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Integrated Practical Solutions

Report on Preliminary (Subsurface) Contaminated Land Investigation

Proposed Mixed Use Development
WIN Grand
Crown Street, Wollongong

Prepared for
Birketu Pty Ltd

WOLLONGONG CITY COUNCIL
DEVELOPMENT CONSENT
This is the plan/document referred to in Consent DA-2021/957
Dated 12 December 2022

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

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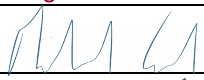
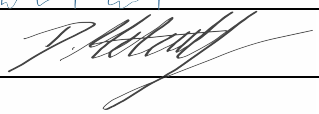
Author			23 June 2022
Reviewer		For Glyn Eade CEnvP (SC40962)	23 June 2022

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1. Introduction

This report presents the results of a preliminary (subsurface) contaminated land investigation undertaken for a proposed mixed use development (WIN Grand) located at Crown Street, Wollongong (hereinafter referred to as 'the site'). The investigation was commissioned by Mr Jonathon Tuer of Probuild Pty Ltd acting on behalf of Birketu Pty Ltd (the client) in an email dated 18 August 2020 and was undertaken in general accordance with Douglas Partners Pty Ltd (DP) proposal WOL200332 dated 11 August 2020. This report should be read in conjunction with the accompanying notes about this report provided in Appendix A.

The investigation described within was conducted to provide preliminary information on subsurface ground conditions, potential contaminated land constraints, to provide a preliminary waste classification for off-site disposal of any surplus soils generated during the redevelopment of the site, to inform preliminary design and for submission to Wollongong City Council (Council) to support a Development Application. The investigation was undertaken in conjunction with a preliminary geotechnical investigation which has been reported under separate cover (DP, 2020b).

The most recent revision of this report was conducted to incorporate the findings of a Historical Archaeological Assessment (HAA) undertaken for the site by Austral Archaeology (Austral, 2022), which was provided to DP for review following the completion of the preliminary subsurface contaminated land investigation. The findings of the HAA that are relevant to contaminated land investigation, have been discussed in Section 12.4.

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

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM]* (NEPC, 2013); and
- NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020); and
- NSW DUAP/EPA (1998). *Managing Land Contamination, Planning Guidelines, SEPP 55 – Remediation of Land.* NSW Department of Urban Affairs and Planning / Environment Protection Authority (hereinafter referred to as 'SEPP 55'). It is noted that since the original preparation of this report, SEPP 55 has been repealed and replaced by the *State Environmental Planning Policy (Resilience and Hazards) 2021* (hereinafter referred to as 'SEPP 2021'). It is further noted that most of the provisions from SEPP 55 have been retained and consolidated in SEPP 2021.

2. Proposed Development

The proposal comprises the redevelopment of the street block, which will comprise:

- Demolition of all existing buildings and structures on site, besides the Marcus Clark heritage building facade and The Grand Hotel facade, which will be carefully retained in accordance with specialist advice;
- Removal of 14 trees located internally within the site (the six mature street trees will be retained);
- Excavation to allow three levels of basement car parking containing 496 car parking spaces;
- Erection of a series of buildings, with maximum heights including:
  - Tower 1 (Residential): 39 storeys
  - Tower 2 (Residential): 23 storeys
  - Tower 3 (Residential): 17 storeys
  - Commercial building: 7 storeys
  - Cinema building: 2 storeys
  - Gym/ pool building: 4 storeys
- Various land uses, comprising:
  - Residential accommodation (in a shop top housing configuration).
  - Commercial premises (business, office and retail premises).
  - Health and wellness facilities.
  - Entertainment facilities (cinema, performance and exhibition space).
  - Recreation facilities (pool and gym).
- Various ancillary works including landscape/hardscape improvements, including:
  - Publicly accessible central plaza, supported by various stairs, walkways and public lifts.
  - Various streetscape improvements, including tree planting and provision for a bus shelter.

3. Scope of Work

The scope of work for the investigation comprised:

- A review of a previous DP preliminary site investigation for contaminated land (PSI) (DP, 2020a);
- As recommended in DP (2020a), a search of the SafeWork NSW Stored chemical Information Database (SCID) was undertaken for the site to provide information on historic licenses to store dangerous goods in order to provide further information relating to the possible presence of underground storage tanks (USTs) at the site.
- Soil sampling from all geotechnical investigation locations for contaminated land investigation and preliminary waste classification purposes. Sampling directly from the augers during drilling;
- Laboratory testing of selected samples for a range of the following identified contaminants of potential concern (CoPC):

  - Metals / metalloids (arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel and zinc);
  - Polycyclic aromatic hydrocarbons (PAH);
  - Total recoverable hydrocarbons (TRH);
  - Benzene, toluene, ethylbenzene and xylene (BTEX);
  - Phenols;
  - Organochlorine pesticides (OCP) and organophosphorus pesticides (OPP);
  - Polychlorinated biphenyls (PCB); and
  - Asbestos (asbestos containing material (ACM), asbestos fines and fibrous asbestos);
- Additional leachability analysis on soil samples with elevated concentrations of metals relative to the adopted waste classification criteria;
- Analysis of selected samples for pH and cation exchange capacity (CEC) for the purposes of determining site specific Ecological Investigation Levels (EILs);
- Field sampling and laboratory analysis will be undertaken in compliance with standard environmental protocols, including a Quality Assurance/Quality Control (QA/QC) plan consisting of replicate sampling of approximately 5% inter-laboratory replicates, 5% intra-laboratory replicates, Chain of Custody procedures and in–house laboratory QA/QC testing; and
- Preparation of this report.

4. Site Description

The site incorporates an entire city block bound by Crown Street to the north, Keira Street to the east, Burelli Street to the south and Atchison Street to the west. The site area is approximately 1.308 hectares with maximum north-south and east-west dimensions of approximately 110 m and 180 m respectively.

The site has a 180 m frontage to the southern side of Crown Street, a 50 m frontage to the eastern side of Atchison Street, a 160 m frontage to the northern side of Burelli Street and a 100 m frontage to the western side of Keira Street. An internal road (Findlay Place) is located in the central southern section of the site, accessed from Burelli Street.

At the time of the assessment, the site was fully developed with multiple low to medium rise (up to eight storeys) mixed use and commercial buildings with associated infrastructure and parking. Most of the buildings were typically of masonry (rendered or clad) or of full masonry construction and based on historical aerial photographs, appear to have mostly been constructed between about 1950 and 1990. Several masonry block retaining walls up to about 2 to 3 m high were located in the southern central part of the site, supporting car parking areas.

Based on the site survey provided by the client, surface levels fall in the south easterly direction (ie away from Crown Street) with the maximum difference in level of approximately 11 m between RL 24.5 m relative to Australian Height Datum (AHD) in the north-western part of the site to RL 13.5 m AHD in the south-eastern part of the site.

5. Regional Geology and Acid Sulfate Soils

Reference to the NSW seamless geology layer published by the NSW Department of Geoscience indicates that the site is mapped as being underlain by Budgong Sandstone (Broughton Formation) of Permian age, belonging to the Shoalhaven group unit. Shoalhaven group sandstones are described as comprising red, brown and grey lithic sandstone, which weather to form clays of moderate to high plasticity. In the Wollongong CBD, the Budgong Sandstone can be massive and of very high strength. No fault zones are mapped on the broadscale NSW mapping in the vicinity of site, however, previous experience on adjacent sites have indicated the presence north to south and northeast to southwest orientated geological faults to the north of the site.

The results of the investigation were consistent with the geological mapping, with sandstone encountered in each of the boreholes.

Reference to the 1:25 000 Acid Sulfate Risk Maps indicates that the site is located in an area mapped as "*no known occurrences of acid sulfate materials*". Furthermore, the site is located approximately 500 m from the nearest area mapped as having a potential for acid sulfate soil occurrence. As the topographical and geological setting is inconsistent with the occurrence of acid sulfate soil conditions, it is considered that investigation for acid sulfate soils is not required.

Regional groundwater is anticipated to flow to the south-east, i.e. towards the Tasman Sea, with possible localised groundwater flows (seepage) to the south (i.e. within the underlying bedrock).

6. Background

DP has previously completed a PSI at the site (DP, 2020a).

Based on the findings of DP (2020a) it was considered that the site exhibits a low to moderate potential for contamination to be present at the site associated with:

- fill across the site of unknown quality and origin;
- fill across the site potentially impacted by hazardous building material; and
- fill underlying car park areas that may be impacted by coal tar from old asphaltic concrete pavement materials.

However, given the proposed development includes three levels of basement car parking across most of the site (excavation of up to a maximum of approximately 9 to 10 m), it was considered that any soils impacted by residual contamination that may be present associated with the former land uses, will be excavated and removed from site as part of the proposed development.

On the basis of the investigation findings, it is considered that the site can be rendered suitable for the proposed mixed use development on the understanding that all existing site fill will likely be removed from site as part of the proposed basement excavation.

As such, DP (2020a) indicated that a waste classification assessment would be required prior to removal of any surplus material from the site. This may include waste classification assessment prior to demolition (i.e. this investigation) but should also include further waste classification assessment following demolition of site structures and removal of existing surficial hardstand areas. As a minimum, the further waste classification assessment should include an inspection of the site surface following demolition and removal of surficial hardstand areas, with any intrusive investigation (if required) targeting observed potential sources of contamination for the purpose of waste classification.

It was further recommended that as part of the off–site disposal or reuse classification for the site natural materials, following the complete removal of all fill, assessment should be undertaken to validate that natural materials have not been impacted by former site activities.

It is noted that the limited desktop study undertaken as part of DP (2020) did not indicate the presence of USTs at the site. However, it was considered, based on DP's experience in the area and the long-term commercial land use, possible that USTs may be present at the site. As such, it was recommended that a search of the SafeWork NSW Stored chemical Information Database (SCID) be undertaken for the site, in order to provide further information relating to the possible presence of USTs at the site.

As a matter of due diligence and given the current buildings and hardstand areas precluding visual and physical access to the entire site, it was recommended that an unexpected finds protocol (UFP) be implemented as part of a construction environmental management plan (CEMP) for any future proposed earthworks or development.

It was further recommended that a pre-demolition hazardous building materials survey and testing of the asphaltic concrete for the potential presence of coal tar be undertaken prior to the demolition of the site structures.

7. SafeWork NSW Search Results

As recommended in DP (2020a) a search of the SafeWork NSW Stored chemical Information Database (SCID) was commissioned for the site. No records relating to any licenses to keep dangerous goods were able to be located.

A copy of the results, dated 22 October 2020, is included in Appendix C.

8. Preliminary Conceptual Site Model

A preliminary conceptual site model (CSM) has been developed based on the site desktop study and observations made during the site walkover. The CSM identifies potential sources of CoPC, sensitive receptors, and potential transport mechanisms that could expose sensitive receptors to unacceptable ecological and/or health risks.

The objective of the CSM is to highlight actual or potential exposure pathways that may exist, and identify any data gaps that may need to be addressed during this investigation.

For potential ecological and/or health risks to be present, all of the following elements of an exposure pathway are required:

1. Contaminant source (e.g. fuel tank or fill);
2. Receptor (e.g. site worker, site occupier or terrestrial/aquatic ecosystem); and
3. Transport mechanism/exposure route between the source and receptor (e.g. vapour/ groundwater migration, ingestion and inhalation).

If all three elements are present, it is considered that a complete exposure pathway exists. Partial or incomplete exposure pathways may also be present. A qualitative assessment of the presence, or otherwise, of the above elements at the site and the CSM is discussed in the following subsections.

8.1 Potential Contamination Sources and Contaminants of Concern

Based on DP's previous experience in the area, the findings of the site history investigation and the site walkover, it is considered that potential for contamination exists at the site primarily through the progressive development and use of the site for commercial use.

The progressive development of the site is considered to have included the filling of the site with materials of unknown quality and origin, the construction of site structures potentially consisting hazardous building materials, subsequent demolition of site structures and the historic construction of asphaltic concrete pavements potentially containing coal tar binder.

Potential sources of contamination include:

- filling of the site with materials of unknown quality and origin;
- the potential use of hazardous building materials in the construction of the site's current and former structures, including asbestos-containing materials and lead-based paint; and
- the potential for the asphaltic concrete surfaced part of the site to contain a coal tar binder.

As such, and based on the findings of the site history and site walkover, the potential sources (S) of contamination comprise:

- S1 - Fill of unknown quality and origin;
- S2 - Hazardous building materials (HBM) associated with the construction of current and former site structures and the demolition of former site structures in the eastern portion of the site; and
- S3 – Asphaltic concrete pavement materials containing coal tar binder.

Common CoPC associated with the above identified potential sources include metals / metalloids, petroleum hydrocarbons (such as total recoverable hydrocarbons, monocyclic and polycyclic aromatic hydrocarbons), coal tar, polychlorinated biphenyls (PCB), asbestos and other hazardous building materials.

8.2 Potential Receptors

Receptors (R) that potentially could be influenced by the potential contaminants at this site include:

Human health receptors:

- R1 – Current and end users (commercial and high density residential);
- R2 - Construction workers during development; and
- R3 - Adjacent users (commercial).

Environmental receptors:

- R4 – Groundwater;
- R5 - Surface water (Gurungaty Waterway); and
- R6 – Flora and Fauna.

8.3 Potential Pathways

Potential pathways (P) for contaminants on the site, with consideration to the site's proposed end use, current condition, and geological, topographical and hydrogeological characteristics, include:

- P1 - Direct contact with soil (ingestion and dermal);
- P2 - Inhalation of dust and/or vapours;
- P3 - Leaching of contaminants and vertical migration into groundwater;
- P4 - Surface water run-off from areas during heavy rainfall;
- P5 - Lateral migration of groundwater providing base flow to watercourses; and
- P6 - Direct contact of contaminated ground with ecological receptors.

8.4 Summary of Preliminary CSM

A 'source–pathway–receptor' approach has been used to assess the potential risks to human and environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways.

The possible pathways between the sources and receptors are provided in Table 1.

Table 1: Potential Complete Pathways

Source	Transport Pathway	Receptor	Action Recommended
S1 - Fill of unknown quality and origin; S2 - HBM associated with the construction of current and former site structures and the demolition of former site structures; S3 – Asphaltic concrete pavement materials containing coal tar binder	P1 - Direct contact with soil P2 - Inhalation of dust / vapours	R1 – Current and end users R2 - Construction workers during development	Given the proposed development includes two levels of basement car parking across most of the site, it is considered that any soils impacted by residual contamination that may be present associated to any fill of unknown quality and origin or fill impacted by hazardous building material or coal tar from old asphaltic concrete pavement materials, will likely be excavated and removed from site as part of the proposed development. A waste classification assessment must be undertaken prior to removal of any surplus material from the site. This should specifically target identified potential sources of contamination for the purpose of waste classification.
	P2 - Inhalation of dust / vapours	R3 - Adjacent users	
	P3 - Leaching of contaminants	R4 – Groundwater	
	P4 - Surface water run-off P5 - Lateral migration of groundwater	R5 - Surface water	
	P6 - Direct contact with ecological receptors	R6 - Flora and Fauna	

It is further noted that as underground storage tanks (USTs) or gross contamination have not been identified at this time, associated contaminant migration pathways such as off-site migration, vapour intrusions etc., have not been considered.

9. Sampling and Analysis Quality Plan

9.1 Data Quality Objectives

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

9.2 Soil Sampling Rationale

Based on the preliminary nature of the investigation and access being limited by existing building / hardstand, sampling and analysis from the five borehole locations utilised as part of DP's geotechnical investigation was considered appropriate at this stage.

Soil samples were collected from each borehole at depths of approximately 0.15 m, 0.5 m, 1.0 m and every 0.5 m thereafter to a maximum of roughly 0.5 m into natural, and at changes in lithology or signs of contamination.

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

10. Site Assessment Criteria

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

The investigation and screening levels applied in the current investigation comprise levels adopted for a generic residential with minimal access to soils land use scenario. The derivation of the SAC is included in Appendix F and the adopted SAC are listed on the summary analytical results tables in Appendix H.

11. Results

11.1 Field Work Results

The borehole logs for this assessment are included in Appendix G. These should be read in conjunction with the accompanying notes defining classification methods and descriptive terms.

Relatively uniform ground conditions were encountered underlying the site, which can be broadly summarised as follows:

FILL:	Fill comprising asphalt and pavement gravels, gravelly sands, sandy clays, silty gravels and/or gravelly clays encountered in all boreholes (Bores 1 to 5) to depths of between 0.3 and 1.8 m;
CLAY:	Typically stiff to very stiff clay and / or sandy clay at all borehole locations to depths of between 2.5 and 4.7 m. It is noted that the clays were interbedded with bands of weathered sandstone below depths of 1.7 and 2.0 m in Bores 3 and 4, respectively;
BEDROCK:	Sandstone bedrock encountered underlying the clays in all boreholes. The sandstone was typically initially medium or high strength (except for Bore 3, which was initially low strength) and generally increased in strength with depth. The bedrock continued to termination depths of between 7.6 and 11.4 m (the limit of the investigation), terminating in rock of high and very high strength.

Some non-soil anthropogenic items (bricks) were observed within the fill in Bores 2 and 5.

There were no apparent records of visual or olfactory evidence (eg: staining, odours, free phase product) to suggest the presence of obvious contamination within the soils or groundwater observed in the investigation.

Groundwater seepage was observed at a depth of about 1.2 m (RL 15.3 m AHD) in Bore 1 during auger drilling. Groundwater observations during NMLC coring are not possible as a result of the introduction of drilling fluids. Table 2 summarises the depths and RL at which groundwater was observed in the boreholes prior to development and during the subsequent rounds of monitoring.

