ* in a series of stockpiles in accordance with the sampling requirements in Appendix C.

The boreholes shall be extended to the top of rock or 1.0 m below the maximum depth of the proposed excavation / disturbance, whichever is the lesser.

In addition to collection and analysis of groundwater samples from proposed additional groundwater wells a supplementary round of groundwater testing is recommended from the existing wells.

The proposed sampling methodology is described in Appendix C and the proposed analytical suite is provided in Section 4.3.2.

It is noted that soils in the vicinity of W1 and CP1 were provisionally classified as restricted solid waste (W1 and CP1) and at W5 as hazardous waste. Soils in these areas will only be excavated for foundations for the proposed land bridge or the podium structure over the water. Therefore, it is recommended that soils in these areas (if excavated) be assessed ex situ per the requirements in Section 8.5.

4.3.2 Proposed Analytical Suite

A minimum of three soil samples must be analysed from each soil test location. Soil samples must be (at a minimum) analysed for the following contaminants of concern per Table 8.

Table 8: Minimum Soil Analysis Requirements

Area	Analytical Suite
Tower	Heavy metals, PAH, TRH, BTEX, asbestos (500 ml FA / AF), OCP, phenols TCLP as required Acid sulfate soil screening and chromium reducible sulphur suite
Fire Tank	Heavy metals, PAH, TRH, BTEX, asbestos (500 ml FA / AF), OCP, phenols TCLP as required Acid sulfate soil screening and chromium reducible sulphur suite
Podium on Fill	Heavy metals, PAH, TRH, BTEX, phenols*
Podium on Water	Heavy metals, PAH, TRH, BTEX, asbestos (500 ml FA / AF), OCP, phenols Tributyl tin TCLP as required Acid sulfate soil screening and chromium reducible sulphur suite
Land Bridge	Heavy metals, PAH, TRH, BTEX, ssbestos (500 ml FA / AF), OCP phenols TCLP as required Acid sulfate soil screening and chromium reducible sulphur suite

Groundwater samples should be analysed for the following potential contaminants of concern as per Table 9.

Table 9: Proposed Groundwater Analysis

Wells	Analytical Suite
Existing and Proposed new wells	Heavy metals, PAH, TRH, phenols and VOC OCP, OPP, PCB, TBT, iron (total, ferric and ferrous), total suspended solids, and oil and grease

4.3.3 QA / QC Requirements

The QA / QC requirements are outlined in Appendix C.

4.3.4 Acid Sulfate Soils

Based on the acid sulfate soil findings of DP (2021b) it is recommended that acid sulfate soil investigations be undertaken in conjunction with the data gap assessment. The acid sulfate soil assessment will be undertaken in accordance with the recommendations in Sullivan et al (2018a)[1] and shall comprise the following:

- Each of the proposed boreholes will be utilised for acid sulfate soil investigation. The boreholes shall be extended to the top of rock or 1.0 m below the maximum depth of the proposed excavation / disturbances;
- Soil samples shall be collected at the surface and then at 0.5 m intervals, at changes in strata and upon signs of potential ASS;
- Samples must be stored in air tight containers and delivered to the laboratory within 24 hours or frozen pending dispatch;
- All samples must be subject to field screening for field pH an pHfox (oxidised pH);
- Selected / representative samples that exceed the field screening criteria in Appendix D will be subject to chromium reducible sulphur suite analysis;
- The minimum QA / QC procedures shall include:
  - Collection of one field duplicate for every 20 investigative samples;
  - Use of standardised field sampling forms, methods and Chains of Custody; and
  - Documented calibration of field instruments.

The results shall be compared to the action criteria in Appendix D. Following the completion of the detailed acid sulfate soil investigation an acid sulfate soil management plant will be prepared.

[1] Sullivan, L, Ward, N, Toppler, N and Lancaster, G 2018, National Acid Sulfate Soils guidance: National acid sulfate soils sampling and identification methods manual, Department of Agriculture and Water Resources, Canberra ACT. CC BY 4.0 (Sullivan et al 2018a)

4.3.5 Additional Gas Screening

Based on the elevated PID readings detected during the gas screening (DP 2021b) a soil vapour sample is recommended at CW6. The proposed data gap testing is as follows:

- Field screening for general gases and VOC using a GA5000 and PID; and
- Collection of a Summa Canister sample (and replicate) for laboratory analysis of VOC and TPH fractions.

The field methods are described in Appendix C.

4.3.6 Data Gap Assessment Report

A data gap assessment report should be prepared, or may be prepared in stages, which includes the results of the following:

- Results of the additional soil groundwater and soil gas testing;
- Results of acid sulfate soil assessment including a determination on whether an acid sulfate soil management plan is required;
- Preliminary in situ waste classification; and
- Advice on requirements for any revision to this RAP (i.e., groundwater remediation) as required.

If considered necessary based on the findings of the data gap assessment a revised RAP will be prepared. This may include requirements to remediate specific sources of contamination identified, groundwater remediation requirements and / or capping strategies (as required).

5. Site Assessment Criteria

5.1 Site Acceptance Criteria

The site acceptance criteria for the proposed data gap investigation works will be that no contamination presenting an unacceptable risk of harm to human health or the environment remains within the site. In addition, there will be no recorded highly malodorous soils or groundwater at the site boundaries with the potential to impact the future use of the site. This will be assessed based on site observation and the quality of groundwater extracted during site construction activities.

The Site Assessment Criteria (SAC) are informed by the CSM (Section 3) which identified human and environmental receptors to potential contamination on the site. Analytical results are assessed (as a Tier 1 assessment) against the SAC comprising primarily the investigation and screening levels of Schedule B1 of NEPC (2013).

The investigation and screening levels applied in the current investigation comprise levels adopted for a generic recreational / commercial land use scenario. The derivation of the SAC is included in Appendix D.

The investigation and screening levels are not intended to be used as clean up levels. They establish concentrations above which further appropriate investigation (e.g., Tier 2 assessment) should be undertaken.

5.2 Classification for Off-site Disposal

All soils to be disposed off-site will be assessed and classified in accordance with the POEO Act. At the time of preparation of the preliminary RAP, classification options comprised:

- EPA assessment requirements for Virgin Excavated Natural Material (VENM);
- A General or Specific Resource Recovery Order (RRO) under the *Protection of the Environment Operations (Waste) Regulation* 2014; and
- The EPA *Waste Classification Guidelines* 2014.

6. Roles and Responsibilities

The roles and responsibilities, as it relates to this preliminary RAP, of the key personal including the Principal, Principal Contractor, Surveyor, Asbestos Contractor, Sub-contractors, Environmental Consultant, Licensed Asbestos Assessor and Site Workers are outlined in Appendix F, Section 2.

7. Regulatory Requirements and Relevant Standards

All works must be conducted in accordance with the development consent conditions. All works must be also undertaken in accordance with the relevant regulatory criteria, including *inter alia*:

- NSW *Work Health and Safety Act* 2011 (WHS Act);
- NSW *Work Health and Safety Regulation* 2011 (WHS Regulation);
- NSW *Contaminated Land Management Act* 1997;
- *National Environment Protection Measure 2013 (NEPM);* and
- *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (WA DoH 2021).

Reference to relevant Codes of Practice, Australian Standards and industry standards should also be made in determining appropriate safe work practices. These include, *inter alia:*

- *National Code of Practice How to Manage and Control Asbestos in the Workplace* (Safe Work Australia 2011);
- *National Code of Practice How to Safely Remove Asbestos* (Safe Work Australia 2011);
- NSW EPA Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019;

- NOHSC *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition* [NOHSC:3003 (2005)];
- NOHSC *Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:3008 (1995)] 3rd edition;
- AS/NZS 1715:2009 *Selection, Use and Maintenance of Respiratory Protective Devices;*
- AS/NZS 1716:2012 *Respiratory Protective Devices;*
- AS/NZS 1716:2003/Amdt 1:2005: *Respiratory protective devices;* and
- WorkCover NSW: *Working with Asbestos: Guide 2008.*

8. Proposed Remediation Methodology and Validation Plan

Based on the proposed development, the proposed remediation strategy will be to remove the identified potential sources of contamination via excavation and disposal to the extent practical (limited by excavation zones of the Tower / fire tank or those deemed unsuitable to be capped in place).

The identified potential contaminant sources to be removed, disposed and validated include:

- Fill soils within the proposed excavation zones of the tower / fire tank footprint: and
- Contaminated soils posing an unacceptable risk to human health or the environment identified during the data gap assessment (if any).

If contaminated soils are identified outside the proposed bulk excavation areas it may be appropriate to encapsulate the material below a capping layer. In addition to these there is a potential for groundwater contamination. The presence of and requirement to remediate groundwater will be determined during the data gap assessment.

8.1 Contaminated Soils Identified in Data Gap Assessment

If no significant contamination is identified during the data gap assessment it may be appropriate to adopt the unexpected finds protocols for minor contamination finds such as isolated asbestos finds (refer to Appendix E).

However, if significant contamination is identified during the data gap assessment then the preliminary RAP must be either revised or an addendum prepared for the identified contaminant / source(s).

8.2 Groundwater Contamination Identified in Data Gap Assessment

If contaminated groundwater is identified during the data gap assessment which warrants remediation, then the preliminary RAP should be revised specific to the identified groundwater contamination.

8.3 Bulk Excavation - Tower, Fire Tank and General Earthworks

The excavation works should be conducted by experienced and appropriately licensed contractors. An experienced environmental consultant will be engaged to inspect the progress of the works and to provide ongoing advice and recommendations as required. The success of remediation works will be validated by the environmental consultant.

It is noted that bulk excavations are expected to encounter potential acid sulfate soils (PASS) in both the fill and natural soil. As per Section 8.6 there is insufficient information to prepare an acid sulfate soil management plan (ASSMP). Data gap investigation is required to prepare the ASSMP. All PASS must be treated and handled in accordance with a ASSMP.

8.3.1 General Procedure

It is anticipated that the majority of contaminated soils within the excavation footprints will be removed as part of the bulk excavation works required for the development and will managed in accordance with this preliminary RAP. If unexpected contamination is identified during excavation, it will be managed in accordance with the Unexpected Finds Protocol (UFP) provided in Section 8.10.

The general strategy is as follows:

a. Review of all waste classification information by the Environmental Consultant and the results of the data gap investigation;

b. Start up meeting on site between, as a minimum, the Contractor and the Environmental Consultant to discuss the requirements of this preliminary RAP, the Contractors programme and requirements from the Environmental Consultant or Contractor;

c. Progressive inspection by the Environmental Consultant of the excavation footprint following removal of hard stands. The purpose of the inspections is to look for signs of contamination, including asbestos containing materials (ACM). This may include additional test pitting, sampling and analysis to refine boundaries between different waste classifications and / or unexpected finds;

d. Notification of the Environmental Consultant by the Contractor of the proposed commencement date of the targeted remediation / waste excavation works. The Environmental Consultant will pass this information onto the Site Auditor;

e. Review the risk of asbestos and establishment of an asbestos works area by the Contractor in accordance with Section 8.3.2 in areas where asbestos is observed or is considered to have a high risk of being present. The extent of the asbestos works area is to be determined by the Contractor in consultation with the Licenced Asbestos Assessor, and will be reviewed and amended as necessary during excavation works. Works undertaken in areas of asbestos contamination will be undertaken in accordance with Section 10.2 (as well as other relevant sections) of this preliminary RAP;

f. Assessment of the presence and extent of asbestos contamination to be undertaken by the Environmental Consultant through a visual inspection of materials during excavation; and

g. If any signs of ACM are observed in fill, management, waste classification and disposal in will be undertaken accordance with this preliminary RAP;

As stated elsewhere potential acid sulfate soils (PASS) have been encountered in the fill and natural soils. Following the completion of the data gap investigations an acid sulfate soil management plan must be prepared and the excavated materials handled and treated in accordance with that plan including validation of the ASS treatment.

8.3.2 Asbestos Contaminated Soils

DP (2021b) did not identify asbestos contamination at the site. However, given the nature, depth and extent of the fill and that the boreholes used for the DSI are generally an inefficient method of detecting asbestos, it is considered that there is an elevated risk of asbestos being identified during excavation. As such, for the purposes of this preliminary RAP it is presumed that asbestos will be identified during excavation works.

As such the Principal / Contractor may wish to consider having all earthworks in fill conducted by the Asbestos Contractor to minimise delays associated with asbestos finds during earthworks. The need for management of asbestos in fill needs to be considered in the planning phase, with actual management requirements determined by the Asbestos Contractor and Asbestos Assessor based on observations made during works.

An appropriately licensed Asbestos Contractor will be required to undertake all asbestos works and an independent Asbestos Assessor will be required to provide advice and air monitoring as required. Further details on this are provided in Section 10.2.

8.3.3 Material Tracking and Disposal Records

The Contractor will track from cradle to grave all soil materials imported onto or disposed of off the site. These will include the tracking of:

- Off-site disposal records for soils (trucking record, landfill dockets, on-site source where applicable);
- The receiving site or facility to which any materials from the site were sent;
- Sources, volumes, dates and location of any imported materials; and
- Estimated volume(s) of any soils imported to or exported from the site.

Any Special Waste-Asbestos or Hazardous Waste from the site will need to be tracked. Entities involved with the transport or disposal of hazardous waste in NSW, or arranging the transport of these wastes in NSW, must use the EPA's online tool, WasteLocate. Restricted Waste may also need to be tracked depending on the waste characteristics.

8.3.4 Minimising Cross Contamination

Prevention of cross contamination during remediation works is vital to the successful remediation of the site. The following measures must be conducted to manage the potential for cross contamination:

- Undertaking all work in accordance with the preliminary RAP;
- Segregating soils with different contaminant profiles / waste classification during handling works. This includes separation during excavation and loading into trucks and/ or placement of clearly identified, separate stockpiles; and

- Disposing of all liquids, including surface runoff, leachate from soils excavated from beneath the water table and extracted groundwater in accordance with POEO Act, and as discussed herein.

8.3.5 Validation.

Validation testing will be required on the walls of the excavations and at the top of the natural soil profile and / or the base of the excavation/s. The validation plan is described in Section 9.3.

As per Appendix C validation sample analysis will be determined based on the outcome of the data gap investigation, however as minimum validation samples will be analysed for heavy metals, TRH, PAH and asbestos

8.4 Capping of Contaminated Soils

Outside of the proposed excavation areas it may be appropriate to cap contaminated soils. The need for capping will be determined based on the outcome of the data gap assessment. The nature of the cap would be commensurate to the type and extent of contamination identified and proposed end use in the location of contaminated material.

A capping system would be the preferred method for managing contaminated soils identified below the proposed land bridge. In this regard capping of lead impacted soils identified at CP1 (below the existing pavement) would be the preferred remediation option. As noted in DP (2021b) boreholes for the proposed land bridge / western distributor and were drilled primarily for geotechnical and waste classification purposes. In that regard soil exceedances at the surface would not impact upon users of the proposed land bridge as there will be no direct exposure pathway from the surface soils to the users of the land bridge. However, it would be recommended that the presence of elevated lead be noted in an environmental management plan.

8.5 Waste Classification Requirements

All off-site disposal of wastes, where required, will be undertaken in accordance with the POEO Act. The proposed data gap investigation shall include preliminary in situ waste classification assessment/s. Following the *in situ* classification, *ex situ* classifications and / or further assessment during excavation will be required.

Further details on the requirements for waste classification testing are provided in the Site Management Plan (Appendix F).

Soils excavated from the vicinity of areas which have been provisionally classified as Restricted Solid Waste (W1 and CP1) or hazardous waste (W5) (if excavated / disposed off-site) should be stockpiled upon excavation in accordance with the requirements of Appendix F, sampled to confirm the classification at the rates specified in Appendix C (Section C6.3) and if found to exceed restricted solid waste disposed in accordance with the requirements of the Spoil Contingency Plan (Appendix F).

8.6 Acid Sulfate Soils

At this stage there is insufficient data to prepare an acid sulfate soil management plan (ASSMP). In particular high resolution data is required within the proposed excavation zones (the commercial tower and proposed fire water tank).

Following the completion of the data gap investigation an acid sulfate soil management plan will be required. The preliminary ASS investigation identified PASS in both the fill and natural alluvial soils at the site. Excavation works and any remediation excavations will need to be undertaken in accordance with a ASSMP once completed.

8.7 Natural Soils

Based on the expected depth of fill soils and the proposed basement excavation it is possible that natural soils will be encountered during bulk excavation. The natural soils must be validated following the removal of the overlying fill as per the requirements in Appendix C.

Alternatively, natural materials can be assessed in stockpiles. Stockpiles should be assessed per the requirements of Appendix C. As per Appendix C validation sample analysis will be determined based on the outcome of the data gap investigation, however as minimum validation samples will be analysed for heavy metals, TRH, PAH and asbestos

It is noted that potential or actual acid sulfate soils cannot be classified as VENM. If acid sulfate soils are detected in the data gap assessment this will need to be taken into account in regards to classification of materials.

8.8 Imported Materials

Bulk importation of soil onto the site is not expected, however soil may be imported for capping materials, temporary works e.g., piling platforms and other uses. Details of the requirements for imported materials is provided in the Site Management Plan (Appendix F).

8.9 QA / QC Requirements

QA / QC testing in conjunction with validation sampling must also be undertaken as outlined in Appendix C.

8.10 Unexpected Finds

Should unexpected occurrences be identified during works (such as unidentified buried tanks or unexpected contaminants e.g., friable asbestos material), the following general approach will be adopted:

- Foreman will barricade the impacted area and stop all works which are potentially impacted by or which will potentially impact the issue / area of concern;

- The Contractor will notify the PR and Environmental Consultant of the occurrence;
- The Environmental Consultant will assess the identified issue / area of concern, and provide advice to the PR regarding potential remedial / management options;
- The PR will instruct the Environmental Consultant of the preferred remedial / management strategy;
- The Environmental Consultant will prepare a plan detailing the works required for the preferred remedial / management option;
- The PR / Contractor will obtain any necessary approvals for undertaking the remedial / management works; and
- The Contractor will undertake the remedial / management works in accordance with the provided plan upon instruction by the PR.

Further contingency plans are provided in Appendix E.

8.11 Incident Response

If during works any incident of non-conformance ('incident') with this or other plans (as outlined below) is observed, then this is to be immediately reported to the PC. The PC is to record the incident and the rectification works which were subsequently undertaken to address the non-conformance. Depending on the nature of the non-conformance, input from the asbestos contractor, environmental consultant and / or occupational hygienist may be required.

8.12 Reporting Requirements

8.12.1 Data Gap Assessment

Refer to Section 4.3.6 for data gap assessment reporting requirements.

8.12.2 Revised RAP

Following the completion of the data gap assessment this preliminary RAP must be revised unless no contamination is identified or where the proposed remediation strategies are insufficient (i.e., if groundwater remediation is required in relation to the diesel UST).

8.12.3 Acid Sulfate Soil Management Plan

Following the completion of the data gap investigation an acid sulfate soil management plan will be required. The preliminary ASS investigation identified PASS in both the fill and natural alluvial soils at the site. Bulk excavation works and any remediation excavations will need to be undertaken in accordance with a ASSMP once completed.

8.12.4 Waste Classification

As required additional waste classification reports may be required for materials proposed for removal from the site.

8.12.5 Validation Report

At the completion of the works a validation report must be prepared by the Environmental Consultant that details the following:

All previous investigation results;

- Summaries of the validation testing results;
- Summaries of previous waste classifications, clearances and validation letters;
- A summary of this preliminary RAP and the remedial strategy adopted;
- Records (including photographic records) of site inspections completed during the works;
- Records of off-site disposal of surplus soils, including landfill disposal dockets where applicable;
- Documented validation process adopted for all imported materials used in the cap; and
- Validates the site is suitable for the proposed land use.

8.12.6 Long-Term Environmental Management Plan

Based on the results of DP (2021b) significant capping is not anticipated. However, if capping is required a Long-Term Environmental Management Plan (EMP) may be required.

In the event that some amount of capping of contaminated materials is deemed necessary this may be considered by the Environmental Consultant subject to the type and extent of contamination identified. If capping is adopted in any part of the site and / or long-term management of residual contamination is required (such as residual groundwater contamination) then a long-term EMP may be required. If required, the EMP must include:

- Details the extent of contaminated soils that remain present at the site;
- A description of the expected conditions at the site;
- Details the remediation works completed at the site;
- The management and maintenance protocols for the capping system or other management system;
- The protocols for future works at the site within contaminated areas;
- The hazards associated with the contaminated materials at the site and the corresponding management controls; and
- The responsibilities of the appropriate parties to the EMP.

The EMP must be legally enforceable (by the consent authority). It is recommended that the preparation of an EMP, if required, be made a condition of the development consent for the works. The EMP would be prepared following the completion of the (development) works and the preparation of the validation report.

9. Validation Plan

9.1 Data Quality Objectives and Indicators

The validation assessment will be conducted in accordance with Data Quality Objectives (DQOs) and Quality Assurance / Quality Control (QA / QC) procedures to ensure the repeatability and reliability of the results.

The validation assessment will be planned in accordance with the following DQOs:

- State the Problem;
- Identify the Decision;
- Identify Inputs to the Decision;
- Define the Boundary of the Assessment;
- Develop a Decision Rule;
- Specify Acceptable Limits on Decision Errors; and
- Optimise the Design for Obtaining Data.

A checklist of Data Quality Indicators (DQI) in accordance with NEPC (2013) Schedule B2 will be completed as part of the validation assessment. The DQIs are:

- Documentation completeness;
- Data completeness;
- Data comparability and representativeness; and
- Data precision and accuracy.

Based on a fulfilment of the DQOs and DQIs an assessment of the overall data quality will be presented in the validation assessment report.

9.2 Site Inspections

The Environmental Consultant will conduct site inspections as required. This will include:

- Following removal of hardstand;
- During targeted waste excavations (as described in Section 6.5);
- When any issue of concern is identified;
- Following the removal of contaminated materials/ wastes of a different classification;
- For supplementary waste classification, including ASS testing and VENM classification purposes;
- Following the placement of each component of a capping system (if such as system is deemed necessary / appropriate); and
- Following completion of the excavation.

A record of the inspections and observations will be provided as part of the Validation Assessment Report. This will include a photographic record.

9.3 Soil Validation

Soil sampling and testing may be required to meet the following outcomes:

- Validation samples following the removal of unexpected finds and / or contamination identified in the data gap assessment;
- Validation samples at the completion of bulk excavation (fire tank, excavation elements of the tower etc.)
- Validation samples following removal of wastes with a higher contamination risk (e.g., a higher waste classification) (for waste classification / segregation purposes); and
- Natural soils following removal of fill/ ASS / anthropogenic impacted natural soils to confirm their classification as VENM (if required). Potential anthropogenic impacts from contaminants will be assessed by comparison with published background ranges for Australian soils and the data from other natural materials of similar description from the site

The proposed validation sampling frequencies are set out in Appendix C.

10. Management and Responsibilities

10.1 Site Management Plan

A general site management plan for the operational phase of site remediation is included in Appendix F. The management plan includes soil, noise, dust, work health safety (WHS), remediation schedule, hours of operation and incident response. The Remediation Contractor is to implement the general site management plan for the duration of remedial works by incorporating the plan into their over-arching construction environmental management plan (CEMP).

10.2 Site Responsibilities

The site management plan (Appendix F) provides a summary of the general program management and associated responsibilities. Contact details for key utilities are also included in the event of needing to respond to any incidents.

10.3 Contingency Plan and Unexpected Finds Protocol

Plans for contingency situations (e.g., encountering asbestos in fill), along with an unexpected finds protocol for dealing with unexpected finds during remediation work / earthworks, are included in Appendix E.

11. Documentation Requirements

11.1 Documentation Requirements

The following documents will be prepared / obtained by the relevant party, and provided to other parties (the PR, Contractor, Environmental Consultant and / or Occupational Hygienist) as required. The purpose of the documentation is to demonstrate the works are conducted in accordance with all applicable regulations and that appropriate records of the works are kept for future reference. Documentation should be provided by the relevant parties in a timely manner to allow the works to be conducted efficiently.

11.1.1 Principal or PR

The Principal or Principal Representative (PR) will prepare / obtain the following documents:

- Any licences and approvals required for the Works which are not the responsibility of the Contractor to provide.

11.1.2 Contractor

The Contractor will prepare / obtain the following documents:

- Any licences and approvals required for the Works which are the responsibility of the Contractor to provide;
- A dewatering management plan (the contractor may engage such sub-contractors to prepare a dewatering management plan on their behalf as required);
- Excavation and stockpiling records: These will record the source of any stockpiled material, the date of excavation and any issues of concern;
- Transportation record: This will comprise a record of any truckloads of soil entering or leaving the site, including truck identification (e.g., registration number), date, time, load characteristics (i.e., classification, on-site source, destination);
- Tip dockets: These comprise dockets of receipt provided by the receiving waste facility and from the suppliers of materials imported to the site;
- Survey levels of remedial and excavation works including surveys of capping layers (if used); and
- Incident Reports: Any WHS or environmental incidents which occur during the works will be documented and the PR and appropriate regulatory authority will be informed in accordance with regulatory requirements.

11.1.3 Environmental Consultant

The Environmental Consultant will prepare / obtain the following documents:

- Data gap assessment report/s. Depending on the scheduling of works this may be a single data gap assessment report or several;
- Interim validation advice as required during the remediation works;
- Validation test results for remediation excavation testing;

- Waste classification reports, including records of sampling and analysis (if required);
- Validation reports associated with imported materials;
- Validation report, including records of inspections, sampling and analysis; and
- Long-Term Environmental Management Plan (EMP) (if required).

11.1.4 Licenced Asbestos Assessor

If asbestos is encountered during the works, the Licenced Asbestos Assessor will prepare / obtain the following documents:

- Airborne asbestos monitoring records as required;
- Interim visual clearances of asbestos removal (if any undertaken);
- A written final clearance certificate stating that:
  - The assessor or competent person found no visible asbestos residue from asbestos removal work on the surface of the works area, or on the surface in the vicinity of the area where the work was carried out, and
  - If air monitoring was carried out by the assessor or competent person as part of the clearance inspection - the airborne asbestos fibre level was less than 0.01 asbestos fibres / mL.

12. Conclusions

It is considered that the site can be rendered suitable for the proposed development subject to implementation of this preliminary RAP, or a revised version of this RAP.

Given the limited data available at this stage a detailed RAP cannot be prepared at this time. It is the purpose of this preliminary RAP to provide the unexpected finds protocols and outline the recommended data gap assessment. Following the completion of the data gap investigations the following additional plans / reports are anticipated to satisfy the recommendations of DP (2021b):

- Revisions to this preliminary RAP;
- An acid sulfate soil management plan:
- A long-term environmental management plan to manage lead impacted soils below the concrete pavement in the vicinity of borehole CP1 (and any additional contaminants that are proposed to be capped / left in place);
- Preparation of a detailed soil management plan to provide procedures to limit the impacts of disturbing soils / sediments around the harbour foreshore; and
- A Dewatering Management Plan.

13. Limitations

Douglas Partners (DP) has prepared this report for this project at 241-249 Wheat Road, Sydney in accordance with DP's proposal 202546.02.P.002 dated 8 April 2022 and acceptance received from DPT Operator Pty Ltd. The work was carried out under the CBP Professional Services Agreement (513963472.3). This report is provided for the exclusive use of DPT Operator Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

The assessment of atypical safety hazards arising from this advice is restricted to the (geotechnical / environmental / groundwater) components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

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

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

Asbestos has not been detected by observation or by laboratory analysis, either on the surface of the site, or in filling materials at the test locations sampled and analysed. Building demolition materials, such as concrete, brick, tile were, however, located in filling and these are considered as indicative of the possible presence of hazardous building materials (HBM), including asbestos.

