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Report on
Detailed Site Investigation (Contamination)

Surface & Civil Alignment Works (SCAW) Package for
Sydney Metro - Western Sydney Airport (SMWSA)
Area of Environmental Concern (AEC) 31b, 146E
Samuel Marsden Road, Orchard Hills

Prepared for
CPB Contractors Pty Limited
& United Infrastructure Pty Limited
Joint Venture (CPBUI JV)

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

	Signature	Date
Author		19 July 2023
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Douglas Partners acknowledges Australia's First Peoples as the Traditional Owners of the Land and Sea on which we operate. We pay our respects to Elders past and present and to all Aboriginal and Torres Strait Islander peoples across the many communities in which we live, visit and work. We recognise and respect their ongoing cultural and spiritual connection to Country.

FS 604853

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666

Executive Summary

Douglas Partners Pty Ltd (DP) has been engaged by CPB Contractors Pty Limited & United Infrastructure Pty Limited Joint Venture (CPBUI JV) to complete this detailed site investigation (contamination) (DSI) for the Sydney Metro – Western Sydney Airport (SMWSA) Surface and Civil Alignment Works (SCAW) package at Area of Environmental Concern (AEC) 31b.

Technical Paper 8: Contamination, prepared as part of Sydney Metro - Western Sydney Airport, Environmental Impact Statement (EIS), documents areas of environmental concern identified for the Sydney Metro - Western Sydney Airport project. The objective of the DSI is to assess the suitability of AEC 31b and to determine whether further investigation and / or management is required. The site is shown on Drawing AEC31b-01, Appendix A.

It is understood that the site will be subject to a Site Audit by Melissa Porter, a NSW Environment Protection Authority (EPA) Site Auditor accredited under the *Contaminated Land Management Act 1997.*

Field work for the DSI included the collection of soil samples from eight test pits; collection of soil samples from a stockpile; installation of groundwater monitoring wells at three locations; and development and sampling of the groundwater monitoring wells.

At the test pits, fill was encountered to depths ranging from 0.15 m to 0.7 m. Fill materials comprised sandy gravel, and silty sand. A trace of irrigation hose was noted in the fill at AEC31BTP02, depth 0 - 0.3 m. Trace concrete was identified in the fill at AEC31BTP04, depth 0-0.2 m. Fill was underlain by silty clay to test pit termination depths of between 0.8 m and 1.2 m.

The stockpile (AEC31BSP1) was observed to comprise approximately 32 m^3 of red-brown and brown silty clay with trace rootlets, fine to medium ironstone gravel, plastic, glass, wire and metal.

Fill comprising silty clay was encountered at boreholes AEC31BBH02 and AEC31BBH03 to depths of 0.7 m and 1 m, respectively. Fill was not encountered at AEC31BBH01. Natural soils comprising silty clay was observed at each borehole to depths of 4.5 m and 5 m. Silty clay was underlain by siltstone which was encountered to the borehole termination depths of up to 11.5 m. Measured groundwater depths ranged between 3.92 m bgl to 7.28 m bgl.

Concentrations of chemicals for all analysed soil samples (including stockpile samples) were below the site assessment criteria (SAC) for all CoPC analysed. Asbestos was not detected in any analysed sample.

Concentrations of contaminants in groundwater were with the SAC except for some metals (chromium, copper, nickel and zinc) and ammonia. The recorded concentrations of metals were considered to be representative of background concentrations and the recorded concentrations of ammonia are not considered to be indicative of contamination.

Field observations and analysis of soil and groundwater samples has not revealed contamination that requires remediation. Based on the results reported herein, it is considered, from a contamination perspective, that the site (AEC 31b) is suitable for the final intended land use. Tested soils (including the tested stockpile) are considered suitable to remain onsite.

Prior to demolition, a hazardous materials building survey should be undertaken for structures that will be demolished at the site (if not undertaken already). Where asbestos is (or has been) identified in structures at the site, clearances for asbestos removal works should be obtained from an Occupational Hygienist following removal of asbestos and demolition works.

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Report on Detailed Site Investigation (Contamination)

Surface & Civil Alignment Works (SCAW) Package for Sydney Metro - Western Sydney Airport (SMWSA)

Area of Environmental Concern (AEC) 31b, 146E Samuel Marsden Road, Orchard Hills

1. Introduction

Douglas Partners Pty Ltd (DP) has been engaged by CPB Contractors Pty Limited & United Infrastructure Pty Limited Joint Venture (CPBUI JV) to complete this detailed site investigation (contamination) (DSI) for the Sydney Metro - Western Sydney Airport (SMWSA) Surface and Civil Alignment Works (SCAW) package at Area of Environmental Concern (AEC) 31b.

Technical Paper 8: Contamination, prepared as part of *Sydney Metro - Western Sydney Airport, Environmental Impact Statement* (EIS), documents areas of environmental concern identified for the Sydney Metro - Western Sydney Airport project. The objective of the DSI is to assess the suitability of AEC 31b and to determine whether further investigation and / or management is required. The site is shown on Drawing AEC31b-01, Appendix A.

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

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

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

It is understood that the site will be subject to a Site Audit by Melissa Porter, a NSW Environment Protection Authority (EPA) Site Auditor accredited under the *Contaminated Land Management Act 1997*.

2. Site Identification and Proposed Development

Table 1 provides a summary of information for site identification. The site includes AEC 31b as shown on Drawing AEC31b-01, Appendix A.

Table 1: Site Identification Information

Item	Details
Site Address (from SIX Maps)	146E Samuel Marsden Road, Orchard Hills
Legal Description (from SIX Maps)	(Part of) Lot 131, Deposited Plan 1276954
Approximate area of site (AEC 35)	0.2 ha
Zone (from ePlanning Spatial Viewer)	RU2: Rural Landscape
Local Government Area	Penrith City Council
Site owner	Sydney Metro

The SCAW package relates to the proposed construction of approximately 10 km of rail alignment between Orchard Hills and the Western Sydney International (future) Airport consisting of a combination of viaducts and surface rail. Areas alongside the proposed rail alignment will be used by contractors or for staging and maintenance for the Metro.

Cardno, *Human Health and Ecological Risk Assessment, Spoil Re-use Sydney Metro and Western Sydney Airport*, 29 June 2021 (80021888 SMSWA HHERARev3-Issued.docx) (Cardno, 2021b) (HHERA) provides (simple) conceptual site models (CSMs) for different general future land uses for the overall SMWSA project. The two general future land uses associated with the SCAW component of the project are considered to be:

- The rail corridor which will include the rail line, embankments / noise barriers, a stabling yard and maintenance facility and Luddenham station; and
- Passive open space. These are areas immediately adjacent to the rail corridor that may be used for bike / commuter paths. It is presumed that there is an absence of buildings in areas of passive open space.

It is presumed that the future use of the site (post-construction of the rail line) will be passive open space.

Development of the site will likely include stripping of topsoil. Stripped topsoil from the site will be subject to reuse elsewhere within the greater SCAW area.

3. Scope of Work

The scope of work for the DSI was generally based on DP, *Sampling and Analysis Quality Plan (SAQP), Surface & Civil Alignment Works (SCAW) Package for Sydney Metro - Western Sydney Airport (SMWSA) Area of Environmental Concern (AEC) 31b, 146E Samuel Marsden Road, Orchard Hills,* August 2022, (204814.01.SAQP.009.DftA). It is noted that the scope for the DSI was expanded from the SAQP to include sampling from one additional (*in situ*) sampling point and stockpile sampling and analysis.

The scope of work was as follows:

- Collection of soil samples from eight test pits using an excavator;
- Collection of soil samples from a stockpile;
- Installation of groundwater monitoring wells at three locations using a drilling rig;
- Development of each of the three groundwater monitoring wells;
- Sampling of each of the three installed groundwater monitoring wells;
- Analysis of selected soil samples for potential contaminants and soil parameters;
- Analysis of groundwater samples for potential contaminants and water parameters; and
- Preparation of this DSI including an assessment of analytical and field results.

4. Site Condition and Environment Information

Table 2 provides a summary of information relating to the site condition and environment.

Table 2: Site Condition and Environment Information

Item	Details
Geology	Bringelly Shale (for majority of site): comprising shale, carbonaceous claystone, claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff. (Penrith 1:100,000 Geology Sheet)
Soil landscape	The site is within the Blacktown soil landscape which comprises residual soils (Penrith 1:100,000 Soils Landscape Sheet). The South Creek soil landscape is located approximately 20 m to the west and comprises alluvial soils.
Topography	The site is at approximately 35 m AHD. Slopes are generally down to the north-east. (NSW 2 m elevation contours map).
Salinity	The site is in an area of moderate salinity potential (Department of Infrastructure Planning and Natural Resources, Salinity Potential in Western Sydney Map).
Acid sulfate soils	The site is not within an area or close to an area associated with a risk of acid sulfate soils (NSW Acid Sulfate Soil Risk map).
Surface water bodies and surface water flow	There are no surface water bodies at the site. An unnamed creek is located approximately 130 m to the north of the site and flows to the east. Blaxland Creek is located approximately 130 m to the east of the site and flows to the northeast. The unnamed creek flows into Blaxland Creek. A cluster of farm dams are located approximately 200 m to the south-west of the site. Rainfall at the site may penetrate permeable surfaces. Based on topography, surface water runoff is expected to flow to the north-east towards the creeks.
Groundwater flow direction and discharge	Based on topography, shallow groundwater (if any) is expected to flow to the north-east and potentially discharge at the unnamed creek.

Item	Details
Registered groundwater bores	There are no registered groundwater bores within 500 m of the site (WaterNSW).
Site use and features	The site appears to be used for rural and residential. Buildings / sheds are present (EIS).
Surrounding land use and features	Surrounding land is used for rural and residential purposes including grazier land with minor buildings, sheds, animal shelters / pens and dams. A building is in close proximity to the north. Small sheds / shelters are also in close proximity. Waste storage / dumping areas were identified at land approximately 100 m to the west of the site (at AEC 31a) and further to the west. Former poultry farm sheds and former potential workshops were identified approximately 250 m to the west of the site (EIS). Although the site is somewhat downgradient of the waste storage / dumping areas given that the site level is below the level of the former poultry farm sheds and former potential workshops, the site is not considered to be directly (hydrogeological) downgradient of these areas given the surrounding topography.
Information from historical aerial photographs	The land at and surrounding the site appears to have been previous used as pastoral land (EIS).
NSW EPA records	There were no NSW EPA regulated sites (under the *Contaminated Land Management Act 1997*) within 1 km of the site (EIS). There were no sites notified to the NSW EPA (under the *Contaminated Land Management Act 1997*) within 500 m of the site (EIS). There were no (current or former) NSW EPA licensed sites (under the *Protection of the Environment Operations Act 1997*) within 500 m of the site (EIS). There were no NSW EPA PFAS investigation sites within 2 km of the site (EIS). No penalty notices were issued by NSW EPA for the site or nearby surrounding land (EIS).

At the time of field work for the DSI, the site could be accessed by a gravel driveway and structures at the site were observed to comprise a caged dog shelter / kennel (west), a possible old house (north) and a shed for vehicle storage (south). Neighbouring structures included a house (north) and a chicken coop (south). A stockpile was present at the eastern part of the site. Site features are indicated on Drawing AEC31b-01, Appendix A. Site photographs are provided in Appendix K.

The dog shelter / kennel was observed to have an unmarked waterproof drum on the ground surface (and was possibly previously used for food or water storage). The possible old house could not be accessed and was observed to be made of potential asbestos-containing building materials. The neighbouring house to the north appeared to be a relatively modern structure. Some waste items such as old timber and metal sheets were observed on the ground surface, particularly at the rear of the shed for vehicle storage. It is noted that much of the ground surface around the buildings and gravel driveway was grassed-covered which prevented observations of the soil surface. No signs of contamination (e.g., oil staining) were observed on the gravel driveway or concrete slabs surrounding buildings. The concrete slab within the shed for vehicle storage had very minor staining and appeared to be in good condition.

5. Potential Contamination Sources and Preliminary Conceptual Site Model

The potential source of contamination for AEC 31b as identified in the EIS is: *potential workshops, minor waste disposal, use or storage of hazardous building material.* For this potential source of contamination, contaminants of potential concern (CoPC) were identified in the EIS to be: heavy metals, total recoverable hydrocarbons (TRH), semi-volatile organic compounds (SVOC), volatile organic compounds (VOC) and asbestos. DP notes that specific heavy metals, SVOC and VOC were not listed in the EIS and workshops were not observed at the site during fieldwork.

AEC 31a is located somewhat upgradient of the site, although not in close proximity of the site and not directly (hydrogeological) upgradient of the site given the surrounding topography. CoPC were identified in the EIS to be: heavy metals, TRH, semi-volatile organic SVOC, VOC, nutrients, asbestos and other unknown chemicals. DP notes that specific heavy metals, SVOC, VOC and nutrients are not listed in the EIS.

Table 3 summarises the potential source of contamination and what are considered to be the contaminants of potential concern for the DSI.

Table 3: Potential Source of Contamination and Contaminants of Potential Concern

Potential Source of Contamination		Contaminants of Potential Concern
Contaminated ground from:	– potential workshops	– Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) – TRH – Benzene, toluene, ethylbenzene and xylenes (BTEX) – Polycyclic aromatic hydrocarbons (PAH)* – Phenols – Organochlorine pesticides (OCP) – Organophosphorus pesticides (OPP) – VOC (groundwater)
	– minor waste disposal	– Metals – TRH – BTEX – PAH* – Polychlorinated biphenyls (PCB) – Asbestos
	– use or storage of hazardous building material	– Asbestos – PCB – Lead (in lead-paint)

Potential Source of Contamination	Contaminants of Potential Concern
Contaminated groundwater migrating onto the site from land to the west (AEC 31a)	– Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) – TRH – VOC (including BTEX) – PAH* – OCP – OPP – PCB – Speciated phenols – Ammonia**

Note: *Based on a review of site history, analysis for a larger suite of SVOC was not considered warranted.
**Ammonia has been adopted as an indicator for potential nutrient contamination

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM provides the framework for identifying how the site may become contaminated and how potential receptors may be exposed to contamination either in the present or the future i.e., it enables an assessment of the potential source – pathway – receptor linkages (complete pathways). The preliminary conceptual site model for the proposed development of the site is presented in Table 4.

Table 4: Preliminary CSM

Potential Contamination Source	Potential Exposure Pathway	Potential Receptors
Contaminated ground from waste storage and potential dumping at the site.	– Ingestion and direct contact – Inhalation of dust – Inhalation of vapours	– Construction workers (for the proposed development) – Future site workers including maintenance workers (post-development) – Pedestrians and commuters
	– Inhalation of dust – Inhalation of vapours	– Adjacent site users
	– Surface run-off – Leaching of contaminants into groundwater and lateral migration of groundwater	– Surface water bodies
	– Leaching of contaminants into groundwater	– Groundwater
	– Ingestion, inhalation and direct contact	– Terrestrial ecosystems

Potential Contamination Source	Potential Exposure Pathway	Potential Receptors
	– Direct contact	– In ground structures
Contaminated groundwater or surface water migrating onto the site from land to the west or from the north.	– Ingestion and direct contact – Inhalation of vapours	– Construction workers (for the proposed development) – Future site workers including maintenance workers (post-development) – Pedestrians and commuters
	– Ingestion, inhalation and direct contact	– Terrestrial ecosystems

Although *Table B2: Activities associated with PFAS contamination more broadly* of Appendix B of HEPA, *PFAS National Environmental Management Plan* (NEMP) (HEPA, 2020) lists '*Agriculture: Potentially used as an adjuvant or active ingredient in fertilisers and pesticides*….', it is considered that investigation for PFAS is not warranted given that crops did not appear to be established at the site, and, thus, there is a low probability that substantial fertiliser application has occurred. In addition, although there are off-site former poultry farm sheds (noted on Table 2), it is considered that there is a very low probability of this being a potential source of PFAS contamination as firefighting foam application to destroy infected flocks would only be used for large flocks with highly infectious disease (e.g., avian influenza) and there is no information to suggest this activity has occurred near the site.

6. Field Work

6.1 Data Quality Objectives

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

6.2 *In Situ* Soil Sampling

Based on the CSM and data quality objectives (DQO), eight soil sampling points (test pits AEC31BTP01 to AEC31BTP08) were adopted and positioned to provide site coverage. This number of samples points was based on the minimum recommended sample density listed in Table 2 of NSW EPA, *Sampling design part 1 – application*, 2022 (NSW EPA, 2022) for a 0.2 ha site. Access for test pits at some parts of the site were prevented by the presence of buildings. It is noted that it was assumed for the SAQP that the buildings would have been demolished prior to fieldwork. It is also noted that seven sample points were proposed in the SAQP, however, this number was based on the minimum recommended sample density listed in NSW EPA, *Sampling Design Guidelines*, 1995 which has been superseded by NSW EPA (2022). Sampling from test pits (AEC31BTP01 to AEC31BTP08) was carried out on 12 December 2022.