Table 2: Groundwater Observations (Bores 2, 4 and 5)

Bore	Date	Surface RL (m AHD)	Groundwater Level	
			Depth (m bgl)	RL (m AHD)
2	7/9/2020	19.5	3.8(1)	15.7
	10/9/2020		3.8	15.7
	29/10/2020		3.8	15.7
4	3/9/2020	14.4	1.2(1)	13.2
	10/9/2020		7.8	6.6
	29/10/2020		7.7	6.7
5	4/9/2020	18.0	2.2(1)	15.8
	10/9/2020		5.0	13.0
	29/10/2020		4.9	13.1

Notes: (1) Reading taken prior to groundwater well development (i.e. immediately following drilling).

The groundwater readings taken on 10 and 29 September 2020 indicate that groundwater is typically within the underlying Sandstone bedrock. It must be noted that groundwater levels at the site are transient and would be expected to vary over time with preceding climatic conditions and soil permeability. Locally higher groundwater inflows may be expected if the fault zone intersects the site (as identified in previous investigations to the north of the site, and possibly observed in Bores 4 and 5). Locally lower groundwater may also be expected in the more elevated parts of the site (i.e. along Crown Street).

11.2 Laboratory Analytical Results

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

- Table H1: Summary of Laboratory Results – Metals, TRH, BTEX and PAH;
- Table H2: Summary of Laboratory Results – Phenol, OCP, OPP, PCB and Asbestos; and
- Table H3: Summary of Waste Classification Assessment.

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

12. Discussion

12.1 Contamination Status of Soils for On-Site Reuse

The analytical results for all contaminants tested in all samples were below the SAC.

Based on the results of the preliminary testing completed as part of the investigation no contaminated land constraints with respect to on-site reuse have been identified.

If soils are to be reused onsite and further confidence is required on the contamination status of soils, detailed investigation of the specific soils to be reused would be warranted.

12.2 Waste Classification of Soils for Off-Site Disposal

The following Table 3 presents the results of the six-step procedure outlined in NSW EPA (2014) for determining the type of waste and the waste classification. This process applies to the fill at the site, which do not meet the definition of VENM.

Table 3: Six Step Classification Procedure - Fill

Step	Comments	Rationale
1. Is the waste special waste?	No	No asbestos-containing materials (ACM), clinical or related waste, or waste tyres were observed in the boreholes; Asbestos was not detected by the analytical laboratory.
2. Is the waste liquid waste?	No	The fill comprised a soil matrix.
3. Is the waste "pre-classified"?	No	The fill is not pre-classified with reference to NSW EPA (2014). The natural material, if classified as VENM, is pre-classified as General Solid Waste (non-putrescible).
4. Does the waste possess hazardous waste characteristics?	No	The fill was not observed to contain or considered at risk to contain explosives, gases, flammable solids, oxidising agents, organic peroxides, toxic substances, corrosive substances, coal tar, batteries, lead paint or dangerous goods containers.
5. Determining a wastes classification using chemical assessment	Conducted	Refer to Table H3, Appendix H.
6. Is the waste putrescible or non-putrescible?	Non-putrescible	The fill does not contain materials considered to be putrescible [a].

Note: a wastes that are generally not classified as putrescible include soils, timber, garden trimmings, agricultural, forest and crop materials, and natural fibrous organic and vegetative materials (NSW EPA, 2014)

The field and laboratory data quality assurance and quality control results for the samples have been reviewed and are considered to be acceptable. The laboratory certificate is attached.

As shown in Table H3, Appendix H, after additional leachability analysis was undertaken on one sample, all laboratory results were below the relevant criteria for General Solid Waste as defined in the NSW EPA (2014).

Table 4: Preliminary Waste Classification Summary - Fill

Item	Description
Based on the observations at the time of sampling and the reported analytical results, the fill described as:	Asphalt and pavement gravels, gravelly sands, sandy clays, silty gravels and / or gravelly clays
Within the area subject to classification as shown on Drawing 1, Appendix B is classified as:	Stockpile and In-situ Fill; General Solid Waste.

Table 5 presents the results of the assessment of natural soils and bedrock at the site with reference to the VENM definition in the POEO Act and the EPA[1] website.

Table 5: VENM Classification Procedure

Item	Comments	Rationale
1. Is the material natural?	Yes	Natural materials logged in the boreholes as stiff to very stiff clay and / or sandy clay overlying sandstone bedrock. These materials underlie the fill at the site.
2. Is the material impacted by manufactured chemicals or process residues?	No	There were no visual or olfactory indicators of chemical contamination of the materials in the test pits. Concentrations of contaminants were considered to be typical of background concentrations (Table H1 and Table H2, Appendix H).
3. Are the materials acid sulfate soils?	No	Refer to Section 5.
4. Are there current or previous land uses that have (or may have) contaminated the materials?	No	Development of the site for its current use may have impacted on surface soils overlying the materials. Low chemical concentrations indicate no likely impact on the natural materials.

[1] https://www.epa.nsw.gov.au/your-environment/waste/classifying-waste/virgin-excavated-natural-material

Table 1: Preliminary Waste Classification Summary - Natural

Item	Description
Based on the outcomes presented in Table 6, the natural soils and bedrock described as:	Stiff to very stiff clay and/or sandy clay and sandstone bedrock
Within the area subject to classification as shown on Drawing 1, Appendix B is classified as:	VENM

12.3 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.

12.4 Historical Archaeological Assessment

The purpose of the HAA (Austral, 2022) was to assess the potential impact from the development on any features or items of archaeological value that may be present at the site and provides recommendations to manage any potential impacts to archaeological values.

The HAA comprised a desktop study of relevant background material (including a thorough historical literature review) and a site inspection to provide an understanding of the historical context of the site and undertake an assessment of heritage impact.

It is noted that the HAA historical context desktop study included information from pre 1770 to present, Therefore the HAA included information on former site activities relevant to the consideration of potentially contaminating historical activities well beyond the information obtained as part of the DP site history desktop study conducted as part of a preliminary site investigation for contaminated land, which typically looks at information relating to the last 100 years only.

Based on the findings of the HAA, it was considered that archaeological remains and relics of local significance are likely to be impacted during the proposed development. As such it was recommended by Austral that further archaeological investigations be undertaken as part of the proposed development, following demolition of the existing buildings and in advance of construction.

The historical activities reported in the HAA relevant for consideration as part of this contaminated land investigation include the operation of:

- a farrier and blacksmiths between 1875 and 1885 at 221 - 229 Crown Street (Lot 1 DP 220513);
- a farrier and blacksmiths between 1885 and 1904 at 226 - 230 Keira Street (Lot100 DP774957); and
- a tannery between 1850 to 1875 and a tannery and charcoal producer between 1875 and 1891 at 243 - 251 Crown Street (Lot 1 DP1135333).

Information relating to the operation of the tannery and of particular interest includes the description of the former site features which were summarised in the HAA as follows:
"This lot was first developed as a tannery by Josiah Allen c.1850 and later used by J.Richards & Sons. Later accounts of this lot state that it contained a number of large and deeply cut features such as a 10 metre wide and 11 metre deep water cistern, weighing scales, a lime kiln, cottage and warehouses."

Excerpts from Austral (2022), with relevant sections highlighted, are provided in Appendix K.

While it is considered possible that all features relating to the blacksmiths and the tannery have been altered or completely removed by the subsequent site development, it is also possible that some remnants of the former site features and activities may still be present at the site.

Of particular interest is the aforementioned deep cut feature that may potentially be backfilled with fill of unknown origin or quality, such as waste materials form former site activities.

As such, an inspection to confirm or refute the presence of these former site features identified during the HAA, should be conducted during or following the proposed further archaeological investigation.

13. Conclusions and Recommendations

Based on the findings of DP (2020a), and in the context of SEPP 2021, it is considered that the site exhibits a low to moderate potential for contamination to be present associated to:

- fill across the site of unknown quality and origin;
- fill across the site potentially impacted by hazardous building material; and
- fill underlying car park areas that may be impacted by coal tar from old asphaltic concrete pavement materials.

However, given the proposed development includes three levels of basement car parking across most of the site (excavation of up to a maximum of approximately 9 - 10 m), it is considered that any soils impacted by residual contamination that may be present associated with the former land uses, will be excavated and removed from site as part of the proposed development.

Based on the limited results of this investigation undertaken no contaminated land constraints with respect to the on-site reuse of soils have been identified in the samples analysed.

On the basis of the DP (2020a) and this investigation findings it is considered, in the context of SEPP 2021, that the site can be rendered suitable for the proposed mixed use development on the understanding that all existing site fill will likely be removed from site as part of the proposed basement excavation. Based on the proposed development and the results of DP (2020a) and this investigation it is considered that a detailed site investigation (DSI) for contaminated land is not warranted.

However, given the information relating to historical (pre 20th Century) activities at the site as reported in the recent HAA (Austral, 2022), it is recommended that inspections for the former site features identified by the HAA be undertaken during or following the proposed post demolition archaeological investigation. If remanent site features associated to the former tannery and blacksmiths are identified,

a further intrusive investigation targeting the remnant site features and surrounds will be required for both contaminated land and waste classification purposes.

If the proposed development changes so that soils are to be reused onsite and further confidence is required on the contamination status of soils, detailed investigation of the specific soils to be reused would be warranted and is recommended.

Based on the preliminary waste classification undertaken, the fill encountered at the site is preliminarily classified as General Solid Waste and the natural clays and bedrock are preliminarily classified as VENM. Given the preliminary nature of the waste classification it is recommended that further waste classification investigation be undertaken following demolition of site structures and removal of surficial hardstand areas. As a minimum, the further waste classification assessment should include an inspection of the site surface following demolition and removal of surficial hardstand areas, with any intrusive investigation (if required) targeting observed potential sources of contamination for the purpose of waste classification.

Furthermore, following the complete removal of all fill, assessment should be undertaken to validate that natural materials have not been impacted by former site activities as part of a final assessment as to whether this material can be classified as VENM.

As a matter of due diligence and given the current buildings and hardstand areas precluding visual and physical access to the entire site, it is still recommended that an unexpected finds protocol (UFP) be prepared and implemented as part of a construction environmental management plan (CEMP) for future proposed earthworks and development.

It is further recommended that a pre-demolition hazardous building materials survey and testing of the asphaltic concrete for the potential presence of coal tar be undertaken prior to the demolition of the site structures.

14. References

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NSW EPA. (2014). *Waste Classification Guidelines, Part 1: Classifying Waste.* NSW Environment Protection Authority.

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

15. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at WIN Grand, Crown Street, Wollongong in accordance with DP's proposal WOL200332 dated 11 August 2020 and acceptance received from Mr Jonathon Tuer of ProBuild Pty Ltd on behalf of Birketu Pty Ltd (the client) dated 18 August 2020. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Birketu Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

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

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Appendix A

About this Report

About this Report

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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.

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.

Soil Descriptions

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Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. 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	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

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

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

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	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

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;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and 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 test procedure is described by Australian Standard 4133.4.1 - 2007. The terms used to describe rock strength are as follows:

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

* 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
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

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 some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and longer sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

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

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

where 'sound' rock is assessed to be rock of low strength or better. 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

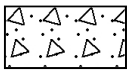
Symbols & Abbreviations

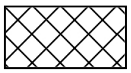
Graphic Symbols for Soil and Rock

General


Asphalt


Road base

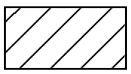

Concrete

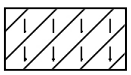

Filling

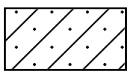
Soils


Topsoil

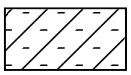

Peat

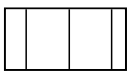

Clay

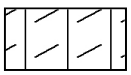

Silty clay

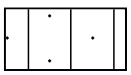

Sandy clay

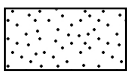

Gravelly clay

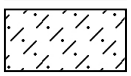

Shaly clay

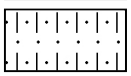

Silt


Clayey silt


Sandy silt

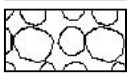

Sand

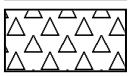

Clayey sand


Silty sand


Gravel

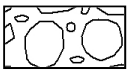

Sandy gravel


Cobbles, boulders

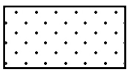

Talus

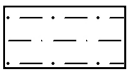
Sedimentary Rocks

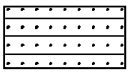

Boulder conglomerate

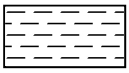

Conglomerate


Conglomeratic sandstone

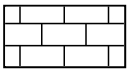

Sandstone


Siltstone

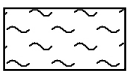

Laminite

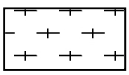

Mudstone, claystone, shale


Coal


Limestone

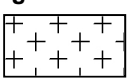
Metamorphic Rocks

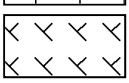

Slate, phyllite, schist

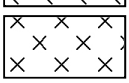

Gneiss

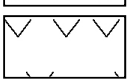

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite

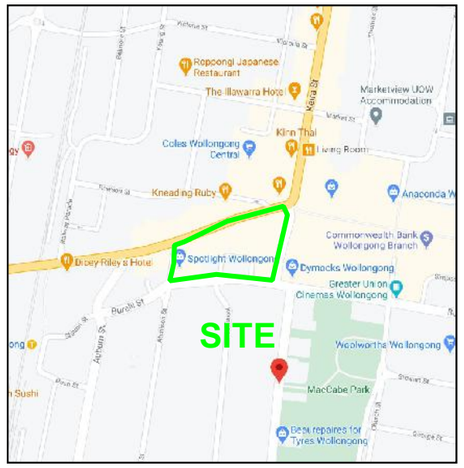

Dacite, epidote


Tuff, breccia


Porphyry

Appendix B

Drawing 1



Locality Plan

Legend

- Borehole Location
- Site Boundary
- Approximate 0.5m Spatial Services (NSW ELVIS) Contours

0 10 20 30 40 50 m

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	Birketu Pty Ltd		
OFFICE:	Wollongong	DRAWN BY:	FH
SCALE:	1:750 @ A3	DATE:	07/09/2020

TITLE: **Borehole Location Plan**
Proposed Mixed Use Development
221 - 291 Crown Street, Wollongong

N

PROJECT No:	89584.01
DRAWING No:	1
REVISION:	0

Appendix C

SafeWork NSW Search Results

Locked Bag 2906, Lisarow NSW 2252
Customer Experience 13 10 50
ABN 81 913 830 179 | www.safework.nsw.gov.au

Our Ref: D20/203741

22 October 2020

Mr Kyle Johannes
Douglas Partners Pty Ltd
Email: kyle.johannes@douglaspartners.com.au

Dear Mr Johannes

RE SITES:

- 221-235 Crown Street, Wollongong NSW 2500
- 243-291 Crown Street, Wollongong NSW 2500
- 86 Burelli Street, Wollongong NSW 2500
- 216-238 Kiera Street, Wollongong NSW 2500

I refer to your site search request received by SafeWork NSW on 07 October 2020 requesting information on Storage of Hazardous Chemicals for the above site.

A search of the records held by SafeWork NSW has not located any records pertaining to the above-mentioned premises.

For further information or if you have any questions, please call us on 13 10 50 or email licensing@safework.nsw.gov.au

Yours sincerely

Gabriela Draper

Licensing Representative
Licensing and Funds, Better Regulation
SafeWork NSW

Appendix D

Data Quality Objectives

Appendix D, Data Quality Objectives
Proposed Mixed-Use Development
WIN Grand, Crown Street, Wollongong

D1.0 Data Quality Objectives

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

Step	Summary
1: State the problem	The objective of the investigation is to provide preliminary information on subsurface conditions potential contaminated land constraints and to provide a preliminary waste classification for off-site disposal of surplus soils generated during site redevelopment. A preliminary conceptual site model (CSM) has been prepared (Section 8) for the proposed development. The project team consisted of experienced environmental engineers and scientists working in the roles of Project Principal, Project Reviewer, Project Manager and Field staff.
2: Identify the decisions / goal of the study	The site history has identified possible contaminating previous uses which are identified in the CSM (Section 8). The CSM identifies the associated contaminants of potential concern (CoPC) and the likely impacted media. The site assessment criteria (SAC) for each of the CoPC are detailed in Appendix F. The decision is to establish whether or not the results fall below the SAC. On this basis, an assessment of the site's suitability from a contamination perspective and whether (or not) further assessment and / or remediation will be derived.
3: Identify the information inputs	Inputs to the investigation will be the results of analysis of samples to measure the concentration of CoPC identified in the CSM (Section 8) at the site using National Association of Testing Authorities (NATA) accredited laboratories and methods, where possible. The SAC for each of the CoPC are detailed in Appendix G.
4: Define the study boundaries	The lateral boundaries of the investigation area are shown on Drawing 1, Appendix B. The vertical boundaries are to the extent of contamination impact as determined from the site history assessment and site observations. The assessment is limited to the timeframe over which the field investigation was undertaken.
5: Develop the analytical approach (or decision rule)	The decision rule is to compare all analytical results with SAC (Appendix F, based on NEPC (2013)). Where guideline values are absent, other sources of guideline values accepted by NEPC (2013) shall be adopted where possible. Where a sample result exceeds the adopted criterion, a further site-specific assessment will be made as to the risk posed by the presence of that contaminant(s). Initial comparisons will be with individual results then, where required, 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. Quality control results are to be assessed according to their relative percent difference (RPD) values. For

Step	Summary
	field duplicates, triplicates and laboratory results, RPDs should generally be below 30%; for field blanks and rinsates, results should be at or less than the limits of reporting (NEPC, 2013). The field and laboratory quality assurance assessment is included in Appendix J.
6: Specify the performance or acceptance criteria	Baseline condition: Contaminants at the site exceed human health and environmental SAC and poses a potentially unacceptable risk to receptors (null hypothesis). Alternative condition: Contaminants at the site complies with human health and environmental SAC and as such, does not pose a potentially unacceptable risk to receptors (alternative hypothesis). Unless conclusive information from the collected data is sufficient to reject the null hypothesis, it is assumed that the baseline condition is true.
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 9.