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

Douglas Partners Pty Ltd

Appendix A

About this Report

Drawings

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

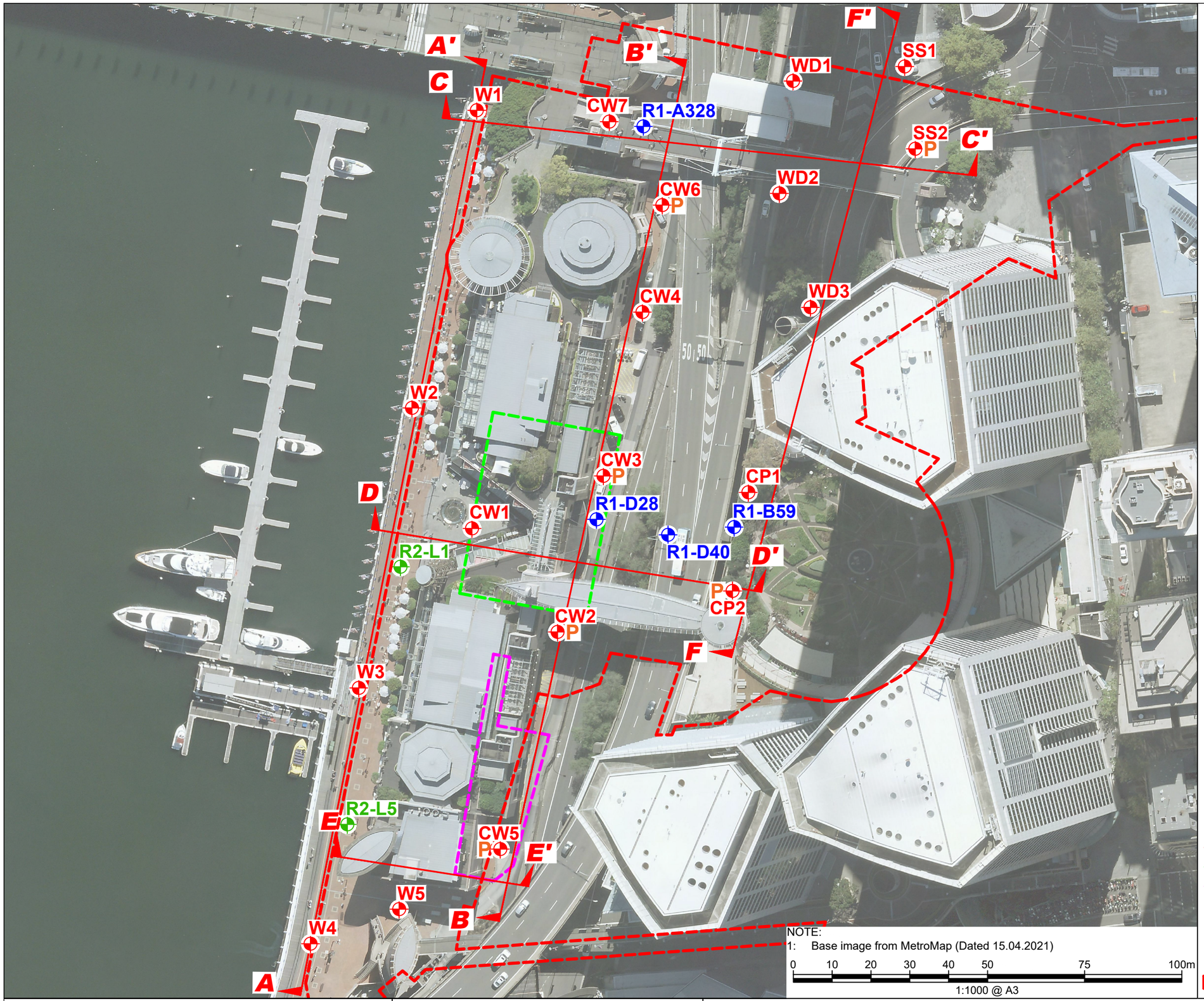
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later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

Information for Contractual Purposes

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

Site Inspection

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



Locality Plan

NOTE:
1: Base image from MetroMap (Dated 15.04.2021)

0 10 20 30 40 50 75 100m

1:1000 @ A3

LEGEND

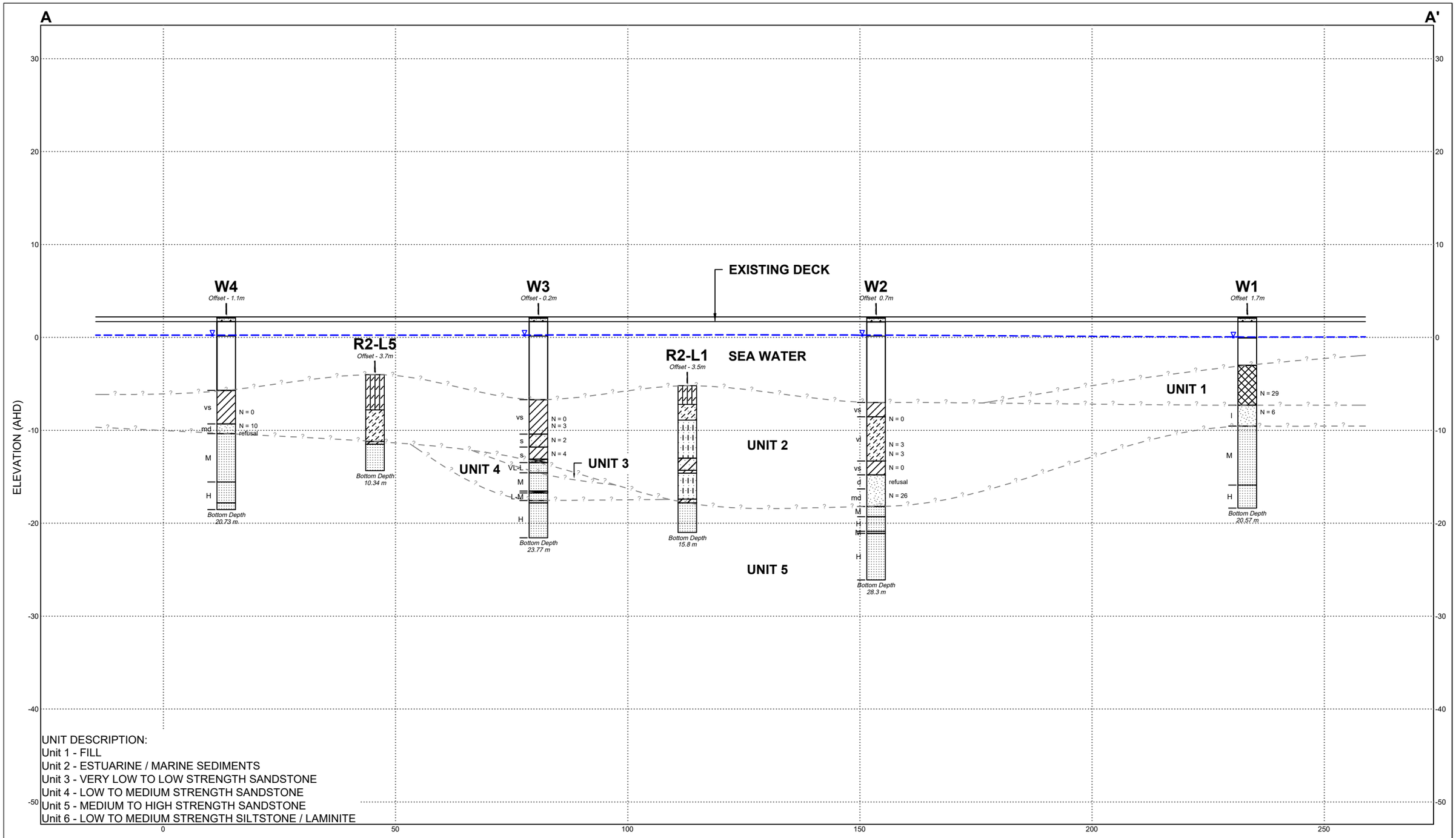
- Approximate Proposed Development Outline
- Approximate Tower Outline
- Approximate Proposed Bulk Excavation Outline
- Borehole Location, Current Investigation
- Borehole Location, Coffey, 1971
- Borehole Location, Coffey, 1985
- P Standpipe Piezometer
- Geological Cross Section

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		TITLE: **Test Location Plan**
OFFICE: Sydney	DRAWN BY: MG	**Cockle Bay Park Redevelopment**
SCALE: 1:1000 @ A3	DATE: 12.10.2021	**241-249 Wheat Road, Sydney**

N

PROJECT No:	202546.00
DRAWING No:	1
REVISION:	2



UNIT DESCRIPTION:
Unit 1 - FILL
Unit 2 - ESTUARINE / MARINE SEDIMENTS
Unit 3 - VERY LOW TO LOW STRENGTH SANDSTONE
Unit 4 - LOW TO MEDIUM STRENGTH SANDSTONE
Unit 5 - MEDIUM TO HIGH STRENGTH SANDSTONE
Unit 6 - LOW TO MEDIUM STRENGTH SILTSTONE / LAMINITE

LEGEND

Core Loss	Concrete	Sand
Clay	Blank Lithology (with border)	Sandstone
Clayey Sand	Filling	Sandy Clay
Clayey Silt	Pavers	Silty Sand

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

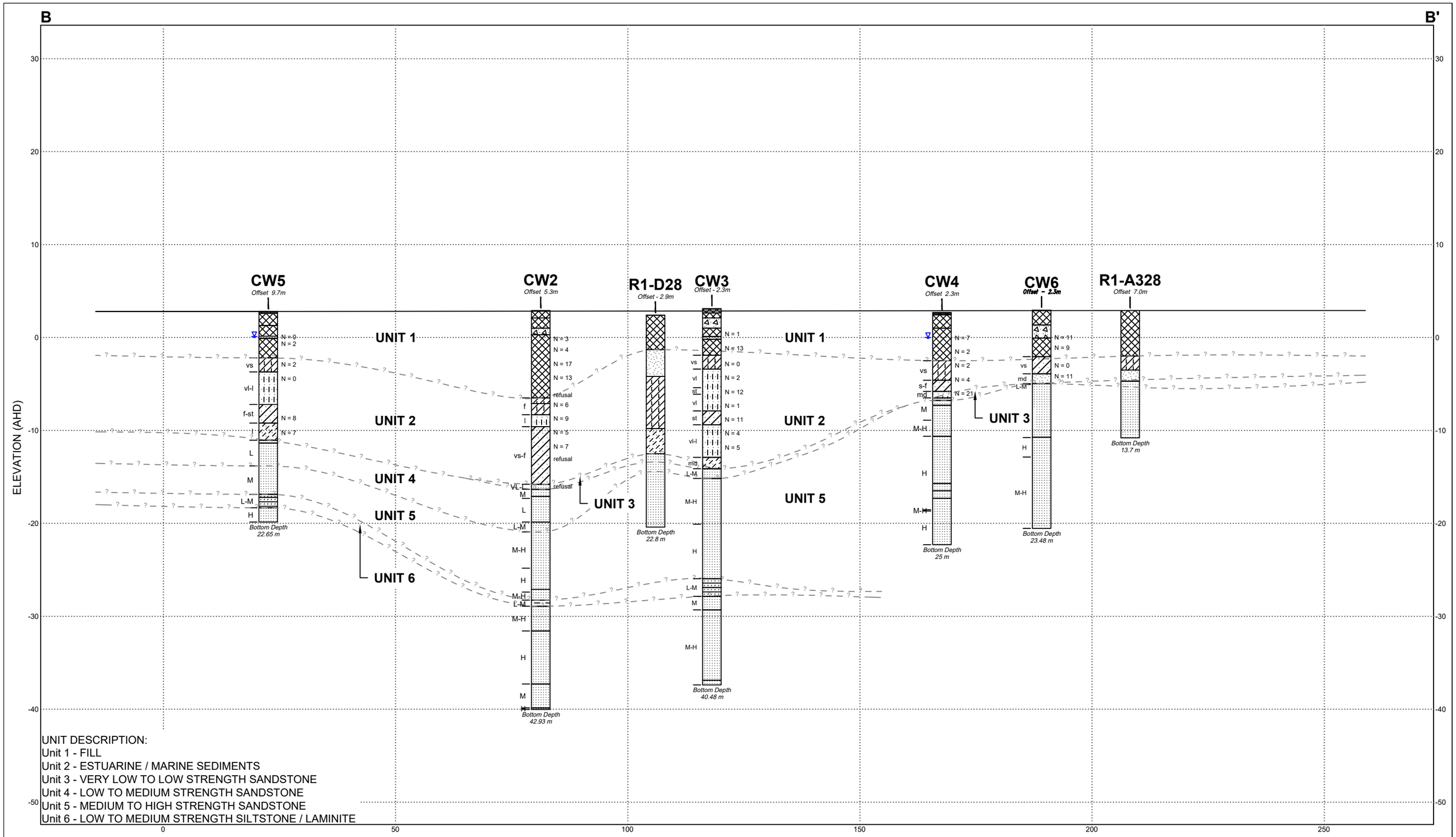
ROCK STRENGTH	SOIL CONSISTENCY	SOIL DENSITY
EL - Extremely Low	vs - Very Soft	vl - Very Loose
VL - Very Low	s - Soft	l - Loose
L - Low	f - Firm	md - Medium Dense
M - Medium	st - Stiff	d - Dense
H - High	vst - Very Stiff	vd - Very Dense
VH - Very High	h - Hard	

TESTS / OTHER
N - Standard penetration test value
— ? — — - Interpreted geotechnical boundary
▽ - Water level

0 16
Horizontal Scale (metres)
Vertical Exaggeration = 2.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		TITLE: **Cross-Section A-A'**	PROJECT No: 202546.00
OFFICE: Sydney	DRAWN BY: MG	**Cockle Bay Park Redevelopment**	DRAWING No: 2
SCALE: 1:800 (H) 1:400 (V) @ A3	DATE: 03.08.2021	**241-249 Wheat Road, Sydney**	REVISION: 0



UNIT DESCRIPTION:
Unit 1 - FILL
Unit 2 - ESTUARINE / MARINE SEDIMENTS
Unit 3 - VERY LOW TO LOW STRENGTH SANDSTONE
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Unit 6 - LOW TO MEDIUM STRENGTH SILTSTONE / LAMINITE

LEGEND

- Asphaltic Concrete
- Filling
- Concrete
- Silty Clay
- Silty Sand
- Sandy Clay
- Sandstone
- Siltstone
- Blank Lithology (with border)
- Clayey Sand
- Laminite
- Sand

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
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ROCK STRENGTH		SOIL CONSISTENCY		SOIL DENSITY	
EL -	Extremely Low	vs -	Very Soft	vl -	Very Loose
VL -	Very Low	s -	Soft	l -	Loose
L -	Low	f -	Firm	md -	Medium Dense
M -	Medium	st -	Stiff	d -	Dense
H -	High	vst -	Very Stiff	vd -	Very Dense
VH -	Very High	h -	Hard		

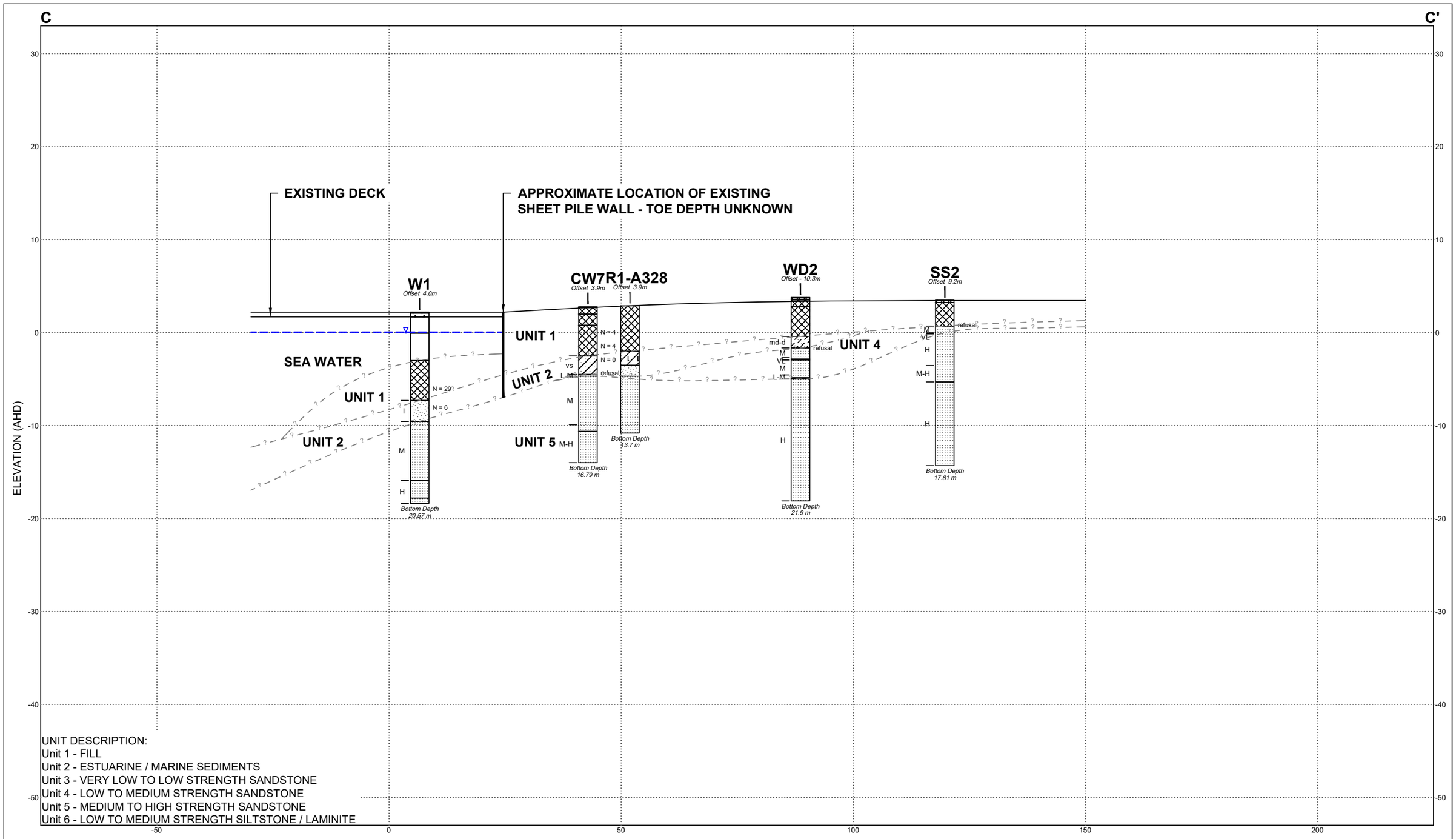
TESTS / OTHER
- N - Standard penetration test value
- Interpreted geotechnical boundary
- Water level

0 16
Horizontal Scale (metres)
Vertical Exaggeration = 2.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		PROJECT No: 202546.00
OFFICE: Sydney	DRAWN BY: MG	DRAWING No: 3
SCALE: 1:800 (H) 1:400 (V) @ A3	DATE: 09.09.2021	REVISION: 1

TITLE: **Cross-Section B-B'**
Cockle Bay Park Redevelopment
241-249 Wheat Road, Sydney



UNIT DESCRIPTION:
Unit 1 - FILL
Unit 2 - ESTUARINE / MARINE SEDIMENTS
Unit 3 - VERY LOW TO LOW STRENGTH SANDSTONE
Unit 4 - LOW TO MEDIUM STRENGTH SANDSTONE
Unit 5 - MEDIUM TO HIGH STRENGTH SANDSTONE
Unit 6 - LOW TO MEDIUM STRENGTH SILTSTONE / LAMINITE

LEGEND

- Core Loss
- Clayey Sand
- Concrete
- Blank Lithology (with border)
- Filling
- Pavers
- Sand
- Sandstone
- Sandy Clay
- Silty Clay

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

ROCK STRENGTH		SOIL CONSISTENCY		SOIL DENSITY	
EL	Extremely Low	vs	Very Soft	vl	Very Loose
VL	Very Low	s	Soft	l	Loose
L	Low	f	Firm	md	Medium Dense
M	Medium	st	Stiff	d	Dense
H	High	vst	Very Stiff	vd	Very Dense
VH	Very High	h	Hard		

TESTS / OTHER
N - Standard penetration test value
— ? — — - Interpreted geotechnical boundary
▽ - Water level

0 16
Horizontal Scale (metres)

Vertical Exaggeration = 2.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		TITLE: **Cross-section C-C'**	PROJECT No: 202546.00
OFFICE: Sydney	DRAWN BY: MG	**Cockle Bay Park Redevelopment**	DRAWING No: 4
SCALE: 1:800 (H) 1:400 (V) @ A3	DATE: 12.10.2021	**241-249 Wheat Road, Sydney**	REVISION: 2

D

D'

ELEVATION (AHD)

EXISTING DECK

APPROXIMATE LOCATION OF EXISTING SHEET PILE WALL - TOE DEPTH UNKNOWN

SEA WATER

UNIT 1

UNIT 2

UNIT 3

UNIT 4

UNIT 5

UNIT 6

CW1 Offset 7.2m

CW2 Offset - 13.0m

R1-D28 Offset 11.2m

R1-D40 Offset 10.2m

CP2 Offset - 1.0m

R2-L1 Offset - 8.7m

Bottom Depth 15.8 m

Bottom Depth 22.8 m

Bottom Depth 20.7 m

Bottom Depth 18.55 m

Bottom Depth 42.93 m

Bottom Depth 45 m

DISTANCE ALONG PROFILE (m)

UNIT DESCRIPTION:
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Unit 3 - VERY LOW TO LOW STRENGTH SANDSTONE
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Unit 5 - MEDIUM TO HIGH STRENGTH SANDSTONE
Unit 6 - LOW TO MEDIUM STRENGTH SILTSTONE / LAMINITE

LEGEND

Core Loss
Asphaltic Concrete
Clay
Clayey Sand
Clayey Silt
Concrete
Blank Lithology (with border)
Filling
Sand
Sandstone
Sandy Clay
Siltstone
Silty Clay
Silty Sand

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - Very Soft
s - Soft
f - Firm
st - Stiff
vst - Very Stiff
h - Hard

SOIL DENSITY
vl - Very Loose
l - Loose
md - Medium Dense
d - Dense
vd - Very Dense

TESTS / OTHER
N - Standard penetration test value
- Interpreted geotechnical boundary
- Water level

Horizontal Scale (metres) 0 16

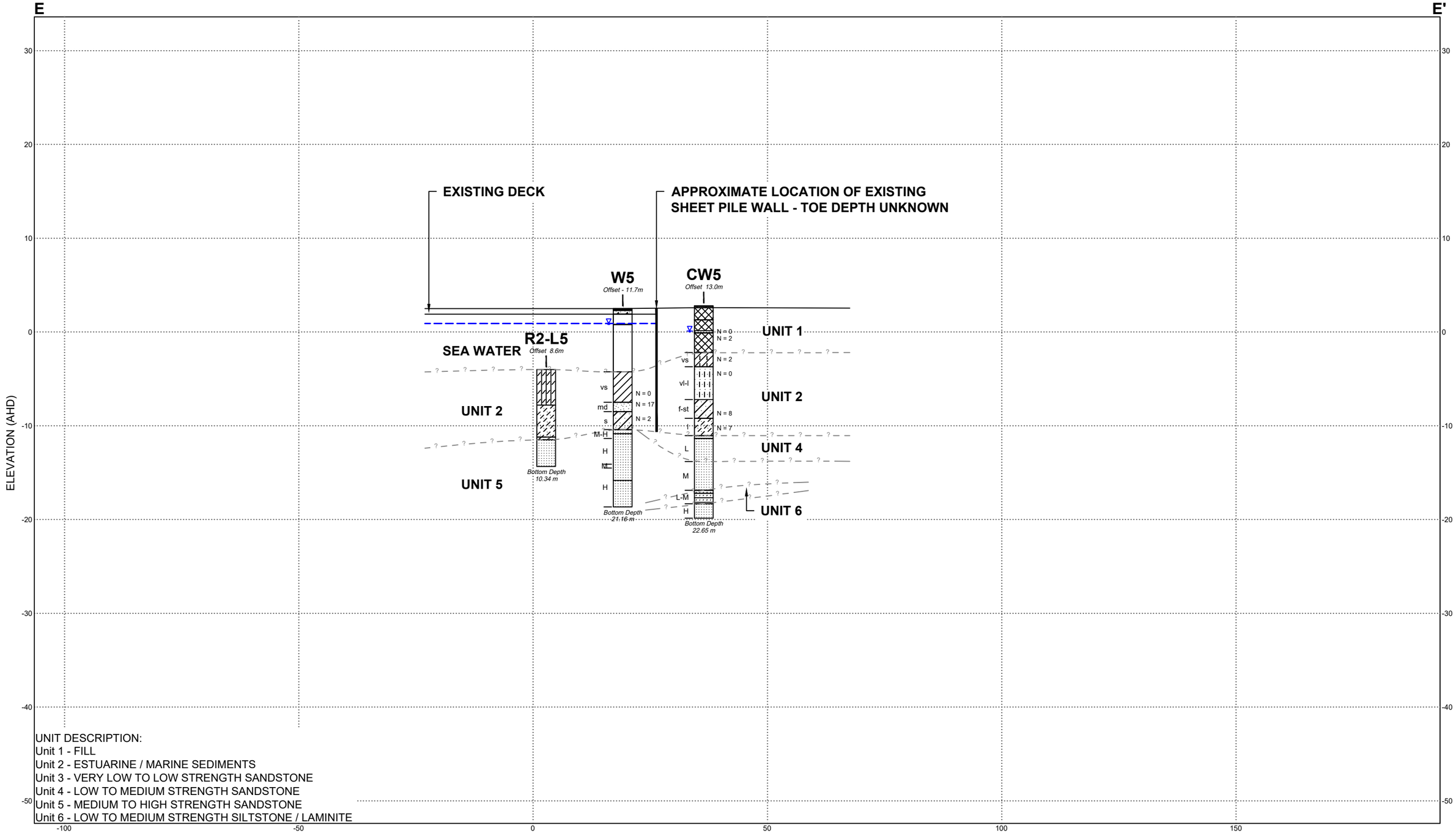
Vertical Exaggeration = 2.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		TITLE: **Cross-Section D-D'**	PROJECT No: 202546.00
OFFICE: Sydney	DRAWN BY: MG	**Cockle Bay Park Redevelopment**	DRAWING No: 5
SCALE: 1:800 (H) 1:400 (V) @ A3	DATE: 09.09.2021	**241-249 Wheat Road, Sydney**	REVISION: 1

E

E'



UNIT DESCRIPTION:
Unit 1 - FILL
Unit 2 - ESTUARINE / MARINE SEDIMENTS
Unit 3 - VERY LOW TO LOW STRENGTH SANDSTONE
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Unit 5 - MEDIUM TO HIGH STRENGTH SANDSTONE
Unit 6 - LOW TO MEDIUM STRENGTH SILTSTONE / LAMINITE

DISTANCE ALONG PROFILE (m)

LEGEND

- Asphaltic Concrete
- Concrete
- Filling
- Blank Lithology (with border)
- Silty Clay
- Silty Sand
- Sandy Clay
- Clayey Sand
- Sandstone
- Laminite
- Clayey Silt
- Pavers
- Clay
- Sand

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
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3. Horizontal and vertical scales are not equal.

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - Very Soft
s - Soft
f - Firm
st - Stiff
vst - Very Stiff
h - Hard

SOIL DENSITY
vl - Very Loose
l - Loose
md - Medium Dense
d - Dense
vd - Very Dense

TESTS / OTHER
N - Standard penetration test value
— ? — — - Interpreted geotechnical boundary
▽ - Water level

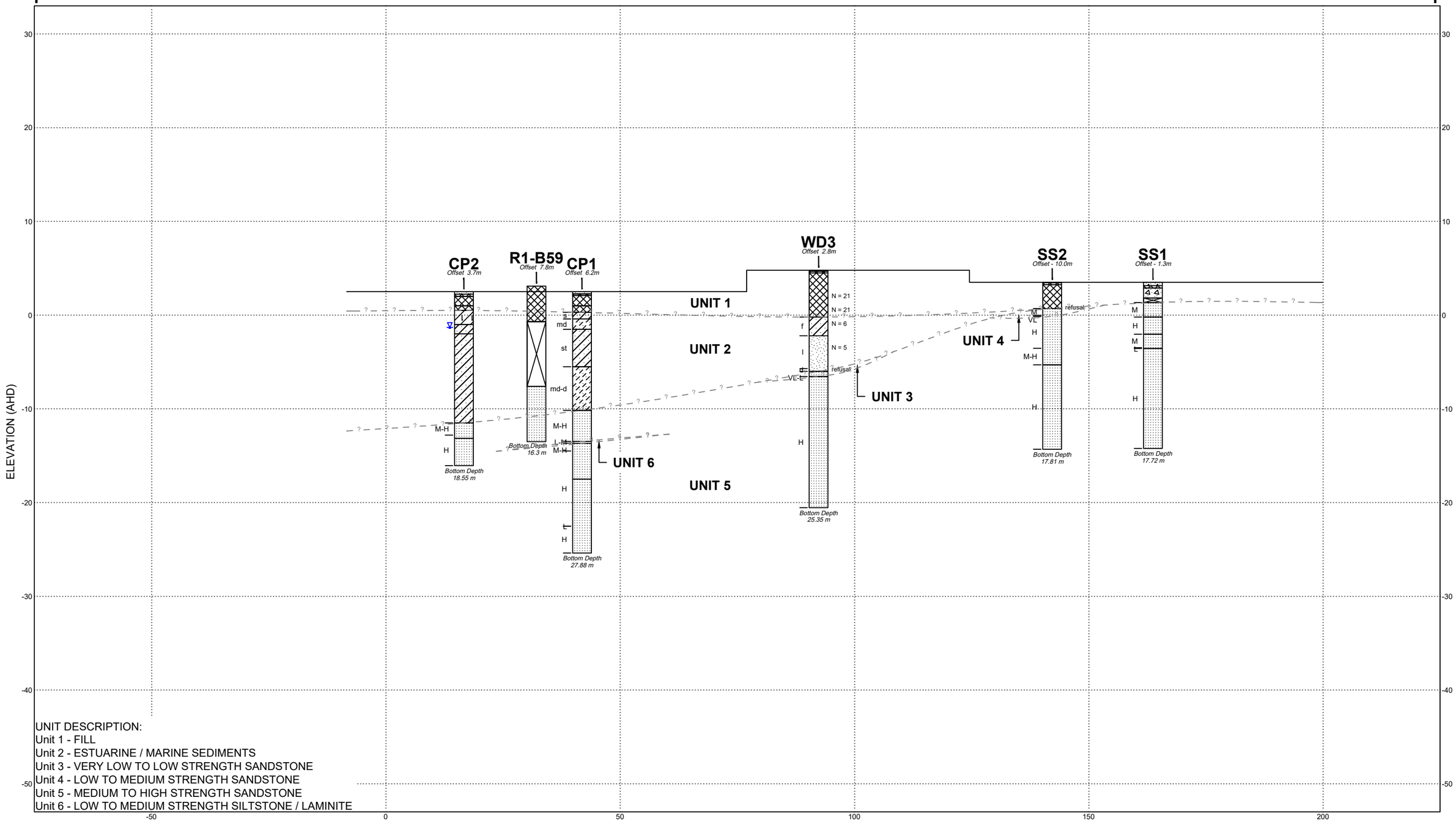
Horizontal Scale (metres) 0 16
Vertical Exaggeration = 2.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		TITLE: **Cross-Section E-E'**	PROJECT No: 202546.00
OFFICE: Sydney	DRAWN BY: MG	**Cockle Bay Park Redevelopment**	DRAWING No: 6
SCALE: 1:800 (H) 1:400 (V) @ A3	DATE: 03.08.2021	**241-249 Wheat Road, Sydney**	REVISION: 0

F

F'



UNIT DESCRIPTION:
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Unit 6 - LOW TO MEDIUM STRENGTH SILTSTONE / LAMINITE

DISTANCE ALONG PROFILE (m)

LEGEND

Core Loss
Clayey Sand
Concrete
Filling
Pavers
Sand
Sandstone
Sandy Clay
Siltstone
Silty Clay

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
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ROCK STRENGTH		SOIL CONSISTENCY		SOIL DENSITY		TESTS / OTHER	
EL -	Extremely Low	vs -	Very Soft	vl -	Very Loose	N	- Standard penetration test value
VL -	Very Low	s -	Soft	l -	Loose	— ? — —	- Interpreted geotechnical boundary
L -	Low	f -	Firm	md -	Medium Dense	▽	- Water level
M -	Medium	st -	Stiff	d -	Dense		
H -	High	vst -	Very Stiff	vd -	Very Dense		
VH -	Very High	h -	Hard				

0 16
Horizontal Scale (metres)
Vertical Exaggeration = 2.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: DPT Operator Pty Ltd		TITLE: **Cross-section F-F'**	PROJECT No: 202546.00
OFFICE: Sydney	DRAWN BY: MG	**Cockle Bay Park Redevelopment**	DRAWING No: 7
SCALE: 1:800 (H) 1:400 (V) @ A3	DATE: 13.10.2021	**241-249 Wheat Road, Sydney**	REVISION: 0

Appendix B

Descriptive Notes

Borehole Logs

Sampling Methods

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Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

Description and Classification Methods

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

Soil Types

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

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

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

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

Definitions of grading terms used are:

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

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

In fine grained soils (>35% fines)

