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WOLLONGONG DEVELOPMENTS NO.5 PTY LTD



Remediation Action Plan





2 - 4 Gladstone Avenue & 357 - 363 Crown Street,
Wollongong NSW

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2 - 4 Gladstone Avenue & 357 - 363 Crown Street, Wollongong NSW

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EXECUTIVE SUMMARY

EI Australia (EI) was engaged by Wollongong Developments No.5 Pty Ltd ('the client') to prepare a Remediation Action Plan (RAP) for 2 - 4 Gladstone Avenue & 357 - 363 Crown Street, Wollongong NSW (herein referred to as the 'the site') for proposed redevelopment of the property. This version of the RAP report has been prepared in support of an Early Works State Significant Development Application (SSDA). The Early Works SSDA includes bulk excavation and shoring works activities. Please refer to report E25862.E06_Rev1 for the original version of the report, which also includes the main architectural drawing for the site.

The land parcel can also be identified as Lots 1 and 2 in Deposited Plan (DP) 201949, Lot 6 and DP 14480, and Lot 7 in DP661845 (see **Figure A.1, Appendix A**), within the Local Government Area of Wollongong City Council, and is approximately 6,500 m², as depicted in **Figure A.2, Appendix A**. During previous investigations, the site was occupied by low density residential properties (2-4 Gladstone Avenue), a public parking lot (357-339 Crown Street) and various commercial businesses (363 Crown Street) including Café's, medical facilities and beauty salons.

This RAP follows on from previous investigations completed at 357-359 Crown Street, Wollongong by Reditus (2020), as well as across the entire site by EI (2022b, 2023b). The Reditus (2020) assessment identified one exceedance of the adopted criteria for asbestos at location BH5 within 357 Crown Street, however, visual inspection conducted during subsequent EI investigations (EI, 2022b, 2023b) did not identify any potential asbestos containing materials (ACM). Four in-situ underground storage tanks (USTs) were also identified using ground penetrating radar (GPR) within the eastern and southern portions of 357 Crown Street.

Groundwater investigation during the DSI (EI, 2023b) identified minor metal (copper, nickel and zinc) impacts in groundwater. EI considered that the detected metal concentrations were indicative of regional disturbed, urban, background conditions, rather than site specific impact. No light non-aqueous phase liquids (LNAPLs) were measured in monitoring wells near the USTs.

The purpose of this RAP is to establish a sequential process for remediation and validation works, to support the proposed site redevelopment in compliance with the *State Environment Protection Policy (Resilience and Hazards) 2021*.

The preferred remedial approach involves excavation of UPSS infrastructure and any impacted materials, followed by waste classification and off-site disposal according to NSW EPA (2014a) *Waste Classification Guidelines*. It is envisaged that the remediation works will be implemented in stages, as follows:

- **Stage 1** – Preliminaries / site establishment
- **Stage 2** – Additional assessment – building footprints
- **Stage 3** – UPSS/UST removal and validation
- **Stage 4** – Waste classification and bulk excavation
- **Stage 5** – Validation report preparation.

This RAP provides protocols for the appropriate management of any unexpected finds that may be discovered during the course of the remediation works. In addition, should any phase of the validation assessment identify residual contamination requiring additional remediation, the procedures described under the validation plan (**Section 8**) will be implemented until the remediation goals have been achieved and the site is deemed suitable for proposed land use.

In conclusion, EI considers that the site can be made suitable for the proposed land use through the implementation of the site remediation and validation process described in this RAP.

Table of Contents

	Page Number
EXECUTIVE SUMMARY	III
1. INTRODUCTION	1
1.1 Background	1
1.2 Proposed Development	2
1.3 Objectives of the RAP	2
1.4 Scope of Works	3
1.5 Regulatory Framework	3
1.6 Deviations from RAP	4
2. SITE DESCRIPTION	5
2.1 Property Identification, Location, and Physical Setting	5
2.2 Local Land Use	6
2.3 Regional Setting	6
3. SITE CHARACTERISATION	8
3.1 Previous Investigations	8
3.2 Monitoring Well Survey	12
3.3 Conceptual Site Model	12
4. REMEDIATION GOAL AND CRITERIA	14
4.1 Remediation Goal	14
4.2 Remediation Criteria	14
5. REMEDIATION TECHNOLOGY	16
5.1 Regulatory Overview	16
5.2 Remediation Technologies Review	16
5.3 Preferred Remediation Option	19
5.4 Remediation Works Category, Consent and Planning	19
6. REMEDIATION WORKS	21
6.1 Remediation Sequence	21
6.2 Stage 1 – Preliminaries and Site Establishment	21
6.3 Stage 2 - Additional Assessment – Building Footprints	22
6.4 Stage 4 –Excavation and Waste Classification	23
6.5 Stage 5 –Reporting	26
6.6 Remedial Contingencies	26
7. SITE MANAGEMENT	28
7.1 Responsibilities and Contacts	28
7.2 Materials Handling and Management	29
7.3 Environmental Management	31
7.4 Contingency Plan for Environmental Incidents	32

7.5	Work Health and Safety Plan (WHSP)	33
8.	VALIDATION SAMPLING AND QUALITY PLAN	36
8.1	Remedial Excavations and Soil Validation Methodology	36
8.2	Validation Reporting	38
9.	CONCLUSION	39
10.	STATEMENT OF LIMITATIONS	40
	REFERENCES	41
	ABBREVIATIONS	43

Schedule of Tables

Table 2-1	Lot, Address and Zoning Data	5
Table 2-2	Site Identification	5
Table 2-3	Local Land Uses	6
Table 2-4	Regional Setting	6
Table 3-1	Summary of Previous Investigation Works and Findings (Entire Site)	8
Table 3-3	Conceptual Site Model	13
Table 4-1	Remediation Acceptance Criteria	14
Table 5-1	Remedial Technology Review - Soils	17
Table 5-2	Remediation Works Category Determination	19
Table 6-1	Remedial Contingencies	27
Table 7-1	Site Management Responsibilities	28
Table 7-2	Materials Handling and Management Requirements	29
Table 7-3	Environmental Management Requirements	31
Table 7-4	Contingency Management	32
Table 7-5	Remedial Hazards	34
Table 7-6	Asbestos Criteria for Air Monitoring	34
Table 8-1	Validation Sampling Design	36
Table 8-2	Validation Sample Collection and Handling Procedures	37

Appendices

APPENDIX A - FIGURES

APPENDIX B – SITE INVESTIGATION RESULTS

APPENDIX C - PROPOSED DEVELOPMENT PLANS

APPENDIX D - UNEXPECTED FINDS PROTOCOL

APPENDIX E – REMEDIATION CRITERIA

APPENDIX F – PREVIOUS BOREHOLE LOGS (EI, 2023B)

1. INTRODUCTION

1.1 Background

EI Australia (EI) were engaged by Wollongong Developments No.5 Pty Ltd ('the client') to prepare a Remediation Action Plan (RAP) for 2 - 4 Gladstone Avenue & 357 - 363 Crown Street, Wollongong NSW ('the site') for proposed redevelopment of the property.

The land parcel can also be identified as Lots 1 and 2 in Deposited Plan (DP) 201949, Lot 6 and DP 14480, Lot 7 in DP661845 (see **Figure A.1, Appendix A**), within the Local Government Area of Wollongong City Council. The site is approximately 6,500 m², as depicted in **Figure A.2, Appendix A**. During previous investigations, the site was occupied by low density residential properties (2-4 Gladstone Avenue), a public parking lot (357-339 Crown Street) and various commercial businesses (363 Crown Street) including Café's, medical facilities and beauty salons.

This version of the RAP report has been prepared in support of an Early Works State Significant Development Application (SSDA). The Early Works SSDA includes bulk excavation and shoring works activities. Please refer to report E25862.E06_Rev1 for the original version of the report, which also includes the main architectural drawing for the site.

This RAP covering the amalgamated properties, considers the previous investigations completed entitled:

- Fortify Geotech (2019) *Geotechnical Investigation Report – Proposed Serviced Apartment Development Wollongong, 357 to 359 Crown Street, Wollongong NSW*, Job Number: S1138, dated 31 October 2019.
- Reditus (2020) *Remedial Action Plan, 357-359 Crown Street, Wollongong NSW*, Report Number: 2008RP01, Rev. 1, dated 8 May 2020.
- EI Australia (2022a) *Preliminary Geotechnical Assessment, 2-4 Gladstone Avenue & 357-363 Crown Street, Wollongong*, Report No. E25862.G01_Rev0, dated 25 November 2022.
- EI Australia (2022b) *Preliminary Site Investigation, 2-4 Gladstone Avenue & 357-363 Crown Street, Wollongong*, Report No. E25862.E01_Rev0, dated 25 November 2022.
- EI Australia (2023a) *Geotechnical Investigation, 2-4 Gladstone Avenue & 357-363 Crown Street, Wollongong*, Report No. E25862.G03_Rev0, dated 13 January 2023.
- EI Australia (2023b) *Detailed Site Investigation, 2-4 Gladstone Avenue & 357-363 Crown Street, Wollongong*, Report No. E25862.E02_Rev0, dated 2 February 2023.

The Reditus (2020) assessment identified one exceedance of the adopted criteria for asbestos at location BH5 within 357 Crown Street, however, visual inspection during subsequent investigations (EI, 2022b, 2023b) did not identify any potential asbestos containing materials (ACM). Four in-situ underground storage tanks (USTs) were also identified using ground penetrating radar (GPR) within the eastern and southern portions of 357 Crown Street. The USTs may be decommissioned, as some of the dip/fill points were noted to be filled with concrete; however, this was not confirmed. Sampling around the USTs did not identify shallow hydrocarbon impact, however, impacts were noted to potentially be present below the tanks and infrastructure in areas not able to be sampled.

Groundwater investigation during the DSI (EI, 2023b) identified minor metal (copper, nickel and zinc) impacts in groundwater. EI considered that the detected metal concentrations were indicative of regional disturbed, urban, background conditions, rather than site specific impact. No light non-aqueous phase liquids (LNAPLs) were measured in monitoring wells near the USTs.

It was concluded in EI (2023b) that the site could be made suitable for the proposed development, following remediation and validation. The purpose of this RAP is to establish a sequential process for remediation and validation works, in support of a Development Application to Wollongong City Council and to comply with the *State Environment Protection Policy (Resilience and Hazards) 2021*.

This investigation was reviewed by a certified practitioner experienced in site contamination (SC) under the scheme by the Environment Institute of Australia and New Zealand (EIANZ).

1.2 Proposed Development

The following drawings and survey plans were provided, and are attached as **Appendix C**:

- BKA Architecture (2025) Bulk Excavation Drawings, Project: 2-4 Gladstone Avenue / 357-363 Crown Street, Wollongong NSW, Project No. 22003, Issue for Coordination, dated 30 January 2026.
- Geosurv (2022) Survey Plans, Drawing No: 220013-DT-02 [A], dated 22 February 2022.

The proposed development includes the demolition of the existing site structures and the construction of a 34-39 level twin tower structure. The development is proposed to be a mixed commercial/residential building, which overlies a lower ground and basement level. The ground floor and lower ground floor of the development is proposed for commercial premises combined with retail and visitor parking, with residential units proposed from level 1 onwards. Parking is also proposed up to level 3. A deep soil and tree protection zone is proposed along the south-western boundary of the site.

The stepped lower ground and basement levels are proposed to have a finished floor level (FFL) ranging between Reduced Level (RL) 22.9 (basement) and 25.8 (lower ground floor) metres Australian Height Datum (mAHD). Excavation depths between 4.6 m to 11.6 m below existing ground level (BEGl) have been estimated. Locally deeper excavations may be required for footings, service trenches, crane pads, and lift overrun pits.

1.3 Objectives of the RAP

The main objective of this RAP is to set the remediation objectives and document the process to remediate the site, with the following sub-objectives:

- To provide details on how to close any identified data gap;
- To provide details on the contaminant sources and site impacts;
- To detail the procedures to be implemented for site remediation;
- To demonstrate that the proposed remediation strategy for the site is environmentally justifiable, practical and technically feasible, and there are no unacceptable risks to onsite and offsite receptors;
- To remediate the site to a condition suitable for mixed commercial/residential land use in accordance with the conditions of consent and without the need for ongoing environmental monitoring;
- To define the remediation acceptance criteria to be adopted to validate that the site, so that it can be rendered suitable for the proposed land-uses;
- To provide guidance on options for mitigating the risk of potential off-site migration of contaminants (including migration via existing utilities such as the sewer, stormwater and other subsurface pipes or service trenches); and

- To demonstrate that the plans for site management during remediation consider work health and safety, environmental management, and contingent action that may be warranted should unexpected finds be discovered during the site remediation and validation process.

1.4 Scope of Works

The above objectives will be achieved by completing the following tasks:

- Review of the available data relevant to the remediation of the site, provided by the previous investigation reports;
- Definition of remediation goals and acceptance criteria;
- Review of the literature on remediation technologies relevant to the site;
- Evaluation of available remediation options and selection of the most appropriate remedial strategy (or combination of strategies) for the site;
- Provision of information so that remedial works may be carried out in accordance with relevant laws and regulations;
- Provision of information to assist the contractor in preparation of a Work Health and Safety Plan (WHSP) and other site management/planning documents; and
- Development of a Sampling and Analysis Quality Plan (SAQP) for hotspot delineation and post-remedial validation.

1.5 Regulatory Framework

The following legislation, guidelines and standards were considered during the preparation of this RAP:

Legislation

- *Contaminated Land Management Act 1997 (CLM Act)*;
- *Environment Planning Assessment Act (1979)* and any associated planning policies and Secretary's environmental assessment requirements (SEARs);
- *Protection of the Environment Operations Act 1997 (POEO Act)* and associated regulations, including the *Waste Regulation 2014* and *Underground Petroleum Storage Systems Regulation 2019*;
- *State Environment Protection Policy (Resilience and Hazards) 2021*;
- *Water Management Act 2000 (Water Act)*;
- *Wollongong Development Control Plan 2009 (DCP 2009)*;
- *Wollongong Local Environment Plan 2009 (LEP 2009)*; and
- *Work Health and Safety Act 2011 (WHS Act)* and associated regulations and codes of practice.

Guidelines

- *NSW EPA Sampling Design Guidelines* (NSW EPA,2022);
- *NSW EPA Waste Classification Guidelines* (NSW EPA, 2014a);
- *NSW EPA Guidelines for the NSW Site Auditor Scheme* (NSW EPA, 2017);
- *NSW EPA Consultants reporting on contaminated land, Contaminated Land Guidelines* (NSW EPA, 2020a);
- *NSW EPA Guidelines for Implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation* (NSW EPA, 2020b);
- *NSW EPA Position Statement – WA Guidelines for Asbestos Contaminated Sites* (NSW EPA 2022);
- *National Environment Protection (Assessment of Site Contamination) Amendment Measure* (NEPC, 2013);
- *SafeWork NSW (2019) Code of Practice: How to Manage and Control Asbestos in the Workplace*, August 2019;
- *SafeWork NSW (2019) Code of Practice: How to Safely Remove Asbestos*, August 2019; and
- *Western Australia Department of Health Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (WADoH, 2009).
- *Western Australia Department of Health Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (WADoH, 2021).

Standards

- AS 4976:2008 *The Removal and Disposal of Underground Petroleum Storage Tanks*.

1.6 Deviations from RAP

During the course of the program, it may become necessary to vary the sequence and/or details of the site remediation and validation works to meet site constraints. EI note that at the time of preparing this RAP, there are a number of items that will need to be considered prior to undertaking remediation. If required, any deviation from the methodology specified in this RAP is to be properly documented and approved, as required under existing guidelines (NSW EPA, 2020).

Performing remedial works without the supervision of a qualified environmental engineer/scientist may lead to project delays and extra costs, due to additional investigation requirements imposed by an independent consultant, or the appointed Site Auditor, to confirm the environmental status of the site.

In worst case scenarios, waste materials removed from the site without proper characterisation and/or tracking, may lead to regulatory action and potential penalties, as described under the *Waste Regulation 2014* and the *Contaminated Land Management Act 1997*.

2. SITE DESCRIPTION

2.1 Property Identification, Location, and Physical Setting

The site identification details and associated information are presented in **Table 2-1**, while the site locality is shown in **Figure A.1**.

Table 2-1 Lot, Address and Zoning Data

Lot/DP or SP	Address	Size (approx.) (m ²)	Current Zoning
Lot 6 DP 14480	2 Gladstone Avenue, Wollongong	855	B3
Lot 7 DP 661845	4 Gladstone Avenue, Wollongong	800	B3
Lot 2 DP 201949	357-359 Crown Street, Wollongong	1,640	B3
Lot 1 DP 201949	363 Crown Street, Wollongong	3,225	B3

Note 1 DP – Deposited Plan

Note 2 SP – Strata Plan

Note 3 B3 – Commercial Core (*Wollongong Local Environmental Plan, 2009*)

Site identification details pertinent to the site are presented in **Table 2-2**.

Table 2-2 Site Identification

Attribute	Description
Location Description	<p>The site was located in an area of primarily commercial use, being located on the commercial area of Crown Street, and approximately 550m west of Wollongong CBD. The site was bound by:</p> <ul style="list-style-type: none"> ▪ North: Crown Street, followed by Commercial (restaurants/café's, shops, offices); ▪ East: Gladstone Ave, followed by Commercial (shops and offices) and Wollongong Train Station; ▪ South: Commercial (Hotel) and Medium density residential. ▪ West: Mixed-use high density residential and ground floor commercial followed by commercial and childcare centre.
Site Coordinates	<p>Northern-eastern corner of site (GDA2020-MGA56):</p> <ul style="list-style-type: none"> ▪ Easting: 305850.286 ▪ Northing: 6188604.082 <p>(Source: http://maps.six.nsw.gov.au)</p>
Site Area	<p>Approx. 6,500 m²</p> <p>(Source: http://maps.six.nsw.gov.au)</p>
State Survey Marks	<p>Three State Survey Markers (SS) are situated within close proximity (approx. 100m) to the site:</p> <ul style="list-style-type: none"> ▪ SS23203: on the street, frontage of Crown St (approx. 3m north); ▪ SS23189D: on the north-eastern corner of the intersection of Crown St and Gladstone Ave (approx. 48m north-east); ▪ SS23204: on the northern street frontage of Crown St (approx. 72m north-west). <p>(Source: http://maps.six.nsw.gov.au).</p>
Local Government Area	Wollongong City Council

Attribute	Description
Parish	Wollongong
County	Camden
Current Zoning	B3 – Commercial Core (Wollongong Local Environmental Plan 2009)

2.2 Local Land Use

The site is situated within an area of mixed use, as described in **Table 2-3**. The local sensitive receptors within close proximity to the site are also identified in this table.

Table 2-3 Local Land Uses

Direction	Land Use Description	Sensitive Receptors (& distance from site)
North	<ul style="list-style-type: none"> Commercial/retail premises 	<ul style="list-style-type: none"> Commercial patrons/workers (20m)
East	<ul style="list-style-type: none"> Commercial/retail shopping premises; Wollongong Train Station 	<ul style="list-style-type: none"> Commercial patrons/workers (20m) Train station patrons/workers (115m)
South	<ul style="list-style-type: none"> Mantra Wollongong Hotel Accommodation Medium density residential 	<ul style="list-style-type: none"> Hotel patrons/workers (directly adjacent) Residential occupants (20m)
West	<ul style="list-style-type: none"> Mixed use commercial and residential premises Child Care Centre 	<ul style="list-style-type: none"> Commercial patrons/workers (directly adjacent) Residential occupants (directly adjacent) Child care patrons/workers (60m)

2.3 Regional Setting

The topography, hydrogeology, geology and soil landscape information are summarised in **Table 2-4**.

Table 2-4 Regional Setting

Attribute	Description
Topography	The site slopes from approximately RL 35 -37 mAHD in the east to RL 25mAHD in the west (Source: geosurv, 2022).
Site Drainage	<p>Site drainage is expected to run off from paved surfaces to Gladstone Avenue, where stormwater is collected via pit and pipe drainage. Following this, stormwater is expected to drain into the municipal stormwater system via various canals, which drain into the South Pacific Ocean.</p> <p>In areas of the ground surface with exposed soils, it is expected that drainage will be in the form of surface run-off consistent with topography (i.e. to the south-east) and direct infiltration.</p>
Regional Geology	The 1:100 000 scale Geological Series Wollongong-Port Hacking Sheet 9029-9129 (DMR, 1985), indicates the site is underlain by Budgong Sandstone from the Shoalhaven Group, comprising red, brown and grey lithic sandstone.

Attribute	Description
Soil Landscapes	<p>The NSW Government Department of Planning, Industry, and Environment eSPADE v2.2 website indicates that the site overlies the <i>Gwynneville - Residual Landscape (gw)</i>. The landscape is on the foot-slopes of the Illawarra Escarpment and isolated rises of the Wollongong Plain. It comprises broad to moderately rounded ridges and gently to steeply inclined slopes. Structural benches and occasional rock outcrops.</p> <p>Soils are identified as shallow Brown Podzolic Soils and Xanthozems on upper slopes, Lithosols on simple slopes and shallow Brown Earths on midslopes and lower slopes.</p>
Acid Sulfate Soil (ASS) Risk	<p>Based on a review of the previous reports, ASS was not known to be located in or within close proximity (i.e. 500m) of the site. Given such information, further Acid Sulfate Soils Assessment was not considered to be warranted</p>
Likelihood & Depth of Filling	<p>Based on the previous environmental and geotechnical investigation works (EI, 2023a,b), the maximum depth of fill is considered to be 2.3 mBGL.</p>
Typical Soil Profile	<p>Based on the previous environmental and geotechnical intrusive works (EI, 2023a,b), the typical soil profile at the site is a layer of filling, overlying residual soils, with sandstone bedrock at depth. Sandstone bedrock was observed at shallow depths (i.e. < 0.5 mBGL) in some locations.</p>
Depth to Groundwater	<p>Groundwater was observed during the previous DSI (EI, 2023b) at depths of 1.03 – 7.27 mBGL.</p>
Nearest Surface Water Feature	<ul style="list-style-type: none"> ▪ Gurungaty Waterway (approximately 1.32km south-east) ▪ South-Pacific Ocean (approximately 1.63km east)
Anticipated Groundwater Flow Direction	<p>Groundwater is anticipated to flow in a south-easterly direction, towards the Gurungaty Waterway.</p>

3. SITE CHARACTERISATION

3.1 Previous Investigations

Previous investigations completed at the site included:

- Fortify Geotech (2019) *Geotechnical Investigation Report – Proposed Serviced Apartment Development Wollongong, 357 to 359 Crown Street, Wollongong NSW*, Job Number: S1138, dated 31 October 2019.
- Reditus (2020) *Remedial Action Plan, 357-359 Crown Street, Wollongong NSW*, Report Number: 2008RP01, Rev. 1, dated 8 May 2020.
- EI Australia (2022a) *Preliminary Geotechnical Assessment, 2-4 Gladstone Avenue & 357-363 Crown Street, Wollongong*, Report No. E25862.G01_Rev0, dated 25 November 2022.
- EI Australia (2022b) *Preliminary Site Investigation, 2-4 Gladstone Avenue & 357-363 Crown Street, Wollongong*, Report No. E25862.E01_Rev0, dated 25 November 2022.
- EI Australia (2023a) *Geotechnical Investigation, 2-4 Gladstone Avenue & 357-363 Crown Street, Wollongong*, Report No. E25862.G03_Rev0, dated 13 January 2023.
- EI Australia (2023b) *Detailed Site Investigation, 2-4 Gladstone Avenue & 357-363 Crown Street, Wollongong*, Report No. E25862.E02_Rev0, dated 2 February 2023.

The previous Reditus RAP (2020) discusses a Preliminary and Detailed Site Investigation, conducted in 2019 which were not been provided for review. The above listed assessments are summarised in **Table 3-1**. Previous sampling locations are presented as **Figure A.2, Appendix A**, with summaries of previous soil and groundwater results presented as **Table B.1 and B.2, Appendix B**.

Table 3-1 Summary of Previous Investigation Works and Findings (Entire Site)

Assessment Details	Project Tasks and Findings
Fortify Geotech (2019) – Geotechnical Investigation (357 – 359 Crown Street)	
Purpose	To assess the likely site surface and sub-surface conditions, and anticipated geotechnical factors associated with the proposed development.
Scope of Works	<ul style="list-style-type: none"> ▪ Provide a site classification to AS2870 “Residential Slabs & Footings”; ▪ Recommend suitable footing systems for the buildings including types, founding depths and allowable bearing pressures; ▪ Provide advice on excavation conditions and procedures, site drainage and other relevant geotechnical issues; ▪ Site inspection and drilling of 3 boreholes down to a maximum 10m below ground level (BGL) across the site.
Key Findings	<ul style="list-style-type: none"> ▪ A conceptual ground model inferred fill materials to be present at the site, overlying sandstone bedrock. ▪ Depth to bedrock was inferred between 0.2 – 1.2 mBGL. ▪ Groundwater level was not determined during this investigation.