D1.0 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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Appendix E

Field Work Methodology

Appendix E, Field Work Methodology
Proposed Mixed-Use Development
WIN Grand, Crown Street, Wollongong

E1.0 Guidelines

The following key guideline was consulted for the field work methodology:

- NEPC *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)* [NEPM] (NEPC, 2013).

E2.0 Soil Sampling

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

- Collect soil samples directly from solid flight augers at nominated sample depths;
- Transfer samples in laboratory-prepared glass jars with Teflon lined lids by hand, capping immediately and minimising headspace within the sample jar;
- Collect replicate samples in zip-lock bags for PID screening;
- Collect ~500 ml samples for FA and AF analysis;
- Wear a new disposable nitrile glove for each sample point thereby minimising potential for cross-contamination;
- Collect 10% replicate samples for QC purposes;
- Label sample containers with individual and unique identification details, including project number, sample location and sample depth (where applicable);
- Place samples into a cooled, insulated and sealed container for transport to the laboratory; and
- Use chain of custody documentation.

E3.0 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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Appendix F

Site Assessment Criteria

Appendix F, Site Assessment Criteria
Proposed Mixed-Use Development
WIN Grand, Crown Street, Wollongong

F1.0 Introduction

F1.1 Guidelines

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

- NEPC National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) [NEPM] (NEPC, 2013); and
- CRC CARE *Health screening levels for petroleum hydrocarbons in soil and groundwater* (CRC CARE, 2011).

F1.2 General

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

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

- Land use: residential.
    - Corresponding to land use category 'B', defined as residential with minimal opportunities for soil access includes dwellings with fully and permanently paved yard space such as high-rise buildings and flats.
- Soil type: sand.

F2.0 Soils

F2.1 Health Investigation and Screening Levels

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

Table 1: Health Investigation Levels (mg/kg)

Contaminant	HIL-B
Metals	
Arsenic	500
Cadmium	150
Chromium (VI)	500
Copper	30 000
Lead	1200
Mercury (inorganic)	120
Nickel	1200
Zinc	60 000
PAH	
B(a)P TEQ	4
Total PAH	400
Phenols	
Phenol	45 000
Pentachlorophenol	130
OCP	
DDT+DDE+DDD	600
Aldrin and dieldrin	10
Chlordane	90
Endosulfan	400
Endrin	20
Heptachlor	10
HCB	15
Methoxychlor	500
OPP	
Chlorpyrifos	340
PCB	
PCB	1

Table 2: Health Screening Levels (mg/kg)

Contaminant	HSL-A&B
SAND	**0 m to <1 m**
Benzene	0.5
Toluene	160
Ethylbenzene	55
Xylenes	40
Naphthalene	3
TRH F1	45
TRH F2	110

Notes: TRH F1 is TRH F1 minus BTEX

TRH F2 is TRH F2 minus naphthalene

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

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

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

Contaminant	DC HSL-B	DC HSL-IMW
Benzene	140	1100
Toluene	21 000	120 000
Ethylbenzene	5900	85 000
Xylenes	17 000	130 000
Naphthalene	2200	29 000
TRH F1	5600	82 000
TRH F2	4200	62 000
TRH F3	5800	85 000
TRH F4	8100	12 000

Notes: TRH F1 is TRH F1 minus BTEX

TRH F2 is TRH F2 minus naphthalene

IMW intrusive maintenance worker

F2.2 Asbestos in Soil

Based on the CSM and/or current site access limitations, a detailed asbestos assessment was not considered to be warranted at this stage.

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

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

The HSL are in Table 4.

Table 4: Health Screening Levels for Asbestos

Form of Asbestos	HSL-B
ACM	0.04%
FA and AF	0.001%
FA and AF and ACM	No visible asbestos for surface soil *

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

F2.3 Ecological Investigation Levels

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

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

Variable	Input	Rationale
Age of contaminants	“Aged” (>2 years)	-
pH	8.6	Analysis Range: 6.7 – 9.9
CEC	35 $cmol_c/kg$	Analysis Range: 29 – 40
Clay content	30%	Assumed based on clay being the predominant soil type tested
Traffic volumes	high	-
State / Territory	NSW	-

Table 6: Ecological Investigation Levels (mg/kg)

Contaminant	EIL-B
Metals	
Arsenic	100
Copper	240
Nickel	390
Chromium III	410
Lead	1100
Zinc	1200
PAH	
Naphthalene	170
OCP	
DDT	180

F2.4 Ecological Screening Levels

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

Table 7: Ecological Screening Levels (mg/kg)

Contaminant	Soil Type	EIL-B
Benzene	Coarse	50
Toluene	Coarse	85
Ethylbenzene	Coarse	70
Xylenes	Coarse	105
TRH F1	Coarse/ Fine	180*
TRH F2	Coarse/ Fine	120*
TRH F3	Coarse	300
TRH F4	Coarse	2800
B(a)P	Coarse	0.7

Notes: ESL are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability
TRH F1 is TRH F1 minus BTEX
TRH F2 is TRH F2 including naphthalene

F2.5 Management Limits

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

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

The adopted management limits are in Table 8.

Table 8: Management Limits (mg/kg)

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

Notes: TRH F1 is TRH F1 including BTEX
TRH F2 is TRH F2 including naphthalene

F3.0 References

CRC CARE. (2011). *Health screening levels for petroleum hydrocarbons in soil and groundwater.* Parts 1 to 3, Technical Report No. 10: Cooperative Research Centre for Contamination Assessment and Remediation of the Environment.

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

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Appendix G

Borehole Logs

BOREHOLE LOG

CLIENT: Birketu Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: WIN Grand, Crown Street, Wollongong

SURFACE LEVEL: 16.5 AHD
EASTING: 306265
NORTHING: 6188612
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 89584.01
DATE: 31/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
16	0.03	ASPHALTIC CONCRETE: dark grey, medium to coarse gravel							E			
	0.2	FILL/Gravelly SAND SP: grey brown, fine sand, medium to coarse gravel with clay, dry to moist							D			
	0.7	FILL/Sandy CLAY CL: low plasticity, brown, orange and dark brown, fine to coarse sand with medium gravel, w~PL						Unless otherwise stated, rock fractures along planar, rough iron stained joint.	E			
15	1								D			14,10,7
	1.3	FILL/Gravelly SAND SP: grey brown, fine sand, fine to medium gravel, dry to moist				▽			S			N = 17
	2								E			
14		Sandy CLAY CI: medium plasticity, fine sand, brown mottled orange, w~PL, very stiff							D			
	2.6	- becoming stiff, w>PL, below 1.5m							D			25/10 refusal
		SANDSTONE: fine grained, brown, high strength, moderately weathered							S			
	3							3.06m: J (80°)				
13								3.49m: J (85°)	C	100	87	
	4							4.1m: J (70°)				PL(A) = 2
12								4.19m: J (70°)				
								4.34m: J (70°)				
								4.42m: J (70°)				
		- becoming slightly weathered below 4.74m						4.66m: J (70°)				
	5							4.83m: J (60°)				PL(A) = 2
11		- becoming fresh below 5.53m						4.86m: J (30°), cu, ro, fe stn				
								5.29m: J (35°)				
	6								C	100	99	PL(A) = 2.4
10												
	7											
9	7.6	Bore discontinued at 7.6m										PL(A) = 2.7
		Limit of investigation										
	8											
8												
	9											
7												
	10											
6												
	11											
5												

RIG: Hanjin **DRILLER:** Total Drilling **LOGGED:** FH **CASING:** HWT

TYPE OF BORING: Solid flight auger TC bit to 2.5m, rotary mud flush to 2.6m, NMLC coring to 7.6m

WATER OBSERVATIONS: Water seepage observed at 1.2m during auger drilling

REMARKS: w = moisture content, PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Birketu Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: WIN Grand, Crown Street, Wollongong

SURFACE LEVEL: 19.5 AHD
EASTING: 306271
NORTHING: 6188633
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 89584.01
DATE: 1/9/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
19	0.03	ASPHALTIC CONCRETE: dark grey, medium to coarse gravel							E			
		FILL/Silty GRAVEL GM: dark brown grey, coarse gravel, dry							E			
18	1	- with anthropogenic material (bricks) from 0.3m-0.5m										
17	1.8	CLAY CI: medium plasticity, orange brown with extremely weathered rock bands, w<PL, very stiff							E D S			9,25/75 refusal
16	3.0	SANDSTONE: fine grained, pale brown, high strength, moderately weathered				10-09-20			D			
15	4								C	100	100	PL(A) = 2.1 PL(A) = 1.1
14	5	- becoming grey slightly weathered below 4.5m						4.38m: B, ir, ro, fe stn 5.08m: J (70°), pl, ro, fe stn				
13	6											PL(A) = 1.8
12	7	- becoming fresh below 6.65m						6.57m: J (80°), pl, ro, fe stn	C	100	100	
11	8							>>				PL(A) = 2.8
10	9								C	100	100	
9	10											
8	10.5	Bore discontinued at 10.5m Limit of investigation										
	11											

RIG: Hanjin **DRILLER:** Total Drilling **LOGGED:** FH **CASING:** HWT

TYPE OF BORING: Solid flight auger TC bit to 3.0m, roller bit to 3.15m, NMLC coring to 10.5m

WATER OBSERVATIONS: No free groundwater observed whilst auger drilling

REMARKS: Non destructive potholing to 1.9m, w = moisture content, PL = plastic limit, Standpipe piezometer installed to 10.5m: slotted interval 1.5 - 10.5m, blank interval 0 - 1.5m, sand interval 1.0 - 10.5m, gatic cover installed

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Birketu Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: WIN Grand, Crown Street, Wollongong

SURFACE LEVEL: 17.3 AHD
EASTING: 306325
NORTHING: 6188636
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 89584.01
DATE: 2/9/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low / Very Low / Low / Medium / High / Very High / Ex High		0.01 / 0.05 / 0.10 / 0.50 / 1.00	B - Bedding J - Joint S - Shear F - Fault				
17	0.02	ASPHALTIC CONCRETE: dark grey, medium to coarse gravel, dry							E/BD			
	0.15	FILL/Silty GRAVEL GM: grey, medium to coarse gravel, trace fine sand, dry						Unless otherwise stated, rock fractures along planar, rough clay coated bedding parting.	E D			
16	1								E S			3,4,5 N = 9
	1.2	FILL/Gravelly CLAY CL: low plasticity, brown, fine to medium gravel with silt, w~PL							E D			
15	2	CLAY CI: medium plasticity, orange brown with silt, w<PL, stiff - with extremely weathered rock bands below 1.7m							D			
	2.5	SANDSTONE: fine grained, orange brown, low strength, highly weathered to moderately weathered							S			25/150 refusal
14	3							2.73m: Cs (20mm) 2.78m: B 2.88m: B 2.9m: B				PL(A) = 0.1
								2.92m: B, pl, ro, cly vn 2.94m: B, pl, ro, cly vn 2.97m: B				
13	4	- becoming very high strength slightly weathered below 3.7m						3.07m: B, pl, ro, fe stn 3.08m: B 3.16m: B, pl, ro, fe stn 3.21m: B, pl, ro, fe stn 3.41m: Cs (25mm) 3.47m: B 3.49m: B 3.59m: B, pl, ro, cly vn 3.61m: J (50°), pl, ro, fe stn 3.65m: B	C	100	0.8	PL(A) = 3.1
12	5											
11	6							4.74m: B, pl, ro, fe stn 4.79m: B, pl, ro, fe stn				PL(A) = 3.3
10	7	- becoming high strength below 7.0m						7.34m: B, pl, ro, fe stn	C	100	98	PL(A) = 2.4
9	8							7.77m: B, pl, ro, fe stn 7.9m: B, pl, ro, fe stn 7.92m: B, pl, ro, fe stn 7.94m: B, pl, ro, fe stn				
	8.54	Bore discontinued at 8.54m Limit of investigation										PL(A) = 2.9
8	9											
7	10											
6	11											

RIG: Hanjin **DRILLER:** Total Drilling **LOGGED:** FH **CASING:** HWT

TYPE OF BORING: Solid flight auger TC bit to 2.6m, rotary mud flush to 2.7m NMLC coring to 8.54m

WATER OBSERVATIONS: No free groundwater observed whilst auger drilling

REMARKS: w = moisture content, PI = plastic limit

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Birketu Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: WIN Grand, Crown Street, Wollongong

SURFACE LEVEL: 14.4 AHD
EASTING: 306321
NORTHING: 6188612
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 89584.01
DATE: 3/9/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.02	ASPHALTIC CONCRETE: dark grey, coarse gravel, dry						B - Bedding J - Joint S - Shear F - Fault	E			
	0.3	FILL/Silty GRAVEL GM: grey, medium to coarse gravel, dry							E			
		CLAY CI: medium plasticity, brown mottled red and grey, w<PL, stiff						Unless otherwise stated, rock fractures along planar, rough, iron stained joint.	D			
	1	- becoming very stiff below 0.7m							E			
									D			
									E			
									D			3,11,15 N = 26
	2	- with extremely weathered rock bands below 2.0m							S			
									D			PL(A) = 0.4
	2.5	SANDSTONE: fine grained, brown orange, medium strength, highly weathered to moderately weathered							S			25/10 refusal
	3							2.62m: B, pl, ro, cly co 2.66m: J (25°) 2.68m: J (25°) 2.72m: J (20°) 2.77m: B, pl, ro, cly vn 2.85m: Cs (50mm) 2.9m: J (85°) 2.93m: B, pl, ro, cly vn 3.01m: Cs (20mm) 3.13m: J (85°) 3.29m: J (25°), pl, ro, cly vn 3.36m: J (15°) 3.45m: B, ir, ro, fe stn 3.59m: J (60°) 3.6m: J (60°) 3.7m: Fz (250mm) 3.97m: Cs (200mm)	C	100	47	
	4											
		- becoming moderately weathered below 4.6m										PL(A) = 1.6
	5											PL(A) = 0.5
	6							4.15m: J (20°) 4.21m: J (30°) 4.29m: J (25°) 4.32m: J (30°), pl, ro, cly vn 4.34m: J (30°), pl, ro, cly vn 4.37m: J (50°), pl, ro, cly vn 4.45m: J (45°) 5.01m: J (55°), pl, ro, cln 5.29m: J (20°) 5.39m: J (20°) 5.41m: J (20°) 5.72m: J (25°) 5.86m: J (25°), ir, ro, fe stn 5.97m: J (30°), ir, ro, fe stn 6.1m: B, pl, ro, fe stn 6.12m: B, pl, ro, fe stn 6.4m: J (10°) 6.42m: J (20°) 6.74m: J (25°), cu, ro, fe stn 7.17m: B, pl, ro, cly vn 7.33m: B, pl, ro, cly co 7.39m: J (15°) 7.45m: J, (20°), pl, ro, cly vn 7.58m: J (50°, pl, ro, fe stn				PL(A) = 2
	7								C	100	95	
		- becoming grey, very high strength, fresh below 7.6m				10-09-20						PL(A) = 5.8
	8											
	8.6	Bore discontinued at 8.6m Limit of investigation										
	9											
	10											
	11											

RIG: Hanjin **DRILLER:** Total Drilling **LOGGED:** FH **CASING:** HWT

TYPE OF BORING: Solid flight auger TC bit to 2.6m, NMLC coring to 8.6m

WATER OBSERVATIONS: No free groundwater observed whilst auger drilling

REMARKS: w = moisture content, PL = plastic limit, Fz = fault zone, Standpile piezometer installed to 8.5m: slotted interval 8.5 - 2.5m, blank interval 0 - 2.5m, sand interval 1.0 - 8.5m, gatic cover installed

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Birketu Pty Ltd
PROJECT: Proposed Mixed Use Development
LOCATION: WIN Grand, Crown Street, Wollongong

SURFACE LEVEL: 18.0 AHD
EASTING: 306352
NORTHING: 6188667
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 89584.01
DATE: 4/9/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
18	0.15	FILL/Silty GRAVEL GM: grey, medium gravel, dry							E/BD2			
		FILL/Gravelly CLAY CI: medium plasticity, dark brown, w~PL = with anthropogenic material (bricks) from 0.4-0.6m							E			
17	1							Unless otherwise stated, rock fractures along planar, rough, iron stained joint.				
	1.8	CLAY CI: medium plasticity, pale grey mottled red orange, w<PL, stiff to very stiff = trace ironstone gravel below 2m							E			
16	2								D			6,11,11 N = 22
15	3								S			
14	4								S			8,16,35 N = 51
	4.1							4.1m: CORE LOSS: 400mm				
	4.5											
	4.71	SANDSTONE: fine grained, brown orange, medium strength, highly weathered to moderately weathered							C	39		PL(A) = 0.8
13	5					10-09-20		4.84m: B, pl, ro, cly vn 4.98m: J (30°) 5.02m: J (15°) 5.16m: J (35°)				
								5.29m: B, pl, ro, cly vn 5.32m: J (90°) 5.38m: Cs (40mm) 5.44m: J (90°)				
12	6							5.67m: J (80°) 5.83m: J (80°) 5.92m: J (70°) 5.98m: J (80°)				PL(A) = 0.9
11	7	- becoming grey low strength, slightly weathered below 7.14m = becoming medium strength below 7.5m						6.13m: B, pl, ro, fe stn 6.28m: B, pl, ro, fe stn 6.42m: J (15°) 7.08m: J (45°)	C	43		PL(A) = 0.3
10	8							7.89m: J (10°)				PL(A) = 0.2 PL(A) = 0.1
9	9											
												PL(A) = 0.1
8	10							10.05m: B, pl, ro, fe stn 10.26m: J (50°), pl, ro, cly vn	C	100		PL(A) = 0.6 PL(A) = 0.4
7	11	- becoming high strength below 10.85m										PL(A) = 2.3
	11.35	Bore discontinued at 11.35m Limit of investigation										

RIG: Hanjin **DRILLER:** Total Drilling **LOGGED:** FH **CASING:** HWT

TYPE OF BORING: Solid flight auger TC bit to 4.0, rotary mud flush to 4.1m, NMLC coring to 11.35