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

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

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

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

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

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

Soil Descriptions

Cohesive Soils

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

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

Cohesionless Soils

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

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

Soil Origin

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

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

Moisture Condition – Coarse Grained Soils

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

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

Moisture Condition – Fine Grained Soils

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

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

Rock Strength

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

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

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Rock Descriptions

Degree of Fracturing

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

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

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

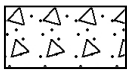
Symbols & Abbreviations

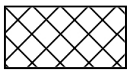
Graphic Symbols for Soil and Rock

General

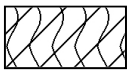

Asphalt

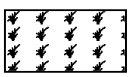

Road base

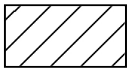

Concrete

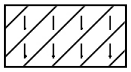

Filling

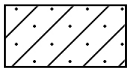
Soils


Topsoil

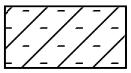

Peat

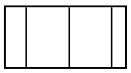

Clay

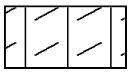

Silty clay

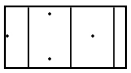

Sandy clay

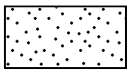

Gravelly clay

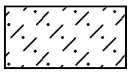

Shaly clay

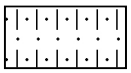

Silt


Clayey silt


Sandy silt

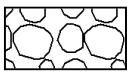

Sand

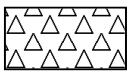

Clayey sand


Silty sand


Gravel

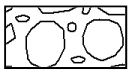

Sandy gravel


Cobbles, boulders

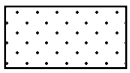

Talus

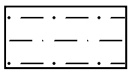
Sedimentary Rocks

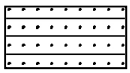

Boulder conglomerate

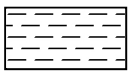

Conglomerate


Conglomeratic sandstone

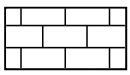

Sandstone


Siltstone

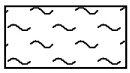

Laminite

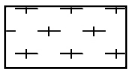

Mudstone, claystone, shale

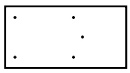

Coal


Limestone

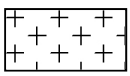
Metamorphic Rocks

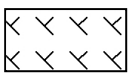

Slate, phyllite, schist

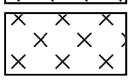

Gneiss

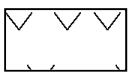

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333784
NORTHING: 6250591
DIP/AZIMUTH: 90°/--

BORE No: CP1
PROJECT No: 202546.00
DATE: 18 - 19/9/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
2	0.24	CONCRETE: grey, igneous aggregate of 12mm nominal diameter, 18mm steel reinforcement							A			
	0.4	FILL/Sandy GRAVEL: fine to medium igneous gravel, dark grey, fine to coarse sand, with silt, moist, appears medium dense							A			
1	1	FILL/Silty SAND: fine to coarse, brown, trace fine sandstone gravel and concrete cobbles, moist, appears in a medium dense condition							A*			
	1.5	FILL/Sandy SILT: low plasticity, grey, fine to coarse sand, trace fine sandstone gravel, W<PL, appears in a firm condition							A			
0	2	Sandy CLAY CL: low plasticity, grey-brown, fine to medium sand, W<PL, appears soft, estuarine							A			
	2.2								A			
-1	2.9	Clayey SAND SC: fine to medium, grey, trace shells, sulphurous odour, w>PL, appears medium dense, estuarine							A			
	3								U_{50}			
-2	4	Sandy CLAY CL: low plasticity, orange-brown mottled grey, fine to medium sand, w>PL, stiff, estuarine										
	4.0											
	5											
-3									U_{50}			pp = 180
	6											
-4		Below 6.5m: grading to grey										
	7											
-5												
	8											
	8.0	Clayey SAND SC: fine to medium, red-brown, wet, appears medium dense to dense, estuarine										
-6		Below 8.7m: grading to grey										
	9											
-7		Below 9.4m: grading to orange-brown										

RIG: XC rig **DRILLER:** Terratest **LOGGED:** LHS **CASING:** HW to 3.5m; HQ to 12.66m

TYPE OF BORING: Diacore to 0.24m, Hand auger to 0.5m, Solid flight auger to 3.0m; Rotary wash bore to 12.66m; NMLC Coring to 27.88m

WATER OBSERVATIONS: Free groundwater observed at 3.0m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD01/180921 taken at 1.0-1.1m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333784
NORTHING: 6250591
DIP/AZIMUTH: 90°/--

BORE No: CP1
PROJECT No: 202546.00
DATE: 18 - 19/9/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-8	11	Clayey SAND SC: fine to medium, red-brown, wet, appears medium dense to dense, estuarine *(continued)*										
-9	12							Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-10°				
-10	12.66	SANDSTONE: medium to coarse grained, orange-brown, distinctly and indistinctly bedded at 0-10°, with siltstone specks, medium to high strength, moderately weathered, slightly fractured, Hawkesbury sandstone							C	100	100	PL(A) = 0.5
-11	13											PL(A) = 1.1
-12	14	Below 14.07m: becoming pale grey, fresh						13.8m: B5°, pl, ro, fe stn 14.07m: B10°, un, cbs 1mm	C	100	99	PL(A) = 0.9
-13	15	Between 15.27-15.28m: siltstone clasts Below 15.74m: siltstone clasts and lenses						15.28m: Cs, 10mm				PL(A) = 1.1
-14	15.98 16 16.18	SILTSTONE: dark grey, with 5% pale grey, fine grained sandstone laminations and beds, low to medium strength, fresh, slightly fractured, Hawkesbury sandstone						15.84m: B10°, un, ro, cln 16.17m: B20°, pl, cly vnr 16.37m: B0°, pl, cly vnr 16.4m: B5°, pl, cly 2mm	C	100	98	PL(A) = 0.3 PL(A) = 0.7
-15	17	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high strength, fresh, slightly fractured, Hawkesbury sandstone Below 17.00m: high strength, unbroken										PL(A) = 1
-16	18								C	100	100	PL(A) = 1.1 PL(A) = 1.3
-17	19								C	100	100	PL(A) = 1.1
	20.0											

RIG: XC rig **DRILLER:** Terratest **LOGGED:** LHS **CASING:** HW to 3.5m; HQ to 12.66m

TYPE OF BORING: Diacore to 0.24m, Hand auger to 0.5m, Solid flight auger to 3.0m; Rotary wash bore to 12.66m; NMLC Coring to 27.88m

WATER OBSERVATIONS: Free groundwater observed at 3.0m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD01/180921 taken at 1.0-1.1m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333784
NORTHING: 6250591
DIP/AZIMUTH: 90°/--

BORE No: CP1
PROJECT No: 202546.00
DATE: 18 - 19/9/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-18	21	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, high strength, fresh, unbroken, Hawkesbury sandstone							C	100	100	PL(A) = 1
-19									C	100	100	PL(A) = 1.4
-20	22								C	100	100	PL(A) = 1.1
-21	23								C	100	100	PL(A) = 1.5
-22	24											PL(A) = 1.2
-23	25	Below 25.4m: 5% siltstone clasts and specks						25.02-25.03m: B0°, pl, cly vnr	C	100	96	PL(A) = 1.2
-24	26							26m: B10°, un, cly 5mm				PL(A) = 1.8
-25	27	Below 26.6m: massive							C	100	100	PL(A) = 1.5
	27.88											
-26	28	Bore discontinued at 27.88m - Limit of investigation										
-27	29											

RIG: XC rig **DRILLER:** Terratest **LOGGED:** LHS **CASING:** HW to 3.5m; HQ to 12.66m

TYPE OF BORING: Diacore to 0.24m, Hand auger to 0.5m, Solid flight auger to 3.0m; Rotary wash bore to 12.66m; NMLC Coring to 27.88m

WATER OBSERVATIONS: Free groundwater observed at 3.0m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD01/180921 taken at 1.0-1.1m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: CP1 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

12.66 – 17.00m

BORE: CP1 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

17.00 – 22.00m

BORE: CP1 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

22.00 – 27.00m

BORE: CP1 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

27.00 – 27.88m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333780
NORTHING: 6250566
DIP/AZIMUTH: 90°/--

BORE No: CP2
PROJECT No: 202546.00
DATE: 20 - 21/8/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
2.5	0.26	CONCRETE: two rows of reo (approximately 10mm diameter)										
2	0.5	FILL/Clayey GRAVEL: medium to coarse gravel, dark grey, low plasticity clay, moist							A/E			
1	1	FILL/Gravelly SAND: fine to medium sand, medium to coarse gravel, dark grey, moist							A/E			
0.5	1.5	FILL/Silty CLAY: medium plasticity, dark grey, with medium to coarse gravel, w~PL							A/E			
0	2.0	Silty CLAY: medium plasticity, pale brown, w>PL, estuarine							A/E			
-0.5	3								A/E			
-1	3.5	Sandy CLAY: low plasticity, dark grey, medium sand, with shell fragments, w>PL, estuarine				20-08-21			A/E			
-1.5	4								A/E			
-2	4.5	Sandy CLAY: low to medium plasticity, pale brown mottled orange, medium sand, w~PL, estuarine							A/E			
-2.5	5								A/E			
-3	6											
-4	7											
-5	8											
-6	9											
-7												

RIG: Underpinner **DRILLER:** Ground Test **LOGGED:** JY **CASING:** 90mm PVC to 6.0m

TYPE OF BORING: Diacore to 0.26m, hand auger to 0.50m, Spiral flight auger (TC Bit) to 5.0m, Rotary drilling to 14.0m, NMLC to 18.55m

WATER OBSERVATIONS: Free groundwater observed at 3.9m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 3.0m, Slotted PVC pipe 3.0 to 18.55m, backfill 0.0 to 2m, bentonite 2 to 2.5m, gravel 2.5 to 18.55m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333780
NORTHING: 6250566
DIP/AZIMUTH: 90°/--

BORE No: CP2
PROJECT No: 202546.00
DATE: 20 - 21/8/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
-8		Sandy CLAY: low to medium plasticity, pale brown mottled orange, medium sand, w~PL, estuarine *(continued)*										
-9	11											
-10	12											
-11	13							Unless otherwise stated, rock is fractured along planar, rough and clean bedding plane defects dipping 0-10°				
-12	14 14.0	SANDSTONE: medium to coarse grained, red brown and pale brown, thinly bedded, medium to high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone						14.22m: B 20°, pl, ro, cln 14.4m: B 20°, pl, ro, cly 10mm 14.59m: B 20°, pl, ro, cln	C	100	87	PL(A) = 0.5
-13	15							14.92m: B 20°, pl, ro, fe 15.05m, 15.06m: Bx2 0°, pl, ro, fe 15.14m: B 20°, pl, ro, cln 15.18m, 15.20m: Bx2 0°, pl, ro, fe 15.2m: B 0°, pl, ro, fe, cly 25mm 15.3m: Jx2 20°, cu, ro, fe 15.65m, 15.69m: B 0°, un, ro, cbs				PL(A) = 1.2
	15.65	SANDSTONE: fine to medium grained, pale grey, thinly bedded, high strength, slightly weathered to fresh, unbroken, Hawkesbury Sandstone Below 16.7m: with siltstone clasts							C	100	100	
-14	16											PL(A) = 1.5
-15	17								C	100	100	PL(A) = 1.7
-16	18	Below 18m: medium to coarse grained										PL(A) = 1.5
	18.55	Bore discontinued at 18.55m - Limit of investigation (equipment limitation)										
-17	19											

RIG: Underpinner **DRILLER:** Ground Test **LOGGED:** JY **CASING:** 90mm PVC to 6.0m

TYPE OF BORING: Diacore to 0.26m, hand auger to 0.50m, Spiral flight auger (TC Bit) to 5.0m, Rotary drilling to 14.0m, NMLC to 18.55m

WATER OBSERVATIONS: Free groundwater observed at 3.9m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 3.0m, Slotted PVC pipe 3.0 to 18.55m, backfill 0.0 to 2m, bentonite 2 to 2.5m, gravel 2.5 to 18.55m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

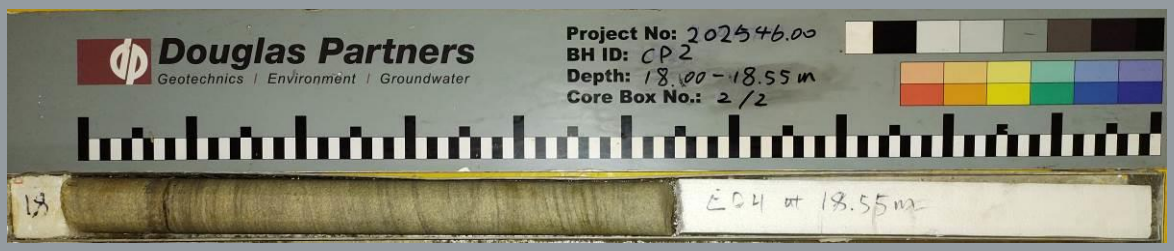
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: CP2 PROJECT: Cockle Bay Wharf AUGUST 2021

14.00 – 18.00m

BORE: CP2 PROJECT: Cockle Bay Wharf AUGUST 2021



18.00 – 18.55m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.3 AHD
EASTING: 333717
NORTHING: 6250585
DIP/AZIMUTH: 90°/--

BORE No: CW1
PROJECT No: 202546.00
DATE: 12 - 14/7/2021
SHEET 1 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.2	CONCRETE: igneous gravel of 20mm nominal diameter										
		VOID										
	0.93	CONCRETE: igneous gravel of 20mm nominal diameter										
	1.31	VOID										
	3.4	SEAWATER				12-07-21						
	6.8	FILL/SAND: fine to coarse, brown, with sandstone gravel, cobbles and brick fragments, wet, appears generally in a loose condition							S^			25/140 refusal
									S^			9,25/100 refusal

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 21.0m

TYPE OF BORING: Diacore to 0.2m, NDD to 0.93m, Diacore to 1.31m; Rotary wash bore 6.8m to 20.8m, NMLC Coring to 45.0m

WATER OBSERVATIONS: Water observed at 3.40m at 2:00pm on 12 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.15m and 8.75m undertaken in HW casing; *Field replicate BD07/120721 taken at 12.0-12.45m depth and field replicate BD08/130721 taken at 20.5-20.95m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.3 AHD
EASTING: 333717
NORTHING: 6250585
DIP/AZIMUTH: 90°/--

BORE No: CW1
PROJECT No: 202546.00
DATE: 12 - 14/7/2021
SHEET 2 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-7									S			12,13,8 N = 21
	10.5	Sandy CLAY CL: low plasticity, grey, medium to coarse sand, w>PL, stiff, estuarine										
-8	11											
									U_{75}			pp = 190
-9	12								S/E*			4,8,8 N = 16
	12.7	Clayey SILT MH: high plasticity, grey, with medium to coarse sand, w>PL, firm, estuarine										
-10	13								S/E			1,2,4 N = 6
-11	14											
									S/E			13,11,6 N = 17
-12	15											
		Below 15.5m: grading to grey mottled orange-brown, trace medium to coarse sand, soft										
-13	16								S/E			0,0,3 N = 3
	17 17.0	SAND SP: medium to coarse, grey mottled orange-brown, trace clay, wet, dense, estuarine										
-14		Below 17.5m: grading to pale brown, without clay							S/E			25/140 refusal
	18											
-15												
	19	Below 19m: grading to medium dense							S/E			2,1,10 N = 11
-16												

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 21.0m

TYPE OF BORING: Diacore to 0.2m, NDD to 0.93m, Diacore to 1.31m; Rotary wash bore 6.8m to 20.8m, NMLC Coring to 45.0m

WATER OBSERVATIONS: Water observed at 3.40m at 2:00pm on 12 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.15m and 8.75m undertaken in HW casing; *Field replicate BD07/120721 taken at 12.0-12.45m depth and field replicate BD08/130721 taken at 20.5-20.95m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.3 AHD
EASTING: 333717
NORTHING: 6250585
DIP/AZIMUTH: 90°/--

BORE No: CW1
PROJECT No: 202546.00
DATE: 12 - 14/7/2021
SHEET 3 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
-17		SAND SP: medium to coarse, grey mottled orange-brown, trace clay, wet, dense, estuarine *(continued)*						Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°				
		Below 20.4m: grading to pale brown mottled yellow-brown, possibly residual							S/E*			12,23,27 N = 50
	20.8											
	21	SANDSTONE: medium to coarse grained, red and orange-brown, very low to low strength, highly										PL(A) = 0.08 PL(A) = 0.2
-18								21.15m: Ds, 60mm				PL(A) = 0.2 PL(A) = 0.5
	21.45	weathered to moderately weathered, slightly fractured, Hawkesbury Sandstone										
								21.79m: B10°, pl, cly 3mm				PL(A) = 0.5
	22	SANDSTONE: medium to coarse grained, pale grey and orange-brown, distinctly and indistinctly bedded at 5-10°, medium strength, slightly weathered, Hawkesbury Sandstone						22.11-22.23m: J70°, pl, ro, fe stn	C	100	89	
-19								22.32m: B20°, un, ro, cln				
		Below 22.23m: becoming pale grey, fresh						22.79-22.95m: B20° (x2), pl, cly vn				PL(A) = 0.4
	23	Between 22.79-22.81m: carbonaceous laminations						23m: B0°, pl, cly 5mm				PL(A) = 0.7
-20	23.3											PL(A) = 1.3
		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 5-20°, high strength, fresh, slightly fractured, Hawkesbury Sandstone										PL(A) = 1.1
	24							23.9m: B10°, pl, cly vn				
-21								24.4-24.47m: B10° (x2), pl, cly vn				PL(A) = 1.4
	25								C	100	98	
-22								25.33m: B5°, pl, cly vn				
												PL(A) = 1.2
	26											
-23												PL(A) = 1.5
	27											
-24								27.63m: B10°, pl, cly vn				PL(A) = 1.5
	28							27.84m: B0°, pl, cly vn	C	100	98	
-25		Between 28.4-29.3m: with siltstone specks and clasts										PL(A) = 1.7
	29											
-26								29.12m: B5°, un, ro, cln 29.19m: B0°, pl, cly vn				PL(A) = 2.2
								29.75m: B10°, pl, cly	C	100	94	

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 21.0m

TYPE OF BORING: Diacore to 0.2m, NDD to 0.93m, Diacore to 1.31m; Rotary wash bore 6.8m to 20.8m, NMLC Coring to 45.0m

WATER OBSERVATIONS: Water observed at 3.40m at 2:00pm on 12 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.15m and 8.75m undertaken in HW casing; *Field replicate BD07/120721 taken at 12.0-12.45m depth and field replicate BD08/130721 taken at 20.5-20.95m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.3 AHD
EASTING: 333717
NORTHING: 6250585
DIP/AZIMUTH: 90°/--

BORE No: CW1
PROJECT No: 202546.00
DATE: 12 - 14/7/2021
SHEET 4 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
-27		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 5-20°, high strength, fresh, slightly fractured, Hawkesbury Sandstone *(continued)*						2mm	C	100	94	PL(A) = 1.3
	30.92											PL(A) = 0.2
-28	31	SILTSTONE: dark grey, low strength with 40% clay bands, highly weathered, slightly fractured, Hawkesbury Sandstone						31.18m: Cs, 100mm				
	31.48	Between 31.28-31.36: medium grained sandstone bed						31.37m: Cs, 110mm				
	32	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded 5-20°, high strength, fresh, unbroken, Hawkesbury Sandstone										PL(A) = 1.2
-29		Between 32.67-32.74m: with carbonaceous laminations, low strength							C	100	96	PL(A) = 1.4
	33	Between 32.99-34.44m: slightly fractured						32.99m: Cs, 15mm				
-30		Between 33.43-34.5m: with siltstone specks and clasts						33.37m: B5°, pl, cly 3mm				PL(A) = 2
	34							33.59m: B10°, un, ro, cln				
-31								34.44m: B0°, un, ro, cln				PL(A) = 1.4
	35	Between 34.79-34.81m: carbonaceous laminations										
		Between 34.85-36.4m: massive							C	100	100	PL(A) = 1.5
-32	36											
-33												PL(A) = 1.8
	37											
-34												PL(A) = 1.5
	38											
-35		Between 38.3-39.75m: massive							C	100	100	PL(A) = 1.4
	39							>>				
-36												PL(A) = 1.6

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 21.0m

TYPE OF BORING: Diacore to 0.2m, NDD to 0.93m, Diacore to 1.31m; Rotary wash bore 6.8m to 20.8m, NMLC Coring to 45.0m

WATER OBSERVATIONS: Water observed at 3.40m at 2:00pm on 12 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.15m and 8.75m undertaken in HW casing; *Field replicate BD07/120721 taken at 12.0-12.45m depth and field replicate BD08/130721 taken at 20.5-20.95m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.3 AHD
EASTING: 333717
NORTHING: 6250585
DIP/AZIMUTH: 90°/--

BORE No: CW1
PROJECT No: 202546.00
DATE: 12 - 14/7/2021
SHEET 5 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-37		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded 5-20°, high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*							C	100	100	PL(A) = 1.4
	41											
-38		Between 41.3-41.5m: siltstone breccia										
		Between 41.5-42.1m: with siltstone specks							C	100	100	PL(A) = 1.5
	42											
-39												PL(A) = 1.5
	43											
-40								43.3m: B10°, un, cly vn				PL(A) = 1.4
	44								C	100	100	
-41								44.16m: B10°, pl, cly vn				PL(A) = 1
	45 45.0	Bore discontinued at 45.0m - Limit of investigation										
-42												
	46											
-43												
	47											
-44												
	48											
-45												
	49											
-46												

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 21.0m

TYPE OF BORING: Diacore to 0.2m, NDD to 0.93m, Diacore to 1.31m; Rotary wash bore 6.8m to 20.8m, NMLC Coring to 45.0m

WATER OBSERVATIONS: Water observed at 3.40m at 2:00pm on 12 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.15m and 8.75m undertaken in HW casing; *Field replicate BD07/120721 taken at 12.0-12.45m depth and field replicate BD08/130721 taken at 20.5-20.95m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: CW1 PROJECT: Cockle Bay Wharf JULY 2021

20.80 – 25.00m

BORE: CW1 PROJECT: Cockle Bay Wharf JULY 2021

25.00 – 30.00m

BORE: CW1 PROJECT: Cockle Bay Wharf JULY 2021

30.00 – 35.00m

BORE: CW1 PROJECT: Cockle Bay Wharf JULY 2021

35.00 – 40.00m

BORE: CW1 PROJECT: Cockle Bay Wharf JULY 2021

40.00 – 45.00m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.9 AHD
EASTING: 333732
NORTHING: 6250562
DIP/AZIMUTH: 90°/--

BORE No: CW2
PROJECT No: 202546.00
DATE: 9 - 13/7/2021
SHEET 1 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.06	ASPHALTIC CONCRETE							E			
		FILL/Sandy GRAVEL: fine to coarse igneous gravel, grey, fine to coarse sand, moist, appears moderately compacted							E			
	0.8	Below 0.2m: grading to fine to coarse sandstone gravel, brown, with bricks, trace steel bars, concrete rubble, glass fragments and possible charcoal, appears generally in a loose condition							E*			
	1.9	FILL/Gravelly SAND: fine to coarse sand, brown, with fine to coarse sandstone gravel, trace sandstone cobbles, moist, appears generally in a loose condition							E			
	2.6	FILL/CONCRETE										
		FILL/Clayey SAND: medium to coarse, brown and pale grey, silty clay, sandstone gravel, cobbles, boulders and brick fragments, wet, appears generally in a very loose to loose condition							S/E			3,2,1 N = 3
									S/E			1,2,2 N = 4
		Below 5.5m: appears generally in a medium dense condition							S/E			9,9,8 N = 17
									S/E			5,6,7 N = 13
		Between 7.6-8.3m: likely concrete rubble										
									S			10 refusal bouncing, no sample recovered
	9.4	Between 9.15-9.4m: piece of timber (possible sleeper)										
		Silty CLAY CL-CI: (continued on next page)										
	10.0											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.35m; HQ to 20.6m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.9m, Solid flight auger (TC Bit) to 2.35m, Rotary wash boring to 19.24m, NMLC Coring to 42.93m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD02/20210630 taken at 0.9-1.0m; Groundwater well constructed: blank PVC 0.0 to 3.1m, Slotted PVC pipe 3.1 to 12.6m, backfill 0.0 to 0.6m, bentonite 0.6 to 2.6m, gravel 2.6 to 12.6m; gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.9 AHD
EASTING: 333732
NORTHING: 6250562
DIP/AZIMUTH: 90°/--

BORE No: CW2
PROJECT No: 202546.00
DATE: 9 - 13/7/2021
SHEET 2 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-8	11	Silty CLAY CL-CI: low to medium plasticity, dark grey, with roots and rootlets, trace charcoal, w>PL, firm, estuarine							S/E S/E U_{50}			2,3,3 N = 6
-9	11.2 12	Silty SAND SM: medium to coarse, pale grey, with sandy clay beds, trace seashells, wet, loose, estuarine							S			3,4,5 N = 9
-10	12.5 13	Sandy CLAY CL-CI: low to medium plasticity, pale grey, brown and red-brown, with silt, clayey sand and silty clay beds, trace ironstone gravel, w>PL, firm with very soft to soft beds, estuarine							S			2,2,3 N = 5
-11	14											
-12	15								S			5,4,3 N = 7
-13	16								S			25/100 refusal bouncing, no sample recovered
-14	17											
-15	18							Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-10°, with ironstaining or clay coating				
-16	18.7 19	SANDSTONE: brown, pale grey and red-brown, apparently very low to low strength							S			10/50 refusal bouncing, no sample recovered
-17	19.24 20.0	SANDSTONE: (continued on next page)							C	100	97	PL(A) = 0.5

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.35m; HQ to 20.6m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.9m, Solid flight auger (TC Bit) to 2.35m, Rotary wash boring to 19.24m, NMLC Coring to 42.93m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD02/20210630 taken at 0.9-1.0m; Groundwater well constructed: blank PVC 0.0 to 3.1m, Slotted PVC pipe 3.1 to 12.6m, backfill 0.0 to 0.6m, bentonite 0.6 to 2.6m, gravel 2.6 to 12.6m; gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.9 AHD
EASTING: 333732
NORTHING: 6250562
DIP/AZIMUTH: 90°/--

BORE No: CW2
PROJECT No: 202546.00
DATE: 9 - 13/7/2021
SHEET 3 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
-18	21	SANDSTONE: medium to coarse grained, brown, pale grey and red-brown, distinctly and indistinctly bedded at 0-10°, low to medium strength with very low strength bands, highly weathered to slightly weathered, fractured and slightly fractured, Hawkesbury Sandstone						20.54m: J60°, ir, ro, cln (healed) 20.57m: J40°, ir, ro, cly vn 20.64m: Ds, 30mm 21.05m: J50°, ir, ro, cly vn 21.15m: Ds, 10mm 21.32m: Ds, 10mm 21.44-21.46m: J50°(x2), pl, ro, cly co 21.52m: B0-10°, un, ro, cly co 5mm 21.62-21.76m: J70°, ir, ro, cly co 21.96-22.05m: J50°, pl, ro, cly vn 22.07-22.12m: J80°, ir, ro, cln 22.10-22.17m: J50°, pl, ro, cly vn 22.38m: J50°, pl, ro, cly vn 23.61m: Ds, 10mm 23.83m: J20°, pl ro, cly co 24.15m: J20°, pl, ro, cly vn 25.11m: B10°, pl, ro, cly co 5mm	C	100	97	PL(A) = 0.2
-19	22								C	100	25	PL(A) = 0.2
-20	22.75 23	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, 1-5% siltstone and carbonaceous laminations, low to medium strength, slightly weathered, slightly fractured, Hawkesbury Sandstone										PL(A) = 0.4
-21	24	Below 23.83m: medium to high strength, fresh										PL(A) = 0.6
-22	25								C	100	88	PL(A) = 1.1
-23	26											PL(A) = 0.9
-24	27											PL(A) = 1
-25	28								C	100	100	PL(A) = 1.3
-26	29											PL(A) = 1.2
-27	30.0	Between 29.45-29.51m: 25% siltstone clasts							C	100	98	PL(A) = 1.5

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.35m; HQ to 20.6m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.9m, Solid flight auger (TC Bit) to 2.35m, Rotary wash boring to 19.24m, NMLC Coring to 42.93m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD02/20210630 taken at 0.9-1.0m; Groundwater well constructed: blank PVC 0.0 to 3.1m, Slotted PVC pipe 3.1 to 12.6m, backfill 0.0 to 0.6m, bentonite 0.6 to 2.6m, gravel 2.6 to 12.6m; gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.9 AHD
EASTING: 333732
NORTHING: 6250562
DIP/AZIMUTH: 90°/--

BORE No: CW2
PROJECT No: 202546.00
DATE: 9 - 13/7/2021
SHEET 4 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
-28		SANDSTONE: (continued)							C	100	98	
	31											PL(A) = 0.9
	31.15	SILTSTONE: dark grey, thinly laminated at 0-10°, low strength, fresh, slightly fractured, Hawkesbury Sandstone										PL(A) = 0.2
-29	31.82	Between 31.59-31.69m: sandstone bed, pale grey, medium strength						31.45m: J40°, pl, ro, cly vn 31.81m: Ds, 10mm				PL(A) = 0.6
	32	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, 1-5% siltstone laminations and clasts, medium to high strength, fresh, slightly fractured, Hawkesbury Sandstone										PL(A) = 1
-30									C	100	99	
	33											
		Between 33.45-33.47m: siltstone clasts										PL(A) = 0.8
-31	34							33.99-34.06m: B0-5°(x5), pl, ro, cly co				
	34.47	Between 34.43-34.47m: siltstone clasts										
-32		SANDSTONE: medium to coarse grained, pale grey, indistinctly bedded, 5% siltstone flecks, high strength, fresh, unbroken, Hawkesbury Sandstone										PL(A) = 1.3
	35								C	100	97	(UCS Sample 35.61-35.95m)
-33												PL(A) = 1.3
	36											
-34								>>				PL(A) = 1.3
	37											
-35												PL(A) = 1.2
	38								C	100	100	
-36												PL(A) = 1.3
	39											
-37												

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.35m; HQ to 20.6m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.9m, Solid flight auger (TC Bit) to 2.35m, Rotary wash boring to 19.24m, NMLC Coring to 42.93m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD02/20210630 taken at 0.9-1.0m; Groundwater well constructed: blank PVC 0.0 to 3.1m, Slotted PVC pipe 3.1 to 12.6m, backfill 0.0 to 0.6m, bentonite 0.6 to 2.6m, gravel 2.6 to 12.6m; gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.9 AHD
EASTING: 333732
NORTHING: 6250562
DIP/AZIMUTH: 90°/--

BORE No: CW2
PROJECT No: 202546.00
DATE: 9 - 13/7/2021
SHEET 5 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-38	40.19	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, 5-10% dark grey siltstone laminations, medium strength, fresh, slightly fractured, Hawkesbury Sandstone						40.21m: Ds, 10mm	C	100	99	PL(A) = 1.4
	41	Between 40.99-41.33m: 20% siltstone clasts, up to 30mm										PL(A) = 0.7
-39	42								C	100	99	PL(A) = 0.6
		Between 42.33-42.38m: 10% siltstone clasts										
-40	42.76											PL(A) = 1.5
	42.93	SANDSTONE: fine to medium grained, grey, 10% dark grey siltstone laminations, high strength, fresh, slightly fractured, Hawkesbury Sandstone										
	43	Bore discontinued at 42.93m - Limit of investigation										
-41	44											
-42	45											
-43	46											
-44	47											
-45	48											
-46	49											
-47												

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.35m; HQ to 20.6m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.9m, Solid flight auger (TC Bit) to 2.35m, Rotary wash boring to 19.24m, NMLC Coring to 42.93m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD02/20210630 taken at 0.9-1.0m; Groundwater well constructed: blank PVC 0.0 to 3.1m, Slotted PVC pipe 3.1 to 12.6m, backfill 0.0 to 0.6m, bentonite 0.6 to 2.6m, gravel 2.6 to 12.6m; gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: CW2 PROJECT: Cockle Bay Wharf JULY 2021