Assessment Details	Project Tasks and Findings
Reditus (2020) Remedial Action Plan (357 – 359 Crown Street)	
Purpose	To inform and guide site remediation of the contamination identified at the site.
Proposed Remedial Strategy	<ul style="list-style-type: none"> ▪ Stage 1 – Removal/validation of known and potential underground petroleum storage systems (UPSS), and asbestos impacted soil hotspot at BH5. Consisting of: <ul style="list-style-type: none"> ▸ Removal of primary sources of petroleum hydrocarbons, underground storage tanks (USTs) and associated infrastructure (UPSS): <ul style="list-style-type: none"> - Tank Farm 1 (3 USTs) – assuming 1x 20kL, 1x 15kL, 1x 10kL; - Tank Farm 2 (1 UST / waste oil) – assuming 1x 5kL; and - Lines, vents and bowsers (locations unknown due to new hardstand, but assume lines will be chased out and validated) ▪ Stage 2 – visual validation of the bulk excavation after all hardstand and soil/fill has been removed down to bedrock.
EI Australia (2022a) – Preliminary Geotechnical Investigation (entire site)	
Purpose	To assess the likely site surface and subsurface conditions and anticipated geotechnical factors associated with the proposed development.
Key Findings	<ul style="list-style-type: none"> ▪ A conceptual ground model was produced for the site, indicating the likely sub-surface conditions as a layer of filling, overlying residual soils, followed by Budgong sandstone bedrock. ▪ Depth to groundwater was inferred to be at approximately 3 mBGL, based on limited in house information.
Recommendations	<ul style="list-style-type: none"> ▪ Detailed sub-surface geotechnical investigation was recommended, to determine site specific sub-surface profile and geotechnical parameters for design of footings.
EI Australia (2022b) – Preliminary Site Investigation (entire site)	
Purpose	<p>The primary objective of this PSI was to provide a qualitative assessment of the environmental condition of the site, by appraising the potential for contamination on the basis of field observations, historical land uses and anecdotal and documentary evidence.</p> <p>A secondary objective was to make recommendations for further environmental investigation of the site (if necessary), in relation to the proposed development.</p>
Scope of Works	<ul style="list-style-type: none"> ▪ Review of relevant topographical, geological and soil landscape maps for the project area; ▪ A search for groundwater bore records within close vicinity (500m radius) of the site; ▪ A site walkover; ▪ Review of site history, based on previous reports, land titles records, SafeWork NSW records and property files archived by Wollongong City Council; ▪ Searches of public registers maintained by the NSW Environment Protection Authority (EPA) for statutory notices and licensing agreements issued under the <i>Contaminated Land Management Act 1997</i> and <i>Protection of the Environment Operations Act 1997</i>; ▪ A search of the List of NSW Contaminated Sites Notified to the EPA; and ▪ A search of the Australian Government Department of Defence <i>Unexploded Ordnance Mapping Application</i>.

Assessment Details	Project Tasks and Findings
Key Findings	<ul style="list-style-type: none"> ▪ The site was observed to slope to the east/south-east. The sub-surface layers are inferred to comprise of 0.1-0.5m of fill, overlying residual clayey sands, followed by slightly weathered sandstone bedrock. Groundwater was anticipated to 2-4m below ground level. ▪ Based on the aerial imagery, the site has been used for various commercial and residential premises since the late 1950s, with residential prior to. The residential structures on No.2 and 4 Gladstone have remained largely unchanged. No. 357-359 Crown St was a service station with bowsers until the late 1980's, where the bowsers were removed and the site remained vacant. Various commercial businesses have occupied the same building at No. 363 Crown St until present. ▪ Land titles information suggested that 357-359 Crown and 2 Gladstone have been under various private ownerships since the early 1900s, until the late 1950s. A mechanics 'garage' was leased on the site. Both lots were then owned by Mobil Oil for at least a few years, where Gladstone was sold and Crown was kept until the 1980's. 4 Gladstone was privately owned for the majority of its time. 363 Crown Street was private from the early 1900s until the 1940s where it was converted into a commercial shopfront. In the 1980s, the lot was converted into a strata plan, inhibiting land titles records. ▪ Council records related primarily to 357-359 Crown St, included within the documents for this site was a plan by Mobil Oil Australia depicting the site layout, including bowser pumps, and sketched outlines that correlated with the Reditus (2020) plans for USTs. ▪ Searches of NSW EPA records indicated the site was not known to be contaminated nor have previously identified contamination issues.
Conclusions and Recommendations	<ul style="list-style-type: none"> ▪ The CSM developed for the site identified complete potential pollutant linkages and a number of data gaps to remain. These data gaps are as follows and require closure: <ul style="list-style-type: none"> ▸ Confirmation of the presence / absence of hazardous materials within existing buildings, and the effective removal of any material to ensure no residual impacts remain on site; ▸ Confirmation of the condition and contamination associated with sub-surface infrastructure, including USTs; and ▸ Further evaluation of the potential contaminants of concern that may have resulted from the potentially contaminating activities that historically occurred within the land. ▪ The following recommendations were provided: <ul style="list-style-type: none"> ▸ Undertake a Hazardous Materials Survey (HMS) within the existing building structures, and include methods to effectively remove the material to ensure no residual impacts remain. ▸ Undertake a ground penetrating radar (GPR) scan to identify suspected USTs and services. ▸ Undertake a Stage 2 Detailed Site Investigation (DSI) to define existing contamination. ▸ Prepare a Remediation Action Plan (and updating the existing RAP if required), to address any identified contamination.
EI Australia (2023a) –Geotechnical Investigation (entire site)	
Purpose	To assess the likely site surface and sub-surface conditions, and anticipated geotechnical factors associated with the proposed development.

Assessment Details	Project Tasks and Findings
Scope of Works	<ul style="list-style-type: none"> ▪ Review of relevant hydrogeological, soil landscape and geological maps; ▪ Site investigation including: <ul style="list-style-type: none"> ▸ Drilling six boreholes across the site (with rock coring) to depths of 12 mBGL; ▪ Data interpretation and reporting.
Key Findings	<ul style="list-style-type: none"> ▪ Sub-surface conditions encountered fill materials overlying residual silty clays and weathered sandstone bedrock. <ul style="list-style-type: none"> ▸ Topsoil/fill was encountered from 0.0 – 0.4 mBGL. ▸ Residual clays were encountered from 0.4 – 2.3 mBGL; ▸ Sandstone bedrock was encountered from depths of 0.2 mBGL. ▪ Groundwater was observed in all monitoring wells, and varied from RL 29.6m to the west, to RL 25.6m to the east (Gladstone Avenue). The water levels observed in the monitoring wells are all within fractured sandstone bedrock. <ul style="list-style-type: none"> ▸ It was inferred that some minor seepage inflows may occur into the excavation, but these can be managed via conventional sump and pump systems.
EI Australia (2023b) –Detailed Site Investigation (entire site)	
Purpose	<ul style="list-style-type: none"> ▪ Investigate the degree of potential contamination by intrusive sampling and laboratory analysis, for relevant contaminants; ▪ Make recommendations for the appropriate management of any contaminated soils and/or groundwater identified.
Scope of Works	<ul style="list-style-type: none"> ▪ Review of all previous environmental reports; ▪ Underground search for buried services and USTs using a GPR. ▪ Drilling of 12 soil test boreholes and 4 groundwater monitoring bores. ▪ Multiple level soil sampling and one round of groundwater sampling.
Key Findings	<ul style="list-style-type: none"> ▪ Visual evidence of asbestos contamination was not observed within the previously identified location of BH5 (Reditus, 2020), but the area surrounding was noted to be heavily vegetated and general refuse was noted to be present throughout. ▪ No olfactory indicator of contamination (i.e. suspicious odour) was detected on the site at surface level, with the exception of a hydrocarbon odour detected within BH103M. ▪ Four in-situ USTs were identified via GPR within the eastern and southern sections of 357 Crown Street, inferred to be decommissioned yet not confirmed. ▪ The sub-surface layers comprised a layer of filling to an average depth of 0.8m, overlying residual silty clays, followed by weathered sandstone bedrock; ▪ Soil sampling and analysis indicated that all samples complied to the adopted human health and ecological criteria. ▪ Groundwater sampling and analysis indicated that standing water levels were recorded between 1.13 – 7.37 mBGL (RL 25.60 – 29.86 mAHD). <ul style="list-style-type: none"> ▸ Minor heavy metal (copper, nickel and zinc) impacts were identified in groundwater. EI considered that the detected chromium and zinc concentrations were indicative of regional disturbed, urban, background conditions, rather than site specific impact. Furthermore, no light non-aqueous phase liquids (LNAPLs) were measured in monitoring wells near the USTs.
Recommendations	<ul style="list-style-type: none"> ▪ An addendum to the Reditus (2020) RAP should be prepared to address the additional combined sites as per the proposed development. ▪ A Hazardous Materials Survey should be undertaken prior to demolition works. ▪ An Asbestos Clearance Inspection and Certificate should be completed following fill removal from 357 Crown Street.

3.2 Monitoring Well Survey

Subsequent to the DSI (EI, 2023b), a survey of all existing monitoring wells was completed in order to confirm groundwater flow direction, and provide groundwater contour diagrams. The survey (Geosurv, 2023) confirmed the findings of the DSI (EI, 2023b), with groundwater noted to be flowing in a south-easterly direction.

Higher standing water levels (SWLs) recorded in monitoring wells in the vicinity of UST pits may have been influenced by rain and surface water run-off accumulating in the pits. The SWLs recorded may also reflect groundwater pressure within the water bearing zone rather than true groundwater depths.

Groundwater contours have been developed as **Appendix A, Figure A.4**, with a copy of the monitoring well survey presented as **Appendix C**.

3.3 Conceptual Site Model

In accordance with NEPC (2013) *Schedule B2 - Guideline on Site Characterisation*, EI developed a conceptual site model (CSM) as part of the investigation phase assessing plausible linkages between potential contamination sources, migration pathways and receptors.

3.3.1 Subsurface Conditions

The general site lithology encountered during the previous investigations was a layer of filling, overlying residual silty clays. Budgong Sandstone bedrock was encountered at relatively shallow depths, (i.e. < 1 mBGL).

3.3.2 Groundwater

Groundwater was analysed across the site at eight monitoring well locations (BH101M, BH102M, BH103M, BH105M, EMW1, MW1, MW2 and MW3), four of which were constructed during this site investigation (BH101M, BH102M, BH103M and BH105M). Standing water levels (SWLs) were recorded between 1.13 – 7.37 mBGL (RL 25.60 – 29.86 mAHD) during the GME, conducted three weeks following well installation/development. SWLs were recorded at the highest point in BH105M (7.37 mBGL, 29.86 RL mAHD), and lowest point at BH103M (1.90 mBGL, RL 25.60 mAHD).

3.3.3 Existing Site Contamination

Intrusive investigations conducted by EI (2023b) and Reditus (2020) identified impacted areas requiring remediation as follows:

- Asbestos impacted fill material at location BH5, identified at a depth of 0.4 mBGL. It is noted that fill material was identified to 1.1 mBGL at this locality, followed by Budgong Sandstone bedrock.
- Four in-situ underground storage tanks (USTs) were also identified using ground penetrating radar (GPR) within the eastern and southern portions of 357 Crown Street. The USTs may be decommissioned, as some of the dip/fill points were noted to be filled with concrete; however, this was not confirmed.

For groundwater samples (EI, 2023b), dissolved copper, nickel and zinc concentrations exceeded the adopted groundwater investigation level (GIL), but were considered to represent background conditions and not a risk to receptors at the site, while all other potential contaminants were either reported below the laboratory practical quantitation limit (PQL) or below the adopted GIL. No light non-aqueous phase liquids (LNAPLs) were measured in monitoring wells near the USTs.

3.3.4 Potential Sources, Exposure Pathways and Receptors

Following review of the previous investigations (**Section 3.1**), the potential contamination sources, exposure pathways and human and environmental receptors that were considered relevant for this RAP are summarised in **Table 3-3**.

Table 3-2 Conceptual Site Model

Potential Source	Media	Potential Contaminants	Exposure Pathway	Potential Receptor	Source-Pathway-Receptor (S-P-R) Linkage Complete?
Asbestos contamination at BH5	Soil	Asbestos	Inhalation of dust	Maintenance workers Demolition / construction workers Future site users	Potentially complete. However, workers must use personal protective equipment (PPE) as per SafeWork NSW regulations.
Building footprints (following demolition)	Soil	Metals TRH BTEX PAH OCP/OPP PCB Asbestos	Inhalation of dust	Maintenance workers Demolition / construction workers Future site users	Potentially complete. Workers must use personal protective equipment (PPE) as per SafeWork NSW regulations.
Storage of petroleum-based products in underground storage tanks	Soil Ground-water	Metals TRH PAH BTEX VOCs Phenols	Physical spreading during excavation Migration of impacts in groundwater	Site workers (during construction) Ecological receptors	Potentially complete. USTs potentially decommissioned. Workers must use personal protective equipment (PPE) as per SafeWork NSW regulations.

3.3.5 Data Gaps

Based on the information review for the CSM, EI consider there were no remaining data gaps identified for the site, so long as the recommendations listed in the DSI (EI, 2023b) for additional works are followed prior to and during the remediation program. That being:

- A Hazardous Materials Survey should be undertaken prior to the commencement of any demolition works.
- Assessment of soils underneath building footprints should be completed post site demolition, with analysis for potential contaminants;
- An asbestos clearance inspection and certificate should be completed by a suitable qualified professional (e.g. SafeWork NSW Licensed Asbestos Assessor or competent person) following the removal of any asbestos contaminated fill from the site.

4. REMEDIATION GOAL AND CRITERIA

4.1 Remediation Goal

The remediation goal is to make the site suitable for the proposed mixed residential and commercial (including child care centre) land uses, in line with *State Environment Protection Policy (Resilience and Hazards) 2021* and Council's contaminated land policy.

4.2 Remediation Criteria

Based on the proposed development (**Section 1.2**), the land use of the proposed development is equivalent to a generic NEPC (2013) setting of residential with minimal opportunities for soil access. The development drawings provided (**Appendix C**) also indicate deep soil zones in the south-western portion of the site will be retained for landscaped areas. The following remediation criteria were adopted for the site, as outlined in **Table 4-1**, and with individual criteria values tabulated within **Appendix E**. These were selected from available Tier 1 NSW EPA statutory made or approved guidelines, or NSW EPA non-statutory published or endorsed guidelines (where necessary), with due consideration of the exposure scenario that is expected for the site, the likely exposure pathways and the identified potential receptors.

Table 4-1 Remediation Acceptance Criteria

Medium	Guidelines	Rationale
Soil	NEPC (2013) HILs, HSLs, EILs, ESLs and Management Limits for TRH	<p>Soil Health-based Investigation Levels (HILs) NEPC (2013) <i>HIL-B</i> thresholds for residential with minimal opportunities for soil access settings.</p> <p>Soil Health-based Screening Levels (HSLs) NEPC (2013) <i>HSL-D</i> thresholds to be applied for vapour intrusion, as commercial premises are designated for use on the ground floor (per Section 2.4.8, Schedule B(1) NEPC (2013)). Soil texture classification of clay soils will be applicable. Depth ranges of samples to be considered in accordance with NEPC (2013).</p> <p>For asbestos:</p> <ul style="list-style-type: none"> ▪ Bonded ACM - HSL-B for building footprint and paved areas; ▪ Bonded ACM - HSL-A for deep soil area; ▪ Friable Asbestos: 0.001% w/w in all areas of the site; ▪ No visible asbestos on soil surface in all areas of the site. <p>Ecological Investigation Levels (EILs) / Ecological Screening Levels (ESLs) Soil will be assessed against the NEPC 2013 EILs/ESLs for urban residential land use scenarios. Ecological criteria has been adopted to assess the potential impact to potential proposed landscaping areas where plants could be exposed to soils, and where precipitation may result in subsurface infiltration and resulting leaching of contaminants.</p> <p>Management Limits for Petroleum Hydrocarbons Should the HSLs be exceeded for petroleum hydrocarbons, soil samples would also assessed against the NEPC 2013 <i>Management Limits</i> for the TRH fractions F1 – F4 to assess propensity for phase-separated hydrocarbons (PSH), fire and explosive hazards & adverse effects on buried infrastructure.</p>

Note 1 Ecological values derived using site specific Added Contamination Limits (ACL) of fill soils for the site (pH= 7.43 / CEC= 23.2), plus an ambient background concentration for the area (ABC) (ACL + ABC).

Note 2 Wollongong (Crown Street) is defined as an old suburb (houses generally >20 years old) with high traffic (>250 cars pass by per hour at peak traffic conditions). Aged soils >2 years have been used in determination of EILs.

Prior to being removed from the site, any excavated soils must be classified in accordance with the NSW EPA (2014a) *Waste Classification Guidelines*. Under these guidelines, waste soils are classified into the following groups: *General Solid Waste (including Virgin Excavated Natural Materials (VENM))*, *Restricted Solid Waste*, or *Hazardous Waste*, subject to chemical assessment. The chemical assessment must use NATA-registered laboratory methods for testing total contaminant concentrations and leachable contaminant concentrations using the *toxicity characteristics leaching procedure (TCLP)* methodology. Any soils containing asbestos would additionally be classified as *Special Waste - Asbestos Waste*.

In accordance with the *NSW Waste Regulation 2014*, waste soils must only be disposed to a waste facility that is appropriately licenced to receive the incoming waste. It is therefore recommended that confirmation is obtained from the waste facility prior the materials being removed from the site. In the case of *Asbestos Waste*, special tracking requirements include entering relevant details of the waste transfer into the NSW EPA's Waste Locate Tracking System, as described in **Section 7.2**.

Should the importation of 'clean' materials be required, to backfill remedial voids and bring the site to the intended finished floor levels, imported materials must be previously classified as *virgin excavated natural material (VENM)* or *excavated natural material (ENM)*, or deemed suitable under another NSW EPA resource recovery exemption/order. In the absence of suitable validation information (as confirmed by the appointed environmental scientist), imported materials must be sampled and analysed to confirm suitability for on-site use. The corresponding methodology is outlined in **Section 8.1**.

5. REMEDIATION TECHNOLOGY

5.1 Regulatory Overview

Under the NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Amendment Measure*, the preferred hierarchy for site remediation and/or management is:

- On-site treatment of the contamination so that it is destroyed or the associated risk is reduced to an acceptable level; and
- Off-site treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level, after which soil is returned to the site; or, if the above are not practicable:
- Consolidation and isolation of the soil on-site by containment with a properly designed barrier; and
- Removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material; or
- Where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

When deciding which option to choose, the sustainability (environmental, economic, and social) of each should be considered, in terms of achieving an appropriate balance between the benefits and effects of undertaking the method.

For this site, a number of remediation options were reviewed to examine the suitability of each method, the surrounding properties, geological and hydrogeological limitations and the following considerations:

- Development requirements (mixed-use, commercial and residential);
- Prioritisation of works in areas of most concern;
- Ability of remedial method to treat contamination with respect to material and infrastructure limitations;
- Remedial timetable;
- Defensible method to ensure the site is remediated to appropriate levels / validation criteria; and
- Regulatory compliance.

5.2 Remediation Technologies Review

Various soil remediation options were reviewed to examine the suitability of each method, with due regard for the surrounding land uses, as well as the geological limitations. As a standard approach, a few typical remediation options were checked for their viability on this site. Each of the remediation technologies is summarised in terms of its suitability in **Table 5-1**.

Table 5-1 Remedial Technology Review - Soils

Remediation Methodology	Description	Advantages	Disadvantages	Suitability
No Action	<p>'No Action' can be considered if:</p> <ul style="list-style-type: none"> There is no measurable contamination (i.e. contaminant concentrations are below adopted criteria); Exposure is unlikely; and Contaminants are not mobile. 	<p>No remediation costs. Creates minimal disturbance to the site. Retains material on-site.</p>	<p>Would pose limitations on land use options. May require an Environmental Management Plan (EMP) and ongoing monitoring.</p>	<p>Not suitable –USTs require removal in accordance with relevant NSW EPA guidance. Key objective of the remedial strategy is to make the suite suitable without the need for on-going monitoring.</p>
On-site bioremediation	<p>Excavated soils are thoroughly broken down and aerated, mixed with microorganisms and nutrients, stockpiled and aerated in above ground enclosures.</p>	<p>Cost effective if soils are reused on site. Lower disposal costs. Limited requirement to import fill material to site. Retains material on-site.</p>	<p>Significant area required. Undefined remediation timeframe. Potential for odour problems.</p>	<p>Potentially suitable - Depending on time and space limitations; could be applied to remediation of the UST area (if contamination is present beneath). Not suitable for asbestos contamination.</p>
<i>In situ</i> treatment	<p><i>In situ</i> treatment of impacted soils within the smear zone and saturated zone using treatment methods such as soil vapour extraction, injection of oxidising agents etc.</p>	<p>Minimal disturbance (no excavation). Cost effective for large scale site remediation of light to mid-weight petroleum hydrocarbons. Potential to simultaneously remediate groundwater (if contaminated).</p>	<p>High establishment costs. Potential for odour problems. Requires detailed design and pilot trials.</p>	<p>Potentially suitable – Any residual impacts that may present a human or environmental health risk may be degraded further using in-situ treatments. Not suitable for asbestos contamination.</p>
Consolidation and/or capping	<p>Risk minimisation approach where impacted soils are managed on-site by capping the ground surface with a clean, impermeable layer of fill material.</p>	<p>Effectively removes risk to human health by eliminating exposure pathways. Lower disposal costs. Limited requirement to import fill material to site. Retains material on-site</p>	<p>Detailed capping design required. Would pose limitations on land use. Typically requires EMP.</p>	<p>Not suitable – Key objective of the remedial strategy is to make the suite suitable without the need for on-going monitoring.</p>
Excavation and off-site disposal	<p>Excavate impacted materials. Transport directly to a licensed landfill facility. Reinstate site with imported clean fill material.</p>	<p>Fast – impacted material removed immediately, significantly reducing potential for impact to groundwater. No storage or treatment problems. Reduced vapour/odour issues as impacted materials removed from site. Minimal design and management costs.</p>	<p>High costs associated with the disposal of waste soils and importation of clean backfill). Requires waste classification prior to disposal, keeping of thorough waste records, waste tracking and reporting. Sustainability issues related with disposal to landfill.</p>	<p>Suitable – For meeting the key project objective to make the site suitable for mixed use, without the need for on-going monitoring.</p>

Remediation Methodology	Description	Advantages	Disadvantages	Suitability
Monitored natural attenuation	Allowing the contaminants to biodegrade naturally, while monitoring spatial and temporal trends.	No disposal costs. Retains materials on site. Sustainable, cost effective remediation method.	Slow process. Potential for contamination to further impact the groundwater aquifer and nearby environmental receptors. Typically requires EMP and ongoing monitoring.	Potentially suitable - Depending on time limitations; could be applied to remediation of the UST area (if contamination is present).

5.3 Preferred Remediation Option

Based on the available remedial technologies presented in **Table 5-1**, the proposed site development (mixed use, commercial and residential), the potential risks to human health and the environment, as well as the relative cost effectiveness of feasible remedial techniques, the preferred remedial option for the site is:

- Excavation followed by off-site disposal of impacted soils to licensed waste facilities.

All wastes should be transported to appropriate, NSW EPA-licensed facilities, after classification in accordance with NSW EPA guidelines. All excavated (remediation) areas should be validated by base and wall soil sampling. If required, any backfilling should be undertaken with validated, imported (or recovered) excavated natural materials.

5.4 Remediation Works Category, Consent and Planning

5.4.1 SEPP (R&H, 2021) Requirements

In accordance with *State Environment Protection Policy (Resilience and Hazards) 2021 (i.e. SEPP 2021)*, the category of the remediation works defines whether consent is required prior to commencement. Under *SEPP 2021*, works where there is the potential for significant environmental impact are classed as *Category 1* and require development consent. *Category 2* works pose a low potential for environmental impact and do not therefore require prior consent. The determination for the subject site is outlined in **Table 5-2**.

Table 5-2 Remediation Works Category Determination

Significant Environment Impact	Yes/No	Category
Designated Development or State Significant Development	No	2
Critical or threatened species habitat	No	2
Impact on threatened species, populations, ecological communities or their habitats	No	2
In area identified environmental significance such as scenic areas, wetlands (see list*)	No	2
Comply with a policies made under council's contaminated land management policies	Yes	2
Is work ancillary to other development	No	2

Notes: * Environmental significance list -coastal protection, conservation or heritage conservation, habitat area, habitat protection area, habitat or wildlife corridor, environment protection, escarpment, escarpment protection or escarpment preservation, floodway, littoral rainforest, nature reserve, scenic area or scenic protection, or wetland.

Based on the above determination, the remediation works for the site are considered Category 2 and will not require development consent. Nevertheless, 30 days prior to commencement of remediation, notification to the consent authority (Wollongong City Council) will be made. Council has the right of intervention after that time for a breach of the *EPA Act 1997* or non-compliance with *State Environment Protection Policy (Resilience and Hazards) 2021*. The notification will also serve as the basis for updating Council records on properties in the local government area and will:

- Be in writing;
- Provide contact details for the notice;
- Briefly describe the remediation work;
- Show why the work is considered Category 2 remediation work;
- Specify the property description and street address on which the remediation work is to be carried out;

- Provide a location map; and
- Provide estimates for commencement and completion dates of the work.

Provision of this RAP, as well as an indication of commencement and completion dates of the works in writing, is usually sufficient to meet the requirements of this notification.