WATER OBSERVATIONS: No free groundwater observed whilst auger drilling

REMARKS: Non destructive potholing to 1.8m, w = moisture content, PL = plastic limit, Standpipe peizometer installed to 11.3m: slotted interval 2.3 - 11.3m, blank interval 0 - 2.3m, sand interval 1.0 - 11.3m, gatic cover installed

SAMPLING & IN SITU TESTING LEGEND

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

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Appendix H

Laboratory Results Summary Tables

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Table H1: Summary of Laboratory Results – Metals, TRH, BTEX, PAH

			Metals								TRH								BTEX				PAH			
			Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	TRH C6 - C9	TRH C10-C36	TRH C6 - C10	TRH >C10-C16	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene [b]	Benzo(a)pyrene (BaP)	Benzo(a)pyrene TEQ	Total PAHs
		PQL	4	0.4	1	1	1	0.1	1	1	25	50	25	50	25	50	100	100	0.2	0.5	1	1	1	0.05	0.5	0.05
Sample ID	Depth	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1	0 - 0.1 m	31/08/2020	<4 500 100	<0.4 150 NC	16 500 670	52 3000 340	67 1200 1100	<0.1 120 NC	5 1200 670	66 60000 1800	<25 NC NC	<50 NC NC	<25 NC NC	<50 NC 120	<25 45 180	<50 110 NC	<100 NC 300	<100 NC 2800	<0.2 0.5 50	<0.5 160 85	<1 55 70	<1 40 105	<1 3 170	<0.05 NC 0.7	<0.5 4 NC	<0.05 400 NC
1	0.4 - 0.5 m	31/08/2020	5 500 100	<0.4 150 NC	18 500 670	39 3000 340	39 1200 1100	<0.1 120 NC	5 1200 670	56 60000 1800	<25 NC NC	<50 NC NC	<25 NC NC	<50 NC 120	<25 45 180	<50 110 NC	<100 NC 300	<100 NC 2800	<0.2 0.5 50	<0.5 160 85	<1 55 70	<1 40 105	<1 3 170	<0.05 NC 0.7	<0.5 4 NC	<0.05 400 NC
2	0.4 - 0.5 m	1/09/2020	<4 500 100	<0.4 150 NC	12 500 670	25 3000 340	33 1200 1100	0.1 120 NC	7 1200 670	66 60000 1800	<25 NC NC	<50 NC NC	<25 NC NC	<50 NC 120	<25 45 180	<50 110 NC	<100 NC 300	<100 NC 2800	<0.2 0.5 50	<0.5 160 85	<1 55 70	<1 40 105	<1 3 170	0.06 NC 0.7	<0.5 4 NC	0.2 400 NC
2	2.4 - 2.5 m	1/09/2020	<4 500 100	<0.4 150 NC	27 500 670	31 3000 340	9 1200 1100	<0.1 120 NC	23 1200 670	61 60000 1800	<25 NC NC	<50 NC NC	<25 NC NC	<50 NC 120	<25 150 180	<50 NL NC	<100 NC 1300	<100 NC 5600	<0.2 2 65	<0.5 NL 105	<1 NL 125	<1 NL 45	<1 NL 170	<0.05 NC 0.7	<0.5 4 NC	<0.05 400 NC
3	0 - 0.1 m	2/09/2020	<4 500 100	<0.4 150 NC	16 500 670	75 3000 340	3 1200 1100	<0.1 120 NC	3 1200 670	18 60000 1800	<25 NC NC	360 NC NC	<25 NC NC	<50 NC 120	<25 45 180	<50 110 NC	250 NC 300	490 NC 2800	<0.2 0.5 50	<0.5 160 85	<1 55 70	<1 40 105	<1 3 170	0.05 NC 0.7	<0.5 4 NC	2.8 400 NC
BD1	0-0.1	2/09/2020	<4 500 100	<0.4 150 NC	14 500 670	58 3000 340	4 1200 1100	<0.1 120 NC	3 1200 670	18 60000 1800	<25 NC NC	<50 NC NC	<25 NC NC	<50 NC 120	<25 45 180	<50 110 NC	<100 NC 300	<100 NC 2800	<0.2 0.5 50	<0.5 160 85	<1 55 70	<1 40 105	<1 3 170	NT NC 0.7	NT 4 NC	NT 400 NC
3	0.4 - 0.5 m	2/09/2020	5 500 100	<0.4 150 NC	24 500 670	76 3000 340	74 1200 1100	0.3 120 NC	9 1200 670	79 60000 1800	<25 NC NC	<50 NC NC	<25 NC NC	<50 NC 120	<25 45 180	<50 110 NC	<100 NC 300	<100 NC 2800	<0.2 0.5 50	<0.5 160 85	<1 55 70	<1 40 105	<1 3 170	0.09 NC 0.7	<0.5 4 NC	0.3 400 NC
4	0 - 0.1 m	3/09/2020	<4 500 100	<0.4 150 NC	17 500 670	53 3000 340	3 1200 1100	<0.1 120 NC	2 1200 670	16 60000 1800	<25 NC NC	<50 NC NC	<25 NC NC	<50 NC 120	<25 45 180	<50 110 NC	<100 NC 300	<100 NC 2800	<0.2 0.5 50	<0.5 160 85	<1 55 70	<1 40 105	<1 3 170	<0.05 NC 0.7	<0.5 4 NC	<0.05 400 NC
5	0 - 0.1 m	4/09/2020	<4 500 100	<0.4 150 NC	5 500 670	140 3000 340	36 1200 1100	<0.1 120 NC	7 1200 670	110 60000 1800	<25 NC NC	<50 NC NC	<25 NC NC	<50 NC 120	<25 45 180	<50 110 NC	<100 NC 300	<100 NC 2800	<0.2 0.5 50	<0.5 160 85	<1 55 70	<1 40 105	<1 3 170	<0.05 NC 0.7	<0.5 4 NC	<0.05 400 NC
5	0.4 - 0.5 m	4/09/2020	<4 500 100	<0.4 150 NC	4 500 670	18 3000 340	**290** 1200 1100	0.1 120 NC	4 1200 670	110 60000 1800	<25 NC NC	<50 NC NC	<25 NC NC	<50 NC 120	<25 50 180	<50 280 NC	<100 NC 1300	<100 NC 5600	<0.2 0.7 65	<0.5 480 105	<1 NL 125	<1 110 45	<1 5 170	0.2 NC 0.7	<0.5 4 NC	1.7 400 NC
5 - [TRIPLICATE]	0.4 - 0.5 m	4/09/2020	9 500 100	0.8 150 NC	14 500 670	73 3000 340	**780** 1200 1100	0.4 120 NC	11 1200 670	510 60000 1800	NT NC NC	NT NC NC	NT NC NC	NT NC 120	NT 50 180	NT 280 NC	NT NC 1300	NT NC 5600	NT 0.7 65	NT 480 105	NT NL 125	NT 110 45	NT 5 170	NT NC 0.7	NT 4 NC	NT 400 NC
5	2.4 - 2.5 m	4/09/2020	<4 500 100	<0.4 150 NC	10 500 670	6 3000 340	4 1200 1100	<0.1 120 NC	1 1200 670	7 60000 1800	<25 NC NC	<50 NC NC	<25 NC NC	<50 NC 120	<25 150 180	<50 NL NC	<100 NC 1300	<100 NC 5600	<0.2 2 65	<0.5 NL 105	<1 NL 125	<1 NL 45	<1 NL 170	<0.05 NC 0.7	<0.5 4 NC	<0.05 400 NC
NSW Waste Classification Guidelines																										
CT1			500	20	1500	NC	100	4	40	NC	650	10000	NC	NC	NC	NC	NC	NC	10	288	600	1000	NC	0.8	NC	200
CT2			400	80	400	NC	400	16	160	NC	2600	40000	NC	NC	NC	NC	NC	NC	40	1152	2400	4000	NC	3.2	NC	800

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 below the PQL, refer to the lab report **Blue** = DC exceedance

Bold = Exceedance of NSW waste classification guidelines NT = Not tested NL = Non limiting NC = No criteria NA = Not applicable NAD = No asbestos detected at the reporting limit

Notes:

HIL/HSL/DC	NEPC, Schedule B1 - HIL B (undefined), HSL A/B (undefined), DC HSL B (undefined)
EIL/ESL	NEPC, Schedule B1 - EIL UR/POS (undefined), ESL UR/POS (undefined)
ML	NEPC, Schedule B1 - ML R/P/POS (undefined)
a	QA/QC replicate of sample listed directly below the primary sample
b	Reported naphthalene laboratory result obtained from BTEXN suite
c	Criteria applies to DDT only
d	Criteria for scheduled chemicals used as an initial screen
e	Criteria for Chlorpyrifos used as initial screen
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
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

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Table H2: Summary of Laboratory Results – Phenol, OCP, OPP, PCB, Asbestos

			Phenol	OCP												OPP		PCB	Asbestos		
			Phenol	DDT+DDE+DDD [c]	DDD	DDE	DDT	Aldrin & Dieldrin	Total Chlordane	Total Endosulfan	Endrin	Heptachlor	Hexachlorobenzene	Methoxychlor	Total Analysed OCP [d]	Chlorpyriphos	Total Analysed OPP [e]	Total PCB	Asbestos ID in soil >0.1g/kg	Trace Analysis	Asbestos (50 g)
		PQL	5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1			
Sample ID	Depth	Sample Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	-	-	-
1	0 - 0.1 m	31/08/2020	<5 130 NC	<0.1 600 180	<0.1 NC NC	<0.1 NC NC	<0.1 NC 180	<0.1 10 NC	<0.1 90 NC	<0.1 400 NC	<0.1 20 NC	<0.1 10 NC	<0.1 15 NC	<0.1 500 NC	<0.1 NC NC	<0.1 340 NC	<0.1 NC NC	<0.1 1 NC	NAD	NAD	NAD
1	0.4 - 0.5 m	31/08/2020	<5 130 NC	<0.1 600 180	<0.1 NC NC	<0.1 NC NC	<0.1 NC 180	<0.1 10 NC	<0.1 90 NC	<0.1 400 NC	<0.1 20 NC	<0.1 10 NC	<0.1 15 NC	<0.1 500 NC	<0.1 NC NC	<0.1 340 NC	<0.1 NC NC	<0.1 1 NC	NAD	NAD	NAD
2	0.4 - 0.5 m	1/09/2020	<5 130 NC	<0.1 600 180	<0.1 NC NC	<0.1 NC NC	<0.1 NC 180	<0.1 10 NC	<0.1 90 NC	<0.1 400 NC	<0.1 20 NC	<0.1 10 NC	<0.1 15 NC	<0.1 500 NC	<0.1 NC NC	<0.1 340 NC	<0.1 NC NC	<0.1 1 NC	NAD	NAD	NAD
2	2.4 - 2.5 m	1/09/2020	<5 130 NC	<0.1 600 180	<0.1 NC NC	<0.1 NC NC	<0.1 NC 180	<0.1 10 NC	<0.1 90 NC	<0.1 400 NC	<0.1 20 NC	<0.1 10 NC	<0.1 15 NC	<0.1 500 NC	<0.1 NC NC	<0.1 340 NC	<0.1 NC NC	<0.1 1 NC	NAD	NAD	NAD
3	0 - 0.1 m	2/09/2020	<5 130 NC	<0.1 600 180	<0.1 NC NC	<0.1 NC NC	<0.1 NC 180	<0.1 10 NC	<0.1 90 NC	<0.1 400 NC	<0.1 20 NC	<0.1 10 NC	<0.1 15 NC	<0.1 500 NC	<0.1 NC NC	<0.1 340 NC	<0.1 NC NC	<0.1 1 NC	NAD	NAD	NAD
BD1	0 m	2/09/2020	NT 130 NC	NT 600 180	NT NC NC	NT NC NC	NT NC 180	NT 10 NC	NT 90 NC	NT 400 NC	NT 20 NC	NT 10 NC	NT 15 NC	NT 500 NC	NT NC NC	NT 340 NC	NT NC NC	NT 1 NC	NT	NT	NT
3	0.4 - 0.5 m	2/09/2020	<5 130 NC	<0.1 600 180	<0.1 NC NC	<0.1 NC NC	<0.1 NC 180	<0.1 10 NC	<0.1 90 NC	<0.1 400 NC	<0.1 20 NC	<0.1 10 NC	<0.1 15 NC	<0.1 500 NC	<0.1 NC NC	<0.1 340 NC	<0.1 NC NC	<0.1 1 NC	NAD	NAD	NAD
4	0 - 0.1 m	3/09/2020	<5 130 NC	<0.1 600 180	<0.1 NC NC	<0.1 NC NC	<0.1 NC 180	<0.1 10 NC	<0.1 90 NC	<0.1 400 NC	<0.1 20 NC	<0.1 10 NC	<0.1 15 NC	<0.1 500 NC	<0.1 NC NC	<0.1 340 NC	<0.1 NC NC	<0.1 1 NC	NAD	NAD	NAD
5	0 - 0.1 m	4/09/2020	<5 130 NC	<0.1 600 180	<0.1 NC NC	<0.1 NC NC	<0.1 NC 180	<0.1 10 NC	<0.1 90 NC	<0.1 400 NC	<0.1 20 NC	<0.1 10 NC	<0.1 15 NC	<0.1 500 NC	<0.1 NC NC	<0.1 340 NC	<0.1 NC NC	<0.1 1 NC	NAD	NAD	NAD
5	0.4 - 0.5 m	4/09/2020	<5 130 NC	<0.1 600 180	<0.1 NC NC	<0.1 NC NC	<0.1 NC 180	<0.1 10 NC	<0.1 90 NC	<0.1 400 NC	<0.1 20 NC	<0.1 10 NC	<0.1 15 NC	<0.1 500 NC	<0.1 NC NC	<0.1 340 NC	<0.1 NC NC	<0.1 1 NC	NAD	NAD	NAD
5 - [TRIPLICATE]	0.4 - 0.5 m	4/09/2020	NT 130 NC	NT 600 180	NT NC NC	NT NC NC	NT NC 180	NT 10 NC	NT 90 NC	NT 400 NC	NT 20 NC	NT 10 NC	NT 15 NC	NT 500 NC	NT NC NC	NT 340 NC	NT NC NC	NT 1 NC	NT	NT	NT
5	2.4 - 2.5 m	4/09/2020	<5 130 NC	<0.1 600 180	<0.1 NC NC	<0.1 NC NC	<0.1 NC 180	<0.1 10 NC	<0.1 90 NC	<0.1 400 NC	<0.1 20 NC	<0.1 10 NC	<0.1 15 NC	<0.1 500 NC	<0.1 NC NC	<0.1 340 NC	<0.1 NC NC	<0.1 1 NC	NAD	NAD	NAD
NSW Waste Classification Guidelines																					
CT1			288	NC	NC	NC	NC	NC	NC	60	NC	NC	NC	NC	<50	4	4	<50	NC	NC	NC
CT2			1152	NC	NC	NC	NC	NC	NC	240	NC	NC	NC	NC	<50	16	16	<50	NC	NC	NC

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 below the PQL, refer to the lab report **Blue** = DC exceedance

Bold = Exceedance of NSW waste classification guidelines NT = Not tested NL = Non limiting NC = No criteria NA = Not applicable NAD = No asbestos detected at the reporting limit

Notes:

HIL/HSL/DC	NEPC, Schedule B1 - HIL B (undefined), HSL A/B (undefined), DC HSL B (undefined)
EIL/ESL	NEPC, Schedule B1 - EIL UR/POS (undefined), ESL UR/POS (undefined)
ML	NEPC, Schedule B1 - ML R/P/POS (undefined)
a	QA/QC replicate of sample listed directly below the primary sample
b	Reported naphthalene laboratory result obtained from BTEXN suite
c	Criteria applies to DDT only
d	Criteria for scheduled chemicals used as an initial screen
e	Criteria for Chlorpyrifos used as initial screen
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
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

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Table H3: Summary of Laboratory Results – Complete PAH suite, TRH, Complete OCP suite, Complete OPP suite, Non-metals

			Complete PAH suite												TRH		Complete OCP suite										Complete OPP suite				Non-metals		
			Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(g,h,i)perylene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	TRH C6 - C9	C10-C36 recoverable hydrocarbons	alpha-BHC	beta-BHC	Bromophos-ethyl	Chlorpyriphos-methyl	delta-BHC	Diazinon	Dimethoate	Endrin Aldehyde	Lindane	Heptachlor Epoxide	Azinphos methyl (Guthion)	Ethion	Fenitrothion	Ronnel (fenchlorphos)	Moisture	Chloride	Sulphate
		PQL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	25	50	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	10	10
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
1	0 - 0.1 m	31/08/2020	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<25 NC	<50 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	12 NC	NT NC	NT NC
1	0.4 - 0.5 m	31/08/2020	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<25 NC	<50 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	18 NC	NT NC	NT NC
2	0.4 - 0.5 m	1/09/2020	<0.1 NC	<0.1 NC	<0.1 NC	0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<25 NC	<50 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	12 NC	NT NC	NT NC
2	2.4 - 2.5 m	1/09/2020	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<25 NC	<50 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	12 NC	<10 NC	10 NC
3	0 - 0.1 m	2/09/2020	<0.1 NC	<0.1 NC	<0.1 NC	0.1 NC	<0.1 NC	0.2 NC	<0.1 NC	1 NC	<0.1 NC	<0.1 NC	0.7 NC	0.7 NC	<25 NC	360 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	4.2 NC	NT NC	NT NC
BD1	0 m	2/09/2020	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	<25 NC	<50 NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	6.1 NC	NT NC	NT NC
3	0.4 - 0.5 m	2/09/2020	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	0.1 NC	<25 NC	<50 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	41 NC	NT NC	NT NC
4	0 - 0.1 m	3/09/2020	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<25 NC	<50 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	22 NC	NT NC	NT NC
5	0 - 0.1 m	4/09/2020	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<25 NC	<50 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	7.2 NC	NT NC	NT NC
5	0.4 - 0.5 m	4/09/2020	<0.1 NC	<0.1 NC	0.2 NC	0.1 NC	0.1 NC	0.1 NC	<0.1 NC	0.2 NC	<0.1 NC	<0.1 NC	0.2 NC	0.3 NC	<25 NC	<50 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	31 NC	NT NC	NT NC
5 - [TRIPLICATE]	0.4 - 0.5 m	4/09/2020	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC	NT NC
5	2.4 - 2.5 m	4/09/2020	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<25 NC	<50 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	<0.1 NC	18 NC	20 NC	45 NC