19.24 – 24.00m

BORE: CW2 PROJECT: Cockle Bay Wharf JULY 2021

24.00 – 29.00m

BORE: CW2 PROJECT: Cockle Bay Wharf JULY 2021

29.00 – 34.00m

BORE: CW2 PROJECT: Cockle Bay Wharf JULY 2021

34.00 – 39.00m

BORE: CW2 PROJECT: Cockle Bay Wharf JULY 2021

39.00 – 42.93m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.1 AHD
EASTING: 333747
NORTHING: 6250596
DIP/AZIMUTH: 90°/--

BORE No: CW3
PROJECT No: 202546.00
DATE: 8/7 - 11/8/2021
SHEET 1 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
3	0.05	ASPHALTIC CONCRETE							E			
	0.45	FILL/Sandy GRAVEL: fine to coarse igneous gravel, dark grey, fine to coarse sand, possibly cement stablised, moist							E			
2	1.0	FILL/Silty Sandy GRAVEL: fine to coarse igneous and sandstone gravel, brown, fine to coarse sand, with sandstone cobbles, asphalt and concrete fragments, moist, appears loose							E			
		CONCRETE										
1	2.1	FILL/SAND: fine to medium, brown and pale grey, with fine gravel and shell fragments, generally very loose							S			1,0,1 N = 1 No sample recovered
0	3.0	CONCRETE										
	3.3	FILL/SAND: fine to coarse, brown and grey, with sandy clay, fine to medium gravel, concrete rubble, generally medium dense							S/E			6,5,8 N = 13
-1	5.0	Silty CLAY CL-CI: low to medium plasticity, grey, with fine sand, shell fragments, rootlets, w>PL, very soft, estuarine							S/E*			0,0,0 N = 0
-2	6.5	Silty SAND SW: fine to coarse, grey and brown, with pale grey sandy clay and shell fragments, wet, very loose, estuarine							U_{75}			No sample recovered
-3									S			2,2,0 N = 2
-4		Between 8.5-9.2m: sandy clay bed, pale grey, w>PL, stiff							S			3,6,6 N = 12
-5												
-6												

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 1.0m, HQ to 17.8m

TYPE OF BORING: NDD to 1.0m, Rotary wash boring to 17.22m, NMLC Coring to 40.48m

WATER OBSERVATIONS: No free ground water observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *BD1/09.08.21 and PFAS taken at 5.7-6.15m depth
Standpipe installed to 15.0m, bentonite seal 0.5-2.5m, gravel pack 2.5-15.0m, screen length 3.0-15.0m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.1 AHD
EASTING: 333747
NORTHING: 6250596
DIP/AZIMUTH: 90°/--

BORE No: CW3
PROJECT No: 202546.00
DATE: 8/7 - 11/8/2021
SHEET 2 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-7		Silty SAND SW: fine to coarse, grey and brown, with pale grey sandy clay and shell fragments, wet, very loose, estuarine *(continued)*										
									S			3,1,0 N = 1 No sample recovered
-8	11 11.0	Sandy CLAY CL: low plasticity, pale grey, brown and red-brown, w>PL, stiff, estuarine										
-9	12								S			3,6,5 N = 11
	12.5	Silty SAND SW: fine to coarse, brown and pale grey, wet, very loose to loose, estuarine										
-10	13											
									S			4,2,2 N = 4
-11	14											
-12	15								S			7,4,1 N = 5
-13	16 16.0	Clayey SAND SW: medium to coarse, brown and red-brown, with very low strength sandstone bands, medium dense, residual						Unless otherwise stated, rock is fractured along rough planar bedding dipping at 0-10° with ironstaining or clay coating				
-14	17											
	17.22	SANDSTONE: medium to coarse grained, brown and red-brown, low then medium strength, moderately weathered, slightly fractured, Hawkesbury Sandstone						17.71m: Ds, 20mm	C	100	65	PL(A) = 0.1 PL(A) = 0.6
-15	18											
	18.26	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high then high strength, fresh, slightly fractured, Hawkesbury Sandstone							C	100	99	PL(A) = 0.9
-16	19											PL(A) = 1

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 1.0m, HQ to 17.8m

TYPE OF BORING: NDD to 1.0m, Rotary wash boring to 17.22m, NMLC Coring to 40.48m

WATER OBSERVATIONS: No free ground water observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *BD1/09.08.21 and PFAS taken at 5.7-6.15m depth
Standpipe installed to 15.0m, bentonite seal 0.5-2.5m, gravel pack 2.5-15.0m, screen length 3.0-15.0m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.1 AHD
EASTING: 333747
NORTHING: 6250596
DIP/AZIMUTH: 90°/--

BORE No: CW3
PROJECT No: 202546.00
DATE: 8/7 - 11/8/2021
SHEET 3 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-17		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high then high strength, fresh, slightly fractured, Hawkesbury Sandstone *(continued)*							C	100	99	
-18	21								C	100	100	PL(A) = 0.9
		Between 21.80-22.00m: fine to medium grained										PL(A) = 1.1
-19	22							22.12m: Ds, 5mm				
-20	23								C	100	99	PL(A) = 0.9
-21	24											PL(A) = 1.3
-22	25											PL(A) = 1.7
-23	26								C	100	100	PL(A) = 1.1
		Between 26.30-26.36m: 20% siltstone clasts, up to 15mm										PL(A) = 1.4
-24	27											
-25	28							27.87m: B15°, ir, ro, cly co				PL(A) = 1.8
-26	29	29.05 INTERBEDDED SANDSTONE AND SILTSTONE: *refer to following page*							C	100	65	PL(A) = 1.3
								29.31-29.41m: J30°-50°(x3), pl, ro, cly vn				PL(A) = 0.4
	30.0											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 1.0m, HQ to 17.8m

TYPE OF BORING: NDD to 1.0m, Rotary wash boring to 17.22m, NMLC Coring to 40.48m

WATER OBSERVATIONS: No free ground water observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *BD1/09.08.21 and PFAS taken at 5.7-6.15m depth
Standpipe installed to 15.0m, bentonite seal 0.5-2.5m, gravel pack 2.5-15.0m, screen length 3.0-15.0m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.1 AHD
EASTING: 333747
NORTHING: 6250596
DIP/AZIMUTH: 90°/--

BORE No: CW3
PROJECT No: 202546.00
DATE: 8/7 - 11/8/2021
SHEET 4 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-27		INTERBEDDED SANDSTONE AND SILTSTONE: medium to coarse grained, pale grey sandstone, interbedded with 30-40% dark grey siltstone beds up to 200mm thick, medium strength, fresh, fractured to slightly fractured, Hawkesbury Sandstone						29.95m: Ds, 10mm 30.01-30.30m: J70°-80°, pl, ro, cln 30.09m: Ds, 10mm 30.12m: J70°-80°(x2), ir, ro, cln 30.33m: Ds, 5mm 30.36m: Ds, 80mm	C	100	65	
-28	31 30.95											PL(A) = 0.7
		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, 10% fine grained beds up to 80mm thick, medium to high strength, fresh, slightly fractured, Hawkesbury Sandstone										
-29	32											PL(A) = 0.9
	32.4	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high and high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone						32.03-32.08m: B5°-10°(x3), pl, ro, cly co	C	100	94	
-30	33											PL(A) = 1.3
												PL(A) = 1
-31	34	Between 33.79-34.80m: 20% siltstone clasts up to 20mm						33.83m: Ds, 5mm				
-32	35											PL(A) = 1.3
									C	100	100	
-33	36											PL(A) = 1.1
-34	37								C	100	100	PL(A) = 1.2
									C	100	100	
-35	38											PL(A) = 1.1
-36	39	Between 39.60-39.65m: 50% siltstone clasts							C	100	100	PL(A) = 0.9
	39.98	39.7-39.98m: interbedded siltstone and sandstone										PL(A) = 0.9

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 1.0m, HQ to 17.8m

TYPE OF BORING: NDD to 1.0m, Rotary wash boring to 17.22m, NMLC Coring to 40.48m

WATER OBSERVATIONS: No free ground water observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *BD1/09.08.21 and PFAS taken at 5.7-6.15m depth
Standpipe installed to 15.0m, bentonite seal 0.5-2.5m, gravel pack 2.5-15.0m, screen length 3.0-15.0m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.1 AHD
EASTING: 333747
NORTHING: 6250596
DIP/AZIMUTH: 90°/--

BORE No: CW3
PROJECT No: 202546.00
DATE: 8/7 - 11/8/2021
SHEET 5 OF 5

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-37		SANDSTONE: medium grained, pale grey, indistinctly bedded, 10% siltstone flecks, high strength, fresh, slightly fractred to unbroken, Hawkesbury Sandstone *(continued)*							C	100	100	PL(A) = 1.3
	40.48	Bore discontinued at 40.48m - Limit of investigation										
-38	41											
-39	42											
-40	43											
-41	44											
-42	45											
-43	46											
-44	47											
-45	48											
-46	49											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 1.0m, HQ to 17.8m

TYPE OF BORING: NDD to 1.0m, Rotary wash boring to 17.22m, NMLC Coring to 40.48m

WATER OBSERVATIONS: No free ground water observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *BD1/09.08.21 and PFAS taken at 5.7-6.15m depth
Standpipe installed to 15.0m, bentonite seal 0.5-2.5m, gravel pack 2.5-15.0m, screen length 3.0-15.0m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: CW3 PROJECT: Cockle Bay Wharf AUGUST 2021

17.22 – 21.00m

BORE: CW3 PROJECT: Cockle Bay Wharf AUGUST 2021

21.00 – 26.00m

BORE: CW3 PROJECT: Cockle Bay Wharf AUGUST 2021

26.00 – 31.00m

BORE: CW3 PROJECT: Cockle Bay Wharf AUGUST 2021

31.00 – 36.00m

BORE: CW3 PROJECT: Cockle Bay Wharf AUGUST 2021

36.00 – 40.48m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.7 AHD
EASTING: 333753
NORTHING: 6250645
DIP/AZIMUTH: 90°/--

BORE No: CW4
PROJECT No: 202546.00
DATE: 14 - 15/7/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.06	ASPHALTIC CONCRETE							E			
	0.2	FILL/Sandy GRAVEL: fine to coarse igneous gravel, grey, fine to coarse sand, dry, appears moderately compacted							E			
	0.25	CONCRETE										
	1	FILL/Gravelly SAND: fine to coarse sand, brown, fine to coarse igneous and sandstone gravel, cobbles and brick fragments, moist, appears generally in a loose condition							E			
	1.7	Below 1.0m: with ceramic fragments, trace ash and charcoal							E			
	2	FILL/Clayey SAND: medium to coarse, grey and brown, with sandstone and igneous gravel and cobbles, building rubble (concrete and brick), moist, appears generally in a loose condition							A/E*			
						14-07-21			S/E			3,4,3 N = 7
	4	Between 4.4-5.8m: likely concrete rubble							S/E			0,1,1 N = 2 no sample recovered
	5	Between 5.0-5.2m: piece of timber (possible sleeper)										
	5.2	Silty CLAY CL-CI: low to medium plasticity, grey, with fine to medium sand, fine seashells, w>PL, very soft, estuarine							S/E			0,1,1 N = 2
	6								U_{75}			no sample recovered
	7								S			2,2,2 N = 4
	7.3	Sandy CLAY CL-CI: low to medium plasticity, brown, pale grey and red-brown, w>PL, soft to firm, estuarine										
	8											
	8.5	Silty SAND SM: medium to coarse, pale grey and brown, with clayey sand, wet, medium dense, alluvial						Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-10°, with ironstaining or clay coating	S			4,9,12 N = 21
	9											
	9.2	SANDSTONE: brown, apparently low to medium strength										
	9.46	SANDSTONE: (continued on next page)							C	100	96	PL(A) = 0.7
	10.0											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 4.5m; HQ to 9.46m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.5m, Solid flight auger (TC Bit) to 4.5m, Rotary wash boring to 9.46m, NMLC Coring to 25.0m

WATER OBSERVATIONS: Free groundwater observed at 2.8m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD1/14.07.21 taken at 1.9-2.0m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.7 AHD
EASTING: 333753
NORTHING: 6250645
DIP/AZIMUTH: 90°/--

BORE No: CW4
PROJECT No: 202546.00
DATE: 14 - 15/7/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-8	11	SANDSTONE: medium to coarse grained, brown, pale grey and red-brown, distinctly and indistinctly bedded at 0-10°, medium then medium to high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone							C	100	96	PL(A) = 0.8
-9	12											PL(A) = 1
-10	13								C	100	100	PL(A) = 1.1
-11	13.33	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, 1-5% carbonaceous laminations up to 3mm thick, high strength, fresh, slightly fractured then unbroken, Hawkesbury Sandstone										PL(A) = 1.7
-12	14											
-13	15											PL(A) = 1.2
-14	16								C	100	99	PL(A) = 1.2
-15	17											PL(A) = 1.1
-16	18											PL(A) = 1.4
-17	18.41	SANDSTONE: fine to medium grained, pale grey, distinctly bedded at 0-5°, high strength, fresh, slightly fractured, Hawkesbury Sandstone							C	100	97	
	19											PL(A) = 1.5
	19.19	Below 19.08m: 30-40% siltstone clasts and beds, up to 30mm thick						19.16m: Ds, 30mm				
		SANDSTONE: (continued next page)										
	20.0											PL(A) = 1.1

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 4.5m; HQ to 9.46m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.5m, Solid flight auger (TC Bit) to 4.5m, Rotary wash boring to 9.46m, NMLC Coring to 25.0m

WATER OBSERVATIONS: Free groundwater observed at 2.8m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD1/14.07.21 taken at 1.9-2.0m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.7 AHD
EASTING: 333753
NORTHING: 6250645
DIP/AZIMUTH: 90°/--

BORE No: CW4
PROJECT No: 202546.00
DATE: 14 - 15/7/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-18	21	SANDSTONE: medium to coarse grained, distinctly and indistinctly bedded at 0-10°, high strength, fresh, slightly fractured to unbroken, Hawkesbury Sandstone							C	100	97	
												PL(A) = 1.2
-19		Between 21.24-21.37m: fine to medium grained bed, medium to high strength						21.37m: Ds, 5mm				PL(A) = 0.9
	22								C	100	100	
-20		Between 22.62-24.16m: slightly weathered										
	23											PL(A) = 1.7
-21												
	24								C	100	100	PL(A) = 2.3 (UCS Sample 23.48-23.79m) PL(A) = 1.5
-22	25 25.0	Bore discontinued at 25.0m - Limit of investigation										
-23												
	26											
-24												
	27											
-25												
	28											
-26												
	29											
-27												

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 4.5m; HQ to 9.46m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.5m, Solid flight auger (TC Bit) to 4.5m, Rotary wash boring to 9.46m, NMLC Coring to 25.0m

WATER OBSERVATIONS: Free groundwater observed at 2.8m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD1/14.07.21 taken at 1.9-2.0m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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BORE: CW4 PROJECT: Cockle Bay Wharf JULY 2021

9.46 – 14.00m

BORE: CW4 PROJECT: Cockle Bay Wharf JULY 2021

14.00 – 19.00m

BORE: CW4 PROJECT: Cockle Bay Wharf JULY 2021

19.00 – 24.00m

BORE: CW4 PROJECT: Cockle Bay Wharf JULY 2021

24.00 – 25.00m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.8 AHD
EASTING: 333715
NORTHING: 6250505
DIP/AZIMUTH: 90°/--

BORE No: CW5
PROJECT No: 202546.00
DATE: 7 - 8/7/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.06	ASPHALTIC CONCRETE										
	0.21	CONCRETE										
		FILL/Sandy GRAVEL: fine to coarse igneous gravel, grey, fine to coarse sand, with concrete rubble, dry, appears moderately compacted							E			
		Below 0.4m: grading to fine to coarse igneous and sandstone gravel, brown, with bricks and clay, trace siltstone, moist, appears generally in a loose condition							E			
	1.5	Below 1.1m: grading to sandstone cobbles							E			
		FILL/Sandy CLAY: low to medium plasticity, grey, with building rubble (concrete and brick), sandstone and igneous gravel and cobbles, w>PL,							A/E			
	2.65	appears generally in a soft condition							S			5,0,0 N = 0 no sample recovered
	2.9	VOID				07-07-21						
		FILL/Silty SAND: fine to medium, dark grey, with clay and fine to medium gravel, with seashells, wet, appears generally in a very loose condition							S			1,1,1 N = 2 no sample recovered
	5.0	Silty CLAY CH: high plasticity, dark grey, with rootlets, trace shells, w>PL, very soft, estuarine							A			
									S/E			0,1,1 N = 2
	6.5	Silty SAND SM: fine to medium, grey, with shells, wet, very loose, estuarine										
									S			1,0,0 N = 0
		Between 8.7m and 9.2m: apparently loose										
									U_{75}			no sample recovered
	10.0											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.2m; HQ to 11.25m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.5m, Solid flight auger (TC Bit) to 7.0m, Rotary wash boring to 14.15m, NMLC Coring to 22.65m

WATER OBSERVATIONS: Free groundwater observed at 2.8m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 1.0m, Slotted PVC pipe 1.0 to 5.0m, backfill 0.0 to 0.3m, bentonite 0.3 to 1.0m, gravel 1.0 to 5.0m, bentonite 5.0 to 22.65m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.8 AHD
EASTING: 333715
NORTHING: 6250505
DIP/AZIMUTH: 90°/--

BORE No: CW5
PROJECT No: 202546.00
DATE: 7 - 8/7/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-8	11	Sandy CLAY CL: low plasticity, pale grey mottled brown and red-brown, w~PL, firm to stiff, estuarine										
									S			3,4,4 N = 8
-9	12											
	12.0	Clayey SAND SC: medium to coarse, pale grey, brown and red-brown, wet, loose, residual										
-10	13							Unless otherwise stated, rock is fractured along rough, planar bedding dipping 0-10°, with ironstaining or clay coating	S			4,2,5 N = 7
-11	13.85	SANDSTONE: brown, pale grey and red-brown, apparently low strength										
	14											
	14.15	SANDSTONE: medium to coarse grained, brown, pale grey and red-brown, distinctly and indistinctly bedded at 0-10°, low then medium strength, moderately weathered, slightly fractured, Hawkesbury Sandstone										
-12	15								C	100	88	PL(A) = 0.2
-13	16							15.84m: Ds, 70mm 16.30m: Ds, 120mm 16.50m: Ds, 120mm				PL(A) = 0.2
-14	17											PL(A) = 0.7
-15		Between 17.6-18.4m: slightly weathered										
	18								C	100	98	PL(A) = 0.6
-16	19											PL(A) = 0.8
		Below 19.08m: 5% carbonaceous laminations						19.08m: B10-50°, ir, ro, cbs co 19.47m: B10-30°, ir, ro, cbs vn				
-17	19.68							19.68m: Ds, 220mm				
	20.0	INTERBEDDED SILTSTONE AND SANDSTONE: (continued page 3)							C	100	86	PL(A) = 0.2

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.2m; HQ to 11.25m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.5m, Solid flight auger (TC Bit) to 7.0m, Rotary wash boring to 14.15m, NMLC Coring to 22.65m

WATER OBSERVATIONS: Free groundwater observed at 2.8m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 1.0m, Slotted PVC pipe 1.0 to 5.0m, backfill 0.0 to 0.3m, bentonite 0.3 to 1.0m, gravel 1.0 to 5.0m, bentonite 5.0 to 22.65m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.8 AHD
EASTING: 333715
NORTHING: 6250505
DIP/AZIMUTH: 90°/--

BORE No: CW5
PROJECT No: 202546.00
DATE: 7 - 8/7/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-18	21	INTERBEDDED SILTSTONE AND SANDSTONE: dark grey, interbedded with 20-30% medium to coarse grained, pale grey sandstone with siltstone clasts up to 50mm, distinctly bedded at 0-20°, low then medium strength, fresh, slightly fractured, Hawkesbury Sandstone										PL(A) = 0.6
	21.12	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, 1-5% siltstone clasts and flecks, high strength, fresh, slightly fractured, Hawkesbury Sandstone						21.05m: Ds, 70mm	C	100	86	
-19	22	Between 21.90 and 22.05m: fine to medium grained bed						21.49m: J20°, pl, ro, cly vn				PL(A) = 1.7
	22.65	Bore discontinued at 22.65m - Limit of investigation										PL(A) = 1.5
-20	23											
-21	24											
-22	25											
-23	26											
-24	27											
-25	28											
-26	29											
-27												

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** JS **CASING:** HW to 2.2m; HQ to 11.25m

TYPE OF BORING: Diacore to 0.06m, NDD to 1.5m, Solid flight auger (TC Bit) to 7.0m, Rotary wash boring to 14.15m, NMLC Coring to 22.65m

WATER OBSERVATIONS: Free groundwater observed at 2.8m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 1.0m, Slotted PVC pipe 1.0 to 5.0m, backfill 0.0 to 0.3m, bentonite 0.3 to 1.0m, gravel 1.0 to 5.0m, bentonite 5.0 to 22.65m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: CW5 PROJECT: Cockle Bay Wharf JULY 2021

14.15 – 19.00m

BORE: CW5 PROJECT: Cockle Bay Wharf JULY 2021

19.00 – 22.65m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.0 AHD
EASTING: 333762
NORTHING: 6250665
DIP/AZIMUTH: 90°/--

BORE No: CW6
PROJECT No: 202546.00
DATE: 16/7 - 3/8/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.06	ASPHALTIC CONCRETE							E			
		FILL/Sandy GRAVEL: fine to coarse igneous gravel, grey, fine to coarse sand, moist, appears moderately compacted							E*			
2	1	Below 0.3m: grading to fine to coarse sandstone gravel, brown, with bricks, with clay, trace siltstone, moist, appears loose							E			
		Below 1.0m: trace igneous gravel, trace glass										
	1.6	1.3m to 1.9m: with sandstone cobbles										
1	2	CONCRETE										
									S/E			4,4,7 N = 11
0	3	FILL/Clayey SAND: medium to coarse, brown, wet, generally in a loose condition										
	3.0											
-1	4								S/E			2,2,7 N = 9
-2	5	Sandy CLAY CL-CI: low to medium plasticity, dark grey, fine to medium sand, trace shell fragments, w>PL, very soft, estuarine							U_{75}			no recovery
	5.0											
-3	6								S/E			0,0,0 N = 0
	6.85											
-4	7	SAND SW: fine to medium, grey and brown, trace silty clay, trace shell fragments, medium dense, estuarine							S			2,5,6 N = 11
	7.9											
-5	8	SANDSTONE: medium to coarse grained, yellow-brown and pale pink-grey, distinctly and indistinctly bedded at 0-10°, medium strength, moderately and slightly weathered, slightly fractured, Hawkesbury Sandstone						Unless otherwise stated, rock is fractured along rough planar bedding dipping at 0-10° with ironstaining or clay veneer	C	100	100	PL(A) = 0.3
									C	100	100	
-6	9								C	100	100	PL(A) = 0.8
									C	100	100	
									C	100	96	
		Between 9.65-10.70m: becoming purple-brown, high strength						9.71-9.73m: J20°(x2), pl, ro, cly vn	C	100	100	PL(A) = 1

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** TM **CASING:** HW to 2.7m; HQ to 7.9m

TYPE OF BORING: NDD to 1.6m, Solid flight auger (TC Bit) to 1.7m, Rotary wash boring to 7.9m, NMLC Coring to 23.48m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Blind duplicate BD01/20210630 taken at 0.5-0.6m depth; Groundwater well constructed: blank PVC 0.0 to 1.2m, Slotted PVC pipe 1.2 to 7.0m, backfill 0.0 to 0.2m, bentonite 0.2 to 0.7m, gravel 0.7 to 7.0m, bentonite 7.0 to 23.48m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.0 AHD
EASTING: 333762
NORTHING: 6250665
DIP/AZIMUTH: 90°/--

BORE No: CW6
PROJECT No: 202546.00
DATE: 16/7 - 3/8/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
-7		SANDSTONE: medium to coarse grained, yellow-brown and pale pink-grey, distinctly and indistinctly bedded at 0-10°, medium strength, moderately and slightly weathered, slightly fractured, Hawkesbury Sandstone *(continued)*						9.92m: B0-5°, pl, ro, cly inf 5mm				
-8	11											PL(A) = 0.9
								11.12m: B0-5°, pl, he, cly inf 5mm	C	100	100	
-9	12											PL(A) = 0.8
								12.13m: B0-5°, pl, ro, fe stn, cly inf 5mm				
-10	13											PL(A) = 0.9
	13.67	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high strength, fresh, slightly fractured and unbroken, Hawkesbury Sandstone						13.68m: B0°, pl, ro, cbs stn				PL(A) = 1.6
-11	14								C	100	99	
-12	15											PL(A) = 1.6
								15.57m: B0°, pl, ro, cbs vn				
-13	16							15.85m: B0°, pl, ro, cbs/cly vn				PL(A) = 0.9
												PL(A) = 0.9
-14	17	Between 16.88-16.93m: siltstone clast						16.83m: B0-5°, pl, ro, cbs vn				PL(A) = 1
-15	18											PL(A) = 0.9
								18.13m: B5-10°, pl, ro, cbs vn				
-16	19								C	100	100	PL(A) = 0.8
									C	100	100	

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** TM **CASING:** HW to 2.7m; HQ to 7.9m

TYPE OF BORING: NDD to 1.6m, Solid flight auger (TC Bit) to 1.7m, Rotary wash boring to 7.9m, NMLC Coring to 23.48m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Blind duplicate BD01/20210630 taken at 0.5-0.6m depth; Groundwater well constructed: blank PVC 0.0 to 1.2m, Slotted PVC pipe 1.2 to 7.0m, backfill 0.0 to 0.2m, bentonite 0.2 to 0.7m, gravel 0.7 to 7.0m, bentonite 7.0 to 23.48m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.0 AHD
EASTING: 333762
NORTHING: 6250665
DIP/AZIMUTH: 90°/--

BORE No: CW6
PROJECT No: 202546.00
DATE: 16/7 - 3/8/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-17		SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high strength, fresh, slightly fractured and unbroken, Hawkesbury Sandstone *(continued)*										PL(A) = 0.8
-18	21								C	100	100	PL(A) = 1
-19	22											PL(A) = 1.1
									C	100	100	
-20	23											PL(A) = 1.1
	23.48	Bore discontinued at 23.48m - Limit of investigation										PL(A) = 1.1
-21	24											
-22	25											
-23	26											
-24	27											
-25	28											
-26	29											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** TM **CASING:** HW to 2.7m; HQ to 7.9m

TYPE OF BORING: NDD to 1.6m, Solid flight auger (TC Bit) to 1.7m, Rotary wash boring to 7.9m, NMLC Coring to 23.48m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Blind duplicate BD01/20210630 taken at 0.5-0.6m depth; Groundwater well constructed: blank PVC 0.0 to 1.2m, Slotted PVC pipe 1.2 to 7.0m, backfill 0.0 to 0.2m, bentonite 0.2 to 0.7m, gravel 0.7 to 7.0m, bentonite 7.0 to 23.48m, gatic at surface.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: CW6 PROJECT: Cockle Bay Wharf AUGUST 2021

7.90 – 12.00m

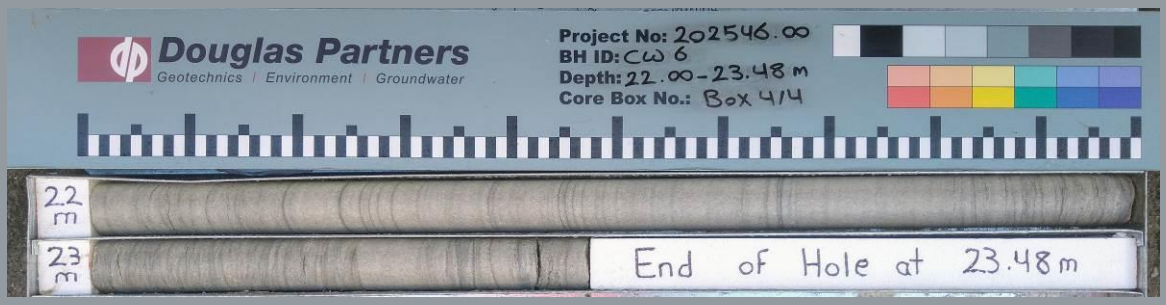
BORE: CW6 PROJECT: Cockle Bay Wharf AUGUST 2021

12.00 – 17.00m

BORE: CW6 PROJECT: Cockle Bay Wharf AUGUST 2021

17.00 – 22.00m

BORE: CW6 PROJECT: Cockle Bay Wharf AUGUST 2021



22.00 – 23.48m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.8 AHD
EASTING: 333748
NORTHING: 6250687
DIP/AZIMUTH: 90°/--

BORE No: CW7
PROJECT No: 202546.00
DATE: 6/7 - 5/8/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
	0.07	PAVER										
	0.1	FILL/SAND: medium to coarse, brown, moist							E*			
									B			
	0.8	FILL/Sandy GRAVEL: medium to coarse igneous gravel, brown, fine to coarse sand, trace silt, moist, appears moderately compacted							E			
		Below 0.4m: appears poorly compacted							B			
		FILL/SAND: fine to coarse, brown, trace coarse sandstone gravel, moist, appears poorly compacted										
	2.0	1.3-2.0m: with brick and ceramic fragments							A			
		FILL/SAND: fine to coarse, dark brown and brown, trace clay, fine to coarse sandstone gravel, moist, very loose							S			0,2,2 N = 4
		3.5m: becoming dark grey and grey							S			1,2,2 N = 4
		4.8-4.9m: possible concrete rubble										
	5.3	Sandy CLAY CL-CI: low to medium plasticity, dark grey, medium to coarse, with silt, trace rootlets and shell fragments, w>PL, very soft, estuarine						Unless otherwise stated, rock is fractured along rough, planar bedding dipping at 0-10° with clay veneer	S			0,0,0 N = 0
									U			
	7.3	SANDSTONE: brown, apparently low to medium strength							S			0,0,25/100 refusal
	7.5	SANDSTONE: medium to coarse grained, red-brown and pale brown, cross bedded at 0-10°, medium strength, moderately weathered, slightly fractured, Hawkesbury Sandstone						8.35m: B0-10°, un, he, fe stn 8.45m: B0-10°, un, he, fe stn 8.55m: B0-5°, pl, he, fe stn 8.61m: B0-5°, pl, he, fe stn	C	100	97	PL(A) = 0.7 PL(A) = 0.9
									C	100	100	PL(A) = 0.7

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** LHS/YB **CASING:** HW to 7.5m; HQ to 8.0m

TYPE OF BORING: NDD to 2.0m,Solid flight auger (TC bit) to 4.0m, Rotary wash boring to 7.5m, NMLC Coring to 16.79m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Blind duplicate BD03/060721 taken at 0.4-0.5m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.8 AHD
EASTING: 333748
NORTHING: 6250687
DIP/AZIMUTH: 90°/--