5.4.2 Development Consent and Planning

All works must be in accordance with State Significant Development Secretary's environmental assessment requirements (SEARs) and /or *Wollongong Development Control Plan (DCP) 2009* and any specific consent conditions issued for the development.

The appointed site contractor must also prepare a site-specific Work Health and Safety Plan (WHSP) and Construction Environmental Management Plan (CEMP) for the project, covering human / environmental health and safety issues, as well as all measures required under Council's Development Application (DA) approval and DCPs.

6. REMEDIATION WORKS

6.1 Remediation Sequence

The overall site remediation works will therefore include (though not necessarily be limited to):

- **Stage 1** – Preliminaries / site establishment
- **Stage 2** – UPSS/UST removal and validation
- **Stage 3** – Waste classification and excavation
- **Stage 4** – Validation report preparation.

6.1.1 Contingent Action

Should additional impacted soils be encountered or unexpected finds be discovered during the course of the remediation program, or should any phase of the validation identify residual, gross contamination requiring additional remediation, then the procedures described under the Unexpected Finds Protocol (**Appendix D**) and/or the validation plan (**Section 8**) will be implemented, until the remediation goals have been achieved and the site is deemed suitable for the intended land use.

6.2 Stage 1 – Preliminaries and Site Establishment

6.2.1 Council Notification

Notice must be given to Council at least 30 days prior to the commencement of remediation works as outlined in **Section 5.4.1**. A list of all required work permits must be obtained from Council and arrangements are to be made to obtain the necessary approvals from the relevant regulatory authorities.

6.2.2 Site Preparation and Planning

The site should be prepared in accordance with the general requirements of the site management details outlined in **Section 5**. Before site works commence, the site contractor would prepare site specific plans including a WHSP, CEMP and AMP (as required by WHS legislation and Council development controls).

It will also be necessary to establish environmental controls, site access, security, fencing and any required warning signage prior to works commencement, if they have not already been established.

A project plan should also be developed to outline engineering design for excavation support (if required), water treatment requirements and design, staging of excavation works, stockpiling, waste stabilisation, waste material loading, traffic management and waste tracking.

The Project Plan should incorporate a staging plan that outlines the basic stages of the remediation works. The staging plan should include, but not be limited to:

- Staging of areas to be excavated;
- Areas designated for waste segregation, screening and storage (stockpiling), amenities, soil and groundwater treatment (if required);
- Truck movements to allow loading to mitigate impacts to surrounding land users and council infrastructure; and
- Details of any required environmental management measures such as, dust control.

As part of site planning, it is recommended that an initial remediation workshop/induction be considered by the appointed contractor(s) to further develop required remedial measures, outline asbestos management, excavation plans, waste classifications, and environmental management requirements. The appointed environmental consultant could provide further guidance in relation to environmental management measures to be applied during the remediation, asbestos removal and site validation activities.

6.3 Stage 2 - Additional Assessment – Building Footprints

Following site demolition, assessment of site soils underneath building footprints is required to confirm the presence or absence of potential contaminants (particularly asbestos) and site suitability. The number of sampling points should be in accordance with the NSW EPA Sampling Design Guidelines (NSW EPA, 2022) and WA DoH (2021), which specifies the required amount of sampling locations for possible asbestos (i.e. uncontrolled fill, building waste, demolished structure footprints).

The combined building footprints at the site have an approximate area of 1,800 m², requiring a total of eight sampling points in accordance with the guidelines. Any asbestos or contamination identified will require management (i.e. excavation and waste classification) in accordance with the procedures listed in **Section 6.5. Stage 3 – UPSS/UST Removal and Validation**

6.3.1 UST/UPSS Removal

Four in-situ USTs were identified during previous investigations (EI, 2023b) using ground penetrating radar (GPR) surveyed by a DBYD certified locator. It was reported that the USTs were likely decommissioned, as some dip/fill points had been filled with concrete. Information on the specifications of the UST were not available. The site plan (**Appendix A, Figure A.2**) shows the inferred locations of these features within the site. Procedures for removal of USTs are as follows:

- A licensed liquid waste transporter will be required to remove any liquid contents from the UST and UPSS infrastructure (including any seepage identified within tank pits) and dispose of any liquid waste to a suitably licensed liquid waste facility;
- The contractor must provide appropriate documentation for the waste disposal; and
- Tanks should then be rendered safe, excavated and transported off-site by a licensed contractor for destruction/disposal in accordance with SafeWork NSW guidelines.

The contractor must provide formalised certification of the tank destruction/disposal for the works described below, and undertake all works in accordance with the NSW EPA (1994) *Guidelines for Assessing Service Station Sites*, NSW EPA (2020a) *Underground Petroleum Storage Systems: Guidelines for implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019*, DECC (2010) *UPSS Technical Note: Decommissioning, abandonment and removal of UPSS* and AS4976-2008 (R2016) *The removal and disposal of underground petroleum storage systems*.

- Infrastructure including bowsers, fuel lines and vent lines have either recently or historically been removed. Once the USTs have been decommissioned and excavated, they will be rendered safe for transport by a licensed contractor for offsite destruction/disposal. The contractor must provide formalised certification of the tank destruction/disposal as previously stated;
- Any soil showing signs of contamination will be screened using a photoionization device (PID) and all soil producing readings greater than 30 parts per million (ppm) will be excavated, segregated and stockpiled awaiting further classification. Any impacted soil will

be 'chased' and removed until no further signs of contamination are present and PID readings are <30 ppm;

- Excavated soil is to be managed appropriately and remain segregated from clean soil awaiting waste classification. Should significant volumes of material or contaminant concentrations be identified other remediation options outlined in **Table 5-1** may be suited, and samples will be collected to evaluate the suitability of this method. Once classified, material will be transported to an off-site waste disposal facility to minimise dust and odour issues;
- All excavation works should be undertaken by licensed contractors experienced in the decommissioning and removal of fuel infrastructure and the remediation of hydrocarbon contaminated soils (if identified); and
- Validation of excavations will be required as described in **Section 8.1** of this report.

6.3.2 UST pit validation

Soil validation assessment is to be conducted within the tank pit following removal of the USTs. Samples of the bases and walls of pits are to be obtained in accordance with methodologies outlined in **Section 8.1**. Samples that do not comply with the adopted criteria will require further excavation where applicable.

Samples that comply with the adopted criteria can be used for validation purposes, and will be considered suitable. Resultant soil material from tank pits which is not applicable with site acceptance criteria will be stockpiled in separate waste streams for classification and off-site disposal (where applicable).

6.4 Stage 4 –Excavation and Waste Classification

Material handling and management procedures will be implemented as detailed in **Section 7** for any excavated material. Any material designated for offsite disposal must be classified in accordance with NSW EPA (2014a) *Waste Classification Guidelines*. The procedure for waste classification will occur as follows:

6.4.1 Asbestos (BH5 – Reditus, 2020)

The previous Reditus (2020) investigation identified one exceedance of the adopted criteria for asbestos at location BH5 within 357 Crown Street, however, visual inspection conducted during subsequent EI investigations (EI, 2022b, 2023b) did not identify any potential asbestos containing materials (ACM). Double density asbestos analysis should be completed within the BH5 area, in accordance with **Table 8.1**. Should asbestos be identified during sampling for waste classification, removal and validation will be required as follows:

- Since non-friable asbestos was identified, asbestos airborne fibre monitoring is not required but is recommended to assess appropriate asbestos controls are adequate
 - Air quality data shall be checked daily and management thresholds actioned if exceeded as detailed in **Section 7.5**.
- Management of asbestos must be undertaken by a minimum Class B asbestos removal contractor
- Wet down all soil prior to excavation. Soil should be damp during all disturbance works, and staff will require implementation of asbestos related personal protective equipment (PPE), including the use of P2 dust masks.
- Carefully excavate asbestos impacted material from the entirety of the site to an approximate depth of 200 mm. This includes the two identified stockpiled. Excavated

material will be handled in accordance with the material management procedures presented in **Section 7.2**. All stockpiles are to be placed on hardstand or builders plastic and covered to prevent cross contamination.

- Surface walkover inspection and validation samples would be collected by the environmental consultant from the exposed surfaces and analysed for asbestos, to demonstrate effective removal of contamination.
- Removal of asbestos impacted material from the site shall only be carried out by experienced asbestos contractors holding the appropriate SafeWork NSW and NSW EPA licenses, consents and approvals. All loads must be transported with a copy of the relevant Waste Classification Report for the waste load.
- Waste classification of soil material shall be completed in accordance with the NSW EPA (2014b) *Waste Classification Guidelines*.
- Once classified, the asbestos impacted fill will be directly loaded into trucks for off-site disposal to a licensed waste facility authorised to accept the waste.
- Generators and transporters of Asbestos Waste have a legal obligation to ensure their waste is transported to a lawful place under Clauses 76 and 79 of the *Protection of the Environment (Waste) Regulation 2014*. The NSW EPA 2015 Asbestos and Waste Tyres Guidelines states that consignors and transporters of Asbestos Waste, and facilities receiving these wastes, must use "WasteLocate" to provide information to the NSW EPA regarding their movement within the state. The NSW EPA Website at: <https://wastelocate.epa.nsw.gov.au/> provides further information about "WasteLocate".
- Once the material has been removed from the site and the area validated, an asbestos clearance certificate can be completed issued by a suitably qualified professional (e.g. SafeWork NSW Licensed Asbestos Assessor or competent person) for the respective area.

6.4.2 Waste Classification – Stockpiles

- Any material requiring excavation for the proposed construction works will be stockpiled;
- Stockpiled materials designated for waste classification would be collected at a rate of one sample per 25 m³ (minimum of three samples) up to 250 m³. For stockpiles exceeding 250 m³ but less than 2,500 m³, a minimum of 10 samples is required and 95% UCL statistical calculations of contaminant concentrations may be used for classification.
- The analytical suite for waste classification will include six priority metals (arsenic, cadmium, chromium, lead, mercury and nickel), TRH, BTEX, PAH, OCP, OPP, PCB and asbestos (10L samples for quantification analysis according to NEPM 2013), with TCLP testing (as required) and any additional chemicals of potential concern that may be identified during site remediation.
- Preparation of a Waste Classification report detailing the interpreted soil waste classification for each stockpile, NSW EPA (2014a) *Waste Classification Guidelines*, to enable appropriate off-site disposal.
- Excavated and stockpiled material will be handled in accordance with the material management procedures presented in **Section 7.2**.

6.4.3 Waste Management of Excavations

The general process for conducting appropriate waste characterisation, transport and disposal is as follows:

- Surplus fill and natural soil to be disposed from the site must be classified according to NSW EPA (2014a) *Waste Classification Guidelines*.
- Waste Classification reports must be issued by the environmental consultant according to the assessed classification and quantity prior to off-site disposal.
- It is the responsibility of the appointed Site Manager to make arrangements for the Environmental Consultant to assess the need for additional sampling and analysis, to classify any additional spoil that is produced during the construction process.
- The earthworks contractor must identify suitably licenced waste landfill premises for disposal of waste materials and confirm that the premises will accept the waste in accordance with its Environmental Protection License.
- Waste classified soils for disposal shall be loaded onto NSW EPA-licensed waste vehicles for transport to the designated landfill premises.
- Waste transport contractors must carry a copy of the relevant Waste Classification with every transported load.
- The waste must be transferred to the designated premises in accordance with applicable legislation.
- The earthworks contractor must supply the individual waste dockets for each waste load to the environmental consultant via the Site Manager, in a timely manner. The waste dockets are required for validation reporting purposes.

Other important requirements as part of the waste management are as follows:

- Additional waste classification may be necessary for suspicious materials which exhibit odours or appear stained or discoloured. The discovery of such soils should be treated as “unexpected finds” and will trigger application of the Unexpected Finds Protocol provided in **Appendix D**. In this situation, the Environmental Consultant should be immediately consulted for evaluation and waste characterisation of the materials.
- A site log shall be maintained by the contractor for each discrete excavation (numbered locations) to enable the tracking of disposed loads against on-site origin and location of the materials.
- Transport of contaminated material should be via a clearly designated haul route from the site to the landfill premises that minimises exposure to sensitive communities. The proposed waste transport route should be notified to Council and truck dispatch shall be logged and recorded by the contractor for each load leaving the site.
- Each waste load should be disposed to a licensed waste facility authorised to accept the waste, in accordance with the relevant Waste Classification Reports, and documentation (waste dockets) confirming disposal must be maintained for reporting purposes.
- Environmental controls must be implemented to prevent exposure to workers and the public and are described further in **Section 7** of this RAP.
- Removal of asbestos materials (if found) from the site should only be carried out by licensed asbestos contractors holding the appropriate SafeWork NSW and EPA licenses, consents and approvals.

6.4.4 Management of VENM

During site works, virgin excavated natural materials (VENM), as defined in the NSW EPA (2014a) *Waste Classification Guidelines*, may be identified as suitable for off-site re-use. Confirmation of the VENM waste classification must be made with the concurrence of appointed environmental consultant. The re-use of VENM at an off-site location must be approved in writing by the receiving site land owner before it is transported from the site.

The earthworks contractor must provide the following to the environmental consultant and client for reporting purposes:

- All approval documents and correspondence from the receiving site authority and approver;
- Details of VENM volumes excavated from the site, including the measured depth below existing ground level, or surveyed elevation of the VENM at the top and bottom excavation levels;
- Laboratory results from samples of designated material verifying a classification as VENM;
- A description of the VENM that was sent to the receiving site; and
- Copies of VENM weighbridge dockets, trip tickets and/or consignment disposal confirmation that confirms the date, exit time, and truck license plate and operator for each load.

In advance of VENM excavation, VENM must be protected from exposure to site contamination activities or materials. Measures to protect VENM from exposure to contamination may include:

- Covering VENM in-situ or in stockpile with plastic sheeting;
- Placing stockpiled VENM on top of protective plastic sheeting;
- Minimising time of exposure to the site environmental conditions; and
- Relocating contaminated soils and/or contaminating activities (i.e. plant refuelling) away from VENM.

6.4.5 Management of ENM

If the volume of natural soils to be removed includes up to 2% of foreign materials, then a classification of *excavated natural material* (ENM) might be achievable, subject to compliance with the ENM classification. This classification must be verified by sampling and laboratory analysis to confirm that the materials meet the specific chemical and other material requirements detailed in the NSW EPA *Excavated natural material order 2014*; and *The excavated natural material exemption 2014*.

6.4.6 Disposal of Contaminated Material and Waste Tracking

All contaminated materials excavated and removed from the site shall be disposed at an appropriately licensed landfill facility. Copies of all necessary approvals shall be provided to the environmental consultant prior to any contaminated material being removed from the site.

Details of all contaminated materials removed from the site shall be documented by the contractor including copies of weighbridge dockets, trip tickets and consignment disposal confirmation (where appropriate). Such information must be provided to the environmental consultant for reporting purposes.

6.5 Stage 5 –Reporting

All results shall be presented in a Site Validation Report, prepared by the Environmental Consultant in accordance with the NSW EPA (2020) *Consultants Reporting on Contaminated Land: Contaminated Land Guidelines*. The report will document all aspects of the remediation and site validation program, include an assessment of the environmental data for remaining site soils against the adopted remediation acceptance criteria and provide a clear conclusion that the site has been remediated to a suitable standard for the proposed land uses.

6.6 Remedial Contingencies

It is anticipated that the proposed remedial technology will be effective in dealing with the identified contamination; however, remedial contingencies may be required should the scenarios detailed in **Table 6-1** arise.

Table 6-1 Remedial Contingencies

Scenario	Remedial Contingencies/Actions Required
Highly contaminated soils not identified during previous investigations are encountered, particularly at site boundaries	Work to be suspended until the Environmental Consultant can further assess impacted soils/ materials and associated risks. Follow the unexpected finds protocol as detailed in Appendix D of this RAP.
Additional underground storage tanks (USTs) are encountered at the site	Systems to be removed and the excavations appropriately validated and backfilled by experienced contractor. Tank removal works reported by appropriate environmental consultant in accordance with NSW EPA (2020b) <i>Guidelines for the implementation of the POEO (underground petroleum storage systems) Regulation 2019</i> and Australian Standard AS4976 (2008). Follow the unexpected finds protocol as detailed in Appendix D .
Asbestos wastes are encountered	Work to be suspended and asbestos work removed by a suitably qualified contractor, in accordance with SafeWork NSW regulations. Follow the unexpected finds protocol as detailed in Appendix D .
Residual soil impacts remain on-site between site boundary and any excavation	Review/assess soil conditions. Carry out site specific second tier risk assessment (if required). Review/assess potential vapour hazard. If there is a vapour risk additional remedial measures may be required such as installation of a vapour barrier or passive or active vapour extraction system. Amendment to RAP required.
Contaminated groundwater encountered	Review groundwater conditions on site (if required) and determine need for further investigation/remediation and/or longer-term management plan. Dewatering for the site will likely be required, and will need approval under the <i>Water Management Act 2000</i> . Remedial options may include natural attenuation, extraction, bioremediation, phase-separated hydrocarbons (PSH) recovery using active pumping (including hydraulic control), installation of a groundwater permeability barrier, in situ oxidation or stabilisation. Amendment to RAP will be required.
Groundwater contaminant plume is identified and is migrating off-site, or there are increases in concentration due to increased infiltration	Review contaminant increase and analytes. Review active remediation alternatives (if necessary). Ensure down-gradient monitoring is undertaken. Carry out fate and transport modelling (if required) and assess the need for further action. Amendment to RAP required.
Contamination is identified near heritage items or significant trees	Stop work. Review contaminant concentrations and risks to heritage items / flora. Assess human health and environmental risks if contamination remains in place. Review natural attenuation options.
Changes in proposed excavation depths or lateral extent	Review remediation works for the site.
Changes in proposed land use(s) at the site	Review remediation works for the site.

7. SITE MANAGEMENT

7.1 Responsibilities and Contacts

The responsibilities for the various parties involved with the remediation program are outlined in **Table 7-1**.

Table 7-1 Site Management Responsibilities

Responsible Party	Details/Contacts	Responsible for:
Project Manager	Principal contractor to be confirmed	<ul style="list-style-type: none"> Overall management of the site remedial activities.
Property Owner and Site Contractor	Wollongong Developments No.5 Pty Ltd and/or Principal Contractor	<ul style="list-style-type: none"> Notification of site conditions to the NSW EPA under the duty to report contamination under the <i>Contaminated Land Management Act 1997</i>. Registration of details of Site Audit Statement (if Auditor engaged). Implementation of and compliance with the RAP. Notification to contractors of the existence of RAP. Provision of copies of the RAP.
Environmental Management Coordinator (EMC) / Remediation Supervisor	Wollongong Developments No.5 Pty Ltd (and/or Principal Contractor) and Environmental Consultant	<ul style="list-style-type: none"> Ensuring site remediation works are carried out in an environmentally responsible manner. Liaison between the appointed Environmental Consultant and Council, providing regular updates and informing of any problems encountered. Ensuring all environmental protection measures are in place and functioning correctly during site remediation works. Reporting any environmental issues to owner.
Environmental Consultant	To be confirmed before remedial works are started	<ul style="list-style-type: none"> Preparation of the RAP. On-site management and guidance of the remedial works. Coordination of validation works, documentation, notifications and permits required to conduct remedial works to a standard suitable of obtaining approval from the NSW EPA. Completing validation sampling and monitoring as requested by the Remediation Contractor and dictated by the RAP. Liaison between remediation contractor and the client. Preparation and submission of supporting documentation for Site Auditor review.
Earthworks or Remediation Contractor	Engaged by Wollongong Developments No.5 Pty Ltd and/or Principal Contractor	<ul style="list-style-type: none"> Ensuring all operations are carried out as identified in the RAP (remediation), as directed by the Project Manager and EMC. Inducting all employees, subcontractors and authorised visitors on procedures with respect to site works, WHS and environmental management procedures. Reporting any environmental issues to EMC. Maintaining site induction, site visitor and complaint registers.

Responsible Party	Details/Contacts	Responsible for:
		<ul style="list-style-type: none"> Ensuring that fugitive emissions and dust potentially leaving the confines of the site are suitably controlled and minimised. Ensuring that water containing any suspended matter or contaminants is minimised, does not leave the site and is suitably controlled, so as not to pollute the environment. Ensuring that vehicles are cleaned and secured so that no mud, soil or water is deposited on any public roadways or adjacent areas. Ensuring that noise and vibration levels at the site boundaries comply with the legislative requirements. Preparation of site specific plans including WHSP and CEMP (and AMP if required) as stated in Section 6.2.
Local Council	Wollongong City Council	<ul style="list-style-type: none"> Ensuring requirements of Development Consent and other planning instruments are met. Registration of details of a Site Audit Statement (if a requirement) on Planning Certificate.
Qualified Independent Consultant – NSW Accredited Site Auditor (if required)	Engaged by Wollongong Developments No.5 Pty Ltd and/or Principal Contractor	<ul style="list-style-type: none"> Review of RAP, Site Validation Report. Preparation of Site Audit Statement and Site Audit Report. Review of updates, revisions or amendments as applicable. Provide interim audit advice of consultant or client submissions. Conduct inspections during remedial works.

7.2 Materials Handling and Management

Table 7-2 summarises the measures that should be implemented in respect of materials handling during remedial and bulk excavation works at the site.

Table 7-2 Materials Handling and Management Requirements

Item	Description/ Requirements
Earthworks contractors	<p>Excavation of fill materials should be completed by a suitably qualified contractor to ensure:</p> <ul style="list-style-type: none"> All employees and contractors are aware of the environmental and health and safety requirements to be adhered to. There is no discernible release of dust into the atmosphere as a consequence of the works. There is no discernible release of contaminated soil into any waterway as a consequence of the works. There are no pollution incidents, health impacts or complaints. All site specific management plans such as CEMP (and AMP if required) should be followed.
Stockpiling of materials	<p>All stockpiles will be maintained as follows:</p> <ul style="list-style-type: none"> Stockpiles must be located on sealed surfaces such as sealed concrete, asphalt, or high density polyethylene. Should stockpiles be placed on bare soils, which may occur adjacent to remediation areas, bare soil should be lined with builder's plastic before stockpile placement in locations that do not pose any environmental risk, and covered with builder's plastic. Excavated soils should be stored in an orderly and safe condition ($\leq 2\text{m}$ height).

Item	Description/ Requirements
Loading of material	<ul style="list-style-type: none"> ▪ Stockpiles should be battered with sloped angles to prevent collapse. ▪ Stockpiles should be covered after being lightly conditioned by water sprinkler to prevent dust blow and control odours. ▪ Air emissions to be controlled, if required, by using a hydrocarbon mitigation agent, such as BioSolve®, Pinkwater®, Anotech® or an equivalent product selected by the contractor, in combination with the fine mist spraying. ▪ Should the stockpile remain <i>in situ</i> for over 24 hours, silt fences or hay bales should be erected around each stockpile to prevent losses from surface erosion (runoff). ▪ Stockpiles shall be strategically located to mitigate environmental impacts while facilitating material handling requirements. <p>Loading of stockpiles / materials will be as follows:</p> <ul style="list-style-type: none"> ▪ Transport of contaminated material off the site is to be via a clearly distinguished haul route. ▪ Measures shall be implemented to ensure that no contaminated material is spilled onto public roadways or tracked off-site on vehicle wheels. Such measures should include the use of a wheel washing/cleaning facility, placed before the egress point on the site, and should be able to handle all vehicles and plant operating on-site. ▪ Residue from the cleaning facility should be collected and either dewatered on site in a contained / bunded area, or disposed as a slurry to an approved facility. Such residue will be deemed contaminated unless proven otherwise.
Transport of materials	<p>Prior to being assigned to an appropriate waste disposal facility, all waste fill/soils will be classified in accordance with the NSW EPA (2014a) <i>Waste Classification Guidelines</i>. If prior immobilisation treatment of the waste soils is required, disposal consent will be obtained from the NSW EPA prior to spoil transport.</p> <ul style="list-style-type: none"> ▪ All trucks transporting soils from the site are to be covered with tarpaulins (or equivalent). ▪ All haulage routes for trucks transporting soil, materials, equipment and machinery shall comply with all road traffic rules, minimise noise, vibration and odour to adjacent premises, utilise state roads and minimise use of local road. ▪ All deliveries of soil, materials equipment or machinery should be completed during the approved hours of remediation and exit the site in a forward direction. ▪ Removal of waste materials from the site shall only be carried out by a recognised contractor holding the appropriate NSW EPA licenses, consents and approvals. ▪ Waste materials must be transported less than 150km from the source (POEO 1997, Waste 2014) and landfills are required to be licensed for the category of waste they are scheduled to receive. Additional conditions apply to material that is classified as Hazardous Waste.
Material tracking	<p>Materials excavated from the site should be tracked from the time of excavation until disposal. Tracking of the excavated materials should be completed by recording the following:</p> <ul style="list-style-type: none"> ▪ Origin of material; ▪ Material type; ▪ Approximate volume; and ▪ Truck registration number. <p>Disposal locations will be determined by the remediation contractor. Disposal location, waste disposal documentation (weighbridge dockets) and the above listed information should be provided to the remediation consultant for reporting purposes. The NSW EPA 2015 Asbestos and Waste Tyres Guidelines state that consignors and transporters of Asbestos Waste, and facilities receiving these wastes, must use "WasteLocate" to provide information to the EPA regarding their movement within NSW. Further information about the "WasteLocate" system is available online from the NSW EPA Website at: https://wastelocate.epa.nsw.gov.au/.</p>

Item	Description/ Requirements
Material visual inspection prior to validation sampling.	<p>Following the completion of remedial works as specified within this RAP, the following applies:</p> <ul style="list-style-type: none"> ▪ A suitably qualified environmental consultant should undertake a visual inspection of the work area. If visual observations indicate contamination, the earthworks contractors should rectify any issues arising from the inspection (i.e. further excavation or 'chasing out' until soils show no evidence of contamination based on visual inspection and/or odours). ▪ Following satisfactory completion of the visual inspection, validation sampling of soils should be completed. Validation sampling is discussed in Section 8. <p>Only following satisfactory validation will remedial works be deemed as completed.</p>

7.3 Environmental Management

All remediation work must be undertaken with due regard to the minimisation of environmental effects and meet all statutory environmental and safety requirements. The WHSP, CEMP and AMP (if required) must therefore address the issues identified in **Table 7-3**.