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 below the PQL, refer to the lab report **Blue** = DC exceedance

Bold = Lab detections NT = Not tested NL = Non limiting NC = No criteria NA = Not applicable NAD = No asbestos detected at the reporting limit

Notes:

HIL/HSL/DC	NEPC, Schedule B1 - HIL B (undefined), HSL A/B (undefined), DC HSL B (undefined)
EIL/ESL	NEPC, Schedule B1 - EIL UR/POS (undefined), ESL UR/POS (undefined)
ML	NEPC, Schedule B1 - ML R/P/POS (undefined)
a	QA/QC replicate of sample listed directly below the primary sample
b	Reported naphthalene laboratory result obtained from BTEXN suite
c	Criteria applies to DDT only

Appendix I

Laboratory Certificates of Analysis, Chain-of-Custody Documentation and Sample Receipt Advice

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

CERTIFICATE OF ANALYSIS 250924

Client Details

Client	Douglas Partners Unanderra
Attention	David Metcalf
Address	Unit 1, 1 Luso Drive, Unanderra, NSW, 2526

Sample Details

Your Reference	**89584.01, Wollongong**
Number of Samples	19 SOIL
Date samples received	10/09/2020
Date completed instructions received	10/09/2020

Analysis Details

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

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

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

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

Report Details

Date results requested by	17/09/2020
Date of Issue	16/09/2020

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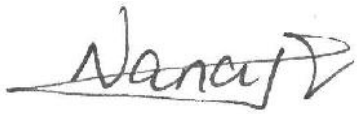
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Asbestos Approved By
Analysed by Asbestos Approved Identifier: Lucy Zhu
Authorised by Asbestos Approved Signatory: Lucy Zhu

Results Approved By
Diego Bigolin, Team Leader, Inorganics
Dragana Tomas, Senior Chemist
Jaimie Loa-Kum-Cheung, Metals Supervisor
Loren Bardwell, Senior Chemist
Lucy Zhu, Asbestos Supervisor
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		250924-3	250924-9	250924-11	250924-12	250924-13
Your Reference	UNITS	2	5	1	1	2
Depth		2.4-2.5	2.4-2.5	0-0.1	0.4-0.5	0.4-0.5
Date Sampled		1/09/2020	4/09/2020	31/08/2020	31/08/2020	1/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	95	99	93	94	92

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		250924-14	250924-15	250924-16	250924-17	250924-18
Your Reference	UNITS	3	3	4	5	5
Depth		0-0.1	0.4-0.5	0-0.1	0-0.1	0.4-0.5
Date Sampled		2/09/2020	2/09/2020	3/09/2020	4/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	99	95	96	96	91

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		250924-19
Your Reference	UNITS	BD1
Depth		-
Date Sampled		2/09/2020
Type of sample		SOIL
Date extracted	-	14/09/2020
Date analysed	-	15/09/2020
TRH C_6 - C_9	mg/kg	<25
TRH C_6 - C_{10}	mg/kg	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
naphthalene	mg/kg	<1
Total +ve Xylenes	mg/kg	<3
Surrogate aaa-Trifluorotoluene	%	102

svTRH (C10-C40) in Soil						
Our Reference		250924-3	250924-9	250924-11	250924-12	250924-13
Your Reference	UNITS	2	5	1	1	2
Depth		2.4-2.5	2.4-2.5	0-0.1	0.4-0.5	0.4-0.5
Date Sampled		1/09/2020	4/09/2020	31/08/2020	31/08/2020	1/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	90	92	92	88	88

svTRH (C10-C40) in Soil						
Our Reference		250924-14	250924-15	250924-16	250924-17	250924-18
Your Reference	UNITS	3	3	4	5	5
Depth		0-0.1	0.4-0.5	0-0.1	0-0.1	0.4-0.5
Date Sampled		2/09/2020	2/09/2020	3/09/2020	4/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	360	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	250	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	490	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	740	<50	<50	<50	<50
Surrogate o-Terphenyl	%	99	90	94	90	94

svTRH (C10-C40) in Soil		
Our Reference		250924-19
Your Reference	UNITS	BD1
Depth		-
Date Sampled		2/09/2020
Type of sample		SOIL
Date extracted	-	14/09/2020
Date analysed	-	15/09/2020
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	<100
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	88

PAHs in Soil						
Our Reference		250924-3	250924-9	250924-11	250924-12	250924-13
Your Reference	UNITS	2	5	1	1	2
Depth		2.4-2.5	2.4-2.5	0-0.1	0.4-0.5	0.4-0.5
Date Sampled		1/09/2020	4/09/2020	31/08/2020	31/08/2020	1/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	0.06
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05	0.2
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	99	99	101	94	100

PAHs in Soil						
Our Reference		250924-14	250924-15	250924-16	250924-17	250924-18
Your Reference	UNITS	3	3	4	5	5
Depth		0-0.1	0.4-0.5	0-0.1	0-0.1	0.4-0.5
Date Sampled		2/09/2020	2/09/2020	3/09/2020	4/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.7	<0.1	<0.1	<0.1	0.2
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.2
Fluoranthene	mg/kg	1	0.1	<0.1	<0.1	0.2
Pyrene	mg/kg	0.7	0.1	<0.1	<0.1	0.3
Benzo(a)anthracene	mg/kg	0.1	<0.1	<0.1	<0.1	0.1
Chrysene	mg/kg	0.2	<0.1	<0.1	<0.1	0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	0.3
Benzo(a)pyrene	mg/kg	0.05	0.09	<0.05	<0.05	0.2
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.1
Total +ve PAH's	mg/kg	2.8	0.3	<0.05	<0.05	1.7
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	99	94	97	99	96

Organochlorine Pesticides in soil						
Our Reference		250924-3	250924-9	250924-11	250924-12	250924-13
Your Reference	UNITS	2	5	1	1	2
Depth		2.4-2.5	2.4-2.5	0-0.1	0.4-0.5	0.4-0.5
Date Sampled		1/09/2020	4/09/2020	31/08/2020	31/08/2020	1/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	101	98	100	97	98

Organochlorine Pesticides in soil						
Our Reference		250924-14	250924-15	250924-16	250924-17	250924-18
Your Reference	UNITS	3	3	4	5	5
Depth		0-0.1	0.4-0.5	0-0.1	0-0.1	0.4-0.5
Date Sampled		2/09/2020	2/09/2020	3/09/2020	4/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	94	98	100	99	101

Organophosphorus Pesticides in Soil						
Our Reference		250924-3	250924-9	250924-11	250924-12	250924-13
Your Reference	UNITS	2	5	1	1	2
Depth		2.4-2.5	2.4-2.5	0-0.1	0.4-0.5	0.4-0.5
Date Sampled		1/09/2020	4/09/2020	31/08/2020	31/08/2020	1/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	101	98	100	97	98

Organophosphorus Pesticides in Soil						
Our Reference		250924-14	250924-15	250924-16	250924-17	250924-18
Your Reference	UNITS	3	3	4	5	5
Depth		0-0.1	0.4-0.5	0-0.1	0-0.1	0.4-0.5
Date Sampled		2/09/2020	2/09/2020	3/09/2020	4/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	94	98	100	99	101

PCBs in Soil						
Our Reference		250924-3	250924-9	250924-11	250924-12	250924-13
Your Reference	UNITS	2	5	1	1	2
Depth		2.4-2.5	2.4-2.5	0-0.1	0.4-0.5	0.4-0.5
Date Sampled		1/09/2020	4/09/2020	31/08/2020	31/08/2020	1/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	101	98	100	97	98

PCBs in Soil						
Our Reference		250924-14	250924-15	250924-16	250924-17	250924-18
Your Reference	UNITS	3	3	4	5	5
Depth		0-0.1	0.4-0.5	0-0.1	0-0.1	0.4-0.5
Date Sampled		2/09/2020	2/09/2020	3/09/2020	4/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	94	98	100	99	101

Acid Extractable metals in soil						
Our Reference		250924-3	250924-9	250924-11	250924-12	250924-13
Your Reference	UNITS	2	5	1	1	2
Depth		2.4-2.5	2.4-2.5	0-0.1	0.4-0.5	0.4-0.5
Date Sampled		1/09/2020	4/09/2020	31/08/2020	31/08/2020	1/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Arsenic	mg/kg	<4	<4	<4	5	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	27	10	16	18	12
Copper	mg/kg	31	6	52	39	25
Lead	mg/kg	9	4	67	39	33
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	0.1
Nickel	mg/kg	23	1	5	5	7
Zinc	mg/kg	61	7	66	56	66

Acid Extractable metals in soil						
Our Reference		250924-14	250924-15	250924-16	250924-17	250924-18
Your Reference	UNITS	3	3	4	5	5
Depth		0-0.1	0.4-0.5	0-0.1	0-0.1	0.4-0.5
Date Sampled		2/09/2020	2/09/2020	3/09/2020	4/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Arsenic	mg/kg	<4	5	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	16	24	17	5	4
Copper	mg/kg	75	76	53	140	18
Lead	mg/kg	3	74	3	36	290
Mercury	mg/kg	<0.1	0.3	<0.1	<0.1	0.1
Nickel	mg/kg	3	9	2	7	4
Zinc	mg/kg	18	79	16	110	110

Acid Extractable metals in soil			
Our Reference		250924-19	250924-20
Your Reference	UNITS	BD1	5 - [TRIPLICATE]
Depth		-	0.4-0.5
Date Sampled		2/09/2020	4/09/2020
Type of sample		SOIL	SOIL
Date prepared	-	15/09/2020	15/09/2020
Date analysed	-	15/09/2020	15/09/2020
Arsenic	mg/kg	<4	9
Cadmium	mg/kg	<0.4	0.8
Chromium	mg/kg	14	14
Copper	mg/kg	58	73
Lead	mg/kg	4	780
Mercury	mg/kg	<0.1	0.4
Nickel	mg/kg	3	11
Zinc	mg/kg	18	510

Misc Soil - Inorg						
Our Reference		250924-3	250924-9	250924-11	250924-12	250924-13
Your Reference	UNITS	2	5	1	1	2
Depth		2.4-2.5	2.4-2.5	0-0.1	0.4-0.5	0.4-0.5
Date Sampled		1/09/2020	4/09/2020	31/08/2020	31/08/2020	1/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5

Misc Soil - Inorg						
Our Reference		250924-14	250924-15	250924-16	250924-17	250924-18
Your Reference	UNITS	3	3	4	5	5
Depth		0-0.1	0.4-0.5	0-0.1	0-0.1	0.4-0.5
Date Sampled		2/09/2020	2/09/2020	3/09/2020	4/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5

Moisture						
Our Reference		250924-3	250924-9	250924-11	250924-12	250924-13
Your Reference	UNITS	2	5	1	1	2
Depth		2.4-2.5	2.4-2.5	0-0.1	0.4-0.5	0.4-0.5
Date Sampled		1/09/2020	4/09/2020	31/08/2020	31/08/2020	1/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Moisture	%	12	18	12	18	12

Moisture						
Our Reference		250924-14	250924-15	250924-16	250924-17	250924-18
Your Reference	UNITS	3	3	4	5	5
Depth		0-0.1	0.4-0.5	0-0.1	0-0.1	0.4-0.5
Date Sampled		2/09/2020	2/09/2020	3/09/2020	4/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Moisture	%	4.2	41	22	7.2	31

Moisture		
Our Reference		250924-19
Your Reference	UNITS	BD1
Depth		-
Date Sampled		2/09/2020
Type of sample		SOIL
Date prepared	-	14/09/2020
Date analysed	-	15/09/2020
Moisture	%	6.1

Asbestos ID - soils						
Our Reference		250924-3	250924-9	250924-11	250924-12	250924-13
Your Reference	UNITS	2	5	1	1	2
Depth		2.4-2.5	2.4-2.5	0-0.1	0.4-0.5	0.4-0.5
Date Sampled		1/09/2020	4/09/2020	31/08/2020	31/08/2020	1/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Sample mass tested	g	Approx. 30g	Approx. 45g	Approx. 60g	Approx. 55g	Approx. 50g
Sample Description	-	Brown coarse-grained soil & rocks	Brown clayey soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils						
Our Reference		250924-14	250924-15	250924-16	250924-17	250924-18
Your Reference	UNITS	3	3	4	5	5
Depth		0-0.1	0.4-0.5	0-0.1	0-0.1	0.4-0.5
Date Sampled		2/09/2020	2/09/2020	3/09/2020	4/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Sample mass tested	g	Approx. 30g	Approx. 25g	Approx. 50g	Approx. 35g	Approx. 25g
Sample Description	-	Beige coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Beige coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Misc Inorg - Soil						
Our Reference		250924-1	250924-2	250924-3	250924-4	250924-5
Your Reference	UNITS	1	1	2	2	3
Depth		1.4-1.5	4.0	2.4-2.5	7.0	1.4-1.5
Date Sampled		31/08/2020	31/08/2020	1/09/2020	1/09/2020	2/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
pH 1:5 soil:water	pH Units	9.9	8.9	8.8	9.6	6.7
Electrical Conductivity 1:5 soil:water	µS/cm	350	26	26	160	150
Chloride, Cl 1:5 soil:water	mg/kg	10	<10	<10	20	32
Sulphate, SO4 1:5 soil:water	mg/kg	350	<10	10	53	200
Resistivity in soil*	ohm m	29	380	380	62	67

Misc Inorg - Soil						
Our Reference		250924-6	250924-7	250924-8	250924-9	250924-10
Your Reference	UNITS	3	4	4	5	5
Depth		7.75	1.4-1.5	4.0	2.4-2.5	6.0
Date Sampled		2/09/2020	3/09/2020	3/09/2020	4/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020	11/09/2020
pH 1:5 soil:water	pH Units	9.4	7.4	7.7	8.4	9.0
Electrical Conductivity 1:5 soil:water	µS/cm	29	210	350	86	31
Chloride, Cl 1:5 soil:water	mg/kg	<10	47	73	20	<10
Sulphate, SO4 1:5 soil:water	mg/kg	10	280	510	45	10
Resistivity in soil*	ohm m	340	48	28	120	320

Misc Inorg - Soil				
Our Reference		250924-12	250924-13	250924-18
Your Reference	UNITS	1	2	5
Depth		0.4-0.5	0.4-0.5	0.4-0.5
Date Sampled		31/08/2020	1/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL
Date prepared	-	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	11/09/2020	11/09/2020	11/09/2020
pH 1:5 soil:water	pH Units	9.2	8.9	8.5

CEC				
Our Reference		250924-12	250924-13	250924-18
Your Reference	UNITS	1	2	5
Depth		0.4-0.5	0.4-0.5	0.4-0.5
Date Sampled		31/08/2020	1/09/2020	4/09/2020
Type of sample		SOIL	SOIL	SOIL
Date prepared	-	15/09/2020	15/09/2020	15/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020
Exchangeable Ca	meq/100g	22	37	33
Exchangeable K	meq/100g	0.3	0.2	0.6
Exchangeable Mg	meq/100g	5.6	2.3	0.88
Exchangeable Na	meq/100g	1.3	0.13	<0.1
Cation Exchange Capacity	meq/100g	29	40	35

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons. Resistivity is calculated from Conductivity (non NATA). Resistivity (calculated) may not correlate with results otherwise obtained using Resistivity-Current method, depending on the nature of the soil being analysed.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.