Soil sampling from test pits was carried out in accordance with DP standard operating procedures. The general soil sampling and sample management procedure adopted is as follows:

- Collect soil samples from excavator bucket returns including at the surface / near surface and regular depth intervals (approximately every 0.5 m) and / or at changes of strata;
- 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 screening using a photo-ionisation detector (PID);
- For fill / topsoil samples, collect ~500 ml samples in zip-lock bags (for asbestos analysis);
- Wear a new disposable nitrile glove for each sample point thereby minimising potential for cross-contamination;
- 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.

As trace irrigation hose (anthropogenic material) was noted in the fill at AEC31BTP02, a bulk soil sample from this location, from a depth of 0-0.1 m, was subject to screening / sieving for asbestos-containing materials (ACM). The screening / sieving procedure was as follows:

- Weigh the bulk (10 L) sample;
- Screen the bulk sample through a ≤7 mm aperture sieve;
- Weigh all retrieved potential ACM fragments; and
- Calculate the asbestos concentration (% w/w) in soil as per the procedure described in NEPC (2013).

6.3 Stockpile Sampling

Stockpile sampling (of stockpile AEC31BSP1) was undertaken on 12 December 2022 and 17 January 2023. Soil sampling was carried out with the use of an excavator (on 12 December 2022) and using hand tools 17 January 2023 in accordance with DP standard operating procedures. The general soil sampling and sample management procedure adopted is as follows:

- Collection of three soil samples from different locations / depths of the stockpile to achieve a sampling rate of approximately one sample per 10 m^3 (generally as per NSW EPA,2022 for small stockpiles);
- Transfer samples in laboratory-prepared glass jars with Teflon lined lids by hand, capping immediately and minimising headspace within the sample jar;
- Collect~500 ml samples in zip-lock bags (for asbestos analysis);
- Wear a new disposable nitrile glove for each sample point thereby minimising potential for cross-contamination;

- 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.

The three primary samples were labelled AEC31BSP1A, AEC31BSP1B and AEC31BSP1C. It is noted that stockpile sampling was not proposed in the SAQP as the stockpile was identified at the time of field work.

As anthropogenic materials were identified in the stockpile, bulk samples from the locations of AEC31BSP1A and AEC31BSP1B were subject onsite sieving for ACM as per the method described in Section 6.2.

6.4 Groundwater Monitoring Well Installation and Development

Boreholes for groundwater monitoring wells (AEC31BBH01 to AEC31BBH03) were drilled to depths of between 11 m and 11.5 m on 1 February 2023 using a track-mounted drilling rig with solid flight auger and tc-bit attachment. The wells were positioned to provide general site coverage as per proposed locations in the SAQP.

Monitoring wells were constructed using class 18 uPVC machine slotted screen and blank sections with screw threaded joints. The screened section of each well was backfilled with a washed sand filter pack to approximately 1 m above the screened interval. Each well was completed with a hydrated bentonite plug of 2 m thickness and then backfilled to the surface.

The three groundwater monitoring wells were developed on 7 February 2023 using a Twister (plastic) pump.

6.5 Groundwater Well Sampling

Groundwater sampling of the three installed groundwater wells (AEC31BBH01 to AEC31BBH03) was carried out on 13 February 2023 in accordance with DP standard operating procedures. The sampling method adopted is as follows:

- Wear a new pair of disposable nitrile gloves for each sample point thereby minimising potential for cross-contamination;
- Measure the static water level using an electronic interface probe;
- Lower the well-dedicated tubing into the well at a depth that is at the screened section of the well;
- Set up the peristatic pump to draw water at a low rate that produces laminar flow;
- Measure physical parameters by continuously passing the purged water through a flow cell;
- Following stabilisation of the field parameters using a water quality meter, collect samples in laboratory-prepared bottles minimising headspace within the sample bottle and cap immediately;

- Place samples into a cooled, insulated, and sealed container for transport to the laboratory; and
- Use chain of custody documentation.

7. Laboratory Analysis

7.1 Soil Samples from *In Situ* Test Locations

Fill samples from each test location were analysed at a NATA accredited laboratory for COPC comprising: metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), TRH, BTEX, PAH, OCP, OPP, PCB, total phenols and asbestos (in 500 mL soil) as fill was considered to have a greater risk of contamination compared to the observed underlying natural soil.

Natural soil samples from four sample locations were analysed to obtain data for the natural soil profile. The natural soil samples were analysed for metals, TRH, BTEX, PAH, OCP, OPP, PCB and total phenols.

Three soil samples were analysed for pH and cation exchange capacity (CEC) for the calculation of EIL.

Laboratory certificates and chain of custody are provided in Appendix D.

7.2 Soil Samples from Stockpile

Three stockpile samples (AEC31BSP1A to AEC31BSP1C) were analysed for COPC comprising: metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), TRH, BTEX, PAH, OCP, OPP, PCB, total phenols and asbestos (in 500 mL soil).

7.3 Groundwater Samples

A groundwater sample from each sample location (AEC31BBH01 to AEC31BBH03) was analysed for COPC comprising metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), PAH, TRH, BTEX, VOC, OCP, OPP, PCB, phenols and ammonia. Hardness was also analysed for the calculation of hardness adjusted default guideline values (DGV). (Samples were also analysed for pH, chlorides, sulphates, cations / anions, TDS, carbonate/bicarbonates, electrical conductivity and Langelier saturation index for geotechnical purposes and results for these have not been reported herein). Groundwater samples issued to the primary laboratory (Envirolab Services) were filtered at the laboratory prior to metals analysis.

8. Site Assessment Criteria

Tier 1 Site Assessment Criteria (SAC) for the assessment of soils and groundwater, informed by the CSM, at the site are listed in Appendices E and F. Given that the future use of the site is presumed to be for passive open space, the SAC for passive open space (land use C) apply for assessment of the site (AEC 31b). Given that soil at the site may be used at other areas of the SCAW project including for the proposed rail corridor (as well as other areas of passive open space), SAC for the rail corridor (land use corridor D) have been included as part of the assessment.

9. Field Work Results

9.1 Test Pits (*in situ* Soil)

The test pit logs for this assessment are included in Appendix G and should be referenced for detailed soil descriptions. In summary:

- Fill was encountered to depths ranging from 0.15 m to 0.7 m. Fill materials comprised sandy gravel, and silty sand. A trace of irrigation hose was noted in the fill at AEC31BTP02, depth 0 – 0.3 m. Trace concrete was identified in the fill at AEC31BTP04, depth 0-0.2 m. Anthropogenic materials were not observed in fill in the majority of test pits; and
- Fill was underlain by silty clay to test pit termination depths of between 0.8 m and 1.2 m.

No ACM was recovered from screening/sieving of fill sample from AEC31BTP02. The record of asbestos samples is provided in Appendix H.

PID results were less than 5 ppm, indicating a low potential for the presence of volatile contaminants. The PID calibration certificate is provided in Appendix H.

No signs of gross contamination (e.g., odours, staining or potential asbestos-containing materials) were observed during sampling.

Free groundwater was not observed in test pits.

9.2 Stockpile

The stockpile (AEC31BSP1) was observed to comprise approximately 32 m^3 of red-brown and brown silty clay with trace rootlets, fine to medium ironstone gravel, plastic, glass, wire and metal. The stockpile was covered in grass (see Photograph 4, Appendix K). No signs of contamination were observed in the sampled soil. No ACM was recovered from sieving of samples AEC31BSP1A and AEC31BSP1B. The record of asbestos samples is provided in Appendix H.

9.3 Groundwater Well Boreholes

The borehole logs with monitoring well construction details are provided in Appendix G and should be referenced for detailed soil descriptions. In summary:

- Fill comprising silty clay was encountered at AEC31BBH02 and AEC31BBH03 to depths of 0.7 m and 1 m, respectively. Fill was not encountered at AEC31BBH01. No anthropogenic materials were observed in the fill;
- Natural soils comprising silty clay was observed at each borehole to depths of 4.5 m and 5 m; and
- Silty clay was underlain by siltstone which was encountered to the borehole termination depths of up to 11.5 m.

No signs of contamination were noted whilst drilling. Groundwater was observed at 9 m (AEC31BBH01 and AEC31BBH03) and 10 m (AEC31BBH02) whilst drilling.

9.4 Groundwater Sampling

Measured groundwater levels are summarised in Table 5.

Table 5: Groundwater Levels

Borehole	Prior to Well Development on 7 February 2023		Prior to Well Sampling on 13 February 2023	
	Groundwater Depth (m bgl)	Groundwater Level (m AHD)	Groundwater Depth (m bgl)	Groundwater Level (m AHD)
AEC31BBH01	6.83	27.87	5.75	28.95
AEC31BBH02	7.28	26.32	3.92	29.68
AEC31BBH03	5.64	27.76	5.54	27.86

Groundwater levels on 7 February 2023 indicate groundwater flow at the site is to the north (generally in the anticipated direction), however, groundwater levels on 13 February 2023 indicate the groundwater flow is to the south. There was significant rainfall on 9 and 10 February 2023, which may have resulted in a (temporary) spike in the groundwater level measured at AEC31BBH02 (compared to other wells) on 13 February 2023.

It should be noted that groundwater levels are affected by climatic conditions and soil permeability and will therefore vary with time.

The water from development of AEC31BBH01 was observed to be brown and cloudy (moderately turbid). The water from the development of AEC31BBH02 was observed to be dark brown and highly turbid. The water from development of AEC31BBH03 was observed to be pale brown and cloudy (slightly turbid). No odours were associated with the water from each well. Phase separated hydrocarbons were not identified from use of the interface dipmeter.

No phase separated hydrocarbons were identified in any of the wells from the use of the interface dipmeter prior to sampling. The water sampled from AEC31BBH01 and AEC31BBH03 was observed to be clear (low turbidity). The water sampled from AEC31BBH02 was observed to be brown and highly turbid. No odours were associated with the sampled water.

The groundwater field sheets, and water quality meter calibration record are provided in Appendix H.

10. Discussion of Laboratory Analytical Results

10.1 Soil and Stockpile Samples

Analytical results for soil samples including stockpile samples are summarised in Table I1, Appendix I, against (Tier 1) SAC (see Appendix E). The most conservative health-based SAC are shown on the table as well as the ecological SAC for public open space which are more conservative than for a commercial / industrial land use.

Concentrations of chemicals for all analysed soil samples were below the SAC for all CoPC analysed. Asbestos was not detected in any analysed sample. It is noted that concentrations of TRH >C_6-C_{10}, TRH >C_{10}-C_{16}, BTEX, naphthalene, OCP, OPP, PCB and phenols were less than the practical quantitation limits (PQL).

10.2 Groundwater Samples

Analytical results for groundwater samples for the current investigation are summarised in Table I2, Appendix I, against the SAC.

Concentrations of metals were below the SAC except for:

- Chromium in the replicate sample (BD4/20230213) from AEC31BBH02 (44 µg/L) which exceeded the DGV (3.3 µg/L for Chromium III and 1 µg/L for Chromium VI). The recorded chromium concentrations are considered to be representative of background concentrations in groundwater, particularly given that the chromium concentrations in soil were low. It is noted that groundwater at the site is extremely hard (3600 to 4600 mgCaCO3/L) and the recorded concentrations are low compared to adjusted DGV for Chromium III in extremely hard water (e.g., 103.3 µg/L for a hardness of 2000 mgCaCO3/L);
- Copper in the sample from AEC31BBH01 (5 µg/L) and the replicate sample (BD4/20230213) from AEC31BBH02 (48 µg/L) which exceed in the freshwater DGV (1.4 µg/L). The recorded copper concentrations are considered to be representative of background concentrations in groundwater, particularly given that the copper concentrations in soil were low;
- The concentrations of nickel in samples from AEC31BBH01 (19 µg/L) and AEC31BBH02 (14 µg/L and 45 µg/L) which exceeded the DGV (11 µg/L). The recorded nickel concentrations are considered to be representative of background concentrations in groundwater, particularly given that the nickel concentrations in soil were low. It is noted that the recorded concentrations are low compared to adjusted DGV for extremely hard water (e.g., 390 µg/L for a hardness of 2000 mgCaCO3/L); and

- The concentrations of zinc in the sample from AEC31BBH01 (25 µg/L), the replicate sample (BD4/20230213) from AEC31BBH02 (93 µg/L), and the samples from AEC31BBH03 (14 µg/L) which exceeded the DGV (8 µg/L). The recorded zinc concentrations are considered to be representative of background concentrations in groundwater, particularly given that the zinc concentrations in soil were low. It is also noted that recorded concentrations are low compared to adjusted DGV for extremely hard water (e.g., 284 µg/L for a hardness of 2000 mgCaCO3/L).

Concentrations of TRH and VOC (including BTEX) were below the practical quantitation limits and hence, within the SAC. Low concentrations of naphthalene were detected in samples from all wells. Concentrations of PAH (including naphthalene) were within the SAC.

Concentrations of OCP, OPP, PCB and phenols were below the practical quantitation limits and hence, within the SAC.

Ammonia was detected in all samples with the concentrations exceeding the aesthetic criterion for recreational water (382 µg/L for ammonia as N). The ammonia concentration in the primary sample from AEC31BBH02 (1100 µg/L) also exceeded the DGV (900 µg/L for pH 8.0). The groundwater at AEC31BBH02 was recorded to have a pH in the field of 6.7 and a pH in the laboratory sample of 7.0. According to the Ammonia technical brief (on the ANZG, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* website), the freshwater trigger value is 2380 µg/L for pH 6.7 and 2180 µg/L for pH 7.0. The recorded concentrations of ammonia for AEC31BBH02 are within these trigger values. Overall, the recorded concentrations of ammonia are not considered to be indicative of contamination.

10.3 Waste Classification Comments

Although it is understood that excavated soil is to be reused for the SCAW project, waste classification comments are provided below in the eventuality that spoil is to be disposed to landfill or is not to be reused within the SCAW project.

Table I3, Appendix I, presents the results for soil for the current investigation against criteria from NSW EPA, *Waste Classification Guidelines*, 2014 (NSW EPA, 2014) and NSW EPA, *The excavated natural material order 2014*.

With respect to the stockpile AEC31BSP1, concentrations were below the CT1 criteria for general solid waste. Asbestos was not identified in the stockpile during sampling or from laboratory analysis. On the basis of laboratory and field results, stockpile AEC31BSP1 (as described Section 9.2) has a waste classification as general solid waste (non-putrescible). This waste classification does not apply to any of the stockpiled material that is encountered to be different to those sampled and tested or exhibit signs of potential contamination (e.g., ACM, staining or odours). The presence of anthropogenic materials (plastic, glass, wire and metal) may preclude this stockpile from being classifiable as excavated natural material (ENM).

With respect to fill, concentrations were below the CT1 criteria for general solid waste. Asbestos was not identified in fill during sampling or from laboratory analysis. On the basis of laboratory and field results, fill at the site (as described in the logs, Appendix G) has a preliminary classification as general solid waste (non-putrescible). This preliminary waste classification does not apply to any fill that is encountered to be different to those sampled and tested or exhibit signs of potential contamination (e.g., ACM, staining or odours). It is noted that concentrations of metals, TRH, BTEX, PAH and pH are within the criteria for ENM.

With respect to natural soil samples, concentrations of chemical contaminants were within what are considered to be background levels and are considered to be consistent with the definition of virgin excavated natural material (VENM), as defined in *Protection of the Environment Operations Act 1997*

10.4 Data Quality Assurance and Quality Control

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

11. Conclusion

Field observations and analysis of soil and groundwater samples has not revealed contamination that requires remediation. Based on the results reported herein, it is considered, from a contamination perspective, that the site (AEC 31b) is suitable for the final intended land use. Tested soils (including the tested stockpile) are considered suitable to remain onsite.

Prior to demolition, a hazardous materials building survey should be undertaken for structures that will be demolished at the site (if not undertaken already). Where asbestos is (or has been) identified in structures at the site, clearances for asbestos removal works should be obtained from an Occupational Hygienist following removal of asbestos and demolition works.

Based on site observations, there appears to be a low potential for contamination from activities within existing structures. Nevertheless, footprints (exposed soil) of structures should be inspected for signs of contamination following demolition.

An unexpected finds protocol has been established in Appendix C5 of CPBUI JV, *Soil and Water Management Sub-plan*, Project N8150, Revision 1, 4 November 2022. The unexpected finds protocol is to be implemented for the case that potential contamination is encountered following demolition (e.g., at building footprints), vegetation clearance, excavation and construction activities.