Table 7-3 Environmental Management Requirements

Category	Measure
Site Stormwater Management and Control	<p>Appropriate measures shall be taken to ensure that potentially contaminated water does not leave the site. Such measures should include, but not be limited to:</p> <ul style="list-style-type: none"> ▪ Diversion and isolation of any stormwater from any contaminated areas; ▪ Provision of sediment traps including geotextiles or hay bales; and ▪ Discharge of any water to drains and water bodies must meet the appropriate effluent discharge consent condition under the <i>Protection of the Environmental Operations Act 1997</i>.
Soil Management	<p>Appropriate measures shall be taken to ensure soils are excavated using an appropriate methodology to reduce nuisance dust and odours from leaving the boundary, and soils are disposed of in accordance with the NSW Government <i>Protection of the Environment Operations (Waste) Regulation 2014</i>.</p>
Dust and Odour	<p>Control of dust and odour during the course of the remediation works shall be maintained by the contractor to ensure no nuisance dust or odours are received at the site boundary according to requirements of the Wollongong DCP.</p> <p>Action levels and specific control measures would be described in the site CEMP and may include, but not necessarily be limited to the following:</p> <ul style="list-style-type: none"> ▪ Site wide water spraying, as and when appropriate, to eliminate wind-blown dust; ▪ Use of mist sprays, and/or sprinklers on stockpiles, fill screening areas and loaded fill to lightly condition the material; ▪ Use of tarpaulin or tack-coat emulsion or sprays to prevent dust blow from stockpiles or from vehicle loads; ▪ Covering of stockpiles or loads with polythene or geotextile membranes; ▪ Restriction of stockpile heights to 2m above surrounding site level; ▪ Ceasing works during periods of inclement weather such as high winds or heavy rain; and ▪ Regular checking of the fugitive dust and odour issues to ensure compliance with the CEMP requirements, undertaking immediate remedial measures to rectify any cases of excessive dust or odour (e.g. use of misting sprays or odour masking agent). <p>It is advised that all site workers use adequate dust masks during soil excavation and that machine operators remain within an enclosed, air conditioned cabin.</p>
Noise and Vibration	<p>Noise and vibration will be restricted to reasonable levels. All plant and machinery used on site will be noise muffled to ensure emissions do not breach statutory levels as defined within the Wollongong DCP.</p>
Hours of Operation	<p>Working hours will be restricted to those specified in the site specific DA conditions.</p>

Category	Measure
Community Engagement	<p>Community engagement should be carried out in accordance with Schedule B(8) of the NEPM (NEPC, 2013). Prior to the commencement of any remediation works at the site, every owner and occupier of any land located either wholly or partly within 100m of the boundary of the premises (including local council) should be notified at least 30 days in advance. The notice should include:</p> <ul style="list-style-type: none"> ▪ Advice of demolition and excavation work to be carried out on the premises; ▪ State the time and date such work is to commence; ▪ Indicate that the works are being conducted to minimise any risk of site contamination impacting on off-site receptors; ▪ Provide appropriate site signage at an easily readable location on the site fencing, including site contact name and phone number to be contacted should any matter arise; and ▪ Provide contact information and procedure for registering any complaints.
Incident Management and Community Relations	<p>While various environmental management and occupational safety plans will be developed to protect human health and the environment, incidents may occur which pose a risk to the various stakeholders. To mitigate these risks and ensure that a suitable response is carried out quickly, a response plan to any incident that may occur on site should be prepared and various responsibilities assigned.</p> <p>The site health and safety plan and environmental management plan should document these procedures and responsibilities, and incident contact numbers should be maintained in an on-site register.</p> <p>All other relevant emergency contact numbers such as Police, Fire Brigade, and Hospital should be listed in the Health and Safety Plan and posted on-site for easy access.</p>

7.4 Contingency Plan for Environmental Incidents

A contingency plan to deal with incidents that could arise during the proposed remediation works must form part of the site-specific plans: WHSP and CEMP and AMP (if required). Refer to **Table 7-4** for a selection of potential issues that may require specific management. The Unexpected Finds Protocol (**Appendix D**) should also be followed should an incident occur.

Table 7-4 Contingency Management

Anticipated Problems	Corrective Actions
Chemical / Fuel Spill	Stop work, notify above site project manager. Use accessible soil or appropriate absorbent material on site to absorb the spill (if practicable). Stockpile the impacted material in a secure location, sample and determine the appropriate disposal/treatment option.
Additional Asbestos Identified	Stop work, notify above site project manager. Follow the unexpected finds protocol and asbestos assessment procedure as detailed in Appendix D of this RAP. A suitably qualified environmental consultant/occupational hygienist to assess risk to workers and assess whether asbestos air monitoring required.
Excessive Dust	Use water sprays to suppress the dust or stop site activities generating the dust until it abates.
Excessive Noise	Identify the source, isolate the source if possible, modify the actions of the source or erect temporary noise barriers if required.

Excessive Odours / Vapours	<p>Stage works to minimise odours/vapours. If excessive organic odours/vapours are being generated, stop works and monitor ambient air across site for organic vapours with a Photo-ionisation Detector (PID) and odours at site boundaries. Implement control measures including respirators for on-site workers, use of odour suppressants, wetting down of excavated material.</p> <p>No nuisance odours shall be detected at any site boundary as part of the remedial works. Should odour emissions be detected at or beyond the site boundary, it is recommended, as part of the CEMP and community consultation, that the Remediation Contractor and the Project Manager notify the owners and occupiers of premises adjoining and across the road from the site regarding potential odour issues. Notification should be in writing. .</p> <p>In the notification, as well as on street signage, provide contact details of the site personnel for anyone who may be concerned by odour emission during the remediation.</p> <p>Temporarily pause site works to allow for excess odour to subside to a level acceptable by off-site receptors, should it be necessary, after implementation of the above-listed control measures.</p> <p>Record logs for volatile emissions and odours. Such records should be kept on-site and made available for inspection on request.</p> <p>In regard to off-site impact from petroleum vapour, odour is generally detected at concentrations much lower than what will constitute a health-based risk. Measures listed above for odour control (Table 7-3) may also be applied for vapour control.</p>
Excessive Rainfall	<p>Ensure sediment and surface water controls are operating correctly. If possible divert surface water away from active work areas or excavations.</p>
Water in Excavations	<p>Collect samples and assess against relevant POEO requirements to enable disposal options to be formulated.</p>
Leaking Machinery or Equipment	<p>Stop the identified leak (if possible). Clean up the spill with absorbent material. Stockpile the impacted material in a secure location, sample and determine the appropriate disposal/treatment option.</p>
Failure of Erosion or Sedimentation Control Measures	<p>Stop work, repair failed control measure.</p>
Unearthing Unexpected Materials, Fill or Waste	<p>Stop activities, contact the site project manager. Follow the unexpected finds protocol as detailed in Appendix D of this RAP. Prepare a management plan if required, to address the issue.</p>
Identification of Cultural or Building Heritage Items	<p>Stop work and notify site project manager. Follow the unexpected finds protocol as detailed in Appendix D of this RAP. Prepare action or conservation plan as required.</p>
Equipment Failures	<p>Ensure that spare equipment is on hand at site, or that the failed equipment can be serviced by site personnel or a local contractor.</p>
Complaint Management	<p>Notify Client, Project Managers and Environmental Consultant (if required) following complaint. Report complaint as per management procedures. Implement control measures to address reason of complaint (if possible). Notify complainant of results of remedial actions.</p>

7.5 Work Health and Safety Plan (WHSP)

As required by the NSW *Work Health and Safety Act 2011* and associated regulations, a WHSP should be prepared, to manage the health and safety of site workers and nearby residents, and address such issues as site security, exclusion zones, excavation safety, vibration, noise, odour and dust levels. The plan should address the risks during the remediation works and cover site specific requirements associated with the contaminants present within the site soils and groundwater.

The site officer responsible for implementing health and safety procedures should induct all site personnel so that they are aware of and comply with, the requirements of this document. It is the contractor's responsibility, with assistance from client/owner(s) of the site to ensure that all other permits, approvals, consents or licences are current. The following hazards and mitigation measures relevant to the remedial works are summarised in **Table 7-5**.

Table 7-5 Remedial Hazards

Anticipated Problems	Corrective Actions
Chemical Hazards	Contaminated sites have chemical compounds, substances or materials that may present a risk to human health and the environment. Chemicals of concern and associated risks are as detailed within the Conceptual Site Model, within Section 3 . The site specific WHSP should set out controls to mitigate any potential risks.
Physical Hazards	The following hazards are associated with conditions that may be created during site works: <ul style="list-style-type: none"> ▪ Heat exposure; ▪ Buried services; ▪ Buried underground tanks ▪ Noise, vibration and dust; ▪ Electrical equipment; and ▪ The operation of heavy plant equipment.
Personal Protective Equipment and Monitoring	Personnel should, wherever possible, avoid direct contact with potentially contaminated material. Workers are to ensure that surface waters or groundwater is not ingested or swallowed and that direct skin contact with soil and water is avoided. Standard PPE with the addition of disposable P2 dust masks as specified for the contractor will be sufficient for the prescribed remedial works. Standard PPE includes: <ul style="list-style-type: none"> ▪ Long sleeve shirt and trousers ▪ Steel-toe footwear ▪ Safety glasses (as required) ▪ Helmet (as required) ▪ Hi-vis vest/clothing (as required)

Asbestos Air Monitoring

Air monitoring is not required for the removal of non-friable (bonded) ACM. Should friable asbestos or asbestos fines be identified during the remediation program, appropriate air quality monitoring and other management measures may be required during the excavation and ground disturbance works. It is however recommended that air monitoring is conducted during any works involving the removal of ACM, to ensure that the implemented controls are sufficient and not posing a risk to adjacent site users and nearby general public.

In the case that asbestos air monitoring is required, it must be conducted in accordance with the *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres* [NOHSC: 3003 (2005)] and analysed by a NATA-accredited laboratory. The criteria and actions that will apply to this project are summarised in **Table 7-6**.

Table 7-6 Asbestos Criteria for Air Monitoring

Control Level (fibres/mL)	Control / Action
< 0.01	No Action. Continue with existing control measures.

Control Level (fibres/mL)	Control / Action
≥0.01	Asbestos Consultant to notify Project Manager of results as soon as practicable. Project Manager to notify/engage a Licensed Asbestos Removal Contractor. Asbestos Consultant and Project Manager to review current control measures and improve, where applicable. This may include improved work practices, use of further control measures (e.g. plastic screening or wet wiping techniques) or changing the work methodology.
≥0.02	Asbestos Consultant to notify Project Manager of results as soon as practicable. Asbestos Consultant to advise Licensed Asbestos Removal Contractor to <u>stop work</u> immediately. Asbestos Consultant to conduct investigations to establish cause of problem. Asbestos Consultant to advise Licensed Asbestos Removal Contractor on necessary works to rectify problem. Asbestos air monitoring to be continued by Asbestos Consultant. Contractors will be allowed to return to works area after results are <0.01 fibres/mL.

Contingent asbestos assessment procedure is described below:

Asbestos Assessment Procedure (if required):

In addition to the above, should additional asbestos be suspected or identified in soil during the walkover inspections or remediation excavation, further assessment for asbestos, preferably using test pitting, should be carried out prior to disturbance of site soils. The assessment procedure is described below:

1. Follow the Unexpected Finds Protocol and notify the appointed Environmental Consultant.
2. The appointed consultant to design investigation program to delineate asbestos impacts in soil in accordance with relevant, EPA endorsed, asbestos assessment guidelines.
3. If not already prepared, an Asbestos Management Plan should be prepared by the appointed remediation contractor for the remedial works program.
4. Areas impacted by asbestos should be segregated from the remainder of the site, and marked by prominent features that withstand weathering (e.g. star picket and danger tape).
5. Undertake separate waste classification assessments for areas impacted by asbestos and the remainder of the site.
6. Soils from asbestos-impacted areas will need to be excavated and disposed of separately from the remainder of the site. Should temporary stockpiling be required, the material handling and management requirements in **Section 7.2** should be followed.
7. Validate underlying materials after complete removal of asbestos-impacted soils on site.
8. Asbestos Assessment:
 - Asbestos quantification analysis will be conducted in hot spot locations and other areas earmarked for excavation and disposal.
 - Asbestos analysis will be conducted from 10L samples according to NEPC (2013) protocol from areas where there will be exposed soil (landscaped areas) or for validation.

8. VALIDATION SAMPLING AND QUALITY PLAN

The remediation of the impacted soil areas will be deemed acceptable based on the achievement of the following validation objectives:

- **Remedial Excavations** – Validation of the natural remedial excavation surface and/or walls and bases of excavations where contaminated soils/UPSS infrastructure have been removed will involve sampling and analysis to ensure that contaminant concentrations are below the *Remediation Acceptance Criteria (Appendix E)*. The sampling frequency will be in accordance with the NEPC (2013) and NSW EPA (2022) Sampling Design Guidelines, along with the NSW EPA (2014) *Technical Note* regarding the investigation of service station sites. All tests shall be performed by NATA-accredited environmental analytical laboratories.
- **Backfill Materials** – Should backfilling be required, validation of imported fill (or excess on-site) materials used for the backfilling of remediated areas would be required to verify their suitability for the proposed land use

8.1 Remedial Excavations and Soil Validation Methodology

Validation sampling will be undertaken following the removal of identified contaminated material to ensure that the vertical and lateral extent of the contamination has been defined, as outlined in **Table 8-1**. Should additional contamination be identified, it would be “chased out” where appropriate until material exceeding the validation criteria has been removed. Soil sampling and handling of the collected samples will be as described in **Table 8-2**.

Table 8-1 Validation Sampling Design

Remediation Area	Sampling Density	Chemicals of Concern
Asbestos impacted areas (BH5)	2 samples per 10 m grid (i.e. double density)	Asbestos
Building footprints (following demolition)	8 samples	Metals, TRH, BTEX, PAH, OCP, OPP, PCB and asbestos.
UST pit and associated infrastructure	Wall – 1 sampling location per wall or per 5 m length of excavation wall.	Lead, TRH, BTEX, PAHs, Phenols, and VOCs
	Base – 1 sample per excavation base (minimum) or 25 m ² . Fuel lines (if present) – 1 sample per 10m	
Stockpiled materials	Any soil material stockpiled on-site for off-site disposal (not pre-classified), will be sampled for waste classification purposes at a rate of one per 25m ³ (with a minimum of 3 samples for stockpiles <25m ³) up to 250 m ³ . For stockpiles >250m ³ but <2,500 m ³ in size, a statistical analysis approach may be used for classification, with the collection of at least 10 samples	Metals, TRH, BTEX, PAH, OCP, OPP, PCB and asbestos
Excavations	Surplus soil materials to be disposed from the site must be classified according to NSW EPA (2014a) <i>Waste Classification Guidelines</i> .	Metals, TRH, BTEX, PAH, OCP, OPP, PCB and asbestos

Remediation Area	Sampling Density	Chemicals of Concern
Imported soil materials	<p>Any material imported as fill, is to be certified as either Virgin Excavated Natural Material (VENM) or Excavated Natural Material (ENM) criteria by the supplying contractor.</p> <p>If material cannot be certified, it may be sampled at a rate of one per 25 m³ (with a minimum of 3 samples for stockpiles <25 m³).</p>	Metals, TRH, BTEX, PAH, OCP, OPP, PCB and asbestos

Note 1 Metals = Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc.

Excavation of identified contaminated material shall continue until the analytical results indicate compliance with the criteria (i.e. either the concentrations of all contaminants are within the criteria, or the 95% upper confidence limit (UCL) of the average concentration for each detected parameter is within the corresponding criterion). If results indicate that additional excavation is necessary, the excavation shall be extended until the excavation surface samples indicate that the location is validated as meeting the criteria for each respective contaminant.

Table 8-2 Validation Sample Collection and Handling Procedures

Action	Description of Required Works
Sample Collection	Soil validation sampling will be directly from the exposed (excavated) surface, or from the material brought to the surface by the backhoe / excavator bucket. Sampling data shall be recorded to comply with routine chain of custody requirements.
Sampling, Handling, Transport and Tracking	<ul style="list-style-type: none"> ▪ The use of stainless-steel or disposable (one time use) equipment. ▪ All sampling equipment (including hand tools or excavator parts) to be washed in a 3% solution of phosphate free detergent (Decon 90), followed by a rinse with potable water prior to each sample being collected. ▪ Direct transfer of the sample into new glass jars, bottles, vials or plastic bags is preferred, with each plastic bag individually sealed to eliminate cross contamination during transportation to the laboratory. ▪ Label sample containers with individual and unique identification including Project No., Sample No., depth, date and time of sampling. ▪ Place sample containers into a chilled, enclosed, and secure container for transport to the laboratory. ▪ Provide chain of custody documentation to ensure that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to the laboratory.
Sample Containers and Holding Times	<ul style="list-style-type: none"> ▪ Metals - 250g glass jar / refrigeration 4°C / 6 months (maximum holding period). ▪ TRH/BTEX - 250g glass jar / refrigeration 4°C / 14 days (maximum holding period). ▪ PAH/OCP/OPP - 250g glass jar / refrigeration 4°C / 14 days (maximum holding period). ▪ Asbestos - up to a 10 Litre resealable plastic (polyethylene) bag / no refrigeration / indefinite holding time.
Field QA/QC	Quality assurance (QA) and quality control (QC) procedures will be adopted throughout the field sampling program, to ensure sampling precision and accuracy, which will be assessed through the analysis of 10% field duplicate/replicate samples.

Action	Description of Required Works
	<p>Appropriate sampling procedures will be undertaken to prevent cross contamination, in accordance with EI's Standard Operating Procedures Manual. This will ensure:</p> <ul style="list-style-type: none"> ▪ Standard operating procedures are followed; ▪ Site safety plans are developed prior to works commencement; ▪ Split duplicate field samples are collected and analysed; ▪ Samples are stored under secure, temperature-controlled conditions; ▪ Chain of custody documentation is employed for the handling, transport and delivery of samples to the contracted environmental laboratory; and ▪ Contaminated soil, fill or groundwater originating from the site area is disposed in accordance with relevant regulatory guidelines. <p>In total, field QA/QC will include one in 10 samples to be tested as intra-laboratory, blind field duplicates, one in 20 samples to be tested as inter-laboratory, split field duplicates, as well as one VOC trip blank, one VOC spike sample per sample batch and one equipment wash blank (rinsate blank) per sample day.</p>
<p>Laboratory Quality Assurance and Quality Control</p>	<p>The contract laboratory will conduct in-house QA/QC procedures involving the routine analysis of:</p> <ul style="list-style-type: none"> ▪ Reagent blanks; ▪ Matrix spike and surrogate recoveries; ▪ Laboratory duplicates; ▪ Calibration standards and blanks; ▪ Control standards; and ▪ Statistical analysis of each QC measure.
<p>Achievement of Data Quality Objectives</p>	<p>DQOs are to be achieved and an assessment of the overall data quality should be presented in the final validation report, in accordance with the EPA (2017) <i>Guidelines for the NSW Site Auditor Scheme</i>.</p>

8.2 Validation Reporting

Once validation assessment as listed in **Section 8.1** is achieved, all results shall be presented in a Site Validation Report, prepared by the Environmental Consultant in accordance with the NSW EPA (2020) *Consultants Reporting on Contaminated Land: Contaminated Land Guidelines*. The validation report will document all desk study findings, fieldwork, laboratory analyses, conceptual site model, the implementation of the RAP, investigation methodologies and results, data quality assessment, and conclusions and recommendations. It will be prepared in accordance with requirements described in:

- NSW EPA (2020) *Consultants Reporting on Contaminated Land: Contaminated Land Guidelines, Table 2.6 Site Remediation and Validation*;
- NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme*; and
- Wollongong Development Control Plan 2009 (DCP 2009).

The site validation report should also:

- Provide a clear concluding statement that the site has been remediated to a suitable standard for the proposed development; and
- Be submitted for Council and/or a Site Auditor (if engaged) at the completion of the remediation works program.

9. CONCLUSION

This RAP has been prepared to inform the remediation works at 2 - 4 Gladstone Avenue & 357 - 363 Crown Street, Wollongong NSW. Remediation of identified UPSS infrastructure and impacted soils was deemed required in order to render the site suitable for the proposed development.

The purpose of this RAP is to establish a sequential process for remediation and validation works, to support the proposed site redevelopment in compliance with the *State Environment Protection Policy (Resilience and Hazards) 2021* and any *Secretary's environmental assessment requirements (SEARs)*.

The objectives of this RAP, as outlined in **Section 1.3**, have been addressed and the preferred remedial approach involves excavation of UPSS infrastructure and impacted materials, followed by waste classification and off-site disposal according to NSW EPA (2014a) *Waste Classification Guidelines*. It is envisaged that the remediation works will be implemented in stages, as follows:

- **Stage 1** – Preliminaries / site establishment
- **Stage 2** – Additional assessment – building footprints
- **Stage 3** – UPSS/UST removal and validation
- **Stage 4** – Waste classification and bulk excavation
- **Stage 5** – Validation report preparation.

This RAP provides protocols for the appropriate management of any unexpected finds that may be discovered during the course of the remediation works. In addition, should any phase of the validation assessment identify residual contamination requiring additional remediation, the procedures described under the validation plan (**Section 8**) will be implemented until the remediation goals have been achieved and the site is deemed suitable for proposed land use.

In conclusion, EI considers that the site can be made suitable for the proposed land use through the implementation of the site remediation and validation process described in this RAP.

10. STATEMENT OF LIMITATIONS

This report has been prepared for the exclusive use of Wollongong Developments No.5 Pty Ltd (the client), being the only intended beneficiaries of our work. The scope of the RAP is limited to that agreed with our client.

No other party should rely on the document without the prior written consent of EI, and EI undertakes no duty, or accepts any responsibility or liability, to any third party who purports to rely upon this document without EI's approval.

EI has used a degree of care and skill ordinarily exercised in similar investigations by reputable members of the environmental industry in Australia as at the date of this document. No other warranty, expressed or implied, is made or intended. Each section of this report must be read in conjunction with the whole of this report, including its appendices and attachments.

The methods and conclusions presented in this report are based on a limited investigation of conditions, with specific sampling locations chosen to be as representative as possible under the given circumstances.

EI's professional opinions are reasonable and based on its professional judgment, experience, training and results from analytical data. EI may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified by EI.

EI's professional opinions contained in this document are subject to modification if additional information is obtained through further investigation, observations, or validation testing and analysis during remedial activities. In some cases, further testing and analysis may be required, which may result in a further report with different conclusions.