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

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	250924-9
Date extracted	-			14/09/2020	3	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			15/09/2020	3	15/09/2020	15/09/2020		15/09/2020	15/09/2020
TRH C_6 - C_9	mg/kg	25	Org-023	<25	3	<25	<25	0	109	105
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	3	<25	<25	0	109	105
Benzene	mg/kg	0.2	Org-023	<0.2	3	<0.2	<0.2	0	115	109
Toluene	mg/kg	0.5	Org-023	<0.5	3	<0.5	<0.5	0	112	106
Ethylbenzene	mg/kg	1	Org-023	<1	3	<1	<1	0	103	100
m+p-xylene	mg/kg	2	Org-023	<2	3	<2	<2	0	107	104
o-Xylene	mg/kg	1	Org-023	<1	3	<1	<1	0	113	108
naphthalene	mg/kg	1	Org-023	<1	3	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	97	3	95	95	0	101	93

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	18	14/09/2020	14/09/2020		[NT]	[NT]
Date analysed	-			[NT]	18	15/09/2020	15/09/2020		[NT]	[NT]
TRH C_6 - C_9	mg/kg	25	Org-023	[NT]	18	<25	<25	0	[NT]	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-023	[NT]	18	<25	<25	0	[NT]	[NT]
Benzene	mg/kg	0.2	Org-023	[NT]	18	<0.2	<0.2	0	[NT]	[NT]
Toluene	mg/kg	0.5	Org-023	[NT]	18	<0.5	<0.5	0	[NT]	[NT]
Ethylbenzene	mg/kg	1	Org-023	[NT]	18	<1	<1	0	[NT]	[NT]
m+p-xylene	mg/kg	2	Org-023	[NT]	18	<2	<2	0	[NT]	[NT]
o-Xylene	mg/kg	1	Org-023	[NT]	18	<1	<1	0	[NT]	[NT]
naphthalene	mg/kg	1	Org-023	[NT]	18	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	[NT]	18	91	89	2	[NT]	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	250924-9
Date extracted	-			14/09/2020	3	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			15/09/2020	3	15/09/2020	15/09/2020		15/09/2020	15/09/2020
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	3	<50	<50	0	120	108
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	3	<100	<100	0	90	90
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	3	<100	<100	0	108	97
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	3	<50	<50	0	120	108
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	3	<100	<100	0	90	90
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	3	<100	<100	0	108	97
Surrogate o-Terphenyl	%		Org-020	92	3	90	90	0	96	94

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	18	14/09/2020	14/09/2020		[NT]	[NT]
Date analysed	-			[NT]	18	15/09/2020	15/09/2020		[NT]	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-020	[NT]	18	<50	<50	0	[NT]	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-020	[NT]	18	<100	<100	0	[NT]	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-020	[NT]	18	<100	<100	0	[NT]	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	[NT]	18	<50	<50	0	[NT]	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	[NT]	18	<100	<100	0	[NT]	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	[NT]	18	<100	<100	0	[NT]	[NT]
Surrogate o-Terphenyl	%		Org-020	[NT]	18	94	95	1	[NT]	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	250924-9
Date extracted	-			14/09/2020	3	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			15/09/2020	3	15/09/2020	15/09/2020		15/09/2020	15/09/2020
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	94	90
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	87	96
Fluorene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	93	91
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	115	113
Anthracene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	102	102
Pyrene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	100	109
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	86	86
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	3	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	3	<0.05	<0.05	0	90	95
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	101	3	99	95	4	101	96

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	18	14/09/2020	14/09/2020		[NT]	[NT]
Date analysed	-			[NT]	18	15/09/2020	15/09/2020		[NT]	[NT]
Naphthalene	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Acenaphthylene	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Phenanthrene	mg/kg	0.1	Org-022/025	[NT]	18	0.2	0.2	0	[NT]	[NT]
Anthracene	mg/kg	0.1	Org-022/025	[NT]	18	0.2	<0.1	67	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	[NT]	18	0.2	0.3	40	[NT]	[NT]
Pyrene	mg/kg	0.1	Org-022/025	[NT]	18	0.3	0.2	40	[NT]	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	[NT]	18	0.1	0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	[NT]	18	0.1	0.2	67	[NT]	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	[NT]	18	0.3	0.3	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	[NT]	18	0.2	0.2	0	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	[NT]	18	0.1	0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	[NT]	18	96	94	2	[NT]	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	250924-9
Date extracted	-			14/09/2020	3	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			15/09/2020	3	15/09/2020	15/09/2020		15/09/2020	15/09/2020
alpha-BHC	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	92	82
HCB	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	79	72
gamma-BHC	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	95	91
delta-BHC	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	105	103
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	112	99
gamma-Chlordane	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	103	96
Dieldrin	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	97	97
Endrin	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	95	118
Endosulfan II	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	88	85
Endrin Aldehyde	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	67	63
Methoxychlor	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	100	3	101	95	6	97	95

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	18	14/09/2020	14/09/2020		[NT]	[NT]
Date analysed	-			[NT]	18	15/09/2020	15/09/2020		[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
HCB	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
gamma-BHC	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
delta-BHC	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
gamma-Chlordane	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Dieldrin	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Endrin	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Endosulfan II	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Methoxychlor	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	[NT]	18	101	102	1	[NT]	[NT]

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	250924-9
Date extracted	-			14/09/2020	3	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			15/09/2020	3	15/09/2020	15/09/2020		15/09/2020	15/09/2020
Dichlorvos	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	67	65
Dimethoate	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	95	93
Fenitrothion	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	61	65
Malathion	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	73	67
Chlorpyriphos	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	99	82
Parathion	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	60	61
Bromophos-ethyl	mg/kg	0.1	Org-022	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	89	89
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-022/025	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	100	3	101	95	6	97	95

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	18	14/09/2020	14/09/2020		[NT]	[NT]
Date analysed	-			[NT]	18	15/09/2020	15/09/2020		[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Dimethoate	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Fenitrothion	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Malathion	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Parathion	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-022	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-022/025	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	[NT]	18	101	102	1	[NT]	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	250924-9
Date extracted	-			14/09/2020	3	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			15/09/2020	3	15/09/2020	15/09/2020		15/09/2020	15/09/2020
Aroclor 1016	mg/kg	0.1	Org-021	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	<0.1	3	<0.1	<0.1	0	100	80
Aroclor 1260	mg/kg	0.1	Org-021	<0.1	3	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	100	3	101	95	6	97	95

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	18	14/09/2020	14/09/2020		[NT]	[NT]
Date analysed	-			[NT]	18	15/09/2020	15/09/2020		[NT]	[NT]
Aroclor 1016	mg/kg	0.1	Org-021	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1260	mg/kg	0.1	Org-021	[NT]	18	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	[NT]	18	101	102	1	[NT]	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	250924-9
Date prepared	-			15/09/2020	3	15/09/2020	15/09/2020		15/09/2020	15/09/2020
Date analysed	-			15/09/2020	3	15/09/2020	15/09/2020		15/09/2020	15/09/2020
Arsenic	mg/kg	4	Metals-020	<4	3	<4	<4	0	96	79
Cadmium	mg/kg	0.4	Metals-020	<0.4	3	<0.4	<0.4	0	94	78
Chromium	mg/kg	1	Metals-020	<1	3	27	30	11	86	86
Copper	mg/kg	1	Metals-020	<1	3	31	32	3	87	91
Lead	mg/kg	1	Metals-020	<1	3	9	10	11	90	86
Mercury	mg/kg	0.1	Metals-021	<0.1	3	<0.1	<0.1	0	110	95
Nickel	mg/kg	1	Metals-020	<1	3	23	20	14	88	85
Zinc	mg/kg	1	Metals-020	<1	3	61	61	0	86	79

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	18	15/09/2020	15/09/2020		[NT]	[NT]
Date analysed	-			[NT]	18	15/09/2020	15/09/2020		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	18	<4	6	40	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	18	<0.4	0.4	0	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	18	4	11	93	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	18	18	59	106	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	18	290	440	41	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	18	0.1	0.3	100	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	18	4	7	55	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	18	110	300	93	[NT]	[NT]

QUALITY CONTROL: Misc Soil - Inorg						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	250924-9
Date prepared	-			14/09/2020	3	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			14/09/2020	3	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	3	<5	<5	0	101	103

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	250924-5
Date prepared	-			11/09/2020	1	11/09/2020	11/09/2020		11/09/2020	11/09/2020
Date analysed	-			11/09/2020	1	11/09/2020	11/09/2020		11/09/2020	11/09/2020
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	9.9	9.9	0	102	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	350	340	3	102	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	10	10	0	103	102
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	350	310	12	108	#
Resistivity in soil*	ohm m	1	Inorg-002	<1	1	29	29	0	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	10	11/09/2020	11/09/2020		[NT]	[NT]
Date analysed	-			[NT]	10	11/09/2020	11/09/2020		[NT]	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	10	9.0	9.0	0	[NT]	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	10	31	28	10	[NT]	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	10	<10	<10	0	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	10	10	10	0	[NT]	[NT]
Resistivity in soil*	ohm m	1	Inorg-002	[NT]	10	320	350	9	[NT]	[NT]

QUALITY CONTROL: CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			15/09/2020	[NT]	[NT]	[NT]	[NT]	15/09/2020	[NT]
Date analysed	-			15/09/2020	[NT]	[NT]	[NT]	[NT]	15/09/2020	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	124	[NT]
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	124	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	121	[NT]
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	117	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

MISC_INORG_DRY:
#SO4 Percent recovery is not possible to report due to the high concentration of the element in the sample. However an acceptable recovery was obtained for the LCS.

pH/EC
Samples were out of the recommended holding time for this analysis.

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteria has been exceeded for 250924-18 for Cr, Cu, Pb, Ni & Zn. Therefore a triplicate result has been issued as laboratory sample number 250924-20.

Asbestos: Excessive sample volume was provided for asbestos analysis. A portion of the supplied sample was sub-sampled according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Samples were sub-sampled from bags provided by the client.

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 89584.01	**Suburb:** Wollongong	**To:** Envirolab	
Project Name: Proposed Mixed Use Development	**Order Number**		
Project Manager: David Metcalf	**Sampler:** FH	**Attn:** Aileen Hie	
Emails: david.metcalf@douglaspartners.com.au		**Phone:**	
Date Required: Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☒		**Email:**	
Prior Storage: ☒ Esky ☒ Fridge ☐ Shelved	Do samples contain 'potential' HBM? Yes ☐ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)		

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Combo 8A	Combo 1m	pH / CEC							Notes/preservation
1/0.0-0.1	11	31/08/20	S	G/P	X									
1/0.4-0.5	12	31/08/20	S	G/P	X		X							
2/0.4-0.5	13	01/09/20	S	G/P	X		X							
2/2.4-2.5	3	01/09/20	S	G/P	X									
3/0.0-0.1	14	02/09/20	S	G/P	X									
3/0.4-0.5	15	02/09/20	S	G/P	X									
4/0.0-0.1	16	03/09/20	S	G/P	X									
5/0.0-0.1	17	04/09/20	S	G/P	X									
5/0.4-0.5	18	04/09/20	S	G/P	X		X							
5/2.4-2.5	9	04/09/20	S	G/P	X									
BD1	19	02/09/20	S	G		X								
BD2	ALS	04/09/20	S	G		X								Inter-lab replicate - please sned to ALS
PQL (S) mg/kg													**ANZECC PQLs req'd for all water analytes** ☐	

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Metals to Analyse: 8HM unless specified here:

Lab Report/Reference No:

Total number of samples in container: | **Relinquished by:** | **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd | **Address** | **Phone:** | **Fax:**

Signed: | **Received by:** May | **Date & Time:** 250924

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 89584.01	**Suburb:** Wollongong	**To:** Envirolab	
Project Name: Proposed Mixed Use Development	**Order Number**		
Project Manager: David Metcalf	**Sampler:** FH	**Attn:** Aileen Hie	
Emails: david.metcalf@douglaspartners.com.au		**Phone:**	
Date Required: Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☒		**Email:**	
Prior Storage: ☒ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM? Yes ☐	No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)	

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil W - water)	Container Type (G - glass P - plastic)	Analytes: Aggressivity Suite									Notes/preservation
1 / 1.4-1.5	1	31/08/20	S	G	X									
1 / 4.0	2	31/08/20	S	P	X									
2 / 2.4-2.5	3	01/09/20	S	G	X									
2 / 7.0	4	01/09/20	S	P	X									
3 / 1.4-1.5	5	02/09/20	S	G	X									
3/ 7.75	6	02/09/20	S	P	X									
4 / 1.4-1.5	7	03/09/20	S	G	X									
4 / 4.0	8	03/09/20	S	P	X									
5 / 2.4-2.5	9	04/09/20	S	G	X									
5 / 6.0	10	04/09/20	S	P	X									
PQL (S) mg/kg													**ANZECC PQLs req'd for all water analytes** ☐	

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

Job No: 250924
Date Received: 10/9/2020
Time Received: 1500
Received By: AL
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Metals to Analyse: 8HM unless specified here:

Lab Report/Reference No:

Total number of samples in container: | **Relinquished by:** | **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd | **Address:** | **Phone:** | **Fax:**

Signed: | **Received by:** Ray | **Date & Time:** 1500 10/9/2020

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Unanderra
Attention	David Metcalf

Sample Login Details

Your reference	89584.01, Wollongong
Envirolab Reference	250924
Date Sample Received	10/09/2020
Date Instructions Received	10/09/2020
Date Results Expected to be Reported	17/09/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	19 SOIL
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	14.2
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

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

Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticides in soil	Organophosphorus Pesticides in Soil	PCBsin Soil	Acid Extractable metalsin soil	Misc Soil - Inorg	Asbestos ID - soils	Misc Inorg - Soil	CEC
1-1.4-1.5										✓	
1-4.0										✓	
2-2.4-2.5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2-7.0										✓	
3-1.4-1.5										✓	
3-7.75										✓	
4-1.4-1.5										✓	
4-4.0										✓	
5-2.4-2.5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
5-6.0										✓	
1-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓		
1-0.4-0.5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2-0.4-0.5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓		
3-0.4-0.5	✓	✓	✓	✓	✓	✓	✓	✓	✓		
4-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓		
5-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓		
5-0.4-0.5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BD1	✓	✓					✓				

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

Additional Info

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

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CERTIFICATE OF ANALYSIS 250924-C

Client Details

Client	Douglas Partners Unanderra
Attention	Kyle Johannes
Address	Unit 1, 1 Luso Drive, Unanderra, NSW, 2526

Sample Details

Your Reference	**89584.01, Wollongong**
Number of Samples	19 SOIL
Date samples received	10/09/2020
Date completed instructions received	07/10/2020

Analysis Details

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

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

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

Report Details

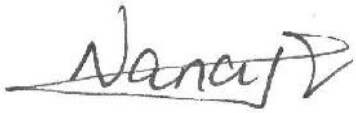
Date results requested by	14/10/2020
Date of Issue	08/10/2020

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

Results Approved By
Hannah Nguyen, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Metals in TCLP USEPA1311		
Our Reference		250924-C-18
Your Reference	UNITS	5
Depth		0.4-0.5
Date Sampled		4/09/2020
Type of sample		SOIL
Date extracted	-	08/10/2020
Date analysed	-	08/10/2020
pH of soil for fluid# determ.	pH units	8.8
pH of soil TCLP (after HCl)	pH units	1.8
Extraction fluid used	-	1
pH of final Leachate	pH units	5.2
Lead in TCLP	mg/L	2.9

Method ID	Methodology Summary
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using in house method INORG-004. Please note that the mass used may be scaled down from the default based on sample mass available.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.

QUALITY CONTROL: Metals in TCLP USEPA1311						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			08/10/2020	[NT]	[NT]	[NT]	[NT]	08/10/2020	[NT]
Date analysed	-			08/10/2020	[NT]	[NT]	[NT]	[NT]	08/10/2020	[NT]
Lead in TCLP	mg/L	0.03	Metals-020 ICP-AES	<0.03	[NT]	[NT]	[NT]	[NT]	100	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

To find information on our COVID-19 measures, please visit douglaspartners.com.au/news/covid-19

From: Steven Luong <SLuong@envirolab.com.au>
Sent: Wednesday, 7 October 2020 2:37 PM
To: Kyle Johannes <Kyle.Johannes@douglaspartners.com.au>
Cc: Samplereceipt <Samplereceipt@envirolabservices.com.au>
Subject: RE: Results for Registration 250924 89584.01, Wollongong

Ref: 250924-C
TAT: Standard.
Due: 14/10/2020 MT

Hi Kyle,

I will have to get back to you on that. We should have it in our warehouse but need to confirm.

What TAT do you need?

Kind Regards,

Steven Luong | Organics Supervisor | Envirolab Services

Celebrating 15 years of **Great Science. Great Service.**

12 Ashley Street Chatswood NSW 2067
T 612 9910 6200
E SLuong@envirolab.com.au | W www.envirolab.com.au

Follow us on: LinkedIn | Facebook | Twitter

Samples will be analysed per our T&C's.

From: Kyle Johannes <Kyle.Johannes@douglaspartners.com.au>
Sent: Wednesday, 7 October 2020 2:28 PM
To: Steven Luong <SLuong@envirolab.com.au>
Cc: Samplereceipt <Samplereceipt@envirolabservices.com.au>
Subject: RE: Results for Registration 250924 89584.01, Wollongong

Hi Steven,

If it is not to late, can we please get leachability testing on for Lead on either sample 5/0.4-0.5 (18) (sample code: 250924-18) or the TRIPLICATE sample (sample code: 250924-20).

Leachability testing for Lead on the TRIPLCATE sample would be preferred as it had the highest lead result but either would be ok.

Regards,

Kyle Johannes | Environmental Engineer
Douglas Partners Pty Ltd | ABN 75 053 980 117 | www.douglaspartners.com.au
1/1 Luso Drive Unanderra NSW 2526 | PO Box 486 Unanderra NSW 2526
P: 02 4271 1836 | M: 0447 976 999 | E: Kyle.Johannes@douglaspartners.com.au

<image009.pn

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Unanderra
Attention	Kyle Johannes

Sample Login Details

Your reference	89584.01, Wollongong
Envirolab Reference	250924-C
Date Sample Received	10/09/2020
Date Instructions Received	07/10/2020
Date Results Expected to be Reported	14/10/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	19 SOIL
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	14.2
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

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12 Ashley St Chatswood NSW 2067
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www.envirolab.com.au

Sample ID	pH of soil for fluid#determ.	pH of soil TCLP (after HCl)	Extraction fluid used	pH of final Leachate	Lead in TCLP	On Hold
1-1.4-1.5						✓
1-4.0						✓
2-2.4-2.5						✓
2-7.0						✓
3-1.4-1.5						✓
3-7.75						✓
4-1.4-1.5						✓
4-4.0						✓
5-2.4-2.5						✓
5-6.0						✓
1-0-0.1						✓
1-0.4-0.5						✓
2-0.4-0.5						✓
3-0-0.1						✓
3-0.4-0.5						✓
4-0-0.1						✓
5-0-0.1						✓
5-0.4-0.5	✓	✓	✓	✓	✓	
BD1						✓
5 - [TRIPLICATE]-0.4-0.5						✓

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

Additional Info

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

Appendix J

Data Quality Assessment

Appendix J, Data Quality Assessment
Proposed Mixed-Use Development
WIN Grand, Crown Street, Wollongong

J1.0 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 J1. 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 at the end of this Appendix.