BORE No: CW7
PROJECT No: 202546.00
DATE: 6/7 - 5/8/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-8	11	SANDSTONE: medium to coarse grained, red-brown and pale brown, cross bedded at 0-10°, medium strength, moderately weathered, slightly fractured, Hawkesbury Sandstone *(continued)*						10.57m: B0°, pl, ro, fe stn, cly vn	C	100	100	PL(A) = 0.8
-9	12							11.89m: B0-5°, pl, ro, fe stn, cly vn	C	100	100	PL(A) = 0.8 PL(A) = 0.8
-10	13							13.03m: B0°, pl, ro, cbs/cly vn				PL(A) = 1.3
-11	13.42	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, medium to high strength, fresh, slightly fractured, Hawkesbury Sandstone										
-12	14							14.18m: B0°, pl, ro, cbs vn 14.5m: B0°, pl, ro, cbs stn				PL(A) = 0.7
-13	15								C	100	100	PL(A) = 1.1
-14	16							15.76m: B0°, pl, ro, cly inf 5mm 15.87m: Cs 20mm				PL(A) = 0.8
-15	16.79	Bore discontinued at 16.79m - Limit of investigation										PL(A) = 0.7
-16	17											
-17	18											
	19											

RIG: Bobcat **DRILLER:** Ground Test **LOGGED:** LHS/YB **CASING:** HW to 7.5m; HQ to 8.0m

TYPE OF BORING: NDD to 2.0m,Solid flight auger (TC bit) to 4.0m, Rotary wash boring to 7.5m, NMLC Coring to 16.79m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Blind duplicate BD03/060721 taken at 0.4-0.5m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: CW7 PROJECT: Cockle Bay Wharf AUGUST 2021

7.50 – 12.00m

BORE: CW7 PROJECT: Cockle Bay Wharf AUGUST 2021

12.00 – 16.79m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.5 AHD
EASTING: 333822
NORTHING: 6250707
DIP/AZIMUTH: 90°/--

BORE No: SS1
PROJECT No: 202546.00
DATE: 15 - 16/7/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
	0.35	CONCRETE: igneous gravel of 20mm nominal diameter						Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°				
	0.6	FILL/Sandy GRAVEL: fine to coarse igneous gravel, dark grey, fine to coarse sand, trace silt, moist, appears generally in a medium dense to dense condition							E			
		below 0.4m: grading to fine to coarse sandstone and igneous gravel, brown							E			
	1.67	CONCRETE: sandstone and igneous gravel of up to 40mm diameter						1.67m: CORE LOSS: 490mm	C	75	70	
	2.16	CORE LOSS										
		SANDSTONE: medium to coarse grained, pale grey and yellow-brown, distinctly and indistinctly bedded at 0-20°, medium strength, slightly weathered, fractured to slightly fractured, Hawkesbury Sandstone						2.67-2.78m: B10°(x4), un, ti				PL(A) = 0.9
								3.39m: B20°, pl, cly vn 3.44m: B0°, pl, cly vn	C	100	95	PL(A) = 0.5 PL(A) = 1.3
	3.7	SANDSTONE: medium to coarse grained, orange-brown, high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone										PL(A) = 1.2
		Below 4.21m: becoming red-brown, high strength with very high strength bands, highly weathered						4.21m: B0°, un, ro, cln	C	100	100	PL(A) = 1.4 PL(A) = 3.3
	5.53	SANDSTONE: medium to coarse grained, orange-brown, medium strength, moderately weathered, unbroken, Hawkesbury Sandstone										PL(A) = 0.8
								6.45m: B10°, pl, cly vn				PL(A) = 0.9
	7.05	Below 6.98m: becoming pale grey, low strength, highly weathered							C	100	100	PL(A) = 0.2 PL(A) = 1.2
		SANDSTONE: fine to medium grained, pale grey, with siltstone laminations, distinctly and indistinctly bedded at 5-10°, high strength, fresh, unbroken, Hawkesbury Sandstone										PL(A) = 1.1
		Below 7.8m: grading to medium to coarse grained										
		Between 8.3-9.8m: with siltstone specks, clasts and beds										PL(A) = 1.3
		Below 9.8m: medium bedded, with							C	100	97	PL(A) = 1.1

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HQ to 1.0m

TYPE OF BORING: Diacore to 0.35m, NDD to 0.6m, Auger to 1.0m, NMLC Coring to 17.72m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.5 AHD
EASTING: 333822
NORTHING: 6250707
DIP/AZIMUTH: 90°/--

BORE No: SS1
PROJECT No: 202546.00
DATE: 15 - 16/7/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-7		occasional cross-beds										
		SANDSTONE: fine to medium grained, pale grey, with siltstone laminations, distinctly and indistinctly bedded at 5-10°, high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*						10.23-10.42m: J sv, pl, ro, cln 10.29m: B0°, pl, cly vn 10.33m: B20°, un, cly vn	C	100	97	PL(A) = 1.3
	11	Between 10.29-10.34m: siltstone bed										
-8												PL(A) = 1.4
	12											
-9								12.55m: B0°, pl, cly vn				PL(A) = 1.3
	13								C	100	100	
-10								13.53m: B10°, pl, cly vn				PL(A) = 1.6
	14											
-11								14.56m: B0°, pl, cly vn				PL(A) = 1.1
	15											
-12								15.21m: B0°, un, cly 1mm				PL(A) = 1.4
	16								C	100	100	
-13		Below 16.18m: distinctly and indistinctly bedded at 20°										PL(A) = 1.4
	17							16.9m: B10°, pl, cly 3mm				
-14												PL(A) = 1.8
	17.72	Bore discontinued at 17.72m										
	18	- Limit of investigation										
-15												
	19											
-16												

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HQ to 1.0m

TYPE OF BORING: Diacore to 0.35m, NDD to 0.6m, Auger to 1.0m, NMLC Coring to 17.72m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: SS1 PROJECT: Cockle Bay Wharf JULY 2021

1.00 – 5.00m

BORE: SS1 PROJECT: Cockle Bay Wharf JULY 2021

5.00 – 10.00m

BORE: SS1 PROJECT: Cockle Bay Wharf JULY 2021

10.00 – 15.00m

BORE: SS1 PROJECT: Cockle Bay Wharf JULY 2021

15.00 – 17.72m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.5 AHD
EASTING: 333825
NORTHING: 6250684
DIP/AZIMUTH: 90°/--

BORE No: SS2
PROJECT No: 202546.00
DATE: 14 - 15/7/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.05	PAVER										
	0.25	FILL/Gravelly SAND: fine to coarse, brown, fine to medium igneous gravel, moist, appears generally in a medium dense condition							E			
		FILL/Sandy GRAVEL: fine to coarse igneous and sandstone gravel, grey, fine to coarse sand, with sandstone cobbles and boulders, moist, appears generally in a medium dense to dense condition						Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°	E			
									S/E			19,10/90 refusal
	2.79	SANDSTONE: medium to coarse grained, pale grey and orange-brown, medium and high strength, highly weathered, slightly fractured, Hawkesbury Sandstone										PL(A) = 1.5
												PL(A) = 0.6
		Between 3.51-3.64m: fine grained with carbonaceous laminations, very low strength						3.52m: B0°, pl, cly vn 3.64m: B0°, pl, cly 5mm				PL(A) = 0.07
		Below 4.05m: grading to pale grey and orange-brown, moderately weathered						3.66-3.69m: B0°(x3), pl, ro, fe stn 3.91m: B0°, pl, ro, fe stn	C	100	89	PL(A) = 1.7
								4.39-4.49m: B0°(x2), un, ti 4.75-5.26m: B10°(x5), un, ti				PL(A) = 1.2
		Below 5.5m: grading to orange and red-brown						5.65m: B0°, pl, cly vn				PL(A) = 1
		Below 6.52m: grading to pale grey and orange-brown, distinctly and indistinctly bedded at 0-20°, slightly weathered										PL(A) = 1.3
								7.04m: Cs, 80mm 7.22m: B0°, un, ro, cln 7.31m: B5°, pl, cly vn	C	100	97	PL(A) = 0.5
												PL(A) = 1.5
		Below 8.2m: grading to fresh						8.24m: B10°, pl, cly 1mm				PL(A) = 0.5
		Between 8.5-8.72m: with siltstone specks and clasts						8.64m: B10°, cu, ro, cln				PL(A) = 0.8
	8.8	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-20°, high strength, fresh, unbroken, Hawkesbury Sandstone										PL(A) = 1.2
									C	100	97	
		Between 9.65-10.32m: grading to fine to medium grained						9.65m: B0°, pl, cly vn				PL(A) = 1.3

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HQ to 1.1m

TYPE OF BORING: NDD 0.05m to 1.1m, Rotary wash bore to 2.79m, NMLC Coring to 17.81m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 3.8m; Slotted PVC 3.8 to 17.81m; bentonite 0.0 to 3.3m; gravel 3.3 to 17.81m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.5 AHD
EASTING: 333825
NORTHING: 6250684
DIP/AZIMUTH: 90°/--

BORE No: SS2
PROJECT No: 202546.00
DATE: 14 - 15/7/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-7	11	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-20°, high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*						10.24m: B5°, pl, cly vn 10.31m: Cs, 15mm	C	100	97	PL(A) = 1.4
-8	12	Between 11.85-16.65m: with siltstone specks and clasts						12.08-12.56m: J 80°, un, ro , cln	C	100	100	PL(A) = 1.6 PL(A) = 1.1
-9	13							12.94-13.34m: J 80°, un, ro, cln				
-10	14								C	100	100	PL(A) = 1.6 PL(A) = 1.8
-11	15											
-12	16								C	100	100	PL(A) = 1.5 PL(A) = 1.3
-13	17											
-14	17.81	Between 17.45-17.5m: carbonaceous laminations										PL(A) = 1.4
-15	18	Bore discontinued at 17.81m - Limit of investigation										
-16	19											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HQ to 1.1m

TYPE OF BORING: NDD 0.05m to 1.1m, Rotary wash bore to 2.79m, NMLC Coring to 17.81m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. Groundwater well constructed: blank PVC 0.0 to 3.8m; Slotted PVC 3.8 to 17.81m; bentonite 0.0 to 3.3m; gravel 3.3 to 17.81m, gatic at surface

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: SS2 PROJECT: Cockle Bay Wharf JULY 2021

2.79 – 7.00m

BORE: SS2 PROJECT: Cockle Bay Wharf JULY 2021

7.00 – 12.00m

BORE: SS2 PROJECT: Cockle Bay Wharf JULY 2021

12.00 – 17.00m

BORE: SS2 PROJECT: Cockle Bay Wharf JULY 2021

17.00 – 17.81m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333712
NORTHING: 6250691
DIP/AZIMUTH: 90°/--

BORE No: W1
PROJECT No: 202546.00
DATE: 6 - 11/7/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
2	0.07	PAVER										
	0.12	FILL/SAND: medium to coarse, brown, moist, appears poorly compacted										
	0.51	CONCRETE: igneous gravel of 20mm nominal diameter										
1		VOID										
0	2.25	WATER				06-07-21						
-1												
-2												
-3	5.2	FILL/SAND: medium to coarse, dark grey, with clay, sandstone cobbles, timber and possible brick fragments, wet, appears generally in a loose condition							S/E			7,12,17 N = 29
-4												
-5												
-6												
-7	9.5	SAND SP: medium to coarse, grey, wet, loose, estuarine										

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 11.5m; HQ to 13.0m

TYPE OF BORING: Diacore 0.07m to 0.51m, Rotary wash bore 5.2m to 11.75m, NMLC Coring to 20.57m

WATER OBSERVATIONS: Water observed at 2.25m at 10:36pm on 6 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333712
NORTHING: 6250691
DIP/AZIMUTH: 90°/--

BORE No: W1
PROJECT No: 202546.00
DATE: 6 - 11/7/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-8		SAND SP: medium to coarse, grey, wet, loose, estuarine *(continued)*							S/E			2,4,2 N = 6
-9	11							Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°				
-10	11.75 12	SANDSTONE: medium to coarse grained, red and yellow-brown, medium strength, highly to moderately weathered, slightly fractured, Hawkesbury Sandstone						12.08m: B20°, pl, ro, cln	C	100	100	PL(A) = 0.3
-11	13	Between 13.08-15.23m: unbroken						12.32-12.47m: J80°, pl, ro, cln 12.47m: B0°, un, ti 13.02m: Ds, 60mm	C	100	92	PL(A) = 0.5
-12	14	Below 14.15m: grading to slightly weathered, distinctly and indistinctly bedded at 20° Between 14.55-14.95m: distinctly and indistinctly bedded at 0-10°							C	100	100	PL(A) = 0.4
-13	15	Below 15.55m: distinctly and indistinctly bedded at 0-10°						15.23m: J40°, pl, ro, cln 15.6m: B20°, pl, ro, cln 15.8m: B0°, un, ro, cbs vn	C	100	100	PL(A) = 0.9 PL(A) = 0.7
-14	16							16.44m: B5°, pl, cly vn 16.57m: Ds, 10mm	C	100	99	PL(A) = 0.9
-15	17	Between 17.30-17.85m: massive Below 17.32m: fresh						17.11-17.32m: J80°, un, ro, fe stn				PL(A) = 0.6
-16	18 18.1	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-10°, high strength, fresh, unbroken, Hawkesbury Sandstone						17.9m: B10°, pl, cly 3mm 17.92m: B0°, pl, cly 1mm				PL(A) = 0.5 PL(A) = 1.4 PL(A) = 1.2
-17	19	Between 18.9-19.05m: siltstone clasts and bits						18.92m: B0°, un, ro, cln	C	100	100	PL(A) = 1
	20.0											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 11.5m; HQ to 13.0m

TYPE OF BORING: Diacore 0.07m to 0.51m, Rotary wash bore 5.2m to 11.75m, NMLC Coring to 20.57m

WATER OBSERVATIONS: Water observed at 2.25m at 10:36pm on 6 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333712
NORTHING: 6250691
DIP/AZIMUTH: 90°/--

BORE No: W1
PROJECT No: 202546.00
DATE: 6 - 11/7/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-18		SANDSTONE: (continued)										
		Below 20.25m: distinctly and indistinctly crossbedded at 20° with siltstone specks							C	100	100	PL(A) = 1.1
	20.57	Bore discontinued at 20.57m - Limit of investigation										
-19	21											
-20	22											
-21	23											
-22	24											
-23	25											
-24	26											
-25	27											
-26	28											
-27	29											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 11.5m; HQ to 13.0m

TYPE OF BORING: Diacore 0.07m to 0.51m, Rotary wash bore 5.2m to 11.75m, NMLC Coring to 20.57m

WATER OBSERVATIONS: Water observed at 2.25m at 10:36pm on 6 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: W1 PROJECT: Cockle Bay Wharf JULY 2021

11.75 – 16.00m

BORE: W1 PROJECT: Cockle Bay Wharf JULY 2021

16.00 – 20.57m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333698
NORTHING: 6250613
DIP/AZIMUTH: 90°/--

BORE No: W2
PROJECT No: 202546.00
DATE: 5 - 6/7/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
2	0.07	PAVER										
1.87	0.13	FILL/SAND: medium to coarse, brown, moist, appears poorly compacted										
1.67	0.53	CONCRETE: igneous gravel of 20mm nominal diameter										
1	1	VOID										
0	2					06-07-21						
0	2.05	WATER										
-1	3											
-2	4											
-3	5											
-4	6											
-5	7											
-6	8											
-7	9											
-7	9.2	CLAY CI: medium plasticity, grey, w>PL, very soft, estuarine										

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 13.5m; HQ to 20.4m

TYPE OF BORING: Diacore 0.13m to 0.53m, Rotary wash bore 9.2m to 20.4m, NMLC Coring to 28.3m

WATER OBSERVATIONS: Water observed at 2.05m at 10:06pm on 6 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.75m undertaken within HW casing

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333698
NORTHING: 6250613
DIP/AZIMUTH: 90°/--

BORE No: W2
PROJECT No: 202546.00
DATE: 5 - 6/7/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
-8		CLAY CI: medium plasticity, grey, w>PL, very soft, estuarine *(continued)*										
	10.75											
-9	11	Clayey SAND SC: fine to coarse, pale brown, wet, very loose, estuarine							S^			1,0,0 N = 0
									U_{75}			pp = 0
-10	12											
-11	13								U_{75}			pp = 50
									S			3,2,1 N = 3
-12	14								S			1,0,3 N = 3
-13	15											
	15.5	CLAY CI: medium plasticity, grey, trace fine to medium sand, w>PL, very soft, estuarine										
-14	16								S			1,0,0 N = 0
-15	17 17.0	SAND SP: medium to coarse, grey, with clay, wet, dense, estuarine							S			12,21,25/130 refusal
-16	18											
		Below 18.5m: grading to grey mottled orange-brown, trace clay, medium dense										
-17	19							Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°	S			8,14,12 N = 26

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 13.5m; HQ to 20.4m

TYPE OF BORING: Diacore 0.13m to 0.53m, Rotary wash bore 9.2m to 20.4m, NMLC Coring to 28.3m

WATER OBSERVATIONS: Water observed at 2.05m at 10:06pm on 6 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.75m undertaken within HW casing

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333698
NORTHING: 6250613
DIP/AZIMUTH: 90°/--

BORE No: W2
PROJECT No: 202546.00
DATE: 5 - 6/7/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-18		SAND SP: medium to coarse, grey, with clay, wet, dense, estuarine *(continued)*										
	20.4	SANDSTONE: medium to coarse grained, brown, medium strength, moderately weathered, slightly fractured, Hawkesbury Sandstone						20.95m: B0°, pl, ro, fe stn 21.1m: Ds, 50mm 21.24m: B0°, pl, cly 3mm	C	100	97	PL(A) = 0.3 PL(A) = 0.4 PL(A) = 0.9 PL(A) = 1 PL(A) = 1.4
-19	21	Below 21.15m: grading to slightly weathered to fresh										
	21.5	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 10-20°, high strength, fresh, slightly fractured, Hawkesbury Sandstone										
-20	22							22.19m: B5°, un, ro, cln				PL(A) = 1.2 PL(A) = 1.3
	23.05	SANDSTONE: fine grained, grey, with siltstone laminations, medium strength, fresh, slightly fractured, Hawkesbury Sandstone						23.04m: B0°, pl, cly vn 23.29m: B0°, pl, cly vn				PL(A) = 0.3
-21	23.3	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly crossbedded at 20°, high strength, fresh, unbroken, Hawkesbury Sandstone							C	100	100	PL(A) = 1.1
-22	24	Below 24.7m: distinctly and indistinctly bedded at 5-20° with siltstone laminations and specks										PL(A) = 1.9
-23	25							24.94m: B5°, pl, cly 10mm				PL(A) = 1.7
-24	26	Below 26.24m: slightly fractured						26.24m: B10°, pl, cly vn 26.28m: B10°, pl, cly 3mm 26.37m: B10°, pl, cly 1mm	C	100	100	PL(A) = 1.3
-25	27	Between 27.36-27.37m: carbonaceous lamination Below 27.45m: distinctly and indistinctly bedded at 0-5°						27.34m: B0°, un, cly 5mm				PL(A) = 1.1
-26	28	Below 27.91m: grading to massive						27.91m: B0°, pl, cly 5mm				PL(A) = 1.6
	28.3	Bore discontinued at 28.3m - Limit of investigation										
-27	29											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 13.5m; HQ to 20.4m

TYPE OF BORING: Diacore 0.13m to 0.53m, Rotary wash bore 9.2m to 20.4m, NMLC Coring to 28.3m

WATER OBSERVATIONS: Water observed at 2.05m at 10:06pm on 6 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.75m undertaken within HW casing

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: W2 PROJECT: Cockle Bay Wharf JULY 2021

20.40 – 24.00m

BORE: W2 PROJECT: Cockle Bay Wharf JULY 2021

24.00 – 28.30m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333685
NORTHING: 6250541
DIP/AZIMUTH: 90°/--

BORE No: W3
PROJECT No: 202546.00
DATE: 3 - 5/7/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
2	0.07	PAVER										
1.87	0.13	FILL/SAND: medium to coarse, brown, moist, appears poorly compacted										
1.7	0.5	CONCRETE: igneous gravel of 20mm nominal diameter										
1		VOID										
0	2.05	WATER				04-07-21						
-1												
-2												
-3												
-4												
-5												
-6												
-7	8.9	CLAY CL: low plasticity, dark grey, trace medium sand and charcoal, sulphurous odour, w~PL, very soft, estuarine										

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 12.6m; HQ to 15.3m

TYPE OF BORING: Diacore 0.13m to 0.5m, Rotary wash bore 8.9m to 15.3m, NMLC Coring to 23.77m

WATER OBSERVATIONS: Water observed at 2.05m at 7:33pm on 4 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.75m and 11.5m undertaken within HW casing; *Field replicate BD01/040721 taken at 13.0-13.45m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333685
NORTHING: 6250541
DIP/AZIMUTH: 90°/--

BORE No: W3
PROJECT No: 202546.00
DATE: 3 - 5/7/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
-8		CLAY CL: low plasticity, dark grey, trace medium sand and charcoal, sulphurous odour, w~PL, very soft, estuarine *(continued)*										
-9	11								S^/E			0,0,0 N = 0
									S^/E			0,1,2 N = 3
-10	12											
	12.6	Sandy CLAY CL: low plasticity, red-brown mottled pale grey, fine to medium sand, w>PL, soft, estuarine										
-11	13								S/E			2,1,1 N = 2
-12	14 14.0	CLAYEY SILT MH: high plasticity, grey, w>PL, soft, estuarine						Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°				
									S/E			0,1,3 N = 4
-13	15											
	15.67	SANDSTONE: medium to coarse grained, red and yellow-brown, low to medium strength with very low strength bands, extremely weathered then highly weathered, slightly fractured, Hawkesbury Sandstone						15.3m: CORE LOSS: 370mm	C	84	74	PL(A) = 0.1
-14	16											PL(A) = 0.1
												PL(A) = 0.3
-15	17											PL(A) = 0.3
								17.51m: B20°, pl, cly vn				PL(A) = 0.4
-16	18							18m: B10°, pl, ro, fe stn				PL(A) = 0.4
								18.74m: CORE LOSS: 200mm	C	93	88	
-17	19 18.94	Between 18.94-19.44m: with 15% clay bands, fractured to slightly fractured						18.94m: Ds, 20mm				PL(A) = 0.3
		Below 19.43m: grading to pale grey, fresh						19.18m: Cs, 60mm 19.34m: B5°, pl, cly 8mm 19.37m: B0°, pl, cly 10mm				PL(A) = 0.4 PL(A) = 0.8
	19.75	SANDSTONE:(continue next page)						19.38m: B5°, pl, ro, fe				PL(A) = 1.4
	20.0											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 12.6m; HQ to 15.3m

TYPE OF BORING: Diacore 0.13m to 0.5m, Rotary wash bore 8.9m to 15.3m, NMLC Coring to 23.77m

WATER OBSERVATIONS: Water observed at 2.05m at 7:33pm on 4 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.75m and 11.5m undertaken within HW casing; *Field replicate BD01/040721 taken at 13.0-13.45m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333685
NORTHING: 6250541
DIP/AZIMUTH: 90°/--

BORE No: W3
PROJECT No: 202546.00
DATE: 3 - 5/7/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-18		SANDSTONE: medium grained, grey, massive, high strength, fresh, unbroken, Hawkesbury Sandstone						stn 19.43m: B0°, pl, cly 3mm 19.95m: B20°, pl, ro, fe stn	C	93	88	PL(A) = 1.2
												PL(A) = 1.9
-19	21	Below 20.75m: grading to medium to coarse grained, pale grey, distinctly and indistinctly bedded at 0-20°						>>				PL(A) = 1.2
-20	22								C	100	100	
												PL(A) = 1
-21	23											PL(A) = 1.4
	23.77	Bore discontinued at 23.77m - Limit of investigation										
-22	24											
-23	25											
-24	26											
-25	27											
-26	28											
-27	29											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 12.6m; HQ to 15.3m

TYPE OF BORING: Diacore 0.13m to 0.5m, Rotary wash bore 8.9m to 15.3m, NMLC Coring to 23.77m

WATER OBSERVATIONS: Water observed at 2.05m at 7:33pm on 4 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.75m and 11.5m undertaken within HW casing; *Field replicate BD01/040721 taken at 13.0-13.45m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: W3 PROJECT: Cockle Bay Wharf JULY 2021

15.30 – 19.00m

BORE: W3 PROJECT: Cockle Bay Wharf JULY 2021

19.00 – 23.77m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333672
NORTHING: 6250475
DIP/AZIMUTH: 90°/--

BORE No: W4
PROJECT No: 202546.00
DATE: 1 - 2/7/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
2	0.07	PAVER										
1.89	0.11	FILL/SAND: medium to coarse, brown, moist, appears poorly compacted										
1.7	0.5	CONCRETE: igneous gravel of 20mm nominal diameter										
1		VOID										
0.15	2.05	WATER				01-07-21						
-5.7	7.9	CLAY CI: medium plasticity, dark grey, trace sand, sulphurous odour, w~PL, very soft, estuarine										

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 11.5m; HQ to 12.55m

TYPE OF BORING: Diacore 0.11m to 0.5m, Rotary wash bore 7.9m to 12.55m, NMLC Coring to 20.72m

WATER OBSERVATIONS: Water observed at 2.05m at 11:16pm on 1 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.0m and 11.5m undertaken within HW casing

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333672
NORTHING: 6250475
DIP/AZIMUTH: 90°/--

BORE No: W4
PROJECT No: 202546.00
DATE: 1 - 2/7/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-8		CLAY CI: medium plasticity, dark grey, trace sand, sulphurous odour, w~PL, very soft, estuarine *(continued)*							S^/E			1,0,0 N = 0
-9	11											
	11.5	SAND SP: medium to coarse, brown, with clay, wet, medium dense, estuarine						Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°	S^/E			0,3,7 N = 10
-10	12											
	12.55	SANDSTONE: medium to coarse grained, orange and red-brown, medium strength, highly to moderately weathered, slightly fractured, Hawkesbury Sandstone							S/E			6/100 refusal PL(A) = 0.8
-11	13	Below 13.38-15.45m: unbroken						13.38m: B10°, pl, ro, fe stn	C	100	100	PL(A) = 0.9
-12	14	Below 14.27m: grading to pale grey, distinctly and indistinctly bedded at 5-20°, slightly weathered then fresh with occasional slightly weathered bands										PL(A) = 0.7
-13	15							>>				PL(A) = 0.8
-14	16								C	100	100	PL(A) = 0.9
-15	17							17.37m: J10°, pl, ro, cln				PL(A) = 0.9
	17.75	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 5-20°, high strength, fresh, unbroken, Hawkesbury Sandstone										PL(A) = 1.2
-16	18											PL(A) = 1.2
								18.62m: B0°, pl, cly vn				PL(A) = 1.7
-17	19								C	100	100	
								19.32m: B0°, pl, cly 1mm				PL(A) = 1.5
	20.0											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 11.5m; HQ to 12.55m

TYPE OF BORING: Diacore 0.11m to 0.5m, Rotary wash bore 7.9m to 12.55m, NMLC Coring to 20.72m

WATER OBSERVATIONS: Water observed at 2.05m at 11:16pm on 1 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.0m and 11.5m undertaken within HW casing

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.2 AHD
EASTING: 333672
NORTHING: 6250475
DIP/AZIMUTH: 90°/--

BORE No: W4
PROJECT No: 202546.00
DATE: 1 - 2/7/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-18		SANDSTONE: (continued)							C	100	100	PL(A) = 1.7
	20.73	Bore discontinued at 20.73m - Limit of investigation						20.62m: B40°, cu, cly 1mm				
-19	21											
-20	22											
-21	23											
-22	24											
-23	25											
-24	26											
-25	27											
-26	28											
-27	29											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 11.5m; HQ to 12.55m

TYPE OF BORING: Diacore 0.11m to 0.5m, Rotary wash bore 7.9m to 12.55m, NMLC Coring to 20.72m

WATER OBSERVATIONS: Water observed at 2.05m at 11:16pm on 1 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 10.0m and 11.5m undertaken within HW casing

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: W4 PROJECT: Cockle Bay Wharf JULY 2021

12.55 – 17.00m

BORE: W4 PROJECT: Cockle Bay Wharf JULY 2021

17.00 – 20.73m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333694
NORTHING: 6250483
DIP/AZIMUTH: 90°/--

BORE No: W5
PROJECT No: 202546.00
DATE: 7 - 8/7/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
2.5	0.07	PAVER										
2.4	0.14											
2.3	0.2	FILL/SAND: medium to coarse, brown, moist, appears poorly compacted										
1.9	0.59	FILL/Sandy GRAVEL: fine to coarse igneous gravel, dark grey, fine to coarse sand, trace silt, moist, appears moderately compacted										
		CONCRETE: igneous gravel of 20mm nominal diameter										
0.8	1.7	VOID										
		WATER				07-07-21						
-4.25	6.75	CLAY CL: low plasticity, dark grey, trace fine to medium sand, sulphurous odour, w~PL, very soft, estuarine							S^/E			1,0,0 N = 0
									U_{75}			pp = 120
-7.5	10.0											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 12.9m

TYPE OF BORING: Diacore 0.07m to 0.14m, Rotary wash bore 6.75m to 12.9m, NMLC Coring to 21.16m

WATER OBSERVATIONS: Water observed at 1.70m at 7:10pm on 7 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.8m undertaken within HW casing; *Field replicate BD05/070721 taken at 11.5-11.95m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333694
NORTHING: 6250483
DIP/AZIMUTH: 90°/--

BORE No: W5
PROJECT No: 202546.00
DATE: 7 - 8/7/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
-8		SAND SP: medium to coarse, grey, trace clay, wet, medium dense, estuarine							S/E			3,7,10 N = 17
-9	11 11.0	Sandy CLAY CL: low plasticity, brown, medium to coarse sand, w<PL, soft, estuarine							S/E*			2,1,1 N = 2
-10	12							Unless otherwise stated, rock is fractured along rough, planar bedding, dipping 0-10°	U_{75}			No Recovery
-11	13 12.9	SANDSTONE: medium to coarse, red and yellow-brown, medium strength, highly weathered, slightly fractured, Hawkesbury Sandstone						13.03m: B20°, pl, ro, cln 13.19m: Ds, 30mm				PL(A) = 0.4 PL(A) = 0.4
-12	13.35 14	SANDSTONE: medium to coarse grained, red and yellow-brown, high strength with medium strength bands, highly weathered, unbroken, Hawkesbury Sandstone							C	100	99	PL(A) = 1.3 PL(A) = 0.6 PL(A) = 1.2 PL(A) = 1.4 PL(A) = 1.4
-13	15	Below 14.8m: grading to moderately weathered Below 15.19m: with occasional cross-beds, slightly fractured						15.19m: B20°, pl, cly vn 15.43m: B0°, un, ro, cln				PL(A) = 1.2 PL(A) = 1.2
-14	16	Below 16.05m: grading to pale grey and brown, distinctly and indistinctly bedded at 5-20°, slightly weathered						16.05m: B0°, un, ro, cln 16.35m: B10°, pl, cly vn				PL(A) = 1.7 PL(A) = 1.1 PL(A) = 0.7
-15	17							16.9m: B10°, pl, cly 3mm 16.93m: B0°, un, cly 4mm 17.5m: B5°, un, ro, cln	C	100	98	PL(A) = 1
-16	18 18.33	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 5-20°, high strength, fresh, unbroken, Hawkesbury Sandstone						18.29m: B20°, pl, cly vn 18.33m: B10°, pl, cly 1mm				PL(A) = 1.3
-17	19							19.76m: B0°, pl, cly vn	C	100	100	PL(A) = 1.7