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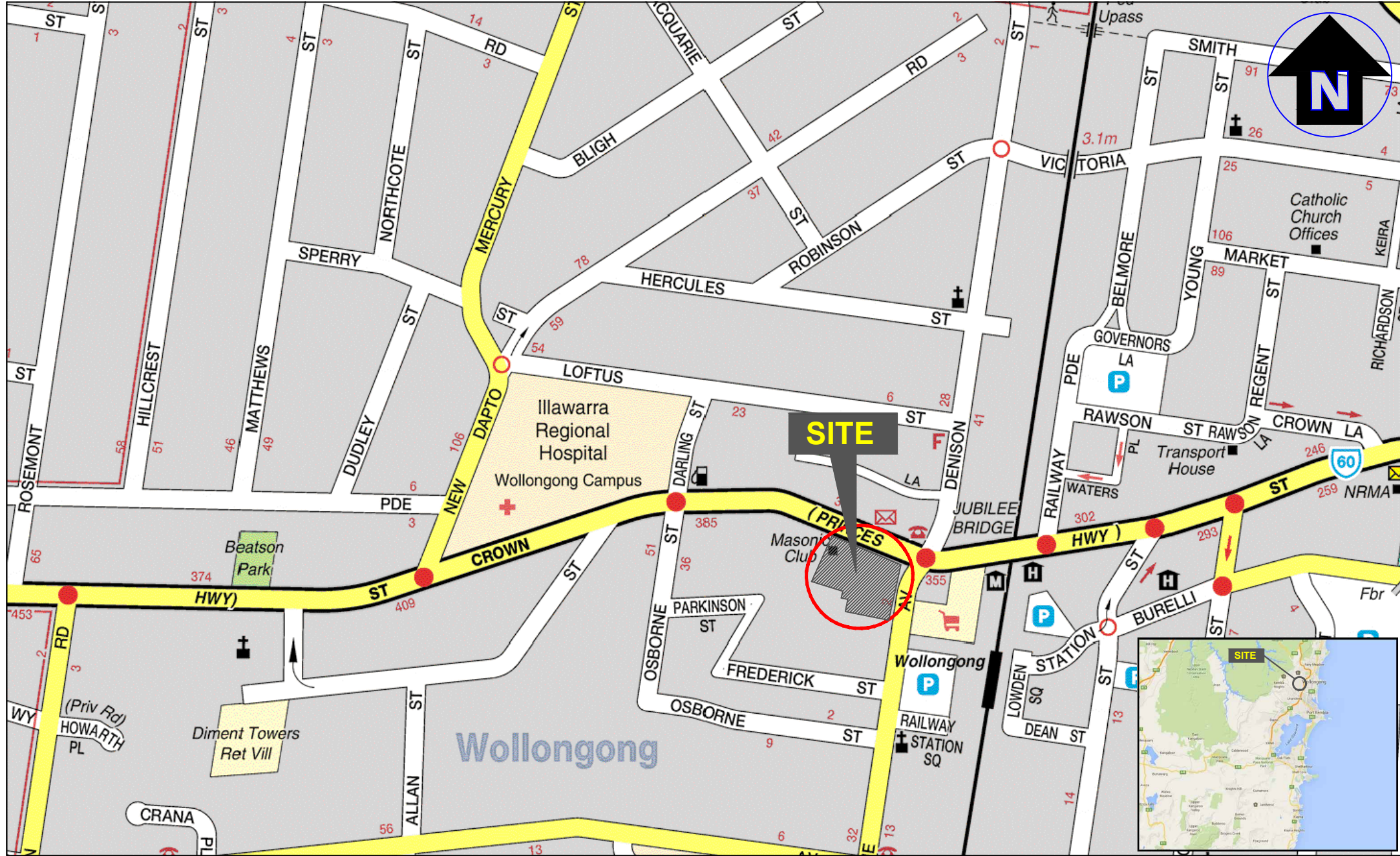
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ABBREVIATIONS

ABC	Ambient Background Concentration
ACL	Added Contaminant Limit
ACM	Asbestos-Containing Materials
AMP	Asbestos Management Plan
AS	Australian Standard
ASI	Additional Site Investigation
ASS	Acid Sulfate Soils
B(a)P	Benzo(a)Pyrene (a PAH compound)
BH	Borehole
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CBD	Central Business District
CEMP	Construction Environmental Management Plan
CLM	Contaminated Land Management
COC	Chain of Custody
CSM	Conceptual Site Model
DA	Development Application
DCP	Development Control Plan
DMP	Dewatering Management Plan
DNAPL	Non-Aqueous Phase Liquid
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objective
EIL	Ecological Investigation Level
EMC	Environmental Management Coordinator
EMP	Environmental Management Plan
ENM	Excavated Natural Material
EPA	NSW Environment Protection Authority
ESL	Ecological Screening Level
mAHD	metres Australian Height Datum
mBGL	metres Below Ground Level
HDPE	High Density Polyethylene
HIL	Health-based Investigation Level
HSL	Health-based Screening Level
LDPE	Low Density Polyethylene
LEP	Local Environmental Plan
LGA	Local Government Area
LNAPL	Light Non-Aqueous Phase Liquid (also referred to as PSH)
LOR	Limit of Reporting (of laboratory analytical method)
m	Metres
NATA	National Association of Testing Authorities, Australia
NEPC	National Environmental Protection Council
NEPM	National Environmental Protection Measure
NSW	New South Wales
OCP	Organochlorine Pesticides
OPP	Organophosphate Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Poly-Chlorinated Biphenyls
PID	Photo-ionisation Detector
POEO	Protection of the Environment Operations Act
PPE	Personal Protective Equipment

PQL	Practical Quantitation Limit (limit of detection for laboratory method)
PSH	Phase-Separated Hydrocarbons (also referred to as LNAPL / DNAPL)
QA/QC	Quality Assurance / Quality Control
RAP	Remediation Action Plan
RPD	Relative Percentage Difference
SAQP	Sampling and Analysis Quality Plan
SAR	Site Audit Report
SAS	Site Audit Statement
SEPP	State Environment Protection Policy
SOP	Standard Operating Procedure
SRA	Sample Receipt Advice
TCLP	Toxicity Characteristics Leaching Procedure
TEQ	Toxicity Equivalent Quotient
TRH	Total Recoverable Hydrocarbons (non-specific petroleum hydrocarbon fractions)
TRH-F1	C ₆ -C ₁₀ TRH fraction, less sum of BTEX concentrations
TRH-F2	>C ₁₀ -C ₁₆ TRH fraction, less naphthalene
TRH-F3	>C ₁₆ -C ₃₄ TRH fraction
TRH-F4	>C ₃₄ -C ₄₀ TRH fraction
UCL	Upper Confidence Limit of the Mean
UPSS	Underground Petroleum Storage System
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VENM	Virgin Excavated Natural Material
VOC	Volatile Organic Compounds
WHSP	Work Health and Safety Plan

Appendix A - Figures



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Drawn:	J.M.
Approved:	J.H.
Date:	2-11-22
Scale:	Not To Scale

Wollongong Investments No. 5 Pty Ltd
 Remediation Action Plan
 2-4 Gladstone Ave & 357 - 363 Crown St, Wollongong NSW
 Site Locality Plan

Figure:

A.1

Project: E25862 E06



LEGEND (Note: All locations are approximate)

- - - Site boundary
- Lot boundaries



Drawn:	J.H.
Approved:	M.D.
Date:	15-03-23

Wollongong Investments No.5 Pty Ltd
 Remediation Action Plan
 2-4 Gladstone Avenue & 357-363 Crown Street,
 Wollongong NSW
 Individual Lot and Address Plan

Figure:

A.2

Project: E25862.E06



Map Source: Nearmap, Imagery date: 16-9-2022

LEGEND (Note: All locations are approximate)

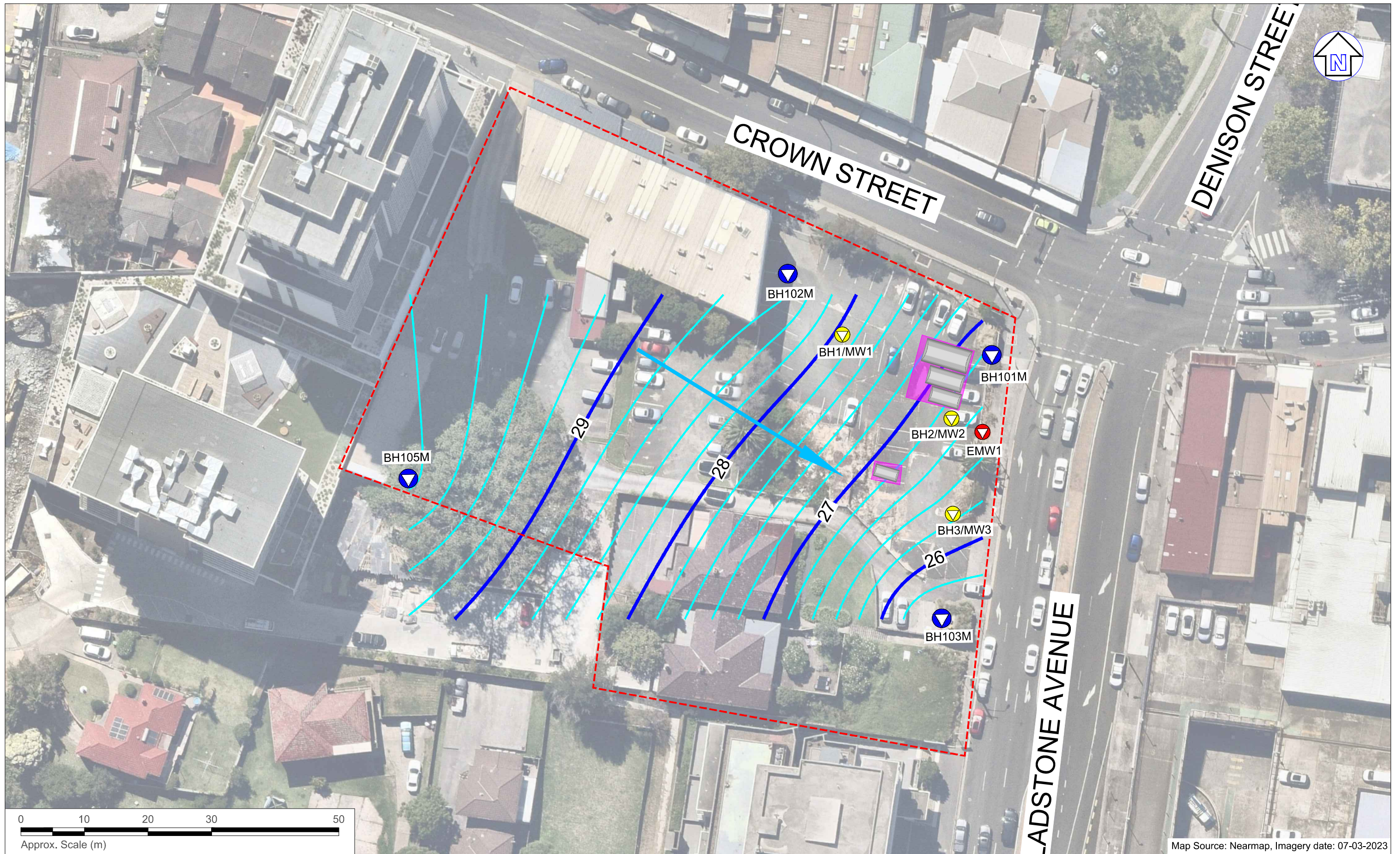
- Site boundary
- Environmental borehole location (EI, 2023b)
- Environmental borehole / Monitoring well location (EI, 2023b)
- Previous monitoring well location (unknown origin)
- Previous borehole / Monitoring well location (Reditus, 2020)
- + Geotechnical borehole location (EI, 2023a)
- + Previous borehole location (Reditus, 2020)
- Inferred UST location
- Inferred UST area



Drawn:	J.H.
Approved:	M.D.
Date:	15-03-23

Wollongong Investments No.5 Pty Ltd
 Remediation Action Plan
 2-4 Gladstone Avenue & 357-363 Crown Street,
 Wollongong NSW
 Previous Sampling Location Plan

Figure:
A.3
 Project: E25862.E06



LEGEND (Note: All locations are approximate)

- - - Site boundary
- Inferred UST location
- Inferred UST area
- ▼ Environmental borehole / Monitoring well location (EI, 2023b)
- ▼ Previous monitoring well location (unknown origin)
- ▼ Previous borehole / Monitoring well location (Reditus, 2020)
- Inferred groundwater flow direction



Drawn:	L.C.
Approved:	-
Date:	28-03-23

Wollongong Investments No.5 Pty Ltd
 Remediation Action Plan
 2-4 Gladstone Avenue & 357-363 Crown Street,
 Wollongong NSW
 Groundwater Contour Plan

Figure:
A.4
 Project: E25862.E06

Appendix B – Site Investigation Results

Table B.1 – Summary of Previous Soil Analytical Results

E25862.E06 - Wollongong

Sample ID	Sampling Date	Metals							PAHs				BTEX				TRHs				OCFs	OPPs	Total PCBs	Asbestos		
		As	Cd	Cr ⁶	Cu	Pb	Hg	Ni	Zn	Carcinogenic PAHs (as B[a]P/TEQ)	Benzo[a]pyrene	Naphthalene	Total PAHs	Benzene	Toluene	Ethylbenzene	Total Xylenes	F1	F2	F3					F4	
Reditus Detailed Site Investigation, as reported in the Remediation Action Plan (Reditus, 2020)																										
BH2_0.5	9/10/2019	4.2	<0.4	18	20	11	<0.1	17	40	NR	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.3	<20	<50	<100	<100	ND	ND	NA	ND	
BH2_1.0		6.4	<0.4	54	45	13	<0.1	29	95	NR	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.3	<20	<50	<100	<100	NA	NA	NA	ND	
BH3_1.0		2.4	<0.4	10	9.6	<5	<0.1	<5	31	NR	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.3	<20	77	<100	<100	NA	NA	NA	ND	
BH4_0.5		4.1	<0.4	24	20	6.6	<0.1	10	43	NR	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.3	<20	<50	<100	<100	ND	ND	NA	ND	
BH4_1.5		2.7	<0.4	5.2	<5	<5	<0.1	<5	8.3	NR	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.3	<20	<50	<100	<100	NA	NA	NA	ND	
BH5_0.4		5.2	<0.4	25	45	86	<0.1	15	1700 ⁵	NR	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.3	<20	<50	<100	<100	ND	ND	NA	Detected	
BH5_1.1		3.4	<0.4	17	22	25	<0.1	9.9	480 ⁵	NR	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.3	<20	<50	<100	<100	NA	NA	NA	ND	
Detailed Site Investigation (EI, 2023b)																										
Fill Soils																										
BH101M_0.2-0.3	23/11/2022	5	<0.3	19	58	10	<0.05	14	56	<0.2	0.2	<0.1	1.1	<0.1	<0.1	<0.1	<0.3	<25	<25	190	160	<1	<1.7	<1	ND	
BH201_0.1-0.2		42	0.6	22	52	99	0.06	8.8	260	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	<1	<1.7	<1	ND	
BH202_0.1-0.2		4	<0.3	21	31	70	0.08	6.3	84	0.4	0.3	<0.1	2.1	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	<1	<1.7	<1	ND	
BH203_0.2-0.3		3	<0.3	5	8.4	3	<0.05	3.6	14	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	<1	<1.7	<1	ND	
BH204_0.1-0.2		2	<0.3	6	15	15	<0.05	3.9	33	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	<1	<1.7	<1	ND	
BH205_0.1-0.2		5	<0.3	23	56	77	<0.05	12	86	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	<1	<1.7	<1	ND	
BH206_0.1-0.2		3	<0.3	24	23	6	<0.05	11	47	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	<1	<1.7	<1	ND	
BH207_0.1-0.2		6	0.4	8	24	70	<0.05	11	87	2	1.3	0.2	18	<0.1	<0.1	<0.1	<0.3	<25	<25	110	<120	<1	<1.7	<1	ND	
BH208_0.1-0.2		2	<0.3	2.4	13	8	<0.05	4.7	12	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	<1	<1.7	<1	ND	
BH209_0.1-0.2		5	0.5	15	26	53	0.06	6.8	280	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	<1	<1.7	<1	ND	
BH210_0.3-0.4		5	<0.3	16	22	48	0.21	8.5	89	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	<1	<1.7	<1	ND	
BH211_0.1-0.2		3	<0.3	15	23	19	0.06	5.1	43	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	<1	<1.7	<1	ND	
Residual Soils																										
BH101M_0.7-0.8	23/11/2022	4	<0.3	23	28	7	<0.05	13	69	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	NA	NA	NA	NA	
BH201_0.9-1.0		4	<0.3	26	16	6	<0.05	6	36	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	NA	NA	NA	NA	
BH203_0.5-0.6		5	<0.3	25	24	8	<0.05	15	51	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	NA	NA	NA	NA	
BH205_0.5-0.6		5	<0.3	33	37	12	<0.05	14	71	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	NA	NA	NA	NA	
BH206_1.3-1.4		5	<0.3	32	38	10	0.06	12	68	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	NA	NA	NA	NA	
BH207_0.9-1.0		6	<0.3	8	29	97	0.34	8.4	200	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	190	150	NA	NA	NA	NA	
BH208_2.5-2.6		3	<0.3	6.6	11	4	<0.05	0.7	9.4	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	NA	NA	NA	NA	
BH211_0.5-0.6		3	<0.3	15	22	11	<0.05	4.1	35	<0.2	<0.1	<0.1	<0.8	<0.1	<0.1	<0.1	<0.3	<25	<25	<90	<120	NA	NA	NA	NA	
SILs																										
HIL B - Residential with minimal opportunities for soil access	500	150	500 Cr(VI)	30,000	1,200	120	1,200	60,000	4	NR	400											600	NR	1		
HSL D - Commercial / Industrial	Source depths (0 m to <1 m BGL)										NL	4	NL	NL	NL	NL	310	NL								
Soil texture classification – Clay ¹	Source depths (1 m to <2 m BGL)										NL	6	NL	NL	NL	NL	480	NL								
	Source depths (2 m to <4 m BGL)										NL	9	NL	NL	NL	NL	NL	NL								
	Source depths (4 m + BGL)										NL	20	NL	NL	NL	NL	NL	NL								
EIL/ESL - Urban Residential and Public Open Space ²	100	NR	640 Cr(VI)	130	1,100	NR	45	320	NR	33 ³	NR	170	50	85	125	45	180	120	1,300	5,600	180	NR	NR			
Management Limits – Residential, parkland and public open space, Fine grained soil texture ¹																		800	1,000	3,500	10,000					
Asbestos contamination HSL																							<0.05			
Bonded ACM (%w/w)																							<0.001			
Asbestos contamination HSL																							<0.001			
Non Bonded / Friable Asbestos (%w/w)																							<0.001			

Notes: All results are recorded in mg/kg, unless otherwise specified.

	Highlighted value indicates concentration exceeds HIL / HSL
	Highlighted value indicates concentration exceeds EIL / ESL
	Highlighted value indicates concentration exceeds HIL / HSL and EIL / ESL

HIL B	NEPM 2013 'HIL B' - Health Investigation Level - Residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments.
HSL D	NEPM Health Screening Level 'HSL D' - Commercial / Industrial
#	Thresholds are for Chromium VI.
NR	No current published criterion.
NL	'Not Limiting'
ND	'Not detected' i.e. all concentrations of the compounds within the analyte group were found to be below the laboratory limits of detection.
NA	'Not Analysed' i.e. the sample was not analysed.
NC	Not Calculated
NR	Not Reported
1	Fine soil values were applied as the predominant sub-strata.
2	EILs/ESLs were derived using assumed conservative added Contamination Limits (pH = 5.5 / CEC = 5.5) plus Added Background Concentrations (old suburb / high traffic).
3	Value derived from CRC Care Report No. 39, Table 11
4	Most conservative criteria used.
5	BH5 not located within deep soil zone, therefore no exceedance of ecological criteria.
F1	TRH C ₁₀ -C ₁₆ less the sum concentration of BTEX.
F2	TRH C ₁₀ -C ₁₄ less the concentration of Naphthalene.
F3	TRH C ₁₄ -C ₂₄
F4	TRH C ₂₄ -C ₂₈

Table B.2 – Summary of Previous Groundwater Analytical Results

Sample Identification	Date	Metals								PAHs			BTEX					TRHs				Phenols	VOCs	
		As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	Total PAHs	Benzo(a)pyrene	Naphthalene	Benzene	Toluene	Ethylbenzene	m/p-xylene	o-xylene	F1	F2	F3	F4	Total	Total	
Reditus Detailed Site Investigation, as reported in the Remediation Action Plan (Reditus, 2020)																								
EX1	31/10/2019	<1	<0.1	<1	<1	<1	<0.05	<1	1	ND	<1	<1	<1	<1	<1	<2	<1	<10	<50	<100	<100	<50	NA	
MW1		4	<0.1	<1	<1	<1	<0.05	2	1	ND	<1	<1	<1	<1	<1	<2	<1	34	140	580	<100	<50	NA	
MW2		<1	<0.1	<1	<1	<1	<0.05	1	<1	ND	<1	<1	<1	<1	<1	<2	<1	<10	<50	<100	<100	<50	NA	
MW3		1	<0.1	<1	<1	<1	<0.05	1	1	ND	<1	<1	<1	<1	<1	<2	<1	<10	<50	<100	<100	<50	NA	
Detailed Site Investigation (EI, 2023b)																								
BH101M-1	13/12/2022	8	<0.1	<1	5	<1	<0.1	1	<5	<1	<0.1	<0.1	<0.5	<0.5	<0.5	<1	<0.5	<50	<60	<500	<500	<50	<10	
BH102M-1		4	<0.1	<1	<1	<1	<0.1	2	<5	<1	<0.1	<0.1	<0.5	<0.5	<0.5	<1	<0.5	<50	<60	<500	<500	<50	20	
BH103M-1		2	<0.1	<1	3	<1	<0.1	7	9	<1	<0.1	<0.1	<0.5	<0.5	<0.5	<1	<0.5	<50	71	<500	<500	<50	<10	
BH105M-1		<1	<0.1	<1	3	<1	<0.1	3	6	<1	<0.1	<0.1	<0.5	<0.5	<0.5	<1	<0.5	<50	90	<500	<500	<50	28	
EMW1-1		<1	<0.1	<1	3	<1	<0.1	2	<5	<1	<0.1	<0.1	<0.5	<0.5	<0.5	<1	<0.5	<50	<60	<500	<500	<50	<10	
MW1-1		2	<0.1	<1	<1	<1	<0.1	<1	<5	<1	<0.1	<0.1	<0.5	<0.5	<0.5	<1	<0.5	<50	<60	<500	<500	<50	<10	
MW2-1		<1	<0.1	<1	1	<1	<0.1	2	<5	<1	<0.1	<0.1	<0.5	<0.5	<0.5	<1	<0.5	<50	<60	<500	<500	<50	<10	
MW3-1		<1	<0.1	<1	1	<1	<0.1	<1	<5	<1	<0.1	<0.1	<0.5	<0.5	<0.5	<1	<0.5	<50	<60	<500	<500	<50	<10	
GILs																								
ANZG (2018)	Marine Water	24 (AsIII) ¹ 13 (AsV) ¹	0.7 ²	27 (Cr III) 4.4 (Cr VI)	1.3	4.4	0.1 ²	7 ²	8 ²		0.1 ²	50 ³⁴	500 ³⁴	180	80	275 ¹	350 ¹					400		
NEPC (2013)	HSL D - Fine Grain Texture ⁵	Source Depths 2m to <4m										NL	30	NL	NL	NL	NL	NL	NL					
		Source Depths 4m to <8m										NL	30	NL	NL	NL	NL	NL	NL	NL				
		Source Depths 8m+										NL	35	NL	NL	NL	NL	NL	NL	NL				

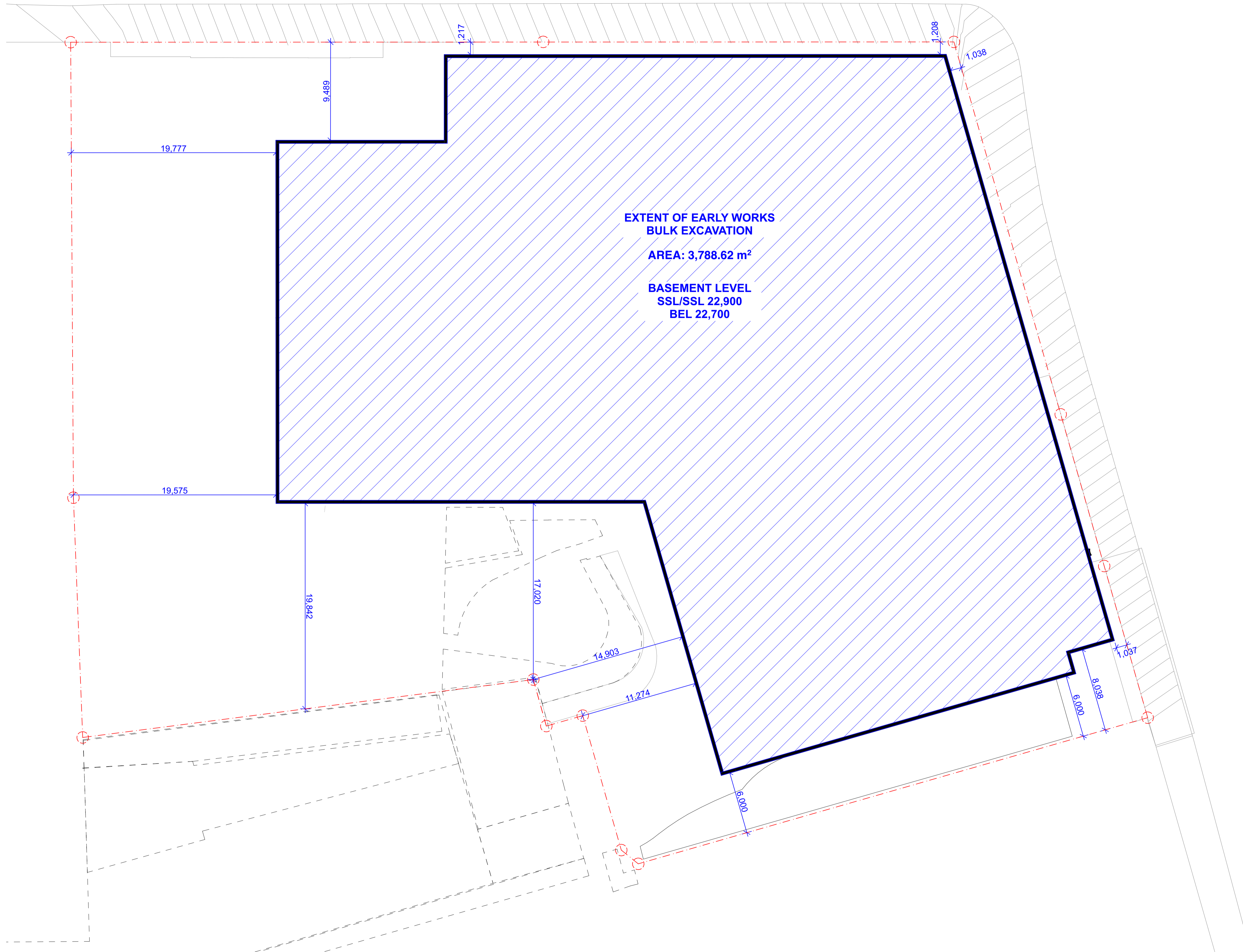
Notes:

- Highlighted indicates ecological criteria exceeded
- Highlighted indicates criteria

All values are µg/L unless stated otherwise

- NEPC The National Environment Protection (assessment of Site Contamination) Measure
- ANZG Australian and New Zealand Guidelines for Fresh and Marine Water Quality
- HSL Health Screening Level
- NL Not Limiting
- NA Not Analysed
- ND Not Detected
- PQL Practical Quantitation Limit (laboratory detection limit)
- F1 To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.
- F2 To obtain F2 subtract naphthalene from the >C10-C16 fraction.
- F3 (>C16-C34)
- F4 (>C34-C40)
- 1 In absence of marine water criteria, fresh water criteria was used.
- 2 The 99% level of species protection was used for this analyte to account for the bioaccumulating nature of the toxicant, as recommended in ANZG (2018).
- 3 The 99% level of species protection was used for this analyte, as recommended in ANZG (2018).
- 4 The default guideline value may not protect key test species from chronic toxicity.
- 5 Fine grained values were applied, being the predominant sub-strata.
- 6 EX1 and EMW1 are inferred to be the same well for comparison purposes.