12. Limitations

Douglas Partners (DP) has prepared this report (or services) for the SCAW package for SMWSA. The work was carried out under a Service Contract. This report is provided for the exclusive use of CPBUI JV 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.

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

The assessment of atypical safety hazards arising from this advice is restricted to the (environmental) 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.

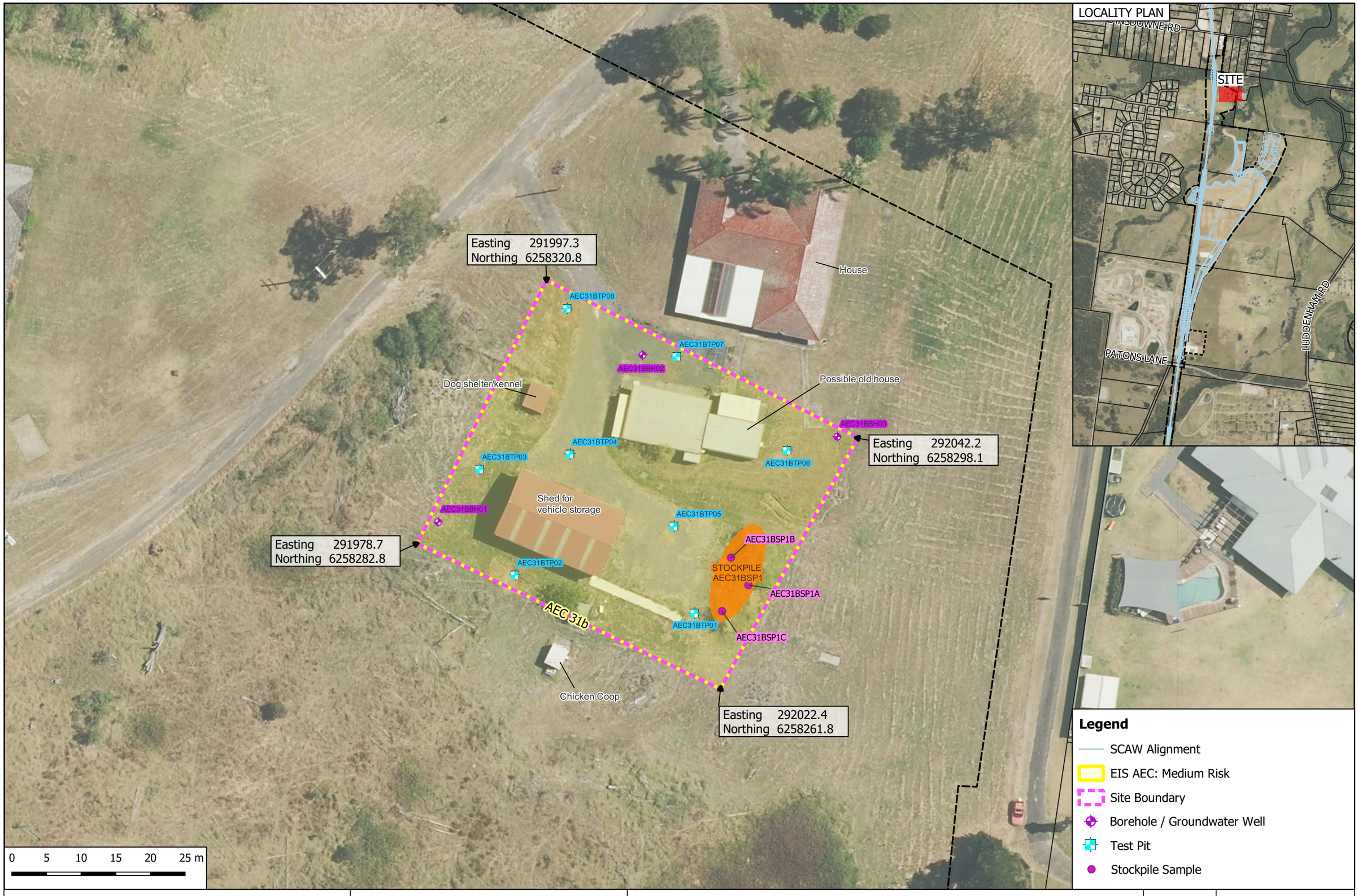
DP personnel are not licenced or accredited surveyors. Any quantities quoted in this report are provided for general guidance only and should not be relied upon. The services of a licenced / accredited surveyor should be engaged if reliable quantities are required.

The handling, transport and disposal of the waste should be conducted in accordance with regulatory and statutory requirements. DP does not accept liability for the unlawful disposal of waste materials from any site. DP accepts no responsibility for the material tracking, loading, management, transport or disposal of waste from the site. Both the receiving site and the site disposing of the soil should satisfy the requirements of the licence before disposal of the soil is undertaken. Note that appropriate prior arrangement with the receiving site/relevant authorities should be obtained prior to the disposal of any soil off site. The receiving site should check to ensure that the soil received matches the description provided in this report and contains no cross contamination.

Douglas Partners Pty Ltd

Appendix A

Drawing



Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: CPBUI JV		TITLE: **AEC31b Test Location Plan**	PROJECT No: 204814.01
OFFICE: Sydney	DRAWN BY: MG	**Sydney Metro Western Sydney Airport - SCAW**	DRAWING No: AEC31b-01
SCALE: 1:500 @ A3	DATE: 28/03/2023	**146E Samuel Marsden Road, Orchard Hills**	REVISION: 1

Appendix B

Notes About this Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Appendix C

Data Quality Objectives

Data Quality Objectives
DSI for AEC31b, 146E Samuel Marsden Road, Orchard Hills
SCAW Package for SMWSA

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

Step	Summary
1: State the problem	The problem to be addressed is that the extent and nature of potential contamination at the site is unknown and it is unclear whether the site is suitable for the proposed uses. The objective of the proposed DSI is to determine the contamination status of the site with respect to the proposed land use and, if contamination is confirmed, to make recommendations for further investigations and / or remediation to render the site suitable for the proposed uses. In addition, soil from the site may potentially be reused elsewhere within SCAW and the data obtained in the DSI, therefore, may also be used for this purpose. A preliminary conceptual site model (CSM) has been prepared for the proposed development. The project team consists of experienced environmental engineers and scientists.
2: Identify the decisions / goal of the study	The site history has identified possible contaminating previous uses which are identified in the preliminary CSM. The SAC for potential contaminants are detailed in Appendices E and F. The decision is to establish whether or not the results fall below the SAC or whether or not the 95% upper confidence limit of the sample population falls below the SAC. On this basis, an assessment of the site's suitability from a contamination perspective and whether (or not) further assessment and / or remediation will be derived.
3: Identify the information inputs	Inputs to the investigation will be the results of analysis of samples to measure the concentrations of potential contaminants at the site using NATA accredited laboratories and methods, where possible. The SAC for each of the potential contaminants are detailed in Appendices E and F. A photoionisation detector (PID) is used on-site to screen soils for volatile contaminants. PID readings were used to inform sample selection for laboratory analysis.
4: Define the study boundaries	The site is identified in Section 2. The lateral boundaries of the investigation area are shown on Drawing AEC31b-01, Appendix A.

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

Appendix D

Laboratory Certificates and Chain of Custody

Appendix E

Site Assessment Criteria for Soil

Site Assessment Criteria for Soil for AEC31b

Surface & Civil Alignment Works (SCAW) Package for Sydney Metro - Western Sydney Airport (SMWSA)

1.0 Introduction

It is understood that the two general future land uses associated at the areas of the SACW project will comprise:

- The rail corridor. The rail corridor will include the rail line, embankments / noise barriers, a stabling yard and maintenance facility and stations; and
- Passive open space. These are areas immediately adjacent to the rail corridor that may be used for bike / commuter paths. It is assumed that there is an absence of buildings in areas of passive open space.

The following references were consulted for deriving 'Tier 1' SAC for soil for the two above-listed land uses:

- 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,* 2011 (CRC CARE, 2011).

It is presumed that the future use of the site (post-construction of the rail line) will be passive open space, however, given the potential reuse of soil at other areas of the SCAW project, SAC for both land uses have been included.

2.0 Human Health-based Criteria

Human health-based SAC for soil and the associated future land uses are listed in Tables 1 to 5. Tier 1 criteria comprise:

- Health Investigation Levels (HIL) for a broad range of metals and organics (Table 1). HIL are applicable for assessing human health risk via all relevant pathways of exposure;
- Health Screening Levels (HSL) for vapour intrusion for selected petroleum hydrocarbons and fractions (Tables 2 and 3). These are applicable for assessing human health via the inhalation pathway. HSL are dependent on soil type and depth. HSL D are applicable to soil / areas to be covered by buildings (e.g., stations, offices and enclosed sheds);
- HSL for direct contact for selected petroleum hydrocarbons and fractions (Table 4). These are applicable for assessing human health via the direct contact pathway; and
- Health screening levels for asbestos (Table 5).

For HSL for vapour intrusion, HSL for sand and clay soils are shown in Tables 2 and 3 as these are the predominant soil types encountered at the site.

Table 1: Health Investigation Levels (Tier 1) from NEPM

Contaminant	HIL C for Passive Open Space (mg/kg)	HIL D for Rail Corridor (mg/kg)
Metals and Inorganics		
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
Cyanide (free)	240	1500
Polycyclic Aromatic Hydrocarbons (PAH)		
Benzo(a)pyrene TEQ	3	40
Total PAH	300	4000
Phenols		
Phenol	40 000	240 000
Pentachlorophenol	120	660
Cresols	4000	25 000
Organochlorine Pesticides (OCP)		
DDT+DDE+DDD	400	3600
Aldrin and dieldrin	10	45
Chlordane	70	530
Endosulfan	340	2000
Endrin	20	100
Heptachlor	10	50
HCB	10	80
Methoxychlor	400	2500
Toxaphene	30	160
Organophosphorus Pesticides (OPP)		
Chlorpyrifos	250	2000
Polychlorinated Biphenyls (PCB)		
PCB	1	7

Table 2: Health Screening Levels (Tier 1) for Vapour Intrusion for Passive Open Space from NEPM

Contaminant	HSL C (mg/kg)	HSL C (mg/kg)	HSL C (mg/kg)	HSL C (mg/kg)
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
TPH C6-C10 less BTEX	NL	NL	NL	NL
TRH >C10-C16 less naphthalene	NL	NL	NL	NL
CLAY	**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
TPH C6-C10 less BTEX	NL	NL	NL	NL
TPH >C10-C16 less naphthalene	NL	NL	NL	NL

Notes: TPH is total petroleum hydrocarbons

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 (Tier 1) for Vapour Intrusion for Rail Corridor from NEPM

Contaminant	HSL D (mg/kg)	HSL D (mg/kg)	HSL D (mg/kg)	HSL D (mg/kg)
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
TPH C6-C10 less BTEX	260	370	630	NL
TPH >C10-C16 less naphthalene	NL	NL	NL	NL
TPH C6-C10 less BTEX	250	360	590	NL
TPH >C10-C16 less naphthalene	NL	NL	NL	NL

Contaminant	HSL D (mg/kg)	HSL D (mg/kg)	HSL D (mg/kg)	HSL D (mg/kg)
CLAY	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4 m**	**4 m+**
Benzene	4	6	9	20
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	NL	NL	NL	NL
Naphthalene	NL	NL	NL	NL
TPH C6-C10 less BTEX	310	480	NL	NL
TPH >C10-C16 less naphthalene	NL	NL	NL	NL

Table 4: Health Screening Levels (Tier 1) for Direct Contact from CRC CARE (2011)

Contaminant	HSL C for Passive Open Space (mg/kg)	HSL D for Rail Corridor (mg/kg)
Benzene	120	430
Toluene	18 000	99 000
Ethylbenzene	5300	27 000
Xylenes	15 000	81 000
Naphthalene	1900	11 000
TPH C6-C10 less BTEX	5100	26 000
TPH >C10-C16 less naphthalene	3800	20 000
TPH >C16-C34	5300	27 000
TPH >C34-C40	7400	38 000

Notes: TPH is total petroleum hydrocarbons.

Table 5: Health Screening Levels (Tier 1) for Asbestos from NEPM

Form of Asbestos	Health Screening Level C for Passive Open Space	Health Screening Level D for Rail Corridor
Bonded asbestos containing materials (ACM)	0.02%	0.05%
Fibrous asbestos (FA) and asbestos fines (AF) (friable asbestos)	0.001%	0.001%
All forms of asbestos	No visible asbestos for surface soil	No visible asbestos for surface soil

Notes: FA comprises friable asbestos material and includes severely weathered cement sheet, insulation products and woven asbestos material. This type of friable asbestos is defined here as asbestos material that is in a degraded condition such that it can be broken or crumbled by hand pressure. This material is typically unbonded or was previously bonded and is now significantly degraded (crumbling).
AF includes free fibres, small fibre bundles and also small fragments of bonded ACM that pass through a 7 mm x 7 mm sieve.
Surface soils defined as top 10 cm.

3.0 Ecological Criteria

Ecological SAC for soil and the associated future use are listed in Tables 6 and 7. Tier 1 criteria comprise:

- Ecological Investigation Levels (EIL) for arsenic, copper, chromium (III), nickel, lead, zinc, DDT and naphthalene (Table 6). These are derived using the interactive (excel) calculation spreadsheet on the NEPM toolbox website and are used to assess contamination with respect to terrestrial ecosystems. Site specific inputs (including soil parameters) are required to calculate EIL. EIL typically apply to the top 2 m of soil; and
- Ecological Screening Levels (ESL) for selected petroleum hydrocarbon compounds and fractions, and benzo(a)pyrene, and are used to assess contamination with respect to terrestrial ecosystems (Table 7). ESL are dependent on soil type and typically apply to the top 2 m of soil.

EIL were determined using the NEPC Ecological Investigation Level Spreadsheet based on the following inputs:

- A pH of 7.7 which is the average pH of the three analysed soil samples (see laboratory certificates 312920 and 312978);
- A Cation Exchange Capacity (CEC) of 9.8 meq/100g which is the average CEC for the three analysed soil samples (see laboratory certificates 312920 and 312978);
- Contamination is assumed to be 'aged' based on site history;
- A organic carbon content value of 1% has been used as a default value;
- A clay content of 1% has been used as a relatively conservative value; and
- The state is NSW and the traffic volume is 'low'.

Clay and sand soils were encountered during the investigation and, so, ESL for fine and coarse soils have been adopted.

Table 6: Ecological Investigation Levels (Tier 1) from NEPM toolbox

Contaminant	Public Open Space EIL for Passive Open Space (mg/kg)	Commercial and Industrial EIL for Rail Corridor (mg/kg)
Metals		
Arsenic	100	160
Copper	210	300
Nickel	160	280
Chromium III	190	320
Lead	1100	1800
Zinc	470	690
PAH		
Naphthalene	170	370
OCP		
DDT	180	640

Table 7: Ecological Screening Levels (Tier 1) from NEPM

Contaminant	Soil Type	Public Open Space ESL for Passive Open Space (mg/kg)	Commercial and Industrial ESL for Rail Corridor (mg/kg)
Benzene	Coarse	50	75
	Fine	65	95
Toluene	Coarse	85	135
	Fine	105	135
Ethylbenzene	Coarse	70	165
	Fine	105	135
Xylenes	Coarse	105	180
	Fine	45	95
TPH C6-C10 less BTEX	Coarse/ Fine	180*	215*
TPH >C10-C16	Coarse/ Fine	120*	170*
TPH >C16-C34	Coarse	300	1700
	Fine	1300	2500
TPH >C34-C40	Coarse	2800	3300
	Fine	5600	6600
Benzo(a)pyrene	Coarse / Fine	0.7	1.4

Notes: ESL are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability TPH is total petroleum hydrocarbons

4.0 Management Limits

In addition to appropriate consideration and application of the human health and ecological criteria, 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.

Management limits are shown in Table 8. Clay and sand soils were encountered during the investigation and, so, management limits for fine and coarse soils have been adopted.

Table 8: Management Limits for TPH from NEPM (mg/kg)

Contaminant	Soil Type	Public Open Space Management Limits for Passive Open Space (mg/kg)	Commercial and Industrial Management Limit for Rail Corridor (mg/kg)
TPH C6-C10	Coarse	700	700
	Fine	800	800
TRH >C10-C16	Coarse	1000	1000
	Fine	1000	1000
TPH >C16-C34	Coarse	2500	3500
	Fine	3500	5000
TPH >C34-C40	Coarse	10 000	10 000
	Fine	10 000	10 000

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Appendix F

Site Assessment Criteria for Groundwater

Site Assessment Criteria for Groundwater for AEC31b

Surface & Civil Alignment Works (SCAW) Package for Sydney Metro - Western Sydney Airport (SMWSA)

1.0 Introduction

The following references were consulted for deriving 'Tier 1' SAC for groundwater:

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013).
- ANZG *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018).
- NHMRC *Guidelines for Managing Risks In Recreational Water* (NHMRC, 2008).
- NHMRC, NRMMC *Australian Drinking Water Guidelines 6 2011, Version 3.8, 2022* (NHMRC, NRMMC, 2022).
- ANZECC *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000).
- HEPA PFAS *National Environmental Management Plan* (NEMP) (HEPA, 2020).