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 12.9m

TYPE OF BORING: Diacore 0.07m to 0.14m, Rotary wash bore 6.75m to 12.9m, NMLC Coring to 21.16m

WATER OBSERVATIONS: Water observed at 1.70m at 7:10pm on 7 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.8m undertaken within HW casing; *Field replicate BD05/070721 taken at 11.5-11.95m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 2.5 AHD
EASTING: 333694
NORTHING: 6250483
DIP/AZIMUTH: 90°/--

BORE No: W5
PROJECT No: 202546.00
DATE: 7 - 8/7/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-18	21	SANDSTONE: medium to coarse grained, pale grey, distinctly and indistinctly bedded at 5-20°, high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*							C	100	100	PL(A) = 2
-19	21.16	Bore discontinued at 21.16m - Limit of investigation										
-20	22											
-21	23											
-22	24											
-23	25											
-24	26											
-25	27											
-26	28											
-27	29											

RIG: Comacchio 205 **DRILLER:** Ground Test **LOGGED:** LHS **CASING:** HW to 10.0m; HQ to 12.9m

TYPE OF BORING: Diacore 0.07m to 0.14m, Rotary wash bore 6.75m to 12.9m, NMLC Coring to 21.16m

WATER OBSERVATIONS: Water observed at 1.70m at 7:10pm on 7 July 2021

REMARKS: Location coordinates are in MGA94 Zone 56. ^SPT at 8.8m undertaken within HW casing; *Field replicate BD05/070721 taken at 11.5-11.95m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BORE: W5 PROJECT: Cockle Bay Wharf JULY 2021

12.90 – 17.00m

BORE: W5 PROJECT: Cockle Bay Wharf JULY 2021

17.00 – 21.16m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 5.2 AHD
EASTING: 333795
NORTHING: 6250697
DIP/AZIMUTH: 90°/--

BORE No: WD1
PROJECT No: 202546.00
DATE: 19 - 20/9/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
5		FILL/Sandy GRAVEL: medium to coarse pale grey, angular to subrounded, slightly cemented,							A/E			
4	0.8	FILL/GRAVEL: medium to coarse sandstone gravel, occasional cobbles and boulders, pale grey brown, trace bricks and wood, appears in a dense condition, moist to wet							A/E			
3	1								A			
2	2								A			
1	3								A			
0	4								S			5,7,8 N = 15
-1	4.8	FILL/Gravelly SAND: fine to medium, brown and pale grey, approximately 40% sandstone gravel/cobbles, appears in a dense to very dense condition, wet (possible weathered sandstone)							S			20/50 refusal
-2	6.5	Sandy CLAY Cl: medium plasticity, pale grey brown, fine to medium sand, w~PL, apparently stiff, residual										
-3	7.0	SANDSTONE: fine to medium grained, pale grey, very low to low strength, highly weathered, Hawkesbury Sandstone							S			20/50 refusal
-4	8.15	SANDSTONE: medium to coarse grained, pale grey then brown, medium then high strength, fresh then moderately weathered, slightly fractured, Hawkesbury Sandstone						8.18m: B5°, cly, fg, 20mm 8.65m: B0°, cly co 3mm 9.32-9.35m: Cs	C	100	95	PL(A) = 0.8 PL(A) = 1

RIG: Bobcat **DRILLER:** JJ **LOGGED:** SI **CASING:** HW to 3.0m; HQ to 7.0m

TYPE OF BORING: NDD to 2.0m, Rotary wash bore to 7.0m, NMLC Coring to 24.9m

WATER OBSERVATIONS: No free groundwater observed during NDD

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 5.2 AHD
EASTING: 333795
NORTHING: 6250697
DIP/AZIMUTH: 90°/--

BORE No: WD1
PROJECT No: 202546.00
DATE: 19 - 20/9/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-5		SANDSTONE: medium to coarse grained, pale grey then brown, medium then high strength, fresh then moderately weathered, slightly fractured, Hawkesbury Sandstone *(continued)*						10.5m: B0°, cly co 5mm	C	100	100	PL(A) = 1.6
-6	11											PL(A) = 1.7
								11.48m: B5°, fe	C	100	100	
-7	12											PL(A) = 1.7
	12.75	SANDSTONE: medium to coarse grained, pale grey, cross bedded (10°-20°), high strength, fresh, slightly fractured and unbroken, Hawkesbury Sandstone						12.75m: B5°, fe				
-8	13											PL(A) = 1.8
								13.45m: B5°, cly vn, ti				
-9	14											PL(A) = 1.7
								14.25m: B10°(x2), cly vn, ti 14.35m: B10°(x2), cly vn, ti	C	100	100	
-10	15											PL(A) = 1.5
								15.4m: B5°, cly vn, ti				
-11	16											PL(A) = 1.9
								16.65m: B10°, cly vn				
-12	17											PL(A) = 2.1
								17.2m: B0°, cly 3mm	C	100	100	
-13	18											PL(A) = 1.7
								18.55m: B10°, cbs cly 1mm				
-14	19											PL(A) = 1
									C	100	100	

RIG: Bobcat **DRILLER:** JJ **LOGGED:** SI **CASING:** HW to 3.0m; HQ to 7.0m

TYPE OF BORING: NDD to 2.0m, Rotary wash bore to 7.0m, NMLC Coring to 24.9m

WATER OBSERVATIONS: No free groundwater observed during NDD

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 5.2 AHD
EASTING: 333795
NORTHING: 6250697
DIP/AZIMUTH: 90°/--

BORE No: WD1
PROJECT No: 202546.00
DATE: 19 - 20/9/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-15		SANDSTONE: medium to coarse grained, pale grey, cross bedded (10°-20°), high strength, fresh, slightly fractured and unbroken, Hawkesbury Sandstone *(continued)*										PL(A) = 1.5
-16	21								C	100	100	PL(A) = 2.1
								21.45m: B0°, cly co 2mm				
								21.85m: J50°, pl, ro, cln				
-17	22							22.1m: J45°, pl, ro, cln				PL(A) = 1.3
								22.25m: J45°, pl, ro, cln				
-18	23											PL(A) = 1.6
									C	100	100	
-19	24											PL(A) = 2.2
	24.9	Bore discontinued at 24.9m - Limit of investigation										
-20	25											
-21	26											
-22	27											
-23	28											
-24	29											

RIG: Bobcat **DRILLER:** JJ **LOGGED:** SI **CASING:** HW to 3.0m; HQ to 7.0m

TYPE OF BORING: NDD to 2.0m, Rotary wash bore to 7.0m, NMLC Coring to 24.9m

WATER OBSERVATIONS: No free groundwater observed during NDD

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: WD1 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

8.15 – 12.00m

BORE: WD1 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

12.00 – 17.00m

BORE: WD1 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

17.00 – 22.00m

BORE: WD1 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

22.00 – 24.90m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.8 AHD
EASTING: 333792
NORTHING: 6250668
DIP/AZIMUTH: 90°/--

BORE No: WD2
PROJECT No: 202546.00
DATE: 19/9/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
	0.06	PAVERS: concrete pavement										
	0.3	FILL/SAND: fine to medium, pale brown, trace roadbase gravel, appears in a loose condition, dry							A/E A			
	1.0	FILL/Sandy GRAVEL: medium to coarse, pale brown, occasional cobbles of ripped sandstone, approximately 30% medium to coarse sand, appears in a medium dense to dense condition, moist										
		FILL/GRAVEL: medium to coarse sandstone gravel, with some sandstone boulders, trace sand, appears in a dense condition, moist										
	4.2	Clayey SAND: fine to medium, pale grey brown, apparently medium dense to dense, residual							A U 50			U 50 No Recovery
	5.45	SANDSTONE: medium grained, pale grey brown, indistinctly bedded and cross bedded (10°-20°), medium strength, moderately weathered, slightly fractured, Hawkesbury Sandstone							S			25/50 refusal PL(A) = 0.4
									C	100	90	PL(A) = 0.3
	6.75							6.50-6.60m: Ds 6.65m: B0°, cly 10mm CORE LOSS: 100mm				
												PL(A) = 0.4
								7.25m: B10°, cly co 2mm 7.35m: B10°, cly co 2mm 7.6m: B5°, cly co 7.75m: B10°, cly 5mm 7.85m: B5°, cly vn				
									C	97	97	PL(A) = 0.5
	8.77							8.35-8.38m: Cs 8.45m: J30°, ti 8.5m: J70°, pl, ro, cln 8.65m: Cs 20mm CORE LOSS: 120mm 8.77m: Cs 20mm				
	8.8	SANDSTONE: medium to coarse grained, pale grey and brown, cross bedded at 0°-25°, high strength, slightly weathered and fresh, slightly fractured and unbroken, Hawkesbury Sandstone										PL(A) = 1.3

RIG: Bobcat **DRILLER:** JJ **LOGGED:** SI **CASING:** HW to 3.0m; HQ to 5.4m

TYPE OF BORING: NDD to 2.0m, Rotary wash bore to 5.45m, NMLC Coring to 21.9m

WATER OBSERVATIONS: No free groundwater observed during NDD

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.8 AHD
EASTING: 333792
NORTHING: 6250668
DIP/AZIMUTH: 90°/--

BORE No: WD2
PROJECT No: 202546.00
DATE: 19/9/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-7	11	SANDSTONE: medium to coarse grained, pale grey and brown, cross bedded at 0°-25°, high strength, slightly weathered and fresh, slightly fractured and unbroken, Hawkesbury Sandstone *(continued)*						10.9m: B10°, cly vn, ti	C	100	100	PL(A) = 1.4
												PL(A) = 1.9
-8	12								C	100	100	PL(A) = 1.7
-9								12.6m: B10°, cly vn, ti				
	13											PL(A) = 1.5
-10	14							14.4m: B5°, cly vn, ti	C	100	100	PL(A) = 2.3
-11	15											PL(A) = 2
-12	16							>>				PL(A) = 1.6
-13	17								C	100	100	PL(A) = 1.6
-14	18							18.25m: B0°, cbs co 1mm				PL(A) = 1.5
-15	19								C	100	100	PL(A) = 1.5
-16												

RIG: Bobcat **DRILLER:** JJ **LOGGED:** SI **CASING:** HW to 3.0m; HQ to 5.4m

TYPE OF BORING: NDD to 2.0m, Rotary wash bore to 5.45m, NMLC Coring to 21.9m

WATER OBSERVATIONS: No free groundwater observed during NDD

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 3.8 AHD
EASTING: 333792
NORTHING: 6250668
DIP/AZIMUTH: 90°/--

BORE No: WD2
PROJECT No: 202546.00
DATE: 19/9/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-17	21	SANDSTONE: medium to coarse grained, pale grey and brown, cross bedded at 0°-25°, high strength, slightly weathered and fresh, slightly fractured and unbroken, Hawkesbury Sandstone *(continued)*						20.2m: Unconformity 20.60-21.10m: J80°, pl, ro, ti	C	100	100	PL(A) = 1.8
		Between 21.2-21.8m: siltstone clasts						21.6m: J25°, pl, ro, cln 21.70-21.80m: breccia siltstone clasts				PL(A) = 1.3
-18	21.9 22	Bore discontinued at 21.9m - Limit of investigation										
-19	23											
-20	24											
-21	25											
-22	26											
-23	27											
-24	28											
-25	29											
-26												

RIG: Bobcat **DRILLER:** JJ **LOGGED:** SI **CASING:** HW to 3.0m; HQ to 5.4m

TYPE OF BORING: NDD to 2.0m, Rotary wash bore to 5.45m, NMLC Coring to 21.9m

WATER OBSERVATIONS: No free groundwater observed during NDD

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BORE: WD2 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

5.45 – 10.00m

BORE: WD2 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

10.00 – 15.00m

BORE: WD2 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

15.00 – 20.00m

BORE: WD2 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

20.00 – 21.90m

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 4.8 AHD
EASTING: 333800
NORTHING: 6250639
DIP/AZIMUTH: 90°/--

BORE No: WD3
PROJECT No: 202546.00
DATE: 11 - 12/9/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
4	0.13	CONCRETE: grey, igneous aggregate of 10mm nominal diameter, 10mm diameter steel reinforcement							A			
1	0.3	FILL/Sandy GRAVEL: fine to medium, igneous gravel, grey, fine to coarse sand, trace silt, dry, appears in a medium dense condition							A			
3		FILL/Gravelly SAND: fine to coarse, brown, fine to medium igneous and sandstone gravel, trace coarse asphalt and concrete gravel, dry, appears in a medium dense condition							A			
2									A			
2									S			9,10,11 N = 21
3												
1		Between 3.5-3.7m: possible concrete fragment							A			
4									S*			10,10,11 N = 21
0	5	5.0 Sandy CLAY CL: low plasticity, dark grey, fine to medium sand, w~PL, firm, estuarine										
-1									S			2,3,3 N = 6
6												
-2	7	7.0 SAND SP: fine to coarse, grey, trace clay and shells, wet, loose, estuarine										
-3									U_{50}			
8									S			2,2,3 N = 5
-4	9											
-5												

RIG: XC rig **DRILLER:** Terratest **LOGGED:** LHS **CASING:** HW to 3.5m; HQ to 10.65m

TYPE OF BORING: Diacore to 0.13m, Hand auger to 0.8m, Solid flight auger to 7.0m; Rotary wash bore to 10.65m; NMLC Coring to 25.35m

WATER OBSERVATIONS: Free groundwater observed at 7.0m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD3/210911 taken at 4.0-4.45m depth

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: DPT Operator Pty Ltd
PROJECT: Cockle Bay Park Redevelopment
LOCATION: 241-249 Wheat Road, Sydney

SURFACE LEVEL: 4.8 AHD
EASTING: 333800
NORTHING: 6250639
DIP/AZIMUTH: 90°/--

BORE No: WD3
PROJECT No: 202546.00
DATE: 11 - 12/9/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
		SAND SP: fine to coarse, grey, trace clay and shells, wet, loose, estuarine *(continued)*						Unless otherwised stated, rock is fractured along rough, planar bedding, dipping 0-10°				
		Below 10.5m: grading to fine to medium, no shells, moist, dense, possibly residual							S			16 refusal bouncing
-6	10.8	SANDSTONE: fine to medium grained, grey, very low to low strength, highly weathered, fractured, Hawkesbury sandstone						10.82m: Cs, 10mm 10.88-10.91m: B0°(x2), pl, cly 1mm 11.2m: J60°, pl, ro, cln 11.31-11.34m: B0°(x2), pl, cly 3mm	C	100	78	PL(A) = 0.2 PL(A) = 1.2
-7	11.35	SANDSTONE: medium to coarse grained, pale grey, distinct and indistinct bedding at 0-10°, high strength, fresh, slightly fractured, Hawkesbury sandstone						12.09-12.27m: B20°(x2), pl, cly vnr 13.32m: B0°, pl, cly vnr	C	100	100	PL(A) = 1.3
-8	12											
-9	13								C	100	93	PL(A) = 1.5 PL(A) = 1.6
-10	14											
-11	15	Between 15.2-15.6m: siltstone specks						15.91m: B0°, pl, cly vnr	C	100	100	PL(A) = 1.5
-12	16							16.5-16.52m: B10°(x2), pl, cly vnr 16.91m: B10°, pl, cly vnr	C	100	99	PL(A) = 1.4 PL(A) = 2.3
-13	17											
-14	18							18.4m: B0°, pl, cly vnr 19.19m: B10°, pl, cly vnr	C	100	100	PL(A) = 1.5
-15	19	Between 19.75-19.85m: carbonaceous laminations						19.83m: B0°, un, cly vnr	C	100	100	PL(A) = 1.6

RIG: XC rig **DRILLER:** Terratest **LOGGED:** LHS **CASING:** HW to 3.5m; HQ to 10.65m

TYPE OF BORING: Diacore to 0.13m, Hand auger to 0.8m, Solid flight auger to 7.0m; Rotary wash bore to 10.65m; NMLC Coring to 25.35m

WATER OBSERVATIONS: Free groundwater observed at 7.0m depth whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. *Field replicate BD3/210911 taken at 4.0-4.45m depth

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

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BORE No: WD3
PROJECT No: 202546.00
DATE: 11 - 12/9/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-16	21	SANDSTONE: medium to coarse grained, pale grey, distinct and indistinct bedding at 0-10°, high strength, fresh, slightly fractured, Hawkesbury sandstone *(continued)*							C	100	100	PL(A) = 1.2
-17	22	Between 21.28-21.31m: carbonaceous laminations Between 21.77-21.78m: carbonaceous laminations						21.35m: B10°, un, cly vnr 21.78m: B0°, un, cly vnr	C	100	100	PL(A) = 1.3
-18	23	Between 22.36-22.4m: siltstone specks							C	100	100	PL(A) = 1.1
-19	24	Between 23.6-23.79m: grading to fine grained Between 24.02-24.12m: siltstone clasts and beds Between 24.12-24.18m: fine grained						23.6m: B0°, un, cly vnr 24.18m: Cs, 10mm	C	100	99	PL(A) = 1.8 PL(A) = 1.2
-20	25											PL(A) = 1.5
	25.35	Bore discontinued at 25.35m - Limit of investigation										
-21	26											
-22	27											
-23	28											
-24	29											
-25												

RIG: XC rig **DRILLER:** Terratest **LOGGED:** LHS **CASING:** HW to 3.5m; HQ to 10.65m

TYPE OF BORING: Diacore to 0.13m, Hand auger to 0.8m, Solid flight auger to 7.0m; Rotary wash bore to 10.65m; NMLC Coring to 25.35m

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SAMPLING & IN SITU TESTING LEGEND

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BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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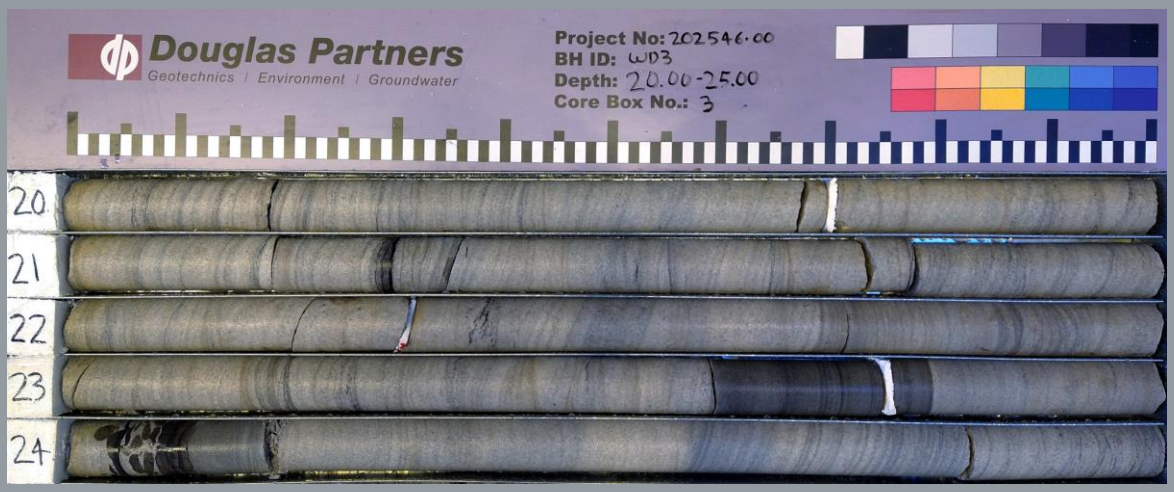
BORE: WD3 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

10.65 – 15.00m

BORE: WD3 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

15.00 – 20.00m

BORE: WD3 PROJECT: Cockle Bay Wharf SEPTEMBER 2021



20.00 – 25.00m

BORE: WD3 PROJECT: Cockle Bay Wharf SEPTEMBER 2021

25.00 – 25.35m

Appendix C

Fieldwork Methods

Appendix C
Fieldwork Methods
Cockle Bay

C1.0 Guidelines

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

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013).
- NSW EPA *Assessment and Management of Hazardous Ground Gases* (NSW EPA, 2020).
- Sullivan, L., Ward, N., Toppler, N., & Lancaster, G. (2018). *National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Sampling and Identification Methods Manual.* Canberra ACT CC BY 4.0: Department of Agriculture and Water Resources (Sullivan, et al., 2018).

C2.0 Soil Sampling from Boreholes

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

- Collect soil samples directly from SPT sample tube / solid flight auger;
- Collect near surface samples using hand tools where potholing is required;
- Transfer samples in laboratory-prepared glass jars with Teflon lined lids by hand, capping immediately and minimising headspace within the sample jar;
- Collect replicate samples in zip-lock bags for PID screening;
- Collect 500 ml samples in zip-lock bags for asbestos fines / fibrous asbestos (AF/FA) where feasible. Where sample volumes are insufficient for 500 ml samples collect ~40 g to 50 g samples in zip-lock bags for asbestos (presence / absence) analysis where sufficient sample recovery was achieved;
- Collect 300 g samples in zip-locked bags, removal of air, placement in a freezer as soon as practical for acid sulfate soil testing;
- Wear a new disposable nitrile glove for each sample point thereby minimising potential for cross-contamination;
- Collect 10% replicate samples for QC purposes;
- Label sample containers with individual and unique identification details, including project number, sample location and sample depth (where applicable);
- Place samples into a cooled, insulated and sealed container for transport to the laboratory; and
- Use chain-of-custody documentation.

C2.1 Field Testing

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

PID Field Test

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

C3.0 Groundwater Sampling

C3.1 Monitoring Well Installation

Monitoring will be constructed using class 18 uPVC machine slotted screen and blank sections with screw threaded joints. The screened section of each well is backfilled with a washed sand filter pack to approximately 0.5 m above the screened interval. Each well is completed with a hydrated bentonite plug of at least 0.5 m thick and then bentonite to the surface, finished as a with cast iron road-box. Groundwater wells were fitted with a gas cap to allow gas screening.

C3.2 Monitoring Well Development

Groundwater monitoring will be developed as soon as practicable following well installation. The purpose of well development is to remove sediments and / or drilling fluid introduced to the well during drilling and to facilitate connection of the monitoring well to the aquifer. The wells are developed by pumping / bailing to remove a minimum of five well volumes, or until dry.

C3.3 Groundwater Sampling

Bladder Pump

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

- Measure the static water level using an electronic interface probe and record the thickness of any LNAPL (if encountered);
- Decontaminate the interface probe and cable between monitoring wells by rinsing in a diluted Decon-90 solution and then rinsing in demineralised water;

- Fit the pump with a well-dedicated bladder and tubing. Lower the pump into the well then clamp at a level estimated to be 1 m below the top of the water column (provided the depth of the pump is within the screened section) or to the approximate mid-point of the well screen;
- Set the pump at the lowest rate possible that could produce laminar flow to minimise drawdown of the water column;
- Measure physical parameters by continuously passing the purged water through a flow cell; and
- Following stabilisation of the field parameters, collect samples in laboratory-prepared bottles minimising headspace within the sample bottle and cap immediately.

Decontaminate the interface probe, pump and cable between monitoring wells by rinsing in a diluted Decon-90 solution and then rinsing in demineralised water.

Sample Handling, All Methods

The general groundwater sample handling and management procedures comprise:

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

C4.0 Acid Sulfate Soil Screening

The ASS screening tests were performed by an experienced DP Environmental Scientist in accordance with the methods in Sullivan et al (2018).

The procedure for the pHF is outlined below:

- Calibrate battery powered field pH meter according to manufacturer's instructions;
- Prepare test tubes in a tube rack;
- For each sample place approximately half a teaspoon of soil into each of the pHF and pHFOX tubes;
- Place enough deionised (DI) water in the pHF test tube to make a paste similar to 'grout mix' or 'white sauce'; stir the soil:water paste to ensure all soil 'lumps' are removed (demineralised water can be substituted; never use tap water). Water must be added to the soil samples within 10 min of sampling to reduce the risk of reduced organic sulfur (RIS) oxidation; monosulfidic material may start to oxidise in less than 5 min, substantially affecting pHF results;
- Immediately place the pH spear point electrode into the soil:water paste, ensuring the spear point is completely submerged;
- Measure the pHF with the calibrated pH meter;

- Wait for the reading to stabilise and record the pH measurement; and
- All measurements should be recorded on a data sheet.

The procedure for the field pH peroxide test (pHFOX) is outlined below:

- Adjust the pH of the H_2O_2 to between 4.5 and 5.5 before going into the field. While stirring, add a few drops of dilute NaOH and regularly check the pH with a calibrated electrode until the correct range is reached. Allow the peroxide to stand for 15 min and then recheck the pH. As H_2O_2 degrades over time, only buffer small quantities at a time and refrigerate when not in use;
- Calibrate field pH meter according to manufacturer's instructions;
- Prepare heat-resistant tubes in a tube rack;
- To the pHFOX tube, prepared while sampling for pHF, add sufficient 30% H_2O_2 (at room temperature) to cover the soil, then stir the mixture;
- Rate the reaction of soil and peroxide using the reaction scale in Table D1;
- Allow approximately 15 min for any reactions to occur. The reaction may be rapid and vigorous if substantial RIS is present. If the reaction is violent and the soil:peroxide mix may overtop the tube, use a wash bottle to add small amounts of deionised or demineralised water to cool and calm the reaction. Do not add too much water as this may dilute the mixture and affect the pH value;
- Add a further 1-2 mL of H2O2, mix, allow to react for 15 min and rate the reaction. Continue this process until the soil:peroxide mixture reaction has slowed. This will ensure most of the RIS have reacted;
- If there is no initial reaction, individual tubes containing the soil:peroxide mixture can be placed in direct sunlight. This may encourage the initial reaction to occur;
- Wait for the soil:peroxide mixture to cool. This may take up to 10 min as the reaction can exceed 90 °C. Check the temperature rating of the pH meter and probe as high temperatures can damage the electrode and result in inaccurate readings. A more accurate pH is recorded if a temperature probe is used, however, this may be impractical in some field situations;
- Place the spear point pH electrode into the soil:peroxide mixture, ensuring the spear point is completely submerged. Never stir the paste with the electrode as this may damage the semipermeable glass membrane;
- Measure the pHFOX with the calibrated pH meter; and
- Wait for the reading to stabilise and record the pHFOX measurement.

Table D1: Soil Reaction Rating Scale for pH_{fox} Test

Reaction Scale	Rate of Reaction
L / 1	Low reaction
M / 2	Medium reaction
H / 3	High reaction
X / 4	Extreme reaction
V / 5	Volcanic reaction

C5.0 Gas Screening

C5.1 Gas Monitoring

Landfill gas monitoring is carried out in accordance with DP standard operating procedures and NSW EPA (2020). The monitoring method is described as follows:

- Record the barometric pressure;
- Connect the tube on the calibrated landfill gas analyser to the quick connect gas fitting on the well cap;
- Set the analyser pump on and record concentrations of methane, carbon dioxide, oxygen, carbon monoxide and hydrogen sulphide, generally at 30 second intervals, for a minimum of ten minutes and until concentrations have generally stabilised;
- Return to the well following at least one hour and re-connect the landfill gas analyser and record the gas flow rate;
- Connect the tube on the calibrated PID to the quick connect gas fitting on the well cap; and
- Set the PID concentrations of VOC at 30 second intervals, for a minimum of ten minutes and until concentrations have generally stabilised.

Note the general weather conditions and record the atmospheric pressure during the monitoring event. The conditions were generally consistent with the Bureau of Meteorology (BOM) data from the weather station at Observation Hill, the closest monitoring location, which records atmospheric pressure was at generally between 1025 and 1030 hPa at during the monitoring period.

C5.2 Vapour Sampling

The soil vapour sampling is carried out in accordance with DP standard operating procedures based on ASTM (2018) and current industry practice. The general sampling and sample management procedures comprise:

- Connect sample tubing directly to the well outlet via a quickconnex fitting;

- Collect the primary soil vapour sample to a Suma canister and the backup sample on carbon tubes. Attach Suma canisters directly to the sample point via disposable tubing. Collect the back-up sample using an air sampling pump, with the flow rate monitored using a rotameter and vacuum gauge;
- Perform shut in tests (minimum 30 seconds) following assembly of the sampling apparatus comprising:
  - Suma canister: Assemble the sample apparatus to the extent practical (i.e., connecting the Suma canister to the regulator), then opening the canister valve to apply the vacuum (of between -29 mm Hg to -30 mm Hg) to the sampling train, while the regulator is still capped; and
  - Carbon back-up tube: Assemble the sample train (fittings to attach to vapour well, carbon tube, vacuum gauge, rotameter and pump plus the associated tubing connecting the sample train) then clamping the sampling tube between the vapour port and carbon tube, activating the pump until a vacuum of 15 in Hg is achieved and then the sampling train is clamped at the pump;
- Purge the soil vapour well prior to sampling by removing one volume of air/vapour from the well (~500 ml);
- Introduce liquid isopropyl alcohol (IPA) into the sampling shroud to act as a tracer gas for leaks in the soil vapour well and/or the sampling train. All samples are analysed for IPA as part of the TO15 analysis;
- Take PID readings from the soil vapour well prior to and following application of the IPA tracer gas. Take a PID reading inside the shroud to provide a field indication of potential leaks;
- Measure general gas parameters from the soil vapour well, including methane, oxygen and carbon dioxide, on-site using a calibrated landfill gas analyser;
- Collect primary samples directly from the soil vapour port into 1 L Suma canisters with a flow regulator set by the analytical laboratory (approximately 100 ml/min). The regulators are supplied by the analytical laboratory and are decontaminated by the laboratory prior to shipment;
- Collect an intra-laboratory QC duplicate soil vapour sample;
- Collect back-up samples directly onto carbon tubes using an SKC constant flow air-sampling pump, low flow adapter and rotameter to confirm the flow rate;
- Collect a shroud sample on a carbon tube to conduct analysis for IPA and determine the concentration of the tracer compound in the shroud;
- Collect the VOC sample from the sample point directly into the sorbent tube / canister so as not to pass through the pump, rotameter or tubing which has the potential to contaminate the samples (rotameter not required for canisters); and
- Label the sample canisters and tubes and record on chain of custody documentation. Complete field sampling sheets and transport samples to the laboratory in an appropriate sealed container.

C6.0 Validation Sampling Frequency

The sampling frequency will depend on the purpose of the sampling, the volume or area to be assessed and the previous results. The following sampling frequencies will be used. These frequencies may be reduced for large volumes or areas.

C6.1 Visual Inspections

Visual inspection of the area / material of concern will be conducted by the Environmental Consultant prior to sampling.