Appendix C - Proposed Development Plans



BASEMENT
1:200

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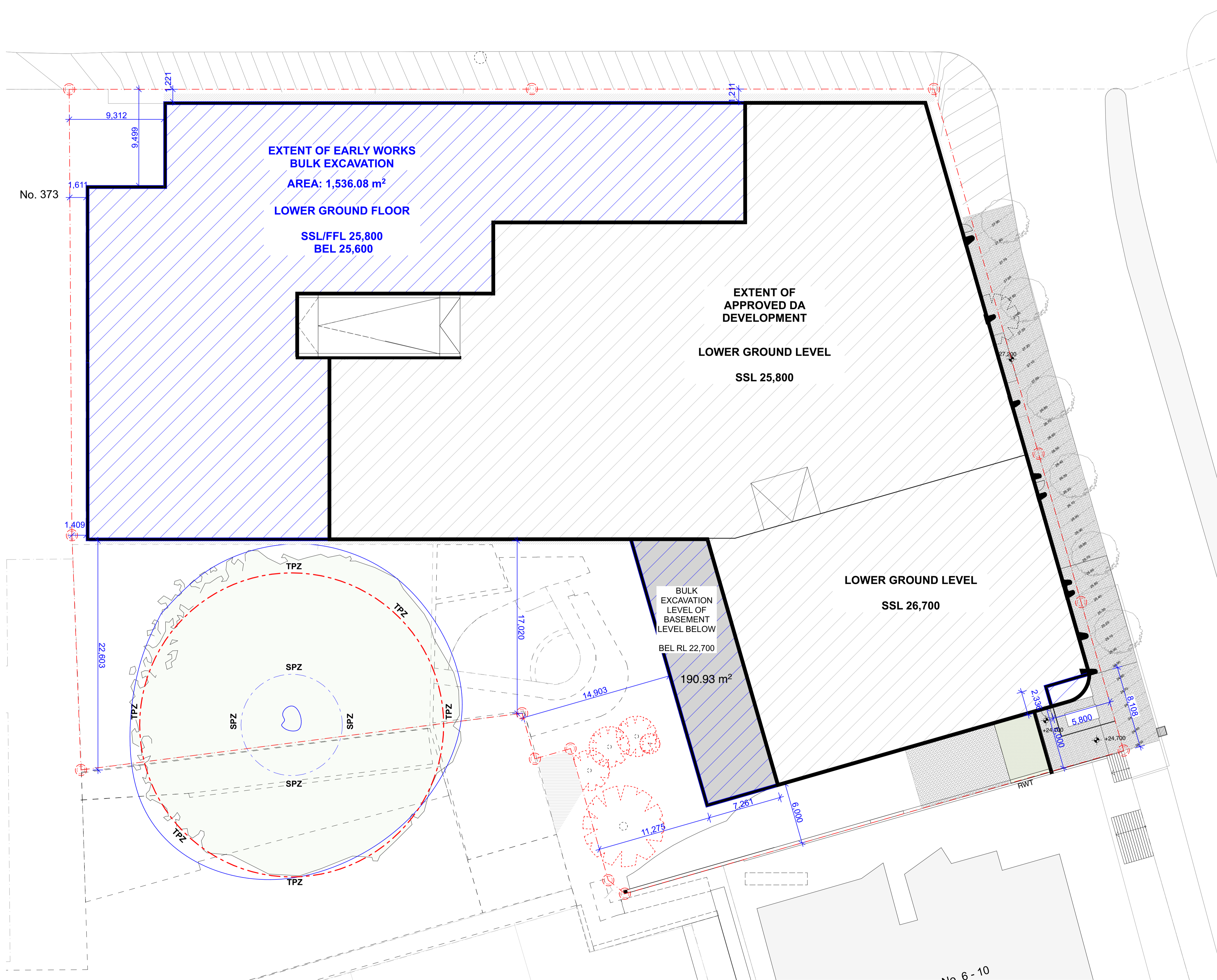
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North	Scale at A1
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Status	Drawn
DA	DC
Date	Checked
30/1/2026	JG
Project	
2-4 Gladstone Ave / 357-363 Crown St Wollongong NSW	

Drawing
BULK EXCAVATION - BASEMENT

Project No.	Revision	Drawing No.
22003		



No. 373

LOWER GROUND FLOOR
1:200

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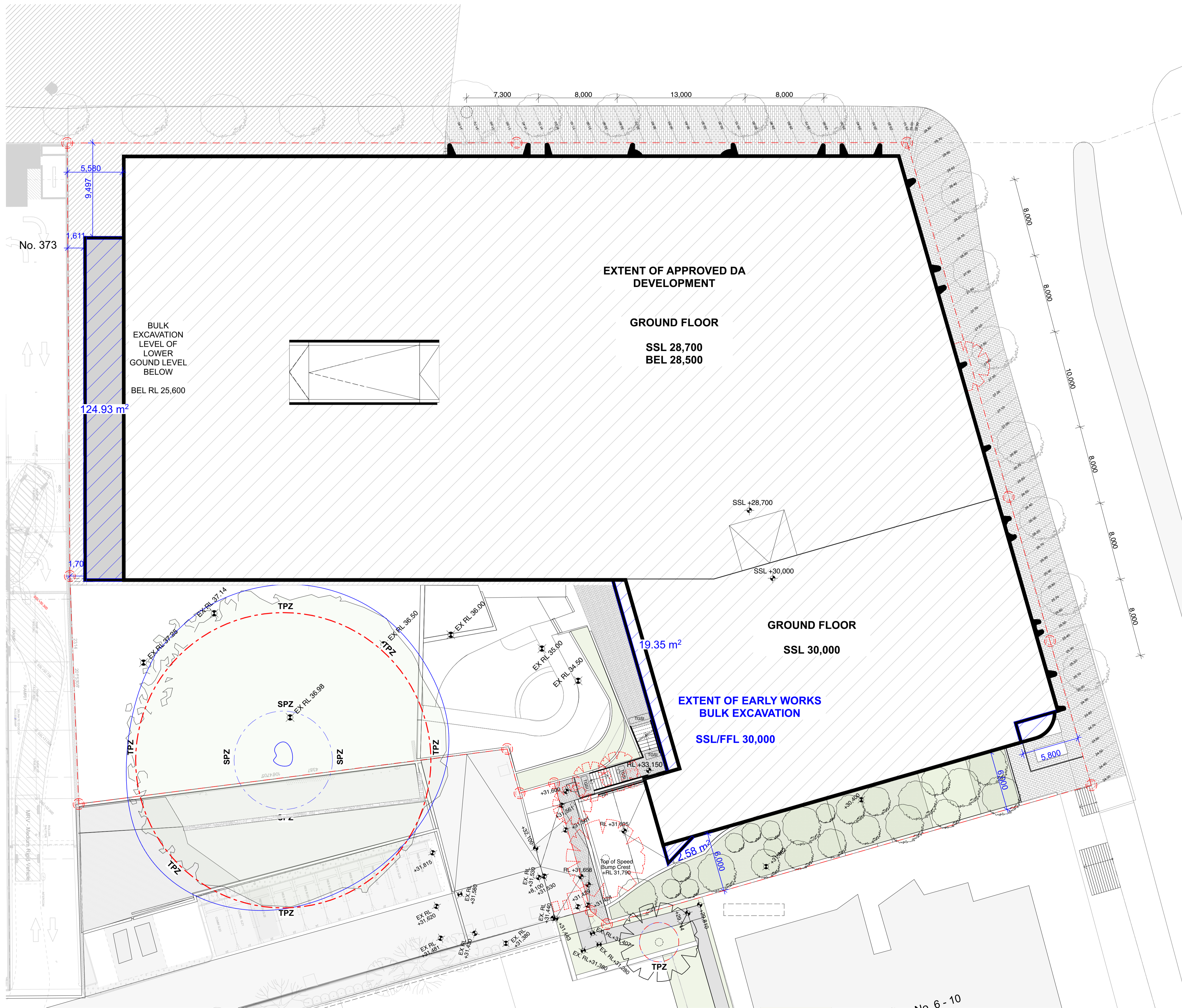
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BULK EXCAVATION - LOWER GROUND FLOOR

Project No.	Revision	Drawing No.
22003		



GROUND FLOOR
1:200

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Client
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LEVEL 33
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(02) 8199 1144

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North	Scale at A1
	1:200
Status	Drawn
DA	DC
Date	Checked
30/1/2026	JG
Project	
2-4 Gladstone Ave / 357-363 Crown St Wollongong NSW	

Drawing
BULK EXCAVATION - GRUND FLOOR

Project No.	Revision	Drawing No.
22003		



MGA NORTH

LEGEND

- INDICATIVE BOUNDARY
- INDICATIVE EASEMENT
- ELECTRICAL OVERHEAD
- SIGNPOST
- LIGHT POLE
- TRAFFIC LIGHT
- POWER POLE
- SECURITY CAMERA
- RAMP LEVEL
- NATURAL SURFACE
- INVERT OF KERB
- TOP OF KERB
- KERB AND GUTTER
- HARDSTAND
- EDGE OF CONCRETE
- CONTOUR 0.25m
- FENCELINE
- BUILDING
- AWNING
- FACE OF WALL
- WALL
- LOW CONCRETE WALL
- PRAM CROSSING
- VEHICLE CROSSING
- TRAFFIC CONTROL BOX
- DRAINAGE PIT
- ELECTRICAL PIT
- COMMUNICATIONS PIT
- UNIDENTIFIED PIT
- TREE
- Trunk G, Height, Canopy Ø

EASEMENT SCHEDULE

- (A) EASEMENT FOR PIPE LINES BK 752 No.307 APPROX. POSITION
- (B) RIGHT OF CARRIAGEWAY 12' & VAR. (DEALING M86644 - L849293)
- (C) RIGHT OF WAY 12' WIDE DP 201949
- (D) RIGHT OF WAY VARIABLE WIDTH M086644

NOTES:

1. NO BOUNDARY SURVEY HAS BEEN UNDERTAKEN. RELATIONSHIP OF IMPROVEMENTS TO BOUNDARIES IS DIAGRAMMATIC ONLY.
2. IF CONSTRUCTION OR DESIGN OF ANY NEW STRUCTURE IS INTENDED WITHIN PROXIMITY OF THE BOUNDARIES OR LOCAL GOVERNMENT REQUIREMENTS, A FURTHER SURVEY SHOULD BE REQUESTED TO MARK BOUNDARIES AND/OR DIMENSION WALL TO BOUNDARY DISTANCES.
3. CONSTRUCTION WORKS MUST BE RELATED TO THE BENCHMARK AND NOT LEVELS OF STRUCTURES SHOWN ON THE PLAN.
4. TREE SPREADS & TRUNK RADIUS SHOWN ARE DIAGRAMMATIC ONLY. SPOT LEVELS SHOULD BE USED IN REFERENCE TO CONTOUR LEVELS. FEATURES AND LEVELS CRITICAL TO DESIGN (IN PARTICULAR DRIP LINES) MORE SPECIFIC DETAILS SHOULD BE REQUESTED FOR ACCURATE LOCATION.
5. CONTOURS ARE AT 0.25m INTERVALS AND ARE APPROXIMATE ONLY. SPOT LEVELS SHOULD BE USED IN REFERENCE TO CONTOUR LEVELS. FEATURES AND LEVELS CRITICAL TO DESIGN SHOULD BE LOCATED BY A MORE ACCURATE SURVEY. ALL SET OUT WITH REGARD TO LEVELS SHOULD REFER TO THE BENCHMARK.
6. NO SERVICES SEARCH HAS BEEN CARRIED OUT FOR THIS SURVEY. SERVICES SHOWN ARE INDICATIVE ONLY. POSITIONS ARE BASED ON SURFACE INDICATORS LOCATED DURING SURVEY. APPROPRIATE DIAL BEFORE YOU DIG SEARCHES SHOULD BE CARRIED OUT PRIOR TO ANY CONSTRUCTION TAKING PLACE. SEE DIAL BEFORE YOU DIG CONTACT INFORMATION ON THIS PLAN.
7. THIS SURVEY IS FOR CONTOUR AND DETAIL PURPOSES ONLY AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE.

A	22.02.22	ISSUED FOR INFORMATION	BTP
REV.	DATE	AMENDMENTS	INT.

PREPARED BY:



www.geosurv.com.au 1300 554 675

PREPARED FOR:

WOLLONGONG INVESTMENTS No.5 Pty Ltd

PLAN OF:

TOPOGRAPHICAL SURVEY PLAN SHOWING DETAIL AND LEVELS No.357-363 CROWN STREET No.2 & No.4 GLADSTONE STREET SP16167, 2 DP201949, 100 DP1214547, 6 DP14480, 7 DP661845

ORIGINAL SIZE: A1

SCALE:	1:200	CO-ORD:	MGA (GDA2020)
DATUM:	AHD	ORIG DATUM:	SSM23204
SURVEY BY:	MA	DATE:	17.01.22
DRAWN BY:	BTP	DATE:	22.02.22
CHECKED BY:	MA	DATE:	22.02.22
APPROVED BY:	ST	DATE:	22.02.22
DRAWING #:	220013-DT-02 [A]		



Monitoring Well Coordinates	JOB NO: 230031
-----------------------------	----------------

DATE:	28.02.2023	SITE:	CORNER GLADSTONE AVE & CORWN ST WOLLONGONG, NSW
-------	------------	-------	---



CONTRA:	LEVEL 33	APPROVED BY:	KURT DE VANZO
---------	----------	--------------	---------------



Locate top of monitoring well cover
Coordinate on MGA2020 Zone 56 Azimuth and A.H.D Datum (AHD Origin SSM 90858)



Well Number
BH1MW1
BH102M
BH101M
BH2MW2
BHMW3
BH103M
BH105M
EMW1

EASTING
305826.04
305816.71
305848.21
305841.64
305840.60
305839.19
305758.02
305844.27

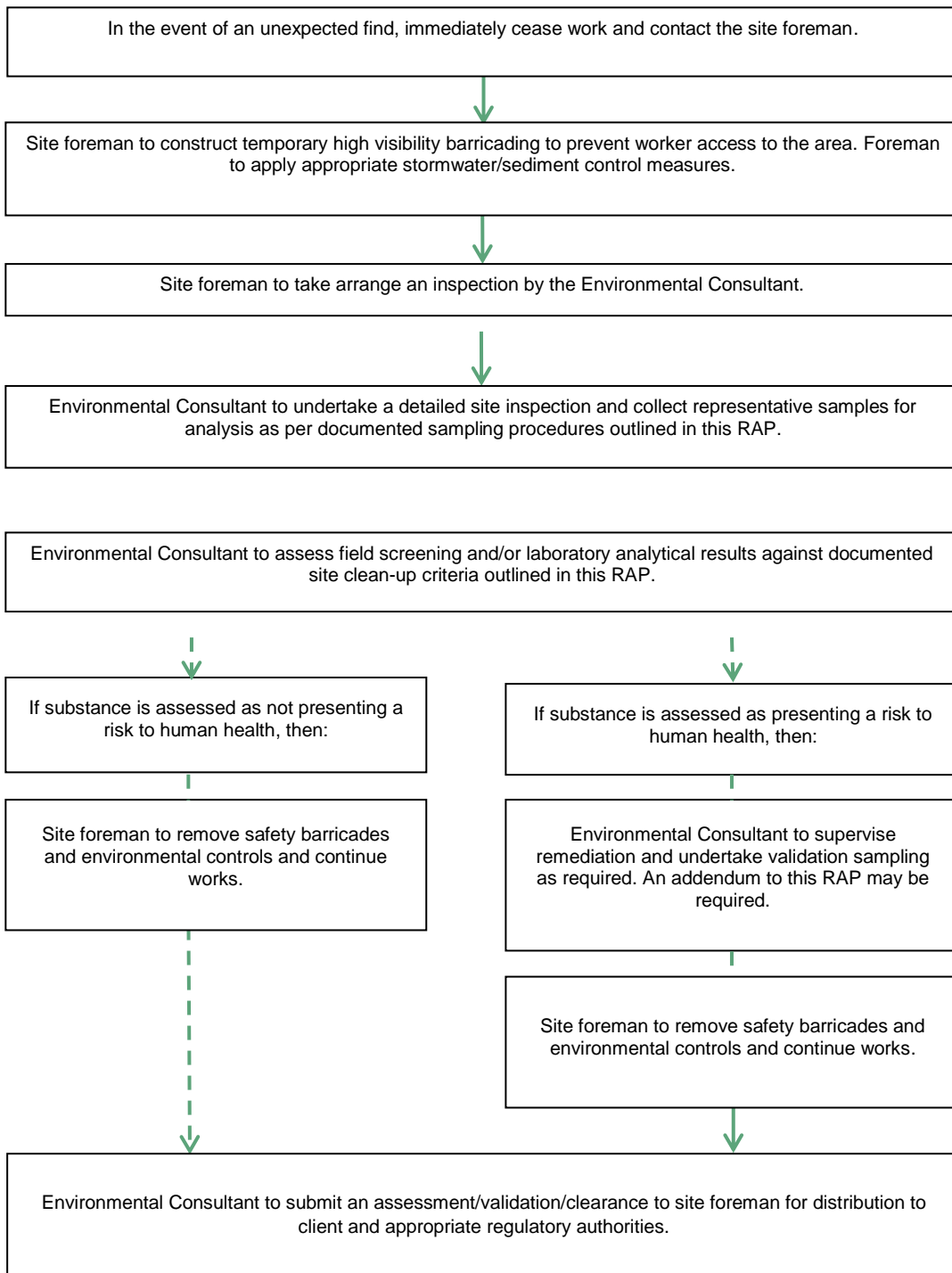
NORTHING
6188600.68
6188606.70
6188597.25
6188589.49
6188575.40
6188555.73
6188577.89
6188589.26

COVER RL
30.22
30.68
28.96
28.58
27.69
27.61
37.20
28.47



Appendix D - Unexpected Finds Protocol

Unexpected Finds Protocol



Appendix E – Remediation Criteria

Table E-1 Soil Remediation Criteria

Chemical	Unit	HIL B ¹	HSL D ³	EIL / ESL ²	Mgt. Limits ¹⁰
Metals					
Arsenic – As	mg / kg	500 ³	-	100	
Cadmium - Cd	mg / kg	150	-	NR	
Chromium(VI) – Cr(VI)	mg / kg	500	-	640	
Copper – Cu	mg / kg	30,000	-	130	
Lead – Pb	mg / kg	1,200	-	1,100	
Mercury – Hg (inorganic)	mg / kg	120	-	NR	
Nickel – Ni	mg / kg	1,200	-	45	
Zinc – Zn	mg / kg	60,000	-	320	
Petroleum Hydrocarbons (TRH)					
F1 ⁴	mg / kg	-	310	180	800
F2 ⁵	mg / kg	-	-	120	1,000
F3 ⁶	mg / kg	-	-	1,300	3,500
F4 ⁷	mg / kg	-	-	5,600	10,000
Polycyclic Aromatic Hydrocarbons					
Naphthalene	mg / kg	-	-	NR	
Benzo(a)pyrene	mg / kg	-	-	33 ²	
Carcinogenic PAHs (as B(a)P TEQ) ⁸	TEQ	4	-	NR	
Total PAHs ⁹	mg / kg	400	-	170	
Monocyclic Aromatic Hydrocarbons					
Benzene	mg / kg	-	4	50	
Toluene	mg / kg	-	-	85	
Ethylbenzene	mg / kg	-	-	125	
Xylenes (total)	mg / kg	-	-	45	
Asbestos					
Asbestos (friable or fines)	w / w		0.001%		
Asbestos (bonded)	w / w		0.05%		

Note 1 Health-based investigation levels: HIL B - Residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments, Ref. NEPC 2013, Schedule B1, Table 1A(1).

Note 2 Ecological values were derived using site specific Added Contamination Limits (ACL) of fill soils for the site (pH= 7.43 / CEC= 23.2), plus an ambient background concentration for the area (ABC) (ACL + ABC). Benzo(a)pyrene value derived from CRC Care Report No. 39, Table 11.

Note 3 Soil HSLs for vapour intrusion assuming coarse texture (sand) soils and a contamination source at 0m to <1m depth.

Note 4 F1: concentration of TRH C₆-C₁₀ fraction minus the sum of BTEX concentrations.

Note 5 F2: concentration of TRH >C₁₀-C₁₆ fraction minus the concentration of Naphthalene.

Note 6 F3: concentration of TRH >C₁₆-C₃₄.

Note 7 F4: concentration of TRH >C₃₄-C₄₀.

Note 8 Carcinogenic PAHs: HIL is based on the 8 carcinogenic PAHs and their TEFs (potency relative to B(a)P) adopted by CCME 2008 (refer Schedule B7). The B(a)P TEQ is calculated by multiplying the concentration of each carcinogenic PAH in the sample by its B(a)P TEF, given below, and summing these products.

Note 9 Total PAHs: HIL is based on the sum of the 16 PAHs most commonly reported for contaminated sites (WHO 1998). The application of the total PAH HIL should consider the presence of carcinogenic PAHs and naphthalene (the most volatile PAH). Carcinogenic PAHs reported in the total PAHs should meet the B(a)P TEQ HIL. Naphthalene reported in the total PAHs should meet the relevant HSL.