2.0 Ecological Criteria

SAC for the protection of aquatic freshwater ecosystems which may receive groundwater from the site include:

- Default guideline values (DGV) recommended for the protection of slightly to moderately disturbed freshwater ecosystems (or otherwise for an unknown level of protection) from ANZG (2018) (Table 1).

It is noted that livestock at surrounding farmland could potentially be a receptor to discharged groundwater (as surface water) that was sourced from the site, however, water quality guidelines for livestock in ANZECC (2000) are generally less conservative than the DGV and have not been listed herein.

Table 1: Default Guideline Values for Protection of Aquatic Ecosystems from ANZG (2018)

Contaminant	Fresh Water DGV (µg/L)
Metals	
Arsenic (III)	24
Arsenic (V)	13
Cadmium	0.2 *
Chromium (III)	3.3 *

Contaminant	Fresh Water DGV (µg/L)
Chromium (VI)	1.0
Copper	1.4
Lead	3.4 *
Mercury (inorganic)	0.06
Nickel	11 *
Zinc	8 *
Aromatic Hydrocarbons (including BTEX)	
Benzene	950
Ethylbenzene	80
Toluene	180
m-Xylene	75
o-Xylene	350
p-Xylene	200
Isopropylbenzene	30
PAH	
Anthracene	0.01
Benzo(a)pyrene	0.1
Fluoranthene	1
Naphthalene	16
Phenanthrene	0.6
Phenols	
2,4-dinitrophenol	45
2,4-dimethylphenol	2
4-nitrophenol	58
Phenol	320
2,3,4,6-tetrachlorophenol	10
2,3,5,6-tetrachlorophenol	0.2
2,4,6-trichlorophenol	3
2,4-dichlorophenol	120
2,6-dichlorophenol	34
2-chlorophenol	340
Pentachlorophenol	3.6
OCP	
Aldrin	0.001
Chlordane	0.03
DDT	0.006
Dicofol	0.5

Contaminant	Fresh Water DGV (µg/L)
Dieldrin	0.01
Endosulfan	0.03
Endrin	0.01
Heptachlor	0.01
Lindane	0.2
Methoxychlor	0.005
Mirex	0.04
Toxaphene	0.1
Hexachlorobenzene	0.05
OPP	
Azinphos methyl	0.01
Chlorpyrifos	0.01
Diazinon	0.01
Dimethoate	0.15
Fenitrothion	0.2
Malathion	0.05
Parathion	0.004
PCB	
Aroclor 1242	0.3
Aroclor 1254	0.01
Ammonia	
Ammonia (as total ammonia nitrogen)	900
Other organics	
1,1,2-trichloroethane	6500
1,1-dichloroethene	700
1,2-dichloroethane	1900
1,2-dichloropropane	900
1,3-dichloropropane	1100
Carbon tetrachloride	240
Chloroform	370
Tetrachloroethene	70
Vinyl chloride	100
1,2,3-trichlorobenzene	3
1,2,4-trichlorobenzene	85
1,2-dichlorobenzene	160
1,3-dichlorobenzene	260
1,4-dichlorobenzene	60

Contaminant	Fresh Water DGV (µg/L)
Chlorobenzene	55
1,1,1-Trichloroethane	270
Trichloroethene	330
1,1,2,2-Tetrachloroethane	400
Carbon disulfide	20

Notes: * Can be modified for hardness

3.0 Human Health and Aesthetic Criteria

Human health-based SAC include:

- Health Screening Levels (HSL) for vapour intrusion for selected petroleum hydrocarbons and fractions (Tables 2 and 3). These are applicable for assessing human health via the inhalation pathway. HSL are shown for clay, given that clay is the predominant soil type. HSL D are applicable for areas to be covered by buildings (e.g., stations, offices and enclosed sheds);
- Health-based guidelines for recreational waters (Table 4). These are health-based criteria from NHMRC, NRMMC (2022) multiplied by 10 (to account for lower human consumption of recreational waters compared to drinking water); and
- Recreational water quality guideline values (Table 5) from NEMP.

Given that groundwater in the area is not used for drinking or domestic purposes (according to groundwater bore registered with Water NSW), health-based drinking water guidelines have not been adopted as SAC.

For the consideration of aesthetics of recreational waters, aesthetic guideline values from NHMRC, NRMMC (2022) have been included in Table 4.

Table 2: Groundwater Health Screening Levels for Vapour Intrusion from NEPM for Passive Open Space

Contaminant	HSL C (µg/L)	HSL C (µg/L)	HSL C (µg/L)
CLAY	**2 m to <4 m**	**4 m to <8 m**	**8 m+**
Benzene	NL	NL	NL
Toluene	NL	NL	NL
Ethylbenzene	NL	NL	NL
Xylenes	NL	NL	NL
Naphthalene	NL	NL	NL
TPH C6-C10 minus BTEX	NL	NL	NL
TPH >C10-C16 minus naphthalene	NL	NL	NL

Notes: 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 3: Groundwater Health Screening Levels for Vapour Intrusion from NEPM for Rail Corridor

Contaminant	HSL D (µg/L)	HSL D (µg/L)	HSL D (µg/L)
CLAY	**2 m to <4 m**	**4 m to <8 m**	**8 m+**
Benzene	30 000	30 000	35 000
Toluene	NL	NL	NL
Ethylbenzene	NL	NL	NL
Xylenes	NL	NL	NL
Naphthalene	NL	NL	NL
TPH C6-C10 minus BTEX	NL	NL	NL
TPH >C10-C16 minus naphthalene	NL	NL	NL

Notes: 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 4: Guidelines for Protection of Recreational Waters from NHMRC (2008) and NHMRC, NRMMC (2022)

Contaminant	Health-based Guideline Value (µg/L)	Aesthetic Guideline Value (µg/L)
Metals		
Arsenic	100	-
Cadmium	20	-
Chromium (VI)	500	-
Copper	20 000	1000
Lead	100	-
Mercury	10	-
Nickel	200	-
Zinc	-	3000
BTEX		
Benzene	10	-
Toluene	8000	25
Ethylbenzene	3000	3
Xylene (total)	6000	20
PAH		
Benzo(a)pyrene	0.1	-
OCP		
Aldrin + Dieldrin	3	-
Chlordane	20	-

Contaminant	Health-based Guideline Value (µg/L)	Aesthetic Guideline Value (µg/L)
DDT	90	-
Endosulfan	200	-
Lindane	100	-
Heptachlor	3	-
Methoxychlor	3000	
OPP		
Azinphos methyl	300	-
Bromophos-ethyl	100	-
Chlorfenvinphos	20	-
Chlorpyrifos	100	-
Diazinon	40	-
Dichlorvos	50	-
Dimethoate	70	-
Disulfoton	40	-
Ethion	40	-
Ethoprophos (Ethoprop)	10	-
Fenitrothion	70	-
Fensulfothion	100	-
Fenthion	70	-
Malathion	700	-
Methyl parathion	7	-
Mevinphos (Phosdrin)	50	-
Monocrotophos	20	-
Omethoate	10	-
Pyrazophos	200	-
Terbufos	9	-
Tetrachlorvinphos	1000	-
Parathion	200	-
Pirimiphos-methyl	900	-
Halogenated Phenols		
2,4,6-trichlorophenol	200	2
2,4-dichlorophenol	2000	0.3
2-chlorophenol	3000	0.1
Pentachlorophenol	100	-
Other Organics		
1,1-dichloroethene	300	-

Contaminant	Health-based Guideline Value (µg/L)	Aesthetic Guideline Value (µg/L)
1,2-dichloroethane	30	-
Carbon tetrachloride	30	-
Hexachlorobutadiene	7	-
Tetrachloroethene	500	-
Vinyl chloride	3	-
1,2-dichlorobenzene	15 000	1
1,3-dichlorobenzene	-	20
1,4-dichlorobenzene	400	0.3
Chlorobenzene	3000	10
Styrene	300	4
Trihalomethanes	2500	-
Trichlorobenzenes (total)	300	5
1,3-Dichloropropene	1000	-
1,2-Dichloroethene	600	-
Dichloromethane (methylene chloride)	40	-
Other inorganics		
Ammonia (as NH_3)	-	500

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Appendix G

Test Pit Logs and Borehole Logs

EXCAVATION - GEOLOGICAL LOG

PIT NO : AEC31BTP01
FILE / JOB NO : 204814.01
SHEET : 1 OF 1

PROJECT : Sydney Metro Western Sydney Airport - Surface and Civil Alignment Works
LOCATION : Lansdowne Road - Orchard Hills

POSITION : E: 292018.5, N: 6258272.6 (56 MGA2020)	SURFACE ELEVATION : 34.20 (mAHD)	
EQUIPMENT TYPE : 12 tonne Excavator	METHOD : 800mm bucket	
DATE EXCAVATED : 12/12/22	LOGGED BY : PJ	CHECKED BY : MB
EXCAVATION DIMENSIONS : 1.00 m LONG 0.80 m WIDE		

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO-METER 100 200 300 400	STRUCTURE & Other Observations
		Not Observed	ES 0.10m 0.20m ES 0.30m 0.50m ES 0.60m 0.90m ES 1.00m	0.0 0.5 1.0		CI-CH	0.10m FILL: sandy GRAVEL: dark grey-brown, fine to medium gravel, fine to coarse sand FILL: silty SAND: dark brown, fine to medium grained sand 0.40m Silty CLAY: medium to high plasticity, red-brown 1.00m EXCAVATION AEC31BTP01 TERMINATED AT 1.00 m Target depth	M M w~PL	St to VSt	× 0.50: HP =210 kPa × 0.90: HP =170 kPa	FILL 0.00: PID<5 0.20: PID<5 RESIDUAL SOIL 0.50: PID<5 0.90: PID<5

1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

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EXCAVATION - GEOLOGICAL LOG

PIT NO : AEC31BTP02
FILE / JOB NO : 204814.01
SHEET : 1 OF 1

PROJECT : Sydney Metro Western Sydney Airport - Surface and Civil Alignment Works
LOCATION : Lansdowne Road - Orchard Hills

POSITION : E: 291992.6, N: 6258278.1 (56 MGA2020)	SURFACE ELEVATION : 34.30 (mAHD)	
EQUIPMENT TYPE : 12 tonne Excavator	METHOD : 800mm bucket	
DATE EXCAVATED : 09/12/22	LOGGED BY : PJ	CHECKED BY : MB
EXCAVATION DIMENSIONS : 1.00 m LONG 0.80 m WIDE		

DRILLING | MATERIAL

VE / PENETRATION (E, F, H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETRO-METER (100, 200, 300, 400)	STRUCTURE & Other Observations
		Not Observed	ES 0.10m	0.0			FILL: silty SAND: dark brown, fine to medium grained sand, trace rootlets, trace irrigation hose	M			FILL 0.00: PID<5
							0.30m				
			0.40m ES 0.50m	0.5		CI-CH	Silty CLAY: medium to high plasticity, red-brown, trace fine to medium ironstone gravel	w~PL	St to VSt	×	RESIDUAL SOIL 0.40: HP =200 kPa 0.40: PID<5
			0.90m ES 1.00m	1.0			1.00m EXCAVATION AEC31BTP02 TERMINATED AT 1.00 m Target depth			×	0.90: HP =180 kPa 0.90: PID<5
				1.5							
				2.0							
				2.5							
				3.0							
				3.5							
				4.0							
				4.5							
				5.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE, E, F, H, VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

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EXCAVATION - GEOLOGICAL LOG

PIT NO : AEC31BTP03
FILE / JOB NO : 204814.01
SHEET : 1 OF 1

PROJECT : Sydney Metro Western Sydney Airport - Surface and Civil Alignment Works
LOCATION : Lansdowne Road - Orchard Hills

POSITION : E: 291987.5, N: 6258293.4 (56 MGA2020)	SURFACE ELEVATION : 34.40 (mAHD)	
EQUIPMENT TYPE : 12 tonne Excavator	METHOD : 800mm bucket	
DATE EXCAVATED : 09/12/22	LOGGED BY : PJ	CHECKED BY : MB
EXCAVATION DIMENSIONS : 1.00 m LONG 0.80 m WIDE		

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO-METER 100 200 300 400	STRUCTURE & Other Observations
		Not Observed	ES 0.10m	0.0			FILL: silty SAND: dark brown, fine to medium grained sand, trace rootlets	M			FILL 0.00: PID<5
			0.30m ES 0.40m				0.25m Silty CLAY: medium to high plasticity, red-brown, trace fine to medium ironstone gravel			×	RESIDUAL SOIL 0.30: HP =180 kPa 0.30: PID<5
			0.80m ES 0.90m	0.5		CI-CH		w~PL	St to VSt	×	0.80: HP =200 kPa 0.80: PID<5
				1.0			1.20m At 1.1m: mottled pale grey EXCAVATION AEC31BTP03 TERMINATED AT 1.20 m Target depth				
				1.5							
				2.0							
				2.5							
				3.0							
				3.5							
				4.0							
				4.5							
				5.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

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EXCAVATION - GEOLOGICAL LOG

PIT NO : AEC31BTP04
FILE / JOB NO : 204814.01
SHEET : 1 OF 1

PROJECT : Sydney Metro Western Sydney Airport - Surface and Civil Alignment Works
LOCATION : Lansdowne Road - Orchard Hills

POSITION : E: 292000.6, N: 6258295.6 (56 MGA2020)	SURFACE ELEVATION : 34.10 (mAHD)	
EQUIPMENT TYPE : 12 tonne Excavator	METHOD : 800mm bucket	
DATE EXCAVATED : 09/12/22	LOGGED BY : PJ	CHECKED BY : MB
EXCAVATION DIMENSIONS : 1.00 m LONG 0.80 m WIDE		

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO-METER kPa 100 200 300 400	STRUCTURE & Other Observations
		Not Observed	ES 0.10m	0.0			FILL: sandy GRAVEL: dark grey to grey, fine to medium gravel, fine to coarse sand, trace concrete	M			FILL 0.00: PID<5
			0.30m ES 0.40m	0.20m			Silty CLAY: medium to high plasticity, red-brown, trace fine to medium ironstone gravel			×	RESIDUAL SOIL 0.30: HP =180 kPa 0.30: PID<5
			0.70m ES 0.80m	0.5		CI-CH		w~PL	St	×	0.70: HP =160 kPa 0.70: PID<5
				0.80m			EXCAVATION AEC31BTP04 TERMINATED AT 0.80 m Target depth				
				1.0							
				1.5							
				2.0							
				2.5							
				3.0							
				3.5							
				4.0							
				4.5							
				5.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

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EXCAVATION - GEOLOGICAL LOG

PIT NO : AEC31BTP05
FILE / JOB NO : 204814.01
SHEET : 1 OF 1

PROJECT : Sydney Metro Western Sydney Airport - Surface and Civil Alignment Works
LOCATION : Lansdowne Road - Orchard Hills

POSITION : E: 292015.6, N: 6258285.2 (56 MGA2020)	SURFACE ELEVATION : 34.20 (mAHD)	
EQUIPMENT TYPE : 12 tonne Excavator	METHOD : 800mm bucket	
DATE EXCAVATED : 12/12/22	LOGGED BY : PJ	CHECKED BY : MB
EXCAVATION DIMENSIONS : 1.00 m LONG 0.80 m WIDE		

DRILLING | MATERIAL

PENETRATION (VE / E / F / H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO-METER (100 / 200 / 300 / 400)	STRUCTURE & Other Observations
		Not Observed	ES 0.10m	0.0			FILL: silty SAND: dark grey, fine to medium grained sand, trace rootlets, with fine to medium gravel	M			FILL 0.00: PID<5
			0.30m ES 0.40m				0.25m Silty CLAY: medium to high plasticity, red-brown, trace fine to medium ironstone gravel			×	Field Replicate BD1/20221212 taken at 0.0-0.1m depth RESIDUAL SOIL 0.30: HP =180 kPa 0.30: PID<5
				0.5		CI-CH		w~PL	St		
			0.80m ES 0.90m				0.90m			×	0.80: HP =170 kPa 0.80: PID<5
				1.0			EXCAVATION AEC31BTP05 TERMINATED AT 0.90 m Target depth				
				1.5							
				2.0							
				2.5							
				3.0							
				3.5							
				4.0							
				4.5							
				5.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

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EXCAVATION - GEOLOGICAL LOG

PIT NO : AEC31BTP06
FILE / JOB NO : 204814.01
SHEET : 1 OF 1

PROJECT : Sydney Metro Western Sydney Airport - Surface and Civil Alignment Works
LOCATION : Lansdowne Road - Orchard Hills