If any signs of environmental concern (e.g., odours, staining) are observed in the area/material being tested, targeted sampling will be conducted as required to assess the contamination potentially associated with the observed sign of concern. This may require additional samples to those required by the testing frequencies given below.

C6.2 Validation of Excavations

Small to Medium Excavations (base <500 m^2):

- Base of excavation: one sample per 25 m^2 to 50 m^2 or part thereof. Where high local variation is expected, a minimum of three samples will be collected; and
- Sides of excavation: one sample per 10 m length or part thereof. Additional samples will be collected at depths of concern where there is more than one depth of concern.

Large Excavations (base ≥500 m^2) Fire tank and Tower:

- Base of excavation: sampling on a grid at a density in accordance with the EPA *Contaminated Sites: Sampling Design Guidelines* (1995) or a minimum of 10 samples. In sub-areas with any specific signs of concern, a higher sampling density may be required; and
- Sides of excavation: one sample per 20 m length or part thereof. Additional samples will be collected at depths of concern where there is more than one depth of concern.

Samples will be analysed for the contaminants of concern identified for the sampling purpose. These contaminants will be identified based on available laboratory results from previous testing, the data gap investigation, field observations and the objective of the analysis.

C6.3 Stockpiles

Samples will be collected from stockpiles at various depths to characterise the full depth of the stockpile.

Validation / assessment of stockpiled soils (note actual frequency will be determined based on volume, contamination risk and homogeneity of the material):

- Stockpiles ≤250 m^3: one sample per 25 m^3 or a minimum of three samples; and
- Stockpiles >250 m^3: one sample per 50-250 m^3, or a minimum of 10 samples.

Where contaminated soils are stored or treated on bare soils, the footprint of the stockpile requires validation following removal of the contaminated soils.

Soil stockpiles which contain PASS (or where the presence / absence of PASS is unknown) shall be managed in accordance with an acid sulfate soil management plan (to be prepared following the completion of the data gap investigation). Soil Stockpiles shall also require testing / validation testing to confirm presence of PASS / treatment of PASS in accordance with the ASSMP.

C6.4 Imported Materials

Imported soil, rock and recovered aggregate will be tested to confirm that they can be legally imported onto the site. The scope of testing will depend on the quality of the paperwork provided and the assessed risk of the source site. The risk will be assessed by the Environmental Consultant based on the material type information provided in the source documentation, the documentation quality and any testing results. Materials assessed to be high risk will not be imported. Documentation will be reviewed for site history; material description, quantity, source, contamination and ASS potential; assessment and testing results; independence of person providing the assessment; and tracking records for the materials transport.

Imported quarried VENM is considered to be a product and testing is not considered necessary for determining its suitability for use on site. It therefore does not fall into the below risk categories.

The risk categories will be assigned by the Environmental Consultant with consideration of the following:

- Low Risk: material considered to have a low risk of contamination based on complete documentation, the material being predominantly naturally derived, availability of site history information with low risk of historic sources of contamination and laboratory results for a range of common contaminants consistent with the site history with all results within the SAC and legal requirements for importation. Low risk materials will be considered to include VENM with the above information; and tunnel spoil with a specific RRO/RRE issued by the EPA;
- Moderate Risk: material considered to have a moderate risk of contamination based on reasonable documentation (but may have some potential data gaps), site history information showing a low to moderate risk of contamination and laboratory results for a range of common contaminants consistent with the site history with all results within the SAC and legal requirements for importation. Moderate risk materials will be considered to ENM with testing results for a range of common contaminants (including asbestos, TRH C6-C10, PCB, OCP, OPP and phenols); and
- High Risk: material considered to have a high risk of contamination based on insufficient documentation, site history information indicating a high risk of contamination for the subject material, materials with insufficient testing results. High risk materials will include ENM with no testing for common contaminants other than those listed in the ENM RRO; recycled materials (such as recovered aggregate) and VENM with insufficient testing based on the site history information.

It is anticipated that materials will be tested at the following frequencies prior to approval for importation to the site:

Low risk material, per source site:

- ≤1,000 m^3: one sample per 200 m^3 or a minimum of three samples; and
- >1,000 m^3: five samples from the first the first 1,000 m^3 plus one sample per additional 1,000 m^3 or part thereof.

Moderate risk material, per source site:

- ≤1,000 m^3: one sample per 100 m^3 or a minimum of three samples; and
- >1,000 m^3: ten samples from the first the first 1,000 m^3 plus one sample per additional 200 m^3 or part thereof.

A visual inspection of the source site and material must be conducted and upon receipt of the material a subsequent inspection must be completed to check that the material is consistent with that approved for importation.

C7.0 Laboratory Analysis

Laboratory analysis of samples will be undertaken by laboratories with NATA accreditation for the analyte being tested and with appropriate QA / QC assessment to meet the requirements of Section D8.

It is anticipated that at least two laboratories will be employed to undertake the testing, a primary laboratory (Envirolab Services) and secondary laboratory (Eurofins MGT), which will analyse inter-laboratory replicate samples.

Samples will be analysed for the contaminants of concern identified for the sampling purpose. These contaminants will be identified based on available laboratory results from previous testing, the data gap investigation, field observations and the objective of the analysis.

C8.0 Quality Control and Quality Assurance

QA / QC procedures will be adopted to assess the repeatability and reliability of the results.

Field QA / QC testing will include the following:

- 5% sample inter-laboratory analysis, analysed for the same suite as primary sample;
- 5% sample intra-laboratory analysis, analysed for the same suite as primary sample;
- Rinsate samples (where re-useable sampling equipment is used), analysed for the suite of analytes analysed by the majority of the primary samples;

- Trip spike samples (one per batch of samples tested for BTEX where volatile contaminants are of concern); and
- Trip blank samples (one per batch of samples tested for BTEX where volatile contaminants are of concern).

The laboratory will undertake analysis in accordance with its accreditation, including in-house QA / QC procedures. These may include:

- Reagent blanks;
- Spike recovery analysis;
- Laboratory duplicate analysis;
- Analysis of control standards;
- Calibration standards and blanks; and
- Statistical analysis of QC data including control standards and recovery plots.

The quality control analytical results will be assessed using the following criteria:

- Sampling location rationale meet the sampling objective;
- Standard operating procedures are followed;
- Appropriate QA / QC samples are collected/prepared and analysed;
- Samples are stored under secure, temperature controlled conditions;
- Chain of custody documentation is employed for the handling, transport and delivery of samples to the selected laboratory;
- Conformance with specified holding times;
- Accuracy of spiked samples within the laboratory's acceptable range (typically 70-130% for inorganic contaminants and greater for some organic contaminants);
- Field and laboratory duplicates and replicate samples have a precision average of +/- 30% relative percentage difference (RPD) for inorganic analytes and +/- 50% RPD for organic analytes; and
- Rinsate samples show that the sampling equipment is free of introduced contaminants, i.e., the analytes show that the rinsate is within the normal range for deionised water.

C9.0 References

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

NSW EPA. (2020). *Assessment and Management of Hazardous Ground Gases.* NSW Environment Protection Authority.

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

Douglas Partners Pty Ltd

Appendix D

Site Assessment Criteria

Appendix D
Site Acceptance Criteria
241-249 Wheat Road, Sydney

1.0 Introduction

1.1 Guidelines

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

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013);
- CRC CARE *Health screening levels for petroleum hydrocarbons in soil and groundwater* (CRC CARE, 2011);
- ANZG *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018);
- NHMRC *Guidelines for Managing Risks In Recreational Water* (NHMRC, 2008);
- ANZECC *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000);
- Sullivan, L., Ward, N., Toppler, N., & Lancaster, G. (2018). *National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Sampling and Identification Methods Manual.* Canberra ACT CC BY 4.0: Department of Agriculture and Water Resources. (Sullivan, et al., 2018);
- NSW EPA. (2016). Addendum to the Waste Classification Guidelines (2014) - Part 1: Classifying Waste. NSW Environment Protection Authority. (NSW EPA, 2016); and
- NSW EPA. (2020). Assessment and Management of Hazardous Ground Gases. NSW Environment Protection Authority. (NSW EPA, 2020).

1.2 General

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

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

- Land use: recreational and commercial / industrial:
  - Corresponding to land use category ‘C‘, public open space such as parks, playgrounds, playing fields (e.g., ovals), secondary schools and footpaths.

- Corresponding to land use category 'D', commercial / industrial such as shops, offices, factories and industrial sites.
- Soil type: sand.

2.0 Soils

2.1 Health Investigation and Screening Levels

The generic health investigation levels (HIL) and health screening levels (HSL) are considered to be appropriate for the assessment of human health risk via all relevant pathways of exposure associated with contamination at the site. The adopted soil HIL and HSL for the contaminants of concern are in Table 1, Table 2 and Table 3.

Table 1: Health Investigation Levels (mg/kg)

Contaminant	HIL-C	HIL-D
Metals		
Arsenic	300	3000
Cadmium	90	900
Chromium (VI)	300	3600
Copper	17 000	240 000
Lead	600	1500
Mercury (inorganic)	80	730
Nickel	1200	6000
Zinc	30 000	400 000
TBT		
Tin		
PAH		
B(a)P TEQ	3	40
Total PAH	300	4000
Phenols		
Phenol	40 000	240 000
Pentachlorophenol	120	660
Cresols	4000	25 000
OCP		
DDT+DDE+DDD	400	3600

Contaminant	HIL-C	HIL-D
Aldrin and dieldrin	10	45
Chlordane	70	530
Endosulfan	340	2000
Endrin	20	100
Heptachlor	10	50
HCB	10	80
Methoxychlor	400	2500
OPP		
Chlorpyrifos	250	2000
PCB		
PCB	1	7
VOC (various analytes)	-	-

Table 2: Health Screening Levels (mg/kg)

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

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

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

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

Table 3: Health Screening Levels (mg/kg)

Contaminant	HSL-D	HSL-D	HSL-D	HSL-D
SAND	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4 m**	**4 m+**
Benzene	3	3	3	3
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	230	NL	NL	NL
Naphthalene	NL	NL	NL	NL
TRH F1	260	370	630	NL
TRH F2	NL	NL	NL	NL

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

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

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

The HSL for direct contact derived from CRC CARE (2011) are in Table 4.

Table 4: Health Screening Levels for Direct Contact (mg/kg)

Contaminant	DC HSL-C	DC HSL-D	DC HSL-IMW
Benzene	120	430	1100
Toluene	18 000	99 000	120 000
Ethylbenzene	5300	27 000	85 000
Xylenes	15 000	81 000	130 000
Naphthalene	1900	11 000	29 000
TRH F1	5100	26 000	82 000
TRH F2	3800	20 000	62 000
TRH F3	5300	27 000	85 000
TRH F4	7400	38 000	12 000

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

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

IMW intrusive maintenance worker

2.2 Asbestos in Soil

Based on the CSM and / or current site access limitations, a detailed asbestos assessment was not considered to be warranted at this stage. However, due to the history of widespread use of ACM products across Australia, ACM can be encountered unexpectedly and sporadically at a site. Therefore, the presence or absence of asbestos at a limit of reporting of 0.1 g/kg (AS:4964) has been adopted for this investigation / assessment as an initial screen.

Where 500 ml or 10L samples are collected the HSL for asbestos in soil are based on likely exposure levels for different scenarios published in NEPC (2013) for the following forms of asbestos:

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

The HSL are in Table 5.

Table 5: Health Screening Levels for Asbestos

Form of Asbestos	HSL-C	HSL-D
ACM	0.02%	0.05%
FA and AF	0.001%	0.001%
FA and AF and ACM	No visible asbestos for surface soil *	No visible asbestos for surface soil *

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

2.3 Ecological Investigation Levels

Ecological investigation levels (EIL) and added contaminant limits (ACL), where appropriate, have been derived in NEPC (2013) for arsenic, copper, chromium (III), nickel, lead, zinc, DDT and naphthalene. The adopted EIL, derived using the interactive (excel) calculation spreadsheet on the NEPM toolbox website are shown in Table 7, with inputs into their derivation shown in Table 6.

Table 6: Inputs to the Derivation of the Ecological Investigation Levels

Variable	Input	Rationale
Age of contaminants	“Aged” (>2 years)	Historic contamination / fill
pH	8.5	Site average, from DP (2021)
CEC	20.0 $cmol_c/kg$	Site average, from DP (2021)
Clay content	5%	assumed
Traffic volumes	high	
State / Territory	NSW	

Table 7: Ecological Investigation Levels (mg/kg)

Contaminant	EIL-A-B-C	EIL-D
Metals		
Arsenic	100	160
Copper	240	330
Nickel	270	460
Chromium III	330	540
Lead	1100	1800
Zinc	820	1200
PAH		
Naphthalene	170	370
OCP		
DDT	180	640

Notes: EIL-AES area of ecological significance

2.4 Ecological Screening Levels

Ecological screening levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. The adopted ESL are shown in Table 8.

Table 8: Ecological Screening Levels (mg/kg)

Contaminant	Soil Type	EIL-A-B-C	EIL-D
Benzene	Coarse	50	75
Toluene	Coarse	85	135
Ethylbenzene	Coarse	70	165
Xylenes	Coarse	105	180
TRH F1	Coarse/ Fine	180*	215*
TRH F2	Coarse/ Fine	120*	170*
TRH F3	Coarse	300	1700
TRH F4	Coarse	2800	3300
B(a)P	Coarse	0.7	1.4

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

2.5 Management Limits

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

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

The adopted management limits are in Table 9.

Table 9: Management Limits (mg/kg)

Contaminant	Soil Type	ML-A-B-C	ML-D
TRH F1	Coarse	700	700
TRH F2	Coarse	1000	1000
TRH F3	Coarse	2500	3500
TRH F4	Coarse	10 000	10 000

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

3.0 Waste Classification

The waste classification was conducted with reference to the NSW EPA Waste Classification Guidelines, Part 1: Classifying Waste (NSW EPA, 2014). In assessing materials as virgin excavated natural materials (VENM) the POEO Act and NSW EPA website were also referenced.

4.0 Acid Sulfate Soils

The following section provides the action criteria to determine if the soil is classified as PASS / ASS and therefore if acid sulfate soil management is required.

4.1 Field Screening

Field screening indicators do not form part of the assessment criteria as such but can be used to provide an indication of the ASS status and to assist in selecting samples for laboratory testing.

Field screening is indicative only and can give false positive and false negative indications of the presence of ASS. False positives can be caused by organic matter, which often "froths" during oxidation. False negatives can be caused by shells in the soil. Indicators of ASS from field screening comprise:

- Field pH is less than or equal to pH 4;
- pHfox is less than 3.5;
- A decrease of more than 1 pH unit from the field pH to the pHfox;
- Bubbling, production of heat or release of sulphur odours during pHfox testing; and
- Change in colour from grey to brown tones during oxidation.

4.2 Laboratory Analysis

The action criteria trigger are the basis for determining if a ASSMP is required. They are based on Net Acidity. As clay content tends to influence a soil's natural buffering capacity, the action criteria are grouped by three broad texture categories - coarse, medium and fine. If the Net Acidity of any individual soil tested is equal to or greater than the action criterion a detailed ASS management will need to be prepared.

The test results can be used to evaluate the presence / absence of ASS in accordance. If the results indicate the absence of ASS treatment is not required. The following Table 10 provides the action criteria.

Table 10: Action Criteria

Type of Material		Net Acidity#			
		1-1000 t materials disturbed		>1000 t materials disturbed	
Texture Range (NCST 2009)*	Approximate Clay Content %)	% S-equiv (oven dried basis)	Mol H+/t (oven dried basis)	% S-equiv (oven dried basis)	Mol H+/t (oven dried basis)
Coarse and Peats: sands to loamy sands	<5	≥ 0.03	≥ 18	≥ 0.03	≥ 18

* If bulk density values are not available for the conversion of cubic meters to tonnes of soil, then the default bulk densities based on the soil texture in Table 11, may be used.

Net Acidity can only include a soil material's measured Acid Neutralising Capacity where this measure has been corroborated by other data (for example slab incubation data) that demonstrates the soil material does not experience acidification during complete oxidation under field conditions (Equation C1). Where the Acid Neutralising Capacity has not been corroborated, the Net Acidity must be determined using Equation C2.

Table 11: Default Bulk Densities Based on Soil Texture

Texture	Bulk Density (t/m^3)
Sand	1.8
Loamy Sand	1.8
Sandy Loam	1.7
Loam	1.6
Silty Loam	1.5
Clay Loam	1.5
Clay	1.4
Peat	1.0

4.2.1 Net Acidity

Net Acidity is the quantitative measure of the acidity hazard of ASS. It is determined from an Acid Base Accounting (ABA) approach using one of the equations below. Equations E1 and E2 are used to determine the net acidity prior to treatment of ASS / PASS and therefore if acid sulfate soil treatment and / or management plan is required. Equation E3 is used to determine the neutralisation treatment has been successful.

- Equation E1 - when the effectiveness of a soil's measured Acid Neutralising Capacity has been corroborated by other data demonstrating the soil does not experience acidification during complete oxidation under field conditions, or
- Equation E2 - when the effectiveness of a soil's measured Acid Neutralising Capacity has not been corroborated by other data, or
- Equation E3 - when the effectiveness of a management approach involving the addition of liming materials is being verified post treatment via calculation of the Verification Net Acidity.

Equation E1 Net Acidity whereby acid neutralising capacity (ANC) has been corroborated by other data.

Net Acidity = potential sulfidic acidity + actual acidity + retained acidity - Acid Neutralising Capacity

Net Acidity = Scr + S-TAA at pH 6.5 + SNAS - s-ANCBT

Equation E2 Net Acidity whereby ANC has not been corroborated by other data.

Net Acidity = potential sulfidic acidity + actual acidity + retained acidity

Net Acidity = Scr + S-TAA at pH 6.5 + SNAS

Equation E3 Verification Net Acidity.

Verification Net Acidity = potential sulfidic acidity + actual acidity + retained acidity - (post neutralised Acid Neutralising Capacity - pre neutralised Acid Neutralising Capacity)

Verification Net Acidity = Scr + S-TAA at pH 6.5 + SNAS - (ANCBT of treated material - ANCBT of untreated material)

4.3 Liming Rates

The required liming rate can be calculated from one of the following formulas.

Equation E4:
Neutralising Material Required (kg $CaCO_3$/tonne soil) = (Net acidity (mol H+/t) / 19.98) x FOS x 100/ENV

Equation E5:
Neutralising Material Required (kg $CaCO_3/m^3$ soil) = D (tonne/m^3) x (Net acidity (mol H+/t) / 19.98) x FOS x 100/ENV

Where:

net acidity (mol H+/t) is derived using the 95% UCL of the Net Acidity (%S) using the methods in 4.2.1;

19.98 converts to kg $CaCO_3$/tonne;

FOS (factor of safety) = a minimum value of 1.5 needs to be adopted, although values of up to 2 can be suitable;

ENV = Effective Neutralising Value (e.g., Approx. 98% for fine (0.3 mm grain size) ag lime with an NV of 98%).

D = bulk density, site specific results can be used, or the bulk densities in Table 11 should be used

Notes:

- The ENV is calculated based on the molecular weight, particle size and purity of the neutralising agent and should be assessed for proposed materials in accordance with ASSMAC (1998).
- Natural net acidity must not be used.

An initial liming rate based on the laboratory result calculation (excluding ANC) is considered appropriate based on it including a safety factor of 1.5 and the use of ag lime with an NV of at least 98% and a grain size of less than 0.5 mm.

5.0 Groundwater

5.1 Introduction

The groundwater investigation levels (GIL) used for interpretation of the groundwater data (as a Tier 1 assessment) have been selected based on the potential risks posed from contamination sourced from the site to receptors at or down-gradient of the site, as identified by the conceptual site model (CSM). The receptors, exposure points and pathways are summarised in Table 12.

Table 12: Summary of Potential Receptors and Potential Risks

Receptor	Location	Exposure Point	Exposure Pathway
Surface water aquatic ecosystem	Down-gradient from site.	Receiving surface water body at the groundwater discharge point.	Exposure to contaminants.
Occupants of buildings	On site and down-gradient from site.	Enclosed buildings (existing or proposed).	Inhalation of VOC (including TRH and BTEX) overlying VOC impacted groundwater via the vapour intrusion pathway.
Human recreation (e.g., swimming)	Down-gradient from site.	Receiving surface water body at the groundwater discharge point.	Ingestion / dermal absorption of contaminants during recreational activities (e.g., swimming).

The rationale for the selection of GIL is in Table 13.

Table 13: Groundwater Investigation Level Rationale

Receptor / Beneficial Use	GIL	Source	Comments / Rationale
Aquatic ecosystem	DGV	ANZG (2018)	Marine water 99% LOP for bioaccumulative contaminants 95% LOP for non-bioaccumulative contaminants
Building occupants (vapour intrusion)	HSL	NEPC (2013)	2 m to <4 m Sand, HSLC & HSLD
Recreational waters	GV	NHMRC (2008)	Based on the NHMRC (2018) values x10 to account for ingestion of water whilst undertaking recreational activities.

Notes: DGV default guideline value
% LOP percentage level of protection of species
HSL health screening level
GV guideline value
LTV long term value (up to 100 years)
STV short term value (up to 20 years)

Based on the highly saline and tidal nature of the groundwater, the groundwater is not considered a possible drinking water aquifer and therefore the drinking water guidelines have not been adopted.

5.2 Groundwater Investigation Levels for Aquatic Ecosystems

The DGV for the protection of aquatic ecosystems derived from ANZG (2018) are in Table 14. Analytes not listed in Table 14 (which are included in the analyte list of Table 5 in Appendix G) do not have a marine water 95%, 99% on unknown reliability DGV.

Table 14: Groundwater Investigation Levels for Protection of Aquatic Ecosystems (mg/L)

Group	Analyte	ANZG (2018) Marine Water (Unknown Reliability) Toxicant DGVs	ANZG (2018) Marine Water 95% Toxicant DGVs	ANZG (2018) Marine Water 99% Toxicant DGVs
Metals	Arsenic (Filtered)			
	Cadmium (Filtered)		0.0055	0.0007
	Chromium (III+VI) (Filtered)			
	Copper (Filtered)		0.0013	0.0003
	Iron (Filtered)			
	Lead (Filtered)		0.0044	0.0022
	Mercury (Filtered)		0.0004	0.0001
	Nickel (Filtered)		0.07	0.007
	Tin (Filtered)			
	Tributyltin as SN		0.000006	0.0000004
	Zinc (Filtered)		0.015	0.007
BTEX	Benzene		0.7	0.5
	Ethylbenzene	0.005		
	Toluene	0.18		
	Xylene (o)	0.35		
MAH	Isopropylbenzene	0.03		
Chlorinated hydrocarbons	1,1,1-trichloroethane	0.27		
	1,1,2-trichloroethane	0.33	1.9	0.14
	1,1-dichloroethene	0.7		

Group	Analyte	ANZG (2018) Marine Water (Unknown Reliability) Toxicant DGVs	ANZG (2018) Marine Water 95% Toxicant DGVs	ANZG (2018) Marine Water 99% Toxicant DGVs
	1,2-dichloroethane	1.9		
	1,2-dichloropropane	0.9		
	1,3-dichloropropane	1.1		
	Carbon tetrachloride	0.24		
	Chloroform	0.37		
	Trichloroethene		0.33	0.2
	Tetrachloroethene	0.07		
	Vinyl chloride	0.1		
Halogenated Benzenes	1,2,3-trichlorobenzene	0.003		
	1,2,4-trichlorobenzene		0.08	0.02
	1,2-dichlorobenzene	0.16		
	1,3-dichlorobenzene	0.26		
	1,4-dichlorobenzene	0.06		
	Chlorobenzene	0.055		
	Hexachlorobenzene	0.00005		
PAH/Phenols	2,4-dimethylphenol	0.002		
	2,4-dinitrophenol	0.045		
	2-nitrophenol	0.002		
	4-nitrophenol	0.058		
	Anthracene	0.0001		
	Benzo(a) pyrene	0.0001		
	Fluoranthene	0.001		
	Naphthalene		0.07	0.05
	Phenanthrene	0.0006		
	Phenol		0.4	0.27
Halogenated Phenols	2,3,4,6-tetrachlorophenol	0.01		
	2,4,5-trichlorophenol	0.004		

Group	Analyte	ANZG (2018) Marine Water (Unknown Reliability) Toxicant DGVs	ANZG (2018) Marine Water 95% Toxicant DGVs	ANZG (2018) Marine Water 99% Toxicant DGVs
	2,4,6-trichlorophenol	0.003		
	2,4-dichlorophenol	0.12		
	2,6-dichlorophenol	0.034		
	2-chlorophenol	0.34		
	3/4-Methylphenol (m/p-cresol)			
	Pentachlorophenol		0.022	0.011
Polychlorinated Biphynels	Arochlor 1242	0.0003		
	Arochlor 1254	0.00001		
Organochlorine Pesticides	4,4-DDE	0.0000005		
	Aldrin	0.000003		
	DDT	0.0000004		
	Dieldrin	0.00001		
	Endrin		0.000008	0.000004
	g-BHC (Lindane)	0.000007		
	Heptachlor	0.0000004		
	Methoxychlor	0.000004		
Organophosphorous Pesticides	Azinophos methyl	0.00001		
	Chlorpyrifos		0.000009	0.0000005
	Diazinon	0.00001		
	Dimethoate	0.00015		
	Fenitrothion	0.000001		
	Malathion	0.00005		
	Parathion	0.000004		

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

5.3 Health Screening Levels for Vapour Intrusion

The HSL to evaluate potential vapour intrusion risks derived from NEPC (2013) are in Table 15.

Table 15: Groundwater Health Screening Levels for Vapour Intrusion (µg/L)

Contaminant	HSL-C	HSL-C	HSL-C	Solubility Limit
SAND	**2 m to <4 m**	**4 m to <8 m**	**8 m+**	**-**
Benzene	NL	NL	NL	59 000
Toluene	NL	NL	NL	61 000
Ethylbenzene	NL	NL	NL	3900
Xylenes	NL	NL	NL	21 000
Naphthalene	NL	NL	NL	170
TRH F1	NL	NL	NL	9000
TRH F2	NL	NL	NL	3000

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

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

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

Table 16: Groundwater Health Screening Levels for Vapour Intrusion (µg/L)

Contaminant	HSL-D	HSL-D	HSL-D	Solubility Limit
SAND	**2 m to <4 m**	**4 m to <8 m**	**8 m+**	**-**
Benzene	5000	5000	5000	59 000
Toluene	NL	NL	NL	61 000
Ethylbenzene	NL	NL	NL	3900
Xylenes	NL	NL	NL	21 000
Naphthalene	NL	NL	NL	170
TRH F1	6000	6000	7000	9000
TRH F2	NL	NL	NL	3000

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

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

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

5.4 Groundwater Investigation Levels for Recreational Water

The GV for recreational water derived from NHMRC (2008) are in Table 17.

Table 17: Groundwater Investigation Levels for Protection of Recreational Waters (mg/L)

Chemical Group	Analyte	Recreational Water Quality and Aesthetics
Metals	Arsenic (Filtered)	0.05
	Cadmium (Filtered)	0.005
	Chromium (III+VI) (Filtered)	0.05
	Copper (Filtered)	1
	Iron (Filtered)	0.3
	Lead (Filtered)	0.05
	Mercury (Filtered)	0.001
	Nickel (Filtered)	0.1
	Zinc (Filtered)	5
BTEX	Benzene	0.01
Chlorinated Hydrocarbons	1,1-dichloroethene	0.0003
	1,2-dichloroethane	0.01
	Carbon tetrachloride	0.003
	Trichloroethene	0.03
	Tetrachloroethene	0.01
PAH	Benzo(a) pyrene	0.00001
Halogenated Phenols	2,3,4,6-tetrachlorophenol	0.001
	2,4,5-trichlorophenol	0.001
	2,4,6-trichlorophenol	0.01
	Pentachlorophenol	0.01
Organochlorine Pesticides	Aldrin	0.001
	DDT	0.003
	Dieldrin	0.001
	Endrin	0.001
	g-BHC (Lindane)	0.01
	Heptachlor	0.003

Chemical Group	Analyte	Recreational Water Quality and Aesthetics
Organophosphorus Pesticides	Azinophos methyl	0.01
	Bromophos-ethyl	0.02
	Chlorpyrifos	0.002
	Diazinon	0.01
	Dichlorvos	0.02
	Dimethoate	0.1
	Ethion	0.006
	Fenitrothion	0.02
	Malathion	0.1
	Methyl parathion	0.006
	Ronnel	0.06
Pesticides	Parathion	0.03

6.0 Soil Vapour

6.1 Interim Soil Vapour Health Investigation Levels

Soil vapour interim HIL for specific chlorinated VOC were published by NEPC (2013) to assess the vapour intrusion exposure pathway.

The interim HIL for chlorinated VOC methodology employs a simple though conservative approach using an attenuation factor that relates the concentration of a volatile contaminant in indoor air to the concentration in soil gas immediately below a building foundation slab.

The interim health investigation levels (IHIL) derived from NEPC (2013) are in **Table 18**.

Table 18: Soil Vapour Interim Health Investigation Levels for Chlorinated Hydrocarbons (µg/m³)

Chemical	IHIL-C	IHIL-D
TCE	400	80
1,1,1–TCA	1 200 000	230 000
PCE	40 000	8000
cis-DCE	2000	300
VC	500	100

Notes: TCE Trichloroethene
1,1,1–TCA 1,1,1-trichloroethane
PCE Tetrachloroethene
cis-DCE cis-1,2-dichloroethene
VC Vinyl chloride

6.2 Health Screening Levels

Soil vapour HSL for petroleum hydrocarbons were published by NEPC (2013) to assess the vapour intrusion exposure pathway.

The HSL derived from NEPC (2013) are in **Table 19** and **Table 20**.

Table 19: Soil Vapour Health Screening Levels for Vapour Intrusion (µg/m³)

Contaminant	HSL-C	HSL-C	HSL-C	HSL-C	HSL-C
SAND	0-1 m	1-2 m	2-4 m	4-8 m	>8 m
Benzene	360 000	2 400 000	4 700 000	9 500 000	19 000 000
Toluene	NL	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL	NL
Xylene Total	NL	NL	NL	NL	NL
Naphthalene	NL	NL	NL	NL	NL
TRH F1	86 000 000	NL	NL	NL	NL
TRH F2	NL	NL	NL	NL	NL

Notes: TRH F1 is TRH C_6-C_{10} minus BTEX
TRH F2 is TRH >C_{10}-C_{16} minus naphthalene
The maximum possible soil vapour concentrations have been calculated based on vapour pressures of the pure chemicals. Where soil vapour HSL exceed these values, a soil-specific source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'

Table 20: Soil Vapour Health Screening Levels for Vapour Intrusion (µg/m^3)

Contaminant	HSL-D	HSL-D	HSL-D	HSL-D	HSL-D
SAND	0-1 m	1-2 m	2-4 m	4-8 m	>8 m
Benzene	4000	10000	30 000	6 5000	130 000
Toluene	4 800 000	16 000 000	39 000 000	84 000 000	NL
Ethylbenzene	1 300 000	4 600 000	11 000 000	25 000 000	53 000 000
Xylene Total	840 000	3 200 000	8 000 000	18 000 000	37 000 000
Naphthalene	3000	15 000	35 000	75 000	150 000
TRH F1	680 000	2 800 000	7 000 000	15 000 000	32 000 000
TRH F2	500 000	2 400 000	NL	NL	NL

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

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

The maximum possible soil vapour concentrations have been calculated based on vapour pressures of the pure chemicals. Where soil vapour HSL exceed these values, a soil-specific source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'

7.0 References

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ANZG. (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Canberra, ACT: Australian and New Zealand Governments and Australian state and territory governments.