Table J1: Field and Laboratory Quality Control

Item	Evaluation / Acceptance Criteria	Compliance
Analytical laboratories used	National Association of Testing Authorities (NATA) accreditation	C
Holding times	Various based on type of analysis	C
Intra-laboratory replicates	10% of primary samples; <30% RPD	PC
Laboratory / Reagent Blanks	1 per batch; <PQL	C
Matrix Spikes	1 per lab batch; 70-130% recovery (inorganics); 60-140% recovery (organics)	C
Surrogate Spikes	All organics analysis; 70-130% recovery (inorganics); 60-140% recovery (organics)	C
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

The RPD results were all within the acceptable range, with the exception of those indicated in the summary results tables. The exceedances are not, however, considered to be of concern given that:

- The typically low actual differences in the concentrations of the replicate pairs where some RPD exceedances occurred
- The replicate pair being collected from fill soils which by its nature is heterogeneous;
- Replicates, rather than homogenised duplicates, were used to minimise risk of volatile loss, hence greater variability can be expected;
- Most of the recorded concentrations being relatively close to the PQL;

- The majority of RPDs within a replicate pair being within the acceptable limits; and
- All other QA/QC parameters met the DQIs.

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

J2.0 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 the variability or reproducibility of data; and
- Accuracy: a measure of the closeness of the data to the 'true' value.

Table J2: Data Quality Indicators

Data Quality Indicator	Method(s) of Achievement
Completeness	Systematic and selected target locations sampled.
	Preparation of borehole logs, sample location plan and chain of custody records.
	Laboratory sample receipt information received confirming receipt of samples intact and appropriateness of the chain of custody.
	Samples analysed for contaminants of potential concern (CoPC) identified in the Conceptual Site Model (CSM).
	Completion of chain of custody (CoC) documentation.
	NATA accredited laboratory results certificates provided by the laboratory.
	Satisfactory frequency and results for field and laboratory quality control (QC) samples as discussed in Section 1.
Comparability	Using appropriate techniques for sample recovery, storage and transportation, which were the same for the duration of the project.
	Experienced sampler used.
	Use of NATA accredited laboratory.
	Satisfactory results for field and laboratory QC samples.
Representativeness	Target media sampled.
	Sample numbers recovered and analysed are considered to be representative of the target media and complying with DQOs.
	Samples were extracted and analysed within holding times.
	Samples were analysed in accordance with the CoC.
Precision	Field staff followed standard operating procedures.
	Acceptable RPD between original sample and replicate.
	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.

J3.0 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.

J4.0 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.

Douglas Partners Pty Ltd

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Table J3: Relative Percentage Difference Results – Intra-laboratory Replicates

			Metals								TRH						BTEX				PAH
			Arsenic	Cadmium	Total Chromium	Copper	Lead	Mercury (inorganic)	Nickel	Zinc	TRH C6 - C10	TRH >C10-C16	F1 ((C6-C10)-BTEX)	F2 (>C10-C16 less Naphthalene)	F3 (>C16-C34)	F4 (>C34-C40)	Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene [b]
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
BD1	0 m	2/09/2020	<4	<0.4	14	58	4	<0.1	3	18	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1
3	0 - 0.1 m	2/09/2020	<4	<0.4	16	75	3	<0.1	3	18	<25	<50	<25	<50	250	490	<0.2	<0.5	<1	<1	<1
		Difference	0	0	2	17	1	0	0	0	0	0	0	0	150	390	0	0	0	0	0
		RPD	0%	0%	13%	26%	29%	0%	0%	0%	0%	0%	0%	0%	**86%**	**132%**	0%	0%	0%	0%	0%

Appendix K

Excerpts from Austral(2022)

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AUSTRAL ARCHAEOLOGY

WIN GRAND WOLLONGONG NEW SOUTH WALES

HISTORICAL ARCHAEOLOGICAL ASSESSMENT

DRAFT REPORT

Colonysix

21 May 2022

DOCUMENT INFORMATION

Project:	Win Grand, Wollongong
Services required:	Historical Archaeological Assessment
Client:	Colonysix
Prepared by:	Peta Rice and Alexander Beben
Project number:	22043

DOCUMENT HISTORY AND APPROVAL STATUS

Version No.	Version Type	Issue Date	Authored by	Approved by	Date Approved
1	Draft	26/05/2022	AJB	DM	26/05/2022
2	Final	-	-	-	-

DISTRIBUTION OF COPIES

Version No.	Quantity	Issue date	Issued to
1	1	26/05/2022	Colonysix
2		-	-

EXECUTIVE SUMMARY

Austral Archaeology Pty Ltd (Austral) has been commissioned by Colonysix (the proponent) to undertake a Historical Archaeological Assessment (HAA) for the proposed development of the street block bound by Crown, Keira, Burelli and Atchison streets, Wollongong, New South Wales (NSW). The proposed development consists of a large mixed-use development known as WIN Grand. This report will form part of a Development Application [DA-2021/957] being made to Wollongong City Council under Part 4 of the *Environmental Planning and Assessment Act 1979* (EPA Act). The study area is located inside the Wollongong Central Business District (CBD) and is within the Wollongong Council Local Government Area (LGA).

The study area encompasses a heritage item listed under Schedule 5 of the *Wollongong Local Environmental Plan 2009*; this is the "Former Marcus Clark Building" (LEP No. 6474). The purpose of this HAA is to assess the potential impact from the development on the significance of any archaeological values that may be present within the study area. The report will provide suitable management recommendations should impacts to archaeological values be anticipated.

IDENTIFIED ARCHAEOLOGICAL SENSITIVITY

It is concluded that there are varying degrees of historical archaeological potential and sensitivity within the study area owing to it being developed during the 1850s for commercial, industrial, and residential uses associated with the development of Crown Street as the main commercial throughfare.

In particular, the study area was utilised by a range of industries and professions that were important to the establishment of Wollongong. These included the Settler's Arms / Cottage of Content public house (c.1847 - 1870) [Lot 1 DP 179179], Carcase and Family Butcher (c.1870 – c.1891) [Lot 1 DP1 179179], Allen's Tannery (1850 - 1875) [Lot 1 DP 1135333], Osbourne's / Parkinson's Cordial Factory (1883 – 1921) [Lot 1 DP 1135333], Commerce House (c.1860 – 1882) [Lot 1 DP 220513], Organ & McCready, Bootmakers (c.1858 – c.1868) [Lot 1 DP 220513], John Williams, Tailor (1868 c.1872) [Lot 1 DP 220513], and Mark Tucker / JA Walker's farrier & blacksmith (1875 – c.1885) [Lot 1 DP 220513]. Numerous mid- to late 19th century residences have also been identified including buildings associated with a number of these businesses and their owners as well as other private individuals (i.e., John McGee, Moses Driver, and JR Healey).

Many of these businesses and their owners are prominent in the early history of Crown Street and reflect its presence as a commercial centre. In particular, the study area represents a large portion of the throughfare, and the nature of their businesses and their change through time is likely to illustrate the changing nature of Upper Crown Street from a fringe area utilised for more industrial purposes into customer-focused services and retail buildings as the commercial centre migrated towards the railway station with it acting as a significant arrival and departure point in Wollongong.

The following historical events and activities have been identified as part of this assessment:

Lot	DP	Events / Identified Businesses
1	220513	Messer's Organ & McCready, bootmakers (c.1858 - c.1868)
		John Williams, tailor (1868 - c.1872)
		Mark Tucker, farrier & blacksmith (1875 - 1876)
		JA Walker, farrier & blacksmith (1876 - c.1885)
		Commerce House, shop (c.1860 - 1882)
		Samuel Cutcher, jeweller (c. 1889 - 1905)
		Alfred Brickwood, jeweller (1905 - 1937
		Union Bank of Australia / CML (1937 - c.1964)
1	112417	JA Walker, residence (1884 - 1938).
100	774957	JA Walker, farrier & blacksmith (1885 - 1904)

Lot	DP	Events / Identified Businesses
9	551157	FW Castle, residence (1905 - c. 1937)
8	546125	
1	88455	
1	179179	“Settlers Arms” or "Cottage of Content", hotel (c. 1847 - 1870)
2		Carcase and Family Butcher (c. 1870 - c.1891)
3		J. Richards and Sons branch establishment (1873 - c.1891)
4		No identifiable development until c.1968
5		
7	878243	c.1912 Terrace Shops
B	395330	
1	1135333	Wollongong Tannery or Mr Allen’s Tannery and Residence (1850 - 1875)
		J. Richards and Sons, charcoal producer and leather tannery (c.1875 - c.1891).
		Osbourne's / Parkinson’s Cordial Factory (1883 - 1921).
		Commonwealth Bank of Australia (c.1921 - c.1977)
1	226374	Foundations for a stone house (c. 1879s)
2		John McGee, residence c.1870
		Moses Driver, residence & shop
1	183348	
1	319452	c.1912 Terrace shops
2		
3		
2	326530	c. 1912 Partial residential lot
2	181570	Possible residence and shop for JR Healey (c.1879)
1	82673	Possible residence and shop for JR Healey (c.1879)
1	927806	Original Marcus Clark & Co. Building (c.1905 - present))
1	1087986	
1	82673	
1	117019	
1	1198873	
1	116034	

The archaeological remains associated with these businesses and associated buildings are likely to be impacted upon through the demolition of the existing buildings, bulk earthworks associated with the construction of basement carparking levels and construction of the proposed new buildings. A program of archaeological testing and open area excavation (if required) is recommended to identify, record, and manage any impacts to the archaeological resource as part of the proposed development.

RECOMMENDATIONS

1) Given that parts of the study area have been assessed as having archaeological potential, and relics of local significance are likely to be impacted during the proposed construction works, an excavation permit is required under the NSW *Heritage Act 1977*. The proponent should apply for a Section 140 Excavation Permit. A suitably accredited archaeologist who is approved by the Heritage NSW to oversee the excavation of sites of local significance will need to be nominated as Excavation Director.
2) Following demolition of the existing modern buildings (except the heritage item), archaeological investigations will be required in advance of construction. The investigations can only be undertaken following the approval of the Section 140 Excavation Permit and will involve a sub-surface testing, and potentially salvage, programme overseen by the nominated Excavation Director.
3) In the event that historical archaeological relics not assessed or anticipated by this report are found during the works, all works in the immediate vicinity are to cease immediately and Heritage NSW be notified in accordance with Section 146 of the *NSW Heritage Act 1977*. A qualified archaeologist is to be contacted to assess the situation and consult with Heritage NSW regarding the most appropriate course of action.
4) In the event that Aboriginal archaeological material or deposits are encountered during earthworks, all works affecting that material or deposits must cease immediately to allow an archaeologist to make an assessment of the find. The archaeologist may need to consult with Heritage NSW and the relevant Aboriginal stakeholders, regarding the find. Section 89A of the *National Parks & Wildlife Act 1974* requires that Heritage NSW must be notified of any Aboriginal objects discovered within a reasonable time.
5) Should the proposed development be altered significantly from the proposed concept design, then a reassessment of the heritage/archaeological impact may be required. This includes any impacts not explicitly stated in Section 7 and the installation of any subsurface services.

Returning to the study area, Burke died in 1848 (Couch & Doyle 1992, p.69), leaving the remainder of his grant to his wife Henrietta Burke and his children John, Eleanor (Ellen), Elizabeth and Margaret Burke. Between the time of Burke's death in 1848 to the early 1880s, Burke's 3 daughters had married and their husbands, Michael Kenny, John Hewitt and Robert Taylor, acquired a large portion of Burke's grant that fronts Crown and Keira Street and which presumably passed to their ownership through their wives' inheritance (NSW Department of Lands PA38455, PA8610, PA7456, PA20407).

Other portions of the Crown Street frontage were systematically sold. In 1849 a portion of the Crown Street frontage associated with modern-day lots 1 to 3, DP17979 was sold to William Smith, who then conveyed the land to John Osbourne in 1852 (NSW Department of Lands PA30177). Interestingly, between 1847 to 1854, John Osbourne is listed as the licensee of the Settler's Arms, located at the corner of Crown and Keira Street, Wollongong (NSW State Archives NRS 14401, NRS14403). In 1853, Osbourne conveyed the land to James Scott but appears to remain the licensee until 1856 when James Scott is then listed as the licensee for the Settler's Inn (NSW Department of Lands PA30177; NSW Archives NRS 14403).

Shortly after obtaining the licence, James Scott passed away at his residence, which is listed as the Settler's Arms, on 26 June 1856, leaving his wife Margaret Scott to be the licensee of the hotel (*IM*, 30 June 1856, p.6). In 1857, James Hetherington is reported as having successfully applied for a license for "the Settler's Arms, now occupied by Mrs M. Scott" (*IM*, 27 April 1857, p.2). The license appears to alternate between Mrs Scott and James Hetherington under the sign of either The Cottage of Content or The Settler's Arms. The signs of The Settler's Arms, The Settler's Inn and the Settler's Arms Inn also appear to be interchangeable and are used in primary sources in reference to Osbourne's, Scott's and Hetherington's time as licensees. These signs are also used in reference to the Royal Alfred Hotel, located on the adjacent side of the Crown and Keira Street intersection to the north-east, indicating that the sign may have been used to refer to different buildings at different times (Herben 2007, p.75). After James Scott's death, his widow Margaret Scott married Benjamin Thackeray (*Ibid*), and she eventually sold part of her portion of the study area in 1864 and the remainder in 1880 (NSW Department of Land PA30177). The Cottage of Content remained licensed until 1870 (*NSW GG*, 24 August 1869, p. 2145).

In 1850, Josiah Allen, a tanner and currier (Primary Application [PA] 29777; *IM*, 24 November 1856, p. 3) purchased Lot 1, DP1135333 from Thomas Cronin. Allen appears to have operated the study area as the "Wollongong Tannery" or "Mr Allen's Tannery" from this point onwards. While there are multiple historical references to a "Wollongong Tannery" operated by R Haworth in Wollongong as early as 1845, this should not be confused with the tannery within the study area as the other one is likely to have been constructed within Haworth's property in Burelli Street where the present Illawarra Performing Arts Centre is located (Herben 2006, pp.35–36).

By 1860, Josiah Allen was advertising for a farm labourer, signing the advert as "Mr. Allen's, Tanner, &c. Crown Street, Wollongong" and in 1861, he advertised as having a "constant supply of superior kiln-burnt lime on sale" at his tannery in Wollongong (*IM*, 29 Jun 1860, p.3; *IM*, 1 October 1861, p.1). Josiah Allen passed away in 1865 and was buried in Wollongong Cemetery (NSW Pioneer Index – Pioneer Series 1778-1888). On his death, the ownership of the study was held in trust by his estate (PA29777). The operation of the tannery was taken over by his wife, and his son Robert Allen until 1875 (*IM*, 29 November 1870, p.3; *IM*, 19 January 1875, p.2). Lot 1, DP1135333 was then leased and operated as a charcoal and leather store by J. Richards & Sons (*IM*, 4 February 1876, p.1). The company J. Richard & Sons appear to have maintained a presence in Crown Street, specifically, the study area, since 1873, when they advertised that they had opened a branch establishment in the premises formerly known as the Cottage of Content (Lots 1-3 DP 17979) (*IM*, 16 May 1873, p.1).

Mr W Parkinson, who later had a long lease on the former tannery site as the owner of Parkinson's Cordials wrote a letter to the *South Coast Times and Wollongong Argus* (SCT&WA), that described Allen's Tannery, the key features of the study area, and the production of lime as part of the tanning process:

> *…over one hundred years ago the site, of the present Commonwealth Bank in Wollongong was the property of R Allen who was a tanner and carried on the business of a tannery. In Crown Street, there was a cottage in which Mr. Allen lived and alongside it there was the entrance to the tannery. Behind the cottage was the shed for the curriers and fleshers and also a big well. 30ft [9.14 metres]. wide and 38ft [11.58 metres]. deep which was used to catch rainwater for use at the tannery.*
>
> *At the bottom of the yard was a huge shed for storing wattle bark but frequently housed other materials required for the yard. Large scales over 10ft [3.05 metres] high used for weighing hides as they were brought into the tannery stood alongside the shed.*
>
> *Some years ago while digging where the scales had stood I unearthed two 56lb [25.40 kilogram] weights evidently used in weighing the hides in years gone by as one of the weights the year 1796 was stamped and still plainly visible.*
>
> *In the corner the yard opposite the shed was a lime kiln and in 1883 the year in which I first saw this place, the kiln was still standing. The kiln had been used to burn shells from the beaches for in the early days, shells were plentiful and there was a heap of shell grit which was all pure lime and only needed to be treated.*
>
> *In the tanning of hides much lime was used and as no limestone had been discovered near the coast the burning of shells was the only way to secure this material…* (*SCT&WA*, 1952, p.1).

Alexander Stewart, in series number 38 of his *Reminisces of the Illawarra,* describes the study area as part of his account of Crown Street in 1870:

> *…Crossing to the other side of Crown Street the first shop met with was John Williams, tailor, later Jack Walker had a blacksmith's shop here, next George Hall butcher. The butcher's shop was previously a hotel, called the Cottage of Content. The hotel was kept by the Scott family. Next was Allen's tannery and private residence, where Parkinson's cordial factory is today. Next an old cottage, the residence of John McGee. This was later occupied as a shop by Moses Driver. Just about this spot a gateway existed to the Gladstone Estate. Next came Healey's shop and residence* (*IM*, 4 July 1924, p.1).

Stewart's description of the study area can be compared to an 1879 survey of Crown Street West (later known as Upper Crown Street) by Surveyor GH Sheaffe which shows the widths of the carriageway and footways as part of the formalisation of the alignment of the road. This plan shows that by 1879 a number of buildings had been constructed fronting Crown Street West; at this time from east to west these included 2 timber buildings owned by Cutcher, a brick building owned by Mrs Thackry, (likely Margarett Thackery), a timber building also owned by Cutcher, a building labelled "stone foundation for a house" owned by M Kenny and an unlabelled timber structure (Figure 3.3).