POSITION : E: 292031.9, N: 6258296.2 (56 MGA2020)	SURFACE ELEVATION : 33.60 (mAHD)	
EQUIPMENT TYPE : 12 tonne Excavator	METHOD : 800mm bucket	
DATE EXCAVATED : 12/12/22	LOGGED BY : PJ	CHECKED BY : MB
EXCAVATION DIMENSIONS : 1.00 m LONG 0.80 m WIDE		

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO-METER kPa 100 200 300 400	STRUCTURE & Other Observations
		Not Observed	ES 0.10m	0.0			FILL: silty SAND: brown, fine to medium grained sand, trace rootlets	M			FILL 0.00: PID<5
			0.50m ES 0.60m	0.5							0.50: PID<5
			0.80m ES 0.90m				0.70m Silty CLAY: medium to high plasticity, red-brown, trace fine to medium ironstone gravel	w~PL	St	×	RESIDUAL SOIL 0.80: HP =140 kPa 0.80: PID<5
			1.10m ES 1.20m	1.0		CI-CH	1.20m EXCAVATION AEC31BTP06 TERMINATED AT 1.20 m Target depth			×	1.10: HP =160 kPa 1.10: PID<5
				1.5							
				2.0							
				2.5							
				3.0							
				3.5							
				4.0							
				4.5							
				5.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

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EXCAVATION - GEOLOGICAL LOG

PIT NO : AEC31BTP07
FILE / JOB NO : 204814.01
SHEET : 1 OF 1

PROJECT : Sydney Metro Western Sydney Airport - Surface and Civil Alignment Works
LOCATION : Lansdowne Road - Orchard Hills

POSITION : E: 292016.0, N: 6258309.7 (56 MGA2020)	SURFACE ELEVATION : 33.60 (mAHD)	
EQUIPMENT TYPE : 12 tonne Excavator	METHOD : 800mm bucket	
DATE EXCAVATED : 09/12/22	LOGGED BY : PJ	CHECKED BY : MB
EXCAVATION DIMENSIONS : 1.00 m LONG 0.80 m WIDE		

DRILLING | MATERIAL

PENETRATION (VE / E / F / H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO-METER (100 / 200 / 300 / 400)	STRUCTURE & Other Observations
		Not Observed	ES 0.10m	0.0			FILL: sandy GRAVEL: grey, fine to medium gravel, sub-angular to angular, fine to coarse sand	M			FILL 0.00: PID<5
			0.30m ES 0.40m	0.25			Silty CLAY: medium to high plasticity, red-brown, trace fine to medium ironstone gravel			×	Field Replicate BD6/20221209 taken at 0.0-0.1m depth RESIDUAL SOIL 0.30: HP =170 kPa 0.30: PID<5
			0.80m ES 0.90m	0.5		CI-CH		w~PL	St	×	0.80: HP =170 kPa 0.80: PID<5
				0.90			EXCAVATION AEC31BTP07 TERMINATED AT 0.90 m Target depth				
				1.0							
				1.5							
				2.0							
				2.5							
				3.0							
				3.5							
				4.0							
				4.5							
				5.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

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EXCAVATION - GEOLOGICAL LOG

PIT NO : AEC31BTP08
FILE / JOB NO : 204814.01
SHEET : 1 OF 1

PROJECT : Sydney Metro Western Sydney Airport - Surface and Civil Alignment Works
LOCATION : Lansdowne Road - Orchard Hills

POSITION : E: 292000.2, N: 6258316.7 (56 MGA2020)	SURFACE ELEVATION : 33.70 (mAHD)	
EQUIPMENT TYPE : 12 tonne Excavator	METHOD : 800mm bucket	
DATE EXCAVATED : 12/12/22	LOGGED BY : PJ	CHECKED BY : MB
EXCAVATION DIMENSIONS : 1.00 m LONG 0.80 m WIDE		

DRILLING | MATERIAL

PENETRATION (VE, E, F, H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO-METER (100, 200, 300, 400 kPa)	STRUCTURE & Other Observations
		Not Observed	ES 0.10m	0.0			FILL: silty SAND: brown, fine to medium grained sand, trace rootlets	M			FILL 0.00: PID<5
			0.20m				0.15m				
			ES 0.30m	0.5		CI-CH	Silty CLAY: medium to high plasticity, red-brown, trace fine to medium ironstone gravel	w<PL	St to VSt	×	Field Replicate BD2/20221212 taken at 0.0-0.1m depth RESIDUAL SOIL 0.20: HP =210 kPa 0.20: PID<5
			0.70m ES 0.80m				0.80m EXCAVATION AEC31BTP08 TERMINATED AT 0.80 m Target depth			×	0.70: HP =200 kPa 0.70: PID<5
				1.0							
				1.5							
				2.0							
				2.5							
				3.0							
				3.5							
				4.0							
				4.5							
				5.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

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PIEZOMETER CONSTRUCTION

HOLE NO : AEC31B-BH01
FILE / JOB NO : 204814.01
SHEET : 1 OF 1

PROJECT : Sydney Metro Western Sydney Airport - Surface and Civil Alignment Works
LOCATION : Lansdowne Road - Orchard Hills

POSITION : E: 291981.6, N: 6258285.9 (56 MGA2020) SURFACE ELEVATION : 34.70 (mAHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hanjin 8D MOUNTING : Track CONTRACTOR : Rockwell

DATE STARTED : 01/02/23 DATE COMPLETED : 01/02/23 DATE LOGGED : 01/02/23 LOGGED BY : JS CHECKED BY : MB

DRILLING				MATERIAL			PIEZOMETER CONSTRUCTION DETAILS
PROGRESS: DRILLING & CASING	PROGRESS: WATER LOSS	GROUND WATER LEVELS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL (See geotechnical log for soil/rock detail)	
AD/T		13/02/23	0.0		CI-CL	0.10m Silty CLAY: low to medium plasticity, brown, with rootlets and grass cover	
					CI-CH	Silty CLAY: medium to high plasticity, brown, trace fine ironstone gravel	
						0.80m	
					CI-CH	Silty CLAY: medium to high plasticity, brown mottled pale grey and red-brown, with fine to medium ironstone gravel	
						1.20m	
			2.0		CI-CH	Silty CLAY: medium to high plasticity, pale grey, brown and red-brown	
						3.00m	
					CI-CH	Silty CLAY: medium to high plasticity, pale brown	
			4.0			4.00m	
					CI-CH	Silty CLAY: medium to high plasticity, pale grey	
						5.00m	
			6.0			SILTSTONE: grey, dark grey and brown, apparently very low then low strength	
						7.50m	
			8.0			SILTSTONE: dark grey and grey, interbedded and interlaminated with fine grained, pale grey sandstone, apparently medium, medium to high and high strength	
			10.0			11.00m	
						AEC31B-BH01 TERMINATED AT 11.00 m Target depth	
			12.0				
			14.0				

ID 1 — Type: Standpipe Piezometer — Stick Up & RL: 1.00 m 33.70 m mAHD — Tip Depth & RL: 11.00 m 23.70 mAHD — Installation Date — Static Water Level

Backfill
5.00m (29.70)
Solid PVC Casing
Bentonite Plug
7.00m (27.70)
5mm Gravel
Slotted PVC Pipe
11.00m (23.70)
End Cap

This report of well/VWP installation must be read in conjunction with accompanying notes and abbreviations. The geotechnical log is a summary only and the detailed log should be referred to for strata details and any core loss zones.

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PIEZOMETER CONSTRUCTION

HOLE NO : AEC31B-BH02

PROJECT : Sydney Metro Western Sydney Airport - Surface and Civil Alignment Works
LOCATION : Lansdowne Road - Orchard Hills

FILE / JOB NO : 204814.01
SHEET : 1 OF 1

POSITION : E: 292011.1, N: 6258310.0 (56 MGA2020) SURFACE ELEVATION : 33.60 (mAHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hanjin 8D MOUNTING : Track CONTRACTOR : Rockwell

DATE STARTED : 01/02/23 DATE COMPLETED : 01/02/23 DATE LOGGED : 01/02/23 LOGGED BY : JS CHECKED BY : MB

DRILLING				MATERIAL			PIEZOMETER CONSTRUCTION DETAILS
PROGRESS: DRILLING & CASING	PROGRESS: WATER LOSS	GROUND WATER LEVELS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL (See geotechnical log for soil/rock detail)	
AD/T		13/02/23 ▽	0.0			0.30m FILL: silty CLAY: medium to high plasticity, dark brown, with fine to coarse igneous gravel, with fine to medium igneous gravel cover (approximately 30mm)	ID 1 Type Standpipe Piezometer Stick Up & RL 0.50 m 33.10 m mAHD Tip Depth & RL 11.50 m 22.10 mAHD Installation Date Static Water Level
						0.70m FILL: silty CLAY: medium to high plasticity, brown, (possibly natural)	
					CI-CH	Silty CLAY: medium to high plasticity, brown mottled pale grey and red-brown	
						1.50m Silty CLAY: medium to high plasticity, pale grey mottled brown and red-brown	
			2.0		CI-CH		
						3.00m Silty CLAY: medium to high plasticity, pale grey and brown	
					CI-CH		
			4.0			4.50m SILTSTONE: grey, dark grey and brown, apparently very low and low strength	
			6.0			6.50m SILTSTONE: dark grey and grey, interbedded and interlaminated with fine grained, pale grey sandstone beds and laminations, apparently medium, medium to high and high strength	
			8.0				
			10.0			11.50m AEC31B-BH02 TERMINATED AT 11.50 m Target depth	
			12.0				
			14.0				

Backfill
5.50m (28.10)
Solid PVC Casing
Bentonite Plug
7.50m (26.10)
5mm Gravel
Slotted PVC Pipe
11.50m (22.10)
End Cap

This report of well/VWP installation must be read in conjunction with accompanying notes and abbreviations. The geotechnical log is a summary only and the detailed log should be referred to for strata details and any core loss zones.

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PIEZOMETER CONSTRUCTION

HOLE NO : AEC31B-BH03

PROJECT : Sydney Metro Western Sydney Airport - Surface and Civil Alignment Works
LOCATION : Lansdowne Road - Orchard Hills

FILE / JOB NO : 204814.01
SHEET : 1 OF 1

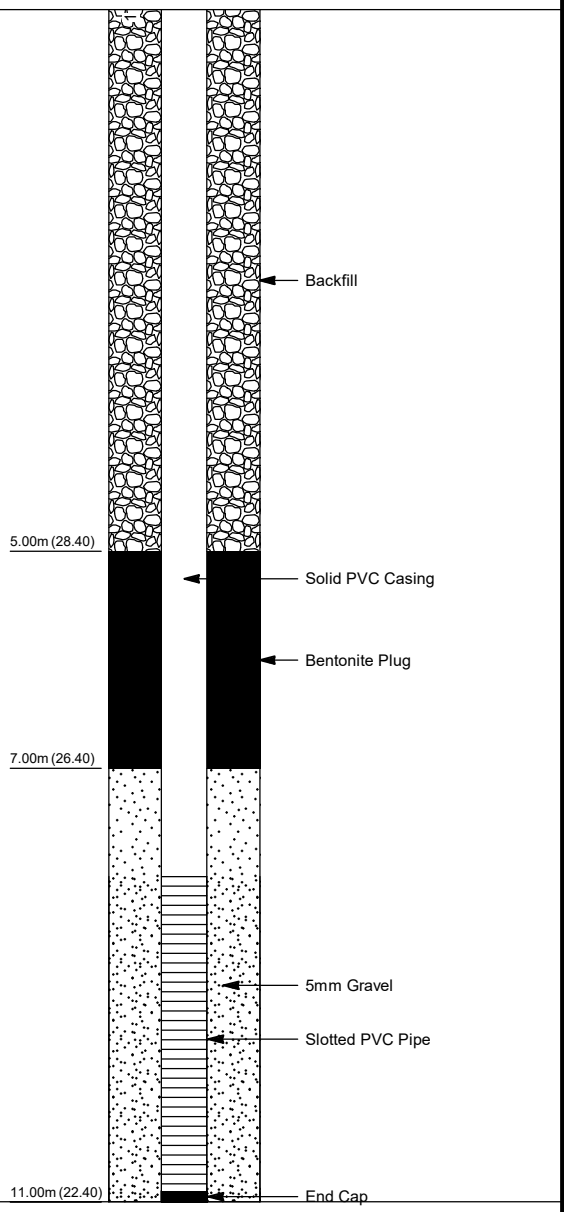
POSITION : E: 292039.3, N: 6258298.2 (56 MGA2020) SURFACE ELEVATION : 33.40 (mAHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hanjin 8D MOUNTING : Track CONTRACTOR : Rockwell

DATE STARTED : 01/02/23 DATE COMPLETED : 01/02/23 DATE LOGGED : 01/02/23 LOGGED BY : JS CHECKED BY : MB

DRILLING				MATERIAL			PIEZOMETER CONSTRUCTION DETAILS
PROGRESS: DRILLING & CASING	PROGRESS: WATER LOSS	GROUND WATER LEVELS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL (See geotechnical log for soil/rock detail)	
AD/T		13/02/23	0.0			0.20m FILL: silty CLAY: medium to high plasticity, brown, with rootlets and grass cover	
						FILL: silty CLAY: medium to high plasticity, brown and grey, with fine to medium ironstone gravel	
						1.00m Silty CLAY: medium to high plasticity, brown pale grey and red-brown, with fine to medium ironstone gravel	
			2.0		CI-CH		
						2.50m Silty CLAY: medium to high plasticity, pale grey and pale brown	
					CI-CH		
						3.50m Silty CLAY: medium to high plasticity, pale grey	
			4.0		CI-CH		
						5.00m SILTSTONE: grey and brown, apparently very low then low strength	
			6.0			6.00m SILTSTONE: dark grey and grey, interbedded and interlaminated with fine grained, pale grey sandstone, apparently medium, medium to high and high strength	
			8.0				
			10.0			AEC31B-BH03 TERMINATED AT 11.00 m Target depth	
			12.0				
			14.0				

ID 1 — Type: Standpipe Piezometer — Stick Up & RL: 1.00 m 32.40 m mAHD — Tip Depth & RL: 11.00 m 22.40 mAHD — Installation Date — Static Water Level



This report of well/VWP installation must be read in conjunction with accompanying notes and abbreviations. The geotechnical log is a summary only and the detailed log should be referred to for strata details and any core loss zones.