CRC CARE. (2011). *Health screening levels for petroleum hydrocarbons in soil and groundwater.* Parts 1 to 3, Technical Report No. 10: Cooperative Research Centre for Contamination Assessment and Remediation of the Environment.

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

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

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

NSW EPA. (2016). *Addendum to the Waste Classification Guidelines (2014) - Part 1: Classifying Waste.* NSW Environment Protection Authority.

NSW EPA. (2020). *Assessment and Management of Hazardous Ground Gases.* NSW Environment Protection Authority.

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

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Appendix E

Contingency Plan

Appendix E Contingency Plan
Preliminary Remediation Action Plan

1. General

Where the site conditions are found to be different than that anticipated during the remediation works, the proposed remediation approach may not be appropriate for the contamination encountered. In such cases the Environmental Consultant is to re-assess the contamination and remediation approach. Where necessary the Environmental Consultant will prepare an addendum to, or revision of, this RAP.

2. Contingency Plan

This contingency plan has been developed to provide guidance on processes to follow if contamination (or indicators of contamination), other than that included in the remediation strategy, (Section 8) is encountered during the remediation works. Any such finds shall be surveyed and the location documented.

Although the site has been subject to previous investigation(s), there remains a potential for soil contamination to be present between sampled locations. In the event that signs of soil contamination, other than that included in the remediation strategy, are encountered during remediation e.g., evidence of asbestos containing material (ACM), petroleum, or other chemical odours which weren't previously identified the following protocols will apply:

- The Site Manager is to be notified and the affected area closed off by the use of barrier tape and warning signs;
- The Environmental Consultant is to be notified to inspect the area and assess the significance of the potential contamination and determine extent of remediation works (if deemed necessary) to be undertaken. An assessment report and management plan detailing this information will be compiled by the Environmental Consultant and provided to the Principal's Representative;
- The assessment results together with a suitable management plan shall be provided by the Principal's Representative to the Consent Authority (if required by the development consent);
- The agreed management / remedial strategy, based on the RAP and relevant guidelines (e.g., WA DoH (2021), for asbestos issues), shall be implemented; and
- All details of the assessment and remedial works are to be included in the site validation report.

3. Unexpected Finds Protocol

This unexpected finds protocol (UFP) has been developed to provide guidance on processes to follow if any unexpected find is encountered during the remediation or future civil and construction works. Any unexpected finds should be surveyed and the location documented.

All site personnel are to be inducted into their responsibilities under this (UFP), which should be included or referenced in the Contractors Environmental Management Plan.

All site personnel are required to report unexpected signs of environmental concern to the Site Manager if observed during the course of their works e.g., presence of potential unexploded ordinance, unnatural staining, potential contamination sources (such as buried drums or tanks) or chemical spills.

Should signs of concern be observed, the Site Manager, as soon as practical, will:

- Stop work in the affected area and ensure the area is barricaded to prevent unauthorised access;
- Notify authorities needed to obtain emergency response for any health or environmental concerns (e.g., fire brigade);
- Notify the Principal's Representative of the occurrence;
- Notify any of the authorities that the Contractor is legally / contractually required to notify (e.g., EPA, Council); and
- Notify the Environmental Consultant.

The Principal's Representative is to notify any of the authorities which the Principal is legally/ contractually required to notify (e.g. EPA, Council). Where appropriate the Principals Representative will also implement appropriate community consultation in accordance with a Communications Plan).

The Environmental Consultant will assess the extent and significance of the find and develop an investigation, remediation or management approach using (where possible) the principles and procedures already outlined in the RAP. Where a Site Auditor is involved, the proposed approach will be discussed and agreed with the Site Auditor prior to implementation.

Typical procedures for common unexpected finds (underground storage tanks and asbestos are provided in the following sub-sections) as a guide however specific advice should be sought from the Environmental Consultant to tailor the approach to the specific find.

3.1 Underground Storage Tanks

Underground Storage Tanks (USTs) can contain flammable liquids and vapours which can explode if incorrectly handled and as such a suitably experienced and qualified contractor / sub-contractor should undertake UST decommissioning and removal works. In the event that a UST requires removal for the site works, the tank(s) and any associated pipe-work should be managed / removed as follows:

- All works to be conducted in accordance with the relevant guidelines at the time of works;
- The Contractor will arrange for the removal of the liquid contents of the UST by an appropriately licenced liquid waste contractor using equipment safe for use with flammable liquids and disposed of to an appropriately licenced liquid waste facility. The Contractor should obtain and keep all records of the removal and disposal of the liquid waste, and provide them to the Environmental Consultant;
- Unless previously appropriately abandoned, the Contractor will purge the UST of product vapour in accordance with AS4976-2008;

- The Contractor will remove the UST and associated pipework along with the tank pit backfill. These comprise:
  - Removal of any overlying pavements, the UST and any associated infrastructure by an experienced contractor in accordance with AS4976-2008;
  - Excavate and stockpile the backfill soils (most likely to be sand) surrounding the UST and stockpile separately; and
  - If grossly impacted soils remain in the tank pit following removal of the backfill sands, excavate the impacted soil from the tank pit under supervision of the Environmental Consultant and stockpile separately. The Environmental Consultant will provide advice on the extent of excavation based on visual observation, readings from a calibrated photoionization detector (PID) and target validation criteria for the tank pit (e.g., the SAC or GSW thresholds).
- The contractor will provide documentation of the appropriate decommissioning and disposal of the UST and pipework;
- The tank pit excavation will be inspected and validated by the Environmental Consultant, validation samples will comprise:
  - Excavation base: one sample per 25 m^2 (5 m grid spacing, minimum one sample) or for excavations over 100 m^2;
  - Side of tank pit excavation - one sample per 10-15 linear metre and one sample per 2-3 depth interval or as required to target each observed depth of concern (minimum of 1 sample per side);
  - Pipe lines: one sample per 5-10 m exposed length (minimum one sample). This density assumes that there is no “chase out” excavation (i.e., excavation only comprises removal of pipes and backfill sands);
  - Stockpiles: one sample per 25 m^3 and a minimum of three samples per stockpile;
  - Water: if water is present in the excavation: one sample; and
  - QA / QC samples: intra- and inter-laboratory replicates (each at 5% of primary samples) and one trip blank and trip spike per day/ sampling event.
- The samples will be analysed at a NATA accredited laboratory for the contaminants of concern potentially associated with contained liquids, these may comprise:
  - Lead;
  - PAH;
  - TPH;
  - BTEX;
  - VOC; and
  - Phenols.
- The Environmental Consultant will assess the laboratory results against the appropriate assessment criteria from Appendix D, and provide a waste classification for the excavated soil and recommendations regarding the success of the remediation or the need for further remediation / management; and
- All results will be included in the final validation report.

3.2 Asbestos Finds

It is possible that asbestos-based materials may be uncovered in previously unidentified locations. In the event that this occurs the following 'Unexpected Asbestos Finds Protocol' has been established:

1. Upon discovery of suspected asbestos containing material, the site manager is to be notified and the affected area closed off by the use of barrier tape and warning signs. Warning signs shall be specific to asbestos hazards and shall comply with the Australian Standard 1319-1994 - Safety Signs for the Occupational Environment;
2. A Licenced Asbestos Assessor is to be notified to inspect the area and confirm the presence of asbestos (and type of asbestos) and determine extent of remediation works to be undertaken. A report detailing this information will be compiled by the Licenced Asbestos Assessor and provided to the site manager;
3. The impacted soil will be stockpiled for waste classification purposes (including sampling and chemical analysis) and will be disposed of, as a minimum, as asbestos waste at an appropriately licensed solid waste landfill site. In dry and windy conditions, the stockpile will be lightly wetted and covered with plastic sheet whilst awaiting disposal;
4. All work associated with asbestos in soil will be undertaken by a contractor holding a class AS1 Licence and all workers working in the asbestos impacted zone must meet the minimum PPE requirement advised by the Licenced Asbestos Assessor;
5. Monitoring for airborne asbestos fibres is to be carried out during the soil excavation. Asbestos air monitoring will be undertaken in accordance with *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition* [NOHSC: 3003 (2005)] and sampling density and locations will be determined by the Occupational Hygienist. All filters will be submitted to a NATA accredited laboratory for analysis. Air samples will be collected from the breathing zone of a person, over a minimum of four hours duration;
6. Documentary evidence (weighbridge dockets) of correct disposal is to be provided to the site manager;
7. At the completion of the excavation, a clearance inspection is to be carried out and written certification is to be provided by the Occupational Hygienist that the area is safe to be accessed and worked. Clearance will include soil samples and asbestos analysis. If required, the filling material remaining in the inspected area can be covered / sealed by an appropriate physical barrier layer of non-asbestos containing material prior to sign-off;
8. Details of the incident are to be recorded in the site record system; and
9. The area may be reopened for further excavation or construction work.

4. References

WA DoH. (2021). *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.* WA Department of Health.

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Appendix F

Site Management Plan

Appendix F Site Management Plan
Preliminary Remediation Action Plan

1. Introduction

This site management plan (SMP) has been developed to minimise potentially adverse impacts on the environment, and worker and public health as a result of the proposed remediation works.

The Remediation Contractor must have in place a construction environmental management plan (CEMP) (or similar) which is specific to the equipment used for the remediation and the proposed methods to be adopted by the Remediation Contractor. This SMP has been prepared to augment the Remediation Contractor's CEMP and contains general details for aspects of the work, as per reporting requirements for a remediation action plan (RAP) under NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020).

Apart from the management principles outlined in this SMP, the Remediation Contractor must also ensure compliance with all relevant environmental legislation and regulations, including (but not limited to) the following:

- *Contaminated Land Management Act 1997* NSW (CLM Act);
- *Protection of the Environment Operations Act 1997* NSW (POEO Act);
- *Protection of the Environment Legislation Amendment Act 2011* NSW;
- *Protection of the Environment Operations Amendment (Scheduled Activities and Waste) Regulation 2008* NSW;
- *Environmentally Hazardous Chemicals Act 1985* NSW;
- *Environmental Offences and Penalties Act 1989* NSW;
- *Pesticide Act 1999* NSW and *Pesticides Regulation 2017*; and
- *Work Health and Safety Act 2011* Cth (WHS Act) and Work *Health and Safety Regulations 2011* Cth.

2. Roles and Responsibilities

2.1 Principal

The Principal is responsible for the environmental performance of the proposed remediation works, including implementation of acceptable environmental controls during remediation works. The Principal will retain the overall responsibility for ensuring this RAP is appropriately implemented. The Principal is to nominate a representative (the Principal's Representative), who is responsible for overseeing the implementation of this RAP. The actual implementation of the RAP will, however, be conducted by the Principal Contractor on behalf of the Principal.

The Principal is responsible for providing appropriate information to the Contractor to allow them to safely plan the required works. This includes the asbestos register for the site and this RAP.

The Principal is also responsible for implementing an appropriate communications plan.

2.2 Principal Contractor

The Principal Contractor ('the Contractor') will be the party responsible for daily implementation of this RAP and shall fulfil the responsibilities of the Contractor as defined by SafeWork NSW. It is noted that the Contractor may appoint appropriately qualified sub-contractors or sub-consultants to assist in fulfilling the requirements of the procedures. The Contractor will appoint a Site Manager.

In addition to the implementation of the RAP it will be the Contractors responsibility to:

- Obtain / ensure relevant sub-contractors obtain specific related approvals as necessary to implement the earthworks including permits for removal of asbestos-containing material, SafeWork NSW notification etc.;
- Develop or request and review any site plans to manage the works to be conducted;
- Ensure that all remediation works and other related activities are undertaken in accordance with this RAP;
- Maintain all site records related to the implementation of this RAP;
- Ensure sufficient information is provided to engage or direct all required parties, including sub-contractors, to implement the requirements of the RAP other than those that are the direct responsibility of the Contractor;
- Manage the implementation of any recommendation made by those parties in relation to work undertaken in accordance with the RAP;
- Inform, if appropriate, the relevant regulatory authorities of any non-conformances with the procedures and requirements of the RAP in accordance with the procedures outlined in this document;
- Retain records of any contingency actions;
- On completion of the project, to review the RAP records for completeness and update as necessary; and
- Recommend any modification to general documentation which would further improve the environmental outcomes of this RAP.

2.3 Surveyor

The project surveyor will be a registered surveyor engaged by the Contractor to undertake surveying works as required by this RAP.

2.4 Asbestos Contractor

The Asbestos Contractor will be responsible for undertaking all asbestos work involving any asbestos impacted filling and will hold a Class A licence for the removal of asbestos (issued by SafeWork NSW), on the basis that the asbestos identified at the site to date has included both friable and bonded asbestos.

The Asbestos Contractor can be the same entity as the Principal Contractor.

2.5 Sub-contractors

All sub-contractors will be inducted onto the site, informed of their responsibilities in relation to this RAP and sign their agreement to abide by the RAP requirements. Where necessary, sub-contractors will also be trained in accordance with the requirements of this document. All sub-contractors must conduct their operations in accordance with the RAP as well as all applicable regulatory requirements.

2.6 Environmental Consultant

The Environmental Consultant will provide advice on implementing the RAP. The Environmental Consultant will be responsible for:

- Undertake any required assessments where applicable (e.g., waste classification, validation);
- Provide advice and recommendations arising from monitoring and / or inspections, including unexpected finds; and
- Notify the Principal with any results of assessments, and any observed non-conformances.

2.7 Licenced Asbestos Assessor

A Licenced Asbestos Assessor will be required to be engaged independently of the Asbestos Contractor to undertake the following:

- Review and approve documentation prepared by the Asbestos Contractor;
- Prepare any WHS plans and advice required by the Contractor;
- Undertake airborne asbestos monitoring;
- Undertake clearance inspections;
- Provide advice and recommendations arising from monitoring and/or inspections; and
- Notify the client with the results of any assessments and any observed non-conformances.

2.8 Site Workers

All workers on the site are responsible for observing the requirements of this RAP and other management plans. These responsibilities include the following:

- Being inducted on the site and advised of the general nature of the remediation/environmental issues at the site;
- Being aware of the requirements of this plan;
- Wearing appropriate personal protective equipment (PPE) as required by this plan;
- Only entering restricted areas when permitted; and
- Requesting clarification when unclear of requirements of this or any other plans (e.g., safe work method statements (SWMS)).

3. Stormwater Management

3.1 Stormwater

Stormwater must be managed during the remediation works such that potential adverse impacts from surface runoff (e.g., cross contamination, mobilisation of contaminants in soil particles, etc.) are appropriately mitigated. Accordingly, the Remediation Contractor will take appropriate measures which may include:

- Construction, where necessary, of stormwater diversion channels, bunding and linear drainage sumps with catch pits in and around the remediation areas to divert stormwater from the contaminated areas;
- Provision of appropriately located sediment traps including geotextiles; and
- Discharge of excess water in excavations / low points on a regular basis to limit the potential for flooding.

3.2 Dewatering of Excavations

Any runoff or seepage water accumulated in site excavations that requires removal must initially be sampled and tested for suspended solids, pH and any contaminants of potential concern (CoPC) as identified by the Environmental Consultant. The options for management of excavation pump-out water, dependent upon the test results, are for disposal of the water as follows:

- Discharge to stormwater with prior approval from Council. Provided the test results comply with relevant ANZG *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018), or any other compliance requirements stipulated by Council. The Environmental Consultant must consider the most appropriate criteria to be used; or
- Discharge to sewer, as industrial trade wastewater, with prior approval from Sydney Water. This option would require the analysis of a larger list of analytes, and compliance with the Sydney Water acceptance standards; or

- Pumping by a liquid waste contractor for removal of the water off-site, in accordance with regulatory requirements.

Note that, depending on the type and scale of the dewatering required, a permit (water use approval) may need to be obtained through NSW Water.

4. Soil Management Plan

4.1 Excavation and Stockpiling of Contaminated Material

Contaminated material shall be excavated and stockpiled at a suitably segregated location(s) away from sensitive areas (e.g.,water bodies, drainage lines, stormwater pits, etc.) and ongoing excavations, and in a manner that will not cause nuisance to the neighbouring properties. Soil stockpiles are to be managed as follows:

- All stockpiles of contaminated material shall be surrounded by star pickets and marking tape or other suitable material to clearly delineate their boundaries;
- Stockpiles shall be lightly conditioned by sprinkler or covered by geotextile or similar cover to prevent dust generation;
- Any stockpile to remain on-site overnight should be adequately secured in order to reduce the risk of sediment runoff; and
- Should the stockpile remain on-site for over 24 hours, geotextile silt fences must be erected to prevent losses by surface erosion.

All movement of soil within the site and off-site is to be tracked by the Remediation Contractor, from cradle to grave. Copies of tracking records must be provided to the Environmental Consultant.

4.2 Loading and Transport of Contaminated Material

Transport of contaminated material from the site shall be via a clearly delineated haul route and this route shall be used exclusively for entry and egress of vehicles used to transport contaminated materials within and away from the site. The proposed waste transport route (to be determined by the Remediation Contractor) will be notified to Council and truck dispatch shall be logged and recorded by the Remediation Contractor for each load leaving the site. A record of the truck dispatch will be provided to the Environmental Consultant.

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

- Comply with all road traffic rules;
- Minimise noise, vibration and dust to adjacent premises; and
- Utilise State roads and minimise use of local roads as far as practicable.

The remediation work will be conducted such that all vehicles:

- Conduct deliveries of soil, materials, equipment or machinery only during the specified hours of remediation;
- Have securely covered loads to prevent any dust or odour emissions during transportation; and
- Exit the site in a forward direction.

In addition, measures will be implemented to ensure no contaminated material is spilled onto public roadways or tracked off-site on vehicle wheels. Roadways will be kept clean throughout the remediation works and will be broomed, if necessary, to achieve a clean environment.

All loads will be securely covered and may be lightly wetted, if required, to ensure that no materials or dust are dropped or deposited outside or within the site. Prior to exiting the site each truck should be inspected by Remediation Contractor personnel and either noted as clean (wheels and chassis) or broomed prior to leaving the site. Any soil spilled onto surrounding streets will be cleaned by mechanical or hand methods, on a daily basis.

Removal of waste materials from the site shall only be carried out contractors holding the appropriate license(s), consent or approvals to dispose the waste materials according to the waste classification and with the appropriate approvals obtained from the EPA, were required.

4.3 Spoil Contingency Plan

This plan caters for the storage, treatment and disposal of excavated spoil which fails to meet the criteria for direct disposal to a landfill (i.e., Hazardous Waste). Any suspected Hazardous Waste materials should have their classification confirmed by the Environmental Consultant, including additional sampling and analysis as appropriate, prior to implementing this contingency plan.

Hazardous Waste (if encountered) will be handled as follows:

- Materials of the same spoil category / contamination issue will be carefully excavated and placed as separate stockpiles at demarcated and contained locations. The categorisation would be done on the basis of on-site observations and the contaminant exceedances detected;
- Stockpiles of excavated materials will be appropriately bunded with hay bales / sandbags and covered with anchored geotextile or impermeable plastic sheeting, or alternatively placed in an appropriate container e.g., waste skip, with appropriate cover. Materials considered to have the potential to produce contaminated leachate will be stockpiled in an area with an appropriate leachate collection system;
- Sampling and analysis of segregated stockpiles will be conducted at the appropriate density to determine and characterise the concentrations of the target parameters in the excavated materials (e.g., leachability of the contaminants of concern, treatability studies).
- If ex situ characterisation assessment determines that the material is not Hazardous Waste it will be disposed of off-site in accordance with its final waste classification. The *ex situ* classification will be conducted with reference to the *in situ* results, but may find that the provisional in situ classification does not apply based on an additional type of data (e.g., TCLP results), observations determining that a General Immobilisation Approval applies;

- Should the sampling and testing confirm the Hazardous Waste category, a treatment methodology will be determined, which may be to treat the material for re-use on-site or to a suitable standard for landfill disposal. It is anticipated that the treatment and management will be provided by a specialist waste sub-contractor, with the treatment conducted off-site. The treatment methodology will be a commercial decision based on the available technology and timing. Companies licenced to treat Hazardous Waste in NSW include:
  - Tox Free Australia Pty Ltd: POEO Licences 4602 (South Windsor) and 12628 (St Marys);
  - Cleanaway Industrial Solutions Pty Ltd: POEO Licence 10771 (Unanderra); and
  - Environmental Treatment Solutions Pty Ltd: POEO Licence 13230 (Blayney).
- If the material is to be disposed off-site, appropriate applications will be made to the EPA. It is anticipated that treatment and management of Hazardous Wastes to be disposed off-site would be conducted by a specialised appropriately licensed Hazardous Waste sub-contractor. Agreement as to the appropriateness of the treatment and disposal method for materials must be obtained from the EPA, and disposal consent must be sought from the Hazardous Waste Regulation Unit of the EPA prior to the removal of such wastes from the site; and
- An appropriately licensed Hazardous Waste remediation sub-contractor will then manage the waste and remove from site in accordance with the methodology agreed with the EPA.

5. Sediment Management Plan

Following the completion of the data gap investigation, completion of the design of the foundations / footings, and determination of the method of foundation construction a construction environmental management plan must be prepared by the Principal Contractor that details the methods by which disturbance of the marine sediments will be limited and where disturbed the impacts minimised.

6. Noise and Vibration Control Plan

All equipment and machinery should be operated in an efficient manner to minimise the emission of noise. The use of any plant and / or machinery should not cause unacceptable vibrations to nearby properties and should meet Council requirements.

7. Dust Control Plan

Dust emissions must be confined within the site boundary as far as is practicable. The following example dust control procedures could be employed to comply with this requirement, as necessary:

- Erection of dust screens around the perimeter of the site (as applicable);
- Securely covering all loads entering or exiting the site;
- Use of water sprays across the site to suppress dust;

- Covering of all stockpiles of contaminated soil remaining on site more than 24 hours;
- Include wheel wash (if applicable); and
- Keeping excavation and stockpile surfaces moist.

Regular checking of the fugitive dust issues is to be undertaken. Remedial measures are to be undertaken to rectify any cases of excessive dust.

8. Odour Control Plan

No odours should be detected at any boundary of the site during remediation works by an authorised Council Officer relying solely on sense of smell. The following example procedures could be employed to comply with this requirement as required:

- Use of appropriate covering techniques such as plastic sheeting, polythene or geotextile membranes to cover excavation faces or stockpiles;
- Fine spray of water and/or hydrocarbon mitigating agent on the impacted areas / materials;
- The use of water spray, as and when appropriate;
- Use of sprays or sprinklers on stockpiles or loads to lightly condition the material;
- Restriction of stockpile heights to ~4 m above surrounding site level. If required, restrict uncovered stockpiles to appropriate sizes to minimise odour generation;
- Ceasing works during periods of inclement weather such as high winds or heavy rain;
- Regular checking of the fugitive dust and odour issues to ensure compliance. Undertake immediate remediation measures to rectify any cases of excessive dust or odour (e.g., use of misting sprays or odour masking agent); and
- Adequate maintenance of equipment and machinery to minimise exhaust emissions.

9. Work Health and Safety Plan

9.1 General

It is the Remediation Contractor's responsibility to devise a SWMS[1] (or series thereof, for various respective tasks) and to implement proper controls that enable the personnel undertaking the remediation to work in a safe environment. This RAP and SMP does not relieve the Remediation Contractor or other contractors of their ultimate responsibility for occupational health and safety of their workforce and to prevent contamination of areas outside the 'remediation' workspace. This RAP and SMP sets out general procedures and the minimum standards and guidelines for remediation that will need to be used in preparing the safe work method statement.

[1] Either a SWMS or construction environmental management plan (CEMP), or other equivalent document incorporating health and safety aspects of the proposed remedial works.

This work health safety plan (WHSP) has been prepared with refence to CRC CARE *Remediation Action Plan: Implementation - Guideline on Health and Safety* (CRC CARE, 2019). The requirements of this WHSP must be incorporated into the Remediation Contractor's SWMS.

All site work must be undertaken in a controlled and safe manner with due regard to potential hazards, training and safe work practices. To attain this the SWMS developed by the Remediation Contractor must comply with policies specified in the Work Health and Safety Regulation 2011.

All appropriate permits, licences and notifications required for the remediation activities must be obtained prior to the commencement of remediation works.

9.2 Site Access

Appropriate fencing and signage must be installed around and within the site to prevent unauthorised access and restrict access to remediation areas and / or deep excavations. Access restrictions and administrative arrangements for management of entry of workers or related personnel on site is the responsibility of the Remediation Contractor.

Any existing pits or unstable areas on site that may generate potential safety, or operational risk should be demarcated and taped off, with appropriate rectification action undertaken (e.g., backfilling of pits).

9.3 Personnel and Responsibilities

Before undertaking works on site, all personnel will be made aware of the officer responsible for implementing WHS procedures. All personnel must read and understand this WHSP and over-arching SWMS prior to commencing site works and sign a statement to that effect. Contractors employed at the site will be responsible for ensuring that their employees are aware of, and comply with, the requirements of this WHSP and Remediation Contractor's SWMS.

9.4 Chemical Contamination Hazards

Chemical compounds or substances that may be present in the soils at the site include the key CoPC PAH, heavy metals and, given the presence of fill, asbestos. There is also a lower probability of other contaminants being present. The likely risk shall be determined by the proposed data gap investigation.

The risks associated with the identified contaminants to site personnel and workers involved in the remediation are considered to be low due to the concentrations within groundwater and soil vapour and limited exposure durations. These risks are associated with:

- Ingestion of contaminated soil and / or water;
- Dermal contact with contaminated soil and/or water; and
- Inhalation of dusts or vapours of the CoPC.

If asbestos is encountered in fill, this risk evaluation should be revised.

Personnel will endeavour, wherever possible, to avoid direct contact with potentially contaminated material. Workers must avoid the potential exposures listed above as far as is practicable. Appropriate personal protective equipment (PPE) must be used to mitigate potential risks.

9.5 Physical Hazards

The following physical hazards are associated with conditions that may be created during remediation works:

- Heat exposure;
- Excavations;
- Buried services;
- Noise;
- Dust;
- Electrical equipment;
- Heavy equipment and truck operation; and
- Asbestos.

Safe work practices must be employed to manage the physical risks identified above. For the most part these risks can be managed through appropriate demarcation, access controls and the use of appropriate PPE.

9.6 Safe Work Practices

The appropriate safe work practices should be clearly defined by the Remediation Contractor in their SWMS. As a minimum, all personnel on site will be required to wear the following PPE:

- Steel-capped boots (mandatory);
- High visibility clothing / vest (mandatory);
- Safety glasses or safety goggles with side shields requirements (as necessary);
- Hard hat (as necessary);
- Appropriate respiratory and protective equipment for any works involving asbestos (as necessary); and
- Hearing protection when working in the vicinity of machinery or plant equipment if noise levels exceed exposure standards (as necessary).

Each item of PPE should meet the corresponding relevant Australian Standard(s).

Specific safe work practices will be adopted when working with asbestos, in accordance with (but not limited to) the following codes of practice:

- SafeWork NSW *Code of Practice, How to Manage and Control Asbestos in the Workplace* (SafeWork NSW, 2019a)
- SafeWork *NSW Code of Practice, How to Safely Remove Asbestos* (SafeWork NSW, 2019b);
- WorkCover NSW *Managing Asbestos in or on Soil* (WorkCover NSW, 2014); and
- NOHSC *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Ed* (NOHSC, 2005).

10. Remediation Schedule and Hours of Operation

The remediation works will be conducted within the days and hours specified in the development consent.

11. Response to Incidents

The key to effective management of incidents is the timely action taken before any situation reaches a reportable or critical level. Therefore, surveillance activities are extremely important, and should be conducted for the measures prescribed herein and any other measures prescribed in any additional environmental management plan developed subsequently. During construction activities on the site, the following inspection or preventative actions should be performed by the Remediation Contractor:

- Regular inspection of works;
- Completion of routine environmental checklists and follow-up of non-compliance situations;
- Maintenance and supervision on-site; and
- An induction process for site personnel involved in the remediation works that includes relevant information on the contamination status of the site, the remediation works being undertaken, worker health and environmental protection requirements and ensures that all site personnel are familiar with the site emergency procedures.

An emergency response plan will be in place for all aspects of site works. Any emergency will be reported immediately to the site office and / or the Site Manager (and Safety Officer), and the appropriate emergency assistance should be sought. The Site Manager should be responsible for initiating an immediate emergency response using the resources available on the site. Where external assistance is required, the relevant emergency services should be contacted. A table such as that below, containing contact details for key personnel who may be involved in an environmental emergency response should be completed and be readily available to personnel at all times. The table should be completed, and thereafter amended, as required.

The Remediation Contractor will be responsible for ensuring that site personnel are aware of the emergency services available and the appropriate contact details. A site Safety Officer should be contactable, or available, on-site during remediation and development works.

Contact details for key utilities are included in the event of needing to respond to incidents. Blank cells are 'to be confirmed' and should be completed prior to works commencing when all entities are confirmed.

Table 1: Summary of Roles and Contact Details

Role	Personnel / Contact	Phone Contact Details
Principal		
Principal's Representative		
Site Manager		
Remediation Contractor and Builder		
Site Office		
Environmental Consultant		
Consent Authority		
Regulator	NSW EPA (pollution line and general enquiries)	131 555
Utility Provider	Water (Sydney Water Corporation)	13 20 92
Utility Provider	Power (Ausgrid)	13 13 88
Utility Provider	Gas (Jemena Limited)	131 909
Utility Provider	Telecommunications (Telstra Corporation Limited)	13 22 03
Utility Provider	Telecommunications (Optus)	1800 505 777
Utility Provider	Telecommunications (NBN Co Limited)	1800 687 626

12. References

ANZG. (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Canberra, ACT: Australian and New Zealand Governments and Australian state and territory governments.

CRC CARE. (2019). *Remediation Action Plan: Implementation - Guideline on Health and Safety.* National Remediation Framework: CRC for Contamination Assessment and Remediation of the Environment.

NOHSC. (2005). *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Ed.* Canberra, April 2005, NOHSC:3003: National Occupational Health and Safety Commission, Commonwealth of Australia.

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

SafeWork NSW. (2019a). *Code of Practice, How to Manage and Control Asbestos in the Workplace.* August 2019.

SafeWork NSW. (2019b). *Code of Practice, How to Safely Remove Asbestos.* August 2019: SafeWork NSW, NSW Government.

WorkCover NSW. (2014). *Managing Asbestos in or on Soil.* March 2014: WorkCover NSW, NSW Government.

Douglas Partners Pty Ltd