NEPC (2013) Management Limits for Petroleum Hydrocarbons – based on coarse size fraction

Appendix F – Previous Borehole Logs
(EI, 2023b)

Location	2-4 Gladstone Avenue, 357-363 Crown ST, Wollongong NSW	Started	23 November 2022
Client	Wollongong Investments No. 5 Pty Ltd	Completed	23 November 2022
Job No.	E25862	Logged By	JM
Sheets	1 of 1	Review By	JH Date 30 January 2023

Drilling Contractor	Geosense Drilling	Surface RL	≈28.90 m (AHD)	Latitude	-
Plant	Comacchio GEO 205	Inclination	90°	Longitude	-

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m(AHD))	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
DT				0		28.90	CONCRETE: 150mm thick			CONCRETE
		BH101M_0.20-0.30 PID = 0.0 PPM	█	28.75		28.75	FILL: Sandy GRAVEL: Blue-grey and dark grey, fine to coarse, sub-angular to angular sandstone gravels, sand is fine to coarse grained, trace silt, No odour			FILL
AD/T	GWNE	BH101M_0.70-0.80	█	28.40		28.40	Clayey SAND: fine grained, brown and grey-brown, No odour	M		RESIDUAL SOIL
				1		27.80	Terminated at 1.10m. Continued for Geotech and for Monitoring Well.			
				2						
				3						
				4						
				5						
				6						
				7						
				8						
				9						
				10						Groundwater Seepage at 3.40m

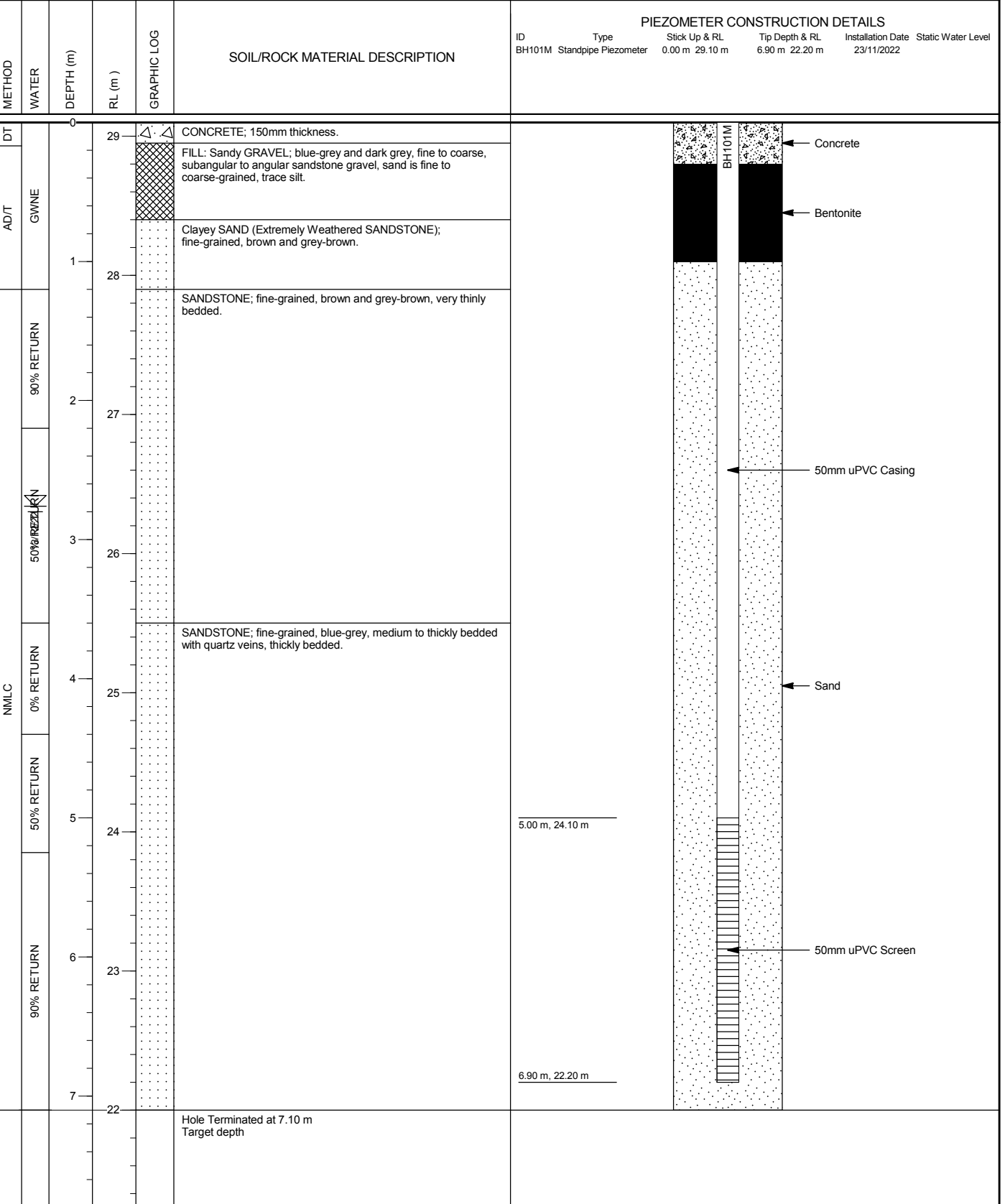
This log should be read in conjunction with EI Australia's accompanying explanatory notes.

Project	Proposed Mixed-use Building	Sheet	1 of 2
Location	2-4 Gladstone Ave, 357-363 Crown St, Wollongong NSW	Date Started	23/11/2022
Position	See Figure 2	Date Completed	23/11/2022
Job No.	E25862.G03	Logged By	DD Date 23/11/2022
Client	Wollongong Investments No.5 Pty Ltd	Reviewed By	SK Date 16/01/2023

Drilling Contractor	Geosense Drilling	Surface RL	≈29.10 m
Drill Rig	Comacchio GEO 205	Inclination	-90°

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
BH101M	Standpipe Piezometer	0.00 m 29.10 m	6.90 m 22.20 m	23/11/2022	

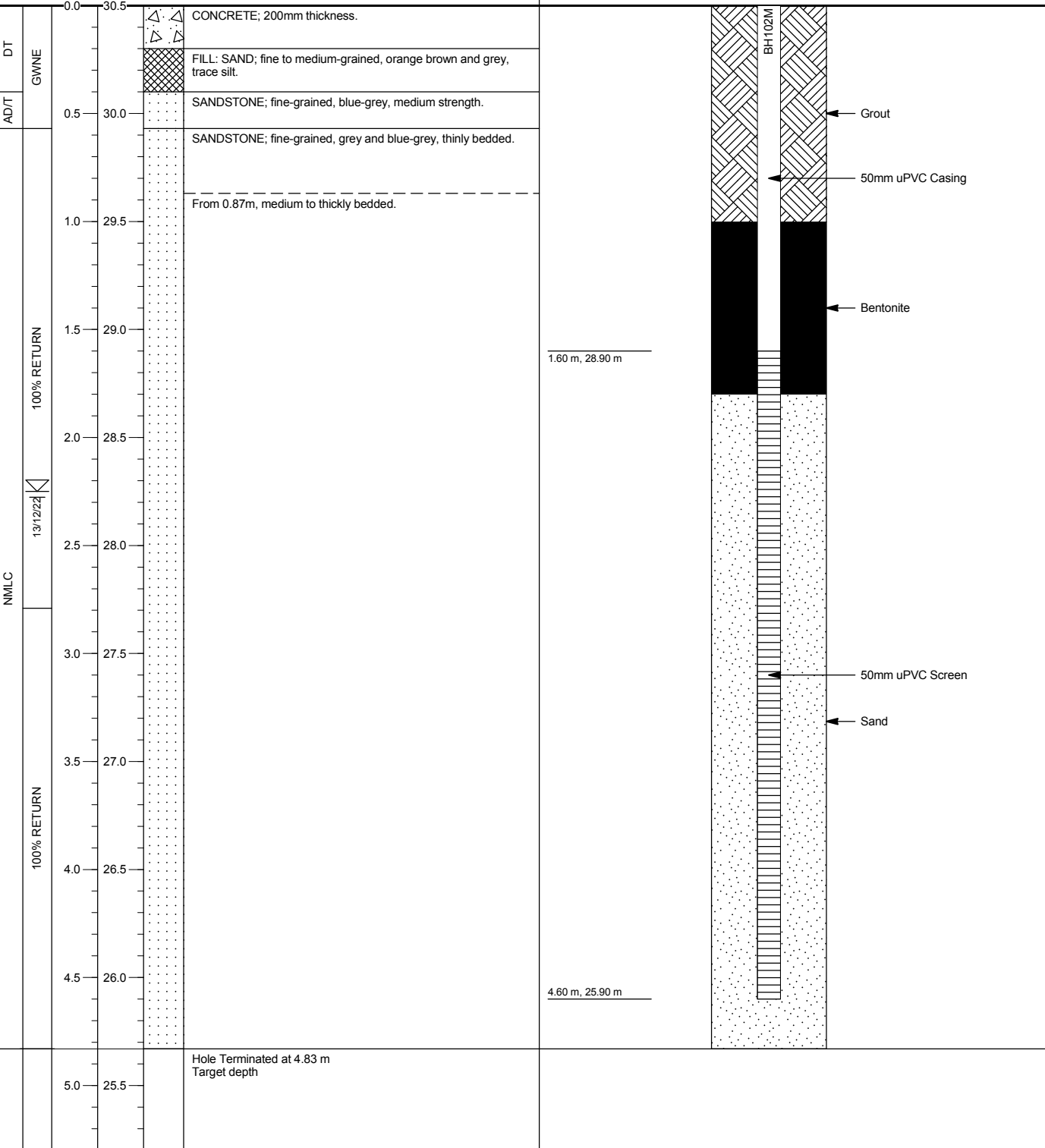


This well log should be read in conjunction with EI Australia's accompanying standard notes.

Project	Proposed Mixed-use Building	Sheet	1 of 2
Location	2-4 Gladstone Ave, 357-363 Crown St, Wollongong NSW	Date Started	23/11/2022
Position	See Figure 2	Date Completed	23/11/2022
Job No.	E25862.G03	Logged By	DD Date 23/11/2022
Client	Wollongong Investments No.5 Pty Ltd	Reviewed By	SK Date 16/01/2023

Drilling Contractor	Geosense Drilling	Surface RL	≈30.50 m
Drill Rig	Comacchio GEO 205	Inclination	-90°

METHOD	WATER	DEPTH (m)	RL (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION	PIEZOMETER CONSTRUCTION DETAILS					
						ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
						BH102M	Standpipe Piezometer	0.00 m 30.50 m	4.60 m 25.90 m	23/11/2022	



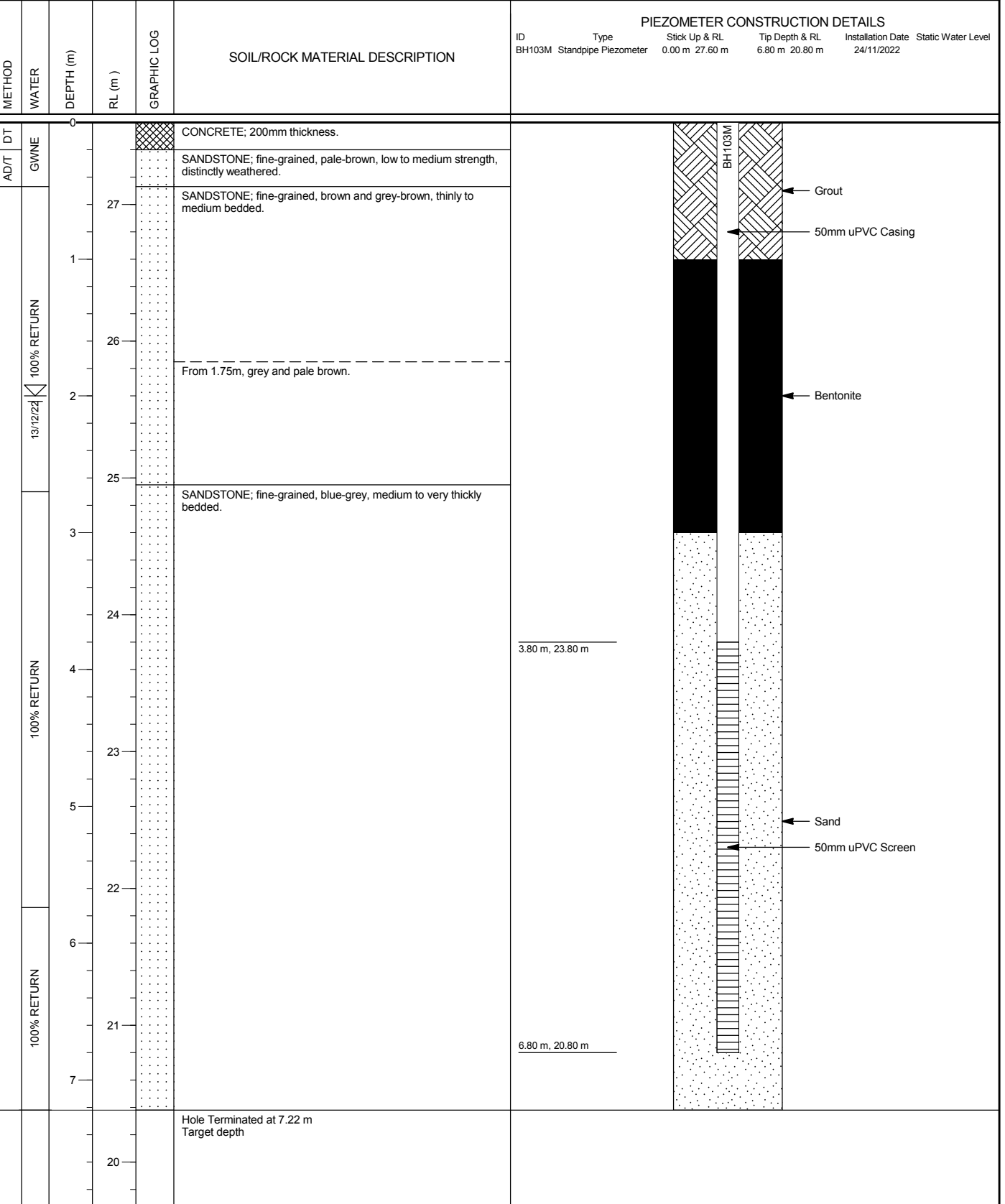
This well log should be read in conjunction with EI Australia's accompanying standard notes.

Project	Proposed Mixed-use Building	Sheet	1 of 2
Location	2-4 Gladstone Ave, 357-363 Crown St, Wollongong NSW	Date Started	24/11/2022
Position	See Figure 2	Date Completed	24/11/2022
Job No.	E25862.G03	Logged By	DD Date 24/11/2022
Client	Wollongong Investments No.5 Pty Ltd	Reviewed By	SK Date 16/01/2023

Drilling Contractor	Geosense Drilling	Surface RL	≈27.60 m
Drill Rig	Comacchio GEO 205	Inclination	-90°

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
BH103M	Standpipe Piezometer	0.00 m 27.60 m	6.80 m 20.80 m	24/11/2022	



This well log should be read in conjunction with EI Australia's accompanying standard notes.

BOREHOLE LOG

BH NO. BH104

Project	Proposed Mixed-use Building	Sheet	1 of 2
Location	2-4 Gladstone Ave, 357-363 Crown St, Wollongong NSW	Date Started	24/11/2022
Position	See Figure 2	Date Completed	24/11/2022
Job No.	E25862.G03	Logged By	DD Date 24/11/2022
Client	Wollongong Investments No.5 Pty Ltd	Reviewed By	SK Date 16/01/2023

Drilling Contractor	Geosense Drilling	Surface RL	≈35.90 m
Drill Rig	Comacchio GEO 205	Inclination	-90°

Drilling			Sampling			Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
AD/T	-	GWNE	0	35.86			-	CONCRETE; 40mm thickness.	-	-	-	PAVEMENT FILL	
			1	1.20 34.70				FILL: Silty Sandy GRAVEL; fine to medium, sub-angular to angular sandstone gravel, brown, sand is fined to medium-grained.	D	-	-		
			2	1.90 34.00	SPT 1.50-1.81 m 5.5,3/10mm HB			CL	Silty Sandy CLAY; low plasticity, orange-brown and brown, trace fine to coarse subangular sandstone gravel, sand is fine-grained.	M (<PL)	St		RESIDUAL SOIL
			2	2.20					From 1.90m, grading into extremely weathered sandstone.				
			3					Continued as Cored Borehole					
			4										
			5										
			6										
			7										
			8										
			9										
			10										

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

Project							Proposed Mixed-use Building		Sheet		2 OF 2	
Location							2-4 Gladstone Ave, 357-363 Crown St, Wollongong NSW		Date Started		24/11/2022	
Position							See Figure 2		Date Completed		24/11/2022	
Job No.							E25862.G03		Logged By		DD Date 24/11/2022	
Client							Wollongong Investments No.5 Pty Ltd		Reviewed By		SK Date 16/01/2023	
Drilling Contractor							Geosense Drilling		Surface RL		≈35.90 m	
Drill Rig							Comacchio GEO 205		Inclination		-90°	
Drilling						Field Material Description				Defect Information		
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $I_{s(60)}$ MPa	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm)	
								VL L M H VH ¹⁰ EH			50 100 200 1000 5000	
				0								
				1								
				2	2.20		Continuation from non-cored borehole					
	90% RETURN	100	0		33.70		SANDSTONE; fine-grained, orange-brown and brown, very thinly to thinly bedded.	DW - SW		2.68-2.71: CS, 30mm		
				3						2.96-2.99: CS, 30mm 3.05: JT, 50°, IR, RF, SN, Fe 3.15-3.20: CS, 50mm 3.23: JT, 50°, PR, RF, SN, Fe 3.33-3.35: XWS, 20 mm		
				4	3.35		SANDSTONE; fine-grained, blue-grey, medium to thickly bedded.	FR		3.95: HB		
	90% RETURN	100	79		32.55					4.46: HB 4.63: HB 4.81: HB		
				5						5.22: XWS, 2 mm 5.52: JT, 40°, PR, RF, SN, Fe		
				6						6.08: HB 6.30: HB		
				7	6.75		Hole Terminated at 6.75 m Target depth			6.68: HB		
				8	29.15							
				9								
				10								

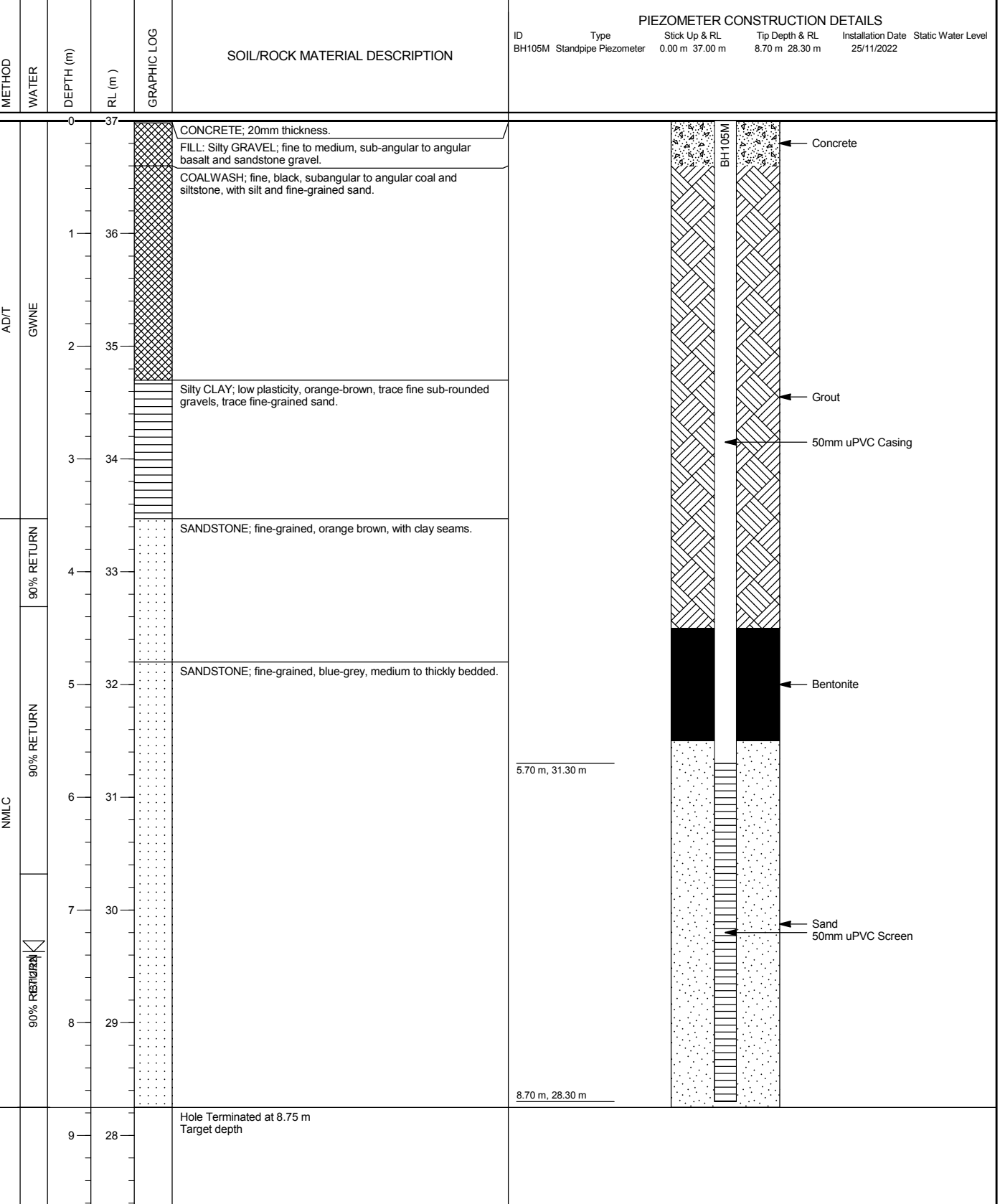
This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

Project	Proposed Mixed-use Building	Sheet	1 of 2
Location	2-4 Gladstone Ave, 357-363 Crown St, Wollongong NSW	Date Started	25/11/2022
Position	See Figure 2	Date Completed	25/11/2022
Job No.	E25862.G03	Logged By	DD Date 25/11/2022
Client	Wollongong Investments No.5 Pty Ltd	Reviewed By	SK Date 16/01/2023

Drilling Contractor	Geosense Drilling	Surface RL	≈37.00 m
Drill Rig	Comacchio GEO 205	Inclination	-90°

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
BH105M	Standpipe Piezometer	0.00 m 37.00 m	8.70 m 28.30 m	25/11/2022	



This well log should be read in conjunction with EI Australia's accompanying standard notes.

BOREHOLE LOG

BH NO. BH106

Project	Proposed Mixed-use Building	Sheet	1 of 2
Location	2-4 Gladstone Ave, 357-363 Crown St, Wollongong NSW	Date Started	25/11/2022
Position	See Figure 2	Date Completed	25/11/2022
Job No.	E25862.G03	Logged By	DD Date 25/11/2022
Client	Wollongong Investments No.5 Pty Ltd	Reviewed By	SK Date 16/01/2023

Drilling Contractor	Geosense Drilling	Surface RL	≈36.50 m
Drill Rig	Comacchio GEO 205	Inclination	-90°

Drilling			Sampling			Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY	REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	-	GWNE	0	36.50			-	FILL: GRAVEL; fine to medium, sub-angular to angular, dark grey and blue-grey, trace fine to medium-grained sand and silt.	D	-		FILL
			0.80	35.70	SPT 1.00-1.45 m 5,6,8 N=14		CL	Sandy Silty CLAY; low plasticity, orange-brown and brown, fine grained sand, trace fine sub-angular to sub-rounded sandstone gravel.	M (<PL)	St		RESIDUAL SOIL
			2.55					Continued as Cored Borehole				
			3									
			4									
			5									
			6									
			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.


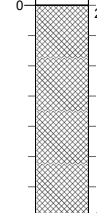

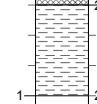
CORED BOREHOLE LOG

BH NO. BH106

Project							Proposed Mixed-use Building		Sheet		2 OF 2	
Location							2-4 Gladstone Ave, 357-363 Crown St, Wollongong NSW		Date Started		25/11/2022	
Position							See Figure 2		Date Completed		25/11/2022	
Job No.							E25862.G03		Logged By		DD Date 25/11/2022	
Client							Wollongong Investments No.5 Pty Ltd		Reviewed By		SK Date 16/01/2023	
Drilling Contractor							Geosense Drilling		Surface RL		≈36.50 m	
Drill Rig							Comacchio GEO 205		Inclination		-90°	
Drilling						Field Material Description				Defect Information		
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $I_{s(60)}$ MPa	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm)	
								VL 0.1 L 0.3 M 0.5 H 3 VH 10 EH			50 100 200 300 1000 3000	
				0								
				1								
				2								
				2.55	33.95		Continuation from non-cored borehole					
				3			SANDSTONE; fine-grained, blue-grey, medium to thickly bedded.	FR		2.95: HB		
				3.31						3.31: HB		
				3.52						3.52: DB		
				4								
				5								
				6						6.01-6.03: CS, 20 mm		
				6.10						6.10-6.11: CS, 10 mm		
				6.16						6.16: JT, 60°, PR, SM, VNR, Clay		
				6.62						6.62: JT, 80°, PR, RF, SN, Fe		
				7								
				7.10						7.10: HB		
				7.46						7.46: JT, 0 - 30°, IR, RF, SN, Fe		
				7.62						7.62: JT, 80°, PR, RF, SN, Fe		
				7.89	28.61		Hole Terminated at 7.89 m Target depth					
				8								
				9								
				10								



This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

Location 2-4 Gladstone Avenue, 357-363 Crown ST, Wollongong NSW	Started 23 November 2022
Client Wollongong Investments No. 5 Pty Ltd	Completed 23 November 2022
Job No. E25862	Logged By JM
Sheets 1 of 1	Review By JH Date 30 January 2023

Drilling Contractor		Surface RL		Latitude						
-		≈27.70 m (AHD)		-						
Plant		Inclination		Longitude						
Hand Auger		90°		-						
METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
HA	GWNE	BH201_0.10-0.20 PID = 0.2 PPM		0		27.70	FILL: Sandy CLAY: low to medium plasticity, brown, sand is fine, with fine to medium sub-angular to angular sandstone gravels, no odour	M		FILL
		BH201_0.90-1.00 PID = 0.4 PPM		27.00		26.70	Silty CLAY: low to medium plasticity, light brown, with fine to medium sub-angular to angular sandstone gravels, no odour			RESIDUAL SOIL
				1			Terminated at 1.00m. Target Depth Reached.			
				2						
				3						
				4						
				5						

This log should be read in conjunction with EI Australia's accompanying explanatory notes.