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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

Douglas Partners

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

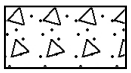
Symbols & Abbreviations

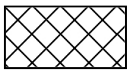
Graphic Symbols for Soil and Rock

General


Asphalt


Road base

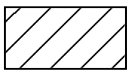

Concrete

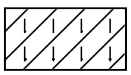

Filling

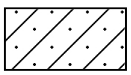
Soils


Topsoil

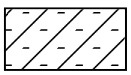

Peat

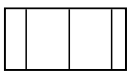

Clay

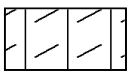

Silty clay

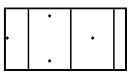

Sandy clay

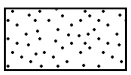

Gravelly clay

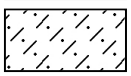

Shaly clay

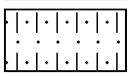

Silt


Clayey silt


Sandy silt

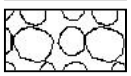

Sand

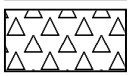

Clayey sand


Silty sand


Gravel

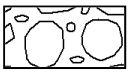

Sandy gravel


Cobbles, boulders

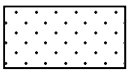

Talus

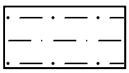
Sedimentary Rocks

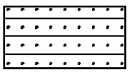

Boulder conglomerate

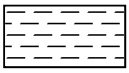

Conglomerate


Conglomeratic sandstone

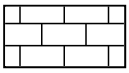

Sandstone


Siltstone

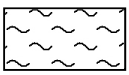

Laminite

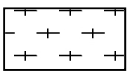

Mudstone, claystone, shale


Coal


Limestone

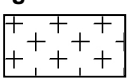
Metamorphic Rocks

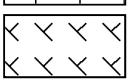

Slate, phyllite, schist

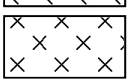

Gneiss

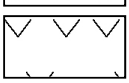

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Appendix H

Field Sheets and Calibration Certificates

Douglas Partners
Geotechnics / Environment / Groundwater

Groundwater Field Sheet

Project and Bore Installation Details	
Bore / Standpipe ID:	AEC31BBH01
Project Name:	SEAW
Project Number:	204814.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	

Bore Development Details	
Date/Time:	7/12/23
Purged By:	RS
GW Level (pre-purge):	6.83 m bgl
Observed Well Depth:	11.20 m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Estimated Bore Volume:	9 L
Total Volume Purged:	40 L (target: no drill mud, min 3 well vol. or dry)
GW Level (post-purge):	DRY m bgl
Equipment:	Twister Pump

100

Micropurge and Sampling Details	
783 Date/Time:	13/12/23
Sampled By:	RJ
1220 Weather Conditions:	Cloudy
GW Level (pre-purge):	5.75 m bgl
Observed Well Depth:	11.20 m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Estimated Bore Volume:	11 L
GW Level (post sample):	7.52 m bgl
Total Volume Purged:	7 L
Equipment:	Peri Pump

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	0.1°C	+/- 0.3 mg/L	+/- 3%	+/- 0.1	+/- 10%	+/- 10 mV
	21.3	4.18	29406	6.82		4.4
	20.6	3.10	28670	6.73		25.9
	20.3	2.54	28434	6.68		38.2
	20.1	2.29	28282	6.66		42.7
	20.1	2.26	28262	6.66		49.5
	20.1	2.65	28202	6.66		53.2
	20.1	2.65	28222	6.66		54.3

Additional Readings Following stabilisation:	DO % Sat	SPC	TDS
	24.2	21170	13758

Sample Details

Sampling Depth (rationale):	8 m bgl.	Mid Screen
Sample Appearance (e.g. colour, siltiness, odour):	Clear/transparent, [redacted], low turbidity, no odour	
Sample ID:	AEC31BBH01	
QA/QC Samples:	[redacted]	
Sampling Containers and filtration:		
Comments / Observations:	Development: Brown, cloudy, mod. turbidity, no odour	

Douglas Partners
Geotechnics / Environment / Groundwater

Groundwater Field Sheet

Project and Bore Installation Details	
Bore / Standpipe ID:	HEL31BBH02
Project Name:	SCAD
Project Number:	104314.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	

Bore Development Details	
Date/Time:	7/2/23
Purged By:	RT
GW Level (pre-purge):	7.28 m bgl
Observed Well Depth:	9.56 m bgl
PSH observed:	Yes / (No) / interface / visual). Thickness if observed:
Estimated Bore Volume:	5 L
Total Volume Purged:	20L (target: no drill mud, min 3 well vol. or dry)
GW Level (post-purge):	DRY m bgl
Equipment:	Twisted Pump

Micropurge and Sampling Details	
Date/Time:	13/2/23
Sampled By:	RT
Weather Conditions:	Cloudy
GW Level (pre-purge):	7.92 m bgl
Observed Well Depth:	9.56 m bgl
PSH observed:	Yes / (No) / interface / visual). Thickness if observed:
Estimated Bore Volume:	11 L
GW Level (post sample):	7.26 m bgl
Total Volume Purged:	11 L
Equipment:	Peri Pump

9.9
7.16
1604

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	0.1°C	+/- 0.3 mg/L	+/- 3%	+/- 0.1	+/- 10%	+/- 10 mV
	22.2	1.27	36605	6.73		-130.7
	21.7	0.88	36004	6.68		-135.2
	21.5	0.56	35714	6.65		-140.3
	21.5	0.47	35681	6.64		-141.7
	21.6	0.40	35608	6.64		-142.0
	21.6	0.40	35406	6.64		-141.9
	21.6	0.40	35402	6.64		-141.8
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			
	3.9	26360	17156			

Sample Details

Sampling Depth (rationale):	8	m bgl,	Mid screen
Sample Appearance (e.g. colour, siltiness, odour):	Brown, silty, high turbidity, no odour		
Sample ID:	HEL31BBH02		
QA/QC Samples:	BD4/20230213		
Sampling Containers and filtration:			
Comments / Observations:	Development: D - Brown, very silty, no odour, high turbid		

Douglas Partners
Geotechnics / Environment / Groundwater

Groundwater Field Sheet

Project and Bore Installation Details	
Bore / Standpipe ID:	AEC31BBH03
Project Name:	SCAU
Project Number:	204814.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	

Bore Development Details	
Date/Time:	7/2/23
Purged By:	AS
GW Level (pre-purge):	5.64 m bgl
Observed Well Depth:	11.32 m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Estimated Bore Volume:	11 L
Total Volume Purged:	40L (target: no drill mud, min 3 well vol. or dry)
GW Level (post-purge):	DRY m bgl
Equipment:	Twister Pump

Micropurge and Sampling Details	
Date/Time:	13/2/23
Sampled By:	FT
Weather Conditions:	Cloudy
GW Level (pre-purge):	5.54 m bgl
Observed Well Depth:	11.32 m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Estimated Bore Volume:	11.5 L
GW Level (post sample):	8.29 m bgl
Total Volume Purged:	11 L
Equipment:	Peri Pump

BF
649
126

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	0.1°C	+/- 0.3 mg/L	+/- 3%	+/- 0.1	+/- 10%	+/- 10 mV
	19.0	4.95	31753	6.63		148.8
	19.1	4.81	31663	6.62		150.2
	18.8	4.75	31480	6.61		151.9
	18.6	4.70	31401	6.60		153.0
	18.6	4.66	31360	6.59		154.0
	18.6	4.66	31344	6.59		154.9
	18.6	4.66	31329	6.59		155.9

Additional Readings Following stabilisation:	DO % Sat	SPC	TDS
	56.4	24079	15651

Sample Details

Sampling Depth (rationale):	10 m bgl, Mid screen
Sample Appearance (e.g. colour, siltiness, odour):	clear / transparent, cloudy, low turbidity, no odour
Sample ID:	AEC31BBH03
QA/QC Samples:	BD3/20230213
Sampling Containers and filtration:	
Comments / Observations:	development: pale brown, cloudy, slightly turbid, no odour

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RECORD OF ASBESTOS SAMPLES

Project: WSA SCAW Tender Design	**Project Number:** 204814.01
Client: CPB Contractors Pty Limited & United Infrastructure Pty Limited (CPBUIJV)	**Date:** 9/12/22 & 12/12/22
Location: Elizabeth Drive, Luddenham	**Field Staff:** PJ

Sample ID	Sample Type	Sample Depth (m)	Weight of 10 L Bulk Sample (g)	Number of Fragments >7 mm	Condition of Fragments (good/ poor)	Size range of fragments (mm)	Weight of ACM and FA collected (g)
AEL31BTP02	Soil	0.0-0.1	14911	-	-	-	-
AEL31BSP1A	Soil	0.3	13867	-	-	-	-
AEL31BSP1B	Soil	0.3	15903	-	-	-	-

PID Calibration Certificate

Instrument PhoCheck Tiger
Serial No. T-108801

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments			
Battery	Charge Condition	✓				
	Fuses	✓				
	Capacity	✓				
	Recharge OK?	✓				
Switch/keypad	Operation	✓				
Display	Intensity	✓				
	Operation (segments)	✓				
Grill Filter	Condition	✓				
	Seal	✓				
Pump	Operation	✓				
	Filter	✓				
	Flow	✓				
	Valves, Diaphragm	✓				
PCB	Condition	✓				
Connectors	Condition	✓				
Sensor	PID	✓	10.6 ev			
Alarms	Beeper	✓	Low	High	TWA	STEL
	Settings	✓	50ppm	100ppm		
Software	Version	✓				
Data logger	Operation	✓				
Download	Operation	✓				
Other tests:						

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Calibration gas and concentration	Certified	Gas bottle No		Instrument Reading
PID Lamp		94ppm Isobutylene	NATA	SY506		94.3ppm

Calibrated by: Alex Buist

Calibration date: 4/11/2022

Next calibration due: 6/05/2023

Multi Parameter Water Meter

Instrument **YSI Pro DSS**
Serial No. **21K104037**

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
	Recharge OK?	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH/ORP	✓	
	2. Turbidity	✓	
	3. Conductivity	✓	
	4. D.O	✓	
	5. Temp	✓	
	6. Depth	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. EC		2.76mS		396172	2.763mS
2. Temp		22.7°C		Instrument temp	23.0°C
3. pH 4		pH 4.00		399527	pH 4.03
4. pH 7		pH 7.00		386467	pH 6.98
5. DO		0%		396172	0.4%
6.Turbidity		100 NTU		396421	100.43 NTU
7. mV		234.72mV		395557/395763	234.8mV

Calibrated by: **Lebelle Chee**

Calibration date: **30/01/2023**

Next calibration due: **1/03/2023**

Appendix I

Summary of Analytical Results

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Table I1: Summary of Laboratory Results for Soil – Metals, TRH, BTEX, PAH

				Metals								TRH						BTEX				PAH			
				Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	TRH C6 - C10	TRH >C10-C16	TRH C6-C10 less BTEX	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene [b]	Benzo(a)pyrene (BaP)	Benzo(a)pyrene TEQ	Total PAHs
Sample ID	Depth	Sample type	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
AEC31BTP01	0 - 0.1 m	Fill	12/12/2022	4	<0.4	54	16	17	<0.1	10	36	<25	<50	<25	<50	160	220	<0.2	<0.5	<1	<1	<0.1	0.2	<0.5	1.8
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	260 180	NL -	- 300	- 2800	3 50	NL 85	NL 70	230 105	NL 170	- 0.7	3 -	300 -
AEC31BTP01	0.2 - 0.3 m	Fill	12/12/2022	7	<0.4	62	6	22	<0.1	4	11	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	260 180	NL -	- 300	- 2800	3 50	NL 85	NL 70	230 105	NL 170	- 0.7	3 -	300 -
AEC31BTP01	0.5 - 0.6 m	Natural	12/12/2022	6	<0.4	40	8	17	<0.1	7	7	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	310 180	NL -	- 1300	- 5600	4 65	NL 105	NL 125	NL 45	NL 170	- 0.7	3 -	300 -
AEC31BTP02	0 - 0.1 m	Fill	9/12/22	6	<0.4	55	3	17	<0.1	4	7	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	260 180	NL -	- 300	- 2800	3 50	NL 85	NL 70	230 105	NL 170	- 0.7	3 -	300 -
AEC31BTP02	0.4 - 0.5 m	Natural	9/12/22	7	<0.4	59	6	17	<0.1	6	8	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	310 180	NL -	- 1300	- 5600	4 65	NL 105	NL 125	NL 45	NL 170	- 0.7	3 -	300 -
AEC31BTP03	0 - 0.1 m	Fill	9/12/22	8	<0.4	53	5	19	<0.1	5	13	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	260 180	NL -	- 300	- 2800	3 50	NL 85	NL 70	230 105	NL 170	- 0.7	3 -	300 -
AEC31BTP04	0 - 0.1 m	Fill	9/12/22	7	<0.4	57	12	20	<0.1	9	23	<25	<50	<25	<50	140	110	<0.2	<0.5	<1	<1	<0.1	0.2	<0.5	1.4
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	310 180	NL -	- 1300	- 5600	4 65	NL 105	NL 125	NL 45	NL 170	- 0.7	3 -	300 -
AEC31BTP05	0 - 0.1 m	Fill	12/12/2022	6	<0.4	45	5	20	<0.1	3	10	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	260 180	NL -	- 300	- 2800	3 50	NL 85	NL 70	230 105	NL 170	- 0.7	3 -	300 -
BD1/20221212	0 - 0.1 m	Fill	12/12/2022	7	<0.4	49	6	20	<0.1	4	11	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	260 180	NL -	- 300	- 2800	3 50	NL 85	NL 70	230 105	NL 170	- 0.7	3 -	300 -
AEC31BTP06	0 - 0.1 m	Fill	12/12/2022	5	<0.4	35	5	20	<0.1	3	7	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	260 180	NL -	- 300	- 2800	3 50	NL 85	NL 70	230 105	NL 170	- 0.7	3 -	300 -
AEC31BTP06	0.5 - 0.6 m	Fill	12/12/2022	5	<0.4	36	4	18	<0.1	2	4	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	260 180	NL -	- 300	- 2800	3 50	NL 85	NL 70	230 105	NL 170	- 0.7	3 -	300 -
AEC31BTP07	0 - 0.1 m	Fill	9/12/22	<4	<0.4	20	53	11	<0.1	13	28	<25	<50	<25	<50	160	220	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	260 180	NL -	- 300	- 2800	3 50	NL 85	NL 70	230 105	NL 170	- 0.7	3 -	300 -
BD6/20221209	0 - 0.1 m	Fill	9/12/2022	6.1	<0.4	28	55	21	<0.1	11	44	<20	<50	<20	<50	150	190	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	<0.5
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	260 180	NL -	- 300	- 2800	3 50	NL 85	NL 70	230 105	NL 170	- 0.7	3 -	300 -
AEC31BTP07	0.3 - 0.4 m	Natural	9/12/22	5	<0.4	32	9	13	<0.1	6	5	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	310 180	NL -	- 1300	- 5600	4 65	NL 105	NL 125	NL 45	NL 170	- 0.7	3 -	300 -
AEC31BTP08	0 - 0.1 m	Fill	12/12/2022	6	<0.4	38	7	16	<0.1	4	9	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	260 180	NL -	- 300	- 2800	3 50	NL 85	NL 70	230 105	NL 170	- 0.7	3 -	300 -
AEC31BTP08	0.2 - 0.3 m	Natural	12/12/2022	9	<0.4	34	14	19	<0.1	4	7	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	310 180	NL -	- 1300	- 5600	4 65	NL 105	NL 125	NL 45	NL 170	- 0.7	3 -	300 -
AEC31BSP1A		Stockpile	12/12/2022	7	<0.4	30	11	15	<0.1	5	19	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	310 180	NL -	- 1300	- 5600	4 65	NL 105	NL 125	NL 45	NL 170	- 0.7	3 -	300 -
AEC31BSP1B		Stockpile	12/12/2022	7	<0.4	43	12	17	<0.1	5	33	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	310 180	NL -	- 1300	- 5600	4 65	NL 105	NL 125	NL 45	NL 170	- 0.7	3 -	300 -
AEC31BSP1C		Stockpile	17/01/2023	7	<0.4	39	18	18	<0.1	5	34	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	310 180	NL -	- 1300	- 5600	4 65	NL 105	NL 125	NL 45	NL 170	- 0.7	3 -	300 -
BD2/20230117		Stockpile	17/01/2023	13	<0.4	67	19	25	<0.1	6.6	49	<20	<50	<20	<50	<100	<100	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	<0.5
				300 100	90 -	300 190	17000 210	600 1100	80 -	1200 160	30000 470	- -	- 120	310 180	NL -	- 1300	- 5600	4 65	NL 105	NL 125	NL 45	NL 170	- 0.7	3 -	300 -

Lab result

HIL/HSL value EIL/ESL value

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

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

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

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

Notes: QA/QC replicate of sample listed directly below the primary sample

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Table I1 (continued): Summary of Laboratory Results for Soil – Phenols, OCP, OPP, PCB, Asbestos

				Phenols					OCP										OPP		PCB	Asbestos		
				Toatl Phenols	Pentachlorophenol	Cresols	Phenol	Other phenols	DDT+DDE+DDD [c]	DDT	Aldrin & Dieldrin	Total Chlordane	Endrin	Total Endosulfan	Heptachlor	Hexachlorobenzene	Methoxychlor	Other OCP	Chlorpyriphos	Other OPP	Total PCB	Asbestos ID in soil >0.1g/kg	Trace Analysis	FA and AF Estimation
Sample ID	Depth	Sample type	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	-	-	%(w/w)
AEC31BTP01	0 - 0.1 m	Fill	12/12/2022	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	NAD	<0.001
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP01	0.2 - 0.3 m	Fill	12/12/2022	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	NAD	<0.001
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP01	0.5 - 0.6 m	Natural	12/12/2022	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	-	-	-
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP02	0 - 0.1 m	Fill	9/12/22	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	NAD	<0.001
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP02	0.4 - 0.5 m	Natural	9/12/22	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	-	-	-
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP03	0 - 0.1 m	Fill	9/12/22	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	NAD	<0.001
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP04	0 - 0.1 m	Fill	9/12/22	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	NAD	<0.001
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP05	0 - 0.1 m	Fill	12/12/2022	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	NAD	<0.001
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
BD1/20221212	0 - 0.1 m	Fill	12/12/2022	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	-	-	-
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP06	0 - 0.1 m	Fill	12/12/2022	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	NAD	<0.001
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP06	0.5 - 0.6 m	Fill	12/12/2022	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	-	-	-
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP07	0 - 0.1 m	Fill	9/12/22	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	NAD	<0.001
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
BD6/20221209	0 - 0.1 m	Fill	09 Dec 2022	-	<1	<1	<0.5	<PQL	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<PQL	<0.5	<PQL	<1	-	-	-
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP07	0.3 - 0.4 m	Natural	9/12/22	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	-	-	-
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP08	0 - 0.1 m	Fill	12/12/2022	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	NAD	<0.001
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BTP08	0.2 - 0.3 m	Natural	12/12/2022	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	-	-	-
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BSP1A		Stockpile	12/12/2022	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	NAD	<0.001
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BSP1B		Stockpile	12/12/2022	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	NAD	<0.001
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
AEC31BSP1C		Stockpile	17/01/2023	<5	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	NAD	<0.001
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			
BD2/20230117		Stockpile	17 Jan 2023	-	<1	<1	<0.5	<PQL	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<PQL	<0.2	<PQL	<0.1	-	-	-
				120 -	120 -	4000 -	40000 -	- -	400 180	- 180	10 -	70 -	20 -	340 -	10 -	10 -	400 -	- -	250 -	- -	1 -			