Table 5.1 Predictive statements for each lot and DP that comprises the study area

Lot	DP	Phase	Events	Predictive Statements	Arch. Potential
1	220513	Phase 2 (1848 - 1888)	Messer's Organ & McCready, bootmakers (c.1858 - c.1868)	Approximate location of the shop and associated outbuildings that are described in various primary sources. No mapping evidence has been identified; however, this building would correspond to one of the 2 the buildings on the 1879 plan. Archaeological remains are likely to consist of stone or timber footings with the potential for sub-floor deposits. It is likely that outbuildings and exterior stone or brick surfaces may be present. If the shop also acted as a residence, a kitchen may be present. To the rear of the building privies, wells, stables, and other buildings may be present. Isolated rubbish pits and yard deposits may also be present. May be overlain or modified by later developmental phases such as Tucker / Walker's blacksmiths (1868 - 1876) and Cutcher / Brickwood's jewellers (c.1889 - c.1964).	Low
			John Williams, tailor (1868 - c.1872)		
			Mark Tucker, farrier & blacksmith (1875 - 1876)	Approximate location of the shop and associated outbuildings that are described in the 1879 plan as having consisted of a timber building. Archaeological remains are likely to consist of stone or timber footings with the potential for sub-floor deposits. It is likely that outbuildings and exterior stone or brick surfaces may be present. If the shop also acted as a residence, a kitchen may be present. To the rear of the building privies, wells, stables, holding pens and other buildings may be present that are associated with its use as a blacksmiths and farriers. Isolated rubbish pits and yard deposits may also be present. May be overlain or modified by later developmental phases associated with Cutcher / Brickwood's jewellers (c.1889 - c.1964).	Low
			JA Walker, farrier & blacksmith (1876 - c.1885)		
			Commerce House, shop (c.1860 - 1882)	Approximate location of the shop and associated outbuildings that is described in the 1879 plan as having consisted of a timber building. Archaeological remains are likely to consist of stone or timber footings with the potential for sub-floor deposits. It is likely that outbuildings and exterior stone or brick surfaces may be present. If the shop also acted as a residence, a kitchen may be present. To the rear of the building privies, wells, stables, and other buildings may be present that are associated with its use as a blacksmiths and farriers. Isolated rubbish pits and yard deposits may also be present. May be overlain or modified by developmental phases associated with Cutcher / Brickwood's jewellers (c.1889 - c.1964). Building may be present on 1912 plan as the 2 buildings share a similar position and orientation.	Low

Lot	DP	Phase	Events	Predictive Statements	Arch. Potential
1	220513	Phase 3 (1882 - Present)	Samuel Cutcher, jeweller (c. 1889 - 1905) Alfred Brickwood, jeweller (1905 - 1937 Union Bank of Australia / CML (1937 - c.1964)	The jewellers is identified in the 1912 plan as a large 2-storey brick building, and this is also reflected in later photographs of the study area. Archaeological remains are likely to consist of stone or brick footings with associated occupational deposits (i.e., sub-floors). The 1912 plan shows multiple outbuildings including a kitchen, washrooms, laundry, and W.C. The lot is also shown as containing a jeweller and draper (occupying the same 2-story brick building) and a single stored weatherboard fruit shop adjoining the building. This fruit shop may correspond with one of the buildings on the 1879 plan (Commerce House). Building appears to be present until c.1964 in modified forms but is eventually demolished to make way for the CML building. Any archaeological remains are likely to have been truncated or removed through the construction of the later 1964 CML building. The CML building is likely to consist of concrete and brick footings, piles, service trenches and benching to create level floor areas. It is noted that the CML building is set back from Crown Street and therefore a large portion of the earlier buildings would have been located within the front forecourt; this area may have been subject to reduced impacts.	Moderate
1	112417	Phase 3 (1882 - Present)	JA Walker, residence (1884 - 1938).	A single storey brick cottage shown on the 1912 plan likely dates to 1884 and is present on the 1888 and 1889 subdivision plans, albeit as the blacksmith's forge and not the residence. This may be an error on the subdivision plans, or it may indicate that the residence and forge have been re-sited within this and the adjacent lots on more than one occasion. The 1912 plan to the rear of the shops shows a separate W.C. and well / cistern. This building appears to have been demolished by c.1938 and replaced with a 20th century commercial building that is still present. The construction of this later building may have truncated the archaeological remains associated with the residence.	High
100	774957	Phase 3 (1882 - Present)	JA Walker, farrier & blacksmith (1885 - 1904) FW Castle, residence (1905 - c. 1937)	Located within property associated with blacksmiths and may contain archaeological remains associated with this usage including structural or depositional features of outbuildings and holding yards. This may include privies, rubbish pits, post holes, brick or stone surfaces, and yard deposits. Later concreate and brick footings may be present associated with the modern commercial building.	Moderate
9	551157				

Lot	DP	Phase	Events	Predictive Statements	Arch. Potential
8	546125	Phase 3 (1882 - Present)	J.A. Walker, Farrier & Blacksmith (1885 - 1904), FW Castle (1905 - c. 1937)	The 1912 plan shows a large single storey weatherboard blacksmiths shop. Archaeological remains associated with this usage may include brick, stone or timber footprints, work surfaces, drains and structural or depositional features associated with outbuildings and holding yards. A large W.C. is located within this lot on the 1912 plan; this is likely to date to 1885 or earlier. Later concrete and brick footings may be present associated with the modern commercial building which extends partially into Lot 1, DP17979, the current location of The Grand Hotel. The Grand Hotel is likely to contain basements and other features that would truncate any features within its footprint. Therefore, while Lot 8, DP546125 has archaeological potential, Lot 1, DP17979 has a lower potential to contain archaeological remains.	High
1	88455				Low
1	179179	Phase 2 (1848 - 1888)	"Settlers Arms" or "Cottage of Content", hotel (c. 1847 - 1870)	Property identified on 1879 plan as being a brick structure owned by Mrs. "Thackry". Both the Carcase and Family Butcher and J. Richards & Sons (as a shop for their tanning and leather business) would have been operating from this building during this time, likely from separate parts of the building. Archaeological remains associated with this structure may comprise brick or stone footings. These buildings are confined to lots 1 – 3, DP179179. Outbuildings and features including kitchens, stables, storage sheds and wells, privies or cesspits may be present within these lots. Given the use of these buildings as a hotel, then later a butcher, shoemaker and leather dealer, extensive rubbish pits and backfill deposits may be present. The 1912 plan shows the study area as containing a single storey brick building with several W.C.'s and a stable to the rear. This may represent the original 19th century building or a later alteration. By 1937 the original buildings had been removed and replaced with larger 2-storey shop fronts; these appear to have been extended and altered until c.1993 when a newer building was constructed. These successive alterations may have removed, or truncated archaeological features associated with the earlier phases of occupation.	Moderate
2		Phase 2 (1848 - 1888)	Carcase and Family Butcher (c. 1870 - c.1891)		
3		Phase 2 (1848 - 1888)	J. Richards and Sons branch establishment (1873 - c.1891)		
4		Phase 3 (1882 - Present)	Undeveloped until c.1968	Whilst these lots have an ownership history associated with Lots 1-3, there is limited evidence of any usage of this portion of the study area. Any archaeological profiles are likely to consist of natural soil profiles (where undisturbed) and unrecorded or isolated features such as rubbish pits, privies, and wells.	Low
5					

Lot	DP	Phase	Events	Predictive Statements	Arch. Potential
7	878243	Phase 3 (1882 - Present)	c.1912 Terrace Shops	This lot does not appear to have been developed until the 1912 plan, this shows a terrace of 2-storey brick shops fronting Crown Street. These have either been replaced or altered by c.1937, based on the roof configurations. These buildings have been progressively extended to the rear during the mid- to late 20th century. Archaeological remains are likely to consist of brick footings and occupation deposits, with the W.C's and storage sheds on the 1912 plan being located within the current building footprint. These archaeological remains are likely to be confined to Lot 7, DP 878243, while Lot B, DP395330 appears to have remained largely undeveloped and is likely to only contain isolated archaeological features such as yard deposits, rubbish pits and unrecorded wells.	Moderate
B	395330				Low
1	1135333	Phase 2 (1848 - 1888)	Wollongong Tannery or Mr Allen's Tannery and Residence (1850 - 1875)	This lot was first developed as a tannery by Josiah Allen c.1850 and later used by J. Richards & Sons. Later accounts of this lot state that it contained a number of large and deeply cut features such as a 10 metre wide and 11 metre deep water cistern, weighing scales, a lime kiln, cottage and warehouses. The buildings fronting Crown Street are depicted on the 1879 plan and the 1886 and 1888 subdivision plans. Archaeological remains are likely to consist of substantial brick, stone or timber-lined features associated with the well / cistern and tanning pits or vats. Other archaeological remains are likely to consist of buildings or rooms that would have formed part of the tanning process, including curing rooms, tallow rooms, and bark storage. There may also be footings associated with boilers and steam engines that would have been used to mechanise parts of the tanning process. Substantial brick or stone footings associated with the warehouse, lime kiln and weighing scales are also likely to be present. In addition to these features, fronting Crown Street was a single storey weatherboard residence that is also likely to consist of stone, brick or timber footings, with subfloor deposits and outbuildings including kitchens, stables, and privies.	High
			J. Richards and Sons, charcoal producer and leather tannery (c.1875 - c.1891).		

Lot	DP	Phase	Events	Predictive Statements	Arch. Potential
		Phase 3 (1882 - Present)	Osbourne's / Parkinson's Cordial Factory (1883 - 1921).	Osbourne's and then Parkinson's cordial factory initially shared Lot 1, DP113533 with J. Richards & Sons' charcoal and leather business until 1891, when the lot is likely to have become totally given over to the manufacture of cordials. It is unclear whether the cordial factory repurposed buildings and features of the tannery as part of its operation or if the site was redeveloped to facilitate this usage. It is likely that archaeological remains associated with Parkinson's Cordials would consist of brick and concrete foundations for buildings and machinery, along with 2 W.C.'s that are noted on the 1912 plan. The 1912 plan appears is absent of any buildings apart from the weatherboard factory and none of the large features described as being present in 1883 are present, indicating that these may have been decommissioned as they were redundant. Given the depth of these features, it is plausible that this would have made the site difficult to develop, and it is likely that any deep features may contain extensive backfill deposits dating from the use of the tannery through to the establishment of the cordial factory.	High
			Commonwealth Bank of Australia (c.1921 - c.1977)	Once Parkinson's Cordials moved to their new premises in 1921, the Commonwealth Bank of Australia redeveloped the lot as a bank fronting Crown Street. This building is likely to have been constructed on brick and reinforced concrete footings. This bank was present until when the lot was redeveloped into a modern building. It is likely that the construction of the bank and then the modern building will have resulted in the archaeological features associated with the tannery and cordial factory being at least partially removed or truncated. However, given the accounts of deep features present across a large portion of the study area it is likely that all or part of these features remain and that these may contain extensive backfill deposits dating to the use of the tannery or the cordial factory.	Moderate
1	226374	Phase 2 (1848 - 1888)	Foundations for a stone house (c. 1879s)	The c. 1879 plan shows a building with a note stating that "stone foundations for house" are present; it is unclear if this was an existing structure, the remains of a former structure or a building under construction. The house is listed as being owned by Mr Kenny. It is possible Kenny occupied the study area as early as 1841. This cottage appears to be referred to as "old" and as being occupied by John McGee and later Moses Driver by Alexander Stewart. The building on the 1912 plan resembles the location, dimensions, and orientations of the one from the 1879 plan indicating that this building may have survived in some form into the 20th century. Archaeological remains associated with this structure are likely to consist of stone foundations with associated occupational deposits, outbuildings including stables, kitchens, cesspits / W.C.s and wells / cisterns. This building appears to have been extended or replaced during into a 2-storey brick shop by 1937 which was progressively extended until it was redeveloped c.1986 into a modern commercial building.	Moderate
2			John McGee, residence c.1870		
1	183348	Phase 3 (1882 - Present)	Moses Driver, residence & shop		

Lot	DP	Phase	Events	Predictive Statements	Arch. Potential
1	319452	Phase 3 (1882 - Present)	c.1912 Terrace shops	This lot does not appear to have been developed until the 1912 plan, which shows a terrace of 2-storey brick shops fronting Crown Street. These have either been replaced or altered by c.1937 and have been expanded on several occasions since this time. Archaeological remains are likely to consist of brick footings and occupation deposits, with the W.C.'s and storage sheds on the 1912 plan being located within the current building footprint. These archaeological remains are likely to be confined to lots 1 – 3, DP319452.	High
2					
3					
2	326530	Phase 3 (1882 - Present)	c. 1912 Partial residential lot	Lot 2, DP326530 appears to have contained a portion of a residential lot that was resumed as part of the Burelli Street resumption and has remained largely undeveloped since. It is likely to only contain isolated archaeological features such as yard deposits, rubbish pits and unrecorded wells.	Low
2	181570	Phase 2 (1848 - 1888)	Possible residence and shop for JR Healey (c.1879)	Possible location of residence and shop operated by JR Healy, mentioned by Alexander Stewart. Lot corresponds with the location of an unlabelled residence on the 1879 plan and contains single storey brick cottages and shops on the 1912 plan. These appear to have been removed by 1937 and then progressively extended and expanded during the late 20th century and early 21st century into their present form. Archaeological remains within this portion of the study area may comprise stone or brick footings with associated occupational deposits. The cottages and shops are likely to have associated outbuildings including kitchens, stables, store buildings, privies / W.C.s and wells or cisterns. These features are likely to have been removed or truncated through the later construction of the 20th century shops and their extensions.	Moderate
1	82673	Phase 2 (1848 - 1888)	Possible residence and shop for JR Healey (c.1879)		Low
1	927806	Phase 3 (1882 - Present)	Original Marcus Clark & Co. Building (c.1905 - present))	The original Marcus Clark & Co. building was constructed on this location in 1905; this was later expanded into Lot 1, DP1087986 and Lot 1, DP82673 as part of renovations completed in 1927 and 1957. There are several other residual lots associated with the realignment of Burelli Street that also form part of the present Marcus Clark & Co. (now Spotlight) complex of buildings. The construction of the Marcus Clark & Co. building is likely to have truncated or removed archaeological remains associated with earlier phases of occupation.	Low
1	1087986				
1	82673				
1	117019				
1	1198873				
1	116034				

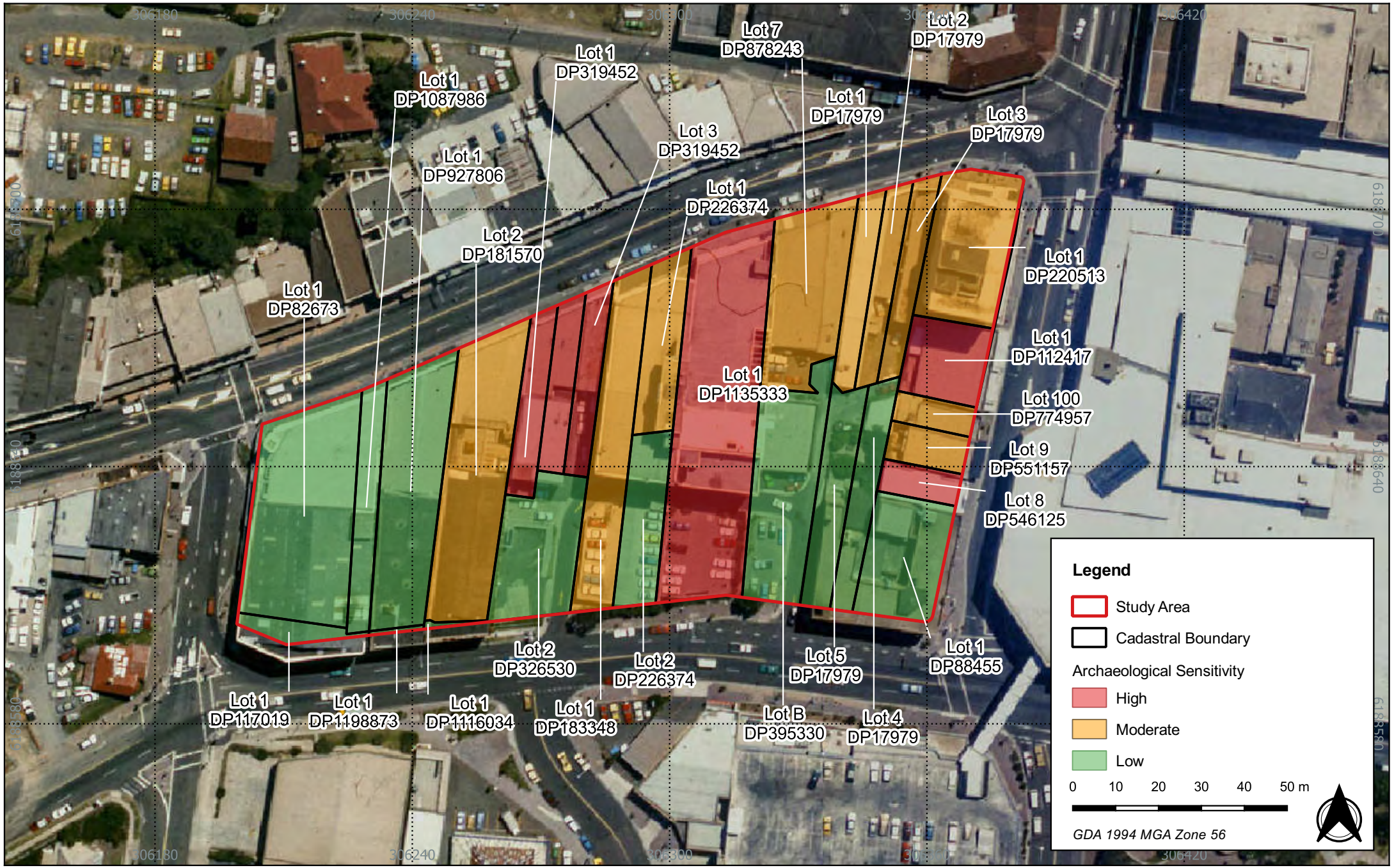

Figure 5.1 - Summary of land-use / archaeological sensitivity

22043 - WIN GRAND DEVELOPMENT, WOLLONGONG - HAA

Source: NSW LPI Aerial

Drawn by: ARH Date: 2022-05-25

AUSTRAL ARCHAEOLOGY