Location	2-4 Gladstone Avenue, 357-363 Crown ST, Wollongong NSW	Started	23 November 2022
Client	Wollongong Investments No. 5 Pty Ltd	Completed	23 November 2022
Job No.	E25862	Logged By	JM
Sheets	1 of 1	Review By	JH Date 30 January 2023

Drilling Contractor		Surface RL		Latitude						
-		≈31.20 m (AHD)		-						
Plant		Inclination		Longitude						
Hand Auger		90°		-						
METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m(AHD))	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
HA	GWNE	BH202_0.10-0.20 PID = 0.2 PPM		0		31.20	FILL: Sandy CLAY: low to medium plasticity, brown, fine sands, with fine to coarse sub-angular to angular gravels and brick/ concrete fragments, no odour	M		FILL
						30.80	Terminated at 0.40m. Refusal in fill.			
				1						
				2						
				3						
				4						
				5						

This log should be read in conjunction with EI Australia's accompanying explanatory notes.

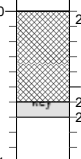
Location	2-4 Gladstone Avenue, 357-363 Crown ST, Wollongong NSW	Started	23 November 2022
Client	Wollongong Investments No. 5 Pty Ltd	Completed	23 November 2022
Job No.	E25862	Logged By	JM
Sheets	1 of 1	Review By	JH Date 30 January 2023

Drilling Contractor	HartGeo	Surface RL	≈29.20 m (AHD)	Latitude	-
Plant	Ute-mounted Drill Rig	Inclination	90°	Longitude	-

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m(AHD))	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH203_0.20-0.30 PID = 0.4 PPM QD/QT221123 BH203_0.50-0.60 PID = 0.3 PPM	█	0	█	29.20	ASPHALT: 10mm thick			ASPHALT
				0.19	█	29.19	CONCRETE: 200mm thick			CONCRETE
				0.39	█	28.99	FILL: SAND: fine grained, brown, with fine to coarse sub-angular to angular gravels, no odour	M		FILL
				0.60	█	28.60	SANDSTONE: distinctly weathered, fine grained, brown / grey-brown, medium strength			BEDROCK
				1.00			Terminated at 0.60m. Refusal on bedrock.			
				2.00						
				3.00						
				4.00						
				5.00						
				6.00						
				7.00						
				8.00						
				9.00						
				10.00						

Location 2-4 Gladstone Avenue, 357-363 Crown ST, Wollongong NSW	Started 23 November 2022
Client Wollongong Investments No. 5 Pty Ltd	Completed 23 November 2022
Job No. E25862	Logged By JM
Sheets 1 of 1	Review By JH Date 30 January 2023

Drilling Contractor HartGeo		Surface RL ≈27.50 m (AHD)	Latitude -
Plant Ute-mounted Drill Rig		Inclination 90°	Longitude -

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m(AHD))	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH204 0.10-0.20 PID = 0.2 PPM		0		27.50	FILL: Gravelly SAND: fine grained, pale brown, with fine to coarse sub-angular to angular gravels, trace root fibres, no odour	M		FILL
				1		26.90 26.80	SANDSTONE: distinctly weathered, fine grained, brown / grey-brown, medium strength, no odour Terminated at 0.70m. Refusal on bedrock.			
				2						
				3						
				4						
				5						
				6						
				7						
				8						
				9						
				10						

Location	2-4 Gladstone Avenue, 357-363 Crown ST, Wollongong NSW	Started	23 November 2022
Client	Wollongong Investments No. 5 Pty Ltd	Completed	23 November 2022
Job No.	E25862	Logged By	JM
Sheets	1 of 1	Review By	JH Date 30 January 2023

Drilling Contractor HartGeo		Surface RL ≈35.00 m (AHD)	Latitude -
Plant Ute-mounted Drill Rig		Inclination 90°	Longitude -

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m(AHD))	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH205_0.10-0.20 PID = 0.2 PPM	█	0		35.00	ASPHALT: 20mm thick	M		ASPHALT FILL
		BH205_0.50-0.60 PID = 0.2 PPM	█	0.10		34.98	FILL: Silty CLAY: low to medium plasticity, brown, with fine to coarse sub-angular to angular gravels, no odour			ASPHALT FILL
				0.20		34.60	Silty CLAY: low to medium plasticity, pale brown, no odour			RESIDUAL SOIL
				0.40		34.40	SANDSTONE: distinctly weathered, fine grained, brown / grey-brown, medium strength, no odour			BEDROCK
				0.80		34.20	Terminated at 0.80m. Refusal on bedrock.			

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Location	2-4 Gladstone Avenue, 357-363 Crown ST, Wollongong NSW	Started	23 November 2022
Client	Wollongong Investments No. 5 Pty Ltd	Completed	23 November 2022
Job No.	E25862	Logged By	JM
Sheets	1 of 1	Review By	JH Date 30 January 2023

Drilling Contractor		HartGeo		Surface RL	≈34.40 m (AHD)	Latitude	-			
Plant		Ute-mounted Drill Rig		Inclination	90°	Longitude	-			
METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH206_0.10-0.20 PID = 0.3 PPM	█	0	[Pattern]	34.40	FILL: Silty CLAY: low to medium plasticity, light brown, with fine to medium sub-angular to angular gravels, no odour	M		FILL
		BH206_0.50-0.60 PID = 0.2 PPM	█	34.10	[Pattern]	34.10	Silty CLAY: low to medium plasticity, pale brown, no odour			RESIDUAL SOIL
		BH206_1.30-1.40 PID = 0.3 PPM	█	33.60	[Pattern]	33.60	SANDSTONE: distinctly weathered, fine grained, brown / grey-brown, medium strength, no odour	BEDROCK		
				1	[Pattern]	33.00	Terminated at 1.40m. Refusal on bedrock.			
				2	[Pattern]					
				3	[Pattern]					
				4	[Pattern]					
				5	[Pattern]					
				6	[Pattern]					
				7	[Pattern]					
				8	[Pattern]					
				9	[Pattern]					
				10	[Pattern]					

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Location	2-4 Gladstone Avenue, 357-363 Crown ST, Wollongong NSW	Started	23 November 2022
Client	Wollongong Investments No. 5 Pty Ltd	Completed	23 November 2022
Job No.	E25862	Logged By	JM
Sheets	1 of 1	Review By	JH
		Date	30 January 2023

Drilling Contractor	HartGeo	Surface RL	≈36.00 m (AHD)	Latitude	-
Plant	Ute-mounted Drill Rig	Inclination	90°	Longitude	-

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m(AHD))	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH207_0.10-0.20 PID = 0.2 PPM	█	0		36.00	ASPHALT: 20mm thick	M		ASPHALT FILL
		BH207_0.90-1.00 PID = 0.3 PPM	█	1		35.98	FILL: Gravelly CLAY: low plasticity, brown to dark brown, fine to coarse sub-angular to angular gravels, with trace sandstone gravels and slag, no odour			RESIDUAL SOIL
		BH207_1.30-1.40 PID = 0.1 PPM	█	2		35.00	Silty CLAY: low plasticity, pale brown to brown, no odour			BEDROCK
				3		34.30	SANDSTONE: distinctly weathered, fine grained, brown / grey-brown, medium strength, no odour			
				3		33.30	Terminated at 2.70m. Refusal on bedrock.			

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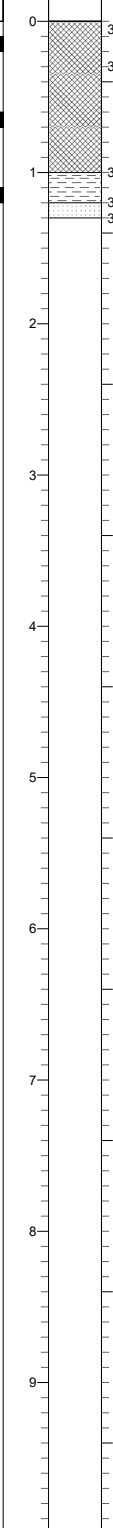
Location 2-4 Gladstone Avenue, 357-363 Crown ST, Wollongong NSW
Client Wollongong Investments No. 5 Pty Ltd
Job No. E25862
Sheets 1 of 1
Started 23 November 2022
Completed 23 November 2022
Logged By JM
Review By JH **Date** 30 January 2023

Drilling Contractor		HartGeo		Surface RL	≈36.95 m (AHD)	Latitude	-				
Plant		Ute-mounted Drill Rig		Inclination	90°	Longitude	-				
METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m(AHD))	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS	
AD/T	GWNE	BH208 0.10-0.20 PID = 0.2 PPM	█	0	█	36.95	ASPHALT: 20mm thick	M		ASPHALT FILL	
				36.93			FILL: Sandy GRAVEL: fine to medium sub-angular to angular gravels, sand is fine to medium grained, dark grey, with coal wash, no odour				
		BH208 1.50-1.60 PID = 0.4 PPM	█	1	█	35.55	FILL: Silty CLAY: medium plasticity, brown, trace fine to medium sub-angular to angular gravels, no odour				
		BH208 2.20-2.30 PID = 0.2 PPM	█	2	█	34.95	Silty CLAY: medium plasticity, pale brown-grey, mottled orange, no odour				RESIDUAL SOIL
				3	█	34.15	SANDSTONE: distinctly weathered, fine grained, brown / grey-brown, medium strength, no odour			BEDROCK	
				3	█	33.95	Terminated at 3.00m. Refusal on bedrock.				

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Client	Wollongong Investments No. 5 Pty Ltd	Completed	23 November 2022
Job No.	E25862	Logged By	JM
Sheets	1 of 1	Review By	JH
		Date	30 January 2023

Drilling Contractor	HartGeo	Surface RL	≈36.40 m (AHD)	Latitude	-
Plant	Ute-mounted Drill Rig	Inclination	90°	Longitude	-

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m(AHD))	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH209_0.10-0.20 PID = 0.2 PPM	█	0		36.40	FILL: Gravelly SAND: grey to brown, sand is fine to medium grained, gravels are fine to medium, sub-angular to angular, no odour	M		FILL
		BH209_0.60-0.70 PID = 0.4 PPM	█	0.6		36.10	FILL: Silty CLAY: medium plasticity, grey / brown, trace yellow / orange, no odour			RESIDUAL SOIL
		BH209_1.10-1.20 PID = 0.4 PPM	█	1.1		35.40	Silty CLAY: medium plasticity, pale brown to dark brown, no odour			BEDROCK
				1.3		35.20	SANDSTONE: distinctly weathered, fine grained, brown / grey-brown, medium strength, no odour			
				1.30		35.10	Terminated at 1.30m. Refusal on bedrock.			

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Location	2-4 Gladstone Avenue, 357-363 Crown ST, Wollongong NSW	Started	23 November 2022
Client	Wollongong Investments No. 5 Pty Ltd	Completed	23 November 2022
Job No.	E25862	Logged By	JM
Sheets	1 of 1	Review By	JH Date 30 January 2023

Drilling Contractor		Surface RL		Latitude						
-		≈37.00 m (AHD)		-						
Plant		Inclination		Longitude						
Hand Auger		90°		-						
METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m(AHD))	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
HA	GWNE	BH210_0.30-0.40 PID = 0.2 PPM		0		37.00	FILL: Silty CLAY: low plasticity, brown, trace tile fragments, rootlets and root fibres, coarse sub-angular to angular gravels, no odour	M		FILL
						36.60	Terminated at 0.40m. Refusal in fill.			
				1						
				2						
				3						
				4						
				5						

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Location	2-4 Gladstone Avenue, 357-363 Crown ST, Wollongong NSW	Started	23 November 2022
Client	Wollongong Investments No. 5 Pty Ltd	Completed	23 November 2022
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		Date	30 January 2023

Drilling Contractor		Surface RL		Latitude						
-		≈37.40 m (AHD)		-						
Plant		Inclination		Longitude						
Ute-mounted Drill Rig		90°		-						
METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m(AHD))	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	MATERIAL ORIGIN & OBSERVATIONS
AD/T	GWNE	BH211_0.10-0.20 PID = 0.4 PPM	█	0		37.40	FILL: Gravelly SAND: brown to red, trace fine to medium sub-angular to angular gravels, no odour	M		FILL
		BH211_0.50-0.60 PID = 0.3 PPM	█			37.00	SANDSTONE: distinctly weathered, fine grained, brown / grey-brown, medium strength, no odour Terminated at 0.60m. Refusal on bedrock.			BEDROCK
						36.80				
				1						
				2						
				3						
				4						
				5						
				6						
				7						
				8						
				9						
				10						

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EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT LOGS

DRILLING/EXCAVATION METHOD

HA	Hand Auger	RD	Rotary blade or drag bit	NQ	Diamond Core - 47 mm
DT	Diatube Coring	RT	Rotary Tricone bit	NMLC	Diamond Core - 52 mm
NDD	Non-destructive digging	RAB	Rotary Air Blast	HQ	Diamond Core - 63 mm
AS*	Auger Screwing	RC	Reverse Circulation	HMLC	Diamond Core - 63 mm
AD*	Auger Drilling	PT	Push Tube	BH	Tractor Mounted Backhoe
*V	V-Bit	CT	Cable Tool Rig	EX	Tracked Hydraulic Excavator
*T	TC-Bit, e.g. AD/T	JET	Jetting	EE	Existing Excavation
ADH	Hollow Auger	WB	Washbore or Bailer	HAND	Excavated by Hand Methods

PENETRATION RESISTANCE

L	Low Resistance	Rapid penetration/ excavation possible with little effort from equipment used.
M	Medium Resistance	Penetration/ excavation possible at an acceptable rate with moderate effort from equipment used.
H	High Resistance	Penetration/ excavation is possible but at a slow rate and requires significant effort from equipment used.
R	Refusal/Practical Refusal	No further progress possible without risk of damage or unacceptable wear to equipment used.

These assessments are subjective and are dependent on many factors, including equipment power and weight, condition of excavation or drilling tools and experience of the operator.

WATER

 **Standing Water Level**

 **Partial water loss**

 **Water Seepage**

 **Complete Water Loss**

GWNO	GROUNDWATER NOT OBSERVED - Observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave-in of the borehole/ test pit.
GWNE	GROUNDWATER NOT ENCOUNTERED - Borehole/ test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/ test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following a 150mm seating drive
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
Sampling	
DS	Disturbed Sample
ES	Sample for environmental testing
BDS	Bulk disturbed Sample
GS	Gas Sample
WS	Water Sample
U50	Thin walled tube sample - number indicates nominal sample diameter in millimetres
Testing	
FP	Field Permeability test over section noted
FVS	Field Vane Shear test expressed as uncorrected shear strength (sv= peak value, sr= residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket Penetrometer test expressed as instrument reading in kPa
WPT	Water Pressure tests
DCP	Dynamic Cone Penetrometer test
CPT	Static Cone Penetration test
CPTu	Static Cone Penetration test with pore pressure (u) measurement








ROCK CORE RECOVERY

TCR=Total Core Recovery (%)	SCR=Solid Core Recovery (%)	RQD = Rock Quality Designation (%)
$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$	$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100$	$= \frac{\sum \text{Axial lengths of core} > 100\text{mm}}{\text{Length of core run}} \times 100$

GEOLOGICAL BOUNDARIES

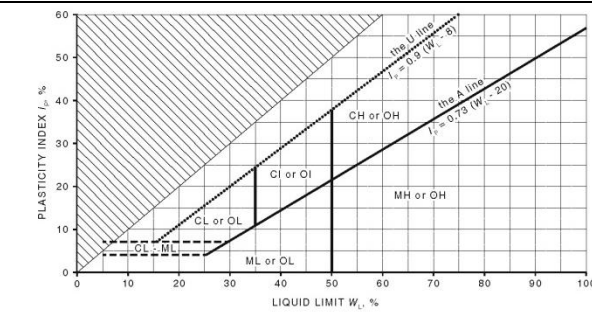
————— = Observed Boundary (position known)	- - - - - = Observed Boundary (position approximate)	- - ? - - ? - - ? - - = Boundary (interpreted or inferred)
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METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT LOGS

	FILL		ORGANIC SOILS (OL, OH or Pt)		CLAY (CL, CI or CH)
	COUBLES or BOULDERS		SILT (ML or MH)		SAND (SP or SW)
	GRAVEL (GP or GW)	Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay			

CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS 1726:2017, Section 6.1 – Soil description and classification.

PARTICLE SIZE CHARACTERISTICS				GROUP SYMBOLS				
Fraction	Components	Sub Division	Size mm	Major Divisions	Symbol	Description		
Oversize	BOULDERS		>200	COARSE GRAINED SOILS More than 65% of soil excluding oversize fraction is greater than 0.075mm	GRAVEL More than 50% of coarse fraction is >2.36mm	GW	Well graded gravel and gravel-sand mixtures, little or no fines.	
	COBBLES		63 to 200			GP	Poorly graded gravel and gravel-sand mixtures, little or no fines.	
Coarse grained soil	GRAVEL	Coarse	19 to 63			GM	Silty gravel, gravel-sand-silt mixtures.	
		Medium	6.7 to 19			GC	Clayey gravel, gravel-sand-clay mixtures.	
		Fine	2.36 to 6.7		SAND More than 50% of coarse fraction is <2.36 mm	SW	Well graded sand and gravelly sand, little or no fines.	
SAND	Coarse	0.6 to 2.36	SP			Poorly graded sand and gravelly sand, little or no fines.		
	Medium	0.21 to 0.6	SM			Silty sand, sand-silt mixtures.		
Fine grained soil	SILT		0.002 to 0.075		SC	Clayey sand, sandy-clay mixtures.		
	CLAY		<0.002		FINE GRAINED SOILS More than 35% of soil excluding oversized fraction is less than 0.075mm	Liquid Limit less than 50%	ML	Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands.
PLASTICITY PROPERTIES							Liquid Limit > 50%	CL, CI
				OL				Organic silts and organic silty clays of low plasticity.
				Highly Organic soil		MH	Inorganic silts of high plasticity.	
						CH	Inorganic clays of high plasticity.	
						OH	Organic clays of medium to high plasticity.	
					PT	Peat muck and other highly organic soils.		

MOISTURE CONDITION

Symbol	Term	Description
D	Dry	Non-cohesive and free-running.
M	Moist	Soils feel cool, darkened in colour. Soil tends to stick together.
W	Wet	Soils feel cool, darkened in colour. Soil tends to stick together, free water forms when handling.

Moisture content of cohesive soils shall be described in relation to plastic limit (PL) or liquid limit (LL) for soils with higher moisture content as follows: Moist, dry of plastic limit ($w < PL$); Moist, near plastic limit ($w \approx PL$); Moist, wet of plastic limit ($w < PL$); Wet, near liquid limit ($w \approx LL$); Wet, wet of liquid limit ($w > LL$).

CONSISTENCY

Symbol	Term	Undrained Shear Strength (kPa)	SPT "N" #
VS	Very Soft	≤ 12	≤ 2
S	Soft	>12 to ≤ 25	>2 to ≤ 4
F	Firm	>25 to ≤ 50	>4 to 8
St	Stiff	>50 to ≤ 100	>8 to 15
VSt	Very Stiff	>100 to ≤ 200	>15 to 30
H	Hard	>200	>30
Fr	Friable	-	

DENSITY

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	≤ 15	0 to 4
L	Loose	>15 to ≤ 35	4 to 10
MD	Medium Dense	>35 to ≤ 65	10 to 30
D	Dense	>65 to ≤ 85	30 to 50
VD	Very Dense	>85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material. # SPT correlations are not stated in AS1726:2017, and may be subject to corrections for overburden pressure and equipment type.

MINOR COMPONENTS

Term	Assessment Guide	Proportion by Mass
Trace	Presence just detectable by feel or eye but soil properties little or no different to general properties of primary component	Coarse grained soils: $\leq 5\%$ Fine grained soil: $\leq 15\%$
With	Presence easily detectable by feel or eye but soil properties little or no different to general properties of primary component	Coarse grained soils: 5 - 12% Fine grained soil: 15 - 30%
Prefix	Presence easily detectable by feel or eye in conjunction with the general properties of primary component	Coarse grained soils: $>12\%$ Fine grained soil: $>30\%$

CLASSIFICATION AND INFERRED STRATIGRAPHY

Rock is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS1726 – 2017, Section 6.2 – Rock identification, description and classification.

ROCK MATERIAL STRENGTH CLASSIFICATION

Symbol	Term	Point Load Index, $I_{s(50)}$ (MPa) #	Field Guide
VL	Very Low	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm can be broken by finger pressure.
L	Low	0.1 to 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	0.3 to 1	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
H	High	1 to 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer.
VH	Very High	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Rock Strength Test Results ▼ Point Load Strength Index, $I_{s(50)}$, Axial test (MPa)

● Point Load Strength Index, $I_{s(50)}$, Diametral test (MPa)

Relationship between rock strength test result ($I_{s(50)}$) and unconfined compressive strength (UCS) will vary with rock type and strength, and should be determined on a site-specific basis. However UCS is typically 20 x $I_{s(50)}$.

ROCK MATERIAL WEATHERING CLASSIFICATION

Symbol	Term	Field Guide
RS	Residual Soil	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
XW	Extremely Weathered	Rock is weathered to such an extent that it has soil properties - i.e. it either disintegrates or can be remoulded, in water.
DW	HW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores. In some environments it is convenient to subdivide into Highly Weathered and Moderately Weathered, with the degree of alteration typically less for MW.
	MW	
SW	Slightly Weathered	Rock slightly discoloured but shows little or no change of strength relative to fresh rock.
FR	Fresh	Rock shows no sign of decomposition or staining.

ABBREVIATIONS AND DESCRIPTIONS FOR ROCK MATERIAL AND DEFECTS

CLASSIFICATION AND INFERRED STRATIGRAPHY						
Rock is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS1726 – 2017, Section 6.2 – Rock identification, description and classification.						
ROCK MATERIAL DESCRIPTION						
Layering			Structure			
Term	Description		Term	Spacing (mm)		
Massive	No layering apparent		Thinly laminated	<6		
Indistinct	Layering just visible; little effect on properties		Laminated	6 – 20		
			Very thinly bedded	20 – 60		
Distinct	Layering (bedding, foliation, cleavage) distinct; rock breaks more easily parallel to layering		Thinly bedded	60 – 200		
			Medium bedded	200 – 600		
			Thickly bedded	600 – 2,000		
			Very thickly bedded	> 2,000		
ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT TYPES						
Defect Type	Abbr.	Description				
Joint	JT	Surface of a fracture or parting, formed without displacement, across which the rock has little or no tensile strength. May be closed or filled by air, water or soil or rock substance, which acts as cement.				
Bedding Parting	BP	Surface of fracture or parting, across which the rock has little or no tensile strength, parallel or sub-parallel to layering/ bedding. Bedding refers to the layering or stratification of a rock, indicating orientation during deposition, resulting in planar anisotropy in the rock material.				
Foliation	FL	Repetitive planar structure parallel to the shear direction or perpendicular to the direction of higher pressure, especially in metamorphic rock, e.g. Schistosity (SH) and Gneissosity.				
Contact	CO	The surface between two types or ages of rock.				
Cleavage	CL	Cleavage planes appear as parallel, closely spaced and planar surfaces resulting from mechanical fracturing of rock through deformation or metamorphism, independent of bedding.				
Sheared Surface	SSU	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.				
Sheared Seam/ Zone (Fault)	SS/SZ	Seam or zone with roughly parallel almost planar boundaries of rock substance cut by closely spaced (often <50 mm) parallel and usually smooth or slickensided joints or cleavage planes.				
Crushed Seam/ Zone (Fault)	CS/CZ	Seam or zone composed of disoriented usually angular fragments of the host rock substance, with roughly parallel near-planar boundaries. The brecciated fragments may be of clay, silt, sand or gravel sizes or mixtures of these.				
Extremely Weathered Seam/ Zone	XWS/ XWZ	Seam of soil substance, often with gradational boundaries, formed by weathering of the rock material in places.				
Infilled Seam	IS	Seam of soil substance, usually clay or clayey, with very distinct roughly parallel boundaries, formed by soil migrating into joint or open cavity.				
Schistosity	SH	The foliation in schist or other coarse grained crystalline rock due to the parallel arrangement of platy or prismatic mineral grains, such as mica.				
Vein	VN	Distinct sheet-like body of minerals crystallised within rock through typically open-space filling or crack-seal growth.				
ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT SHAPE AND ROUGHNESS						
Shape	Abbr.	Description	Roughness	Abbr.	Description	
Planar	PR	Consistent orientation	Polished	POL	Shiny smooth surface	
Curved	CU	Gradual change in orientation	Slickensided	SL	Grooved or striated surface, usually polished	
Undulating	UN	Wavy surface	Smooth	SM	Smooth to touch. Few or no surface irregularities	
Stepped	ST	One or more well defined steps	Rough	RO	Many small surface irregularities (amplitude generally <1mm). Feels like fine to coarse sandpaper	
Irregular	IR	Many sharp changes in orientation	Very Rough	VR	Many large surface irregularities, amplitude generally >1mm. Feels like very coarse sandpaper	
Orientation:						
Vertical Boreholes – The dip (inclination from horizontal) of the defect.						
Inclined Boreholes – The inclination is measured as the acute angle to the core axis.						
ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT COATING				DEFECT APERTURE		
Coating	Abbr.	Description		Aperture	Abbr.	Description
Clean	CN	No visible coating or infilling		Closed	-	Closed.
Stain	SN	No visible coating but surfaces are discoloured by staining, often limonite (orange-brown)		Open	OP	Without any infill material.
Veneer	VNR	A visible coating of soil or mineral substance, usually too thin to measure (< 1 mm); may be patchy		Infilled	-	Soil or rock i.e. clay, talc, pyrite, quartz, etc.