Lab result
HIL/HSL value EIL/ESL value

Notes: QA/QC replicate of sample listed directly below the primary sample

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Table I2 (continued): Summary of Results of Groundwater Analysis (All results in µg/L)

Sample Location / Identification (Borehole or Replicate)	Sample Date	Organochlorine Pesticides													Organophosphorus Pesticides																								Polychlorinated Biphenyls			Phenols												Ammonia
		Aldrin	Dieldrin	gamma-Chlordane	alpha-Chlordane	Total Chlordanes	pp-DDT	Endosulfan I	Endosulfan II	Endrin	Heptachlor	Methoxychlor	Lindane	Other OCP	Azinphos-methyl	Bromophos-ethyl	Chlorpyrifos	Chlorfenvinphos	Diazinon	Dichlorovos	Dimethoate	Disulfoton	Ethion	Ethoprophos (Ethoprop)	Fenitrothion	Fensulfothion	Fenthion	Malathion	Mevinphos (Phosdrin)	Monocrotophos	Omethoate	Parathion	Methyl Parathion	Pyrazophos	Terbufos	Tetrachlorvinphos	Pirimiphos-methyl	Other OPP	Aroclor 1242	Aroclor 1254	Other PCB	Phenol	2,4,6-Trichlorophenol	2,4-Dinitrophenol	4-Nitrophenol	2,3,4,6-Tetrachlorophenol	Total Tetrachlorophenols	Pentachlorophenol	2-Chlorophenol	2,4-Dimethylphenol	2,4-Dichlorophenol	2,6-Dichlorophenol	Other Phenols	Ammonia as N
AEC31BBH01	13/02/2023	<0.01	<0.01	<0.01	<0.01	-	<0.006	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<PQL	<0.02	<0.2	<0.01	-	<0.01	<0.2	<0.15	-	<0.2	-	<0.2	-	-	<0.05	-	-	-	<0.01	<0.2	-	-	-	-	<PQL	<0.1	<0.1	<PQL	<1	<1	<20	<20	<1	-	<5	<1	<1	<1	<1	<PQL	360
AEC31BBH02	13/02/2023	<0.01	<0.01	<0.01	<0.01	-	<0.006	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<PQL	<0.02	<0.2	<0.01	-	<0.01	<0.2	<0.15	-	<0.2	-	<0.2	-	-	<0.05	-	-	-	<0.01	<0.2	-	-	-	-	<PQL	<0.1	<0.1	<PQL	<1	<1	<20	<20	<1	-	<5	<1	<1	<1	<1	<PQL	1100
BD4/20230213	13/02/2023	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<PQL	<1	-	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<PQL	<1	<1	<1	<3	<10	<30	<30	-	<30	<10	<3	<3	<3	<3	<PQL	820
AEC31BBH03	13/02/2023	<0.01	<0.01	<0.01	<0.01	-	<0.006	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<PQL	<0.02	<0.2	<0.01	-	<0.01	<0.2	<0.15	-	<0.2	-	<0.2	-	-	<0.05	-	-	-	<0.01	<0.2	-	-	-	-	<PQL	<0.1	<0.1	<PQL	<1	<1	<20	<20	<1	-	<5	<1	<1	<1	<1	<PQL	630
BD3/20230213	13/02/2023	<0.01	<0.01	<0.01	<0.01	-	<0.006	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<PQL	<0.02	<0.2	<0.01	-	<0.01	<0.2	<0.15	-	<0.2	-	<0.2	-	-	<0.05	-	-	-	<0.01	<0.2	-	-	-	-	<PQL	<0.1	<0.1	<PQL	<1	<1	<20	<20	<1	-	<5	<1	<1	<1	<1	<PQL	670
Assessment Criteria																																																					
Freshwater DGV		0.001	0.01	0.03			0.006	0.03		0.01	0.01	0.005	-	-	0.01	-	0.01	-	0.01	-	0.15	-	-	-	0.2	-	-	0.05	-	-	-	0.004	-	-	-	-	-	-	0.3	0.01	-	320	3	45	58	10	0.2	3.6	340	2	120	34	-	900
Guidelines for Recreational Water	Health	3		20			90	200		-	3	3000	100	-	300	100	100	20	40	50	70	40	40	10	70	100	70	700	50	20	10	200	7	200	9	1000	900	-	-	-	-	-	200	-	-	-	-	100	3000	-	2000	-	-	-
	Aesthetic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	2	-	-	-	-	-	0.1	-	0.3	-	-	382
HSL D for Vapour Intrusion, Clay (depth 2 m to <4 m)		-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

PQL	Practical Quantitation Limit
-	not defined/ not analysed/ not applicable
BD3/20230213	Blind replicate from AEC31BBH03
BD4/20230213	Blind replicate from AEC31BBH02
	Exceedance of drinking water guideline
	Exceedance of DGV and drinking water guideline

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Table I2: Summary of Results of Groundwater Analysis (All results in μg/L)

Sample Location / Identification (Borehole or Replicate)	Sample Date	Metals								Polycyclic Aromatic Hydrocarbons					
		Arsenic	Cadmium	Chromium (III + VI)	Copper	Lead	Mercury	Nickel	Zinc	Naphthalene	Anthracene	Fluoranthene	Benzo(a)pyrene	Phenanthrene	Other PAH
AEC31BBH01	13/02/2023	2	0.2	<1	**5**	<1	<0.05	**19**	**25**	0.04	<0.01	<0.01	<0.01	<0.01	<PQL
AEC31BBH02	13/02/2023	<1	<0.1	<1	<1	<1	<0.05	**14**	2	0.04	<0.01	<0.01	<0.01	<0.01	<PQL
BD4/20230213	13/02/2023	13	<0.2	**44**	**48**	**17**	<0.1	**45**	**93**	<0.01	<0.01	<0.01	<0.01	<0.01	<PQL
AEC31BBH03	13/02/2023	<1	<0.1	<1	<1	<1	<0.05	8	**14**	0.04	<0.01	<0.01	<0.01	<0.01	<PQL
BD3/20230213	13/02/2023	<1	<0.1	<1	<1	<1	<0.05	9	**14**	0.04	<0.01	<0.01	<0.01	<0.01	<PQL
Assessment Criteria															
Freshwater DGV		24 for As(III) 13 for As(V)	0.2	3.3 for Cr(III) 1.0 for Cr(VI)	1.4	3.4	0.06	11	8	16	0.01	1	0.1	0.6	-
Guidelines for Recreational Water	**Health**	100	20	500 for Cr(VI)	20000	100	10	200	-	-	-	-	0.1	-	-
	Aesthetic	-	-	-	1000	-	-	-	3000	-	-	-	-	-	-
HSL D for Vapour Intrusion, Clay (depth 2 m to <4 m)		-	-	-	-	-	-	-	-	NL	-	-	-	-	-

Sample Location / Identification (Borehole or Replicate)	Total Recoverable Hydrocarbons, BTEX and Volatile Organic Compounds																				
	TRH C6-C10 less BTEX	TRH >C10-C16 less Naphthalene	TRH C6-C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toulene	Ethylbenzene	o-xylene	m+p-xylene	Isopropylbenzene	1,1-Dichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	trans-1,3-Dichloropropene	cis-1,3-Dichloropropene	Vinyl chloride	Tetrachloroethene	Trichloroethene	1,2,3-Trichlorobenzene
AEC31BBH01	<10	<50	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1
AEC31BBH02	<10	<50	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1
BD4/20230213	<20	<50	<20	<20	<100	<100	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<5	<1	<1	-
AEC31BBH03	<10	<50	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1
BD3/20230213	<10	<50	<10	<50	<100	<100	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1
Freshwater DGV	-	-	-	-	-	-	950	180	80	350	75 for m-xylene 200 for p-xylene	30	700	-	-	-		100	70	330	3
Guidelines for Recreational Water – Health	-	-	-	-	-	-	10	8000	3000	6000		-	300	600		1000		3	500	-	300
Guidelines for Recreational Water – Aesthetic	-	-	-	-	-	-	-	25	3	20		-	-	-		-		-	-	-	5
HSL D for Vapour Intrusion, Clay (depth 2 m to <4 m)	NL	NL	-	-	-	-	30000	NL	NL	NL		-	-	-	-	-	-	-	-	-	-

Sample Location / Identification (Borehole or Replicate)	1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Chlorobenzene	1,1,2,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,2-Dichloroethane	Carbon tetrachloride	Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	1,2-Dichloropropane	1,3-Dichloropropane	Styrene	Hexachlorobutadiene	Carbon disulfide	Dichloromethane (methylene chloride)	Other VOC
AEC31BBH01	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<PQL
AEC31BBH02	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<PQL
BD4/20230213	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1	<1	-	<1	<5	<PQL
AEC31BBH03	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<PQL
BD3/20230213	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	<PQL
Freshwater DGV	85	160	260	60	55	400	270	6500	1900	240	370	-	-	-	900	1100	-	-	20	-	-
Guidelines for Recreational Water – Health		15000	-	400	3000	-	-	-	30	30	2500				-	-	300	7	-	40	-
Guidelines for Recreational Water – Aesthetic		1	20	0.3	10	-	-	-	-	-	-				-	-	4	-	-	-	-
HSL D for Vapour Intrusion, Clay (depth 2 m to <4 m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

PQL	Practical Quantitation Limit
-	not defined/ not analysed/ not applicable
NL	Not Limiting
*	Modified for hardness of 5000 mgCaCO3/L
BD3/20230213	Blind replicate from AEC31BBH03
BD4/20230213	Blind replicate from AEC31BBH02
(green shading)	Exceendance of DGV

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Table I3: Summary of Laboratory Results for Waste Classification – Metals, TRH, BTEX, PAH, Phenol, OCP, OPP, PCB, Asbestos

				Metals								TRH		BTEX				PAH		Phenols						OCP		OPP		PCB	Asbestos	pH
				Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	TRH C6 - C9	TRH C10-C36	Benzene	Toluene	Ethylbenzene	Xylenes (total)	Benzo(a)pyrene (BaP)	Total PAHs	2-Methylphenol (o-Cresol)	Cresol (total)	Total Phenols	2,4,5-trichlorophenol	2,4,6-trichlorophenol	Phenol (non-halogenated)	Total Endosulfan	Other OCP	Chlorpyriphos	Other OPP	Total PCB	Total Asbestos	pH
Sample ID	Depth	Sample type	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	-	-
AEC31BTP01	0 - 0.1 m	Fill	12/12/2022	4	<0.4	54	16	17	<0.1	10	36	<25	150	<0.2	<0.5	<1	<1	0.2	1.8	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	
AEC31BTP01	0.2 - 0.3 m	Fill	12/12/2022	7	<0.4	62	6	22	<0.1	4	11	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	6.9
AEC31BTP01	0.5 - 0.6 m	Natural	12/12/2022	6	<0.4	40	8	17	<0.1	7	7	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	-	
AEC31BTP02	0 - 0.1 m	Fill	9/12/22	6	<0.4	55	3	17	<0.1	4	7	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	
AEC31BTP02	0.4 - 0.5 m	Natural	9/12/22	7	<0.4	59	6	17	<0.1	6	8	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	-	
AEC31BTP03	0 - 0.1 m	Fill	9/12/22	8	<0.4	53	5	19	<0.1	5	13	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	
AEC31BTP04	0 - 0.1 m	Fill	9/12/22	7	<0.4	57	12	20	<0.1	9	23	<25	<50	<0.2	<0.5	<1	<1	0.2	1.4	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	7.8
AEC31BTP05	0 - 0.1 m	Fill	12/12/2022	6	<0.4	45	5	20	<0.1	3	10	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	
BD1/20221212	0 - 0.1 m	Fill	12/12/2022	7	<0.4	49	6	20	<0.1	4	11	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	-	
AEC31BTP06	0 - 0.1 m	Fill	12/12/2022	5	<0.4	35	5	20	<0.1	3	7	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	
AEC31BTP06	0.5 - 0.6 m	Fill	12/12/2022	5	<0.4	36	4	18	<0.1	2	4	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	-	
AEC31BTP07	0 - 0.1 m	Fill	9/12/22	<4	<0.4	20	53	11	<0.1	13	28	<25	160	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	8.4
BD6/20221209	0 - 0.1 m	Fill	09 Dec 2022	6.1	<0.4	28	55	21	<0.1	11	44	<20	197	<0.1	<0.1	<0.1	<0.3	<0.5	<0.5	<0.5	<1	-	<1	<1	<0.5	<0.5	<PQL	<0.5	<PQL	<1	-	
AEC31BTP07	0.3 - 0.4 m	Natural	9/12/22	5	<0.4	32	9	13	<0.1	6	5	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	-	
AEC31BTP08	0 - 0.1 m	Fill	12/12/2022	6	<0.4	38	7	16	<0.1	4	9	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	
AEC31BTP08	0.2 - 0.3 m	Natural	12/12/2022	9	<0.4	34	14	19	<0.1	4	7	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	-	
AEC31BSP1A		Stockpile	12/12/2022	7	<0.4	30	11	15	<0.1	5	19	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	
AEC31BSP1B		Stockpile	12/12/2022	7	<0.4	43	12	17	<0.1	5	33	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	
AEC31BSP1C		Stockpile	17/01/2023	7	<0.4	39	18	18	<0.1	5	34	<25	<50	<0.2	<0.5	<1	<1	<0.05	<0.05	-	-	<5	-	-	-	<0.1	<PQL	<0.1	<PQL	<0.1	NAD	
BD2/20230117		Stockpile	17 Jan 2023	13	<0.4	67	19	25	<0.1	6.6	49	<20	<50	<0.1	<0.1	<0.1	<0.3	<0.5	<0.5	<0.2	<0.5	-	<1	<1	<0.5	<0.05	<PQL	<0.2	<PQL	<0.1	-	
Waste Classification Criteria [f]																																
CT1				100	20	100	NC	100	4	40	NC	650	10000	10	288	600	1000	0.8	200	4000	4000	288	8000	40	288	60	<50	4	4	<50	NC	
SCC1				500	100	1900	NC	1500	50	1050	NC	650	10000	18	518	1080	1800	10	200	7200	200	518	14400	72	518	108	<50	7.5	7.5	<50	NC	
TCLP1				N/A	N/A	N/A	NC	N/A	N/A	N/A	NC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NC	
CT2				400	80	400	NC	400	16	160	NC	2600	40000	40	1152	2400	4000	3.2	800	16000	16000	1152	32000	160	1152	240	<50	16	16	<50	NC	
SCC2				2000	400	7600	NC	6000	200	4200	NC	2600	40000	72	2073	4320	7200	23	800	28800	28800	2073	57600	288	2073	432	<50	30	30	<50	NC	
TCLP2				N/A	N/A	N/A	NC	N/A	N/A	N/A	NC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NC	
Excavated Natural Material (ENM) criteria																																
Maximum average concentration				20	0.5	75	100	50	0.5	30	150	NC	250	N/A	N/A	N/A	N/A	0.5	20	-	-	-	-	-	-	-	-	-	-	-	-	5 to 9
Absolute maximum concentration				40	1	150	200	100	1	60	300	NC	500	0.5	65	25	15	1	40	-	-	-	-	-	-	-	-	-	-	-	-	4.5 to 10

CT1 exceedance | TCLP1 and/or SCC1 exceedance | CT2 exceedance | TCLP2 and/or SCC2 exceedance | Asbestos detection

NT = Not tested NL = Non limiting NC = No criteria NA = Not applicable

Notes:

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

b Total chromium used as initial screen for chromium(VI).

c Total recoverable hydrocarbons (TRH) used as an initial screen for total petroleum hydrocarbons (TPH)

d Criteria for scheduled chemicals used as an initial screen

e Criteria for Chlorpyrifos used as initial screen

f All criteria are in the same units as the reported results

PQL Practical quantitation limit

CT1 NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values of specific contaminant concentration (SCC) for classification without TCLP: General solid waste

SCC1 NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: General solid waste

TCLP1 NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: General solid waste

CT2 NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values of specific contaminant concentration (SCC) for classification without TCLP: Restricted solid waste

SCC2 NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: Restricted solid waste

TCLP2 NSW EPA, 2014, Waste Classification Guidelines Part 1; Classifying Waste, Maximum values for leachable concentration (TCLP) and specific contaminant concentration (SCC) when used together: Restricted solid waste

Appendix J

Data Quality Assurance and Quality Control

Data Quality Assurance and Quality Control Report for DSI for AEC 31b

Surface & Civil Alignment Works (SCAW) Package for Sydney Metro - Western Sydney Airport (SMWSA)

1.0 Field and Laboratory Data Quality Assurance and Quality Control

The field and laboratory data quality assurance and quality control (QA / QC) procedures and results are summarised in the following Table 1. Reference should be made to the field work methodology and the laboratory results / certificates of analysis for further details. The relative percentage difference (RPD) results, along with the other field QC samples are included in the summary results Table QA1 to QA7.

Table 1: Field and Laboratory Quality Control

Item	Evaluation / Acceptance Criteria	Compliance
Analytical laboratories used	NATA accreditation	C
Holding times	Various based on type of analysis	C
Intra-laboratory replicates	5% of primary samples,	C
	<30% RPD	PC
Inter-laboratory replicates	5% of primary samples;	C
	<30% RPD	PC
Trip Spikes	1 per sampling event; 60-140% recovery	C
Trip Blanks	1 per sampling event; <PQL	C
Rinsates	1 per water sampling event; <PQL	C
Laboratory / Reagent Blanks	1 per batch; <PQL	C
Laboratory Duplicate	1 per lab batch; As laboratory certificate	PC
Matrix Spikes	1 per lab batch; 70-130% recovery (inorganics); 60-140% recovery (organics)	PC
Surrogate Spikes	All organics analysis; 70-130% recovery (inorganics); 60-140% recovery (organics)	PC
Control Samples	1 per lab batch; 70-130% recovery (inorganics); 60-140% recovery (organics)	C
Standard Operating Procedures (SOP)	Adopting SOP for all aspects of the sampling field work	C

Notes: C = compliance; PC = partial compliance; NC = non-compliance; NR Not required

Laboratory comments from a review of the laboratory certificates are listed as follows:

- The RPD results for chromium, copper, lead and nickel for sample 312920-1 exceeded the laboratory acceptance criteria, therefore, a triplicate result was issued as laboratory sample number 312920-127;
- For chromium in sample 312978-2, a spike recovery result was not obtained due to the inhomogeneous nature of the element in the sample, however, an acceptable recovery was obtained for the laboratory control sample;
- For arsenic, lead, nickel and zinc in sample 314763-32, spike recovery results were not obtained due to the inhomogeneous nature of the element in the sample, however, an acceptable recovery was obtained for the laboratory control sample; and
- The RPD results for arsenic and lead in sample S22-De0031674 exceeded the laboratory acceptance criteria, however, the RPD results passed Eurofins Environment Testing's QC - Acceptance Criteria.

It is considered that the above listed comments do not affect the overall assessment.

For soil, the RPD results for intra-laboratory and inter-laboratory analysis were within the acceptable range with the exception of metals (arsenic, chromium, lead, and zinc). The exceedances are not, however, considered to be of concern given the low actual differences in the concentrations between the primary and replicate samples and the nature of sampled fill and stockpile where some heterogeneity is expected.

For water samples, RPD results for intra-laboratory and inter-laboratory analysis were within the acceptable range except for naphthalene and metals (arsenic, chromium, copper, lead, nickel and zinc) in the inter-laboratory pair (AEC31BBH02 and BD4/20230213). The actual difference in naphthalene concentrations is low and, therefore, is not considered to be of concern with respect to the overall assessment. The difference in metals concentrations may be attributed the filtering of the primary sample at the primary laboratory and apparently not at the secondary laboratory. As the metals concentrations are considered to be within background ranges, the elevated RPD results are not considered to be of concern for the overall assessment.

For groundwater sampling, the electronic interface probe, flow cell and probes (where used) were decontaminated between monitoring wells by rinsing in a diluted Liquinox solution and then rinsing in demineralised water. Rinsate samples were collected by running demineralised water over the decontaminated sampling equipment and directing the water into sampling bottles provided by the laboratory. Rinsate test results were all less than the practical quantitation limits. For soil sampling, to avoid the need for decontaminating sampling equipment, disposable nitrile gloves were changed between each sampling event and used for sample collection. A new pair of disposable nitrile gloves was also used at each sampling point for groundwater sampling.

The rinsate sample (RINS01) had concentrations of contaminants less than the PQL.

In summary, the QC data is determined to be of sufficient quality to be considered acceptable for the assessment.

2.0 Data Quality Indicators

The reliability of field procedures and analytical results was assessed against the following data quality indicators (DQIs) as outlined in NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013):

- Completeness: a measure of the amount of usable data from a data collection activity;
- Comparability: the confidence (qualitative) that data may be considered to be equivalent for each sampling and analytical event;
- Representativeness: the confidence (qualitative) of data representativeness of media present on-site;
- Precision: a measure of variability or reproducibility of data; and
- Accuracy: a measure of closeness of the data to the 'true' value.

Table 2: Data Quality Indicators

Data Quality Indicator	Method(s) of Achievement
Completeness	Systematic locations sampled.
	Preparation of logs, sample location plan and chain of custody records.
	Laboratory sample receipt information received confirming receipt of samples intact and appropriateness of the chain of custody.
	Samples analysed for contaminants of potential concern (COPC) identified in the Conceptual Site Model (CSM).
	Completion of chain of custody (COC) documentation.
	NATA accredited laboratory results certificates provided by the laboratory.
	Satisfactory frequency and results for field and laboratory quality control (QC) samples as discussed above.
Comparability	Using appropriate techniques for sample recovery, storage and transportation, which were the same for the duration of the project.
	Experienced sampler(s) used.
	Use of NATA registered laboratories, with test methods the same or similar between laboratories.
	Satisfactory results for field and laboratory QC samples.
Representativeness	Target media sampled.
	Sample numbers recovered and analysed are considered to be representative of the target media and complying with DQOs.
	Samples were extracted and analysed within holding times.
	Samples were analysed in accordance with the COC.

Data Quality Indicator	Method(s) of Achievement
Precision	Field staff followed standard operating procedures.
	Acceptable RPD between original samples and replicates.
	Satisfactory results for all other field and laboratory QC samples.
Accuracy	Field staff followed standard operating procedures.
	Satisfactory results for all field and laboratory QC samples.

Based on the above, it is considered that the DQIs have been generally complied with.

3.0 Conclusion

Based on the results of the field QA and field and laboratory QC, and evaluation against the DQIs it is concluded that the field and laboratory test data obtained are reliable and useable for this assessment.

4.0 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.

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Table QA1: Relative Percentage Difference Results – Soil Replicates

			Metals								TRH				BTEX				PAH				Phenols	OCP											OPP		PCB
			Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	TRH C6 - C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene [b]	Benzo(a)pyrene (BaP)	Benzo(a)pyrene TEQ	Total PAHs	Total / all Phenols	DDD	DDE	DDT	Aldrin & Dieldrin	Total Chlordane	Endrin	Total Endosulfan	Heptachlor	Hexachlorobenzene	Methoxychlor	Other OCP	Chlorpyriphos	Other OPP	Total PCB
Sample ID	Depth	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
BD1/20221212	0 - 0.1 m	12/12/2022	7	<0.4	49	6	20	<0.1	4	11	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<0.1	<0.1
AEC31BTP05	0 - 0.1 m	12/12/2022	6	<0.4	45	5	20	<0.1	3	10	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<0.1	<0.1
		Difference	1	0	4	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
intra-laboratory		RPD	15%	0%	9%	18%	0%	0%	29%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
BD6/20221209	0 - 0.1 m	09 Dec 2022	6.1	<0.4	28	55	21	<0.1	11	44	<20	<50	150	190	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	<0.5	<PQL	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<PQL	<0.5	<PQL	<1
AEC31BTP07	0 - 0.1 m	9/12/22	<4	<0.4	20	53	11	<0.1	13	28	<25	<50	160	220	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1
		Difference	2.1	0	8	2	10	0	2	16	0	0	10	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
inter-laboartory		RPD	**42%**	0%	**33%**	4%	**63%**	0%	17%	**44%**	0%	0%	6%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
BD2/20230117		17 Jan 2023	13	<0.4	67	19	25	<0.1	6.6	49	<20	<50	<100	<100	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	<0.5	<PQL	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<PQL	<0.2	<PQL	<0.1
AEC31BSP1C		17/01/2023	7	<0.4	39	18	18	<0.1	5	34	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.05	<0.5	<0.05	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<PQL	<0.1	<PQL	<0.1
		Difference	6	0	28	1	7	0	1.6	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
inter-laboratory		RPD	**60%**	0%	**53%**	5%	**33%**	0%	28%	**36%**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

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Table QA2: Trip Blank Results - Soils (mg/kg)

Sample ID	Benzene	Toluene	Ethylbenzene	o-Xylene	m+p-Xylene	Naphthalene
TB-091222	<1	<1	<1	<1	<2	-
TB-121222	<1	<1	<1	<1	<2	-
TB-170123	<0.2	<0.5	<1	<1	<2	<1

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Table QA3: Trip Spike Results – Soils (% Recovery)

Sample ID	Benzene	Toluene	Ethylbenzene	o-Xylene	m+p-Xylene
TS-091222	113	119	118	119	120
TS-121222	119	115	115	118	114
TS-170123	101	101	101	100	99

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Table QA4: Relative Percentage Difference Results for Groundwater

	Metals								TRH				BTEX					PAH						Phenols											OCP										
	Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	TRH C6 - C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	o-xylene	m+p-xylene	Naphthalene	Anthracene	Fluoranthene	Benzo(a)pyrene	Phenanthrene	Other PAH	Phenol	2,4,6-Trichlorophenol	2,4-Dinitrophenol	4-Nitrophenol	2,3,4,6-Tetrachlorophenol	Total Tetrachlorophenols	Pentachlorophenol	2-Chlorophenol	2,4-Dimethylphenol	2,4-Dichlorophenol	2,6-Dichlorophenol	Other Phenols	Aldrin	Dieldrin	gamma-Chlordane	alpha-Chlordane	pp-DDT	Endosulfan I	Endosulfan II	Endrin	Heptachlor	Methoxychlor
Sample ID	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BD3/20230213	<1	<0.1	<1	<1	<1	<0.05	9	14	<10	<50	<100	<100	<1	<1	<1	<1	<2	0.04	<0.01	<0.01	<0.01	<0.01	<PQL	<1	<1	<20	<20	<1	-	<5	<1	<1	<1	<1	<PQL	<0.01	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	<0.01	<0.01
AEC31BBH03	<1	<0.1	<1	<1	<1	<0.05	8	14	<10	<50	<100	<100	<1	<1	<1	<1	<2	0.04	<0.01	<0.01	<0.01	<0.01	<PQL	<1	<1	<20	<20	<1	-	<5	<1	<1	<1	<1	<PQL	<0.01	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	<0.01	<0.01
	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
intra-laboratory	0%	0%	0%	0%	0%	0%	12%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
BD4/20230213	13	<0.2	44	48	17	<0.1	45	93	<20	<20	<100	<100	<1	<1	<1	<1	<2	<0.01	<0.01	<0.01	<0.01	<0.01	<PQL	<3	<10	<30	<30	-	<30	<10	<3	<3	<3	<3	<PQL	<0.01	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	<0.01	<0.01
AEC31BBH02	<1	<0.1	<1	<1	<1	<0.05	14	2	<10	<50	<100	<100	<1	<1	<1	<1	<2	0.04	<0.01	<0.01	<0.01	<0.01	<PQL	<1	<1	<20	<20	<1	-	<5	<1	<1	<1	<1	<PQL	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	12	0	43	47	16	0	31	91	0	0	10	0	0	0	0	0	0	0.03	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
inter-laboratory	**171%**	0%	**191%**	**184%**	**177%**	0%	**105%**	**192%**	0%	0%	10%	0%	0%	0%	0%	0%	0%	**120%**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table QA4: Relative Percentage Difference Results for Groundwater (continued)

			OPP											
	Lindane	Other OCP	Azinphos-methyl	Bromophos-ethyl	Chlorpyrifos	Diazinon	Dichlorovos	Dimethoate	Ethion	Fenitrothion	Malathion	Parathion	Methyl Parathion	Other OPP
Sample ID	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BD3/20230213	<0.01	<PQL	<0.02	<0.2	<0.01	<0.01	<0.2	<0.15	<0.2	<0.2	<0.05	<0.01	<0.2	<PQL
AEC31BBH03	<0.01	<PQL	<0.02	<0.2	<0.01	<0.01	<0.2	<0.15	<0.2	<0.2	<0.05	<0.01	<0.2	<PQL
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
intra-laboratory	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
BD4/20230213	<0.01	<PQL	<1	-	<10	<1	<1	<1	<1	<1	<1	<1	<1	<PQL
AEC31BBH02	<0.01	<PQL	<0.02	<0.2	<0.01	<0.01	<0.2	<0.15	<0.2	<0.2	<0.05	<0.01	<0.2	<PQL
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
inter-laboratory	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

	PCB			VOC											
	Aroclor 1242	Aroclor 1254	Other PCB	Isopropylbenzene	1,1-Dichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	trans-1,3-Dichloropropene	cis-1,3-Dichloropropene	Vinyl chloride	Tetrachloroethene	Trichloroethene	1,2,3-Trichlorobenzene	1,2,4-Trichlorobenzene	1,2-Dichlorobenzene
Sample ID	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BD3/20230213	<0.1	<0.1	<PQL	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1
AEC31BBH03	<0.1	<0.1	<PQL	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
intra-laboratory	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
BD4/20230213	<0.1	<0.1	<PQL	<1	<1	<1	<1	<1	<1	<5	<1	<1	-	-	<1
AEC31BBH02	<0.1	<0.1	<PQL	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1
	0	0	0	0	0	0	0	0	0	0	0	0	-	-	0
inter-laboratory	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	-	0%

	VOC																
	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Chlorobenzene	1,1,2,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,2-Dichloroethane	Carbon tetrachloride	Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	1,2-Dichloropropane	1,3-Dichloropropane	Styrene	Hexachlorobutadiene	Other VOC
Sample ID	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BD3/20230213	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<PQL
AEC31BBH03	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<PQL
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
intra-laboratory	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
BD4/20230213	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1	<1	-	<PQL
AEC31BBH02	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<PQL
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0
inter-laboratory	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	0%

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Table QA5: Trip Blank Results - Water (µg/L)

Sample ID	Sampling Date	TRH C6-C10	Benzene	Toluene	Ethylbenzene	o-Xylene	m+p-Xylene	Naphthalene
TB-130223	13-Feb-23	<10	<1	<1	<1	<1	<2	<1

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Table QA6: Trip Spike Results – Water (% Recovery)

Sample ID	Sampling Date	Benzene	Toluene	Ethylbenzene	o-Xylene	m+p-Xylene
TS-130223	13-Feb-23	118	120	120	116	119

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Table QA7: Rinsate Results for Water Sampling

		Metals								TRH				BTEX					PAH						OCP										
		Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	TRH C6 - C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	o-xylene	m+p-xylene	Naphthalene	Anthracene	Fluoranthene	Benzo(a)pyrene	Phenanthrene	Other PAH	Aldrin	Dieldrin	gamma-Chlordane	alpha-Chlordane	pp-DDT	Endosulfan I	Endosulfan II	Endrin	Heptachlor	Methoxychlor	Other OCP
Sample ID	Sampling Date	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
RINS01	13/02/2023	<1	<0.1	<1	<1	<1	<0.05	<1	<1	<10	<50	<100	<100	<1	<1	<1	<1	<2	<0.02	<0.01	<0.01	<0.01	<0.01	<PQL	<0.01	<0.01	<0.01	<0.01	<0.006	<0.01	<0.01	<0.01	<0.01	<0.01	<PQL

Appendix K

Site Photographs

Photograph 1 - possible old house

Photograph 2 - shed for vehicle storage

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Sydney Metro Western Sydney Airport - SCAW, Elizabeth Drive, Badgerys Creek**	PROJECT: 204814.01 PLATE No: 1 REV: 1
	CLIENT: CPBUI JV	DATE: 28-Mar-23

Photograph 3 - caged dog shelter

Photograph 4 - stockpile

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Sydney Metro Western Sydney Airport - SCAW, Elizabeth Drive, Badgerys Creek**	PROJECT: 204814.01 PLATE No: 2 REV: 1
	CLIENT: CPBUI JV	DATE: 28-Mar-23

Photograph 5 - inside of vehicle storage shed

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Sydney Metro Western Sydney Airport - SCAW, Elizabeth Drive, Badgerys Creek**	PROJECT: 204814.01 PLATE No: 3 REV: 0
	CLIENT: CPBUI JV	DATE: 28-Mar-23